

# THE MINERAL INDUSTRY OF BURMA (MYANMAR)

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Myanmar, formerly known as Burma, has large mineral resources of precious and semiprecious stones, such as jade, ruby, and sapphire. The country also has considerable mineral resources of antimony, barite, coal, copper, gold, iron, lead, monazite, natural gas, nickel, petroleum, silver, tin, tungsten, and zinc. Its identified mineral resources of bauxite, bentonite, beryllium, clays, chromium, diamond, feldspar, fluor spar, gypsum, kaolin, manganese, mercury, mica, platinum, and sulfur are small (Ko Ko Myint, 1994).

The Ministry of Mines (MOM), through its Department of Geological Survey and Mineral Exploration (DGSME), had carried out geologic mapping and mineral prospecting in the States of Kachin, Kayah, Kayin, and Shan that covered 17,295 square kilometers (km<sup>2</sup>) during the 1997-98 period. As a result, about 61.3% of the country had been geologically mapped at a scale of 1 inch to 1 mile. During the same period, the DGSME conducted mineral prospecting that focused on coal, gemstones, gypsum, iron ore, lead, and limestone and drilled to prove the iron ore (limonite-hematite-magnetite) reserves at Kathaing Taung in the Pharkant Township, Kachin State, where the reserves had been estimated to be 200 million metric tons (Mt) with an average iron content of 50% (Soe Mra, 1999, p. 17). Drilling also was carried out by the DGSME to extend the gypsum resources in Maukmai Basin in Shan State. Additionally, it discovered a new deposit of high-quality gypsum in Dawwei Township, Tanintharyi Division (Mining Annual Review, 1999, p. A171).

Exploration by foreign companies, which had been awarded contracts to explore for copper, gold, lead, platinum-group metals, and zinc from 1994 to 1997 by the Government, slowed down considerably in 1999 owing to the lack of exploration capital and low metals prices in the world market. In 1999, only 1 block out of 26 awarded blocks was active. Block 10, in the second-round bidding, which had been awarded to Ivanhoe Myanmar Holdings Ltd. (IMHL) in 1996 involved gold exploration (Mining Journal, 1999). Among the Western mining companies exploring for copper, gold, and other base metals, IMHL relinquished Blocks 3, 4, 5, 6, 6A, and 7 of the first-round bidding in 1994 owing to failure to find sizable nonferrous metals deposits and to lack of exploration capital. For the same reasons, Pacific Arc Exploration NL relinquished Blocks 8 and 13 of the first round, East Asia Gold Corp. relinquished Blocks 2 and 3 of the second round, and Leeward Tiger Ltd., which took over exploration from Antina Time Square, relinquished Blocks 1 and 11 of the second round (Mining Annual Review, 1999). In 1999, the Government canceled the fourth round of invitation in October owing to the lack of interest (Far Eastern Economic Review, 1999).

In late 1998, the MOM made several changes in the function and responsibilities of the DGSME and the Department of Planning and Work Inspection (DPWI). The DGSME would continue to undertake geologic surveys, mapping, and mineral exploration; its metallurgical research work, however, was transferred to the Central Research Organization of the newly established Ministry of Science and Technology. The DPWI was renamed the Department of Mines with an increase in responsibilities to enforce the 1994 mining laws and regulations, to implement the Government policy of mineral conservation and mining related environmental controls, and to oversee the mining industry employees' welfare (Mining Annual Review, 1999, p. A171; Mining Journal, 1999).

Myanmar produced a wide variety of minerals in 1999. Production of metallic minerals included chromium, copper, gold, lead, manganese, nickel, silver, tin, tungsten, and zinc. Production of industrial minerals included barite, clays, dolomite, feldspar, gypsum, limestone, salt, and precious and semiprecious stones. Production of mineral fuels included coal, natural gas, and crude petroleum. Production of processed mineral products included cement, refined copper, refined gold, refined lead, refined petroleum products, polished precious gemstones, refined silver, refined tin, and urea. In 1999, most mineral production by the state-owned companies remained at a low level owing to the lack of capital and spare parts, outdated technology, and declining ore grades. Production of copper by the Myanmar Ivanhoe Copper Company Ltd. (MICCL), however, reached a new plateau when the Monywa copper project successfully completed its first-phase full-year operations of mining and solvent extraction-electrowinning (SX-EW) in 1999 (table 1).

