THE MINERAL INDUSTRY OF

PAPUA NEW GUINEA

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Papua New Guinea, which is one of the largest island nations in the South Pacific Ocean, comprises the eastern one-half of the island of New Guinea, which is one of the largest islands in the world, and a string of some 600 islands, atolls, and coral reefs; some of the islands include Bougainville, Manus, Misima, New Britain, and New Ireland. The 463,000-square-kilometer (km^2) nation is east of Indonesia between the Coral Sea and the South Pacific. Papua New Guinea was formed by the merger between the Australian territory of Papua and the German colonial possession of New Guinea following World War I. Australia administered Papua New Guinea until 1975 when it became an independent state.

Although changes in Government leadership have been peaceful since independence, Papua New Guinea has struggled to develop nationhood status in its quarter-century existence. The country's population is diverse and spread out in isolated villages. Ethnic strife has become commonplace as evidenced by the Bougainville civil unrest and tribal skirmishes in the Highlands. These conflicts have had a negative impact on mining exploration and investment. Land disputes have become common because land is communally held and there is no real system of land registration.

In 2000, the mining sector contributed 17.1% to the nation's gross domestic product of $3.75 billion, and the petroleum sector contributed 9.1% (Bank of Hawaii, 2001, p. 3). An estimated 70% of its export income was derived from these two sectors, although they employ only about 2% of the country's workforce. The majority of the population, which has been estimated to be about 85%, relied on subsistence and commercial agriculture and fishing. Papua New Guinea's mineral resources were difficult and expensive to mine, and exploration and mining were hampered by rugged terrain, the high cost of developing infrastructure, and the nation's poor road infrastructure. Nevertheless, Papua New Guinea was the 13th largest copper and the 11th largest gold mining country in the world in 2000 (World Bureau of Metal Statistics, 2001, p. 37, 79).

Government Policies and Programs

Papua New Guinea's tax structure, although largely unchanged since independence, has been criticized for making investment in mining too expensive and leading mineral exploration companies to look for cheaper exploration targets, such as Asia, Latin America, and the countries of the former Soviet Union. To revive waning mineral and petroleum exploration interest, the Government announced a major overhaul of the tax system aimed at encouraging a $3 billion natural gas pipeline between Papua New Guinea and Australia and furthering mineral exploration (Resource Information Unit, 2001, p. 20).

The new tax regime was applicable only when a project was underway and included guaranteed fiscal stability for the financing period of a project, the lowering of corporate tax rates to 30%, and the reduction of dividend holding tax to 10%. Companies also were able to deduct 25% of exploration expenditure against total income. Companies will be required, however, to pay an additional profit tax when accumulated profits exceed a 15% rate of return. In addition, Papua New Guinea's mining levy will be phased out within a 4-year period, and the Mining Act 1992 will be reviewed (Resource Information Unit, 2001, p. 20).

Mining and petroleum exploration and development in Papua New Guinea were regulated by the Mining and the Petroleum Acts of 1992. The Mining Act deals with the types of mining tenements available; making mining development contracts; payments of rents, fees, and royalties; registration of interests and dealings in tenements; and compensation for the occupiers of affected lands. The principal mining tenements for large-scale operations under the Mining Act are exploration licenses (EL) and special mining leases (SML); an EL confers the exclusive right to explore for certain minerals within a defined area, and an SML gives tenure to carry out construction and operations for the mining of a large mineral deposit. There also are mining leases (ML) and alluvial mining leases for smaller scale development, as well as ancillary tenements, such as leases for mining easements. These leases are dependent on the negotiation and signing of a mining development contract with the Government, approval by the Minister for Mining and Petroleum of a proposal for development, and reaching an agreement for appropriate compensation with the indigenous people who occupy the land. The holder of an ML or SML is entitled to conduct mining operations and owns all minerals lawfully extracted.

The Petroleum Act deals with the types of petroleum licenses available, registration of interests and dealings in tenements, compensation for owners and occupiers of affected lands, and payments of rents, fees, and royalties. Three types of licenses may be issued under the Petroleum Act—petroleum prospecting, petroleum development, and pipelines. A petroleum prospecting license (PPL) confers the exclusive right to explore for petroleum, but the holder is required to enter into a further agreement with the Government regarding exploration and development within the tenement area. A petroleum development license (PDL) gives tenure to recover and own the petroleum and to construct and operate all necessary facilities. A Pipeline License confers the authority to construct and operate a pipeline system and related facilities.

