THE MINERAL INDUSTRY OF

MALAYSIA

By John C. Wu

Malaysia's mineral resources of tin are large. Its tin reserves, estimated to contain about 1.2 million metric tons (Mt) of tin, were ranked the world's third largest behind Brazil and China in 1996. Malaysia also has considerable reserves of yttrium associated with its tin ore. Malaysia's other important mineral resources are antimony, barite, bauxite, clays, coal, copper, natural gas, gold, ilmenite, iron ore, lead, limestone, monazite, crude petroleum, silica, silver, tungsten, and zinc. The potential for occurrence of additional resources of copper, gold, and other nonferrous minerals in the States of Pahang, Kelantan, Sabah, Sarawak, and Terengganu is good, based on favorable preliminary geological surveys conducted by the Government of Malaysia..

In 1996, Malaysia's minerals production included barite, bauxite, coal, copper, dolomite, gold, ilmenite, iron ore, kaolin, limestone, mica, monazite, natural gas, crude petroleum, silica, silver, and zirconium. Malaysia's major value-added minerals production was cement, refined lead (secondary), liquefied natural gas (LNG), nitrogen-fertilizer materials (ammonia and urea), refined petroleum products, crude steel, titanium dioxide pigment, and refined tin. *(See table 1.)* In 1996, Malaysia was the third largest producer and exporter of refined tin and LNG in the world. Malaysia was one of the important producers and suppliers of bauxite, copper, ilmenite, kaolin, LNG, monazite, crude petroleum, and refined tin in Asia and the Pacific region.

The mining industry, which contributed about 7% to Malaysia's gross domestic product (GDP), continued to grow, but at a slower pace in 1996 than in 1995. The output of the mining sector grew 4.4% in 1996 compared with 9.1% in 1995, while Malaysia's GDP grew 8.2% in 1996 compared with 9.5% in 1995. According to the Ministry of Finance, Malaysia's GDP, in 1978 constant dollars, was estimated at $52 billion, of which $3.6 billion was contributed by the mining sector in 1996 (Ministry of Finance, Economic Report 1995–96). Malaysia was a net exporter of mineral products in 1996. Malaysia exported most of its mineral products to Japan and neighboring southeast Asian countries. Bauxite was exported mainly to Japan, Taiwan, and Thailand. All copper concentrate was exported to Japan. Ilmenite was exported mainly to France, Japan, and the Republic of Korea. Refined tin was exported mainly to Japan, the Netherlands, the Republic of Korea, and the United Kingdom. LNG and crude petroleum were exported mainly to Japan and the Republic of Korea. Malaysia was an insignificant supplier of crude petroleum to the United States, but was the fifth largest supplier of refined tin to the United States in 1996.

In 1996, export earnings were estimated at $78.2 billion, of which about $2.9 billion was from exports of crude petroleum and about $1.8 billion was from exports of natural gas (in the form of LNG). The estimated export earnings from other minerals were: $212 million from refined tin, $58 million from copper concentrate, and $20 million from bauxite, ilmenite, iron ore, and mica. Imports of nonfuel minerals, such as iron ore and tin concentrate, were mostly reexported after smelting. However, a considerable quantity of coal, heavy crude petroleum, nonferrous metals, and industrial minerals including gypsum, phosphate rock, potash, and salt were imported for domestic consumption. Malaysia imported about 26,000 barrels per day (bbl/d) of heavy crude petroleum from the Middle East to meet the requirement for its oil refineries and about 2.7 million metric tons (Mt) of coal mainly from Australia and Indonesia to meet the requirements for its cement and utility industries. Other important mineral imports in 1996 were iron ore and tin concentrate for reexport after smelting, cement clinker, gypsum, phosphate rock, potash, sodium carbonate, and sulfur for domestic consumption.

The structure of Malaysia's mineral industry expanded considerably in 1996. The capacity of the cement industry increased to 14.23 million metric tons per year (Mt/yr) and the capacity of the LNG industry increased to 15.9 Mt/yr. However, the capacity of the tin smelting industry decreased to 60,000 metric tons per year (t/yr) in 1996 from 80,000 t/yr in 1995. *(See table 2.)* The reduction in tin smelting capacity was caused by lower content of tin in smelter feed. The total number of persons employed by the mining and quarrying industry increased from 40,700 in 1995 to 41,800 in 1996, accounting for 0.5% of Malaysia's labor force. Malaysia's labor force rose from 8.1 million in 1995 to 8.4 million in 1996; of those, 217,400 people were unemployed.

