

THE MINERAL INDUSTRY OF

MALAYSIA

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Malaysia, which borders Brunei, Indonesia, and Thailand in Southeast Asia, is a middle-income developing country with a per capita income of about \$3,630. It has substantial resources of natural gas and tin. Other mineral resources in Malaysia were bauxite, carbonate rocks, clays, coal, copper, gold, iron ore, crude petroleum, silica, and minerals associated with tin placer deposits, such as ilmenite, monazite, struverite [a columbium (niobium)/tantalum-bearing mineral], and zircon. Since 2000, mineral exploration in Malaysia by the Government and the private sector had been focused mainly on extending the reserves of clays, coal, gold, limestone, oil and gas, and silica in peninsular Malaysia, Sabah, and Sarawak.

Although Malaysia's tin reserves ranked second and tin-associated rare-earths reserves (contained in monazite) ranked ninth in the world, most of the high-grade tin reserves had been depleted (Carlin, 2003; Hedrick, 2003). According to the Tin Industry (Research and Development) Board, the remaining tin reserves in leased lands would be depleted in 5 years if production remained between 3,500 and 4,500 metric tons per year (t/yr) and no new lands with identified tin reserves were made available by the Government for mining before such other uses as for housing, industries, and agriculture (Malaysia Tin Bulletin, 2002). Malaysia's reserves of natural gas ranked 14th in the world (Oil & Gas Journal, 2002f). Malaysia was ranked the world's third largest producer and exporter of liquefied natural gas (LNG) after Indonesia and Algeria (Oil & Gas Journal, 2002e).

Malaysia's economic performance improved considerably from that of 2001 owing mainly to a strong rebound in the manufacturing and mining sectors in 2002. Malaysia's gross domestic product (GDP), in 1987 constant dollars, grew by 4.1% in 2002 compared with 0.3% in 2001. The output of the manufacturing sector, which had a 5.8% negative growth in 2001, grew by 4.0% in 2002 owing to a substantial increase in the production of electrical and electronics products (Central Bank of Malaysia, 2003a§¹).

The output of the mining and quarrying sector, which had a negative growth of 0.8% in 2001, grew by 3.7% in 2002. The overall growth in the mining and quarrying sector was owing mainly to increased production of natural gas and crude petroleum. The overall contribution by the mining and quarrying sector to Malaysia's GDP in 2002 was 7.2%, of which 7.0% was contributed by the oil and gas industry and 0.2% by the coal and metallic and industrial minerals industries. Malaysia's GDP, in 1987 constant dollars, was estimated to be \$57.71 billion, of which \$4.16 billion was contributed by the mining and quarrying sector (Central Bank of Malaysia, 2003a§).

¹References that include a section mark (§) are found in the Internet References Cited section.

Government Policies and Programs

To help rejuvenate the mining industry, the Government had formulated a new National Mineral Policy in 1998 to replace the existing Federal and State government laws with the Federal Mineral Act and the State Mineral Enactment. The Federal Mineral Act defines the powers of the Federal Government, and the State Mineral Enactment delineates the powers and rights of the State governments related to issuing exploration and mining leases. The Enactment also provides a standard model. The new policy also introduced security of tenure in which the holder of a current and valid license with a right to prospect and explore shall be given the right of first refusal for a mining lease should a mineral deposit be discovered in the licensed prospected area. The right to a mining lease, however, is contingent on the discoverer's preparation of acceptable documents and development plans required by the relevant law. To harmonize relations between the Federal and state governments, the National Mineral Council had been established in 2000. As of 2002, only the States of Selangor and Sabah had adopted the State Mineral Enactment.

To protect the local iron and steel industry, the Government increased its tariff on imported hot- and cold-rolled coils and electrogalvanized and galvanized iron and steel pipes to 50% from 25% in March 2002. Exemption, however, would be considered for imports by such industries as automotive and components, electrical and electronics, exporters, petroleum and gas, shipping, and steel furniture. Exemption also would be granted for imports from member countries of the Association of Southeast Asian Nations. The import duty, however, would be maintained under the Common Effective Preferential Tariff (Ministry of International Trade and Industry, 2002§).

Environmental Issues

The Penang Island Municipal Council, which owned Malaysia's oldest city stadium in Georgetown, Penang, announced in July 2001 that tantalum-bearing minerals worth several million Malaysian ringgit (M\$) were discovered underneath the stadium. The city council later awarded the right to Kuala Ketil Metal Sdn. Bhd. (KKM) to mine the tantalum-bearing minerals in mid-September 2001. KKM reportedly paid the Municipal Council about \$374,000 for the mining rights. The tantalum mining at the stadium became a big issue following a statement made by the Consumers Association of Penang concerning the high level of radiation and negative impacts on workers and nearby residents (Sun, The, 2001).