Environmental Issues

The Department of Environment and Conservation is the Government agency responsible for environmental protection and conservation of Papua New Guinea's diverse natural environment and serves as the regulatory and monitoring agency for the extraction of all mineral resources in the country.

Structure of the Industry

The country's producing mines centered on four very large operations, one medium-sized enterprise, and a large small-scale sector that included several thousand mechanized alluvial gold mines and primitive manual gold panning-sluicing workings by numerous individuals. The major operations were the Ok Tedi copper-gold mine in Western Province, the Lihir gold mine in New Ireland Province, the Misima gold-silver mine in Milne Bay Province, and the Porgera gold mine in Enga Province. The smaller Tolukuma gold-silver mine in Central Province also was a significant producer. Projects in the petroleum sector included Gobe Main, Kutubu, Central Moran, and SE Gobe Oilfields in the Gulf and the Southern Highlands Provinces. These facilities produced virtually all the country's mineral-petroleum production; clays, sand and gravel, and stone used for construction purposes were excluded.

Projects in an advanced stage of development included Morobe (gold-silver), Mount Kare (gold), and Ramu (nickel).

Commodity Review

Metals

Copper.—In 2000, all the country's copper production was mined from the Ok Tedi Mine at the headwaters of the Ok Tedi River on Mount Fubilan in the Star Mountains, which is about 18 kilometers (km) east of the border with the Indonesian Province of Irian Jaya and 20 km northwest of the town of Tabubil where Ok Tedi Mining Ltd. (OTML), which was the mine operator, was headquartered. Copper production at Ok Tedi began in 1987 following 3 years of gold-only production. The opencut operation used conventional truck-and-shovel methods to mine approximately 30 million metric tons per year (Mt/yr) of ore and 55 Mt/yr of waste rock. About 200,000 metric tons per year (t/yr) of copper-in-concentrate and 12,500 kilograms per year (kg/yr) of gold-in-concentrate were produced (BHP Ltd., 1999, p.7). The final concentrate, which contains about 34% copper and 20 grams per metric ton (g/t) gold, was then thickened and piped 137 km to handling facilities at Kiunga for filtering and drying before shipment down the Fly River in 2,500-metric-ton (t) barges (Resource Information Unit, 2000, p. 37).

Waste rock and tailings from the Ok Tedi Mine have been discharged into the Ok Tedi River ever since successive major landslides forced the abandonment of construction at the tailings dam site shortly after mining startup in 1984. The resulting buildup of mine sediment in the lower Ok Tedi and Fly Rivers produced flooding and sediment deposition on the flood plain that led to about a 100-km^2 vegetation die-back. As a result, OTML has been at the focus of several tailings pollution claims and causing BHP Ltd., which was the majority owner in the operation, to review its position (MBendi, March 29, 2001, Papua New Guinea—Mining—Copper mining, accessed March 29, 2001, at URL http://mbendi.co.za/indy/ming/cppr/au/pg/p0005.htm).

Ore milled in the first quarter of 2000 was lower than normal owing to a 44-day scheduled maintenance shutdown of one of the two semi-autogenous grinding (SAG) mills. The mill throughput increased significantly for the remainder of 2000 as a result of high mill availability, softer ores, and improved SAG mill process controls (Resource Information Unit, 2001, p. 31).

Gold.—Lihir Island comprises five Pliocene-Pleistocene volcanic units, which includes the Luise Volcano. Mineralization is entirely contained within the breached caldera (resulting in the explosion and collapse) of the Luise Volcano. The ore body is hosted by volcanics, which include porphyritic lavas, tuffs, and lahars; quartz-deficient, silica-saturated intrusives of monzonitic composition that range from pyroxene-biotite-microdiorite to biotite-syenite; and fragmental volcanics, which form the bulk of the original near-surface lithologies. Most resources are located in the Lienetz area in the central part of the caldera and in the Minifie area toward its southern margin. Most of the ore is sulfide-rich refractory ore and must be oxidized before the gold can be recovered in a standard carbon-in-leach circuit. Pressure oxidation technology in autoclaves was used to treat the refractory ore (Lihir Gold Ltd., 2000, p. 3).

