#### THE MINERAL INDUSTRY OF

# MALAYSIA

### By John C. Wu

Malaysia has large resources of tin. Most of the high-grade tin reserves, however, were depleted or are beneath developed lands. Malaysia has substantial resources of such tin- associated minerals as ilmenite, monazite, struverite (a columbium (niobium)/tantalum-bearing mineral), and zircon; natural gas and crude petroleum. Other important mineral resources are barite, bauxite, carbonate rocks, clays, coal, copper, gold, iron ore, and silica (Minerals and Geoscience Department [Malaysia], 2001a, p. 4). Malaysia's tin reserves ranked 2d (Carlin, 2002), its rare earths reserves ranked 10th (Hedrick, 2002), and its reserves of natural gas and crude petroleum ranked 14th and 28th in the world, respectively (Oil & Gas Journal, 2001b).

In 2001, Malaysia's economy, as measured by gross domestic product (GDP), grew only slightly owing to a considerable decline in the output of the manufacturing sector, despite the continued growth in the agriculture, forestry and fishing, construction, and other sectors. According to the Department of Statistics [Malaysia], Malaysia's GDP, in 1978 constant dollars, grew by 0.4% in 2001 compared with 8.3% in 2000. The output of the manufacturing sector, which grew by 21.0% in 2000, had a 5.1% negative growth in 2001 mainly owing to reduced output of electrical and electronics products. The output of the mining and quarrying sector grew only 0.2% in 2001 compared with a 3.1% growth in 2000. In 2001, the mining and quarrying sector contributed 6.9% to Malaysia's GDP. Malaysia's GDP, in 1987 constant dollars, was estimated to be \$55.3 billion, of which \$3.8 billion was contributed by the mining and quarrying sector (Central Bank of Malaysia,  $20028^{1}$ ).

#### **Government Policies and Program**

During the Asian financial crisis, the Malaysian Government imposed a stringent capital control to prevent foreign investors from fleeing the Malaysian stock market in 1998. In February 1999, the Government shifted to imposing up to a 30% exit tax depending on the length of time the funds had been in Malaysia. In September 1999, the exit tax was changed to a flat 10% regardless of time invested. In October 2000, the Government announced that only profit repatriated within one year would be taxed effective February 1, 2001, and that there would be no more exit tax beginning on May 2, 2001 (Nikkei Weekly, 2001).

#### **Environmental Issues**

After the conservation group had failed in an attempt to turn mining ponds in Malim Nawar, near Ipoh in Perak, into a nature reserve in 1999, the Malaysian Nature Society (MNS) submitted a proposal to Perak State government in September 2000 for converting a tract of old tin mining land in Batu Gajah, Perak, into a recreation-and-conservation site, which would be called Kinta Park. A technical committee, which comprised the Land and Mines Department, the Drainage and Irrigation Department, the National Parks, the Wildlife Protection Department, and the MNS, had been created to work out the details of the park plan. The Perak State government had allocated about \$167,000 to develop basic facilities for the first year. Under the MNS plan, the park activities may include birdwatching, wildlife watching, nature photography, angling, boating, trekking, scientific research, and nature education. The area's tin-mining heritage would also be promoted (Malaysia Tin Bulletin, 2001c).

In October 2001, LSK Enterprise Sdn. Bhd., which was the owner and operator of a tin-tailings Amang (retreatment) plant at Jalan Gopeng in Simpang Puali, Perak, was fined a total of \$22,400 on two counts of dealing in radioactive tin slag without a licence from the Atomic Energy Licensing Board. The company was fined \$13,200 on pleading guilty under Section 16 (5) of the Atomic Energy Licence act of 1984 in dealing in 98 gunny sacks of radioactive tin slag without a licence from the board. The company also was fined \$19,200 on a second charge of unlawfully dealing in three gunny sacks of tin slag at the same factory premises 2 days later (Malaysian Tin Bulletin, 2001c).

#### **Production**

In 2001, Malaysia's minerals production included barite, bauxite, coal, dolomite, feldspar, gold, ilmenite, iron ore, kaolin, limestone, mica, monazite, natural gas, crude petroleum, sand and gravel, silica, struverite, tin, and zircon concentrate. Production of struverite increased sharply in 2000 and 2001 because of increased world demand for the raw material for the production of tantalum metal products, while production of tin decreased because of lower tin prices in the Kuala Lumpur Tin Market (KLTM). Malaysia ceased copper production at the Mamut Mine in Sabah in 1999. As a result, there had been no silver production as byproduct of copper mining since 2000, but a very small quantity of silver was produced as byproduct of gold mining in the State of Pahang in 2000 and 2001. Production of coal increased substantially in 2001 owing to increased demand by the cement industry. Production of processed mineral products included cement, refined gold, liquefied natural gas (LNG), nitrogen fertilizer materials

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

(ammonia and urea), refined lead (secondary), refined petroleum products, crude steel, titanium dioxide pigment, and refined tin (table 1).

#### **Trade**

According to the Department of Statistics [Malaysia], total exports decreased by 10.4% to \$88 billion, and total imports decreased by 9.9% to \$74 billion in 2001. Malaysia's merchandise trade surplus shrank by 13.1% to \$14 billion because of a substantial decline in exports in 2001 (Ministry of International Trade and Industry, 2002b§). Malaysia remained a net exporter of minerals in 2001 because of its large exports of hydrocarbons in the form of LNG, crude petroleum, and refined petroleum products. In 2001, minerals exports totaled \$8.5 billion and accounted for 9.7% of total exports. Minerals imports totaled \$4.0 billion and accounted for 5.4% of total imports. Malaysia had a minerals trade surplus of \$4.5 billion in 2001.

Among the major mineral exports, crude petroleum was valued at \$2.9 billion; LNG, \$3.0 billion; refined petroleum products, \$2.0 billion; and other mineral products, \$566 million. Among the major mineral imports, refined petroleum products were valued at \$1.8 billion; crude petroleum, \$1.6 billion; metal ore and scrap, \$206 million; crude minerals, \$167 million; and other mineral products, \$215 million (Ministry of International Trade and Industry, 2002a§).

#### Structure of the Mineral Industry

Malaysia's mining industry consisted of a small sector of coal and nonferrous metals mining, a small mineral-processing sector of ferrous and nonferrous metals, and a large mining and processing sector of industrial minerals and oil and gas. With the exception of oil and gas, mining and mineral-processing businesses were owned and operated by private companies incorporated in Malaysia. Oil and gas exploration and exploitation businesses were owned and operated by the stateowned oil and gas company and by joint ventures of the stateowned oil and gas company and foreign companies. According to the Department of Statistics [Malaysia], as of June 2001, the total number of persons employed by the mining and quarrying industries was estimated to be 19,700, or about 0.2% of the total employed labor force of about 9.8 million (Department of Statistics [Malaysia], 2002, p. 138). The structure of the mineral industry remained relatively unchanged.

