THE MINERAL INDUSTRIES OF CAMBODIA AND LAOS

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CAMBODIA

Cambodia, which is located north of the Gulf of Thailand, south of Laos, southeast of Thailand, and southwest of Vietnam in Southeast Asia, is a small country with a total area of about 181,000 square kilometers (km^2), or about the size of Missouri. In 2004, it had a population of about 13.4 million. The country was one of the poorest and least developed in the Asia and the Pacific region. Its per capita gross domestic product (GDP) and GDP, based on purchasing power parity, were estimated to be $2,074 and $29.2 billion, respectively, in 2004 (U.S. Central Intelligence Agency, 2005§[1]; International Monetary Fund, 2005§).

The country's mineral resources were largely unexplored and unexploited. The identified mineral resources were ruby, sapphire, and zircon in the northwestern Province of Batdambang and manganese, phosphate, and salt in the central part of the country (Royal Government of Cambodia, 2004§). In addition to natural gas and petroleum, Cambodia has geologic environments that have the potential to host resources of bauxite, copper, gold, granite, kaolin, limestone, pagodite, peat, sand and gravel, silica sand, slate, tin, and zinc (World Investment News, 2004§).

To attract domestic and foreign mining companies to invest in mineral exploration and development, the Law of Minerals Management and Mining of Cambodia was promulgated by the Government on July 13, 2001 (United Nations, 2002§). The Ministry of Industry, Mines, and Energy (MIME) is the main Government agency that implements the law and the country's mineral policy. The Department of Geology and Mines and the Department of Energy under the MIME are responsible for developing the country's mineral resources, providing mining assistance to the private sector, and administering mining-related regulations and inspections (Asian Journal of Mining, 2000).

Under the country's mineral exploration policy, interested investors and companies are granted an exploration license by the Cambodia Development Council (CDC) for a period of 2 to 6 years to explore and then prepare a feasibility study in a designed area, and the MIME provides assistance with technical recommendations. Following a successful exploration, investors and companies are required to submit a master project plan for mine development. If successful, then the CDC grants a mining license to investors or companies. Royalties and surface rentals are levied on mined minerals. In addition to royalties and surface rentals, investors or companies are required to pay income tax when the mining operations become profitable. The MIME offers investors or companies production-sharing contracts with low tax rates or concessions with high tax rates (World Investment News, 2004§).

The mining sector, which was still in its infancy, was the smallest sector of the Cambodian economy and contributed only a small fraction (about 0.3%) of the country's GDP. According to Labor Force Survey of Cambodia estimates, the total workforce in the mining and quarrying sector was about 11,000 compared with Cambodia's total workforce of 6.3 million (International Monetary Fund, 2004). In 2004, Cambodia's GDP grew by 4.3% compared with 5.2% in 2003. The country's GDP, in current prices, was estimated to be $4.4 billion compared with $4.2 billion in 2003 (International Monetary Fund, 2005§).

According to the Cambodian Department of Mineral Resources Development, the mining activities in Cambodia during the past 2 years involved production of construction aggregates, laterite blocks (red soil), phosphate rock, salt, sand and gravel, and stone. Crushed stone and sandstone were produced mainly in the Kampong Speu area and in several locations between Phom Penh and Takeo. Phosphate rock was mined and processed in the Tul Meas area in the Province of Kampot or processed at a small plant in the Province of Batdambang. Salt was produced from evaporating seawater in the coastal area of the Gulf of Thailand.

In 2004, the International Investment Development Group of Cambodia signed an agreement with Henan Jinqu Gold Company of China to establish the JINQUMINERALS Co. Ltd. to prospect, mine, and smelt gold and silver in the Province of Mondol Kiri. The Chinese company was to take a 90% interest in the joint venture by investing about $17 million in the project, and the International Investment Development Group of Cambodia was to take the remaining 10% interest (Infomine-china.com, 2004§).

According to the Hong Kong-based Corporate Social Responsibility in Asia (CSR Asia), a report disclosed in September 2004 that the increased use of highly toxic chemicals in gold mining had caused serious environmental damage and health hazards in the Cambodian countryside. The official records, however, showed no gold production in Cambodia for the past several years. According to the report, most of the 19 known gold deposits in Cambodia used toxic mercury and cyanide techniques to extract gold. Between 5,000 and 6,000 people, most of whom were unskilled migrant workers, worked as gold miners during the peak mining season from November to May and were, consequently, exposed to serious health risks because of a lack of protective gear and poor training in storing, using, and disposing mercury and cyanide. A case of cyanide poisoning in a river in northeastern Cambodia caused by mining operations early in 2004 reportedly had caused many deaths of fish and cattle. Some villagers felt sick after drinking the contaminated ground water. Other environmental damages included deforestation and the disappearance of wildlife (CSR-Asian.com, 2004§).

