

# BURMA (MYANMAR)

By John C. Wu

Myanmar, formerly known as Burma, has large mineral resources of gemstones and considerable resources of offshore natural gas. Myanmar produced a wide variety of minerals, which included barite, carbonate rocks, chromium, clays, coal, copper, feldspar, gold, gypsum, lead, natural gas, nickel, petroleum, salt, silver, tin, tungsten, and zinc. The country also produced processed mineral products, which included cement, refined copper, polished precious gemstones, refined gold, refined lead, refined petroleum products, refined silver, crude steel, refined tin, and nitrogen fertilizer materials (table1). With the exception of precious gemstones, Myanmar's minerals production was small in quantity and was mostly for domestic consumption. None of Myanmar's mineral production was of world significance.

The mining sector, which included oil and gas, contributed about 2% to Myanmar's gross domestic product (GDP), which was estimated to be \$14.2 billion. The country's GDP growth was 10.9%, and inflation was about 3.6% in fiscal year 1999-2000 (the last year for which data are available by the Government). The International Monetary Fund and the Western embassies, however, estimated that Myanmar's GDP growth was between 2% and 5%, and inflation was about 20% in fiscal year 1999-2000 (International Monetary Fund, 2001, p. 7; Far Eastern Economic Review, 2002).

According to the Department of Geological Survey and Mineral Exploration (DGSME) under the Ministry of Mines, the output share of the mining sector by the state-owned mining enterprises decreased to 5.5% in 2001 from 11.6% in 1998, and the output share by the privately owned companies increased to 93.4% in 2001 from 85.8% in 1998. In 2001, only one gold mine (the Kyaukpahtoe), three nonferrous metals mines (the Bawdwin, the Bawsaing, and the Yadanatheingi), and two coal mines (the Kalewa and the Namma) were still operated by the state-owned mining enterprises; and only one foreign mining company had committed to invest \$6.12 million in 2001 compared with \$18.5 million committed by three foreign mining companies in 2000. Of the four active foreign exploration companies in 2000, only two were active in 2001. As a result of decreased exploration and development, export earnings from the mining sector dropped in 2001 (Than Htay, 2001).

To update geologic mapping and map production by using remote sensing, geographic information system, and digital- and computer-aided technologies, the Metal Mining Agency of Japan (MMAJ) assisted the DGSME in conducting trial field reconnaissance surveys in the Lebyin-Shweminbon, the Monywa-Salingyi, and the Popa-Meiktila areas for copper and gold. The MMAJ also gave a 2-day workshop at the DGSME on intrusive-related mineralization and its detection by using satellite sensors and on the porphyry copper-gold system. The MMAJ also assisted the DGSME in conducting detailed field

surveys in the Kawlin-Pinlebu-Bamauk and the Monywa areas and a regional survey in the Thabeikkyin area. With financial assistance from Japan's Overseas Development Aid Program, the Japan International Cooperation Agency was to dispatch a geologist to carry out a 2-year training program for the DGSME geologists to conduct a detailed survey at the Shangalon copper prospect in Sagaing Division during 2001 and 2002 (Than Htay, 2001).

In minerals exploration, the DGSME's exploration for gypsum in the area north to the Ayuchaungphya deposit between Bann Chaung and the Tanintharyi River had failed to find more gypsum resources but continued drilling at the Mankaung deposit in Thibaw Township, Shan State, where the known gypsum resources were estimated to be 7 million metric tons (Mt). As a result of the DGSME's continued drilling in 2001, the Myalate Taung limestone resources in Kyaukse Township, Mandalay Division, had been extended to 291 Mt from 250 Mt and the Kyaukyan Taung limestone resources of about 2.26 Mt had been tested and upgraded. In 2001, the DGSME also was conducting coal exploration in the Ho-Kho, the Hweparkhaila-Chaung, the Mongyai, and the Naparkaw areas in Shan State (Than Htay, 2001).