#### **Commodity Review**

#### Metals

Aluminum and Bauxite.—Johore Mining and Stevedoring Co. Sdn. Bhd. (JMSC) at Teluk Rumania and Lembaga Kemajuan Johor Tenggara at Sungai Rengit each operated a bauxite mine in Johor with a total workforce of 68 (Department of Statistics [Malaysia], 2002, p. 47). Bauxite production declined sharply in 2001. All bauxite ore was delivered to JMSC's processing plant at Bukit Raja, near Sungai Rengit, for crushing, screening, and washing. Cement-grade bauxite was

sold to the domestic cement manufacturers, and chemical- and refractory-grade bauxite were exported to Taiwan, Thailand, the United States, and Vietnam.

The 1999 proposal of Comalco Aluminium Co. Ltd. of Australia to build a 1.5-million-metric- ton-per-year (Mt/yr) alumina refinery at Similajau near Bintulu, Sarawak, had not materialized. Comalco Aluminium had decided to build the 1.5-Mt/yr alumina refinery at Gladstone in central Queensland, Australia, following the conclusions of feasibility studies, which had been completed in October 2000 (Metal Bulletin, 2002).

The 2000 proposal to build a 500,000 metric-ton-per-year (t/yr) aluminum smelter in the District of Manjung, Perak, by Charus Development Corp. of the United States had been approved by the joint-venture partners in 2001 and was expected to commence groundbreaking work in 2002. The proposed joint-venture aluminum smelter, which would be called Malaysia Aluminium Smelting Co., would be owned by Charus Development (20%), a group of investors from Hong Kong (18%), the State Development Corp. of Perak (15%), and other investors (47%) (Metal Bulletin, 2001b). The groundbreaking work, however, would not take place until a report was completed by the local environmental authorities concerning pollution at the proposed smelter site and the availability of low-rate electricity was secured for the project from the power supplier—Tenaga Nasional Berhad (Metal Bulletin, 2001a).

**Gold.**—In 2001, about 85% of the gold production was from the Penjom Mine in Pahang, and 15% was from two alluvial gold mines in Pahang and four in Kelantan in the central belt of peninsula Malaysia. There was no gold production from the Bau area of Sarawak in 2001.

Avocet Mining PLC operated the Penjom gold mine at Ampang Jaleh near Kuala Lipis through Specific Resources Sdn. Bhd., which was its subsidiary. In 2001, the gold production from the Penjom Mine was lower than the 3,387 kilograms (kg) produced in 2000. According to Avocet Mining, based on the classification guideline set out in the 1999 Australian Code for Reporting of Mineral Resources and Ore Reserves, Penjom's total mineral resources, as of October 1, 2001, were estimated to be 5.2 million metric tons (Mt) at a grade of 4.69 grams per metric ton (g/t) gold, of which 2.1 Mt was measured reserves at a grade of 5.56 g/t gold; 1.3 Mt, indicated reserves at a grade of 4.32 g/t; 1.3 Mt, inferred reserves at grade of 4.36 g/t gold; and 503,000 t, ore stockpile at a grade of 2.9 g/t gold. Penjom in-pit resources, as of October 1, 2001, were estimated to be 1.99 Mt at a grade of 6.22 g/t, of which 1.03 Mt was measured reserves at a grade of 7.10 g/t; 384,200 t, indicated reserves at a grade of 6.02 g/t; 314,700 t, inferred reserves, at a grade of 5.30 g/t; and 260,900 t, ore stockpile at a grade of 4.09 g/t (Avocet Mining PLC, 2002§).

According to a local press report, three new gold deposits were discovered in the Districts of Besut, Kemaman, and Setiu in Terengganu. The state Government planned to carry out gold mining activities in the areas if feasibility studies showed economic potential for gold mining. In June 2001, the state Government reopened the Lubuk Mandt area in Marang, which is south of Kuala Terengganu, to the public for gold mining. The gold mining area was closed following a mine accident in

1987, which claimed 12 lives (Star, 2001).

Lead.—Metal Reclamation (Industries) Sdn. Bhd., which was Malaysia's sole lead smelter, operated a secondary (recycling) lead smelter at Taman Selayang in Selangor. In late 2000, the company brought onstream a new secondary lead smelter at Pulau Indah Industrial Park on Pulau (island) Lumut, which is southwest off Port Klang, and began operations in early 2001. The new secondary lead smelter, which used the MIM Isasmelt technology, has a production capacity of 60,000 t/yr. According to a company official, the total secondary lead production was expected to reach between 40,000 and 50,000 metric tons (t) in 2001. The old smelter would be closed once the new smelter's operation reached full capacity in early 2002. The company produced antimonial lead and planned to produce pure lead and calcium lead strips with new equipment in the future (Metal Bulletin, 2001e).

Iron and Steel.—Production of iron ore increased in 2001 because of an increase in the number of operating mines in the State of Pahang. In 2001, iron ore was produced from between three to six small-scale mines in the States of Pahang, Perak, and Terengganu with a total workforce of about 80 (Department of Statistics [Malaysia], 2002, p. 46). To meet the raw material requirements for production of direct-reduced iron/hot-briquetted iron (DRI/HBI), Malaysia imported about 1.7 Mt of iron ore mainly from Bahrain, Brazil, and Chile in 2001. Production of DRI/HBI was by Amsteel Mills Sdn. Bhd. with the capacity of 800,000 t/yr on Labuan Island off Sabah and by Perwaja Steel Sdn. Bhd. with the capacity of 1.2 Mt/yr in Kemaman, Terengganu.

Production of crude steel increased to 4.1 Mt in 2001 from 3.7 Mt in 2000 because of increased demand for construction steels by the construction industry for the country's major infrastructure projects. Malaysia imported about 5.1 Mt of iron and steel products mainly from Japan and other major Asian steel-producing countries to meet its domestic demand (Southeast Asia Iron and Steel Institute, 2001§).

According to the Malaysian Iron and Steel Industry Federation (MISIF), it would take 2 to 3 years for Malaysia's aggregate apparent steel consumption to return to or surpass the pre-financial-crisis-high of 8.3 Mt in 1997. The MISIF estimated that the aggregate apparent steel consumption increased by 13% to 6.9 Mt in 2000 from 6.1 Mt in 1999. Of the total apparent steel consumption in 2000, 3.0 Mt was finished long products, such as bars and wire rods used by the construction industry, and 3.8 Mt, plate products, such as coil and plate used by the manufacturing industry. The estimated apparent steel consumption per capita was 294 kg in 2000 compared with 267 kg in 1999 (Malaysian Iron and Steel Federation, 2001§)

The state-owned Perwaja Steel, which continued to suffer losses, was operating below capacity in 2001. To resolve the financial problems of the company, the Government revealed that it prefers privatization of Perwaja Steel rather than closing down the plant or injecting more capital to revive and modernize its DRI plant and electric arc furnace steelmaking facilities in Kemaman, Terengganu, and in Gurun, Kedah, if it could attract enough interest. In another development, the

Swiss Government had agreed to assist Malaysia's anticorruption agency to investigate the alleged embezzlement of Perwaja Steel funds, which were being siphoned off to a Swiss bank through Japan and Hong Kong (Metal Bulletin, 2000c).