In May, the State of Perak decided that the deep ponds in former mining areas should be preserved as open spaces to be used for recreational purposes and not to be filled for other

development purposes. The Perak State government planned to sell former mining areas at a lower price in its commitment to keep retention ponds for flood control. Some deep ponds measuring 60 meters (m) in depth had been approved for conversion into theme parks (New Straits Times, 2002a). In September, the State of Selangor also decided to retain two former mining ponds in Jalan Param as the retention ponds to be turned into a recreational area in the vicinity of Sungai Chua. Other former mining ponds in the area, however, had been acquired for the construction of the SILK highway (New Straits Times, 2002c).

Production

In 2002, Malaysia produced barite, bauxite, coal, 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 from tin tailings decreased sharply because of low tantalite prices in the world market in 2002. Production of tin dropped to a historic low in 2002 because of depleting ore reserves and the low tin prices in the Kuala Lumpur Tin Market. There had been no silver production as byproduct of copper mining since 2000.

Production of natural gas and crude petroleum increased in 2002 because of increased domestic natural gas demand and increased crude petroleum exports. Production of processed mineral products included cement, refined gold, LNG, nitrogen fertilizer materials (ammonia and urea), refined lead (secondary), refined petroleum products, crude steel, titanium dioxide pigment, and refined tin (table 1).

Trade

In 2002, Malaysia's total exports increased by 6% to \$93.3 billion, and total imports increased by 8.3% to \$79.9 billion. As a result, Malaysia's merchandise trade surplus shrank by 5.8% to \$13.4 billion because of a substantial increase in imports in 2002. Malaysia remained a net exporter of minerals in 2002 because of its large exports of LNG, crude petroleum, and refined petroleum products (Ministry of International Trade and Industry, 2003a§).

In 2002, minerals exports totaled \$8.1 billion, of which \$3.1 billion was crude petroleum; \$2.6 billion, LNG; \$1.8 billion, refined petroleum products; and \$601 million, other mineral commodities. In 2002, minerals exports accounted for 8.7% of total exports. In 2002, minerals imports totaled \$3.8 billion, of which \$2.0 billion was refined petroleum products; \$1.2 billion, crude petroleum; \$173 million, crude mineral ore; \$156 million, metal scrap (mostly iron and steel scrap); and \$280 million, other mineral commodities. In 2002, minerals imports accounted for 4.8% of total imports. Malaysia's mineral trade surplus amounted to \$4.3 billion in 2002 (Ministry of International Trade and Industry, 2003b§).

Structure of the Mineral Industry

Malaysia's mining industry consisted of a small mining sector of coal and ferrous and nonferrous metals, 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, exploitation, and processing businesses were owned and operated by the state-owned oil and gas company and by joint ventures of the state-owned oil and gas company and foreign companies.

The structure of the mineral industry changed slightly in 2002. Production capacity of cement and titanium dioxide pigment increased because of growing domestic demand. Production capacity of barite, bauxite, and tin decreased because of depleting ore reserves and low prices in the world market. Construction of the country's third LNG plant, Malaysia LNG Tiga, was near completion. When Malaysia LNG Tiga is completed in 2003, Malaysia would become the world's second largest LNG producer after Indonesia.

Commodity Review

Metals

Bauxite and Aluminum.—Johore Mining and Stevedoring Co. Sdn. Bhd. (JMSC) and Kejora Sdn. Bhd. each operated a bauxite mine at Teluk Rumania and at Sungai Rengit, respectively, in the State of Johor. Bauxite production continued the downward trend that started in 2000 and reached a historic low in 2002. JMSC operated a processing plant at Bukit Raja, near Sungai Rengit, for crushing, screening, and washing. The plant produced three grades of bauxite. Cement-grade bauxite was sold to the domestic cement manufacturers, and chemical- and refractory-grade bauxite were exported mainly to Taiwan and Thailand [Minerals and Geoscience Department (Malaysia), 2002a, p. 15, 126].

In September 2002, a group of Middle Eastern investors led by Dubai Aluminum Co. Ltd. (Dubal) of the United Arab Emirates signed an agreement with Gulf International Investment Group of Malaysia for the development of a \$2 billion aluminum smelter with a 500,000-t/yr capacity near Bintulu, Sarawak. Under the agreement, groundbreaking was expected to begin by the end of 2004 with the first production scheduled for 2007. The smelter, however, would be brought onstream in two phases of 250,000 t/yr each. Most of the alumina feed would be imported from Australia and the United States (Metal Bulletin, 2002a).

During the third quarter of 2002, Dubal reportedly was conducting a feasibility study to build an aluminum smelter in Bintulu. The smelter would use electricity to be generated from the \$2.4 billion Bakun hydroelectric power station in Sarawak, which was under construction and due for completion in 2007 (New Straits Times, 2002b).

Gold.—In 2002, gold was produced from three gold mines in the State of Pahang and one each in the States of Kelantan and Terengganu. A small quantity (231 grams) of gold was produced as byproduct of tin mining in the State of Selangor. There was no gold production from the Bau area in Sarawak in 2002.

