

# THE MINERAL INDUSTRY OF BURMA (MYANMAR)

By John C. Wu

Myanmar, formerly known as Burma, has large mineral resources of precious and semiprecious stones, such as jade, ruby, and sapphire. Myanmar also has considerable mineral resources of antimony, barite, coal, copper, gold, iron, lead, monazite, natural gas, nickel, petroleum, silver, tin, tungsten, and zinc. Myanmar's identified mineral resources of bauxite, bentonite, beryllium, clays, chromium, diamond, feldspar, fluorspar, gypsum, kaolin, manganese, mercury, mica, platinum, and sulfur are small (Ko Ko Myint, 1994, p. 238).

The Ministry of Mines (MOM) through its Department of Geological Survey and Mineral Exploration had completed preparation of mineral occurrences, metallogenetic, tectonic, and hydrogeologic maps on a scale of 1:2,000,000. As of 1992, an area of about 386,763 square-kilometers (km<sup>2</sup>), or about 57% of the country landmass, had been mapped geologically. During 1992-94, the Government conducted geologic surveys and exploration drilling mainly for coal, copper, and gemstones. As a result of the 3-year mineral exploration program, three gemstone deposits, two coal deposits, and several alluvial platinum-group metals deposits were discovered (United Nations, 1996, p.138, 142-43).

To increase the country's mineral exploration, the Government awarded 6 foreign companies in 1994 with contracts to conduct exploration for copper and gold in 14 blocks with an area of about 1,400 km<sup>2</sup> each in Upper Myanmar. The Government awarded five foreign companies in 1995 with contracts to explore for copper, gold, lead, platinum, and zinc in nine blocks in central and lower Myanmar. An additional 13 blocks had been offered by the Government in 1997 for exploration of copper, gold, lead, nickel, silver, and zinc, but only 2 foreign companies were awarded contracts by 1998 to conduct exploration in 5 blocks.

During 1994-98, the major Western mining companies exploring for copper, gold, and other base metals in Myanmar were International Panorama Resources Ltd., Ivanhoe Myanmar Holdings Ltd., Mindoro Resources Ltd., and Prime Resources Management Ltd. of Canada; Pacific Arc Exploration NL and Diversified Mineral Resources NL of Australia, and East Asia Gold Corp. and Newmont Mining Corp. of the United States (Myanmar Business, 1998d). In the past 5 years, the mineral exploration conducted by foreign companies had resulted in considerable extension of copper reserves and discovery of several small promising gold targets in various parts of the country.

Myanmar produced a wide variety of minerals in 1998. 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. In 1998, most mineral production remained at a low level owing to the lack of spare parts, outdated technology, and declining ore grades. Myanmar became a producer of refined copper in 1998 with the help of foreign capital and technology. (*See table 1.*)

According to Government statistics, the output of the mining sector contributed about 1.3% to Myanmar's gross domestic product. Of the total output of the mining sector, 52% was produced by the state-owned companies; 47%, by privately owned companies; and 1%, by cooperatives (Ministry of National Planning and Economic Development, 1997). Mineral commodities exports accounted for about 6% of the total export earnings and mineral commodities imports accounted for about 22% of total imports. Exports of major mineral commodities included ores and concentrates of chromium, copper, manganese, tin, tungsten, and zinc; refined metal of copper, lead, and silver; and crude and polished precious and semiprecious stones. Imports of mineral commodities included cement, refined petroleum products, base metals, and steel mill products. Most of Myanmar's mineral trade was with Asian and European countries. Mineral trade with the United States was small and limited to imports of various chemical compounds and exports of gemstones to the United States. Myanmar's exports of gemstones earned about \$23 million in 1998.

The mining industry comprised three state-owned mining enterprises, a state-owned gem enterprise, a state-owned ceramic industries company, 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 was about 132,000, accounting for about 0.7% of Myanmar's total employment (Ministry of National Planning and Economic Development, 1997).