To be more competitive with the low-priced imports in domestic and overseas markets, Malaysia's steel industry began its consolidation in 2000 and 2001. Ann Joo Resources Bhd., which owned 100% of Anshin Steel Industries Sdn. Bhd., acquired 30.04% of Malayawata Steel Bhd. and took over its management in August 2000. Lion Land Bhd., through its 99% owned subsidiary, Amsteel Mills Sdn. Bhd., signed an agreement with the state-owned Johor Corp. to acquire Antara Steel Mills Sdn. Bhd. for about \$28.5 million in February 2001 (Metal Bulletin, 2001d).

Struverite.—Production of struverite, which was produced by tin-tailings Amang (retreatment) plants mainly in the State of Perak, reached a historic high in 2001. The 2001 production level was about 10 times that of 2000. Beh Minerals Sdn. Bhd. in Lahat, Perak, and Syarikat Penderong Sdn. Bhd. in Kuala Dipang, Perak, remained the two major producers of struverite in 2001. According to the Minerals and Geoscience Department [Malaysia], the average metal content of columbium and tantalum in struverite is below 2%. All struverite produced in Malaysia was exported to China (Minerals and Geoscience Department's written commun., 2002). Malaysia Smelting Corp. also produced tin slags, which contain tantalum, from its tin smelter in Butterworth, Penang.

In July, the Penang Island Municipal Council, which is the owner of Malaysia's oldest city stadium in Georgetown, Penang, announced that tantalum-bearing minerals worth several million Malaysian ringgit (M\$) were discovered underneath the stadium. The city council had called for interested parties to prospect and mine out the minerals before renovation work can be started on the stadium (Malaysian Tin Bulletin, 2001a).

Tin.—Tin mine production, for the first time in Malaysia's tin mining history, dropped to below the 5,000 t level in 2001. The decline in tin production was owing to lower tin prices and depleted high-grade ore reserves. The average tin prices in the KLTM during 2001 decreased to \$3.64 per kilogram in October from \$5.14 per kilogram in January. According to the Minerals and Geoscience Department [Malaysia], the number of operating mines in 2001 ranged from 37 in October to 46 in May, and the number of tin miners in 2001 ranged from 1,461 in December to 1,764 in July. In 2001, tin produced by gravel pump accounted for 41.9%; open cast, 29.9%; panning, 10.3%; dredging, 6.3%; Amang (retreatment) plant, 11.2%; and underground, 0.4% (Minerals and Geoscience Department, 2001b, p. 9).

To revitalize the tin mining industry, the Malaysian Chamber of Mines (MCM) had recommended to the State government of Perak, which is a major tin-mining State, to change the existing royalty rate to a flat rate without any benchmarking to the prevailing price level. Under the existing formula, the Perak State government collects royalties solely on tin priced at \$5.25 per kilogram (M\$ 20 per kilogram) and above. In its 2000

annual report, the MCM stressed that the flat tin royalty rate would provide the necessary impetus for the tin mining industry and would generate more revenues for the Perak State government (Metal Bulletin, 2001g).

In 2001, Iluka Resources Ltd. of Australia had agreed to sell its 75% equity interest in PT Koba Tin in Indonesia to the Malaysia Smelting Corp. Bhd (MSC) for about \$20 million, which included \$13.7 million in cash payment and a deferred contingent component of up to \$6 million during 3 years, based on tin prices in the London Metal Exchange. PT Koba Tin, which was engaged in tin mining and smelting operations on Bangka Island in Indonesia, also was 25% owned by PT Timah, the Indonesia state-owned tin mining and smelting company. MSC indicated that the acquisition would reduce its overall cost and improve its efficiency (Metal Bulletin, 2001f).

MSC, which operated a 40,000-t/yr tin smelter in Butterworth, continued to import about 80% of its raw material requirements from overseas. In 2001, the smelter's raw materials were 22% from domestic and 78% from overseas. The overseas raw materials were from Australia (21%), South America (28%), and Asia (14%) (Malaysia Smelting Corp. Bhd., 2001a§). The major suppliers in South America were Bolivia and Peru. The major suppliers in Asia were China and Indonesia. According to MSC, more than 85% of its smelter feed comprised medium-grade tin concentrates and complex medium-grade tin concentrate (40% to 50% tin). In 2001, refined tin production increased substantially because of an increase in smelter feed of high-grade raw materials from Indonesia. MSC produced three brands of refined tin—MSC Strait Refined Tin with tin purity of not less than 99.85%, Electrolytic Grade (4-Nines) Tin with a minimum tin purity of 99.99% and impurities not exceeding 0.01%, and MSC 3-Nines Low Lead Tin with a minimum tin purity of 99.9% and a maximum of 0.01% lead (Malaysia Smelting Corp., 2001b§).

Domestic demand for refined tin dropped sharply by 28.3% to 4,045 t in 2001. In 2001, the Malaysian solder industry remained the major end user and accounted for 47.3% of the total demand, followed by the pewter industry, 16.2%; the tinplating industry, 12.8%; and other end users, 23.7%. Refined tin consumption by the solders and other end users included consumption of domestically refined and high-grade imported refined tin (Malaysian Tin Bulletin, 2002).

Exports of refined tin increased to 27,269 t in 2001 from 20,614 t in 2000. Export earnings from refined tin were valued at \$121.3 million in 2001 compared with \$114.4 million in 2000. In 2001, the major buyers of Malaysian refined tin were the Republic of Korea (12.1%), India (9.2%), Japan (6.7%), the Netherlands (5.9%), Italy (5.7%), and Taiwan (4.4%). Exports to the United States amounted to 532 t and accounted for 2.0% and to all other countries amounted to 14,698 t and accounted for 54.0% of Malaysia's refined tin exports in 2001 (World Bureau of Metal Statistics, 2002, p. 125).