To improve the existing law and regulations for investment in the mining industry and to improve and modernize the investment climate for mineral exploration and development, the Ministry of Primary Industries had undertaken various steps in the past 4 years to implement the National Mineral Policy and the Mineral Development Act. The major issues, which were still waiting for ratification by each State of Malaysia included 1) revision and harmonization of all State and Federal mining laws and regulations, 2) granting licenses to cover larger exploration areas for large-scale mining and longer mining leases to sufficiently cover the estimated ore reserves, 3) security of tenure, and 4) simplification and shortening of the procedure and process of license application. According to Malaysia Chamber of Mines (Current Status of the Malaysia Minerals Industry, Malaysia Chamber of Mines [Kuala

Lumpur], written communi, 1996), to reform the existing rules and regulations for investment in the mining sector, a new administrative framework should be established to carry out systematic mineral title management in the respective State and a more competitive mining taxation system and a more comprehensive mine health and safety regulations should be developed. As of 1996, only the State of Sarawak had ratified the National Mineral Policy and the Mineral Development Act.

Mine production of bauxite increased because one additional mine was in operation in 1996. Johore Mining and Stevedoring Co. Sdn. Bhd., Malaysia's sole bauxite producer, operated a multiple-bench, open pit mine and a processing plant with a capacity of 400,000 t/yr of washed bauxite at the Bukit Raja area near Pengerang Highway, north of Sungai Rengit and east of Johore Bahru. The company produced three grades of bauxite from the mining areas: refractory, metallurgical, and cement. Most chemical- and metallurgical-grade washed bauxite were exported to Japan and the United States, while the cement-grade bauxite was sold as raw material to domestic cement manufacturers. According to Geological Survey of Malaysia, a feasibility study of the BukitGoh/Jabor Valley prospect at the State boundary of Pahang and Terengganu showed that the area's bauxite ore reserves of 66 Mt with ore grade of 40% to 50% Al_2O_3 and abundant natural gas (petroleum gas) nearby can support a 120,000-t/yr aluminum smelter for 25 years (Geological Survey Department, Malaysia, 1995, p. 18).

Production of copper concentrate by the Mamut Copper Mining Sdn. Bhd. (MCM) at the Mamut Mine in Sabah remained at about the same level as that of 1995. At the Mamut Mine, which is located at 1,400 meters (m) above sea level, the open pit mining capacity was 6.5 Mt/yr of ore and the milling capacity was 6.3 Mt/yr of ore. In 1996, production of copper concentrate totaled 87,580 metric tons (t) with an average copper content of 26%. For export to Japan, the copper concentrate was transported by trucks to Usukan Port in Kola Belud, about 115 kilometers (km) from the mine site, then loaded onto bulk carriers. At the end of 1996, there were about 1,000 employees and about 4,000 people including employees and their family members that lived in a mining town, called Miles-2, near Ranau in Sabah. Ore reserves of the Mamut Mine were to be depleted in 1997. However, an additional 30 Mt of ore reserves with an average ore grade of 0.47% copper plus 0.47 grams per metric ton (g/t) gold and 2.88 g/t silver had been delineated near the mine site following a successful exploration in the 1994-95 period. As a result, the mine life was extended to the year 2000. MCM and Perilya Mines NL of Australia formed a 50-50 joint venture in 1996 to identify and explore new exploration and mining opportunities for copper and gold in a 259-square-kilometers area northeast of Ranau near the Mamut Mine.

To minimize mining-related environmental damage, MCM has been Malaysia's role model mining company to implement various environmental control programs. At the Lohan tailing retention dam, about 900 m below the mine site and 16 km southwest of the mill, water was tested regularly and samples were analyzed by the company and the Government independently in accordance with the Government regulations and standards. At the mine, MCM has been continuously undertaking reafforestation and rehabilitation programs since the early 1980's. Because of the high rainfall in the mining area, the dump surfaces were revegetated quickly to stabilized the slopes and minimize erosion. As of 1996, more than 60 hectares (ha) of dump slopes had been revegetated with grasses at the rate of 2 ha per month and trees at the rate of 2,000 trees per month. MCM is spending about $85,000 per month for its reclamation program. MCM also is undertaking experimental cultivation of flowers, grasses, creepers, shrubs, and trees at its own nursery, near the mine site (Mamut Copper Mining, 1996).

Mine production of gold continued to decrease in 1996 because of decreased number of the productive mines and reduced gold production as byproduct of copper and tin mining in Sabah and Peninsular Malaysia. Of the total gold produced in 1996, 53% was byproduct of copper mining in Sabah and byproduct from tin mining mainly in the States of Perak and Selangor. The remaining 47% of gold production was from 8 to 10 small-scale gold mines operating in the States of Kelantan, Pahang, Sarawak, and Terengganu.