The three state-owned mining enterprises under the MOM are No. 1 Mining Enterprise (ME 1), No. 2 Mining Enterprise (ME 2), and No. 3 Mining Enterprise (ME 3). ME 1 mined and processed copper, lead, silver, and zinc. ME 2 mined, processed, and marketed diamond, gold, tin, and tungsten. ME 3 mined, processed, and marketed chromite, coal, industrial minerals, iron, manganese, and nickel. ME 3 also produced and marketed steel and steel mill products. The state-owned Myanma Gems Enterprise (MGE) mined, processed, and marketed jade, ruby, sapphire, and other precious and semiprecious stones. The state-owned Myanmar Ceramic Industries manufactured and marketed cement and other

ceramic products. The state-owned Myanmar Oil and Gas Enterprise (MOGE), under the Ministry of Energy, produced, processed, and marketed crude petroleum, natural gas, and refined petroleum products.

In chromite mining, the Yangon-based Science and Technology Advisory Group (STAG) Ltd. began operations in 1998 under a production-sharing contract with ME 3 at Tagaungtaung in Thabeikyin Township, about 320 kilometers (km) north of Mandalay. Under the contract signed with ME 3 in 1994, STAG was to mine 5,000 metric tons per year (t/yr) of chromite ore, averaging 48% Cr<sub>2</sub>O<sub>3</sub>, with a 30-70 Government/STAG split. In mid-1998, 5,000 metric tons (t) of chromite ore was loaded onto a ship at No. 1 Sule Wharf in the Yangon Port. The chromite ore was sold to Kinsho Mataichi Corp., the Tokyo-based trading company (Myanmar Business, 1998f).

In copper mining, the Myanmar Ivanhoe Copper Company Ltd. (MICCL) completed construction of an open pit mine, crushing facilities, heap leaching pads, and a solvent extraction-electrowinning (SX-EW) recovery plant in Salingyi Township, about 15 km west of Monywa in west-central Myanmar in 1998. In March, MICCL started mining operations at the rate of 12,000 metric tons per day (t/d) from the Sabetaung and Kysisintaung (S & K) Mines at an elevation of 75 to 100 meters. The mined ore, grading 0.97% copper, was placed on the leaching pads at the rate of 375,000 metric tons per month (t/mo). Active leaching began in August but actual production of copper cathode at the SX-EW recovery plant was delayed until early in November because of the late arrival of machinery, equipment, and parts (Mining Journal, 1998).

The first full month production of copper cathode in December totaled 2,117 t, slightly higher than the 2,083-t/mo or 25,000-t/yr capacity. The average cash cost, including shipping and marketing fee, was \$0.42 per pound or about \$0.92 per kilogram. The minable ore reserves of the S & K Mines were estimated at 155 million metric tons (Mt) grading 0.47% copper (Indochina Goldfields Ltd., 1998). According to the company's August 1998 study, the copper resources of the Sabetaung, Sabetaung South, and Kyisingtaung Mines, with a cutoff grade of 0.15% copper, were estimated at 560 Mt, averaging 0.32% copper. The construction costs of the Phase 1 S & K project totaled \$118 million, of which \$28 million in cash was contributed by Indochina Goldfields Ltd. (IGL), and the remaining \$90 million in loan was provided by a Japanese consortium, led by Marubeni Corp. and Nissho Iwai Corp. IGL planned to initiate an expansion program of the S & K Mine to increase capacity by 10,000 t/yr to 35,000 t/yr of copper cathode with an additional cost of about \$7.5 million in 1999. MICCL is a 50-50 joint venture of the state-owned ME 1 and IGL's subsidiary, Ivanhoe Myanmar Holdings Ltd. (Engineering and Mining Journal, 1999).

In June, Ivanhoe Myanmar Holdings signed another contract with the Department of Geological Survey and Mineral Exploration to explore for gold and copper in Block 12 in the Myesaytaung area of Letpadan Township in Bago Division. Ivanhoe Myanmar Holdings previously had signed two contracts with the Government. The first contract was for

production of copper from the S & K Mines in 1994, and the second contract was for development of a copper mine at the Letpadaung concession area in 1995 (Myanmar Business, 1998e).

In lead, silver, and zinc mining, ME 1 operated the Bawdwin and Yadanatheingi Mines in Shan State. The Bawdwin Mine comprised an open pit mine, an underground mine, and two concentrators with a total capacity of 1,500 t/d of ore. The Yadanatheingi Mine is 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 about 2,000 t/yr and 5,000 t/yr, respectively. Byproducts production of antimonial lead, copper matte, and nickel speiss totaled about 160 t/yr. Zinc concentrate estimated at 1,500 t/yr was exported.