Lihir is one of the world's largest gold resources. It was discovered in 1982 by a joint venture of Niugini Mining Ltd. and Kennecott Exploration Ltd. Extensive drilling delineated the Coastal, Lienetz, and Minifie deposits by 1991. An SML was granted in March 1995, and in October, Lihir Gold Ltd. raised $750 million in equity and debt to finance the construction, development, and initial operation predominantly from the Minifie deposit of the mine. First gold was poured in May 1997, and commercial production was achieved in October (Resource Information Unit, 2001, p. 52).

Beginning in 1998, significant damage to the brickwork within the three autoclaves necessitated a series of costly shutdowns in which the autoclaves were relined. Within a few days in mid-April when the final reline had been completed, an additional 2-week shutdown was required to repair an improperly grouted pressure nozzle on autoclave No. 2. In late June when it was determined that the relines were finally determined to be successful, the addition of a fourth autoclave was being considered (Australian Journal of Mining, 2000b).

On April 17, 2000, Lihir Gold took over direct responsibility for all mining activities, paying the previous Thiess-Roche contract mining joint venture $53 million, of which $39 million was for the mining fleet of 3 shovels and 21 haul trucks, as well as a $14 million final contract payment (Metal Bulletin, 2000; Resource Information Unit, 2001, p. 52). The joint venture had been operating Lihir's mine since 1996, and the contract was renewed in 1999 with the stipulation that costs would be reduced by 11% (Mining Journal, 2000a). Lihir Gold expected that moving from contractor to direct mining would reduce total mining costs from $1.94 per metric ton to $1.45 per ton (Australian Journal of Mining, 2000b).

The Misima open cut gold and silver mine is located on Misima Island in the D'Entrecasteaux Islands Group, Milne Bay Province, approximately 240 km southeast of the Papua New Guinea mainland. Misima was a mature operation that experienced a decline in production as its gold grade dropped, the throughput fell as mining became more confined in the deeper parts of the open cut, and the ore became, on average, harder. The ore was free milling and required only crushing and grinding prior to treatment in a conventional carbon-in-pulp (CIP) circuit (Resource Information Unit, 2001, p. 53). Placer Dome Inc., which was the operator and 80% share holder, anticipated that mining would cease by March 2001 owing to the depletion of ore, although Placer Dome anticipated milling to continue until 2004 with the processing of stockpiled ore (Placer Dome Inc., 2000, p. 8). Gold production has declined to about 6,150 kilograms (kg) in 1999 from an average of 10,300 kg/yr from 1990 to 1995. Silver also declined to about 19,600 kg in 1999 from an average of 60,000 kg/yr from 1990 to 1995. These declines were forecast and were primarily the result of a combination of harder and lower grade ore as the mine approached closure (Australian Journal of Mining, 2000a). During the year, the Misima Mine Closure/Sustainability Plan was completed in preparation for the project's closure in 2004 (Orogen Minerals Ltd., 2000, p. 11).

The Mount Kare area properties are in Enga and Southern Highlands Provinces about 325 km west-southwest of the provincial capital and port of Madang, Madang Province. The area was first explored by CRA Ltd. between 1985 and 1993. In joint venture with the local landowners, CRA built a plant and started small-scale production of colluvial and alluvial gold. Between 1988 and 1990, about 31,100 kg (1 million troy ounces) of gold was mined. In 1996, Vancouver's Madison Enterprises Corp. acquired the right to majority ownership from Carpenter Pacific Resources NL of Perth by spending $8 million during a 5-year period. After Madison met this expenditure in 1997, a 73%-27% Madison-Carpenter merger was formed in 1998; it was subject to 10% held in trust for the Mount Kare landowners through Kare-Puga Development Corp. Pty. Ltd. In 1999, Madison bought out Carpenter. In 2000, Madison held 90% through Carpenter's subsidiary Matu Mining Pty. Ltd., and Kare-Puga Development held 10%.

According to an updated resource estimate that was released in February, contained ounces were increased by 20%, and ore tonnages increased by 37% compared with those presented in 1998. Total indicated and inferred resources were 25.5 Mt at 2.2 g/t gold and 29 g/t silver for a contained 70,000 kg of gold at a cutoff of 1 g/t (Resource Information Unit, 2001, p. 54).