Avocet Mining PLC, which was Malaysia's largest gold mining company, operated the Penjom gold mine at Ampang Jaleh near Kuala Lipis through its subsidiary Specific Resources Malaysia Sdn. Bhd. According to Avocet Mining, mined ore and waste at the Penjom Mines increased by 34% to 20.6 million metric tons (Mt), but processed ore decreased by 7% to 539,000 metric tons (t). The average ore head grade increased to 7.14 grams per metric ton (g/t) gold from 6.40 g/t gold, and process recovery rate also increased to 87% in 2002 from 84% in 2001. As a result, gold production from the Penjom Mine increased by 8% to about 3,340 kilograms (kg) in 2002 (Avocet Mining PLC, 2002b§).

In February 2002, Avocet Mining announced that the Penjom Mine's new mineral resources estimate, which had been independently audited to internationally recognized standards, underestimated gold content by 25% because of underestimating the mine's realized ore tonnage and grade. Avocet Mining had added about 3 t (100,000 ounces) of gold to Penjom's open pit resources and lowered cutoff grades to be in line with the prevailing higher prices. As a result, the company increased its estimate of the balance of Penjom's minable ore resources by 56% to 2,678,225 t and increased the estimate of ore grade by 12% to 6.75 g/t of gold, resulting in an increase of estimated gold content of 74% to 18 t (581,500 ounces). In 2002, Avocet Mining allocated \$1 million in its budget for the 2003 exploration program in Malaysia. The program would focus primarily on extending the economic resources base within the Penjom area. The company would also renew exploration at nearby Buffalo Reef prospect containing more than 3 t (100,000 ounces) of drilled, indicated gold resources (Avocet Mining PLC, 2002a§).

Lead.—Metal Reclamation (Industries) Sdn. Bhd. (MRISB) (a subsidiary of Metal Reclamation Bhd.) began operation of its new secondary (recycling) lead smelter at Pulau Indah Industrial Park on Pulau Lumut off Port Klang in 2001. MRISB recycled lead-acid batteries, lead oxides, lead scrap, lead wastes, solder wastes, and waste containers contaminated with hazardous waste. MRISB production facilities included a battery breaking plant, a smelter, and an alloying and casting plant. The new facilities had a capacity to recycle 70,000 t/yr of spent lead-acid batteries. The premium-grade (99.97% purity) lead and lead alloys produced by MRISB were distributed under the "MRISB Malaysia" brand to the Malaysian and overseas markets. MRISB's overseas markets included Bangladesh, Egypt, Indonesia, the Philippines, Singapore, Sri Lanka, and Thailand (Kuala Lumpur Stock Exchange, 2002§; Metal Reclamation (Industries) Sdn. Bhd., 2002§).

In 2002, the secondary lead production was about 40,000 t compared with the demand for lead at about 86,000 t in 2002 (International Lead and Zinc Study Group, 2003). The shortfall was presumably met by imports.

Iron and Steel.—Production of iron ore increased in 2002 despite a decrease in the number of active mines. In 2002, iron ore was produced from four small-scale mines in the State of Pahang and one each in the States of Perak and Terengganu with a total workforce of about 130 [Minerals and Geoscience Department (Malaysia), 2002§]. Most of the domestically

produced iron ore was consumed by the local cement and pipe-coating steel plants. Malaysia exports annually about one-fourth of its iron ore production mainly to China and Singapore. To meet the raw material requirements for its iron and steel industry, Malaysia imports annually about 2 Mt of high-grade iron ore, about 250,000 t of pig iron, about 130,000 t of ferroalloys, and about 2 Mt of iron and steel scrap [Minerals and Geoscience Department (Malaysia), 2002a, p. 29].

According to the Malaysian Iron and Steel Industry Federation (MISIF), Malaysia's rated capacity of direct-reduced iron (DRI) and hot-briquetted iron (HBI) was 1.2 million metric tons per year (Mt/yr) and 720,000 t/yr, respectively; the rated capacity of crude steel (billets and slabs) was 6.9 Mt/yr in 2002. Malaysia's aggregate steel consumption decreased by 3% to 6.64 Mt in 2001 (the last year for which data were available) from 6.86 Mt in 2000. Of the aggregate steel consumption in 2001, 3.14 Mt was finished long products, such as bars and wire rods used by the construction industry, and 3.50 Mt was plate products, such as coil and plate used by the manufacturing industry. Malaysia's steel consumption per capita decreased to 279 kg in 2001 from 294 kg in 2000 (Malaysian Iron and Steel Industry Federation, 2002§).

According to the Southeast Asia Iron and Steel Institute, Malaysia produced 4.1 Mt of crude steel and 7.7 Mt of finished steel products in 2001 (the last year for which data were available). Malaysia's imports and exports of iron and steel products were 5.1 Mt and 3.0 Mt, respectively, in 2001 (Southeast Asia Iron and Steel Institute, 2002§).