#### **Industrial Minerals**

Cement.—Cement production increased by 20.8% to 13.8 Mt in 2001 (Department of Statistics [Malaysia], 2002, p. 58). According to the Cement and Concrete Association [Malaysia] (C&CAM), the cement industry comprised 15 companies in

2001, 8 of which operated integrated plants (clinker and cement), 7 of which are listed in table 2; 6 operated only clinker grinding plants; and 1 operated a small clinker and a clinker grinding (white cement) plant. The seven clinker-grinding companies were Cement Industries (Sabah) Sdn. Bhd. (900,000 t/vr) at Sepangar Industrial Estate, 30 km north of Kota Kinabalu, Sabah; CMS Cement Sdn. Bhd., which operated a plant (1 Mt/yr) at Pending Industrial Estate in Kuching, Sarawak, and another plant (750,000 t/yr) at Kidurong Industrial Estate in Bintulu, Sarawak; Kedah Cement Holdings Bhd. (180,000 t/yr) at Batu Caves, Selangor; Slag Cement Sdn. Bhd. (1 Mt/yr) at Pelabuhan, Klang, Selangor; Southern Cement Industries Sdn. Bhd. (770,000 t/yr) at Kawasan Pelabuhan Johor, Johor; Sarawak Clinker Sdn. Bhd. operated a 600,000t/yr clinker plant at Sentah Segu L. D Jalan Mambong off Jalan Penrissen Lama in Kuching, Sarawak; and Tengarra Cement Manufacturing Sdn. Bhd. (1.3 Mt/yr) at Kawasan Perusahaan Pasir Gudang, Johor. Rock Chemical Industries (M) Bhd., operated a 68,000-t/yr white cement plant at Pinji Estate in Ipoh, Perak (Asean Federation of Cement Manufacturers, 2002§).

In 2001, Malaysia had a clinker capacity of about 16 Mt/yr and a cement capacity of about 21 Mt/yr. The cement industry was operating at about 66% of its installed capacity in 2001. As a result of mergers and acquisitions in the past 3 years, three major players had emerged in Malaysia's cement industry.

Malayan Cement Bhd. (MCB), which is Malaysia's largest cement producer with 7.9 Mt/yr clinker capacity, 12.8 Mt/yr cement capacity, and 52% of market share, owned and operated Associated Pan Malaysia Cement Sdn. Bhd., Kedah Cement Sdn. Bhd., Tenggara Cement Manufacturing Sdn. Bhd., and Kedah Cement Holdings Bhd.; MCB, in turn, is 60.88% owned by Blue Circle Industries PLV of the United Kingdom. In July 2001, Blue Circle was acquired by Lafarge Minerals Ltd., which is a wholly owned subsidiary of Lafarge SA of France (Kuala Lumpur Stock Exchange, 2001b§; Liffe, 2001§).

Cement Industries of Malaysia Berhad (CIMB), which is Malaysia's second largest cement producer with 2.8 Mt/yr clinker capacity, 3.4 Mt/yr cement capacity, and 19% market share, owned and operated CIMB and Negeri Sembilan Cement Industries Sdn. Bhd. (Kuala Lumpur Stock Exchange, 2001a§).

Tasek Corp., which is Malaysia's third largest cement producer with 2.3 Mt/yr clinker capacity, 2.3 Mt/yr cement capacity, and 12% market share, owned and operated Tasek Corp. Tasek exported surplus clinker to its associated company—Cement Industries (Sabah) Sdn. Bhd., which operated a 900,000 t/yr clinker grinding plant in Kota Kinabalu, Sabah (Kuala Lumpur Stock Exchange, 2001c§).

In September 2001, YTL Cement Bhd. of Malaysia and Cemex, S.A. de C.V. of Mexico submitted their bids to acquire a 54% stake in CIMB. Both companies were unsuccessful in gaining control of CIMB because of their lower bids relative to CIMB's share value (Pro Publications, 2001§).

**Silica Sand.**—Silica sand production is mainly from natural sand deposits in the States of Johor and Sarawak and tin mine tailings sand in the States of Perak and Selangor. Silica production from the coastal areas of Johor and Sarawak, however, accounted for more than 80% of the country's total.

In 2001, Syarikat Segangun Sdn. Bhd. (SSSB) was the major silica sand producer, which operated mines at Miri in Sarawak. SSSB held mining rights at Sg. Sebatang, Bintulu, Sg. Terus, Sg. Sebemban, and Btu-Tatau in Sarawak and prospecting rights at Bakong and Marudi in Sarawak. About 56.6 Mt of estimated reserves of silica sand deposits had been delineated in Sarawak. Malaysia exported more than 85% of its silica sand production mainly to Singapore (63%), Japan (14%), and the Philippines (6%) (Minerals and Geoscience Department [Malaysia], 2001a, p. 87-88).

W.R. Grace Specialty Chemicals (Malaysia) Sdn. Bhd., which is a wholly owned subsidiary of W.R. Grace & Co. of the United States, built its first packaging and silica products plant at Gebeng Industrial Estate, in Kuantan, Pahang. In August, a company official announced that W.R. Grace planned to increase its production capacity of silica to more than 7,000 t/yr beginning in 2002 from 6,000 t/yr in 2001 because the demand for silica in the manufacturing sectors of Australia, China, India, Japan, and Thailand are expected to increase rapidly. The company was exporting 95% of its production to Asia and Pacific countries including the United States, while the remaining 5% was for the domestic market. The silica produced by the company was used in the manufacturing of paints, coating, and plastic in the Asia and Pacific region (New Strait Times, 2001a).

In 1998, the Government began promotion of the development of silica-based industry, which was to focus on higher value-added processing activities to produce such valueadded products as silicon wafer, optical fiber, crystal glass, sheet glass, and other glass products. The major producers of such value-added product as sodium silicate were Bintulu Silica Industries Sdn. Bhd. in Bintulu, Sarawak; Malaysia United Chemical Corp. Sdn. Bhd.; and See Sen Chemical Bhd. in Pasir Gudang, Johor. The major producers of silicon wafer were Wafer Technology (Malaysia) Sdn. Bhd. in Kulim Hi-Tech Park, Kedah; Memc Electron Material Sdn. Bhd. in SG Way Free Trade Zone, Selangor; and Seh Malaysia Sdn. Bhd. in Ulu Kelang Free Trade Zone, Selangor. The major producer of silicon rubber was Shin-Etsu polymer (M) Sdn. Bhd. in Kaw Perindus Hicom, Selangor. The major producer of silicon dioxide filler was Tatsumori (Malaysia) Sdn. Bhd. in JLN Bkt. Kemuning Seksyen, Selangor (Minerals and Geoscience Department [Malaysia], 2000a, p. S6-S7).

