

# THAILAND

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Thailand has considerable resources of diatomite, dolomite, gypsum, limestone, potash, and rock salt, as well as a wide variety of other industrial minerals. Thailand's resources of metallic minerals and minerals fuels, however, are small. According to the Department of Mineral Resources (DMR), which is under the Ministry of Industry (MOI), Thailand has estimated reserves of antimony, ball clay, barite, bentonite, copper, diatomite, dolomite, feldspar, fluorite, gold, gypsum, iron ore, kaolin, lead, limestone, manganese, marl, phosphate, potash, quartz, rock salt, silica sand, tin, and zinc (Department of Mineral Resources, 1998, p. 18). All these nonfuel mineral resources except copper and potash have been exploited. Nonfuel minerals exploration in the past 5 years has been focused on copper, gold, and potash. In late 2001, a new gold mine, the Chatree, was officially opened in Pichit Province. Feasibility studies for development of copper and potash were being undertaken; project financing had not been finalized.

In 2001, Thailand was one of the top producers of feldspar and gypsum in the world (Olson, 2002; Potter, 2002). The country's estimated reserves of gypsum, limestone, potash, and rock salt are substantial. Most of Thailand's mineral production was for domestic consumption. The country, however, exported a large percentage of its production of feldspar, fluorite, gypsum, tin, and byproducts of tin mining and smelting, such as ilmenite, monazite, tantalum, and zircon. Thailand's requirements for such ferrous and nonferrous metals as iron and steel, primary aluminum, refined copper, lead, precious metals, and other minor metals were largely met by imports.

According to the Office of the National Economic and Social Development Board, which is under the Office of the Prime Minister, the output of the mining and quarrying sector, which accounted for 2.1% of Thailand's gross domestic product (GDP), grew by only 0.6% in 2001 compared with 5.5% in 2000 mainly because of a smaller increase in the production of crude petroleum and a slight decrease in natural gas and natural gas condensate. Thailand's economy, as measured by the GDP, increased by only 1.8% in 2001 compared with 4.6% in 2000. The GDP, in 1988 constant dollars, was estimated to be \$68.8 billion in 2001. The total labor force increased to 33.8 million in 2001 from 33.2 million in 2000, and the rate of unemployment decreased to 3.2% in 2001 from 3.6% in 2000. Inflation, as measured by the Consumer Price Index, remained unchanged at 1.6% in 2001 (Bank of Thailand, 2002<sup>§1</sup>).

## Government Policies and Programs

The basic mining policies of Thailand are to promote the

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

domestic mining industry and to conserve the country's export-oriented mineral resources. To meet these policy goals, the Government has been gradually shifting its emphasis on exploration, development, and exploitation from minerals that are predominantly exported to minerals that are consumed domestically. To conserve minerals for future consumption and to increase value-added mineral products, the Government has been promoting sustainable development and imposing export controls on several low-unit-valued minerals for which domestic demand was increasing.

According to the policy for sustainable exploration and development of mineral resources, the Government would explore, develop, supply, manage, and administer mineral resources with full capacity to meet the domestic downstream industries' requirements and would ensure that development and use of mineral resources are done efficiently on sustainable principles by balancing environmental quality and incorporating development with use of other resources (Dheeradilok, 1998).

In 1967, the Government enacted the Mineral Act No. 2, which had been amended in 1973 and 1979, to govern the country's mining and mineral processing activities. Under this Act, the Government claims exclusive ownership of all minerals upon, in, or under the surface of public and private land but may grant licences to private individuals or entities for prospecting, mining, mineral dressing, metallurgical processing, transportation, sale, and storage of minerals (Dheeradilok, 1998).

Under the Mineral Act of 1967, the MOI was appointed the principal Government agency to regulate the mining sector. The DMR is responsible for supervising exploration and production activities in accordance with geoscience (geology, mineral resources, petroleum resources, and ground water) and with requirements in environmental protection. The DMR also is responsible for supervising the coastal zone management program, petroleum development, mineral exploration, environmental protection in offshore areas, and the formulation of a viable program for the inspection of all petroleum and mining operations to ensure enforcement of applicable regulations. It conducts research on such environmental issues as mined land rehabilitation and the effect of offshore mining on shoreline, coral reef mangroves, and recreation areas. It also provides consulting services to the mining companies concerning technologies and equipment to be used to prevent environmental pollution (Dheeradilok, 1998).

