



2008 Minerals Yearbook

PAPUA NEW GUINEA

THE MINERAL INDUSTRY OF PAPUA NEW GUINEA

By Susan Wacaster

Papua New Guinea is composed of a group of islands that are situated northeast of Queensland, Australia. The country has 20 Provinces, 1 autonomous region, and a capital district; the Provinces are divided into 4 administrative regions. The New Guinea mobile belt is a metallogenic belt that spans the mainland and has hosted globally significant metal deposits. The islands have such mineral resources as cobalt, copper, crude petroleum, gold, molybdenum, natural gas, nickel, platinum, and silver.

The country, areas of which were unknown to the world until the early 1900s, did not gain political independence until 1975. From the 1880s through the 1940s, political control of the New Guinea Islands was held at different times by Australia, Britain, and Germany. The German administration focused on scientific research in the area rather than prospecting for economic resources, whereas the opposite was true of the Australian administration. The first gold production, which initiated a rush of Australian miners, came from Sudest Island in 1888, but the eluvial and shallow placer gold was soon mined out. Further exploration led to the discovery of gold in other locations, and by the early 1900s, lode mining had begun on Misima, Sudest, and Woodlark Islands. The years between World Wars I and II were boom years for gold prospecting and production. The Morobe Goldfield produced greater than 100,000 kilograms (kg) of alluvial gold, and mining provided significant revenue to the country. Copper ore was mined from 1907 to 1926 near Port Moresby and transported to a smelter near the Tahira Inlet, and two other unnamed mines provided ore for another smelter from 1938 to 1942. Mineral exploration was promoted by the Government in the late 1950s, and in the 1960s, the Panguan copper and gold porphyry was discovered. This deposit produced 30 million metric tons (Mt) of copper and nearly 300,000 kg of gold by the late 1980s. In recent years, as a country with an emerging economy and a relatively large mineral endowment, Papua New Guinea's economy has relied upon commodity exports. In 2008, although the country did not place among the world's highest ranked copper producers, it was estimated to be the world's fifth ranked producer of gold after Chile, South Africa, the United States, and Australia (Harmony Gold Mining Co. Ltd., 2008, p. 47; Coppermoly Ltd., 2009, p. 2; Marengo Mining Ltd., 2009, p. 2, Mineral Resources Authority of Papua New Guinea, 2009; U.S. Department of State, 2009).

Minerals in the National Economy

From 2003 through 2006, the mining, quarrying, and petroleum sector contributed between 17.9% and 27.3% to the nominal gross domestic product (GDP) of Papua New Guinea, with a slight decrease to 26.2% in 2007. Despite a global economic downturn in the second half of 2008, economic growth was recorded in Papua New Guinea for the year. Conversely, all sectors of the economy recorded increases except the mining and the building and construction sectors.

The total real GDP grew by 7.2% and the nonmineral GDP grew by 7.9% compared with 6.5% and 7.3%, respectively, in 2007. Despite the decrease in the mining GDP for the year, increased exports, which were driven by high international commodity prices in the first half 2008, contributed to economic growth. In the 12 months prior to September 2008, the total nominal value of sales in the private sector increased by 12.9%, whereas excluding the mineral sector, it increased by 25.6% (Bank of Papua New Guinea, 2009, p. 1, 31; International Monetary Fund, 2009, p. 22).

In the mineral sector, the nominal value of sales decreased by 24.1% in the third quarter of 2008 compared with a decrease of 7.5% in the previous quarter. The decrease reflected lower prices and decreased production of copper and decreased production of gold in the country as a whole; however, some regions did show growth in the mining industry. In the Islands region, the nominal value of total sales increased by 24.2% in the third quarter of 2008 compared with a decrease of 7.2% in the previous quarter; the increase was reportedly the result of increased sales in the mineral sector. In the Highlands region, the nominal value of total sales increased by 6.6% in the third quarter of 2008 compared with an increase of 8.8% in the previous quarter; this increase was also attributed to the higher prices for and production of gold. In the Southern region, however, the nominal value of sales decreased by 43.3% in the third quarter of 2008 compared with a decrease of 5.1% in the previous quarter. The decrease there was attributed to lower prices and reduced exports of copper ores (Bank of Papua New Guinea, 2009, p. 9-10).