According to Government statistics, the output of the mining sector contributed about 1.6% to Myanmar's gross domestic product, which was estimated to be \$14.2 billion in fiscal year 1998/99 (International Monetary Fund, 1999, p. 4). In fiscal year 1998/99, the state-owned companies produced only 10.8% of the total output of the mining sector; the privately owned companies, 88.2%; and the cooperatives, 1%. As a result of substantial private domestic and foreign investment, the output of the mining sector registered an overall growth rate of 17% despite a significant decline in mine output of the state-owned enterprises owing to the lack of spare parts caused by the foreign exchange shortage and other factors (International Monetary Fund, 1999, p. 10). In fiscal year 1998/99, Myanmar's total exports were estimated to be \$1,134 million, of which export earnings from base metals and ores were only \$2.5 million. Myanmar's exports of gemstones were estimated to be \$20 million. Exports of major mineral commodities included ores and

concentrates of chromium, manganese, tin, tungsten, and zinc; refined metal of copper, lead, silver and tin; and crude and polished precious and semiprecious stones. Myanmar's total imports were estimated to be \$2,480 million, of which 11.6% was base metals and fabricated products; 2.3%, cement; 0.9%, fertilizer materials; and 0.7%, chemical elements and compounds. Additionally, Myanmar imported about 5 million barrels (Mbbbl) of crude petroleum and 3.6 Mbbbl of refined petroleum products, such as diesel fuel, with a total cost of more than \$162 million (International Monetary Fund, 1999, p. 52). Most of Myanmar's mineral trade was with Asian and European countries.

The mining industry comprised three state-owned mining enterprises, a state-owned gem enterprise, a state-owned ceramic industries company, a state-owned salt and marine chemical enterprise, a state-owned oil and gas enterprise, several Government and private joint-venture companies, and many small-scale private and local enterprises. The total number of employees in the mining industry declined from 132,000 in 1998 to 121,000 in 1999, which accounted for about 0.66% of Myanmar's total employment (International Monetary Fund, 1999, p. 54).

The name and activities of the three state-owned mining enterprises under MOM, were No. 1 Mining Enterprise (ME 1), which mined and processed copper, lead, silver, and zinc; No. 2 Mining Enterprise (ME 2), which mined, processed, and marketed diamond, gold, tin, and tungsten; and No. 3 Mining Enterprise (ME 3), which processed, and marketed chromite, coal, industrial minerals, iron, manganese, and nickel and produced and marketed steel and steel mill products. Other state-owned enterprises were Myanma Gems Enterprise (MGE), which mined, processed, and marketed jade, ruby, sapphire, and other precious and semiprecious stones; Myanma Ceramic Industries (MCI), which manufactured and marketed cement and other ceramic products; and Myanmar Salt and Marine Chemical Enterprise, which produced and marketed household salts and associated marine chemicals, such as epsom salts and soda ash; and Myanma Oil and Gas Enterprise (MOGE), under the Ministry of Energy, which produced, processed, and marketed crude petroleum, natural gas, and refined petroleum products.

In 1999, MICCL, a joint venture between ME 1 and IMHL, began the first-phase, full-year operations of its open pit copper mining, crushing, heap leaching, and SX-EW in Salingyi Township about 15 kilometers (km) west of Monywa in west-central Myanmar. Indochina Goldfields Ltd. (IGL), the parent company of IMHL which owned 50% interest in MICCL, announced that it had changed its name to Ivanhoe Mines Ltd. (IML) on June 21, 1999 (Ivanhoe Mines Ltd., 1999b).

According to IML, ore mining from the Sabetaung and Kyisintaung (S & K) Mines was at the rate of 375,000 metric tons per month. In 1999, the heap-leach and SX-EW operations produced a total of 26,736 metric tons (t) of 99.999%-pure cathode copper exceeding the 25,000-metric-ton-per-year (t/yr) designed capacity. The minegate cash cost of production was \$0.28 per pound, and the total production costs, including interest expense, depreciation, marketing, and royalty payment were estimated to be \$0.60 per pound (Ivanhoe Mines Ltd., 2000).

In October, IML announced that it had approved an expansion plan to raise the capacity of the S & K Mine by 40% to 35,000 t/yr of cathode copper with the budgeted cost of about \$7 million, which would be financed internally by MICCL through ongoing copper sales. The expansion project was scheduled for completion in September 2000 (Ivanhoe Mines Ltd., 1999a).