In joint venture with the State-owned Pahang State Development Corp., Avocet Mining PLC (AM) of the United Kingdom, through Avocet Gold Ltd. (AG), completed construction of the Penjom Gold Mine (3 open pits), about 10 km southwest of Kuala Lipis in central Pahang, in December 1996. Gold mining and ore processing, operated by Specific Resources Sdn. Bhd. (SR), began in December 1996. Both AG and SR are wholly owned subsidiaries of AM. At the carbon-in-leach treatment plant, the capacity was at the rate of 600,000 t/yr of ore. As of 1996, ore reserves at the Penjom property were estimated by AM at 3.58 Mt, averaging 3.11 g/t gold. The planned gold production in the first year is 2,100 kilograms (kg) of gold, then increase to 2,500 kg in the second year and to 2,700 kg in the third year (Engineering and Mining Journal, 1996).

The State Government of Pahang approved 73,769 ha of land for gold exloration in 1996. The State Government granted gold exploration permits to five companies including companies from Australia and Canada. Malaysia Mining Corp. Bhd. was awarded a 10,263-ha area. Target Resources Australian NZ was awarded a 18,427-ha area. Euralba Mining (Lipis) Ltd. was awarded a 19,552.4-ha area. Montague Gold NL was awarded a 12,178.8-ha area. Luckfrost Ltd. was awarded a 1,457.6-ha area (New Straits Times, 1996). The exploration sites were mostly in the Districts of Jerantut, Lipis, Raub, and Temerloh in eastern Pahang. In 1996, Target Resources Australian NL, in a joint venture with the Pahang State, was conducting gold exploration and a feasibility study in the Selinsing and the old Bumi-E-Mas gold mine areas. Menzies Gold NL of Australia, in a joint venture with Gladioli Enterprises Sdn. Bhd., conducted exploration in the Pejiru area of the Bau District in Sarawak in 1995-96 and discovered significant gold mineralization in the area.

Production of iron ore increased considerably in 1996. Most of the 1996 production was from six operating mines in the States of Johor, Kedah, Pahang, and Perak. About 7% of the

total iron ore production was recovered as a byproduct of tin mining in 1996. Iron ore produced in 1996 has an average ore grade of 64% iron. Most of the iron ore production was consumed domestically by Malayawate Steel Bhd. and several cement companies as raw material. To meet the raw material requirements for its iron and steel industry, Malaysia imported annually between 1.3 Mt and 1.8 Mt of iron ore mainly from Bahrain, Brazil, Chile, and Sweden and between 100,000 t and 150,000 t of pig iron from China, India, Japan, Switzerland, Ukraine, and other countries. Malaysia also imported annually between 700,000 t and 1 Mt of iron and steel scrap principally from the United Kingdom and the United States. Imported iron ore was consumed by the direct reduction plants in Kemaman, Terengganu, and on Labuan Island, offshore Sabah. Pig iron and iron and steel scrap were consumed by the State-owned Perwaja Steel Sdn. Bhd. (PS) and other major producers of steel billet in Peninsular Malaysia.

PS, Malaysia's only integrated steel producer, continued to struggle with its financial problems resulting from chronic operating problems and its heavy debt load in 1996. To rescue PS, which had a $1.2 billion accumulated losses and more than $2.7 billion debts, the Government had chosen the private-sector Lion Corp. Bhd. and Syarikat Maju Holdings to rescue the insolvent PS in 1996. To meet the rapidly growing market in Malaysia and in southeast Asia, the Lion Group also was planning to build a rolling mill with an annual capacity of 2 Mt near Kuala Lumpur. In 1996, the Government of Malaysia and Kawasaki Steel Corp. of Japan was conducting a joint feasibility study to build an integrated steelworks with an annual capacity of 3 Mt, primarily of high-grade steel sheets for auto industry, possibly in the State of Terengganu. The joint feasibility study was scheduled to be completed by the end of March 1997. According to Kawasaki's preliminary estimate, the total project costs, including related infrastructure, would be about $3.7 billion (The Nikkei Weekly, 1996). Malaysia produced about 3 Mt of raw steel mainly with electric furnaces. Demand for steel was about 5 Mt in 1996. Malaysia steel demand is expected to grow at a annual rates between 15% and 20% in the next 4 years.

