

# 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. Other identified mineral resources in Myanmar included antimony, barite, carbonate rocks, chromium, clays, coal, copper, feldspar, gold, gypsum, iron, lead, natural gas, nickel, petroleum, salt, silver, tin, tungsten, and zinc. In 2000, Myanmar produced a wide variety of minerals, which included 11 metallic minerals, 9 industrial minerals, and mineral fuels (coal, natural gas, and crude petroleum). The country also produced processed mineral products, such as cement, refined copper, refined gold, refined lead, refined petroleum products, polished precious gemstones, refined silver, crude steel, refined tin, and urea (table 1). With the exception of precious gemstones and natural gas, most of Myanmar's minerals production was for domestic consumption, and none was of world significant by world standards.

According to the Government's provisional statistics, the output of the mining sector contributed 1.7% to Myanmar's gross domestic product (GDP), which was estimated to be \$14.2 billion in fiscal year 1999-2000. The country's GDP was estimated to have grown by 10.9%, and the mining sector, 29.5% in fiscal year 1999-2000 (International Monetary Fund, 2000, p. 7). In July, the Deputy Minister of the Ministry of National Planning and Economic Development, however, revealed that the official data for economic growth had been grossly and deliberately exaggerated. A report that was published by the Asian Development Bank in May also pointed out that Myanmar's economic growth had slowed down for the third consecutive year since 1996 (Far Eastern Economic Review, 2001).

In fiscal year 1999-2000, Myanmar's total exports were estimated to be \$1,132 million, of which export earnings from base metals and ores were \$20.7 million. Exports of major mineral commodities included ores and concentrates of chromium, manganese, tin, tungsten, and zinc; refined metals of copper, lead, silver and tin; crude and polished precious and semiprecious stones. Myanmar's total imports were estimated to be \$2,539 million, of which base metals and fabricated products were \$275.1 million; fertilizers, \$52.7 million; cement, \$40.5 million; and chemical elements and compounds, \$25.0 million (Central Statistical Organization, 2000, p. 2, 4-5, 8, 12). To supplement the shortfall of its crude petroleum production to meet its domestic demand, Myanmar imported about 17.9 million barrels (Mbbbl) of crude petroleum and refined petroleum products in fiscal year 1999-2000 (International Monetary Fund, 2000, p. 13). Most of Myanmar's mineral trade was with China, Japan, Singapore, Thailand, and other Southeast Asian 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. In fiscal year 1999-2000, the state-owned companies produced only 5.6% of the total output of the mining sector; the privately owned companies, 92.8%; and the cooperatives, 1.6% (International Monetary Fund, 2000, p. 5). According to the latest available data, the mining industry's work force was about 121,000 in fiscal year 1997-98, which accounted for 0.66% of Myanmar's total employment (International Monetary Fund, 2000, p. 18).

In an effort to extend ore reserves of lead and zinc, the Department of Geological Survey and Mineral Exploration (DGSME) under the Ministry of Mines conducted exploration at the Huelon-Mohochaung area, which is about 32 kilometers (km) from the Bawdwin deposit in Shan State. DGSME also conducted exploration in Kachin State and northern Shan State for base metals and in Kyaukse District in central Myanmar for gypsum and limestone. In late 1999, the Ministry of Mines, through No. 3 Mining Enterprise (ME 3), signed an agreement with an unnamed Japanese company to conduct coal exploration in the Kalewa area of Sagaing Division, where an expansion of the coal mining capacity was planned for the future requirements of a 66-megawatt powerplant and a 500,000-metric-ton-per-year (t/yr) cement plant. By early 2000, nine core holes that totaled more than 2,000 meters (m) had been drilled by the Japanese company, which was to conduct feasibility studies for the capacity expansion at the Kalewa Mine (Soe Mra, 2000).

Three foreign companies were active in exploring for base metals and gold in fiscal year 1999-2000. East Asia Gold Corp., which completed a feasibility study of an alluvial gold deposit in Thabeikkyin area, continued its copper and gold exploration in the Mabein North and the Thabeikkyin areas in 2000. To explore for base metals and gold, Myanmar First Dynasty Mines continued its activity in a 182.5-square-kilometer (km<sup>2</sup>) area in Taungthonlone, and Ivanhoe Myanmar Holdings Ltd. (IMHL), in a 140-km<sup>2</sup> area in Phaugtaw (Soe Mra, 2000).