## Production

Thailand produced more than 50 different minerals and processed mineral products in 2001. The important minerals products were barite, dolomite, feldspar, natural gas, gemstones,

gypsum, kaolin, limestone, crude petroleum, rock salt, silica, tin, and zinc. The important processed mineral products were cement, refined lead, steel, refined tin, and refined zinc. Thailand also produced such minor metals as cadmium as a byproduct of zinc refining and tantalum metal powder and oxides, which were processed from such domestic and imported raw materials as struverite, tantalum-bearing scrap, and tin slag from tin smelting.

The overall output of the mining industry held steady in 2001. Production of all industrial minerals except barite, clays, fluorspar, granite, phosphate rock, and talc, increased; and production of all metallic minerals except tin and tungsten decreased substantially in 2001 because of ore depletion. Thailand opened a new gold mine in late 2001. Thailand also produced silver as a coproduct of gold mining. Production of lignite and crude petroleum increased and production of natural gas and natural gas condensate decreased in 2001. Production of all processed minerals except cadmium, tantalum metal powder, and primary zinc increased because of the continued economic recovery in 2001. The substantial decline in production of tantalum metal powder was a direct results of excessive supply (excessive inventory) in the world market owing to the worldwide speculation on the continued rise in demand for tantalum.

## Trade

According to the Bank of Thailand (2002§), exports decreased to \$63.2 billion in 2001 from \$67.9 billion in 2000, and imports also decreased to \$60.7 billion in 2001 from \$62.4 billion in 2000. As a result, Thai merchandise trade surplus decreased to \$2.5 billion in 2001 from \$5.5 billion in 2000. The Thai baht depreciated further by 9.7% to 44.48 baht in 2001 from 40.16 baht against US\$1.00 in 2000.

In the minerals trade, Thailand was a net importer of minerals mainly because of its large import bills for coal, crude petroleum, iron and steel, and nonferrous metals, such as primary aluminum, refined copper, gold, refined lead, and silver. In 2001, exports of major mineral commodities were as follows: dolomite, 587,900 metric tons (t) at a value of \$4.8 million; feldspar, 337,675 t, \$5.6 million; gypsum, 4.3 million metric tons (Mt), \$46.7 million; iron and steel products, 1.9 Mt, \$735 million; tantalum metal powder, 91 t, \$38 million; refined tin, 18,575 t, \$81 million; and slab zinc and zinc alloy, 24,317 t, \$23.5 million (Department of Mineral Resources, 2002b, p. 82-84).

In 2001, imports of major nonfuel mineral commodities were as follows: primary aluminum ingots and aluminum alloys, 235,196 t at a value of \$385 million; refined copper and copper alloys, 175,331 t, \$308 million; gold, 297 t, \$899 million; pig iron, 113,478 t, \$22 million; steel scrap, 696,512 t, \$105 million; steel billet, ingots, and slab, 2.8 Mt, \$505 million; finished steel products, 4.4 Mt, \$2.1 billion; refined lead and lead alloys, 57,466 t, \$29 million; refined nickel and nickel alloys, 1,872 t, \$10 million; platinum group metals, 20 t, \$26 million; silver, 1,015 t, \$108 million; titanium, 129 t, \$15 million; and slab zinc and zinc alloys, 24,049 t, \$25 million (Department of Mineral Resources, 2002a, p. 11-21). In 2001, imported mineral fuels were as follows: coal, 4.9 Mt at a value

of \$168 million, and crude petroleum, 260 million barrels, \$6.4 billion (National Energy Policy Office, 2002a§).

## Structure of the Mineral Industry

Thailand's mineral industry consisted of a small mining and mineral processing sector of ferrous and nonferrous metals and a large mining and mineral processing sector of industrial minerals. The energy sector, which included production of coal (lignite), natural gas, and crude petroleum, was small but growing. Most of nonfuel minerals mining and mineral processing businesses were owned and operated by private companies incorporated in Thailand. Coal exploration and mining activities were by the state-owned Electricity Generating Authority of Thailand (EGAT) and numerous local private coal mining companies. Oil and gas exploration and production were by the state-owned Petroleum Authority of Thailand (PTT) and joint ventures of the PTT and foreign oil companies.