The huge Porgera open cut gold mine is just north of the Kara deposits 620 km northwest of Port Moresby in the highlands of Enga Province. The mine was commissioned in August 1990 as a 1,500-metric-ton-per-day (t/d) high-grade underground mine. Underground mining was progressively reduced from 1995 until concluding in 1997. Open cut production gradually increased as underground production declined, although overall gold production had been expected to decrease as lower grade ore was mined and waste movement increased.

The gold present in Porgera's high-sulfide ore was refractory, and treatment consisted of conventional crushing and grinding followed by bulk flotation of the sulfides. The resulting concentrate was then oxidized in autoclaves and the gold was recovered by cyanide leaching in a conventional CIP plant. In 1998, which was the first full year solely from the open cut, production increased as the mining and haulage fleet expanded. By the end of 1999, Porgera had produced a total of 283,664 kg of gold (Resource Information Unit, 2000, p. 56).

Production in 2000 from the mine was well in excess of the expectation of 28,318 kg of gold; this was about 21% more than that of 1999. The increased yield was attributed to the selective mining of the high-grade ore in Stage 3 of the open cut where high-grade ore that remained from the underground mine was found. The mine also had higher productivity throughout 2000—an average of 209,000 t/d of ore and waste was moved, which was 10% higher than that of 1999—reflecting improved efficiencies in mining. Additionally, average gold recovery increased to 79% from 78% in 2000, which indicated improved productivity in milling (Orogen Minerals Ltd., 2000, p. 30).

Stripping of the Stage 4 pit continued throughout 2000, as did development of the 2-km-long pit-water drainage adit, the Drainex Tunnel, that was started during the third quarter of 1999. The adit will avoid expensive pumping for pit dewatering in future pit stages, as well as provide access to small high-grade ore pockets beyond the pit shell that could be used for the small-scale underground mining scheduled to start in 2001 (Resource Information Unit, 2001, p. 56).

Dome Resources NL's medium-sized, high-grade Tolukuma Mine, which is located in the rugged Owen Stanley Mountain Range 100 km north of Port Moresby, was atypical in that it was the only mining operation in the world that had been built, serviced, and operated with all materials and personnel transported to the mine site entirely by helicopters (Resource Information Unit, 2001, p. 58). The mine initially was an open cut operation when it started in 1995, but underground mining began in early 1997 and became the only mining method in early 1998. In 2000, mining at Tolukuma was hampered, which adversely affected gold production. Recovery levels in the mill were diminished owing to high levels of stibnite (an ore of antimony that often contains gold and/or silver) in the feed and low quantities of oxide ore available from the open cut; lower gold grade levels than planned; and inadequate availability of mining equipment. Additionally, the mine was closed for 10 days because a 1-t box of cyanide pellets was dropped by a chartered helicopter en route to the mine (Resource Information Unit, 2001, p. 58).

Nickel.—The Ramu nickel-cobalt deposit is at Kurumbukari about 75 km southwest of Madang in northern Madang Province. During 2000, all required licensing for development of the project to proceed, which included approval for the environmental plan in March, the SML and the mining development contract in July, and the memorandum of agreement between the State, developers, provincial and local-level Governments, and local landowners in October was approved and granted.

The development plan detailed that upgraded laterite ore was to be converted into a slurry and sent through a 134-km pipeline to the Basamuk Refinery on the Rai coast about 45 km across Astrolabe Bay from Madang and processed into nickel-cobalt concentrate by using pressure acid leach technology. Tailings

were to be disposed through a deep-sea submarine tailings disposal system. The refinery was to produce 33,000 t/yr of London Metal Exchange-grade cathode nickel by solvent extraction and electrowinning and 3,200 t/yr of cobalt metal during the 20-year life of the mine (Orogen Minerals Ltd., 2000, p. 34-35). The Ramu nickel resource, however, was expected to support a mine life of 40 years (Resource Information Unit, 2001, p. 86).

The $22 million bankable feasibility study completed in November 1998 estimated Ramu's resources to be 143 Mt at 1.01% nickel and 0.1% cobalt, which included minable reserves of 75.5 Mt at 0.91% nickel and 0.1% cobalt (Resource Information Unit, 2001, p. 86).