#### Mineral Fuels

Coal.—Coal production increased considerably because of increased demand by the cement and utility industries in 2001. All coal was produced from the State of Sarawak. Global Minerals (Sarawak) Sdn. Bhd. produced coal from three coal deposits in the Belawie Mujan and Kapit areas; Luckyhill Coal Mining Sdn. Bhd., from two deposits in the Bau and Silantek areas; and Buroi Mining Sdn. Bhd., from the Mukah-Balingian near Sibu. Coal resources in Malaysia were estimated to be 1.7 billion metric tons, of which 275.3 Mt were proven; 346.6 Mt, indicated; and 1.1 billion metric tons, inferred reserves. Of the proven reserves, about 170.3 Mt was identified in the Merit Pila coalfield in Sarawak. Of the total coal resources, about 80% was located in the State of Sarawak, 19% in the State of Sabah,

and 1% in peninsular Malaysia (Minerals and Geoscience Department [Malaysia], 2001a, p. 92).

Coal was consumed principally by the cement and utility industries, which accounted for 99% of Malaysia's coal demand. Coal demand by the cement industry was estimated to be about 1.5 Mt and the utility industry, about 2.5 Mt. In 2001, about 86% of Malaysia coal requirement was met by imports, which was estimated to be 3.5 Mt. The major overseas coal suppliers were Australia, China, Indonesia, and Russia. Demand for coal by the utility industry was expected to increase substantially to more than 15 Mt, when new coal-fired powergeneration plants come onstream in the next 5 years (Minerals and Geoscience Department [Malaysia], 2001a, p. 92).

Natural Gas and Petroleum.—Malaysia remained a net exporter of natural gas and crude petroleum. The country exported 49.7% of its natural gas production in the form of LNG and 47.8% of its crude petroleum production in 2001. Its proven reserves of natural gas were estimated to be 2.12 trillion cubic meters and accounted for 1.4% of the world total, and its proven reserves of crude petroleum were estimated to be 3 billion barrels and accounted for 0.3% of the world total in 2000 (Oil & Gas Journal, 2001b). Malaysia's proven reserves of natural gas equaled five times that of its proven reserves of crude petroleum. Of the natural gas reserves, about 50% was located offshore Sarawak, 41% offshore east coast of peninsular Malaysia, and 9% offshore Sabah; and about 18% of Malaysia's natural gas reserve had been developed (Muhamad Nor Muhamad, 2001).

In oil and gas exploration, Petroliam Nasional Bhd. (PETRONAS) signed only one revenue-over-cost productionsharing contract (PSC) for block SB303 offshore Sabah with a joint venture of Sabah Shell Petroleum Company Ltd. (SSPC), Shell Sabah Selantan Sdn. Bhd. (SSS), and PETRONAS Carigali Sdn. Bhd. (PCSB), which is the wholly owned exploration and production subsidiary of PETRONAS, in June 2001. Block SB303, which covers an area of 8,170 square kilometers (km<sup>2</sup>) in an average water depth of 75 meters (m), is located about 100 kilometers (km) offshore Kota Kinabalu. According to the PSC, the contractor was to drill two wildcat wells to a minimum aggregate depth of 2,600 m and one optional appraisal and development well in the Tiga Papan oilfield. The contractor was expected to acquire and process 600 square meters of new 3-D seismic data, reprocess 1,000 line-kilometers of previous seismic data, and undertake an integrated subsurface study of the Tiga Papan field. The minimum financial commitment to the block by the contractor was about \$7.4 million. According to the agreement, SSPC, which would be the operator of the block, would own a 50% interest in block SB303; PCSB, 40%; and SSS, 10% (PETRONAS, 2001b§).

In 2001, four oil and gas discoveries were made in Malaysia. In March, Amerada Hess Ltd. (AHL) of the United States announced that it had made its first oil and gas discovery in Malaysia at its second exploration well—Cendor-1 in block PM304, about 155 km offshore Terengganu. The well was drilled to a total depth of 1,790 m and tested at a maximum recorded rate of 2,840 barrels per day (bbl/d) of crude petroleum. In another selected zone, natural gas flowed at a

stabilized rate of more than 141,500 cubic meters per day. The block PM304, which covers about 10,260 km<sup>2</sup>, was awarded to AHL and PCSB in 1998. The concession area was owned 65.5% by AHL, 30% by PCSB, and 4.5% by Petroleum Investment and Development Co. of Vietnam (New Strait Times, 2001b). In April, PETRONAS announced that its PCSB discovered natural gas at its F38.1 well in block SK310 in the Central Luconia Province off Sarawak and at its F9.2 well in block SK308 offshore Miri, Sarawak; both tested flowed gas at 2.14 million cubic meters per day and 224 bbl/d of condensate. Additionally, PCSB reportedly discovered oil at its Sumandak 1 offshore Sabah, which tested flowed 2,400 bbl/d of oil. Murphy Oil Corp. of the United States also reported discovery of oil and gas at its West Patricia 2 well in block SK309 offshore Sarawak, which tested 2,900 bbl/d of oil and 150,000 to 235,000 million cubic meters per day of natural gas (American Association of Petroleum Geologists, 2002).

In oil and gas development, PETRONAS announced in December 2001 that the Angsi oil and gasfield, which was jointly developed by PCSB and ExxonMobil Exploration and Production Malaysia Inc. (EMEPMI), began its first oil and gas production on December 21, 2001, at an initial rate of 15,000 bbl/d of oil and 1.7 million cubic meters per day of gas. At its peak, the field was expected to produce 65,000 bbl/d of oil and 12.7 million cubic meters per day of gas. The project, which is equally owned by EMEPMI and PCSB (as the operator of the field), consists of an integrated oil and gas central processing platform connected to a 52-well drilling platform via a 100-m bridge and a 32-well satellite drilling platform. It was claimed to be the largest integrated oil and gas platform in the South China Sea (PETRONAS, 2001a§).

Production of natural gas increased by 3% to 46.7 billion cubic meters, or an average of 128 million cubic meters per day. Production of crude petroleum and condensate decreased by 1.9% to 243.7 million barrels (Mbbl), or an average of 668,000 bbl/d, because of reduced exports in 2001. Exports of crude petroleum decreased by 9.6% to 104.9 Mbbl, and exports of LNG increased only by 0.4% to 15.5 Mt, or about 23.2 billion cubic meters, in 2001 (Department of Statistics [Malaysia], 2002, p. 40-41). Exports of crude petroleum went mainly to Japan, the Republic of Korea, Singapore, and Thailand. Exports of LNG went to Japan, the Republic of Korea, and Taiwan.

The natural gas production by Esso Production Malaysia, Inc., and PCSB from the gasfields offshore Terengganu was delivered to the gas-processing plants in Kerteh. The processed natural gas was then delivered by pipeline as fuel to the end users, which included households, manufacturers, and power companies, and as feedstock to petrochemical, ammonia, and urea plants in peninsular Malaysia. The natural gas production by Sabah Shell Petroleum Co. Ltd. from the gasfields offshore Sabah was delivered to the processing plant on Labuan Island. The processed natural gas was delivered to the methanol plant as feedstock and to the DRI plant as fuel on Labuan Island. The natural gas production by PCSB and SSB from the gasfields offshore Sarawak was delivered to two LNG plants and the ammonia and urea plants at Bintulu in Sarawak.