Government Policies and Programs

The Mining Act of 1992 and the Mining Safety Act of 1977, which are administered by the Department of Mining, are the laws that regulate mining in Papua New Guinea. The Mining Act provides for the following four types of licenses: exploration leases, which are granted for a period of up to 2 years and are extendable by periods of up to 2 years; mining leases, which are generally issued for small- to medium-scale mining for an initial period not to exceed 20 years and which can be extended by up to 10 years; special mining leases, which are issued to large-scale projects for an initial period of 40 years and which are renewable by terms of up to 20 years (the holder must be a party to a mining development contract with the state and issuance is subject to public forum); and alluvial mining leases, which are generally used by Papua New Guineans for small-scale mining activities (Resource Information Unit, 2009, p. 91).

In May 2008, the Government of Papua New Guinea refused to renew Frontier Resources Ltd. of Australia's exploration license at the company's Kodu copper, gold, and molybdenum project. The company's conceptual mining study determined that a 200-Mt operation [20 million metric tons per year (Mt/yr)

for 10 years] was economically viable, and a feasibility study was to follow. In 2007, Frontier reportedly had received approval from the Government to proceed with the project. The company reported that the Government later decided that concerns about a native walking path, called the Kokoda Track, were more important to the national interest than the mine and cited the National Executive Council's concerns about water and power supplies to Port Moresby. The Kokoda Track would have to be diverted to accommodate the mine and there was debate about the degree to which the diversion would affect visitors and communities. The trail held historical significance, as it represented the location where, in 1942 (when Papua New Guinea was an Australian Protectorate), Australian troops recaptured Kokoda after a World War II Japanese invasion. The trail has become a regularly visited site by trekkers and tourists. Some opponents of the mine claimed that plans to re-route the Kokoda Track would desecrate the trail. Villagers have also blocked the trail in protest against their having received little or no benefits from the fees collected from visitors. Frontier reported that an independent initial environmental assessment that was commissioned by the company found the National Executive Council's claims to be baseless. Legal proceedings were initiated by the company in October 2008 (Marshall, 2007; Fox, 2009; Frontier Resources Ltd., 2009, p. 1-9; Kokoda Track Foundation, 2009).

Production

The International Monetary Fund (IMF) reported the following production volumes for Papua New Guinea as of September 2008: crude oil, 8.6 million barrels (Mbbbl); copper, 142,600 metric tons (t); and gold, 44,000 kg compared with 2007 yearend total production volumes of 13.8 Mbbbl, 199,400 t, and 57,500 kg, respectively. The value of those commodities produced as of September 2008 was recorded as follows: crude oil, \$1,002 million; copper, \$1,110 million; and gold, \$1,258 million compared with \$1,018 million, \$1,424 million, and \$1,254 million, respectively, in 2007 (International Monetary Fund, 2009). To estimate yearend totals for the production of copper, crude petroleum, and gold in 2008, 2007 and 2008 export volumes and 2007 total production volumes were used. According to the Central Bank of Papua New Guinea, the country exported about 13.6 Mbbbl of crude petroleum in 2007 (an estimated 11.7% decrease recorded between 2007 and 2008) and, according to the IMF, the country produced about 13.8 Mbbbl of crude oil the same year. If so, about 189,000 barrels (bbl), or about 1.4%, of the country's petroleum was refined or retained domestically. Assuming the same percentage of crude petroleum was directed for domestic use in 2008, an estimate of the country's total production for the year would be about 12.4 Mbbbl. Following the same procedure for copper (0.54% retained for domestic use) and gold (1.03% retained for domestic use), the estimated yearend production volume of copper and gold would be 186,800 t and 64,000 kg, respectively.

Structure of the Mineral Industry

In March, Allied Gold Ltd. of Australia signed a letter of intent with Barrick Gold Corp. of Canada that gave Barrick Gold the option to acquire up to 70% interest in Allied Gold's exploration licenses on Big Tabar and Tatau Islands. Big Tabar and Tatau Islands host 19 identified gold and gold-copper prospects on which little or no exploratory drilling had been done. Barrick Gold would be required to fund \$A8 million of exploration within 4 years to earn a 51% interest, with another \$A12 million required within the next 4-year period to earn a 70% interest in the exploration license (Allied Gold Ltd., 2008, p. 3-13).