Malaysia's tin mining industry remained depressed in 1996. The output of tin dropped by more than 19% to about 5,200 t in 1996, when the average tin price on the Kuala Lumpur Tin Market moved to a lower level (below average production cost) in the second half of 1996. Of the total tin produced in 1996, 15% was by dredging, 46% by gravel pumping, 20% by open pit, 14% by panning, and 5% by retreatment and underground mining. The total number of operating mines was between 35 and 43 during 1996. The tin mining industry's total labor force averaged about 1,896 in 1996. To meet the raw material requirements for two domestic tin smelters, Malaysia imported 32,347 t of tin ore and concentrates mainly from Australia, Bolivia, China, Indonesia, Peru, Portugal, Russia, and several African countries.

Production of refined tin in 1996 was by Escoy Smelting Sdn. Bhd. and Malaysia Smelting Corp. Bhd. At the Escoy Smelting in George Town on the island of Penang, the actual capacity was 20,000 t/yr. The smelter's intake was about 22,000 t of tin concentrate, of which about 90% was met by the low-grade imported ore. Domestic tin concentrate, which averaged 75% tin, accounted for less than 10% of the smelter requirements in 1996. Tin content of imported concentrates averaged 50% tin. Escoy Smelting's imported concentrates came mainly from Australia, Nigeria, Peru, Portugal, Russia, and the United Kingdom. Escoy smelter also imported tin metal from Vietnam to upgrade tin purity from 99.7% tin to 99.85%. The company also was capable of producing low-lead tin metal up to 4,000 t/yr. The smelter exported its refined tin mainly to Australia, Japan, the Netherlands, the United Kingdom, and the United States. The Escoy Smelter is 50.5% owned by Amalgamated Metal Corp.; 33.0%, by Permodalan Nasional Bhd.; and 16.5%, by Malaysia Mining Corp.

At the Malaysia Smelting in Butterworth across the channel from George Town, the actual capacity was 40,000 t/yr. The smelter's intake was about 42,000 t of tin concentrate, of which 85% was met by imported ore. Tin contained in imported tin concentrate ranged between 40% and 75%. The average tin content of the smelter's feed, after blending with the domestic tin concentrate was 61% tin in 1996. Malaysia Smelting's imported concentrates came mainly from Australia, Bolivia, Portugal, and several African countries. The smelter also imported refined tin from Vietnam to upgrade tin purity to 99.85%. The company also operated a 360-t/yr electrolytic refinery at the smelter site starting in October 1995. The specification of this premium-grade refined tin contains 99.995% tin, 0.0006% arsenic, 0.0027% lead, 0.0004% bismuth, 0.0004% copper, 0.0007% antimony, 0.0001% each for indium and iron, less than 0.0001% each for aluminum, cadmium, cobalt, nickel, silver, and zinc. The smelter exported its refined tin mainly to Japan, the Republic of Korea, the Netherlands, Taiwan, and the United Kingdom. It also produced about 1,000 t of low-lead tin metal for export mainly to Japan. The smelter is 37.44% owned by Malaysia Mining Corp. Bhd.; 34.77%, by The Straits Trading Co. Ltd.; 10.45%, by the Great Eastern Life Assurance Co. Ltd.; 2.64%, by Permodalan Nasional Bhd.; 2.54%, by Pacific Nominees Bhd.; and 9.49%, by others.

Domestic demand for refined tin declined to 6,036 t in 1996 from 6,350 t in 1995. Of the total domestic tin consumption, about 50% was consumed by the solder industry, 21% by the tin-plating industry, 10% by the pewter industry, and 19% by others. Exports of refined tin declined from 35,216 t in 1995 to 34, 342 t in 1996. The main buyers of Malaysian tin were, in decreasing order, Japan, the Netherlands, the Republic of Korea, the United Kingdom, Taiwan, the United States, India, and Italy in 1996.

Malaysia's cement production reached a record high, while domestic demand for cement also reached a new high at 15 Mt in 1996. The strong demand in 1996 was a direct result of ongoing construction of major commercial buildings in Kuala Lumpur and public works (highways, bridges, and ports) in various parts of the country. The major construction projects included twin towers of Petroliam Nasional Berhad (PETRONAS), KL City Center, new Kuala Lumpur International Airport, Putrajaya Administrative Center, and

accommodation facilities for the 1998 Commonwealth Games. In 1996, Malaysia's cement industry has a clinker capacity of 10.35 Mt/yr and a cement grinding capacity of 14.23 Mt/yr. To meet the requirement for the domestic cement grinding plants, Malaysia imported more 1.5 Mt of clinker. Malaysia also imported more than 800,000 t of portland cement to meet the annual requirements for cement by its construction industry.

