



# 2007 Minerals Yearbook

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## PAPUA NEW GUINEA

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# THE MINERAL INDUSTRY OF PAPUA NEW GUINEA

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Papua New Guinea is rich in mineral resources. The identified land-based minerals are cobalt, copper, natural gas, gold, nickel, crude petroleum, and silver. Additional identified offshore minerals are copper, gold, lead, silver, and zinc contained in sea floor massive sulfide deposits. Papua New Guinea's ore reserves of copper and gold are of world significance. In 2007, Papua New Guinea ranked fourth in mine production of copper and gold in the Asia and the Pacific region. It ranked ninth in mine production of gold and accounted for 2.4% of the world's gold production. Papua New Guinea's copper mine production accounted for 1.1% of the world's total copper mine production (International Copper Study Group, 2008, p. 11-12; World Bureau of Metal Statistics, 2008, p. 79).

The Mining Act of 1992 governs all aspects of mineral exploration and mining activities in Papua New Guinea. The Mineral Resources Authority (MRA), which replaced the Papua New Guinea Department of Mining, was established by Parliament through the enactment of the Mineral Resources Authority Act of 2005. The MRA Act became effective on January 1, 2006, according to the 2006 Gazettal Notice No. G-16. The MRA is a Government agency, and all functions were executed on behalf of the Government of Papua New Guinea. The MRA missions are (1) to promote a healthy and sustainable mineral industry, and (2) to provide a regulatory environment that maximizes mining opportunities to ensure optimal benefit for the people of Papua New Guinea. The MRA has five divisions and a special project unit under the Managing Director Office. The five divisions are as follows: Corporate Service Division, Development Coordination Division, Geological Survey Division, Information and Marketing Division, and Regulatory Operation Division (Mineral Resources Authority, 2007).

## Minerals in the National Economy

The mineral industry was very important to Papua New Guinea's economy because of its substantial contribution to the country's export earnings, Government tax revenues, and gross domestic product (GDP). In 2006 (the latest year for which data were available), according to estimates provided by Papua New Guinea authorities and the country's Treasury Department to the International Monetary Fund, the mining, quarrying, and petroleum sector contributed about 11.2% to the country's real GDP (in 1998 constant prices) compared with 12.2% in 2005. Mining and petroleum taxes accounted for 39.4% of the country's total tax revenue. Mineral exports accounted for 80.6% of Papua New Guinea's total exports. In 2006, the export value of minerals totaled \$3,391.4 million (of which copper was valued at \$1,413.5 million; gold, \$998.2 million; petroleum, \$967.4 million; and silver, \$12.3 million) and accounted for about 80.6% of total exports (International Monetary Fund, 2008a, p. 77, 83, 92, 93). According to the Papua New Guinea Chamber of Mines and Petroleum, however, the mining and

petroleum industry contributed 82% of total export revenues in 2006. For the first 6 months of 2007, the total contribution was 80% of total exports (Papua New Guinea Chamber of Mines and Petroleum, 2008a, p. 2).

## Production

According to the Papua New Guinea Chamber of Mines and Petroleum, the estimated mine production of gold increased by 11% to about 65 metric tons (t) in 2007. During 2007, the Lihir Mine was upgrading its expanded flotation plant that eventually would boost Lihir's annual mine production of gold by 54% to about 31.1 t, or about 1 million troy ounces.

The Ok Tedi Mine remained the sole copper producer; it also produced gold and silver as byproducts from its copper mining operations. Mine production of copper decreased to 169,184 t in 2007 from 194,355 t in 2006. The active primary gold and silver producers in 2007 were, in declining order of gold production, the Lihir Mine, the Porgera Mine, the Ok Tedi Mine, the Tolukuma Mine, the Kainantu Mine, the Sinivit Mine, and many alluvial artisan gold miners. Production of natural gas and crude petroleum from seven gasfields and eight oilfields, which are located in the Provinces of Southern Highlands and Eastern Highlands, decreased by 12.3% and 5.5%, respectively, in 2007 (table 1; Papua New Guinea Chamber of Mines and Petroleum, 2008b).