In 2001, the two active foreign exploration companies were Cornerstone Resources (Myanmar) Co. Ltd. (CRCL) of Australia and Ivanhoe Myanmar Holdings Ltd. (IMHL) of Canada. CRCL, which signed a joint venture agreement with the DGSME in July 2000 to conduct an exploration and feasibility study for the development of zinc resources in the Longh Keng (Lough Kheng) area in Mongpaw Township, Shan State, dispatched its geologists to the area and began field work in November 2000. CRCL conducted geochemical analysis of rocks, soil, and stream sediment in Hill No. 1 and Hill No. 2 in the Longh Keng area. The first-stage shallow soil geochemical results indicated significant geochemical anomalies in the area that surrounds the Longh Keng zinc carbonate deposit. CRCL was expected to drill test the targets in late 2001 (Asian Journal of Mining, 2001; Than Htay, 2001).

IMHL (83%), in joint venture with the DGSME (17%), continued its exploration for gold by focusing on driving adits, channel sampling, and trenching on a number of quartz veins in the prospect in central Myanmar in 2001. Ivanhoe Mines Ltd. (IML) (the parent company of IMHL) announced in early 2001 that it had discovered a new gold-bearing vein system in a prospect area that measures 3 kilometers (km) by 2 km; visible gold occurs in a persistent quartz vein, which outcrops over a 400-meter (m) vertical interval (Ivanhoe Mines Ltd., 2001a). IML announced in late 2001 that the underground exploration at the Modi Taung gold project, which is located about 150 km southeast of Mandalay in central Myanmar, demonstrated persistence in grade and continuity along the northwesterly

strike and the downdip extension of the high-grade gold discovery. Numerous intercepts from development crosscuts through the quartz vein system display visible gold, and almost 80% of the channel samples taken have uncut gold, which graded between 20 and 50 grams per metric ton (g/t) (Ivanhoe Mines Ltd., 2001b).

In nonferrous metals mining, Myanmar Ivanhoe Copper Company Ltd. (MICCL) [a 50-50 joint venture of the state-owned No. 1 Mining Enterprise (ME-1) and IMHL] produced cathode copper from the Sabetaung and Kyisintaung Mines (S & K Mines) in Salingyi Township, west of Monywa in west-central Myanmar. ME-1 produced copper, lead, silver, and zinc from the Bawdwin, the Bawsaing, and the Yadanatheingi Mines in Shan State. ME-1 also operated a lead-silver smelter at Namtu near the Bawdwin Mine for production of refined lead and silver and such byproducts as antimonial lead, copper matte, and nickel speiss. Three local companies—Hawsaing Mining Co. Ltd., Kachin National Development Co. Ltd., and Wa Region Development General Trading Co. Ltd., which had 70-30 joint ventures with ME-1—also produced lead and zinc ore from Shan State (Than Htay, 2001).

In 2001, MICCL completed the installation of a permanent fine screening unit at S & K Mines to improve the handling of clay-bearing ore and copper recovery. In 2001, the open pit mining operation was mainly at the Sabetaung deposit where ore reserves were estimated to be 51.2 Mt at a grade of 0.432% copper and later at the Sabetaung South deposit where ore reserves were estimated to be 13.7 Mt at grade of 0.379% copper (Metal Bulletin Monthly, 2001). Cathode copper, which was produced by the solvent extraction-electrowinning (SX-EW) plant at the S&K Mines in 2001, was slightly below that of 2000 but above the designed capacity of 25,000 metric tons per year (t/yr).

In 2001, MICCL completed a viable plan for the supply of electricity to the second-phase Monywa copper project, which involved development of the Letpadaung deposit, which is located 10 km south of S & K Mines. According to MICCL, about 70 to 80 megawatts (MW) of electricity requirements for the second-phase copper project was to be supplied by a 200- to 300-MW coal-fired powerplant, which was under construction by the Myanmar Electric Corp. at Diggit in southern Shan State. The planned development of the 125,000-t/yr cathode copper SX-EW plant at the Letpadaung deposit was expected to cost about \$390 million, which included \$25 million for the new power transmission lines from the Thazi substation south of Mandalay into which the electricity from the new coal-fired powerplant would be fed. MICCL planned to start commercial operations of the second-phase project in 2004 pending Government approval and project financing. In late 2001, MICCL reportedly finished high-level meetings with Chinese, Japanese, and Korean lenders, who had expressed interest in participating in the planned second-phase copper project. No agreement, however, had been signed by yearend (Metal Bulletin, 2001b).