Silver.—Following a successful prefeasibility study, Perth, Australia-based Aurora Gold Ltd. announced early in the year that it would proceed to a bankable feasibility study at its 50%-owned Morobe silver-gold project. Aurora had been investigating the Morobe site since acquiring it, in partnership with the United Kingdom's Commonwealth Development Corp., from the administrator of the assets of Australian Gold Fields NL in September 1998 (Mining Journal, 2000b). The project is in Morobe Province 250 km north of Port Moresby and 10 km south of Wau.

The project included four EL's that covered 966 km^2; it comprised the Hamata, the Hidden Valley, the Kaveroi Creek, and the Kerimenge deposits, which were at an advanced exploration stage, as well as numerous identified prospects and significant anomalies. Morobe was forecast to produce about 9,300 kg/yr gold and 124,500 kg/yr silver during a mine life of 10 years. The bankable study was scheduled to be completed by the end of February 2001 (Resource Information Unit, 2001, p. 54).

Mineral Fuels

Petroleum and Natural Gas.—The Kutubu Oilfield, which was 480 km northwest of Port Moresby in Southern Highlands Province, was Papua New Guinea's first successful oilfield. The Kutubu Oilfield consisted of a number of producing wells in the Agogo and the Iagifu-Hedinia fields. Production in 2000 was 12 million barrels (Mbbl) of oil, which was 21% less than that of 1999 owing to natural field decline and increasing gas-production. Cumulative production since commercial production began in 1992 was 258 Mbbl of oil. Production from the Kutubu Oilfield was expected to decline by another 20% in 2001 as the field is depleted and increasing gas production from wells continues to constrain production.

In 2000, the main reservoir strategy to reduce production declines in succeeding years included a swing well program and the adjustment of choke sizes. This comprised the shutting-in of high gas-producing wells and prolonged production from low gas-producing wells with choke sizes adjusted to achieve high oil flow rates (Orogen Minerals Ltd., 2000, p. 16-17).

All production was transported to a marine loading terminal in the Gulf of Papua by pipeline for export mainly to the Asian and Australian markets. Oil was first discovered at Kutubu in 1986, and commercial production began in 1992 (Orogen Minerals Ltd., 1999, p. 12-13).

The Gobe Oilfield consisted of two separate fields—the Gobe Main and the SE Gobe—that are about 5 km apart, straddle two PDL's, and were operated by separate joint-venture partners (Resource Information Unit, 1999, p. 109). The field is located about 85 km southeast of the Kutubu Oilfield in the Gulf and the Southern Highlands Provinces and was Papua New Guinea's second petroleum field to begin commercial production. In 2000, total crude oil produced at the Gobe Oilfield was 10.3 Mbbl, or 18% less than that of 1999, owing to continued increased gas and water production and associated structural complications in the sandstone reservoir. Compared with production in 1999, production in 2000 from SE Gobe Oilfield was 4.8 Mbbl, which was a decrease of 25%, and that from Gobe Main was 5.5 Mbbl, which was a decrease of 10% (Oil Search Ltd., 2000, p. 19).

The Central Moran Oilfield, which was discovered in 1996, is in Southern Highlands Province. Significant progress was made toward beginning full field development during the year that culminated in the issuance of the new PDL-5 (formerly PPL-138), along with a variance to PDL-2 in early 2001. The Extended Well Testing (EWT) Program on the Central Moran Oilfield continued during 2000, with production from the Moran-4x well in PDL-5 beginning in April. In 2000, 3.1 Mbbl of oil was produced under the EWT, 1.2 Mbbl from wells in PDL-2, and 1.9 Mbbl from PDL-5; total cumulative EWT production to the end of December 2000 was 8.23 Mbbl; PDL-2, 6.36 Mbbl; and PDL-5, 1.87 Mbbl.

Construction of the necessary infrastructure and production facilities for Central Moran to be fully developed was expected to take about 18 months. Development would incorporate an oil processing capacity of 24,000 barrels per day of oil and gas handling capacity of 105 million cubic feet (Orogen Minerals Ltd., 2000, p. 20-21).

Natural gas produced by Oil Search Ltd. at its Hides Gasfield was sold to the Porgera joint venture for electricity generation at the Porgera gold mine. In 2000, a new record of 5.2 billion cubic feet of gas was produced; this was an increase of 4% compared with that of 1999 (1.41 million cubic meters) (Oil Search Ltd., 2000, p. 19).