Production of LNG by Malaysia LNG Sdn. Bhd. (MLNG) and Malaysia LNG Dua Sdn. Bhd. (MLNG-2) totaled about 15.5 Mt in 2001. The LNG production by MLNG was exported

to Japan under a 20-year contract with Japanese utilities companies. The LNG production by MLNG-2 was exported to Japan, the Republic of Korea, and Taiwan under long-term contracts.

In May, Malaysia LNG Tiga Sdn. Bhd. (MLNG-3) reportedly had secured a total of \$816 million in loans from the Japan Bank for International Corp. (\$651 million) and from a syndicate of seven international commercial banks (\$165 million) to finance the construction of Malaysia's third LNG plant and related facilities in Bintulu, Sarawak. The plant, which was about 45% completed in May 2001, would consist of two 3.4-Mt/yr LNG trains. The construction would also include a 120,000-cubic-meter-capacity LNG storage tank and an LNG loading jetty. The plant was scheduled to begin operation in 2003 (Oil & Gas Journal, 2001a).

Earlier in 2000, Nippon Mitsubishi Oil Corp. reportedly had secured \$360 million loans from Sakura Bank and three other Japanese banks to develop the natural gasfield in block-10 offshore Sarawak to produce natural gas to feed MLNG-3 LNG plant in Bintulu, Sarawak. The company, along with Mitsubishi Corp. and other partners was to invest \$330 million to construct gas-production facilities and would produce up to 7 million cubic meters per day of natural gas beginning in the fourth quarter of 2003 (Nikkei Weekly, 2000).

#### **References Cited**

American Association of Petroleum Geologists, 2002, Lots of discoveries in lots of places, AAPG Explorer: American Association of Petroleum Geologists, January, p. 17.

Carlin, J.F., Jr., 2002, Tin: U.S. Geological Survey Mineral Commodity Summaries 2002, p. 174-175.

Department of Statistics [Malaysia], 2002, Monthly statistical bulletin: Department of Statistics [Malaysia], March, 157 p.

Hedrick, J.B., 2002, Rare earths: U.S. Geological Survey Mineral Commodity Summaries 2002, p. 132-133.

Malaysian Tin Bulletin, 2001a, News Highlights—Tantalum found under stadium: Malaysian Tin Bulletin, v. 12, no. 7, July, p. 2.

Malaysian Tin Bulletin, 2001b, News Highlights—Tin slag factory fined RM85,000: Malaysian Tin Bulletin, v. 12, no. 10, October, p. 2-3.

Malaysian Tin Bulletin, 2001c, Special Article—Growing from a wasteland: Malaysian Tin Bulletin, v. 12, no. 2, February, p. 4-5.

Malaysian Tin Bulletin, 2002, Domestic tin consumption: Malaysia Tin Bulletin, v. 13, no. 2, February, p. 10.

Metal Bulletin, 2001a, Environment holds back Malaysian Al project: Metal Bulletin, no. 8605, September 6, p. 5.

Metal Bulletin, 2001b, Green light for Malaysian aluminum smelter: Metal Bulletin, no. 8591, July 12, p. 3.

Metal Bulletin, 2001c, Malaysia favor privatization for Perwaja: Metal Bulletin, no. 8550, February 15, p. 23.

Metal. Bulletin, 2001d, Malaysia Lion Group snaps up Antara Steel: Metal Bulletin, no. 8552, February 22, p. 27.

Metal Bulletin, 2001e, Malaysia secondary smelter ramps up new plant: Metal Bulletin, no. 8585, June 21, p. 11.

Metal Bulletin, 2001f, Malaysia Smelting buys Koba Tin stake: Metal Bulletin, no. 8622, November 5, p. 3.

Metal Bulletin, 2001g, Malaysian Chamber of Mines looks to revitalize tin sector: Metal Bulletin, no. 8580, June 4, p. 5.

Metal Bulletin, 2002, Comalco begins work on Gladstone alumina refinery: Metal Bulletin, no. 8641, January 17, p. 7.

Minerals and Geoscience Department [Malaysia], 2000a, Directory of industrial mineral-related industries, 1999: Minerals and Geoscience Department [Malaysia], November, 110 p.

Minerals and Geoscience Department [Malaysia], 2001a, Malaysia minerals yearbook, 2000: Minerals and Geoscience Department [Malaysia], November, 115 p.

 $Minerals\ and\ Geoscience\ Department\ [Malaysia], 2001b,\ Monthly\ statistics\ on$ 

- mining industry in Malaysia: Minerals and Geoscience Department [Malaysia], December, 22 p.
- Muhamad Nor Muhamad, 2001, Malaysia, in Mining annual review: London, Mining Journal Ltd., CD-ROM, 4 p.
- New Strait Times, 2001a, Amerada Hess discovers oil off Terengganu: New Strait Times, March 24, p. 1.
- New Strait Times, 2001b, Grace to increase silica production because of demand: New Strait Times, August 25, p. 1.
- Nikkei Weekly, 2000, Malaysia—gas field to be developed: Nikkei Weekly, v. 38, no. 1,925, May 1, p. 18.
- Nikkei Weekly, 2001, Malaysia drops investor curbs: Nikkei Weekly, v. 39, no. 1,978, May 14, p. 20.
- Oil & Gas Journal, 2001a, Quick Takes—Topping gas processing news: Oil & Gas Journal, v. 99, no. 20, May 14, p. 8.
- Oil & Gas Journal, 2001b, Worldwide look at reserves and production: Oil & Gas Journal, v. 99, no. 52, December 24, p. 126-127.
- Star, 2001, Three new gold sites found: Star [Kuala Lumpure], July, p. 1. World Bureau of Metal Statistics, 2001, World metal statistics: World Bureau of Metal Statistics, v. 55, no. 5, May 15, 150 p.