According to IGL, a detailed study completed in 1998 indicated a 78% increase in the original reserve estimate. The total reserves for the S & K Mine were raised to 226.3 Mt grading 0.40% copper. Of the total reserves, the Sabetaung deposit has 45.5 Mt grading 0.449% copper; the Sabetaung South deposit, 8.8 Mt grading 0.437% copper; and the Kyisintaung deposit, 171.9 Mt, grading 0.372% copper (Indochina Goldfields Ltd., 1998, p. 10).

IMHL continued its preliminary drilling program on Block 10 in the Phaung Daw area, about 100 km north of Yangon, the national capital. Geologic work including underground drifting on Block 10, had identified a zone of gold-bearing breccias that averages up to 7.7 grams per metric ton over 15 meters in a complex structural zone that can be traced for approximately 1.8 km (Indochina Goldfields Ltd., 1998, p. 17). In 1999, IMHL reached an agreement with the DGSME to allow the company to take a majority interest in any future development of copper and gold discoveries within the company's Block 10 concession area. Under the agreement, IMHL's interest in a mining joint venture would be increased to 83% from 50% (Ivanhoe Mines Ltd., 1999a).

In lead, silver, and zinc mining, ME 1 operated the Bawdwin and the Yadanatheingi Mines in Shan State. The Bawdwin Mine comprised an open pit mine, an underground mine, and two concentrators with a total production of about 1,500 metric tons per day (t/d) of ore. The Yadanatheingi Mine was a small underground mine. ME 1 also operated a lead-silver smelter at Namtu near the Bawdwin Mine for production of refined lead, silver metal, and byproducts, such as antimonial lead, copper matte, and nickel speiss. Metal production of lead and silver was estimated to be 1,900 t and 4,000 t, respectively, in 1999. Byproduct production of nickel speiss was estimated to be 40 t. Production of zinc concentrate was estimated to be 700 t.

In 1999, Padaeng Industry Co. Ltd. of Thailand reportedly was evaluating two new zinc prospects in the Mawki area of Kayin State, which is next to Tak Province in Thailand, and in Shan State in northern Myanmar (Asian Journal of Mining, 1999b). In 1999, Corner Stone Resources (Myanmar) Ltd. of Australia reportedly was negotiating a production-sharing agreement with ME 1 for production of zinc at Loung Kheng, Mongpun Township, Shan State (Mining Journal, 1999).

In gold mining, ME 2 operated the Kyaukpahtoe Mine in Kawlin Township, Sagaing Division. Within the past 3 years, ME 2 signed joint-venture agreements for gold mining with three local companies—Myanmar Golden Point Family Co. Ltd., Holi S.P. Company, and Sea Sun Star Company. Under the 1999 agreement, Myanmar Golden Point Family was to operate the Phayaungtaung gold mine with a 50 metric ton per day (t/d) concentration plant in Patheingyi Township (Mining Annual Review, 1999, p. 173). In 1999, ME 2 granted 17 mining rights to

small-scale miners for gold mining in the Kalaw, the Shwegyin, and the Thabeikkyin areas. Gold production from local gold workings was estimated to be about 500 kilograms per year (Maung, 1999, p. 124).

East Asia Gold Corp., which had contracts to explore for copper and gold in the Mabein and the Thabeikkyin areas and identified three porphyry copper deposits at Kodan, Sadwin, and Saldadokhta in its Block 14 concession area and had delineated a 50 km<sup>2</sup> area of Yanbo-Kawdaw for gold and porphyry copper deposits in its Block 4 concession area, suspended its exploration in 1999 (Mining Annual Review, 1999, p. A171).

Prior to 1998, ME 2 operated the Mawchi Mine (tin and tungsten) in Phasaung Township, Kayah State, and the Heinda Mine (tin), the Hermyingyi Mine (tin and tungsten), the Kanbauk Mine (tin), the Kyaukmedaung Mine (tin), and the Pagaye Mine (tungsten) in Tanintharyi Division. By 1999, most of the tin and tungsten mining in Kayah State, Mandalay Division, and Tanintharyi Division had been privatized (Mining Annual Review, 1999, p. A172). In 1999, Myanmar Pongpipat Ltd. of Thailand signed a production-sharing contract with ME 2 to mine tin at the Heinda Mine in Dawei Township, Tanintharyi Division (Mining Journal, 1999).

Production of cement was by the MCI, which operated three cement plants. Cement plant No. 1 in Thayet Township, Magway Division, had a capacity of 270,000 t/yr. Cement plant No. 2 in Kyangin Township, Ayeyarwady Division, had a capacity of about 320,000 t/yr. Cement plant No. 3 in Hpa-an Township, Kayah State, had a capacity of 240,000 t/yr. Because of the economic slowdown during the past 3 years, demand for cement by the construction industry had decreased substantially. As a result, cement production dropped from about 520,000 t in 1997 to 340,000 t in 1999, the lowest level since 1984.