Cambodia reported no proven reserves of natural gas and petroleum. Cambodia and Thailand had overlapping claims in

[1]References that include a section mark (§) are found in the Internet References Cited sections.

a 27,000-km^2 area of the Gulf of Thailand thought to be rich in hydrocarbons. According to an estimate that was based on 12,000 line-kilometers of high-quality seismic data, the overlapping claims area was believed to contain about 311 billion cubic meters of natural gas reserves and an undetermined amount of natural gas liquids and petroleum.

In 2002, the Cambodia National Petroleum Authority awarded block A, which covers a 6,278-km^2 area in the overlapping claims area, to a consortium led by CheveronTexaco Corp. of the United States. In 2004, LG-Caltex Oil Corp. acquired a 15% interest in exploration block A from ChevronTexaco and paid about $18 million. A preliminary study estimated that the block could contain about 400 million barrels of crude petroleum and about 85 billion cubic meters of natural gas. During 2003, CheveronTexaco, which was the operator of block A, drilled one exploration well with subcommercial results. New three-dimensional seismic data were acquired and processed over a portion of the block; as a result, four additional exploration wells were drilled by CheveronTexaco in 2004. In late 2004, Cambodia's National Assembly President disclosed to local reporters that ChevronTexaco had struck a commercially viable oilfield and would start production by 2007. According to ChevronTexaco, however, the company needed to complete the drilling program and to assess the well results fully before it could determine the commercial potential of the oil finds in the Gulf of Thailand (ABC Radio Australia, 2005§; Agency Kampuchea Press, 2004§)

Outlook

The mining sector is expected to remain the smallest sector of the Cambodian economy during the next 5 years unless economically viable reserves of oil and natural gas in block A are discovered and developed by the consortium led by ChevronTexaco by 2007. Cambodia's economy as measured by GDP has been forecasted to grow by 1.9% in 2005 and 4.3% in 2006 (International Monetary Fund, 2005§).

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LAOS

Laos, which is located north of Cambodia, southeast of Burma, south of China, northeast of Thailand, and west of Vietnam in Southeast Asia, is a small landlocked country with a total area of about 237,000 km^2. In 2004, it had a population of about 6.1 million. Laos was one of the poorest and least developed countries in the Asia and the Pacific region. In 2004, the per capita gross domestic product (GDP) and GDP, based on purchasing power parity, were estimated to be $1,921 and $11.1 billion, respectively (U.S. Central Intelligence Agency, 2005§; International Monetary Fund, 2005§).

The identified mineral resources in Laos were barite, clays, coal, copper, dolomite, gold, graphite, gypsum, limestone, rock salt, sapphire, silver, tin, and zinc. Laos has geologic environments that have the potential to host such other resources as antimony, asbestos, bismuth, cobalt, iron ore, kaolin, lead, lignite, manganese, molybdenum, potash, silica sand, and tungsten. There are geologic environments that are favorable for the occurrence of coal, copper, gold, iron ore, potash, rock salt, and tin (Asian Journal of Mining, 2000).

The mining sector, which was dominated by the mining of gold, gypsum, limestone, and tin, was the smallest sector of the Laotian economy. The mining sector was estimated to contribute 0.3% to the country's GDP. In 2004, Laos' real GDP growth was estimated to be 6% compared with 5.3% in 2003 (International Monetary Fund, 2005§). According to the Department of Geology & Mines, production of mineral commodities in 2002 and 2003 included barite, carbonate rocks (construction aggregate and limestone), clay, coal, gemstones (ruby and sapphire), gold, gypsum, rock salt, sand and gravel, silver, tin, and zinc (table 1). Most mining activities in Laos were small scale and owned and operated by State-owned mining enterprises or by joint ventures of State-owned companies and foreign companies.

To promote and encourage foreign investment in the mining sector, a mining law was promulgated by the Government on April 12, 1997, and fiscal incentives (tax holidays) for minerals exploration were also provided. By October 1998, 21 licenses had been issued to foreign companies—8 were for construction materials (clay, granite, gypsum, limestone, and sandstone) exploration; 5, gold; 3, coal; 2, tin; and 1 each, oil and gas, sapphire, and zinc (Asian Journal of Mining, 1999).

By 2004, Oxiana Ltd. of Australia had invested about $330 million and Pan Australian Resources, N.L. (PARNL) of Australia was expected to invest up to $165 million for exploration and development of copper and gold projects in Laos. Padaeng Industry Public Co. Ltd. of Thailand had been investing in the exploration and development of a zinc project in Laos during the past 4 years. These three companies were expected to continue to invest in exploration and development of copper, gold, silver, and zinc resources in Laos (Far Eastern Economic Review, 2004).

