

THE MINERAL INDUSTRY OF

BURMA

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Burma, which is located in Southeast Asia, is bordered by Bangladesh, China, India, Laos, and Thailand and by the Andaman Sea and the Bay of Bengal. Burma has an area of 678,000 square kilometers and had a population of about 52 million in 2001 (International Monetary Fund, 2002; U.S. Central Intelligence Agency, 2002§¹).

Minerals production in Burma was minor and mostly used for domestic consumption with the exception of antimonial lead, copper matte, nickel speiss, and precious gemstones. Almost all the copper produced in Burma was exported to Japan. In 2002, Burmese mine production included barite, carbonate rocks, chromite, clays, coal (lignite), copper, feldspar, gold, gypsum, lead, natural gas, nickel, petroleum, salt, silver, tin, tungsten, and zinc. The country also produced processed mineral products, such as cement, refined copper, polished precious gemstones, refined gold, refined lead, nitrogen fertilizer materials, refined petroleum products, refined silver, crude steel, and refined tin.

In 2002, the gross domestic product (GDP) for Burma grew by 5.5%, which was about one-half the growth achieved in 2001 (10.5% revised) (International Monetary Fund, 2003§). Flooding during 2002 and agricultural shortages of, for example, fertilizers and pesticides affected the agricultural output, which accounted for more than 40% of the country's GDP, thus causing a significant decrease in GDP when compared with that of 2001 (Asian Development Bank, 2003§). In 2002, the mining sector represented only 0.8% of the GDP; in 2001, it had represented 2%. The decrease was principally a consequence of a decline in foreign investment for exploration and mining projects (Than Htay, 2002). Price inflation dropped to below 4% in 2001 after an economic slowdown during fiscal year 2000,² but it increased rapidly, and by the end of December 2002, inflation had risen to 56.8%. The main reason for the high rate of inflation was the increase in salaries of public sector employees, which was financed by the Central Bank (Asian Development Bank, 2003§).

According to the Department of Geological Survey and Mineral Exploration (DGSME), which reports to the Ministry of Mines of Burma, only four foreign exploration companies remained in Burma and invested \$217,000³ during fiscal years 2001 and 2002. Of these four, the only two that were active in 2002 were Ivanhoe Myanmar Holding Ltd. (IMHL) [a subsidiary of Ivanhoe Mines Ltd. (IML) of Canada] (gold) and Cornerstone Resources Ltd. (zinc); the remaining two, which explored for copper and gold, ceased mainly because

of a shortage of funds. Six mines were still operated under state ownership—Bawdwin, Bawsaing, and Yadanatheingi (nonferrous metals); Kalewa and Namma (coal); and Kyaukpahto (gold). The companies under the Ministry of Mines were Mining Enterprise No. 1 (ME-1), No. 2 (ME-2), and No. 3 (ME-3). The state-owned enterprises maintained several joint ventures with private local and foreign companies. From 2001 through March 2002, no new foreign mining company had committed to invest in Burma's mining sector compared with three in 2000 (Than Htay, 2002). In general, mineral production in 2002 was lower than that of 2001.

In an effort to boost foreign investment, the Government of Burma modified the Foreign Investment Law and the Myanmar Mines Law and created a series of incentives to attract international metal producers and mining companies by mid-2002. Some of the changes include a tax holiday during the construction of a mining project and a 3-year tax break from the startup of commercial production. Also, the rate of royalty required by the Government has decreased; for gold and other precious metals, it dropped to 2.5% from 5%, and for base and other metals, to 2% from 4%. Another significant change is the elimination of production sharing between the foreign investor and the local private partners. The only requirement of the Government is its option to buy shares from the investors' project once the investors have recovered the initial investment; in this way, the Government can have an ownership of 50% (Metal Bulletin, 2002c).

The DGSME had completed geologic maps of up to 77% of the country and found occurrences of coal, copper, fluorite, gold, and sapphire in 14 localities. As part of a memorandum of understanding signed in 2001 between the DGSME and the International Scientific and Technological Co-operation Department of China, Chinese geologists studied and analyzed some polymetallic lead-silver-zinc, copper, gold, and platinum-group-metal deposits in northeastern Burma.