MGE continued to mine rubies and sapphires at the Mogok Stone Tract about 175 km northeast of Mandalay. In the Tract, the Yadana Kadeikada Mine of Myanmar Economic Holdings Ltd., the Linyaung Chi Gem Mines, and the Shwe Pyi Aye Gem Mines were among the local famous operating gemstone mines near Kyaukpyattha Village in Mogok in 1999. MGE and local private companies participated in jade and ruby mining at the Mongshu Stone Tract in eastern Myanmar.

In coal mining, ME 3 produced coal (lignite) from the Namma Mine in Lashio Township, Shan State, to meet the energy requirement of its No. 1 Iron and Steel plant. Sub-bituminous coal produced by ME 3 from the Kalewa Mine in Sagaing Division was consumed by industries in the local area. The open pit Namma Mine had about of 2.5 Mt of lignite reserves, and the underground Kalewa Mine had about 46.3 Mt of sub-bituminous coal reserves (Asian Journal of Mining, 1999a, p. 19).

MOGE produced crude petroleum and natural gas. Crude petroleum, which was produced from five onshore oilfields (Chauk-Lanywa, Mann, Myanaung, Prome, and Yenangyaung), decreased slightly to an average of 9,300 barrels per day. Natural gas, which was produced mainly from 23 wells in the Aphyauk Gasfield, which is 72 km northwest of Yangon between Taikkyi Township, Yangon Division and Zalun Township,

Ayeyarwady Division, also decreased slightly to an average of 4.7 million cubic meters per day (Mm<sup>3</sup>/d) in 1999.

Domestic consumption of crude petroleum for production of refined petroleum products was about 7.8 Mbbl, of which about 5 Mbbl was imported (International Monetary Fund, 1999, p. 49 and p. 52). About 68% of the natural gas production was consumed by two powerplants at Thaketa near Yangon and Shwedaung near Pyay for power generation, and the remaining 32% was consumed mainly by the Sittaung Paper Mill at Kyawswa, Kyunchaung, as an energy source and by the nitrogen fertilizer (ammonia and urea) plants at Sale near Yangon as raw material.

The startup date for commercial production of natural gas from the offshore Yadana Gasfield has been postponed for 18 months from July 1998 owing to the extended delay in completing the Ratchaburi powerplant being built for the Electricity Generating Authority of Thailand. This delay further complicated the issue of payment for Yadana gas in the second contract year under the take-or-pay arrangement between the Petroleum Authority of Thailand (PTT) and the Yadana consortium led by Total SA, which had invested \$1 billion in developing the Yadana Gasfield. Under the original contract, PTT was to receive 9.2 Mm<sup>3</sup>/d of Yadana gas in the second contract year beginning March 1, 1999, and 15.6 Mm<sup>3</sup>/d in subsequent years (Oil & Gas Journal, 1999).

PTT also asked the Yetagun consortium to delay delivery of incremental gas supply from the Yetagun Gasfield off the Taninthayi coast in the Gulf of Martaban, owing to a slower growth in gas demand in Thailand. Although PTT wanted to defer taking 3.96 Mm<sup>3</sup>/d of gas under the second-phase supply agreement beyond the 2004 contract date, PTT remained committed to take delivery of 7.36 Mm<sup>3</sup>/d of gas under the first phase of the Yetagun gas supply agreement that will begin in mid-2000. As a result of additional drilling, proven reserves at the Yetagun Gasfield had risen to 82.7 billion cubic meters (Gm<sup>3</sup>) from 31 Gm<sup>3</sup> (Oil & Gas Journal, 2000). The Yetagun gas consortium was owned by Petronas Carigali Sdn. Bhd. of Malaysia (36.3%), Premier Petroleum Myanmar Ltd. of the United Kingdom (32.3%), Nippon Oil Exploration (Myanmar) Ltd. of Japan (17.2%), and PTT Exploration and Production International Ltd. of Thailand (14.2%).