## Structure of the Mineral Industry

Papua New Guinea's mineral industry comprised a small industrial minerals sector, a medium-sized nonferrous metal mining sector, and a small energy sector. The industrial mineral sector mined limestone mainly for domestic consumption as aggregate for the surfacing of roads and airstrips and the manufacturing of cement. The nonferrous metal mining sector included one large-scale, world-class copper mining company (Ok Tedi Mining) and two large-scale, world-class gold and silver mining companies (Lihir Gold Ltd. and Porgera Joint Venture), and three other medium-scale gold and silver mining companies. In the nonferrous metal mining sector, a copper mining company produced copper and byproduct gold and silver, and five gold mining companies produced primary gold. The energy sector produced and processed natural gas and crude petroleum. In 2007, the energy sector included a domestic oil and gas company, several joint ventures of domestic and foreign oil and gas companies, and a foreign oil refining company that produced natural gas, crude petroleum, and refined petroleum products.

The overall capacity of the copper mining industry remained steady during the past 5 years, but gold and silver mining increased because of further upgrading at the Lihir and the Tolukuma gold mines and the opening of the Sinivit open pit gold mine on Tabar Island by New Guinea Gold Corp. in mid-2007.

The production capacity for oil and gas experienced a steady decline in crude petroleum during the past 5 years (table 2).

## Commodity Review

### Metals

**Copper.**—Ok Tedi Mining Ltd. remained the sole producer of copper. The company produced copper ore and concentrate from the Ok Tedi Mine, which is located on Mount Fubilan in the remote Star Mountain about 18 kilometers (km) from the border of Papua New Guinea's Western Province and Indonesia's West Papua Province (formerly called Irian Jaya). In 2007, the production of copper contained in copper concentrates decreased by 13% to 169,184 t; the head grades of mined ores were 0.76% copper and 0.85 gram per metric ton (g/t) gold, respectively, compared with 0.82% copper and 0.88 g/t gold, respectively, in 2006. In 2007, the company sold and exported 668,475 t of copper concentrates, which contained 186,525 t of copper and 16.3 t of gold. Exports of copper concentrate went mainly to China, Germany, India, Japan, the Republic of Korea, and the Philippines. To remove pyrite from mine tailings and to prevent increased water pollution on the Fly River system in the future, the \$150 million Mine Waste and Tailings Project was under construction in 2007. The company planned to start implementing the project beginning in July 2008 (Ok Tedi Mining Ltd., 2008).

On July 27, 2007, Xstrata Frieda River Ltd. (XFRL) officially exercised its Frieda River option to acquire an interest in the Frieda River property. As a result, XFRL had a 73.7% interest in the Frieda River copper and gold project. Other partners of the project were Highlands Pacific Ltd., 16.4%, and OMRD Frieda Co. Ltd., 9.9%. XFRL, however, had not exercised its option to acquire an interest in the Nena deposit within the Frieda River project tenement from Highlands Pacific for \$10.8 million. During 2007, XFRL focused on identifying the appropriate project execution model for moving toward a prefeasibility study. The company reportedly would spend \$25 million for the 2008 drilling programs, which included 16,000 meters (m) infill drilling and 4,000 m exploration drilling (Highlands Pacific Ltd., 2008).

In July 2007, Marengo Mining Ltd. (MML) reportedly completed a conceptual mining study (CMS) for its 100% owned Yandera copper-molybdenum project in the Bundi District, which is located about 95 km southwest of the northern seaport of Madang. According to MML, the CMS, which started in October 2006, had confirmed that the Yandera copper-molybdenum project has the potential to become a significant open pit copper-molybdenum mine. Based on the positive results of the CMS, Marengo Mining's Board of Directors had approved the commencement of a bankable feasibility study. In July 2007, Marengo Mining announced that its CMS estimate of mineral resources comprised 163 million metric tons (Mt) of indicated resources at grades of 0.34% copper and 0.015% molybdenum and 497 Mt of inferred resources at grades of 0.34% copper and 0.013% molybdenum (Marengo Mining Ltd., 2007).