The DGSME explored for coal and lignite to fulfill the coal demand that resulted from the Government's decision to install coal-fired powerplants in Burma. Several coal deposits have been found in the townships of Ngape, Pauk, Saw, and Sidoktaya, which are located in the Magwe Division, central Burma. The coal seams range in thickness from 0.3 to 1.5 meters (m); two sites in Shan State Pinlaung Township have three coal seams that range in thickness from 0.3 to 0.9 m; and Aungban Township has six coal seams that range in thickness from 0.3 to 1.5 m. Another 33 coal outcrops that cover an area of 2.7 by 1.3 kilometers (km) have been found in the Seikphyu Township, Magwe Division. Studies indicated that the total resource of this site consists of 1.1 million metric tons (Mt) of lignite and subbituminous coal. Other mineral exploration activities conducted by the DGSME included exploration for

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

²For Burma, the fiscal year runs from April 1 to March 31.

³Where necessary, values have been converted from Burmese kyat (MMK) to U.S. dollars at the rate of MMK6.64434=US\$1.00.

chromite and gypsum. Chromite has been found in the Falam and the Kale Townships, and a 7-Mt gypsum resource was identified at Mankaung, Thibaw Township (Than Htay, 2002).

During 2002, Cornerstone Resources (Burma) Ltd. of Australia was active in Burma for the third year. The company conducted a drilling program in the area of the Loncheng zinc deposit as a result of geologic assessments that indicated geochemical anomalies. It drilled 10 holes for a total depth of 553 m in Hill No. 1, and 5 holes for a total of 226 m in Hill No. 2. At yearend, findings were disappointing; only a few thousand metric tons of massive smithsonite was found (Than Htay, 2002).

IMHL focused its exploration activities in the Kyauksayit-Modi Taung area, Yamethin Township, Mandalay Division. Geologic mapping, surface trenching, and drilling in the area revealed five gold-quartz mesothermal veins approximately 200 m apart. The thicknesses of the veins ranged from 0.3 to 2.7 m. Almost 80% of the samples collected had uncut gold grades of between 20 and 50 grams per metric ton (Than Htay, 2002). Underground development and core drilling was started in the high-grade gold-bearing quartz vein system at the Modi Taung Project site of IML/IMHL outlined during earlier explorations (Ivanhoe Mines Ltd., 2003a); the site is located 150 km southeast of Mandalay in the Nankwe district. In 2002, IMHL came to an agreement with the Government of Burma to explore areas of block 10, which includes the Modi Taung project site. The agreement was renegotiated in 2002, and IMHL increased its interest to 65%. Also in conjunction with the Government of Burma, IMHL has the right to establish a joint venture to develop minerals identified on the property (Ivanhoe Mines Ltd., 2003b).

In the Central Volcanic Belt of Burma, Myanmar Ivanhoe Copper Co Ltd. (MICCL) (a 50-50 joint venture of IMHL and ME-1) was involved in the Monywa Copper Project. The Monywa Project included the Sabetaung and Kyisintaung Mine (S&K Mine) and the Letpadaung deposit (6 km south of the S&K Mine). Studies in the area began in 1999 when the Metal Mining Agency of Japan (MMAJ) conducted the Indochina-Malay Project, which was a study of the Volcanic Belt from Pinlebu-Banmauk to Taungni (Mount Popa) to evaluate copper deposits in the region. The Indochina-Malay Project included an airborne geophysical survey and a regional geochemical baseline study. In 2002, IMHL reported that total ore reserves at the Monywa Project exceeded 800 Mt (Miyatake, 2002).

The S&K Mine was an open pit copper mine and solvent extraction-electrowinning (SX-EW) plant (Ivanhoe Mines Ltd., 2002c§). The S&K Mine is located in Salingyi Township, west of Monywa, west-central Burma. This mine began production in November 1998; capacity at the SX-EW plant was 30,000 metric tons per year (t/yr) of grade A, 99.99% copper cathode (Metal Bulletin, 2002a; Than Htay, 2002; Embassy of the Union of Myanmar, New Delhi, India, undated§). The Japanese company Marubeni Corp. supplied a project loan of \$90 million to the joint venture in exchange for taking almost all the copper cathode produced by the plant (Metal Bulletin, 2002a). By the end of 2002, MICCL had repaid \$45 million of the loan. A copper sale agreement between the joint venture and Marubeni stated that Marubeni had the exclusive right to market and sell all the copper produced at the Monywa Copper Project in any country throughout the world. The joint venture granted the Government of Burma the option to purchase no more than 10%