BacTech Mining Corp. of Canada announced that it had reached an agreement with Yamana Gold Inc. of Canada to acquire its 33% stake in two refractory gold projects in Papua New Guinea (refractory gold is a high sulfide gold ore that requires oxidation of the sulfides to smelt the gold). Gold Aura Ltd. of Australia was the operator and held a 67% share of the ownership. A new joint-venture company was to be created between BacTech and Gold Aura to replace the previous arrangement between Gold Aura and Yamana. To increase its share to 43%, BacTech would pay Can\$1 million to Gold Aura during a 2-year period and would have an option to increase its ownership to 50%. The properties included in the deal were the Gameta property, where Gold Aura was conducting an infill definition drilling program, and the Wapolu property, which would be drilled further once a Gameta feasibility study was begun. BacTech had been recognized for using bacteria in the processing of precious and base metals from complex refractory ores and concentrates. Until 2002, the company had focused on licensing its technology to mining companies. In 2003, the company began to acquire mining projects where it could directly apply the technology. The purchase of the Papua New Guinea properties was the company's first such project (BacTech Mining Corp., 2009, p. 1-6).

Harmony Gold Mining Co. Ltd. of South Africa completed a joint-venture agreement with Newcrest Mining Ltd. of Australia. By contributing a maximum of about \$525 million in two stages, Newcrest was to earn a 50% interest in Harmony's Papua New Guinea assets, including the Hidden Valley gold and silver project, the Wafi Golpu copper and gold deposit, and more than 3,400 square kilometers (km²) of Harmony's exploration holdings in Morobe Province. The Morobe mining district, although still relatively unexplored, was reported to have a known mineral endowment of more than 559,000 kg of gold, about 3 million kilograms (Mkg) of silver, 1.8 Mt of copper, and 21,300 t of molybdenum. By November 2008, it was reported that several groups of citizens had sought court orders to halt the feasibility studies at the Wafi gold project in the Bulolo district of Morobe Province. Exploration had reportedly stopped while talks were being carried out in Port Moresby between landowner groups, who claimed that the 50,000 hectares of the Wafi gold project belonged to them, and Government authorities. By early 2009, a situation escalated to one of lethal violence between two tribes who disputed ownership rights of gold-bearing land associated with a National Park and the Hidden Valley Mine. The event left hundreds homeless from fires and led to three

deaths (Harmony Gold Mining Co. Ltd., 2008, p.13, 42-43, 47; Indigenous Portal, 2009; Solomon Star News, 2009).

Lihir Gold Ltd. announced that it would further expand its Lihir Island processing plant to increase the plant's gold production capacity to about 31,000 kg by 2012. Construction was to begin in the first quarter of 2009 (Lihir Gold Ltd., 2009, p. 8-10).

Mineral Trade

In 2008, the total value of Papua New Guinea's exported goods was about \$6 billion, which was a 9.7% increase compared with the value in 2007. The top five ranked countries to receive exports from Papua New Guinea in 2008 were Australia (40%), Japan (16.8%), Germany (8.2%), Philippines (7.8%), and China, excluding Hong Kong (3.3%) (Bank of Papua New Guinea, 2009, p. 14; International Monetary Fund, 2009, p. 37).

The value of exported minerals, including petroleum, was about \$4.7 billion in 2008, or nearly 80% of total exports, which was a 70.1% increase compared with the value in 2007. The increase was attributed to higher prices for gold and crude oil combined with a higher export volume of gold, which offset decreases in the export price of copper and decreases in the export volumes of copper and crude oil. Crude oil exports were valued at \$1.4 billion, which was a 17.5% increase compared with exports in 2007, and they accounted for 30% of total goods exported in 2008 compared with 21.2% in 2007. About 12.2 Mbbbl of petroleum was exported in 2008, which was an 11.7% decrease compared with exports in 2007. The decrease was attributed to lower production rates because of the natural decline from wells at the Gobe Main, the Moran, and the South East Gobe oil projects, which offset increased production from the Kutubu oilfield. The average export price of crude oil from Papua New Guinea increased by 33.3% in 2008 compared with the price in 2007. Export receipts of refined petroleum products from InterOil Corp.'s Napanapa oil refinery in 2008 were about \$193 million, which was a 1.4% increase compared with the value in 2007, and accounted for 3.3% of total goods exported in 2008 compared with 3.6% in 2007 (Bank of Papua New Guinea, 2009, p. 14-15).