In the iron and steel industry, Amsteel Mills Sdn. Bhd., Perwaja Steel Sdn. Bhd., and Southern Steel Bhd. were the major integrated steelmakers in Malaysia. Amsteel Mills of the Lion Group operated an 800,000-t/yr HBI plant on Labuan Island off Sabah and a 750,000-t/yr crude steel production facility in Klang, Selangor. The state-owned Perwaja Steel operated a 1.2-Mt/yr DRI plant and an 800,000-t/yr crude steel production facility in Kemaman, Terengganu. Southern Steel Bhd. of Camerlin (a member of the Hong Leong Group Malaysia) operated a 1.2-Mt/yr crude steel production facility in Prai, Penang. Other major Malaysian steel mills for rolled steel products were Antara Steel Mills Sdn. Bhd. in Pasir Gudang, Johor; Gunawan Iron & Steel Sdn. Bhd. in Kemaman, Terengganu; Malayawata Steel Bhd. in Prai, Penang; Megasteel Sdn. Bhd. in Banting, Selangor; and Perwaja Steel in Gurun, Kedah (Metal Bulletin Monthly, 2001).

In February 2002, Perwaja Steel, which had accumulated losses and liabilities of about \$2.8 billion, temporarily closed its two plants in Kemaman, Terengganu State, and in Gurun, Kedah State, and offered a voluntary redundancy package to its 1,490 employees at the Kemaman plant and 700 employees at the Grunun plant to restructure its organization and business. By April, the company reopened its plants, laid off about half of its 2,190 workforce, which reduced its total workforce from the two plants to about 1,000. Perwaja Steel's crude steel production was substantially below its capacity because of the restructuring in 2002 (Metal Bulletin, 2002e, f). In August 2002, Southern Steel was forced to shut down one of its two electric arc furnaces for about 4 months in Prai, Penang State, and incurred a substantial loss of crude steel (billet) production. As a result, Malaysia suffered a tight supply of domestically

produced crude steel in the second half of 2002; several re-rolling steel mills were forced to cut back their production or temporarily closed their plants in 2002 (Metal Bulletin, 2002b).

Tin.—Malaysia, which was once the world's largest tin producer, accounted for less than 2% of the world tin mine production in 2002. The country's tin mine production dropped to a record low in 2002 because of the closure of several major tin mining operations and lower tin price. In the Kuala Lumpur Tin Market, which shifted its price quotation to U.S. dollars from Malaysian ringgit in February 2001, the average tin prices in 2002 dropped to \$4,064 per metric ton from \$4,433 per metric ton in 2001. The number of operating mines in 2002 declined to 24 in December 2002 from 33 in December 2001, and the number of tin miners decreased to 1,311 in December 2002 from 1,461 in December 2001. In 2002, tin produced by open cast accounted for 35%; gravel pump, 34%; retreatment plant, 16%; panning, 14%; and dredging and underground, 1% [Minerals and Geoscience Department (Malaysia), 2002b, p. 9].

In April 2002, the Malaysia Smelting Corp. Bhd (MSC) successfully completed acquisition of a 75% equity interest in Indonesia-based PT Koba Tin from Iluka Resources Ltd. of Australia for \$13.7 million in cash payment and a deferred contingent component of up to \$6 million over 3 years, based on average London Metal Exchange tin prices. The cash component was adjusted downwards by \$300,000 to take into account tin stockpile movements. PT Koba Tin operated tin mining and smelting operations on Bangka Island in Indonesia (Iluka Resources Ltd., 2002).

MSC, which operated a 40,000-t/yr tin smelter in Butterworth, imported about 80% of its requirements for tin concentrate from more than 20 countries worldwide. The major overseas suppliers of its tin concentrates were Australia, Bolivia, Burma, China, Peru, Portugal, and Vietnam. According to MSC, more than 85% of its smelter feed was composed of medium-grade tin concentrates and complex medium-grade (40% to 50% tin) concentrates (Malaysia Smelting Corp. Bhd., 2002§). MSC's smelter was closed for more than a week in October 2002 because of a shortage of workers caused by a dispute over layoff compensation. From November 2002, the smelter shut down two of its four furnaces and operated at about one-half of its capacity because of weak demand for tin in the world market. As a result, refined tin production was estimated to be 30,000 t in 2002 and is expected to decline to between 12,000 t to 15,000 t in 2003 (Metal Bulletin, 2002c, d).

Domestic demand for refined tin declined by 3.7% to 3,896 t in 2002. In 2002, the solder industry remained the major end user and accounted for 54% of the total demand, followed by the pewter industry, 15%; the tin-plating industry, 14%; and other end users, 16%. Refined tin consumption by the solder industry and other end users included consumption of domestically refined and high-grade (99.9% tin) imported refined tin. Exports of refined tin totaled 27,076 t and were valued at \$111.9 million in 2002. In 2002, the major buyers of Malaysian refined tin were Singapore (39.7%), the Republic of Korea (26.7%), Japan (6.7%), South Africa (5.0%), Italy (3.1%), Taiwan (2.6%), and the Netherlands (1.8%) (World Bureau of Metal Statistics, 2003, p. 125).