Nautilus Minerals Inc. reportedly spent about \$23 million in 2007 on environmental studies and exploration to develop

a preliminary geologic resource and related mine plan for its Solwara 1 prospect. In December 2007, the company announced that Golder Associates Pty Ltd. (GAPL) of Australia had completed the world's first NI-101-compliant resource estimate for a sea floor massive sulfide system at Nautilus Minerals' Solwara 1 prospect, which is located in the territorial waters of Papua New Guinea. The resource estimate at Solwara prospect comprised indicated mineral resources of 870,000 t at grades of 6.8% copper, 4.8 g/t gold and 23 g/t silver, and 0.4% zinc; and inferred mineral resources of 1.3 Mt at grades of 7.5% copper, 7.2 g/t gold, 37 g/t silver, and 0.8% zinc. GAPL's estimate was based on the results of 111 core drill holes from the sea floor in 2007, surface mapping, 133 samples, and supporting information from 35 core holes drilled in 2006 (Nautilus Minerals Inc., 2007).

**Gold.**—In 2007, gold mine production was by Emperor Mines Ltd. at the Tolukuma Mine, Highlands Pacific Ltd. at the Kainantu Mine, Lihir Gold Ltd. at the Lihir Mine, New Guinea Gold Corp. at the Sinivit Mine, Ok Tedi Mining at the Ok Tedi Mine, and the Porgera Joint Venture at the Porgera Mine. The Kainantu gold mine, which had upgraded its mining and processing facilities in the first half of 2007, restarted its gold production in mid-2007. The Tolukuma gold mine planned to build a new access road and upgrade its mine. The Sinivit Mine, which started gold production in mid-2007, expected to produce at an annual rate of about 1.1 metric tons per year (t/yr). The Simberi oxide gold project, which is located on the Tabar Island Group about 60 kilometers (km) northwest of Lihir, planned to start gold production in early 2008 at an annual rate of about 2.6 t/yr of gold. New Guinea Gold completed development of the Sinivit Mine in September 2007 and started its commercial gold production in October 2007. For 2007, gold mine production by operating mine in declining order was as follows: the Lihir Mine, 21.8 t; the Porgera Mine, 18.7 t; the Ok Tedi Mine, 15.5 t, the Tolukuma Mine, 1.3 t, and the Kainantu Mine, 1.2 t. Production from small-scale miners and the newly opened Sinivit Mine was estimated to be about 6.5 t. In 2007, Lihir Gold, which improved its mill performance, planned to raise its gold production through further upgrading of its expanded mill capacity to more than 26 t in 2008 from 22 t in 2007 (Lihir Gold Ltd., 2008; Ok Tedi Mining Ltd., 2008; Papua New Guinea Chamber of Mines and Petroleum, 2008c).

According to the Papua New Guinea Chamber of Mines and Petroleum, because of positive results from continued exploration at the mine sites, ore reserves had increased and mine life had been extended at three major gold-producing mines. The Lihir Mine had increased its estimated reserves by about 47 t (1.5 million troy ounces) to 650 t (21 million troy ounces) of gold, the Ok Tedi mine expected to extend its mine life to 2012, and the Porgera Mine expected to extend its open pit beyond 2009 and to extend its underground operations until 2020. In April 2007, Barrick Gold Corp. bought a 20% interest in the Porgera Mine [with proven and probable reserves containing about 295 t (9.42 million troy ounces) of gold] from Emperor Mines Ltd. for \$250 million. Following the acquisition, Barrick Gold's interest in the Porgera Mine increased to 95% from 75%. In October 2007, Barrick Gold reportedly agreed to buy the Kainantu gold mine from Highlands Pacific for

\$141.5 million. The Kainantu gold mine had been producing at a rate of 1,000 troy ounces per month of gold (AFX News Ltd., 2007; Trading Market.com, 2007; Papua New Guinea Chamber of Mines and Petroleum, 2008a).

**Nickel and Cobalt.**—MCC RamuNiCo Ltd. [a subsidiary of the Chinese Metallurgical Group Corporation (MCC)], which became the operator and majority owner (85% interest) in the Ramu nickel-cobalt project, reportedly started preconstruction activities early in 2006 and initiated ground-based preconstruction during September 2006. During the first half of 2007, MCC Ramu NiCo Ltd. reportedly was conducting metallurgical testing of a 120-t ore sample collected from the Kurumbakari Mine site and completed the work by April 2007. As of April 2007, the estimated resources at the Ramu nickel and cobalt project within the Kurumbakari Resource Block and the Ramu West area and the Greater Ramu Block totaled about 143 Mt with an average grade of 1.01% nickel and 0.10% cobalt. The feasibility study and subsequent update studies were based on production of 32,800 t/yr of nickel and 3,200 t/yr of cobalt during a 20-year mine life. The 143 Mt of resources, however, would support much longer operation. In July 2007, Highlands Pacific reportedly was seeking to withdraw from the Ramu nickel/cobalt project and planned to focus its investment strategy on copper and gold production (Highlands Pacific Ltd. 2007, p. 1-3; Resource Information Unit, 2008, p. 78).