In 1996, Kedah Cement Sdn. Bhd. brought on stream a new production line and expanded its clinker capacity from 1.5 Mt/yr to 3.3 Mt/yr at Kangar in Perlis. Associates Pan Malaysia Cement Sdn. Bhd. was expanding its clinker capacity at Kantan in Perak by 1.8 Mt/yr to 3.1 Mt/yr at a cost of about $200 million. Construction of the new kiln at Kantan was by Ishikawajima Harima Heavy Industries Co. Ltd. of Japan. In 1996, Yeoh Tiong Lay Sdn. Bhd. in joint venture with the State Government of Pahang, was building a new 1-Mt/yr cement plant at Bukit Sagu in Pahang. Pahang Cement Sdn. Bhd. will operated the Bukit Sagu plant, after its completion in 1997. In the next 1 to 2 years, Perak-Hanjoong Simen Sdn. Bhd. will add 1.5 Mt/yr clinker capacity to its 1.2-Mt/yr plant at Padang Rengas in Perak and Tasek Cement Bhd. also will add 1.5 Mt/yr clinker capacity to its 1.4- Mt/yr plant at Tasek in Perak.

To meet the growing domestic demand for the construction materials, production of rock aggregates and sand and gravel had been increasing at an annual rate of about 15% for the past 5 years. According to the Geological Survey Department of Malaysia, production of rock aggregates including granite and limestone was estimated at 92.3 Mt in 1995. Production of sand and gravel was estimated at 23.4 Mt in 1995. Limestone resources were estimated at 7,250 Mt. Malaysia's limestones resources are mainly in the following States: Perak, 2,500 Mt; Kedah, 1,220 Mt; Kelantan, 800 Mt; Pahang, 720 Mt; Negeri Sembilan, 600 Mt; Perlis, 540 Mt; Selangor, 530 Mt; Sabah, 240 Mt; Terengganu, 70 Mt; and Johor, 30 Mt (Geological Survey Department, Malaysia, 1995, p. 62).

In the mineral fuels sector, Malaysia produced a small quantity of coal in Sarawak, while importing most of its coal requirements for the cement and utility industries. Malaysia also produced oil and gas, but exported more than 55% of its oil output and major portion of its natural gas production in the form of LNG. To diversify consumption of its energy sources, the Government had completed several major gas utilization projects (gas distribution networks) in the first half of the 1990's. As a result, domestic consumption of natural gas has increased substantially over the past 3 years. Malaysia has considerable reserves of natural gas, but has smaller reserves of crude petroleum. According to *Oil and Gas Journal*, Malaysia's proven reserves of natural gas, ranked 11th largest in the world, were estimated at 2.27 trillion cubic meters, accounting for 1.62% of the world total in 1996. Its proven reserves of crude petroleum, ranked 24th largest in the world, were estimated at 4 billion barrels, accounting for 0.39% of the world total in 1996 (Oil and Gas Journal, 1996).

Production of natural gas increased by more than 22% to 122.8 million cubic meters in 1996 owing to increased consumption by the industrial and households sectors in the West Coast of Peninsular Malaysia and increased consumption of natural gas for production of LNG at Bintulu, Sarawak. Production of LNG by Malaysia LNG Sdn. Bhd. (MLNG) and Malaysia LNG Dua Sdn. Bhd. (MLNG-2) both at Bintulu, Sarawak, reached a record high at 14.1 Mt in 1996 compared with 9.9 Mt in 1995. Malaysia's second LNG plant having a capacity of 7.8 Mt/yr with three trains, adjacent to the first LNG plant, became fully operational by the first quarter of 1996. MLNG-2, the operating company of the second LNG plant, brought on stream its first train with a capacity of 2.6 Mt/yr in May 1995, the second train with a capacity of 2.6 Mt/yr in September 1995, and the third train with a capacity of 2.6 Mt/yr in March 1996. The Central Luconia Gasfields offshore Sarawak supplied natural gas to the two LNG plants. All of the LNG production by MLNG was exported to Japan under a 20-year long-term contract with the Japanese utilities companies. The LNG production by MLNG-2 was exported to various energy companies in Japan, the Republic of Korea, and Taiwan under long-term contracts.

In late 1995, Malaysia LNG Tiga (MLNG-3) was established to own and operate Malaysia's third LNG plant, to be also located at Bintulu in Sarawak. The third LNG, which was scheduled to be completed by year 2001, will have a capacity of 6.8 Mt/yr with two trains. Under an agreement signed between PETRONAS, the State-owned oil and gas company, and Nippon Oil Co. Ltd. of Japan, Royal Dutch/Shell of the Netherlands, and Occidental Petroleum Corp. of the United States in late 1995, the newly discovered gasfields offshore Sarawak will supply natural gas to the planned third LNG plant. MLNG-3 is a joint-venture company of PETRONAS, Nippon Oil, Shell Gas B.V., Occidental LNG(M) Ltd., and the State Government of Sarawak.