Industrial Minerals

Cement.—Cement production increased by 3.7%, which was slightly higher than the growth rate of Malaysia's construction sector in 2002. In 2002, the cement production was equivalent to about 50% of the industry's production capacity; demand for cement was estimated at about 13 Mt; and exports of cement were estimated to be 1.3 Mt. After consolidations in the past 2 years, Malaysia's cement industry still faced oversupply with excess production capacity and an oligopolistic market with few cement companies controlling a large percentage of market shares in 2002.

According to the Cement and Concrete Association (Malaysia) (C&CAM), the cement industry comprised 14 companies, of which 8 operated integrated plants (clinker and grinding), 5 operated only cement grinding plants, and 1 operated only a 600,000-t/yr clinker plant (Sarawak Clinker Sdn. Bhd.). Among the eight integrated companies, seven are listed in table 2, and one operated a 44,000-t/yr clinker and a 68,000-t/yr grinding plant for white cement (Aalborg RCI White Cement). Among the five cement grinding companies, Cement Industries (Sabah) Sdn. Bhd. had a grinding capacity of 900,000 t/yr; CMS Cement Sdn Bhd., 1.75 Mt/yr; Halcim (Malaysia) Sdn. Bhd., 1.3 Mt/yr; Slag Cement Sdn. Bhd., 1.0 Mt/yr; and Southern Cement Industries Sdn. Bhd., 770,000 t/yr. Malaysia's clinker capacity was 17.8 Mt/yr, and cement-grinding capacity was 28.4 Mt/yr in 2001 (the last year for which data were available) (Tasek Corp. Bhd., 2002§).

Malayan Cement Bhd (MCB) owned and operated Associated Pan Malaysia Cement Sdn. Bhd. and Kedah Cement Sdn. Bhd. The companies had a combined clinker capacity of 7.9 Mt/yr and cement grinding capacity of 12.2 Mt/yr and controlled about 52% of market share. MCB remained the country's largest cement producer. Perak-Hanjoong Simen Sdn. Bhd. completed its second clinker and cement grinding plants in 2001. It increased its clinker capacity to 3 Mt/yr and cement grinding capacity to 3.4 Mt/yr, controlled 13% of market share, and was the country's second largest cement producer. Cement Industries of Malaysia Berhad owned and operated Cement Industries of Malaysian Bhd. and Negeri Sembilan Cement Industries Sdn Bhd. With a combined clinker capacity of 2.8 Mt/yr, cement grinding capacity of 3.4 Mt/yr, and controlling 18% market share, it was the third largest cement producer. Tasek Corp. Bhd., which operated a 2.3 Mt/yr capacity clinker and a 2.3 Mt/yr capacity cement grinding plant, controlled 12% market share, and was Malaysia's fourth largest cement producer.

Titanium.—Prior to mid-1999, Tioxide (Malaysia) Sdn. Bhd. (a subsidiary of Tioxide Group plc of the United Kingdom) manufactured titanium dioxide in Malaysia. Huntsman Tioxide Sdn. Bhd. of the United Kingdom acquired Tioxide Group as part of its \$2.8 billion acquisition of four major businesses from Imperial Chemical Industries plc in June 1999. Huntsman Tioxide took over the 50,000-t/yr sulfate-process titanium dioxide pigment plant at Teluk Kalong industrial estate near Kemaman in Terengganu from Tioxide (Malaysia) Sdn. Bhd.; by the end of 2001, Huntsman Tioxide completed capacity expansion of the plant by 6,000 t/yr to 56,000 t/yr. According

to the company, the production capacity could be increased by an additional 10% by optimizing operational efficiency (Asian Chemical News, 2002; Huntsman Tioxide, 1999§).

Mineral Fuels

Natural Gas and Petroleum.—Malaysia, which was a net exporter of natural gas and crude petroleum, is a mature oil- and gas-producing country. In 2002, the Government continued the policy of developing its hydrocarbon resources with a special emphasis on the development of its natural gas resources for industrial, petrochemical, and power generation projects approved by the Government. According to the state-owned Petroliam Nasional Bhd. (PETRONAS), Malaysia's proven and probable resources of natural gas and crude petroleum were 2.48 trillion cubic meters and 4.24 billion barrels, respectively, in 2002 (Trade Partners UK, 2002§). The country's proven reserves of natural gas, however, 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 2002 (Oil & Gas Journal, 2002f).

In July 2002, PETRONAS awarded two production-sharing contracts (PSC) for oil and gas exploration for blocks PM311 and PM312 offshore peninsular Malaysia to Murphy Oil Corp. (MOC) of the United States and PETRONAS Carigali Sdn. Bhd. (PCSB), the wholly owned exploration and production subsidiary of PETRONAS. Blocks PM311 and PM312, which cover a combined area of about 11,000 square kilometers, are located northeast offshore Terengganu. Under the terms of the PSC, MOC was to acquire and reprocess 250 square meters of 3-D seismic data and 2,500 line-kilometers of 2D seismic data for each block. MOC also planned to drill two exploration wells in each block. Under the PSC, MOC would own 75% interest in each of the two blocks with PCSB holding the remaining 25%, and MOC would operate the two blocks (PETRONAS, 2002a§).