Although the total number of operating mines (excluding oil and gas) remained unchanged at 730 in 2001, the number of workers employed by the mining industry (excluding oil and gas) increased to 21,064 in 2001 from 19,619 in 2000. In 2001, of the total number of operating mines, limestone quarries accounted for 32%; granite and marble quarries, 18%; kaolin, 8%; feldspar and gypsum, 5% each; and tin, 4%. Of the total number of operating mines in 2001, 652 were industrial mineral mines, 56 were metal mines, and 22 were coal mines. Of the total number workers employed by the mining industry, 23% was in limestone quarrying, 17% in coal mining, and 5% each in tin and gypsum mining (Department of Mineral Resources, 2002b, p. 72-75).

As a result of the Government's mineral policy, the production capacity of industrial minerals increased in the 1990s. The cement industry, which had expanded by more than 40% of its capacity during the 1990s, had a production capacity of 55 million metric tons per year (Mt/yr) in 2001. The production capacity of such export-oriented minerals as antimony, fluorite, kaolin, manganese, and byproducts of tin, however, had been reduced considerably. In 2001, Thailand opened the first new gold mine since the country stopped gold production in 1996. The country's production capacity of tantalum metal powder had expanded between 1999 and 2000 and could be expanded further if the worldwide demand for tantalum increased. Production capacity of crude petroleum and natural gas also expanded considerably in the second half of the 1990s following several new developments offshore in the Gulf of Thailand.

## Commodity Review

### Metals

**Copper.**—Thailand was not a copper producer in 2001. All Thailand's requirements for refined copper were met by imports. Exploration for copper by Pan Australian Resources N.L. (PAR) of Australia at the Puthep area in Loei Province continued in 2001. PAR began the first phase of a feasibility study in early 2001 to confirm the economic viability of developing the PUT1 deposit with a heap leach and solvent

extraction-electrowinning process to produce refined copper. The company announced that the MOI had signed its submission for land access to complete the feasibility study on the Puthep Copper Project in July 2001 and that the signing of the submission was an important step in the approval process for mining. The prefeasibility study, which was completed in 2000, indicated that the PUT1 deposit could host ore reserves of 44 Mt at a grade of 0.5% copper and that the project could produce 30,000 metric tons per year (t/yr) of copper cathode for 7 to 10 years (Pan Australian Resources, 2002a§).

In 2001, PAR completed a geologic model and re-assay program, established a drill hole and assay data base and an ore typing program to define the principal metallurgical ore type, and planned a metallurgical drilling program of the first phase of the feasibility study. A series of tests was being conducted in the United States to ascertain the physical and material handling characteristics of the ore (Pan Australian Resources N.L., 2001a§).

Domestic demand for refined copper was estimated to be 167,000 t in 2001 compared with 151,000 t in 2000. In 2001, Thailand imported 166,795 t of refined copper and 8,535 t of copper alloys at a total value of about \$308 million. The country exported 5 t of refined copper and 389 t of copper alloys in 2001 (Department of Mineral Resources, 2002a, p. 12, 26).

**Gold.**—In November 2001, Akara Mining Ltd. (a wholly owned subsidiary of Kingsgate Consolidated N.L. of Australia) officially opened its Chatree gold mine, which is located on the eastern edge of the Tertiary Chao Phraya Basin and 45 kilometers (km) southeast of the provincial capital of Pichit on the border of Petchabun and Pichit Provinces. The development project, which took about 11 months, reportedly was under budget with a capital cost of about \$32 million (Mining Journal, 2001b).

At the Chatree mining and mineral processing complex, the open pit mining operations were at the Chantra (Moon) and the Tawan (Sun) pits. Total proven and probable reserves of the Chantra and the Tawan pits were estimated to be 8.2 Mt, of which proven reserves were 5.8 Mt at a grade of 3.3 grams per metric ton (g/t) gold and 15 g/t silver; and probable reserves, 2.4 Mt at a grade of 2.6 g/t gold and 12 g/t silver (Kingsgate Consolidated N.L., 2001b§).

The Chatree Mine would operate at the rate of 1 Mt/yr of ore during the first and second years and then increase to the rate of 1.5 Mt/yr from the third year onward. The ore treatment plant with the capacity to treat 1 Mt/yr of ore by using standard carbon-in-leach processing comprised a single-stage crushing circuit, a stockpiling and reclaiming system, a single-stage closed circuit mill and cyclone classification, a seven-stage leach and adsorption circuit, a carbon regeneration and gold refinery, a tailings disposal system that incorporates a cyanide reduction unit process, and a raw potable and fire water storage and reticulation and related plant reagent system. During the first 5 years, the company planned to produce an average of 3.9 t/yr of gold and 10.7 t/yr of silver (Kingsgate Consolidated N.L., 2001a§).