Mandalay Mining Co. NL (MMC), a subsidiary of Diversified Mining Co. of Australia that signed a production-sharing contract with ME 1 in July 1996, had completed a feasibility study for mine development, ore processing, and marketing of lead, silver, and zinc from the Bawdwin Mine and nearby Namtsu region in late 1997. MMC was seeking a partner to participate in the project because of the large capital requirement. In late 1997, ME 1 signed a joint-venture production-sharing contract with Tarfu Mining Ltd., a local company, to develop a lead and zinc deposit in the Panlon area of Hopang Township in Shan State (Mining Annual Review, 1998). For metal production of antimony, the MOM and Mayflower Mining Enterprise, a local company, were planning to renovate an old antimony smelter in Kalaw Township, near Thazi in Mandalay Division (Myanmar Business, 1998c).

In gold mining, ME 2 operated the Kyaukpahtoe Mine in Kawlin Township, Sagaing Division and the Phayaungtaung Mine in Patheingyi Township, near Mandalay. In July 1996, ME 2 signed a joint-venture agreement with the Newmont Mineral Exploration BV, a subsidiary of Newmont Mining Corp. of the United States, for exploration, development, and production of gold from the Kyaukpahtoe area. However, after spending \$6 million for 10 months in exploration, including drilling, systematic geochemical sampling, and other geologic surveys, Newmont had withdrawn from the Kyaukpahtoe gold project in late 1997 because of the less than expected ore reserves and the low ore grade in the area (Mining Annual Review, 1998). The East Asia Gold Corp., which signed an agreement with the Department of Geological Survey and Mineral Exploration in August 1995 for exploring gold and copper in Thabeikyin Township, reported discovery of new gold targets at Suboktaung in its Block 14 concession area and at the Set Ga Dome in its Block 4 concession area (East Asia Gold Corp., 1998).

In October, ME 2 signed a production-sharing agreement with the Myanmar Gold Point Family Co. Ltd., a local company, for gold mining at Phayaung Hill in Patheingyi Township of Mandalay Division (Myanmar Perspective, 1998a). In November, the Department of Geological Survey and Mineral Exploration signed an agreement with the Liaoning Jin Di Construction Co. Ltd. of China to conduct a feasibility study and explore for gold and copper in northern

Kachin State. This was the first agreement for a Chinese company to conduct mineral exploration in Myanmar (Xinhua News Agency, 1998).

In tin and tungsten mining, ME 2 operated the Mawchi Mine (tin and tungsten) in Phasaung Township of Kayah State, 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. Small-sized, gem-quality diamond was recovered by ME 2 as a byproduct of sluicing tin concentrate at the Theindaw Mine (tin) in Tanintharyi Division.

Production of cement was by the state-owned Myanmar Ceramic Industries (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, Kayin State, had a capacity of 240,000 t/yr. In April, MCI signed a contract with the Mitsubishi Corp. of Japan to carry out a major overhaul of No. 2 kiln of the cement plant No. 1 in Thayet Township. The plant, built in 1935 with kiln capacity of 142,000 t/yr, was poorly maintained owing to lack of spare parts. The Thayet plant previously had been renovated by a Yunnan-based Chinese company in 1968. Cement consumption in 1998 was about 2.4 Mt, of which about 1.9 Mt was met by imports (International Cement Review, 1998, p. 204).

In gemstone and jade mining, MGE continued to mine rubies and sapphires at the Mogok Stone Tract, about 175 km northeast of Mandalay. MGE and local private companies participated in jade and ruby mining at the Mongshu Stone Tract in eastern Myanmar. According to the MOM, the Union of Myanmar Economic Holdings Ltd., MGE, and joint-venture firms of state-owned and private companies were using new equipment to mine raw jade in Pharkant, Lonkhin, Tamakhan, Kwekha, and Khamti in northern Myanmar (Mining Annual Review, 1998).

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 produced by ME 3 from the Kalewa Mine in Sagaing Division was consumed by industries in the local area. In July, the Department of Geological Survey and Mineral Exploration signed an agreement with P.T. Austindo Nusantara Energi Co. (PTANEC) of Indonesia to conduct exploration and a feasibility study for developing coal mines in Taninthayi Division, where several coal resources had been identified. Under the agreement, the Government offered PTANEC incentives in the form of initial tax exemption and an option to purchase the Government's interest in the project at an agreed price, if the feasibility study concluded that the coal resources are economically viable for development (Myanmar Perspective, 1998b).