### **Mineral Fuels**

**Natural Gas and Crude Petroleum.**—Papua New Guinea's natural gas was produced by Oil Search Ltd. of Papua New Guinea with Exxon Mobil Corp. (ExxonMobil) as operator mainly from the Hides gasfield in Southern Highlands Province. Natural gas, which included associated gas from other gasfields and oilfields, including the Agogo, the Gobe Main, the Hedinia, the Kutubu, the Moran, the SE Gobe, and the Usanod, was mostly reinjected into wells. Only natural gas from the Hides gasfield, which totaled about 136 million cubic meters in 2007, was transported to a power station at Hides. Crude petroleum produced by Chevron Niugini Ltd. was mainly from the Central Moran oilfield, the Gobe Main oilfield, and the Kutubu oilfield in Southern Highlands Province and from onshore Papua Basin. Santos Ltd. also produced a smaller quantity of crude petroleum from the SE Gobe oilfield in Southern Highlands Province and from Papua Basin. According to the Papua New Guinea Chamber of Mines and Petroleum, crude petroleum production totaled 16.9 million barrels or about 46,300 barrels per day in 2007 (Papua New Guinea Chamber of Mines and Petroleum, 2008b, c).

According to the Papua New Guinea Chamber of Mines and Petroleum, the number of petroleum prospecting licenses issued in the past several years has been increasing rapidly to 40 in 2007, concentrating mostly in Papuan and North New Guinea Basins, and exploration spending was expected to reach \$100 million per year in the next 2 years. The country's oil and gas industry expected that the number of Foreland exploration wells drilled would increase significantly in the next few years, especially in the Fold Belt proper to increase oil and gas reserves (Papua New Guinea Chamber of Mines and Petroleum, 2008b).

The plan by Papua New Guinea's oil and gas company (Oil Search Ltd.) and ExxonMobil to build a \$5.5 billion natural gas pipeline to Australia was dropped in February 2007. In April 2007, however, the two companies signed a joint-venture agreement with other consortium partners (AGL Energy Ltd., Nippon Oil Co. Ltd., and Santos Ltd.) and local landowners to process gas onshore at a conditioning plant at the Hides Gasfield and pipe it to a 6.3-Mt/yr liquefied natural gas (LNG) plant (gasification terminal) close to Port Moresby. The LNG plant would also use gas produced from the Angore and the Juha gasfields and associated gas produced from the Agogo, the Gobe, the Kutubu, and the Moran oilfields in the Southern Highlands and Western Provinces. According to the agreement, the LNG consortium planned to bring the plant onstream by 2013, and ExxonMobil would market the LNG. This Papua New Guinea LNG project was 41.6% owned by ExxonMobil; 34.1%, by Oil Search; 17.7%, by Santos; 3.6%, by AGL Energy; 1.8%, by Nippon Oil; and 1.2%, by local landowners (Dow Jones & Company, Inc., 2007; Oil & Gas Journal, 2007; Petroleum Economist, 2008).

### **Outlook**

Papua New Guinea's economy grew at a rate of 6.2% in 2007 and was forecasted to grow at rates of 5.75% in 2008 and 4.69% in 2009 (International Monetary Fund, 2008b). Activities in the mining sector are expected to increase gradually as the Simberi Mine on Simberi Island in New Britain begins to produce gold and as further upgrading of the expanded processing facilities at the Lihir and the Kinantu Mines is completed by 2009. In the next 2 to 4 years, other positive factors for the continuing growth in the mining sector are likely to be the development of the Frieda River copper and gold project and the Ramu nickel and cobalt project.

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

Commodity <sup>2</sup>		2003	2004	2005	2006	2007
Copper, mine output, Cu content	metric tons	202,300	173,370	192,978	194,355	169,184
Gas, natural, marketed	million cubic meters	139	156	154	155	136 <sup>e</sup>
Gold, mine output, Au content	kilograms	67,832	73,670	68,483	58,349 <sup>r</sup>	65,000
Petroleum, crude	thousand 42-gallon barrels	17,822	15,495	17,113	17,886 <sup>r</sup>	16,900
Silver, mine output, Ag content	kilograms	61,900	55,600	51,125	51,098 <sup>r</sup>	51,300 <sup>e</sup>

<sup>e</sup>Estimated; estimated data are rounded to no more than three significant digits. <sup>r</sup>Revised.