In the nonferrous metals mining sector, Myanmar Ivanhoe Copper Company Ltd. (MICCL), which was a 50-50 joint venture of No. 1 Mining Enterprise (ME 1) and IMHL, produced 26,711 metric tons (t) of cathode copper compared with 26,736 t in 1999. The open pit copper mining, crushing, heap leaching, and solvent extraction-electrowinning (SX-EW) operations were at the Sabetaung and the Kysisintaung Mines (S & K Mines) in Salingyi Township about 15 km west of Monywa in west-central Myanmar. In 2000, the minegate cash cost of production was about \$0.31 per pound compared with \$0.28 per pound in 1999, and the total production costs, which

included interest expense, depreciation, marketing, and royalty payments, were about \$0.67 per pound compared with \$0.60 per pound in 1999 (Ivanhoe Mines Ltd., 2001). IMHL, which owned 50% interest in MICCL, was a wholly owned subsidiary of Ivanhoe Mines Ltd. (IML).

In the first quarter of 2000, MICCL began its expansion work to raise the capacity of the S & K Mines by 40% to 35,000 t/yr of cathode copper. By the end of the fourth quarter, an organic scrub and a neutralization thickener were installed. The new facilities would increase efficiency and production rate of the SX-EW plant to 30,000 t/yr in 2001 (Ivanhoe Mines Ltd., 2001).

In December 2000, IML had discussion with several Chinese, Japanese, and Korean financial organizations that had expressed interest in providing project development financing and marketing service for the Letpadaung copper deposit. The planned development of the deposit, which is located 10 km south of S & K Mines, would have a designed capacity of 125,000 t/yr of cathode copper and an estimated capital cost of \$390 million. The development project was scheduled to start in April 2003 subject to financing and Government approval. According to the development plan prepared by Minroc Ltd. of Australia in collaboration with Mineral Resources Development Inc. of the United States, the total resources at the Letpadaung deposit were estimated to be 1.48 billion metric tons at an average grade of 0.38% copper. Of the total resources, probable ore reserves were estimated to be 804 million metric tons (Mt) at an average grade of 0.43% copper using a 0.1% copper cut-off grade (Ivanhoe Mines Ltd., 2000, 2001).

ME 1 produced lead, silver, and zinc mainly from the Bawdwin and the Yadanatheingi Mines in Shan State and operated a lead-silver smelter at Namtu near the Bawdwin Mine for production of refined lead and silver and byproducts, such as antimonial lead, copper matte, and nickel speiss. Corner Stone Resources (Myanmar) Ltd. of Australia, which was granted a license by the Government to explore for zinc in a 30-km<sup>2</sup> area in the Loung Kheng in Shan State in October 1999, completed a preliminary feasibility study and a field assessment in September 2000. In July, the company obtained an exploration license from the Government for an additional 696-km<sup>2</sup> area surrounding the Loung Kheng to search for more zinc resources in the area. The preliminary feasibility study completed by Crow Schaffalitzky Associates, the Loung Kheng zinc project manager, essentially confirmed an earlier estimated ore reserves of 233,500 t at an average ore grade of 36.8% zinc in the 1950's with a slightly smaller tonnage. If sufficiently large resources of zinc were proven in the area, then the company would consider on-site metal production using low-cost SX-EW technology similar that used in the copper and nickel industries (Asian Journal of Mining, 2001).

Gold was produced by the state-owned No. 2 Mining Enterprise (ME 2) from the Kyaukpahtoe Mine in Kawlin Township, Sagaing Division, and three joint-venture companies— Myanmar Golden Point Family Co. Ltd., Holi S.P. Company, and Sea Sun Star Company. Myanmar Golden Point Family operated the Phayaungtaung gold mine with a 50-metric-ton- per-day concentration plant in Patheingyi Township. As of 2000, ME 2 had granted 27 large-scale mining permits, 93 small-scale mining permits, and 2 riverine working permits for

gold mining (Soe Mra, 2000).

In 2000, practically all tin and tungsten production was by local and foreign companies, which operated mainly in Kayah State, Mandalay Division, and Tanintharyi Division. After signing a production-sharing contract with ME 2 in July 1999, Myanmar Pongpipat Ltd. of Thailand installed two units of jig-operated gravity separation plants at the Heinda tin mine in Dawei Township, Tanintharyi Division. The company was expected to produce about 1,500 t/yr of tin concentrate in coming years. The concentrate would contain about 72% tin (Soe Mra, 2000).