In 2004, the Sepon gold mine, which was owned and operated by Lane Xang Minerals Ltd. (100% owned by Oxiana through its wholly owned subsidiary Oxiana Resources Laos Ltd.), produced 2.5 million metric tons (Mt) of ore at a grade of 3.01 grams per metric ton (g/t) gold compared with 1.57 Mt at a grade of 4.42 g/t gold in 2003. The mill (treatment plant) processed 1.38 Mt of ore at grades of 3.73 g/t gold and 6.33 g/t silver compared with 1.17 Mt of ore at grades of 5 g/t gold and 8.41 g/t silver in 2003. Recovery rates for gold and silver were 85.4% and 31.3%, respectively, compared with 87.7% and 39.0%, respectively, in 2003. In 2004, mine production of gold and silver from the Sepon gold mine was 4,392 kilograms (kg) (141,213 troy ounces) and 2,735 kg (87,920 troy ounces), respectively, compared with 5,140 kg (165,255 troy ounces) and 3,850 kg (123,782 troy ounces), respectively, in 2003. The total cash operating cost rose to $6,076 per kilogram ($189 per troy ounce) from $4,340 per kilogram ($135 per troy ounce) in 2003 owing mainly to increased royalties and operating costs. As a result, the total production costs (cash operating cost plus depreciation, depletion, amortization, and rehabilitation) rose to $8,295 per kilogram ($258 per troy ounce) from $6,848 per kilogram ($213 per troy ounce) in 2003 (Oxiana Ltd., 2004a§).

In 2004, the designed capacity of the Sepon gold-processing plant was expanded to 2.5 million metric tons per year (Mt/yr) from 1.25 Mt/yr. Design and construction of the expansion project was completed on schedule in 10 months with a budget of $32 million. The expansion project included a new larger capacity crusher and ball mill and four new larger carbon-in-leach tanks. By the end of 2004, Oxiana also completed the Sepon copper-processing plant. Mining of the Khanong copper ore body began in late 2004, and about 45,800 metric tons (t) of ore was mined and stockpiled by the end of 2004. The mine, which was officially scheduled to start in February 2005, will have a capacity to produce 1.3 Mt/yr of ore that would be processed by a plant that will use a whole of ore leach; the resulting liquid will be processed by solvent-extraction electrowinning. The copper-processing plant was designed to produce 60,000 metric tons per year (t/yr) of copper cathodes. The $235 million Khanong copper project was scheduled to start production of copper cathode by the end of March 2005. Ramp up to full production rates of 60,000 t will continue throughout the year with an initial planned production of 30,000 t anticipated in 2005 (Oxiana Ltd., 2004b§).

In December 2004, PARNL announced that it awarded the Lead Consultant's contract to Ausenco Ltd. for the Phu Kham copper-gold feasibility study in the southeastern part of the 2,600-km^2 Phu Bia contract area, which was located about 100 km northeast of Loas' national capital Vientiane. The bankable feasibility study contract included metallurgical and infrastructure studies by Ausenco, a mineral resources estimation by Hellman & Schofield Pty Ltd, an open pit mine design and ore reserve estimation by Australian Mine Design and Development Pty Ltd., drilling and blasting studies by Tim Hagan Blasting Pty Ltd., geotechnical and hydrological studies by Knight Piésold Pty Ltd., and an environmental impact assessment by Earth System Lao. The feasibility study, which was scheduled for completion in August 2005, was expected to confirm the potential for the Phu Kham copper-gold deposit to support an economically viable mining and processing operation at processing rates of 9 Mt/yr with a capital cost of $138.6 million and 12.5 Mt/yr with a capital cost of $163.8 million; annual copper-gold production could range from 57,600 to 100,000 t of copper and from 1,617 kg (52,000 troy ounces) to 2,239 kg (72,000 troy ounces) of gold in concentrate (Pan Australian Resources, N.L., 2004c§).

According to the preliminary study completed by PARNL in March 2003, which focused in the metallurgical and processing characteristics of the Phu Kham copper-gold deposit, the estimated cash operating cost range between $0.47 per pound copper and $0.54 per pound copper with a capital cost range between $138.6 million for the 9-Mt/yr scenario and $163.8 million for the 12.5-Mt/yr scenario and a recovery rate of 80% copper for a 25% grade in concentrate and a recovery rate of 60% gold for a 9-g/t grade in concentrate. Mine life was estimated to be 10 years. The Phu Kham copper-gold deposit is part of a copper-gold porphyry system. Overlying the sulfide copper-gold deposit is an oxide gold cap, which will be mined as part of the Phu Bia gold project. The gold cap would be removed as part of the prestrip for the Phu Kham copper-gold project, which was estimated to contain 213 Mt of inferred mineral resources at grades of 0.6% copper and 0.3 g/t gold that contains 1.27 Mt of copper and nearly 62,200 kg (2 million troy ounces) of gold at a 0.3% copper cut-off grade or 108 Mt at grades of 0.8% copper and 0.3 g/t gold that contains 907,200 t of copper and 31,100 kg (1 million troy ounces) of gold (Pan Australian Resources, N.L., 2004a§).