The Chevron Asiatic Ltd.-managed group, which was working on the proposed natural gas pipeline from the Papua New Guinea highlands to the central eastern coast of Queensland, Australia, which is known as the Project, made less progress than expected during 2000. Elements that delayed the Project included the integration of gas reserves from the Hides Gasfield into the scheme and the necessity for obtaining approval for potential participants ExxonMobile Corp. of the United States and Australia's Santos Ltd. Some encouraging events included the passing of the Queensland Government Energy Strategy, which planned the use of natural gas for electricity generation in the state, and progress on a financial plan and equity arrangements for the Papua New Guinea Government and Papua New Guinea landowner participation in the Project infrastructure (Oil Search Ltd., 2000, p. 20). Further progress on the Project was dependent on the signing of gas sales term agreements, which included prices and volumes. Following these agreements, the Project was expected to move quickly into the front-end engineering and design phase. First commercial deliveries of gas to Queensland still were expected

in 2005 (Orogen Minerals Ltd., 2000, p. 24).

The Project was to include 635 km of pipeline within Papua New Guinea (320 km onshore, 315 km offshore) and 2,615 km within Australia (2,455 km onshore, 160 km offshore). When completed, the Project would transport natural gas from Papua New Guinean gasfields into Northern Queensland via the Torres Strait, down the Cape York Peninsula to the port city of Townsville, down to the industrial city of Gladstone, and on to the Queensland State capital city of Brisbane for an estimated cost of $2.5 billion. The Project included gas wells and associated infrastructure at the Gobe, the Hides, and the Kutubu oilfields and gasfields; a wet gas pipeline that would follow the route of the existing oil pipeline from the oilfields and gasfields to a processing facility off the coast in the Gulf of Papua that will separate the wet gas into its component product streams; and a dry gas pipeline that links with the Queensland markets.

Infrastructure

Essential elements of the transportation infrastructure included 19,600 km of roads, of which 686 km was paved and 18,914 km was unpaved. The length of island waterways totaled about 10,940 km and was of little importance to the transportation industry. Of the 492 airports, 19 principal airports had permanent-surface runways. International shipping ports included Kieta, Lae, Madang, Port Moresby, and Rabaul. There were no railroads. The merchant marine fleet of ships of 1,000 t or more gross included 2 bulk and 10 cargo carriers, 1 chemical tanker, 1 combination ore carrier/oil tanker, 3 petroleum tankers, 1 container ship, and 3 roll on/roll off carriers (U.S. Central Intelligence Agency, 2000, Papua New Guinea—Transportation, World Factbook 2000, accessed May 17, 2000, at URL http://www.odci.gov/cia/publications/factbook/geos/pp.html).

The vast majority of the in-place infrastructure in the country was concentrated in the Provincial capitals; therefore, the lack of infrastructure for most of the country remained a distinct hindrance for the minerals industry, which included exploration, mine construction and development, and transportation of mined products.

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Major Sources of Information

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TABLE 1
PAPUA NEW GUINEA: PRODUCTION OF MINERAL COMMODITIES 1/

Commodity 2/		1996	1997	1998	1999	2000 p/
Copper, mine output, Cu content	metric tons	186,665	111,515	152,200	187,921	200,900
Gold, mine output, Au content	kilograms	51,573	48,482	61,641	65,747	74,300
Gas, natural	million cubic meters	1,990	1,192	1,378	1,353	1,400
Natural gas liquids	42-gallon barrels	110,800	94,764	105,527	105,460	106,000
Petroleum, crude	thousand 42-gallon barrels	38,641	27,592	29,479	32,020	33,000
Silver, mine output, Ag content	kilograms	59,036	49,165	59,294	66,542	73,200

p/ Preliminary.
1/ Table includes data available through April 27, 2001.
2/ In addition to the commodities listed, cement and crude construction materials (common clays, sand and gravel, and stone) are produced, but output is not reported quantitatively, and available general information is inadequate to make reliable estimates.