In April 1996, MLNG-2 signed an agreement with Shizuoka Gas Co. Ltd. of Japan for export of up to 452,000 t/yr of LNG to the gas company for 20 years beginning in June 1996. The newly completed MLNG-2 plant was to supply LNG to Shizuoka Gas. In November 1996, MLNG-3 signed a memorandum of intent with the Chinese Petroleum Corp. (CPC) of Taiwan for exporting up to 2 Mt/yr of LNG to Taiwan for 20 years beginning in 2001. CPC has been importing LNG from Malaysia since 1995 under an existing agreement with MLNG for supplying of 2.25 Mt/yr of LNG for 20 years (PETRONA, 1996, Latest updates—Malaysia LNG Sdn Bhd. signs sale and purchase agreement for LNG supply with Shizuoka Gas Co. Ltd., April; and Malaysia LNG Tiga Sdn. Bhd. signs letter of intent to supply LNG to Taiwan, November 12, accessed January 29, 1997 on the World Wide Web at http://www.jaring.my/petronas/latest/lng3.html.).

Malaysia's crude petroleum production including condensate averaged 706,300 bbl/d, a slight increase from that of 1995. Crude petroleum was produced from 13 oil and gasfields, offshore Terengganu, operated by PETRONAS Carigali Sdn. Bhd. (PETRONAS CAG), the upstream arm of PETRONAS, and Esso Production Malaysia Inc. (EPMI); 13 oil and gasfields offshore Sarawak, operated by Sarawak Shell Bhd. (SSB), and 7 oil and gasfields offshore Sabah, operated by Sabah Shell Petroleum Co. Ltd. (SSP). About 57% of crude petroleum output was by EPMI and a joint venture of EMPI and

PETRONAS CAG from oil and gasfields offshore Terengganu. The remaining 43% was by SSP, SSB, and a joint venture of SSB and PETRONAS CAG from oil and gasfields offshore the States of Sarawak and Sabah. The major oil and gasfields developed and operated by PETRONAS CAG included the Dulang Oilfield and the Duyong Gasfield, both located offshore Terengganu in the East Coast of Peninsular Malaysia; the PM Fields, also located offshore Terengganu; nine oilfields in the Baram Delta region, offshore Sarawak; and the Tembungo Oilfield and the Samarang Oildfield, located offshore Sabah.

Exports of crude petroleum were, in decreasing order, mainly to Japan, Thailand, Singapore, and the Republic of Korea. Malaysia continued to import about 26,000 bbl/d of heavy crude oil to meet the requirement for its domestic oil refineries in 1996. Malaysia has five oil refineries operating in 1996. PETRONAS, operated a 100,000 bbl/d refinery at Melaka in the West Coast of Peninsular Malaysia and a 40,000 bbl/d refinery at Kertik in the East Coast of Peninsular Malaysia. Esso operated a 75,000 bbl/d refinery at Port Dickson in the West Coast of Peninsular Malaysia. Shell operated a 105,000 bbl/d refinery also at Port Dickson and a 45,000 bbl/d refinery at Lutong in East Malaysia. PETRONAS, in joint venture with CONOCO Asia Ltd. of the United States, and Statoil, the state oil company of Norway, was constructing a 100,000 bbl/d refinery at Melaka, which was scheduled for completion in February 1998.

References Cited

Engineering and Mining Journal [Chicago], 1996, This month in mining—Malaysia: Engineering and Mining Journal, v. 197, no. 9, September, pp. 26-28.

Geological Survey Department [Kuala Lumpur], 1995, Malaysia Mineral Yearbook 1993-94, p. 18, 62.

Mamut Copper Mining [Kota Kinabalu], 1996, Environmental control—the Lohan tailings retention dam, water analysis, reafforestation, rehabilitation, and conservation: Mamut Copper Mining, p. 14-18.

Ministry of Finance, Malaysia, Economic Report 1995-96: Gross domestic product by industrial origin 1991-96, p. 2.

New Straits Times [Kuala Lumpur], 1996, Seven firms get permit to prospect for gold in Pahang: New Straits Times, October 26, p. 1.

The Nikkei Weekly [Tokyo], 1996, Steelmaker considers Malaysian furnace: v. 34, no. 1,734, August 5, p. 20.

Oil and Gas Journal, 1996, Worldwide look at reserves and production:Oil and Gas Journal, v. 94, no. 53, December 30, p. 40-41.