per year of the copper cathode production (Ivanhoe Mines Ltd., 2002b§). During 2002, copper cathode production at the S&K Mine increased by about 8% compared with that of 2001 even though the production of cathode was affected by an increase in clay residues encountered in the ore zone. The clay materials diminished the efficiency of leach kinetics and copper extraction. In 2002, a fine material removal pilot plant was constructed, and depending on its success, another plant would be added to the crushing circuit in 2003. Expectations included the sufficient removal of fine material from the ore for the optimum copper leach extraction (Ivanhoe Mines Ltd., 2002a§).

The total operating profit of the S&K Mine in 2002 decreased by \$1.5 million compared with the profit of \$6.3 million in 2001. Administrative costs increased by 28% mainly because of high insurance costs and a mining cost increase of 44%, which were mainly caused by elevated heavy equipment rentals and increases in fuel cost. The processing phase costs increased by 28% owing to increases in heavy equipment rentals (19%) and as a result of the cost of power (9%). Improvements in the S&K Mine for 2002 and 2003 included the construction and expansion of heap pad No. 3 and an additional 303,000 square meters of heap leach; this upgrade will increase the capacity for ore under leach and copper availability (Ivanhoe Mines Ltd., 2002a§).

The Letpadaung deposit had a proposed production of 125,000 t/yr; drill tests indicated the presence of 1,000 Mt at 4% copper. IMHL and ME-1, which were the owners and operators of this project, were planning to develop the project in five consecutive stages; each would be an increase of 25,000 t/yr every 2 years for a final production of 125,000 t/yr. The decision to separate the project into stages was made because of debt servicing and the power supply shortage in the area (Metal Bulletin, 2002b; Than Htay, 2002). During 2002, the joint venture negotiated to finance the development of the Letpadaung deposit. A number of possible foreign investors included Chinese, Japanese, and Korean companies. Another option being considered by the Letpadaung Project management was the merging of this copper deposit with the existing S&K Mine. The approximate cost of the Letpadaung deposit was estimated to be \$390 million; this included about \$25 million to build power transmission lines from the Thazi substation, which is located south of Mandalay (Metal Bulletin, 2002c; Ivanhoe Mines Ltd., 2002a§).

ME-1 owned and operated three mines that produced copper, lead, and zinc in Shan State—Bawdwin, Bawsaing, and Yadanatheingi. The mineral-processing complex Namtu-Bawdwin produced antimonial lead, copper matte, and nickel speiss as byproducts for export and lead metals, refined silver, and zinc concentrate. The Namtu-Bawdwin management acquired a blast furnace to upgrade the purity of the lead and silver production. The furnace had the capacity to smelt 50 metric tons per day of lead concentrate with an average of 40% lead and with a tolerance of 3% copper and 8% zinc. In addition to these improvements in the smelting sector, the Chinese company M-Apex Construction Co. Ltd. built a zinc-fuming plant to produce zinc oxide from zinc slag. One company that benefited from the fuming plant was the ME-1, which earned foreign exchange from the slag sales and the lease of the plant site. The other lead-zinc-producing mines were Bawsaing (lead

sulfide and lead carbonate) and Yadanatheingi (lead sulfide) (Than Htay, 2002).

Hawsaing Mining Co., Kachin National Development Co., and Wa Development General Trading Co., which were the local lead and zinc producers in Shan State, had production-sharing joint ventures with ME-1. Hawsaing and Kachin ceased operations in mid-2001, and Wa produced only smithsonite (zinc carbonate) during 2002 (Than Htay, 2002).