The state-owned Mining Enterprise No. 2 (ME-2) produced gold mainly from the Kyaukpahtoe Mine in Kawlin Township, Sagaing Division, where ore reserves were estimated to be 6 Mt at a grade of 3 g/t. ME-2's gold production dropped to below the 120-kilogram (kg) level during the past 2 years. ME-2

reportedly was negotiating with several private companies to recover gold from gold tailings and was to reinforce proper repair and maintenance at its gold-processing plant to raise its gold production to the 190-kg level. ME-2 had three joint-venture projects with local gold mining companies at Phayaungtaung, Patheingyi Township; at Shwegyin, Bago Division; and at Thayetkhon, Mandalay Division. In January 2001, ME-2 signed a new profit-sharing (25-75) joint-venture contract with East Asia Gold Corp. of Canada to produce gold in the Wethe area in Thabeikkyin Township, Mandalay Division. The 6-year mining lease covers an 850-m by 800-m plot (Than Htay, 2001).

In 2001, tin was mined only by Myanmar Pongpipat Ltd. (MPL) of Thailand, which operated at the Heinda deposit in Dawei Township, Tanintharyi Division. MPL produced 442 metric tons (t) of tin concentrate. Tin and tungsten mixed ore mining was by seven ME-2 joint ventures with local companies, which operated mainly in Kayah State, Mandalay Division, and Tanintharyi Division. The largest production-sharing (30-70) joint venture with Kayah Minerals Trading Co., which operated at the Mawchi Mine in Kayah State, produced 621 t of tin and tungsten mixed ore. The other six local companies in joint ventures with ME-2, which operated at the Bokepyinn, the Hermyingyi, the Kanbauk, the Mailwan, and the Theindaw Mines in Tanintharyi Division, produced a combined total of 618 t of tin and tungsten mixed ore (Than Htay, 2001).

In ferrous metal, industrial minerals, and coal mining, the state-owned Mining Enterprise No. 3 (ME-3) operated the Kya Twin Ye iron ore mine and nearby No. 1 Iron & Steel Plant at Pyin Oo Lwin, which is located about 42 km east of Mandalay. In steelmaking, Ywama Steel Mill, which was privatized in 1998, relied on imports of steel billets for its rolling mill to manufacture bar, rod, and other construction steel products. Its 15-t electric arc furnace was idled owing to the shortage of domestic scrap and the high cost of electricity. Ywama Steel also supplemented its production with imports of finished steel products to meet customer demand in 2001. Myanmar Economic Corp. (MEC), which was under the Ministry of Defense, operated a plate mill, wire mill, and H-beam fabrication shop fed by imported billets from China, the Commonwealth of Independent States, and India (Metal Bulletin, 2001a).

ME-3 produced barite from the Heho and the Kyaukse Mines in Shan State and the Pyin Oo Lwin Mine in Mandalay Division. Myanma ECI (a joint venture of ME-3 and ECI Mineral Pte Ltd. of Singapore) processed barite ore at the barite-powdering plant in Thazi, Mandalay Division. ME-3 produced gypsum from the Hispaw Mine, which is located about 60 km southwest of Lashio in northern Shan State. ME-3 produced limestone from the Pyinmana quarry in southern Mandalay Division and the Patheingyi quarry near Mandalay.