Mineral export receipts, excluding crude oil, accounted for 54.1% of the total exported goods in 2008 compared with 56.3% in 2007 (Bank of Papua New Guinea, 2009, p. 14-15). About 63,300 kg of gold was exported in 2008, which was a 10.1% increase compared with exports in 2007. That increase was attributable to increased production from the Lihir Mine, the Ok Tedi Mine (which extracted higher grade ore in 2008 than in 2007), and the Porgera Mine. About 186,000 t of copper ore was exported in 2008, which was a 6.9% decrease compared with the amount in 2007. That decrease was attributable to lower production and shipment of copper ore from the Ok Tedi Mine. Because more than 70% of Papua New Guinea's exports were mineral products, and given that mineral exports accounted for more than 50% of the country's GDP in 2008, the effects of the global economic downturn of 2008 could be directly observed in the case of Papua New Guinea's trade both by the increased production and export of gold with increasing gold

prices, and by the decreased production, export, and prices of copper. International demand for gold increased among investors looking for a safe haven for capital, as did gold prices, and as international copper demand declined in the latter part of 2008, so did the production, export, and prices of copper. Alternatively, in the petroleum sector, as crude petroleum prices increased dramatically in the second half of 2008, demand for petroleum and petroleum products decreased, as did exports and production (Bank of Papua New Guinea, 2009, p. 14-15, 25).

Commodity Review

Metals

Copper, Gold, Molybdenum, Silver, and Tellurium.—Coppermoly Ltd. began drilling and trenching on its copper, gold, molybdenum projects, including the Simuku and the Mt. Nakru properties on the island of New Britain. At Simuku, porphyry-style copper, gold, and molybdenum mineralization was present across an area of about 4.5 kilometers (km) by 2 km. Historical work, and exploration in 2008, including greater than 5,000 meters (m) of drilling, defined a 3,500-m by 650-m area anomalous for copper and molybdenum. Historical trenching led to the determination of supergene enrichment, and primary copper mineralization in the range of 0.1% to 0.5% copper in quartz feldspar porphyry. Intercepts of greater than 1.0% copper were present in narrow intervals. At the Nayam and the Tobarum prospects, intercepts were found from the surface down to greater than 300-m depth that included 0.38% to 0.71% copper, 0.05 to 0.11 grams per metric ton (g/t) gold, 26 to 136 g/t molybdenum, and 1.29 to 2.82 g/t silver (Coppermoly Ltd., 2009, p. 1-5).

Harmony Gold announced a new zone of porphyry-style copper and gold mineralization at the Nambonga North prospect, which was an advanced prospect in an area surrounding the prefeasibility Wafi-Golpu project. Mineralization occurred as banded quartz, magnetite, and chalcopyrite vein stockwork developed in both diorite porphyry and the surrounding metasediments. In addition to porphyry copper and gold mineralization, exploration at Nambonga North revealed base-metal and gold mineralization associated with a massive sulfide lens at the contact of the intrusion. The Biamena prospect was an advanced project that the company reported had the potential to deliver a multimillion-troy-ounce deposit similar to that of the Wafi-Golpu project. Definition drilling was to remain a priority into 2009. The company reported total resources in Papua New Guinea of 317,000 kg of gold, 1.8 Mkg of silver, 1.2 Mt of copper, and 15,000 t of molybdenum. The Hidden Valley Mine, which is located in Morobe Province, was designed to process about 4.2 Mt/yr of ore from two open pits—one large open pit on the Hamata ore body and a second, larger open pit on the Hidden Valley and the Kaveroi ore bodies. Annual gold production was projected to peak at 8,500 kg in 2019. The mine was scheduled to be commissioned in mid-2009. By yearend 2008, engineering design was 91% complete, procurement was 87% complete, and the overall project was 57% complete (Harmony Gold Mining Co. Ltd., 2008, p. 13, 46-48, 63).