ME-2, which formerly managed tin-tungsten mines, was involved in joint ventures with Myanmar Pongpipat Co. Ltd. (MPC) of Thailand and six local mining companies. MPC mined tin from the Heinda deposit in Dawei Township, Tanintharyi Division. The tin and tungsten mixed ore were mined by the six local mining companies, which operated the Bokepyin, the Hermyingyi, the Kanbauk, the Kyaukmedaung, the Mawchi, and the Theindaw Mines in Tanintharyi Division. The production-sharing ratio between ME-2 and the local mines was 30 to 70, and that between ME-2 and MPC at the Heinda mine was 35 to 65. Additionally, ME-2 also had private leases in Dawai (Tavoy), Mawlamyaing, Myeik (Mergui), and Pyinmana Townships, Tanintharyi Division, southeastern and southern Burma. The only remaining property under ME-2's management was a gold property at Kyaukpahto in Kawlin Township, Sagaing Division. The conditions at the mine were poor, and work was hampered by a lack of equipment; the mining production quota was less than 25 kilograms per month. ME-2 maintained gold production-sharing joint ventures with Golden Family Co. It also maintained gold mining leases in Kachin State, Mandalay Division, and Mon State, Sagaing Division (Than Htay, 2002).

During 2002, ME-2 entered into the first profit-sharing joint venture with a foreign company [East Asia Gold Corp (EAGC)] to mine gold in Burma. The deposit is located in the Wethe area of Thabeikkyin Township, Mandalay Division. After paying 5% in royalties to the Ministry of Mines, the joint-venture ratio will be 25 (ME-2) to 75 (EAGC). The profit sharing will be effective after EAGC recovers all the expenses and costs incurred in the development of the mine (Than Htay, 2002).

ME-3 produced barite from the Heho and the Kyaukse Mines, Shan State; coal from the Kalewa Mine, Sagaing Division, the Namma Mine, Lashio Township, Shan State; gypsum from the Thibaw Mine, Thibaw Township, Shan State; and limestone from two quarries at Patheingyi near Mandalay and Pyinmana, Mandalay Division. It also managed other facilities that produced assorted raw materials, such as antimony, chromite, clays, manganese, and steatite. ME-3 operated an iron and steel plant in Pyin Oo Lwin, which was located 42 km east of Mandalay. It also had joint ventures with other foreign and local partners for the production of antimony concentrate, barite, coal, and dimension stone (Than Htay, 2002).

The Government expected to develop larger scale coal and lignite resources mines. The use of coal as a source of power was the most viable way of power owing to limitations of such other sources as gas, hydroelectric, and oil. Development of this source has been slow because of the unavailability of foreign and local investors. In 2002, ME-3 maintained joint ventures with other companies, such as the AAA International Co. Ltd. for subbituminous coal at the Sam Lao Mine in Thibaw Township, Shan State, and Ayeyarwaddy Myitphya

Co. for lignite in the Lweje area of Momauk Township, Kashin State. Upgrading the power generation infrastructure in Burma included the construction of the first coal-fired powerplant, which had a capacity of 120 megawatts (MW), at Tigyit (Hsikip), Pinlaung Township, Shan State. The plant was expected to begin generating electricity by 2003 and to consume 500,000 t/yr of coal. A drilling test at a coal deposit in Tigyit indicated a resource of 20 Mt, which would be sufficient to feed the plant for the next 40 years. Shwethanlwin Co. Ltd. would mine the coal for the plant through a joint venture with ME-3. Other plants that supplied power to Burma were gas-fired and hydroelectric stations that produced a total of 870 MW (Than Htay, 2002).

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Major Publications

- Central Statistical Organization, Yangon:
Statistical Yearbook, annual.
Selected Economic Indicators, monthly.
- World Bureau of Metal Statistics, United Kingdom:
World Metal Statistics, monthly.