The state-owned Myanma Gems Enterprise (MGE) continued to mine gemstones, such as jade, rubies, and sapphires, mainly at the Mogok Stone Tract in central Myanmar and at the Mongshu Stone Tract in eastern Myanmar and jade mainly at the Lonehkin and the Phakant Tracts in northern Myanmar. Following enactment of the Myanmar Gems Law in 1994, many private companies participated in gemstone mining. As of 2000, the Government, through MGE, had granted 701 permits for jade mining and 919 permits for gemstone mining (Soe Mra, 2000). According to a report, a giant jade dyke, which measured 21.3 m in length and 6.1 m in height with a girth of 4.9 m, was discovered 12.2 m below surface by the Pa-O National Organization. The dyke, which was covered by black serpentine, was found at Phakant about 175 km from Myitkyina in Kachin in northern Myanmar. The weight of the dyke was estimated to be 2,000 t. It has a white underside with a stunning palette of green and purple crystals. The total value of this high-quality jade has not been assessed (Golden Land, 2000, Information—Myanmar found largest massive jade dyke, accessed February 14, 2001, at URL <http://www.myanmar.com/jade/jade.html>).

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. Subbituminous coal production by ME 3 from the Kalewa Mine in Sagaing Division was about 15,000 t in fiscal year 1999-2000. To expand the capacity of the Kalewa Mine to 300,000 t/yr, a Japanese company was conducting exploration to find more reserves in the area. Coal was also produced by private local companies. As of 2000, the Government, through ME 3, had issued 6 large- and 56 small-scale coal mining permits to local companies. Three local companies with production-sharing agreements with ME 3 planned to produce between 15,000 and 70,000 t/yr from the Lweje area in Kachin State and the Tigyit area in southern Shan State, where the local companies were conducting coal exploration (Soe Mra, 2000).

In hydrocarbons production, the state-owned Myanma Oil and Gas Enterprise (MOGE) produced crude petroleum, natural gas, and refined petroleum products. Crude petroleum production was mainly from the onshore Mann Field, which produced about 3,100 barrels per day (bbl/d), and four older, smaller oilfields—Chauk-Lanywa, Myanaung, Prome, and Yenangyaung. In fiscal year 1999-2000, crude petroleum output averaged 9,340 bbl/d compared with 9,260 bbl/d in fiscal year 1998-99. Natural gas production from 23 onshore wells in the Aphyauk Gasfield averaged 4.49 million cubic meters per day (Mm<sup>3</sup>/d) compared with 4.72 Mm<sup>3</sup>/d in fiscal year 1998-99 (Central Statistical Organization, 2000, p. 21).

In 2000, natural gas was also produced by two foreign contractors, the Yadana Group and the Yetagun Group, from offshore gasfields in the Gulf of Martaban. After nearly 2 years of delay, the Yanada Group, which was led by TotalFinaElf SA of France, which was the operator of the offshore Yadana Gasfield, began delivery of natural gas through a 665-km pipeline to the Ratchaburi powerplant of the Electricity Generating Authority of Thailand (EGAT) at an initial rate of 4.25 Mm<sup>3</sup>/d of gas in mid-2000, although the Petroleum Authority of Thailand (PTT) was committed to take delivery of 14.87 Mm<sup>3</sup>/d of gas to feed EGAT's Ratchaburi powerplant (Oil & Gas Journal, 2000). PTT reportedly had agreed to pay a penalty of \$280 million for not being able to take delivery of the full contractual volume from the Yadana natural gas on time (Far Eastern Economic Review, 2001). The dispute between EGAT and PTT over sharing the take-or-pay obligations remained unresolved.

The Yetagun Group, which was led by Premier Petroleum Myanmar Ltd. of the United Kingdom and was the operator of the offshore Yetagun Gasfield, also began delivery of natural gas through a 269-km pipeline to EGAT's Ratchaburi powerplant at an initial rate of 5.66 Mm<sup>3</sup>/d of natural gas in July then increased to 7.37 Mm<sup>3</sup>/d in August under the first phase of the Yetagun gas supply agreement. In the second phase, the gas delivery from the Yetagun Gasfield was to increase to 11.33 Mm<sup>3</sup>/d in 2003. PTT and Premier were discussing arrangements for a delay in taking the additional 3.96 Mm<sup>3</sup>/d of gas until 2005 (Oil & Gas Journal, 2000).

The Yadana Group was owned by TotalFinaElf (31.24%), Unocal Corp. of the United States (28.26%), PTT Exploration & Production of Thailand Ltd. (25.5%), and MOGE (15%). The Yetagun Group was owned by Petronas Carigali Sdn. Bhd. of Malaysia (36.3%), Premier (32.3%), Nippon Oil Exploration (Myanmar) Ltd. of Japan (17.2%), and PTT Exploration and Production of Thailand Ltd. (14.2%).