Major Sources of Information

The Ministry of Primary Industry:
- Department of Mines, Malaysia
  - 22nd Floor, Tabung Haji Bldg.
  - Jalan Tun Razak, 50656 Kuala Lumpur, Malaysia
  - Telephone: 60-3-261-1400
  - Fax: 60-3-261-7300
- Geological Survey Department, Malaysia
  - 19th-21st Floor, Tanbung Haji Bldg.
  - Jalan Tun Razak, 50736 Kuala Lumpur, Malaysia
  - Telephone: 60-3-261-1033
  - Fax: 60-3-261-1036

Major Publications

Department of Mines, Malaysia:
- Bulletin on Mining Statistics, quarterly.
- Statistics on Mining Industry in Malaysia, monthly.

Geological Survey Department, Malaysia:
- Annual Report, and Malaysia Minerals Yearbook, annual.

Department of Statistics, Malaysia:
- Statistical Bulletin, Malaysia, monthly.
- Statistical Bulletin, Sabah, annual.
- Statistical Bulletin, Sarawak, annual.
- Yearbook of Statistics, Malaysia, annual.

TABLE 1
MALAYSIA: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity 3/		1992	1993	1994	1995	1996 p/
METALS						
Aluminum: Bauxite, gross weight	thousand tons	331	69 r/	162	184	219
Copper, mine output, Cu content		28,556	25,182	25,267	20,751 r/	22,771
Gold, mine output, Au content 4/	kilograms	3,513	4,462	4,085	3,161	2,831
Iron and steel:						
Iron ore and concentrate	thousand tons	320	246	243	202	325
Steel, crude	do.	1,559	1,808	2,046	2,450 r/	3,030
Lead metal, secondary		28,500	29,000	33,200	33,600	33,600
Manganese, gross weight		--	--	--	37,600	--
Rare-earth metals: Monazite, gross weight		777	407	425	814	618
Silver, mine output, Ag content 4/	kilograms	15,326	14,013	13,342	11,080	9,507
Tin:						
Mine output, Sn content		14,339	10,384	6,458	6,402	5,174
Metal, smelter		45,598	40,079 r/	37,990 r/	39,433 r/	39,195
Titanium:						
Ilmenite concentrate, gross weight		337,744	288,950	115,885	151,680	244,642
Dioxide		690	22,854	36,000	43,000 e/	46,000 e/
Tungsten, mine output, W content		3	2	--	--	--
Zirconium: Zircon concentrate, gross weight		2,608	2,184	1,656	3,790	4,511
INDUSTRIAL MINERALS						
Barite		10,525	11,551	17,144	16,966	17,458
Cement, hydraulic	thousand tons	8,366	8,797	9,928	10,713 r/	12,335
Clays: Kaolin		244,573	249,852	252,628	211,182	209,562
Mica		4,754	4,659	4,993	5,848	5,501
Nitrogen: N content of ammonia		331,100	333,700	334,000 e/	340,000 e/	340,000 e/
Silica sand		579,491	355,379 r/	245,524 r/	287,515	268,800
Stone:						
Dolomite		25,400	27,800	37,700	28,100	16,500
Limestone e/	thousand tons	22,000	23,000	24,000	26,000	29,000
MINERAL FUELS AND RELATED MATERIALS						
Coal	do.	74	264	174	112	83
Gas, natural: 5/						
Gross	million cubic meters	22,550	28,174	30,251	36,485 r/	44,338
Net 6/	do.	18,186	21,648	24,397	29,022 r/	35,268
Petroleum: 5/						
Crude	thousand 42-gallon barrels	240,541	235,425	238,491	257,471 r/	257,690
Refinery products:						
Gasoline	do.	13,490	14,664	15,879	19,076 r/	19,675
Jet fuel e/	do.	3,000	3,100	3,200	3,300	3,400
Kerosene	do.	7,097	8,257	12,026	14,547 r/	16,862
Diesel	do.	29,421	31,458	38,490	44,148 r/	47,183
Residual fuel oil	do.	13,995	15,901	14,416	15,364 r/	18,611
Other e/ 7/	do.	13,000	13,000	14,000	15,000	17,000
Total e/	do.	80,000 r/	86,400 r/	98,000 r/	111,000 r/	123,000

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

1/ Estimated data are rounded to three significant digits; may not add to totals shown.

2/ Table includes data available through May 30, 1997.

3/ In addition to the commodities listed, a variety of crude construction materials (clays, sand and gravel, and stone), fertilizers, and salt is produced, but not reported and available information is inadequate to make reliable estimates of output levels.

4/ Includes byproduct from copper mine in Sabah and tin mines in Peninsular Malaysia, gold mines in Peninsular Malaysia and Sarawak.

5/ Includes production from Peninsular Malaysia, Sabah, and Sarawak.