#### **Internet References Cited**

- Asean Federation of Cement Manufacturers, 2002, AFCM members, accessed April 24, 2002, at URL http://www.asi.or.id/afcm/malaysia.htm.
- Avocet Mining PLC, 2002, Avocet mining exceeds budgeted gold production, improves gold reserve potential and adjusts to tungsten downturn, Press Release, February 7, accessed April 30, 2002, at URL http://www.avocet.co.uk/avocet%20pr070202.htm.
- Central Bank of Malaysia, 2002, Monthly Statistical Bulletin, March—National accounts VI.2 Gross domestic product by kind of economic activity at 1987 constant prices, accessed May 9, 2002, at URL http://www.bnm.gov.my/en/documents/periodicals/msb/2002/03/vi 02pdf.
- Kuala Lumpur Stock Exchange, 2001a, Cement Industries of Malaysia Berhad, accessed May 21, 2001, at URL http://www.klse.com.my/website/listing/lc/ cima.htm
- Kuala Lumpur Stock Exchange, 2001b, Malayan Cement Berhad, accessed May 21, 2001, at URL http://www.klse.com.my/website/listing/lc/mcement.htm.
- Kuala Lumpur Stock Exchange, 2001c, Tasek Corporation Berhad, accessed May 21, 2001, at URL http://www.klse.com.my/website/listing/lc/tasek.htm.
- Liffe, 2001, Corporate Action—Recommended acquisition of Blue Circle Industries PLC by Lafarge Minerals Limited., a wholly owned subsidiary of Lafarge SA, accessed June 3, 2001, at URL
  - http://www.liffe.com/investor/news/ event/bluecircle\_acq.htm.
- Malaysia Iron and Steel Industry Federation, 2001, Industry Trend—Aggregate steel consumption and Apparent steel consumption per capita, accessed April 30, 2002, at URL http://www.misif.org.my/p\_ho.asp?ThemelD=210.
- Malaysia Smelting Corp. Bhd., 2001a, Feed Products, accessed January 22, 2002, at URL http://www.msmelt.com.

- Malaysia Smelting Corp. Bhd., 2001b, Profile, accessed May 21, 2002, at URL http://www.klse.com.my/website/listing/lc/msc.htm.
- Ministry of International Trade and Industry, 2002a, Export and import by products (1999-2000), accessed May 9, 2002, at URL http://www.miti.gov.my/ trdind/annu4.htm and annu5.htm).
- Ministry of International Trade and Industry, 2002b, Trade statistics January 2002, accessed April 16, 2002, at URL http://www.miti.gov.my/trdind/trade-t1.htm
- PETRONAS, 2001a (December 21), PETRONAS announces Angsi's first oil and gas, News—Media Release, accessed May 1, 2001, via URL http://www.petronas.com.my/internet/corp/corpweb3.nsf/framesetnews?openframeset.
- PETRONAS, 2001b (June 25), PETRONAS awards block SB303 to Shell and PETRONAS Carigali, News—Media Releases, accessed June 10, 2002, via URL http://www.petronas.com.my/internet/corp/corpweb3.nsf/framesetnews?openframeset.
- Pro Publications International Ltd., 2001, Final battle for Malaysian consolidation, accessed April 24, 2002, at URL http://www.propubs.com/GCL/gclnews.html.
- Southeast Asia Iron and Steel Institute, 2001, Annual regional statistics—Crude steel production (year:1991-2001), accessed August 12, 2002, at URL http://www.seaisi.org/fr\_resource1.htm.

#### **Major Source of Information**

The Ministry of Primary Industry:

Department of Minerals and Geoscience [Malaysia]

Floor 19th-22nd, Tanbung Haji Bldg.

Jalan Tun Razak, 50658 Kuala Lumpur, Malaysia

Telephone: 60-03-2161-1033, Fax: 60-03-2161-1036

E-mail: jmgkl@jmg.gov.my, Website:www.jmg.gov.my

#### **Major Publications**

Minerals and Geoscience Department [Malaysia]:

Annual Report and Malaysia Minerals Yearbook, annual.

Department of Statistics [Malaysia]:

Statistical Bulletin, Malaysia, monthly.

Yearbook of Statistics, Malaysia, annual.

Malaysian Chamber of Mines:

Annual Report, annual.

Malaysia Tin Bulletin, monthly.

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

(Metric tons unless otherwise specified)

Commodity 2/	1997	1998	1999	2000	2001 p/
METALS					
Aluminum, bauxite, gross weight thousand tons	279	160	223	123	64
Columbium-tantalum metals, struverite, gross weight	391	521	675	969 r/	9,657
Copper, mine output, Cu content (Sabah)	18,821	13,907	4,600		
Gold, mine output, Au content 3/ kilograms	4,487	3,394	3,449	4,026	3,965
Iron and steel:					
Iron ore and concentrate thousand tons	269	376	337	259	376
Steel, crude do.	2,962	1,903 r/	2,770 r/	3,650 r/	4,100
Lead metal, secondary	42,000	35,000	33,000	35,300	42,000 e/
Rare-earth metals, monazite, gross weight	767	517	1,147	818	643
Silver, mine output, Ag content 3/ kilograms	9,647	7,285	2,744	4	3
Tin:					
Mine output, Sn content	5,065	5,754	7,340	6,307	4,973
Metal, smelter	34,823	27,201	28,913	26,228	32,566
Titanium:					
Ilmenite concentrate, gross weight	167,504	124,689	127,695	124,801	122,462
Dioxide, gross weight e/	46,000	46,000	46,000	46,000	46,000
Zirconium, zircon concentrate, gross weight	4,050	3,057	1,763	3,642	3,768
INDUSTRIAL MINERALS					
Barite	2,608	1,580	13,506	7,274	649
Cement, hydraulic thousand tons	12,668	10,397	10,104	11,445	13,820
Clays and earth materials do.	35,601	25,422	33,083	79,485 r/	80,000 e/
Clays, kaolin	221,769	198,930	213,973 r/	233,885 r/	286,648
Feldspar	9,779	31,369	26,940	29,895 r/	30,000 e/
Mica	5,708	3,642	3,675	3,835	4,015
Nitrogen, N content of ammonia	243,200	351,400	432,000	604,800	726,000
Sand and gravel thousand tons	40,295	45,231	33,351	21,497 r/	22,000 e/
Silica sand (Peninsular Malaysia and Sarawak)	949,948	473,422	508,723	446,838 r/	460,000 e/
Stone:					
Dolomite	8,870	7,500	4,250	4,030 r/	2,850
Limestone thousand tons	25,467	20,124	23,515	26,086 r/	27,000 e/
MINERAL FUELS AND RELATED MATERIALS					
Coal	105,231	349,849	308,502	382,942	545,845
Gas, natural: 4/					
Gross million cubic meters	48,593	48,388	51,376	56,929 r/	58,751
Net 5/ do.	38,631	38,468	40,844	45,259 r/	46,707
Liquefied natural gas thousand tons	15,820	15,450	15,390	15,169 r/	15,200 e/
Petroleum: 4/					
Crude and condensate thousand 42-gallon barrels	260,563	264,641	252,115	249,159 r/	243,696
Refinery products:					
Gasoline do.	20,354	20,331	25,498	22,205	25,500 e/
Jet fuel e/ do.	7,800	7,500	7,500	7,500	7,500
Kerosene do.	17,381	16,924	15,945	19,631	17,500 e/
Diesel do.	50,668	44,563	43,725	57,559	55,500 e/
Residual fuel oil do.	20,997	15,915	11,972	12,413	12,500 e/
Other e/ 6/ do.	15,700	15,000	15,000	15,500	15,500
Total 7/ do.	133,000	120,000	120,000	135,000	134,000 e/

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

Sources: Ministry of Primary Industry, Minerals and Geoscience Department (Kuala Lumpur), Malaysian Minerals Yearbook 2000, Monthly Statistics on the Mining Industry in Malaysia; Department of Statistics (Kuala Lumpur), Monthly Statistical Bulletin, December 2001; Tin Industry (Research and Development) Board, Malaysian Tin Bulletin, Appendix 3-4, v. 12, no. 12, December 2001; and U.S. Geological Survey Minerals Questionnaire, 2000.