The Ok Tedi Mine is an open pit mine located on Mt. Fubilan in the Star Mountain region of Papua New Guinea near the border with the Indonesian Province of Papua. In 2008, the Ok Tedi copper and gold mine produced 159,650 t of copper and 16,032 kg of gold compared with 169,184 t and 15,514 kg, respectively, in 2007. The mine began gold production in 1984 and copper production in 1987. The pit covered about 2.6 km², from which about 160,000 t of ore and waste rock were mined each day. The mine and processing plant were situated near the upper reaches of the Ok Tedi River. The operation had caused increased sedimentation of the Fly and the Ok Tedi River systems that resulted in overbank flooding and localized acid rock drainage. In 2007, 56 Mt of tailings and overburden rock were discharged into the Ok Tedi River. The expected mine life was projected to 2013 and a long-term mine closure plan was under consideration. In 2008, a mine closure manager was appointed to what would be one of the world's largest and most challenging mine closure projects ever attempted. In 2008, the mine had about 2,000 direct employees (out of 6.3 million people in the country) (Ok Tedi Mining Ltd., 2009).

Marengo Mining Ltd. began a definitive feasibility study of its Yandera porphyry copper and molybdenum project in late 2007. The two-phase study was expected to be completed by June 2009. The Yandera project covers 1,500 km² situated along the Bundi Fault Zone and is located near the Provincial capital of Madang. A November 2007 resource estimate included an indicated resource of 163 Mt grading 0.49% copper equivalent and an inferred resource of 497 Mt grading 0.48% copper equivalent (Marengo Mining Ltd., 2009, p. 11).

Nautilus Minerals Inc. of Canada continued exploration of seafloor massive sulfide mineralization for future mining from its deepwater holdings. These deposit types, which form where rising hot hydrothermal fluids mix with cold sea water on the seafloor, have been considered prospective for copper, gold, silver, and zinc because of their similarities with volcanic massive sulfide deposits that have hosted some of the world's significant reserves of precious and base metals. Nautilus had been granted exploration licenses at 74 holdings in the Bismark Sea and the Woodlark Basin, had applied for a mining lease over the Solwara 1 deposit, and had submitted a completed environmental impact statement to the Government to support the mining application. Citing uncertainty in commodity and financial markets related to the global economic downturn, and after suffering net losses in excess of \$80 million in 2008, the company postponed the construction of mining system equipment, but intended to proceed with permitting for the Solara 1 project and to continue exploration that would increase its resource base. All supplier agreements were terminated, including the mining support vessel agreement. The company expected that ore production for the Solara 1 project would be delayed at least until December 2010. Nautilus and its Canadian exploration partner Teck Cominco Ltd., had discovered 21 new seafloor massive sulfide deposits in 2007 and 2008, which were reported to have a high-grade base and precious metal materials, especially gold and silver (Nautilus Minerals, Inc., 2009a p. 1; 2009b, p. 10, 46-47).

Xstrata plc of Switzerland completed more than 20,000 m of drilling and a scoping study for the Frieda River copper project

in 2008. The company's first resource estimate for the project included 51 Mt for the Nena deposit and 840 Mt at the Horse-Ivaal-Trukai porphyry deposit. The Frieda River project is a major copper and gold porphyry epithermal system within the New Guinea mobile belt. The Frieda River igneous complex, from which the project deposits formed, was defined as a 15-km by 7-km oval area with a central zone of basaltic andesite volcanic rocks and diorite intrusive rocks with diorite plugs along the rim. In 1999, the southeastern quadrant of the complex was reported to have at least seven stockwork porphyry copper and skarn hosted deposits, including the Horse-Ivaal and the Koki deposits. An elongated 13-km by 4-km area of advanced argillic alteration in the center of the complex was found to host the Nena deposit and about 20 high sulfidation-type prospects situated along northwest-trending regional-scale siliceous ridges. The Nena deposit is located 4 km from the nearest major porphyry and was a pod of vein and replacement sulfides in a tectonically controlled multiphase breccia (Morrison, Kary, and Handfield, 1999; Xstrata plc, 2009, p. 61).