ME-3 produced coal from the Namma Mine (lignite) in Lashio Township in Shan State and the Kalewa Mine (subbituminous) in Sagaing Division. To expand the capacity of the Kalewa Mine, ME-3 and New Energy and Industrial Technology Development Organization of Japan jointly completed a 6-month exploration project, which estimated coal resources at the Kalewa Mine to be 15.3 Mt, of which 7.43 Mt was proven reserves. In late 2000, ME-3 was negotiating with a

Japanese consortium led by Chiyoda Corp. to conduct a detailed feasibility study for the expansion of the Kalewa colliery. AAA International Co. Ltd. and Eastern Division Welfare Co. Ltd., which signed production-sharing contracts with ME-3, mined coal from the No. 1 and No. 2 work sites of Sam Lao (Samlau) in Thibaw Township, Shan State. Bamboo Result Co. Ltd., which had a production-sharing contract with ME-3, terminated its contract in the Lweje area in Kachin State owing to limited coal resources. Another contractor, however, Ayeyarddy Myitpyar Co. Ltd., completed its exploration and planned to develop a lignite mine in the same area (Than Htay, 2001).

Cement production was mainly by the state-owned Myanmar Ceramics Industry (MCI), which operated three cement plants in Hpa-an Township, Kayin State; Kyangin Township, Ayeyarwady Division; and Thayet Township, Magway Division. To meet the growing demand for cement by the construction industry for building roads, bridges and dams, MCI signed an agreement with the China National Constructional and Agricultural Import and Export Corp. in June 2000 to build a cement plant in Kyaukse, Mandalay Division, where limestone resources were estimated to be 291 Mt. The new cement plant will have the capacity of 500 metric tons per day (t/d). The machinery and technology for the new cement plant would cost \$16.5 million. The new cement plant was scheduled for completion by mid-2002 (Myanmar Information Committee, 2000). Demand for cement in 2001 was estimated to be 2.5 Mt, of which about 2.1 Mt was imported mainly from Thailand (International Cement Review, 2000).

The state-owned Myanmar Gems Enterprise (MGE) continued to mine such gemstones as rubies and sapphires mainly at the Mogok Stone Tract (Gems Land) in central Myanmar and at the Mongshu Stone Tract (Gems Land) in eastern Myanmar. MGE mined jade mainly at the Lonehkin and the Phakant Tracts (Gems Land) in northern Myanmar, as well as in Hkamti Township in Sagaing Division. Of the 10 joint ventures that MGE had with local companies, 8 were for jade mining in Phakant, Kachin State, and 2 were for ruby mining in Mongshu, Shan State. Additionally, MGE issued more than 700 permits for jade mining and more than 900 permits for gemstone mining to local miners and peace groups in the Mogok and the Mongshu Gems Lands (Than Htay, 2001). Production of sapphire totaled 2.643 million carats in the first half of 2001; this was a decrease of 5.2% compared with that of the same period in 2000. Production of rubies, however, totaled 1.184 million carats in the first half of 2001; this was an increase of 13.2% compared with that of the same period in 2000 (Central Statistical Organization, 2001, p. 26).

In hydrocarbons production, the state-owned Myanmar Oil and Gas Enterprise (MOGE) under the Ministry of Energy produced crude petroleum, natural gas, and refined petroleum products. Crude petroleum was produced from 450 productive wells that are located mainly in the onshore Mann Oilfield, and four older, smaller oilfields (Chauk-Lanywa, Myanaung, Prome, and Yenangyaung) (Oil & Gas Journal, 2001). Crude petroleum production by MOGE averaged 9,005 barrels per day (bbl/d) in the first half of 2001, which was down by 3.6% from 9,340 bbl/d in the same period in 2000. Natural gas production by MOGE was from 23 onshore wells in the Aphyauk Gasfield, which averaged 3.76 million cubic meters per day in the first

half of 2001; this was a decrease of 10.8% (4.21 million cubic meters per day) compared with the same period in 2000 (Central Statistical Organization, 2001, p. 22).

Natural gas was also produced by two foreign contractors—the Yadana Group and the Yetagun Group—from offshore gasfields in the Gulf of Martaban and in the Andaman Sea. The Yanada Group [owned by TotalFinaElf SA of France (31.2%), which was the operator of the offshore Yadana Gasfield in the Gulf of Martaban; Unocal Corp. of the United States (28.26%); PTT Exploration & Production of Thailand Ltd. (25.5%); and MOGE (15%)] produced natural gas from 4 offshore platforms with 14 wells. It sold the entire natural gas production to the Ratchaburi powerplant of the Electricity Generating Authority of Thailand (EGAT); the natural gas was sent through a 665-km pipeline. The Yadana Group was expected to produce an average of 14.87 million cubic meters per day of natural gas from the Yanada Gasfield in 2001. On the basis of a report by TotalFinaElf, however, the natural gas output from the Yanada Gasfield averaged 11.69 million cubic meters per day in 2001 compared with 3.8 million cubic meters per day in 2000 (TotalFinaElf SA, 2002).