In July 2004, the feasibility study for the Phu Bia gold project was completed for PARNL by Metallurgical Design & Management Pty Ltd. The study confirmed that the project could support a technically and economically robust oxide heap-leach gold mine based on proved and probable oxide ore reserves of 7.5 Mt at 1.1 g/t for 8,100 kg (262,000 troy ounces) of contained gold. In November 2004, as a result of resources drilling and pit optimization studies, PARNL revised its estimated proved and probable oxide ore reserves at the Phu Bia gold project, which included the Phu Kham Gold Cap, the Ban Houayxai, and the Long Chieng Track deposits, to 8.6 Mt at 1.1 g/t for about 9,300 kg (300,000 troy ounces) of contained gold.

The Phu Bia gold project was scheduled to start gold production in March 2005 (Pan Australian Resources, N.L. 2004b§, c§).

First Pacific Mining Company reportedly signed a contract with the Planning and Cooperation Committee in 2003 to build a plant and start mining in a 20-km^2 area of Pha Luan in Vang Vien, Vientiane Province, following completion of the survey work in a 56-km^2 area, which started in early 2002. The contract allowed First Pacific Mining to mine barite, lead, and zinc for 18 years. The company reportedly had invested $2 million for the survey work and mine development. The project would create about 200 jobs, upgrade roads, and supply electricity in the area's villages (Embassy of Laos in Washington, D.C., 2003§).

Vietnam Economic Cooperation Company reportedly obtained a permit from the Laotian Government in February 2004 to explore and survey gypsum deposits in Nadon Hamlet, Thakhec Town, Kammuon Province. The project involved an 18-month exploration and survey in a 1,550-hectare area with startup capital of $1 million; during the past 6 months, a report on technical and economic facts would be prepared (VietnamTrade.org, 2004§).

Outlook

In the next 4 years, the mining sector is expected to expand considerably. Oxiana is expected to increase its gold production capacity and to begin copper production at its Khanong copper mine by 2005. Production capacities of copper and gold could be increased further following the development of the Phu Kham copper-gold project and the Phu Bia gold project by PARNL in the next 2 years. The Laotian economy is expected to grow by 7% in 2005 and 6.5% in 2006 (International Monetary Fund, 2005§).

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TABLE 1
CAMBODIA AND LAOS: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Country and commodity		2000	2001	2002	2003	2004[e]
CAMBODIA[2]						
Cement, clinker[e]		--	--	--	--	--
Gravel		12,800 [e]	1,880	9,800 [r]	13,800 [r]	10,000
Laterite, blocks		29,700	42,800	381,400 [r]	228,900 [r]	230,000
Phosphate fertilizer		3,617	900	115 [r]	-- [r]	--
Quartz sand		17,017	5,050	--	1,000	--
Sand, construction materials		690,000 [e]	563,860	505,960 [r]	207,800 [r]	500,000
Stone, crude construction material		248,100	280,740	567,500 [r]	713,600 [r]	600,000
Salt		40,000 [e]	11,000	72,500	36,000 [r]	40,000
LAOS[3]						
Barite		2,000	4,400	12,695 [r]	18,070 [r]	18,000
Coal, bituminous		126,290	122,942	233,923 [r]	212,819 [r]	220,000
Cement[e]		92,000	92,000	240,000	250,000	250,000
Gemstones	carats	189,284	--	833,984 [r]	2,302,973 [r]	800,000
Gold	kilograms	--	--	--	5,368 [r]	4,400
Gypsum		131,517	121,220	110,272	101,727 [r]	102,000
Limestone		221,600	287,900	1,315,140 [r]	379,000 [r]	400,000
Salt, rock		1,779	2,635	5,410	16,130 [r]	15,000
Silver	kilograms	--	--	--	3,850	2,740
Tin, mine output, Sn content		408	490	366	360	340
Zinc, mine output, Zn content[e]		60	9,310 [r]	370 [r]	850 [r]	300

[e]Estimated; estimated data are rounded to no more than three significant digits. [r]Revised. -- Zero.

[1]Table includes data available through May 27, 2005.

[2]In addition to the commodities listed, clay, gemstones, gold, iron ore, and lime are presumably produced, but available information is inadequate to make reliable estimates of output levels.

[3]In addition to the commodities listed, crude construction materials, such as sand and gravel, and varieties of stone were produced irregularly.

Sources: Asian Journal of Mining, Asian Mining Yearbook (11th ed.), 2000, p. 13; Cambodia's Ministry of Industry, Mines and Energy; Laos' Ministry of Industry and Handicraft; U.S. Geological Survey Minerals Questionnaires for Cambodia and Laos, 2002-03; Oxiana Ltd. Annual Report 2004.