MOC signed three PSCs with PETRONAS in 1999 for oil and gas exploration for blocks SK309 and SK311 offshore Sarawak and for a deepwater block K offshore Sabah. Also it announced in May 2002 that its first deepwater well (Bagang-1) drilled in block K encountered noncommercial quantities of natural gas and that the well would be plugged and abandoned. MOC announced on October 2002 that it had discovered oil from appraisal wells; the Kikeh No. 1 on deepwater block K encountered several hundred feet of high-quality oil reservoirs; and the results found from the Kikeh No. 2, which was located about 1 mile from the Kikeh No. 1, were the same five primary oil reservoirs full to base. MOC continued to drill its third appraisal well, the Kikeh No. 3, about 2 miles from the Kikeh No. 2 in late 2002 (Oil & Gas Journal, 2002b).

In March 2002, MOC announced that it had completed a three-well exploration and appraisal drilling program on shallow water blocks SK309 and SK311 about 40 kilometers (km) northwest offshore Bintulu, Sarawak. The first well (West Patricia 5) was drilled to 1,240 m total depth (TD) and found 39 m of net oil pay and 7 m of net natural gas pay. The second well (South Acis 5) was drilled to 1,725 m TD and found 39 net meters of natural gas pay. The third well (Sepang 1) was drilled to 1,245 m but was a dry hole. According to the company

official, the company planned to drill two more exploration wells and to conduct additional 3-D seismic operations on blocks SK309 and SK311 in 2002 (Oil & Gas Journal, 2002c).

In oil and gas development, the Larut Field, which was jointly developed by PCSB and ExxonMobil Exploration and Production Malaysia Inc. (EMEPMI), was brought onstream in early 2002 about 201 km off Terengganu. Peak production from the Larut Field was expected to reach 30,000 barrels per day (bbl/d) of oil and 1 million cubic meters per day of gas. The project, which is equally owned by EMEPMI (as the operator of the field) and PCSB, consists of an eight-legs steel jacket platform with slots for 36 wells (Oil & Gas Journal, 2002d).

Sarawak Shell Bhd (SSB), which signed a PSC with PETRONAS for oil and gas exploration for block SK312 in 2000, announced in March 2002 that it was to begin gas production from its M4 field in block SK312 offshore Sarawak. Peak production was expected to reach 8.5 million cubic meters per day. The proven gas reserves of the M4 field were estimated to be between 42 billion and 56 billion cubic meters. Gas production from the Jintan and B11 offshore fields was expected to start in July 2003 and October 2003, respectively. The proven gas reserves of the Jintan and B11 were estimated to be 56 billion cubic meters each. Gas production from the M4, the Jintan, and the B11 would be delivered to Bintulu for gas processing and to the LNG plant (Petroleum Economist, 2002).

In April 2002, EMEPMI announced its \$150 development plans for Bintang Gasfield, about 220 km off Terengganu in the South China Sea. The Bintang Field contains about 28 billion cubic meters (1 trillion cubic feet) of natural gas. Under the development plan, two remotely controlled platforms with capacity for 10 wells were to be installed in the third quarter of 2002. Drilling was to start in the fourth quarter of 2002, and natural gas production was to start shortly after. Peak production was expected to reach 10 million cubic meters per day. Most of the gas produced from the field would be used for power generation. The Bintang Field project is equally owned by EMEPMI (as the operator of the field) and PCSB (Oil & Gas Journal, 2002a).

In 2002, production of natural gas increased by 4% to 48.6 billion cubic meters, or an average of 133 million cubic meters per day. Production of crude petroleum and condensate increased by 4.9% to 256 million barrels (Mbbbl), or an average of 698,500 bbl/d in 2002. Exports of crude petroleum increased by 7.4% to 124.5 Mbbbl and were valued at \$3.05 billion. Exports of LNG decreased by 2.6% to 15.0 Mt, or about 23.2 billion cubic meters, in 2002 (Central Bank of Malaysia, 2003b§). 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 EMEPMI 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 ammonia, petrochemical, 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.

The LNG production by Malaysia LNG Sdn. Bhd. (MLNG) and Malaysia LNG Dua Sdn. Bhd. totaled about 15 Mt, or about 94% of the total capacity in 2002. Exports of LNG went to Japan (73.5%), Taiwan (15.1%), and the Republic of Korea (11.4%). The construction of Malaysia's third LNG plant and related facilities next to the two existing plants in Bintulu, Sarawak, which was scheduled to commence operation in 2003, consisted of two 3.4-Mt/yr LNG trains. The construction also included a 120,000-cubic-meter-capacity LNG storage tank and an LNG loading jetty. After completion of Malaysia's third LNG plant, which would be owned and operated by Malaysia LNG Tiga (MLNG-3), Malaysia's LNG production capacity would increase to 22.7 Mt/yr, and the country would become the world's second largest producer and exporter of LNG in 2003 (PETRONAS, 2002b§).