<sup>1</sup>Table includes data available through June 13, 2008.

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

Sources: U.S. Geological Survey, Minerals Questionnaire 2002-03. British Geological Survey, World Mineral Production 2002-06. Papua New Guinea Chamber of Mines and Petroleum, Papua New Guinea Mineral Production, 2003-2006; Papua New Guinea Oil Production, 2003-2006; Papua New Guinea Gas Production, 2003-2006. December 2007 Presentation at 2008 Annual General Meeting—Executive Director's Report, May 2, 2008.



TABLE 2  
PAPUA NEW GUINEA: STRUCTURE OF THE MINERAL INDUSTRY IN 2007

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities <sup>1</sup>	Annual capacity <sup>c</sup>
Cement	thousand metric tons	Papua New Guinea-Halla Cement Pty. Ltd. (Halla Cement Corp. of the Republic of Korea, 50%, and Government, 50%)	Lae, Morobe Province	200
Copper	do.	Ok Tedi Mining Ltd., operator [National Papua New Guinea Sustainable Development Program Ltd., 52%; Government, 30%; Inmet Mining Ltd. (Canada), 18%]	Ok Tedi open cut, Western Province, 20 km northwest of Tabubil and 390 km southwest of Wewak	210
Gold		Lihir Gold Ltd., operator, 100%	Lihir open cut, Lihir Island, New Ireland Province, 700 km northeast of Port Moresby	22
Do.		Highlands Pacific Ltd., 95%	Kainantu underground mine, Eastern Highlands Province, 180 km west of Port Lae	2
Do.		Ok Tedi Mining Ltd. [National Papua New Guinea Sustainable Development Program Ltd., 52%; Government, 30%; Inmet Mining Ltd. (Canada), 18%]	Ok Tedi open cut, Western Province, 20 km northwest of Tabubil and 390 km southwest of Wewak	16
Do.		Porgera Joint Venture [Placer Dome Inc. (Canada) (the operator), which was a subsidiary of Barrick Gold Corp. (Canada), 95%; Mineral Resources Enga, 5%]	Porgera open cut and underground mines, 620 km northwest of Port Moresby, Enga Province	19
Do.		Tolukuma Gold Mine, PNG [wholly owned subsidiary of Emperor Mines Ltd. (Australia), which was 78.72% owned by DRDGOLD Ltd. (South Africa)]	Tolukuma underground mine and small open pit, Central Province, 100 km north of Port Moresby	2
Do.		New Guinea Gold Corp. (New Guinea Gold Corp., 90%, and Gold Mines of Niugini Holdings, 10%)	The Sinivit open pit on Tabar Island Group, about 60 km northwest of Lihir in New Ireland Province	1
Natural gas	thousand cubic meters per day	Exxon Mobil Corp. (operator) (Oil Search Ltd. 21.5%)	Hides Gasfield, Southern Highlands Province. Onshore Papuan Basin, petroleum development license	140
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%; and 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 Iaquifi-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%; and 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%; and Mountains West Exploration, Inc., 1.94%	SE Gobe oilfield, Gulf and Southern Highlands Provinces. Onshore Papuan Basin, petroleum development licenses 3 and 4	11
Refinery products	do.	InterOil Corp. (Canada)	Port Moresby	33
Silver	do.	Ok Tedi Mining Ltd. (operator) [National Papua New Guinea Sustainable Development Program Ltd., 52%; Government, 30%; Inmet Mining Ltd. (Canada), 18%]	Ok Tedi open cut, Western Province, 20 km northwest of Tabulio and 390 km southwest of Wewak	46
Do.	do.	The Porgera Joint Venture [Placer Dome Inc. (Canada) (operator), which was a subsidiary of Barrick Gold Corp. (Canada), 75%; Orogen Minerals Ltd., 20%; and Mineral Resources Porgera Pty. Ltd., 5%]	Porgera open cut and underground mines, 620 km northwest of Port Moresby, Enga Province	4

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

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