6/ Gross less volume of reinjected and flared.

7/ Includes LPG, naphthas, and lubricants.

Source: Ministry of Primary Industry, Department of Mines (Kuala Lumpur). Monthly Statistics on Mining Industry in Malaysia, Mar. 1997. Quarterly Bulletin, 4th Quarter, Oct.-Dec. 1996.

TABLE 2
MALAYSIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1996

(Thousand metric tons unless otherwise specified)

Commodity		Major operation companies and major equity owners	Location of main facilities	Annual capacity
Bauxite		Johore Mining and Stevedoring Co. Sdn. Bhd. (61% owned by Aluminium Ltd. of Canada, 39% by local investers and other)	Bukit Raja-Pengerang, Johor	400
Cement		Associated Pan Malaysia Cement Sdn. Bhd. (equally owned by Malaysia Cement Bhd. and Pan-Malaysia Cement Work Bhd.)	Rawang, Selangor and Kantan, Perak	4,050
Do.		Cement Industries of Malaysia Bhd. (53.97% owned by United Engineering Malaysia Bhd. and general public)	Kangar, Perlis	2,000
Do.		Kedah Cement Sdn. Bhd. (joint venture of Heavy Industries Corp. of Malaysia, Kedah State Economic Development Corp. Temasek Holding of Singapore, Malaysia Kuwaiti Investment and private investors)	Langwai, Kedah	3,600
Do.		Perak-Hanjoong Simen Sdn. Bhd. (60% owned by Korea Heavy Industries and Construction Co., and 40% by Perak State government)	Padang Rengas, Perak	1,440
Do.		Tasek Cement Bhd. (18.2% owned by Singapore Cement Industrial Co. PTE Ltd., 10.6% by Aik Hoe & Co. PTE Ltd., 4.7% by Boon Siew Sdn. Bhd., and general public)	Ipoh, Perak	1,500
Do.		Tenggara Cement Manufacturing Sdn. Bhd. (100% owned by Brookstone Sdn Bhd., which is a wholly owned subsidiary of Kwong Onn Industries Bhd.)	Pasir Gudang, Johor	1,500
Copper, concentrate		Mamut Copper Mining Sdn. Bhd. (wholly owned subsidiary of Mega First Corp. Bhd.)	Mamut, Sabah	100
Gas:				
Natural	million cubic meters per day	Esso Production Malaysia Inc.	Offshore Terengganu	22.7
Do.	do.	Sabah Shell Petroleum Co. Ltd.	Offshore Sabah	2.8
Do.	do.	Sarawak Shell Bhd.	Offshore Sarawak	38.5
Liquefied		Malaysia LNG Sdn. Bhd. (60% owned by PETRONAS, 17.5% by Shell Gas N.V., 17.5% by Mitsubishi Corp., and 5% by Sarawak State government)	Tanjung Kidurong, Bintulu, Sarawak	8,100
Do.		Malaysia LNG Dua Sdn. Bhd. (ownership is the same as Malaysia LNG Sdn. Bhd.)		7,800
Petroleum, crude	million 42-gallon barrels per day	Esso Production Malaysia, Inc.	Offshore Terengganu	390
Do.	do.	Sabah Shell Petroleum Co. Ltd.	Offshore Sabah	100
Do.	do.	Sarawak Shell Bhd.	Offshore Sarawak	180
Do.	do.	PETRONAS Carigali Sdn. Bhd.	Offshore Terengganu	22
Steel, crude		Perwaja Steel Sdn. Bhd. (Government owned)	Kemaman, Terengganu	1,200
Tin:				
Concentrate		Rahman Hydraulic Tin Bhd. (privately owned company)	Klian Intan, Perak	1
Do.		Petaling Tin Bhd. (wholly owned subsidiary of Malaysia Mining Corp.)	Kuala Langat, Selangor	2
Do.		Tima Langat Bhd. (65% owned by Selangor State government and 35% by Malaysia Mining Corp.)	do.	1
Refined		Escoy Smelting Sdn. Bhd. (formerly Datuk Kermate Smelting Bhd. which is 50.5% owned by Amalgamated Metal Corp.,29% by Consolidated Tin Smelter Ltd., and 20% by Malaysia Mining Corp., Bhd.)	George Town, Penang	20
Do.		Malaysia Smelting Corp. Bhd. (37.44% owned by The Straits Trading Co., Ltd., 37.44% by Malaysia Mining Corp., and 25.12% by other)	Butterworth, Penang	40
Titanium, oxide		Tioxide (Malaysia) Sdn. Bhd. (85% owned by Tioxide Group PLC and 15% by Terengganu State Government)	Kemaman, Terengganu	50