Production of crude petroleum and natural gas was by the state-owned MOGE. Production of crude petroleum, from five onshore oilfields—Chauk-Lanywa, Mann, Myanaung, Prome, and Yenangyaung—averaged 11,500 barrels per day (bbl/d) in 1998 (World Oil, 1999). To boost onshore crude petroleum

production, Baker Hughes Solution Co. and Geco Prakla Co. conducted a 3D seismic survey and other works in the Mann Oilfield. Asian Pacific Energy Co. was working in the Htaushabin Oilfield Ltd., and Macintyre Petroleum Ltd. of Canada and Mercantile Ltd. of The Bahamas conducted 2D seismic survey, drilled test wells, and were to repair old wells in the Myanaung Oilfield under the agreements signed with MOGE in 1997 and 1998 (World Oil, 1998).

Production of natural gas, averaging 4.9 million cubic meters per day (Mm<sup>3</sup>/d) in 1998, was mainly from 23 wells in the Aphyauk Gasfield, about 72 km northwest of Yangon, between Taikkyi Township in Yangon Division and Zalun Township in Ayeyarwady Division. Most of the natural gas production from the Aphyauk Gasfield was piped to two powerplants for the generation of electricity at Thaketa, near Yangon and Shwedaung, near Pyay, and for industrial use at the Sittaung Paper Mill and nitrogen fertilizer (ammonia and urea) plants at Kyawswa, Kyunchaung, and Sale near Yangon.

In oil and gas exploration and development, MOGE signed a production-sharing contract with a consortium of Westborne Oil Ltd. and A&T Exploration Co. of the United Kingdom and Capital Investment Development Corp. of Israel in April for exploration and development of oil in RSF-8 Block onshore in Minbu District, Magway Division. MOGE also signed two other production-sharing contracts for oil and gas exploration with Jamberoo Ltd. in Block M-4 and Roundhay Ltd., Block M-3 in 1998 (Myanmar Business, 1998b).

In January, Texaco Exploration Myanmar Inc. (TEMI) discovered a new oil and gasfield off Taninthayi Division in Block M-12, about 32 km northwest of the Yetagun Gasfield. The Aung Zeya Ya-1 wildcat tested gas at a rate of 268,000 cubic meters per day and condensate at a rate of 123 bbl/d. TEMI relinquished its interest in the block, after it withdrew from Myanmar in early 1998 (Petroleum Economist, 1998).

In August, Atlantic Richfield Co. (ARCO) announced that it would not renew its remaining exploration lease offshore Myanmar. The lease expired in October 1998 owing to new investment priorities resulting from the recent acquisition of Union Texas Petroleum Ltd. and partnership with Triton Energy Ltd. in a major Asian gas project. Since 1995, ARCO had spent about \$50 million exploring for gas off the southern coast of Myanmar. It signed production contracts with MOGE in 1995 and 1996, respectively, for Blocks M-7 and M-9. ARCO drilled two wells on Block M-9 and none on M-7 (Atlantic Richfield Co., 1998).

Development of the offshore Yadana Gasfield, which was scheduled to produce gas at an initial rate of 9.2 Mm<sup>3</sup>/d in July 1, had been postponed because of a delay in completion of the Ratchaburi powerplant of the Electricity Generating Authority of Thailand. According to the sales contract signed between Petroleum Authority of Thailand (PTT) and the consortium led by Total SA in 1995, PTT was to take 14.87 Mm<sup>3</sup>/d of gas beginning in July 1998 (Myanmar Business, 1998a). The Yadana Gasfield, which has an estimated recoverable gas reserves of 207 billion cubic meters, is owned by Total SA of France (31.24%), Unocal Corp. of the United States (28.26%), PTT of Thailand (25.5%), and MOGE of Myanmar (15%).

Development of Yetagun Gasfield off Taninthayi coast

included several development wells and a gas production platform. Drilling of eight test wells was scheduled to be completed by May 1999 and commercial production was scheduled to begin in early 2000 (Myanmar Business, 1998g). The Yetagan Gasfield has estimated reserves of 51 billion cubic meters of natural gas and 48 million barrels of natural gas condensate. The project is 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%) (Myanmar Business, 1998a).