The Yetagun Group [owned by Petronas Carigali Myanmar Inc. of Malaysia (30.00%), Premier Oil plc. of the United Kingdom (26.67%), MOGE (15.00%), Nippon Oil Exploration (Myanmar) Ltd. of Japan (14.17%), and PTT Exploration and Production of Thailand Ltd. (14.17%)] produced natural gas from the offshore Yetagun Gasfield in the Andaman Sea. It also sold the entire natural gas production to EGAT's Ratchaburi powerplant; the natural gas was sent through a 269-km pipeline. The Yetagun Group was expected to produce an average of 5.66 million cubic meters per day of natural gas from the Yetagun Gasfield in 2001. According to Premier Oil, however, the natural gas output from the Yetagun Gasfield averaged 3.23 million cubic meters per day in 2001. The Yetagun also produced condensate, which averaged 1,000 bbl/d in 2001 (Rigzone.com, March 2002b<sup>1</sup>).

Daewoo International Corp. of the Republic of Korea, which signed a production-sharing contract with MOGE in 2000 to explore for oil and gas in the Block A-1 in the Bengal Gulf, had transferred 10% interest in the Block A-1 to Korea Gas Corp. Daewoo International, which still held 90% interest in the project, planned to sell an additional 30% interest to other companies, which would provide funding in excess of their equity interests in the project for the future gas development of the Block A-1, where reserves were estimated to contain 283 billion cubic meters of natural gas (Rigzone.com, 2002a<sup>§</sup>).

In downstream processing, the state-owned Myanmar Petrochemical Enterprise (MPE) under the Ministry of Energy produced such refined petroleum products as aviation fuel, diesel, distillate fuel oil, gasoline, kerosene, and petroleum coke. MPE operated three refineries—No. 1 Refinery at Thanlying (26,000-bbl/d capacity) near Yangon, No. 2 Refinery at Chau (6,000-bbl/d capacity) in central Myanmar, and No. 3 refinery at Thanbayakan (25,000-bbl/d capacity) in central Myanmar. MPE also operated four nitrogen fertilizer plants—No. 1 Fertilizer Factory A plant (205-t/d capacity) and No. 1

<sup>1</sup>References that include a section twist (§) are found in the Internet References Cited section.

Fertilizer Factory B plant (260-t/d capacity) at Sale, No. 2 Fertilizer Factory at Kyun Chaung (207-t/d capacity), and No. 3 Fertilizer Factory at Kyaw Zwar (600-t/d capacity), all in central Myanmar (Ministry of Energy, 2001§).

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## Major Source of Information

The Ministry of Mines  
90 Kanbe Rd., Yankin  
Yangon, Myanmar (Burma)  
Telephone: 95-1-577463, 577454  
Fax: 95-1-577455  
URL: <http://www.myanmar.com/Mines/mines/Department%20of%20Mines.htm>

## Major Publications

- The Ministry of National Planning and Economic Development, Yangon, Review of the Financial, Economic and Social Conditions, 1997-98.
- Central Statistical Organization, Yangon: Statistical Yearbook, annual.
- Selected Economic Indicators, monthly.