Allied Gold completed construction at the Simberi gold project in the Tabar Islands and poured its first gold bar in February 2008. By June, the company had mined about 416,000 t of ore, of which it processed 411,297 t at a grade of 2.95 g/t gold at a recovery rate of 84.3% for 1,028 kg of gold produced. Total estimated gold resources include about 12 Mt at an average grade of 1.29 g/t gold for about 15,500 kg of gold. Ore for the plant was sourced from deposits located at Samat and Sorowar. The processing plant was located on the eastern coast of Simberi Island near Pigiput Bay. The plant used a deep sea placement tailings-management method whereby spent ore or tailings were pumped to a mixing tank on the shore of Pigiput Bay, mixed to a ratio of one part tailings to eight parts seawater, and then discharged by pipeline at a depth of 115 m below sea level so that it would land at a depth of greater than 3 km on the base of a steep submarine slope (Allied Gold Ltd., 2008, p. 3-13; Resource Information Unit, 2009, p. 96).

Barrick Gold's Porgera gold mine produced about 20,000 kg of gold in 2008 compared with about 15,000 kg in 2007. The increase was attributable to increased throughput and grade from the open pit and the fact that production was negatively affected in the third quarter of 2007 by a damaged power station. In the first half of 2008, the company started a mine expansion assessment. The Stage 6 expansion would extend the mine life to 2015. The stockpile of low-grade ore at Porgera was expected to be depleted in 2021 (Barrick Gold Corp., 2009a, p. 3; 2009b, p. 16).

Gold Aura reported that exploration at the Fergusson Island gold project revealed two gold deposits within the project area, including the Wapolu deposit on northwest Fergusson Island, and the Gameta deposit, which is located in the northeast. A prefeasibility study in 2004-05 indicated that a viable gold mine could be established at Gameta with annual gold production capacity of about 55,000 troy ounces (Gold Aura Ltd., 2008, p. 1-6).

Lihir Gold produced about 24,000 kg of gold in 2008 compared with 21,800 kg in 2007 from its Lihir Island operation. The increased production was attributable to a 2007 expansion at the processing plant, including a flotation

circuit with additional milling and oxygen capacity, that led to increased throughput. The Lihir Island operation had produced 218,000 kg of gold since 1997. The mine consisted of a single ore body with three open pits—the Minifie, the Lienetz, and the Kapit. Mining at the Minifie pit was completed and mining proceeded to the Lienetz pit, which is a higher grade zone. The Lienetz open pit was projected to be the major source of ore until 2014 when mining would move to the Kapit open pit. The ore at Lihir Island was predominantly refractory sulfide ore that was processed through pressure oxidation (a process that uses high temperature and pressure autoclaves to oxidize the sulfides). About 75% of the operation's power requirements were met by geothermal power; however, additional drilling to identify expanded resources would be required to remedy an inconsistent steam supply. Total measured and indicated resources at yearend were reported to be 384.1 Mt at an average grade of 2.67 g/t gold for greater than 1 Mkg of gold (Lihir Gold Ltd., 2009, p. 12-15).

New Guinea Gold Corp. expected to produce about 100 kilograms per month of gold toward the end of 2008 from the Sinivit gold mine in 2008; however, the company's crushing and leaching capacity was insufficient, and the project was reported to be undercapitalized. The company has been producing gold since the second quarter of 2007. Production in 2008 amounted to 210 kg of gold and 25 kg of silver sourced from the oxide cap of a copper, gold, quartz, silver, and tellurium epithermal vein system. Tellurium was identified in a drill hole that had 1,467 g/t tellurium, 113 g/t silver, 36 g/t gold, and 3.0% copper. The company announced resource estimates for the Imwauna project, including inferred resources of 1.8 Mt grading 12.2 g/t gold and 20 g/t silver for nearly 22,000 kg of gold and greater than 36,000 kg of silver mineralization that was not refractory, so that an open pit operation was likely. The preliminary feasibility study was in process; production of 1,500 to 3,000 kilograms per year was projected by 2011 (Papua New Guinea Gold Corp., 2009, p. 1-6).