TABLE 1
BURMA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	1998	1999	2000	2001	2002 ^c
METALS					
Chromium, chromite, gross weight ^c	4,059 ³	3,200	3,000	3,000	3,000
Copper:					
Mine output, Cu content	6,700 ^e	26,736	26,711	25,900 ^r	28,000
Matte, gross weight ⁴	58	142	125 ^r	60 ^e	100
Metal, refined	6,700 ^e	26,736	26,711	25,900 ^r	28,000
Gold, mine output, Au content ⁴	334	267	250 ^e	200 ^e	200
Iron and steel: ^{c,4}					
Pig iron	1,500	1,500	1,500	1,500	1,500
Direct-reduced iron	40,000	40,000	40,000	40,000	40,000
Steel, crude	25,000	25,000	25,000	25,000	25,000
Lead:					
Mine output, Pb content ^{e,5}	2,200	1,800	1,200	900 ^r	500
Metal:					
Refined	1,936	1,666	1,054	1,105 ^r	1,000
Antimonial lead (93% Pb) ⁴	116 ^r	65 ^r	117 ^r	-- ^e	--
Manganese, mine output, Mn content ^e	50	50	50	50	50
Nickel:					
Mine output, Ni content ^e	10	10	10	10	10
Speiss (matte), gross weight ⁴	31	77	60 ^r	40 ^e	40
Silver, mine output, Ag content ⁵	3,359	4,168	2,457	1,804 ^r	1,500
Tin, mine output, Sn content: ⁵					
Of tin concentrate	75	77	149	171 ^r	170
Of tin-tungsten concentrate	146	72	63	41 ^r	20
Total	221	149	212	212 ^r	190
Metal, refined	31	32	30 ^e	30 ^e	30
Tungsten, mine output, W content: ⁵					
Of tungsten concentrate	8	3	1	1	--
Of tin-tungsten concentrate	170	84	73	48 ^r	30
Total	178	87	74	49 ^r	30
Zinc, mine output, Zn content ⁵	474	279	437	467 ^r	350
INDUSTRIAL MINERALS					
Barite	22,004	24,651	30,370	31,015 ^r	18,000
Cement, hydraulic	364,959	338,025	393,355	377,961 ^r	460,000
Clays:					
Bentonite ⁴	1,066 ^r	998 ^r	978 ^r	900 ^e	900
Fire clay and fire clay powder ⁴	2,183 ^r	659 ^r	331 ^r	300 ^{r,e}	300
Feldspar ^{e,4}	12,000	12,000	12,000	10,000	10,000
Gypsum	36,411	44,857	48,067	64,609 ^r	113,000
Nitrogen, N content of ammonia	51,605	64,782	78,000	78,000 ^e	78,000
Precious and semiprecious stones:					
Jade	1,525,578	2,342,108	8,318,261	87,277 ^r	33,000
Diamond ^e	5	5	5	5	5
Rubies, sapphires, spinel ⁴	14,446,638	8,970,441	8,350,695	8,630,000	2,760,000
Salt ^{e,6}	35	35	35	35	35
Stone:					
Dolomite	4,468	2,523	166 ^r	4,922 ^r	3,400
Limestone, crushed and broken ^c	2,500	2,000	2,400	2,600 ^r	3,200
MINERAL FUELS AND RELATED MATERIALS					
Coal, lignite	27,766	40,309	52,811	41,736 ^r	57,000
Gas, natural:					
Gross ^c	3,800 ^{r,4}	6,900 ^{r,4}	9,400 ^{r,4}	9,700 ^r	9,400
Marketed	3,398 ^{r,4}	6,213 ^{r,4}	8,477 ^{r,4}	8,804 ^r	8,500

See footnotes at end of table.

TABLE 1--Continued
BURMA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	1998	1999	2000	2001	2002 ^c	
MINERAL FUELS AND RELATED MATERIALS--Continued						
Petroleum:						
Crude	thousand 42-gallon barrels	3,423	3,394	3,538	4,696 ^r	4,920
Refinery products ⁷	do.	5,815	5,605	5,536	5,286 ^r	5,500

^cEstimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. ^rRevised. -- Zero.

¹Table includes data available through July 3, 2003.

²In addition to the commodities listed, construction aggregates, sand and gravel, and silica sand are produced, but available information is inadequate to make reliable estimates of output levels.

³Reported figure.

⁴Data are for fiscal year ending March 31 of the following year.

⁵Data are for the production by the state-owned mining enterprises under the Ministry of Mines.

⁶Brine salt production, in metric tons, reported by the Government was 1998--91,992; 1999--61,674; 2000--69,245; 2001--61,466 (revised); and 2002--60,000 (estimated).

⁷Includes gasoline, jet fuel, kerosene, diesel, distillate fuel oil, and residual fuel oil.

Sources: Ministry of Mines and Central Statistical Organization (Yangon), Statistical Yearbook 2001; Selected Monthly Economic Indicators, January 2001-February 2002; Asian Mining Yearbook 2000, p. 18; World Metal Statistics, March 2003.