 $<sup>1/\,</sup>Table$  includes data available through June 21, 2002.

<sup>2/</sup> In addition to the commodities listed, a variety of crude construction materials, which included clays and stone, fertilizers, and salt, is produced, but not reported, and information is inadequate to make reliable estimates of output levels.

<sup>3/</sup> Includes byproduct from a copper mine in Sabah, tin mines in Peninsular Malaysia, and gold mines in Peninsular Malaysia and Sarawak.

<sup>4/</sup> Includes production from Peninsular Malaysia, Sabah, and Sarawak.

<sup>5/</sup> Gross less volume of reinjected and flared.

<sup>6/</sup> Includes liquefied petroleum gas, naphthas, and lubricants.

<sup>7/</sup> Data are rounded to three significant digits; may not add to totals shown.

# ${\bf TABLE~2} \\ {\bf MALAYSIA: STRUCTURE~OF~THE~MINERAL~INDUSTRY~IN~2001} \\$

(Thousand metric tons unless otherwise specified)

	Commodity	Major operation companies and major equity owners	Location of main facilities	Annua capacity
Commodity Bauxite		Johore Mining and Stevedoring Co. Sdn. Bhd. (61% owned by	Teluk Rumania and Sg. Rengit,	400
		ALCAN Ltd. of Canada, and 39% by local investors and other)	Johor	
Cement 1/		Associated Pan Malaysia Cement Sdn. Bhd. (100% owned by Malayan Cement Berhad)	Rawang, Selangor and Kanthan, Perak	6,070 (4,600)
Do.		Cement Industries of Malaysia Bhd. (publicly owned	Kangar, Perlis	2,000
-		company)	Y 1 . YZ 11	(1,400)
Do.		Kedah Cement Sdn. Bhd. (77.1% owned by Malayan	Langkawi, Kedah	5,940
Do.		Cement Bhd. and minority by general public shareholders)  Negeri Sembilan Cement Industries Sdn. Bhd. (100% owned by	Bahau, Negeri Sembilan	(3,300)
Ъ0.		Cement Industries of Malaysia Berhad)	Banau, regen Semonan	(1,200)
Do.		Pahang Cement Sdn Bhd. (50-50 joint venture of Pahang State	Bukit Sagu, Pahang	1,300
		government and YTL Cement Berhad)	-	(1,000)
Do.		Perak-Hanjoong Simen Sdn. Bhd. (60% owned by	Padang Rengas, Perak	1,600
	Korea Heavy Industries and Construction Co.,		(1,400)	
		and 40% by Perak State government)		
Do.		Tasek Corp. (publicly owned company)	Ipoh, Perak	2,300
Gas:				(2,300)
Natural Natural	million cubic meters per day	Esso Production Malaysia, Inc.	Offshore Terengganu	33
Do.	do.	Sabah Shell Petroleum Co. Ltd.	Offshore Sabah	2.8
Do.	do.	Sarawak Shell Bhd.	Offshore Sarawak	77.7
Liquefied		Malaysia LNG Sdn. Bhd. (65% owned by PETRONAS, 15% by Shell Gas N.V., 15% by Mitsubishi Corp., and 5% by Sarawak State government)	Tanjung Kidurong, Bintulu, Sarawak	8,100
Do.		Malaysia LNG Dua Sdn. Bhd. (60% owned by PETRONAS, 15% by Shell Gas N.V., 15% by Mitsubishi Corp., and 10% by Sarawak State government)	do.	7,800
Gold, refined	kilograms	Specific Resources Sdn. Bhd. (joint venture of Pahang State Development Corp. and Avocet Mining plc of the United Kingdom)	Penjon, Pahang	3,400
Iron and steel:				
Direct-reduced iron		Amsteel Mills Sdn. Bhd. (wholly owned subsidiary of Amsteel Corp.)	Labuan Island, offshore Sabah	800
Crude steel		Perwaja Steel Sdn. Bhd. (51% owned by Maju Holdings Sdn. Bhd., 30% by Lion Group, 19% by Terengganu State government)	Kemaman, Terengganu	1,200
Nitrogen, ammonia		Asean Bintulu Fertilizer Sdn. Bhd. (63.5% owned by PETRONAS, 13% by P.T. Pupuk Sriwidjaja Indonesia, 13% by the Thai Minstry of Finance, 9.5% by the Philippines National Development Co., 1% by Singapore Temasek Holdings Pte. Ltd.)	Bintulu, Sarawak	395
Do.		PETRONAS Fertilizer Kedah Sdn. Bhd. (wholly owned subsidiary of PETRONAS)	Gurun, Kedah	304
Petroleum, crude	thousand 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	184
Do.	do.	PETRONAS Carigali Sdn. Bhd.	Offshore Terengganu	22
Tin:				
Concentrate		Delima Industries Sdn. Bhd.	Dengkil, Selangor	1.1
Do.		Maiju Sama Sdn. Bhd.	Puchong, Selangor	1.6
Do. Do.		New Lahat Mines Sdn. Bhd. Omsam Telecommunication Sdn. Bhd.	Lahat, Perak Bakap and Batu Gajah, Perak	0.3
Do.		Rahman Hydraulic Tin Bhd.	Klian Intan, Perak	1.2
Do.		S.E.K. (M) Sdn. Bhd.	Kampar, Perak	0.4
Do.		Tasek Abadi Sdn Bhd.	Senudong and Kampar, Perak	0.5
Refined		Malaysia Smelting Corp. Bhd. (37.44% owned by The Straits	Butterworth, Penang	40
		Trading Co., Ltd., 37.44% by Malaysia Mining Corp., and 25.12% by other)		10
Titanium, dioxide		Tioxide (Malaysia) Sdn. Bhd. (85% owned by Tioxide Group plc and 15% by Terengganu State government)	Kemaman, Terengganu	50

<sup>1/</sup> All seven companies operated integrated plants. Annual capacity was for cement production and the clinker capacity was in parentheses.