Nickel and Cobalt.—Highlands Pacific Ltd.'s Ramu Nickel Cobalt project was under construction in 2008 and was scheduled to be commissioned in late 2009. The project contained an estimated resource of 143 Mt at grades of 1.01% nickel and 0.1% cobalt. The company reported that the project would produce 31,150 metric tons per year (t/yr) of nickel and 3,300 t/yr of cobalt for at least a 20-year mine life (Highlands Pacific Ltd., 2009, p. 3).

Outlook

At the end of 2008, Papua New Guinea was in a relatively more comfortable economic situation than some other small countries with emerging economies, or even some with advanced economies, and its banks were operating at high levels of liquidity. A reform of the financial sector in 2000 that introduced such legislation as the Central Banking Act and the Banks and Financial Institutions Act combined with the commodities boom of the early 2000s led the financial sector on a path of improved performance. Thus, by 2008, the ratio of nonperforming loans to total loans declined to 1.3% in September 2008 from 16.9% in 2000. Papua New Guinea's

banking system was somewhat isolated from the international capital markets because of its deposit-based funding, rather than wholesale funding, which accounted for more than 80% of its liabilities, about 50% of which were held in the Papua New Guinea kina; the rest were held in Australian or United States dollars. The Australian holders also relied primarily on domestic funding, which further minimized third-party exposure to the stressed international financial institutions.

The mining industry has numerous projects that are under exploration, moving through the permitting process, or coming into production. With the advent of seafloor metals mining, the country may be recognized as a test case for the approach but also raise environmental issues that have not previously been encountered. Given the country's remote location, small land area, and sometimes severe climate and terrain, combined with a large indigenous population and a fragile ecosystem, concerns over mining and environmental sustainability are likely to be numerous in the years to come as the number of projects increases (International Monetary Fund, 2009, p. 3-7).

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TABLE 1
PAPUA NEW GUINEA: PRODUCTION OF MINERAL COMMODITIES¹

Commodity ²		2004	2005	2006	2007	2008 ^e
Copper, mine output, Cu content	metric tons	173,370	192,978	194,355	199,400 ^r	187,000 ³
Gas, natural, marketed	million cubic meters	156	154	155	136 ^e	135
Gold, mine output, Au content	kilograms	73,670	68,483	58,349	57,500 ^r	64,000 ³
Petroleum, crude	thousand 42-gallon barrels	15,495	17,113	17,886	13,800 ^r	12,400 ³
Silver, mine output, Ag content	kilograms	55,600	51,125	51,098	51,300 ^e	52,000

^eEstimated; estimated data are rounded to no more than three significant digits. ^rRevised.

¹Table includes data available through September 11, 2009.

²In 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.

³Calculated from known values of export volumes in 2007 and 2008 and the percentage of the volume retained for domestic use in 2007.

Sources: World Mineral Production 2002-06. Papua New Guinea Chamber of Mines and Petroleum, Papua New Guinea Mineral Production, 2003-06; Papua New Guinea Oil Production, 2003-06; Papua New Guinea Gas Production, 2003-06. 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 2008

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities ¹	Annual capacity ^c
Cement	thousand metric tons	Papua New Guinea-Halla Cement Pty. Ltd. (Halla Cement Corp., 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., 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	24
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., 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. (operator), which was a subsidiary of Barrick Gold Corp., 95%, and Mineral Resources Enga, 5%]	Porgera open cut and underground mines, Enga Province, 620 km northwest of Port Moresby	19
Do.		Tolukuma Gold Mine, PNG (wholly owned subsidiary of Emperor Mines Ltd., which was 78.72% owned by DRDGOLD Ltd.)	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%)	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.	Port Moresby	33
Silver	do.	Ok Tedi Mining Ltd. (operator) (National Papua New Guinea Sustainable Development Program Ltd., 52%; Government, 30%; Inmet Mining Ltd., 18%)	Ok Tedi open cut, Western Province, 20 km northwest of Tabubil and 390 km southwest of Wewak	46
Do.	do.	The Porgera Joint Venture (Placer Dome Inc. (operator), which was a subsidiary of Barrick Gold Corp., 75%; Orogen Minerals Ltd., 20%; and Mineral Resources Porgera Pty. Ltd., 5%)	Porgera open cut and underground mines, Enga Province, 620 km northwest of Port Moresby	4

^cEstimated. Do., do. Ditto.

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