TABLE 1  
BURMA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/	1997	1998	1999	2000	2001 e/
<b>METALS</b>					
Chromium, chromite, gross weight e/	3,299 3/	4,059 3/	3,200	3,000	3,000
<b>Copper:</b>					
Mine output, Cu content	2,927	6,700 e/	26,736	26,711	26,300
Matte, gross weight 4/	53	58	142	60 e/	60
Metal, refined	--	6,700 e/	26,736	26,711	26,300
Gold, mine output, Au content 4/ kilograms	410 r/	334 r/	267 r/	250 e/	200
<b>Iron and steel: 4/</b>					
Pig iron e/	--	1,500	1,500	1,500	1,500
Direct-reduced iron e/	40,000	40,000	40,000	40,000	40,000
Steel, crude e/	--	25,000 r/	25,000 r/	25,000 r/	25,000
<b>Lead</b>					
Mine output, Pb content e/ 5/	1,900	2,200	1,800 r/	1,200 r/	1,300
<b>Metal:</b>					
Refined	1,760	1,936	1,666	1,054 r/	1,200
Antimonial lead (93% Pb) 4/	--	116	-- r/	-- r/ e/	--
Manganese, mine output, Mn content e/	50	50	50	50	50
<b>Nickel:</b>					
Mine output, Ni content e/	7	10	10	10	10
Speiss (matte), gross weight 4/	38	31 r/	77 r/	40 e/	40
Silver, mine output, Ag content 5/ kilograms	1,866	3,359	4,168	2,457 r/	2,300
<b>Tin, mine output, Sn content: 5/</b>					
Of tin concentrate	111	75	77	149 r/	160
Of tin-tungsten concentrate	224	146	72	63 r/	70
Total	335	221	149	212 r/	230
Metal, refined	228	31 r/	32 r/	30 r/ e/	30
<b>Tungsten, mine output, W content: 5/</b>					
Of tungsten concentrate	10	8	3	1 r/	1
Of tin-tungsten concentrate	262	170	84	73 r/	70
Total	272	178	87	74 r/	71
Zinc, mine output, Zn content 5/	467	474	279	437 r/	480
<b>INDUSTRIAL MINERALS</b>					
Barite	17,111	22,004	24,651	30,370 r/	34,000
Cement, hydraulic	515,682	364,959	338,025	393,355 r/	460,000
<b>Clays:</b>					
Bentonite 4/	4,908	3,871	1,066 r/	998 r/	900
Fire clay and fire clay powder 4/	5,118	2,746	2,183 r/	659 r/	600
Feldspar e/ 4/	11,960 3/	12,000	12,000	12,000	10,000
Gypsum	38,481	36,411	44,857	48,067 r/	51,000
Nitrogen, N content of ammonia	61,700	51,605	64,782	78,000 r/	78,000
<b>Precious and semiprecious stones:</b>					
Jade kilograms	1,679,244	1,525,578	2,342,108	8,318,261 r/	1,700,000
Diamond e/ carats	5	5	5	5	5
Rubies, sapphires, spinel 4/ do.	13,684,960	14,446,638	8,970,441 r/	8,350,695 r/	8,630,000
Salt e/ 6/ thousand tons	35	35	35	35	35
<b>Stone:</b>					
Dolomite	3,942	4,468	2,523	--	--
Limestone, crushed and broken e/ thousand tons	3,500	2,500	2,000	2,400	3,200
<b>MINERAL FUELS AND RELATED MATERIALS</b>					
Coal, lignite	27,516	27,766	40,309	52,811 r/	49,000
<b>Gas, natural:</b>					
Gross e/ million cubic meters	1,821 3/	1,800	1,712 3/	3,500 r/	7,100
Marketed do.	1,781	1,750	1,674	3,300 r/ e/	6,800
<b>Petroleum:</b>					
Crude thousand 42-gallon barrels	4,417	3,423	3,394	3,538 r/	3,300
Refinery products 7/ do.	5,414	5,815	5,605	5,536 r/	5,800

See footnotes at end of table.

TABLE 1--Continued  
BURMA: PRODUCTION OF MINERAL COMMODITIES 1/

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

1/ Table includes data available through May 10, 2002.

2/ In 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.

3/ Reported figure.

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

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

6/ Brine salt production, in metric tons, reported by the Government was 1997--97,276; 1998--91,992; 1999--61,674; 2000--69,245 (revised); and 2001--61,000 (estimated).

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

Sources: Ministry of Mines and Central Statistical Organization (Yangon), Statistical Yearbook 2000, p. 157; Selected Monthly Economic Indicators, January-April 2001; Asian Mining Yearbook 2000, p. 18.