MLNG-3 signed a sale and purchase agreement (SPA) in February 2002 with a consortium of Tokyo Gas Co. Ltd., Toho Gas Co. Ltd., and Osaka Gas Co. Ltd. to supply up to 1.6 Mt/yr of LNG for 20 years beginning from 2004. The contract was valued at about \$6 billion at the 2002 prices. In April 2002, MLNG-3 signed an SPA with the Japan Petroleum Exploration Co. Ltd. to supply up to 480,000 t/yr of LNG for 20 years beginning in 2003. The contract was valued at about \$1.6 billion at the 2002 prices (PETRONAS, 2002d§, e§).

In March 2002, MLNG signed a memorandum of agreement (MOA) with the Tokyo Electric Power Co. Inc. and Tokyo Gas Co. Ltd. to supply up to 7.4 Mt/yr of LNG for 15 years beginning in 2003. The MOA comes with an option to extend supply for 5 more years. The MOA was worth about \$20 billion at the 2002 prices (PETRONAS, 2002c§).

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Major Source of Information

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Major Publications

Minerals and Geoscience Department [Malaysia]:
Annual Report and Malaysia Minerals Yearbook, annual.
Monthly Statistics on Mining Industry in Malaysia, monthly.
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 COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	1998	1999	2000	2001	2002 ^P	
METALS						
Aluminum, bauxite, gross weight	thousand tons	160	223	123	64	40
Columbium-tantalum metals, struverite, gross weight		521	675	969	8,430 ^r	2,298
Copper, mine output, Cu content, Sabah		13,907	4,600	--	--	--
Gold, mine output, Au content ³	kilograms	3,394	3,449	4,026	3,965	4,289
Iron and steel:						
Iron ore and concentrate	thousand tons	376	337	259	376	404
Steel, crude	do.	1,903	2,770	3,650	4,100	4,200 ^e
Lead metal, secondary		35,000	33,000	35,300	38,000 ^r	40,000 ^e
Rare-earth metals, monazite, gross weight		517	1,147	818	643	509
Silver, mine output, Ag content ³	kilograms	7,285	2,744	5 ^r	3	--
Tin:						
Mine output, Sn content		5,754	7,339 ^r	6,307	4,972 ^r	4,215
Metal, smelter		27,201	28,913	26,228	30,417 ^r	30,000 ^e
Titanium, gross weight:						
Ilmenite concentrate		124,689	127,695	124,801	129,750 ^r	106,046
Dioxide ^c		46,000	46,000	46,000	50,000 ^r	56,000 ^e
Zirconium, zircon concentrate, gross weight		3,057	1,763	3,642	3,768	5,293
INDUSTRIAL MINERALS						
Barite		1,580	13,506	7,274	649	1,602
Cement, hydraulic	thousand tons	10,397	10,104	11,445	13,820	14,336
Clays and earth materials	do.	25,422	33,083	79,485	29,596 ^r	30,000 ^e
Clays, kaolin		198,930	213,973	233,885	364,458 ^r	258,273
Feldspar		31,369	26,940	29,895	40,509 ^r	40,000 ^e
Mica		3,642	3,675	3,835	4,107 ^r	3,669
Nitrogen, N content of ammonia		351,400	432,000	604,800	726,000	847,900
Sand and gravel	thousand tons	45,231	33,351	21,497	15,020 ^r	16,000 ^e
Silica sand, peninsular Malaysia and Sarawak		473,422	508,723	446,838	575,105 ^r	580,000
Stone:						
Dolomite		7,500	4,250	4,030	2,850	--
Limestone	thousand tons	20,124	23,515	26,086	32,503 ^r	35,000 ^e
MINERAL FUELS AND RELATED MATERIALS						
Coal		349,849	308,502	382,942	497,733 ^r	352,513
Gas, natural: ⁴						
Gross	million cubic meters	48,388	51,376	56,929	58,751	61,091
Net ⁵	do.	38,468	40,844	45,259	46,707	48,567
Liquefied natural gas	thousand tons	15,450	15,390	15,169	15,423 ^r	15,025
Petroleum: ⁴						
Crude and condensate	thousand 42-gallon barrels	264,641	252,115	249,159	243,696	255,922
Refinery products:						
Gasoline	do.	20,331	25,498	22,205	25,500 ^e	26,000 ^e
Jet fuel ⁶	do.	7,500	7,500	7,500	7,500	7,500
Kerosene	do.	16,924	15,945	19,631	25,500 ^{r,e}	25,000 ^e
Diesel	do.	44,563	43,725	57,559	55,500 ^e	57,000 ^e
Residual fuel oil	do.	15,915	11,972	12,413	12,500 ^e	15,000 ^e
Other ^{c,6}	do.	15,000	15,000	15,500	15,500	15,000 ^e
Total ⁶	do.	120,000	120,000	135,000	142,000 ^r	146,000

^eEstimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. ^PPreliminary. ^rRevised. -- Zero.

¹Table includes data available through July 25, 2003.

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

³Includes byproduct from a copper mine in Sabah, tin mines in peninsular Malaysia, and gold mines in peninsular Malaysia and Sarawak.