TABLE 2
PAPUA NEW GUINEA: STRUCTURE OF THE MINERAL INDUSTRY IN 2000

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity e/
Cement	thousand tons	PNG-Halla Cement Pty. Ltd. (Halla Cement Corp. of the Republic of Korea, 50%; Government of Papua New Guinea, 50%)	Lae, Morobe Province	500
Cobalt	do.	Ramu Nickel Ltd., 68.5% and Orogen Minerals Ltd., 31.5%	Ramu nickel-cobalt project, Madang Province. 75 kilometers southwest of Madang 1/	3
Copper	do.	Ok Tedi Mining Ltd., operator [BHP Ltd., 52%; Government of Papua New Guinea, 30%; and Inmet Mining Corp. (Canada), 18%]	Ok Tedi open-cut, Western Province. 390 kilometers southwest of Wewak	210
Gold		Lihir Gold Ltd., operator, 100%	Lihir open-cut mine, Lihir Island, New Ireland Province. 700 kilometers northwest of Port Moresby	18
Do.		Misima Mines Pty. Ltd. [Placer Dome Inc., operator, 80%, and Orogen Minerals Ltd., 20%]	Misima open-cut, Misima Island, Milne Bay Province.	6
Do.		Aurora Gold Ltd., manager, 50%, and CDC Financial Services (Mauritius) Ltd., 50%	Morobe open-cut, 10 kilometers south of Wau, Morobe Province 2/	9
Do.		Ok Tedi Mining Ltd., operator [BHP Ltd., 52%; Government of Papua New Guinea, 30%; and Inmet Mining Corp. (Canada), 18%]	Ok Tedi open-cut, Western Province. 390 kilometers southwest of Wewak	20
Do.		Placer Dome Inc., operator [Highlands Gold Properties Ltd., 25% and Placer (PNG) Ltd., 25%]; Goldfields Porgera Ltd., 25%; Orogen Minerals Ltd., 20%; Minerals Resources Porgera Ltd., 5%	Porgera open-cut, Enga Province. 620 kilometers northwest of Port Moresby	30
Do.		Dome Resources NL, 100%	Tolukuma underground mine, Central Province. 100 kilometers north of Port Moresby	2
Nickel	thousand tons	Ramu Nickel Ltd., 68.5% and Orogen Minerals Ltd., 31.5%	Ramu nickel-cobalt project, Madang Province. 75 kilometers southwest of Madang 1/	33
Silver		Misima Mines Pty. Ltd. [Placer Dome Inc., operator, 80%, and Orogen Minerals Ltd., 20%]	Misima open-cut, Misima Island, Milne Bay Province.	100
Do.		Aurora Gold Ltd., manager, 50%, and CDC Financial Services (Mauritius) Ltd., 50%	Morobe open-cut, 10 kilometers south of Wau, Morobe Province 2/	124
Natural gas	thousand cubic meters per day	Oil Search Ltd., operator, 100%	Hides Gasfield, Southern Highlands Province. Onshore Papuan Basin, Petroleum Development License 1	425
Petroleum	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%; ExxonMobile Corp., 14.52%; Petroleum Resources (Kutubu) Ltd., 6.75%; and Merlin Petroleum Co., 6.78% Petroleum development License 5: ExxonMobile Corp. and manager, 47.5%; 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 3/	15
Do.	do.	Chevron Niugini Ltd., operator and manager, 19.37%; Oil Search Ltd., 27.14%; Orogen Minerals Ltd., 30.19%; ExxonMobile Corp., 14.52%; Merlin Petroleum Co., 6.78%; and Petroleum Resources Ltd., (Gobe), 2.0%	Gobe Main Oilfield, Southern Highlands Province. Onshore Papuan Basin, Petroleum Development License 4	10
Do.	do.	Chevron Niugini Ltd., operator and manager, 19.37%; Oil Search Ltd., 27.14%; Orogen Minerals Ltd., 25.44%; ExxonMobile Corp., 14.52%; Petroleum Resources (Kutubu) Pty. Ltd., 6.75%; Merlin Petroleum Co., 6.78%	Kutubu Oilfield, Southern Highlands Province. Onshore Papuan Basin, Petroleum Development License 2	50
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	10

e/ Estimated.

1/ Special Mining Lease, the final stage of the permitting process, was granted in July and a bankable feasibility study was completed by yearend. Mine and plant construction would be about 30 months once a positive production decision had been made and financing was in place.

2/ Feasibility study underway.

3/ The Central Moran Oilfield [petroleum development licenses (PDL) 2 and 5] will operate as a unit when developed, and equity interest in each will be PDL-2, 45%, and PDL- 5, 55%, based on the proven and probable original oil in place.