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## Major Source of Information

The Ministry of Mines  
90 Kanbe Rd., Yankin  
Yangon, Myanmar (Burma)  
Telephone: 95-1-57457, 52683, 52090  
Fax: 95-1-57309

## Major Publication

The Ministry of National Planning and Economic Development, Review of the Financial, Economic and Social Conditions, annually; Central Statistical Organization: Statistical Abstract, annually; Selected Economic Indicators, monthly.

TABLE 1  
BURMA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/	1994	1995	1996	1997 p/	1998 e/
<b>METALS</b>					
Chromium, chromite, gross weight e/	1,000	1,000	1,000	1,000	5,000
Copper:					
Mine output, Cu content	5,025	5,282	4,841 r/	2,927	2,500
Matte, gross weight	37	210 r/	95 r/	100 r/ e/	90
Metal, refined 3/	--	--	--	--	4,200
Gold, mine output, Au content kilograms	164 r/	101 r/	172 r/	150 r/ e/	100
Iron and steel: 3/					
Pig iron	1,188	1,368 r/	1,500 e/	1,500 e/	1,500
Steel, crude	16,500	23,500	25,000 e/	25,000 e/	23,500
Lead					
Mine output, Pb content e/	2,300	2,400	2,200	1,900 r/	2,200
Metal:					
Refined	1,797	1,753	1,984	1,760 r/	1,940
Antimonial lead (93% Pb)	40	55 r/	88 r/	71 r/	50
Manganese, mine output, Mn content e/	60	50	50	50	50
Nickel:					
Mine output, Ni content e/	50	50	50	50	50
Speiss (matte), gross weight	73 r/	82 r/	35 r/	30 r/ e/	30
Silver, mine output, Ag content kilograms	5,629	4,417	3,950	1,866 r/	3,360
Tin, mine output, Sn content:					
Of tin concentrate	416	372	201	111 r/	80
Of tin-tungsten concentrate	398	375	258	224 r/	160
Total	814	747	459	335 r/	240
Metal, refined	200	190 e/	--	--	--
Tungsten, mine output, W content:					
Of tungsten concentrate	89	93	33	10 r/	10
Of tin-tungsten concentrate	455	438	301	262 r/	190
Total	544	531	334	272 r/	200
Zinc, mine output, Zn content	1,316	721	572	467 r/	490
<b>INDUSTRIAL MINERALS</b>					
Barite	21,969	34,601	24,679	17,111 r/	22,000
Cement, hydraulic	469,582	516,931	504,670	515,682 r/	500,000
Clays:					
Bentonite	795	2,655	4,846 r/	610 r/	1,000
Fire clay and fire clay powder	2,413	2,735	4,273 r/ 3/	5,118 r/ 3/	5,000
Feldspar 3/	5,605	8,749	13,295 r/	11,960 r/	12,000
Gypsum	38,136	34,659	37,899	38,481 r/	36,400
Nitrogen, N content of ammonia	70,000 r/	66,000 r/	57,000 r/	61,700 r/	62,000
Precious and semiprecious stones:					
Jade kilograms	316,543	702,751	1,214,711	1,679,244 r/	1,500,000
Diamond 3/ carats	48	11 r/	50 r/	5 r/	5
Rubies, sapphires, spinel do.	185,418	2,725,038	6,858,298	7,600,000 e/	9,500,000
Salt e/ 4/ thousand tons	30	35	35	35	35
Stone:					
Dolomite	4,115	3,432	5,147	3,942 r/	4,500
Limestone, crushed and broken thousand tons	2,581	3,008	3,000 e/	3,500 e/	3,500
<b>MINERAL FUELS AND RELATED MATERIALS</b>					
Coal, lignite	35,856	32,191	33,407	27,516 r/	27,800
Gas, natural:					
Gross e/ million cubic meters	1,329	1,508	1,659	1,821 r/	1,800
Marketed do.	1,301	1,477	1,625	1,781 r/	1,750
Petroleum:					
Crude thousand 42-gallon barrels	5,188	4,393	3,906	4,417 r/	4,200
Refinery products 5/ do.	4,627	5,313	4,831	5,414 r/	5,500

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

1/ Table includes data available through May 19, 1999.

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.

4/ Brine salt production, in metric tons, reported by the Government was: 1994--58,612; 1995--81,156; 1996--71,350; 1997--70,000 and 1998--72,000 (estimated).

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 1995, p. 147; Statistical Abstract 1996, p. 41-42; Selected Monthly Economic Indicator, January-December 1996-1998.