In August, MOGE signed a production-sharing contract with Daewoo Corp. of the Republic of Korea to explore for oil and gas in Block A-1 in the Bengal Gulf. Daewoo had 100% working interest in the block. The 388,507-hectare block, which was offshore northwestern Myanmar near the Bangladesh

border, was believed to have an estimated 500 Mbbl of oil reserves (World Oil, 2000).

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## Major Source of Information

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TABLE 1  
BURMA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/	1996	1997	1998	1999	2000 e/
<b>METALS</b>					
Chromium, chromite, gross weight	1,000 e/	3,299 3/	4,059 3/	3,200 e/	3,000
Copper:					
Mine output, Cu content	4,841	2,927	6,700 e/	26,736	26,711 3/
Matte, gross weight 4/	95 r/	53 r/	58 r/	142 r/	60
Metal, refined	--	--	6,700 e/	26,736	26,711
Gold, mine output, Au content 4/ kilograms	172 r/	181 r/	172 r/	242 r/	250
Iron and steel: 4/					
Pig iron e/	1,368 3/	--	1,500	1,500	1,500
Direct-reduced iron e/	40,000	40,000	40,000	40,000	40,000
Steel, crude	40,198	--	23,500 e/	23,500 e/	23,500
Lead					
Mine output, Pb content e/	2,200	1,900	2,200	2,000	2,000
Metal:					
Refined	1,984	1,760	1,936	1,666	1,100
Antimonial lead (93% Pb) 4/	159 r/	-- r/	116 r/	65 r/	60
Manganese, mine output, Mn content e/	50	50	50	50	50
Nickel:					
Mine output, Ni content e/	22	7	10	10	10
Speiss (matte), gross weight 4/	35 r/	38 r/	30 r/	76 r/	40
Silver, mine output, Ag content kilograms	3,950	1,866	3,359	4,168	2,500
Tin, mine output, Sn content:					
Of tin concentrate	201	111	75	77	150
Of tin-tungsten concentrate	258	224	146	72	70
Total	459	335	221	149	220
Metal, refined	310	228	150	150 e/	150
Tungsten, mine output, W content:					
Of tungsten concentrate	33	10	8	3	2
Of tin-tungsten concentrate	301	262	170	84	80
Total	334	272	178	87	82
Zinc, mine output, Zn content	572	467	474	279	220
<b>INDUSTRIAL MINERALS</b>					
Barite	24,679	17,111	22,004	24,651	29,200
Cement, hydraulic	504,670	515,682	364,959	338,025	375,000
Clays:					
Bentonite 4/	4,769	4,908	3,871	728 r/	600
Fire clay and fire clay powder 4/	4,273	5,118	2,746	2,800 e/	2,500
Feldspar 4/	13,295	11,960	12,000 e/	12,000 e/	12,000
Gypsum	37,899	38,481	36,411	44,857	46,300
Nitrogen, N content of ammonia	57,000	61,700	51,605	64,782	65,000
Precious and semiprecious stones:					
Jade kilograms	1,214,711	1,679,244	1,525,578	2,342,108	8,970,000
Diamond carats	50	5	5 e/	5 e/	5
Rubies, sapphires, spinel 4/ do.	5,470,566	13,684,960	14,446,638	5,474,932	7,740,000
Salt e/ 5/ thousand tons	35	35	35	35	35
Stone:					
Dolomite	5,147	3,942	4,468	2,523	--
Limestone, crushed and broken e/ thousand tons	3,000	3,500	2,500	2,000	2,400
<b>MINERAL FUELS AND RELATED MATERIALS</b>					
Coal, lignite	33,407	27,516	27,766	40,309	49,500
Gas, natural:					
Gross e/ million cubic meters	1,659	1,821	1,800	1,712	3,700
Marketed do.	1,625	1,781	1,750	1,674	3,600
Petroleum:					
Crude thousand 42-gallon barrels	3,906	4,417	3,423	3,394	3,600
Refinery products 6/ do.	4,831	5,414	5,815	5,605	5,500

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

1/ Table includes data available through April 20, 2001.

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

3/ Reported figure.

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

5/ Brine salt production, in metric tons, reported by the Government was 1996--71,350; 1997--97,276; 1998--91,992; 1999--61,674; and 2000--72,000 (estimated).

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