⁴Includes production from peninsular Malaysia, Sabah, and Sarawak.

⁵Gross less volume of reinjected and flared.

⁶Includes liquefied petroleum gas, naphthas, and lubricants.

Sources: Ministry of Primary Industry, Minerals and Geoscience Department (Kuala Lumpur), Malaysian Minerals Yearbook 2001, Monthly Statistics on the Mining Industry in Malaysia; Department of Statistics (Kuala Lumpur), Monthly Statistical Bulletin, December 2002; Tin Industry (Research and Development Board), Malaysian Tin Bulletin, Appendix 3-4, v. 13, no. 12, December 2002; and U.S. Geological Survey Minerals Questionnaire, 2001.

TABLE 2
MALAYSIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2002

(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. (ALCAN Ltd. of Canada, 61%; local investors and others, 39%)	Teluk Rumania and Sg. Rengit, Johor	400
Cement ¹		Associated Pan Malaysia Cement Sdn. Bhd. (Malayan Cement Berhad., 100%)	Rawang, Selangor and Kanthan Perak	6,060 (4,600)
Do.		Cement Industries of Malaysia Bhd. (United Engineers Malaysia Bhd., 53.97%; others, 46.03%)	Kangar, Perlis	2,000 (1,600)
Do.		Kedah Cement Sdn. Bhd. (Malayan Cement Bhd., 77.1%; general public shareholders, 22.9%)	Langkawi, Kedah	6,120 (3,300)
Do.		Negeri Sembilan Cement Industries Sdn. Bhd. (Cement Industries of Malaysia Berhad, 100%)	Bahau, Negeri Sembilan	1,400 (1,200)
Do.		Pahang Cement Sdn Bhd. (Pahang State government, 50%; YTL Cement Berhad, 50%)	Bukit Sagu, Pahang	1,300 (1,200)
Do.		Perak-Hanjoong Simen Sdn. Bhd. (Gopeng Bhd., 45%; Korea Heavy Industries and Construction Co. and others, 55%)	Padang Rengas, Perak	3,400 (3,000)
Do.		Tasek Corp. (publicly owned company)	Ipoh, Perak	2,300 (2,300)
Gas:				
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. (PETRONAS, 65%; Shell Gas N.V., 15%; Mitsubishi Corp., 15%; Sarawak State government, 5%)	Tanjung Kidurong, Bintulu, Sarawak	8,100
Do.		Malaysia LNG Dua Sdn. Bhd. ((PETRONAS, 60%; Shell Gas N.V., 15%; Mitsubishi Corp., 15%; Sarawak State government, 10%)	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:				
Hot-briquetted iron		Amsteel Mills Sdn. Bhd. (wholly owned subsidiary of Amsteel Corp.)	Labuan Island, offshore Sabah	800
Direct-reduced iron		Perwaja Steel Sdn. Bhd. (Maju Holdings Sdn. Bhd., 51%; Lion Group, 30%; Terengganu State government, 19%)	Kemaman, Terengganu	1,200
Crude steel		Amsteel Mills Sdn. Bhd. (wholly owned subsidiary of Amsteel Corp.)	Klang, Selangor	750
Do.		Perwaja Steel Sdn. Bhd. (Maju Holdings Sdn. Bhd., 51%; Lion Group, 30%; Terengganu State government, 19%)	Kermaman, Terengganu	800
Do.		Southern Steel Bhd. (Camerlin, a member of Hong Leong Group Malaysia, 40.75%; Natsteel Ltd., 27.03%; other, 32.22%)	Prai, Penang	1,200
Nitrogen, ammonia		Asean Bintulu Fertilizer Sdn. Bhd. (PETRONAS, 63.5%; P.T. Pupuk Sriwidjaja Indonesia, 13%; Thai Ministry of Finance, 13%; Philippines National Development Co., 9.5%; Singapore Temasek Holdings Pte. Ltd., 1%)	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

See footnote at end of table.

TABLE 2--Continued
MALAYSIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2002

(Thousand metric tons unless otherwise specified)

Commodity	Major operation companies and major equity owners	Location of main facilities	Annual capacity
Tin:			
Concentrate	Delima Industries Sdn. Bhd.	Dengkil, Selangor	1.1
Do.	Maiju Sama Sdn. Bhd.	Puchong, Selangor	1.6
Do.	New Lahat Mines Sdn. Bhd.	Lahat, Perak	0.3
Do.	Omsam Telecommunication Sdn. Bhd.	Bakap and Batu Gajah, Perak	0.5
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. (The Straits Trading Co., Ltd., 37.44%; Malaysia Mining Corp., 37.44%; other, 25.12%)	Butterworth, Penang	40
Titanium, dioxide	Huntsman Tioxide Sdn. Bhd. (a subsidiary of Huntsman Tioxide of the United Kingdom)	Kemaman, Terengganu	56

¹All seven companies operated integrated plants. Annual capacity was for cement production; clinker capacity is shown in parentheses.