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## Major Source of Information

The Ministry of Mines  
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The Ministry of National Planning and Economic Development,  
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TABLE 1  
BURMA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/	1995	1996	1997	1998	1999 p/
<b>METALS</b>					
Chromium, chromite, gross weight	1,000 e/	1,000 e/	3,299 r/ 3/	4,059 r/ 3/	3,200 e/
Copper:					
Mine output, Cu content	5,282	4,841	2,927	6,700 r/ e/	26,736
Matte, gross weight 3/	43 r/	263 r/	95 r/	53 r/	--
Metal, refined	--	--	--	6,700 r/ e/	26,736
Gold, mine output, Au content 3/ kilograms	369 r/	241 r/	388 r/	410 r/	382
Iron and steel: 3/					
Pig iron	1,188 r/	1,368 r/	-- r/	1,500 e/	1,500 e/
Steel, crude	20,002 r/	40,198 r/	-- r/	23,500 e/	23,500 e/
Lead					
Mine output, Pb content e/	2,400	2,200	1,900	2,200	2,000
Metal:					
Refined	1,753	1,984	1,760	1,936 r/	1,666
Antimonial lead (93% Pb) 3/	55	88	71	-- r/	--
Manganese, mine output, Mn content e/	50	50	50	50	50
Nickel:					
Mine output, Ni content e/	13 r/	22 r/	7 r/	10 r/	10
Speiss (matte), gross weight 3/	49 r/	83 r/	28 r/	38 r/	40
Silver, mine output, Ag content kilograms	4,417	3,950	1,866	3,359 r/	4,168
Tin, mine output, Sn content:					
Of tin concentrate	372	201	111	75 r/	77
Of tin-tungsten concentrate	375	258	224	146 r/	72
Total	747	459	335	221 r/	149
Metal, refined	190 e/	310 r/	228 r/	150 r/	150 e/
Tungsten, mine output, W content:					
Of tungsten concentrate	93	33	10	8 r/	3
Of tin-tungsten concentrate	438	301	262	170 r/	84
Total	531	334	272	178 r/	87
Zinc, mine output, Zn content	721	572	467	474 r/	279
<b>INDUSTRIAL MINERALS</b>					
Barite	34,601	24,679	17,111	22,004 r/	24,651
Cement, hydraulic	516,931	504,670	515,682	364,959 r/	338,025
Clays:					
Bentonite 3/	1,081 r/	4,769 r/	4,908 r/	3,871 r/	3,700 e/
Fire clay and fire clay powder 3/	3,189 r/	4,273	5,118	2,746 r/	2,800 e/
Feldspar 3/	8,749	13,295	11,960	12,000 e/	12,000 e/
Gypsum	34,659	37,899	38,481	36,411 r/	44,857
Nitrogen, N content of ammonia	66,000	57,000	61,700	51,605 r/	64,782
Precious and semiprecious stones:					
Jade kilograms	702,751	1,214,711	1,679,244	1,525,578 r/	2,342,108
Diamond carats	11	50	5	5 e/	5 e/
Rubies, sapphires, spinel 3/ do.	149,600 r/	5,470,566 r/	13,684,960 r/	14,446,638 r/	5,474,932
Salt e/ 4/ thousand tons	35	35	35	35	35
Stone:					
Dolomite	3,432	5,147	3,942	4,468 r/	2,523
Limestone, crushed and broken e/ thousand tons	3,000 r/	3,000	3,500	2,500 r/	2,000
<b>MINERAL FUELS AND RELATED MATERIALS</b>					
Coal, lignite	32,191	33,407	27,516	27,766 r/	40,309
Gas, natural:					
Gross e/ million cubic meters	1,508	1,659	1,821	1,800	1,712
Marketed do.	1,477	1,625	1,781	1,750	1,674
Petroleum:					
Crude thousand 42-gallon barrels	4,393	3,906	4,417	3,423 r/	3,394
Refinery products 5/ do.	5,313	4,831	5,414	5,815 r/	5,605

e/ Estimated. p/ Preliminary. r/ Revised. -- Zero.

1/ Table includes data available through May 26, 2000.

2/ In addition to the commodities listed, pottery clay, silica sand, construction aggregate, and varieties of gemstones are produced, but available information is inadequate to make reliable estimates of output levels.

3/ Data are for fiscal year ending March 31 of that year. In 1999, ruby production from Mine-Shu was not included.

4/ Brine salt production, in metric tons, reported by the Government was 1995--81,156; 1996--71,350; 1997--97,276 (revised), 1998--91,992 (revised), and 1999--61,674.

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

Sources: Ministry of Mines and Central Statistical Organization (Yangon), Statistical Abstract 1998, p. 156-58; Selected Monthly Economic Indicators, January-December 1999.