Tungkum Co. of Thailand, which had been exploring for gold in northern Thailand through Tongkah Harbour Co. Ltd. (its

86% subsidiary), was refused permission in 2001 to start gold mining in its concession area in the Loei Province by the Ministry of Agriculture. The company's gold project had been suspended from 1999 through 2001. The company's gold concession area belonged to the Agricultural Land Reform Organization (ALRO) and was to have been used for agricultural purposes only (Bangkok Post, 2001§).

Tongkah Harbour threatened to take legal action against the Government after being refused permission for the third time since 1999 to start its gold mining in Loei Province. In 1991, the company reportedly had been granted the concession area by the MOI. In 1995, it applied for a mining license and received approval from the DMR. In 1998, the gold project had received approval by the Environment Policy and Planning Office. The ALRO, however, would not permit the company to start mining in 1999, 2000, and 2001 (Metal Bulletin, 2001a).

**Iron and Steel.**—Thailand produced virtually no iron ore because of ore depletion. The country relied on imports of most raw materials and intermediate steel products to meet its steel industry requirements. Thailand imported 2.8 Mt of semifinished products, which included steel billet, slab, and ingot; 696,500 t of steel scrap; 113,500 t of pig iron; and 48,200 t of ferroalloys in 2001 (Department of Mineral Resources, 2002a, p. 13).

In 2001, Thailand's crude steel production increased by 1.3% to 2.13 Mt. The country's total finished products increased by 15.7% to 7.95 Mt, of which 4.65 Mt was hot-rolled steel products. Thailand imports and exports of iron and steel products were 7.38 Mt and 1.63 Mt, respectively, in 2001. The apparent consumption of all steel products in Thailand was 7.54 Mt in 2001 compared with 9.06 Mt in 1995 before the Asian financial crisis (South East Asia Iron and Steel Institute, 2002§).

Imports of finished steel products totaled 4.45 Mt, of which 2.37 Mt was hot-rolled flat products; 716,100 t, cold-rolled flat products; 623,100 t, long products; 556,100 t, coated products, 178,500 t, pipes and fittings, sheet piling, rail and accessories, iron and steel casting, and iron and steel forging; and 1,300 t, sheet piling. The imports of finished steel products were valued at \$2.73 billion in 2001. Exports of finished steel products totaled 1.74 Mt, of which 732,800 t was long products; 494,500 t, cold-rolled flat products; 314,800 t, pipes and fittings, sheet piling, rails and accessories, iron and steel castings, and iron and steel forging; 122,400 t, coated products; and 79,800 t, hot-rolled flat products. The exports of finished steel products were valued at \$735 million in 2001 (Department of Mineral Resources, 2002a, p. 13-14, 27-28).

The Industrial Standard Institute of Thailand (TSIT), which is under the MOI, announced three compulsory standards that pertain to hot-rolled coil, plate, and sheet and began implementing the new rules in August 2001 to stop imports of substandard hot-rolled product. In late August, a petition was filed by six leading steel bar producers with the TSIT against importers and local producers of substandard low-quality steel bar. The Institute also received complaints that alleged that substandard structural steel products had been illegally imported into Thailand (Metal Bulletin, 2001b, c).

According to the Iron and Steel Institute of Thailand, the Ministries of Finance, Industry, and Commerce and the Board

of Investment made the decision to impose a surcharge on imports on hot-rolled sheet, coil, and other steel products in November in response to a petition from Thai steel producers. The import surcharge, however, was to be reviewed and approved by Thailand's house committee on economic affairs before the surcharge was made effective (Metal Bulletin, 2001e, 2002a).

**Tantalum.**—Tantalum was produced in the form of metal powder and compound (oxide) by H.C. Starck (Thailand) Co. Ltd. (2001) (94.98% owned by H.C. Starck GmbH of Germany and became a member of the Bayer Group in 1986) in Map Ta Phut Industrial Estate in Rayong Province (Bayer Group in Thailand, 2002§). The production facilities included a tantalum chemical plant and a metallurgical plant. The chemical plant processed tantalum ore and concentrate and such tantalum- and columbium (niobium)-bearing materials as tin slags, scrap, and struverite and manufactured potassium fluortantalate, tantalum pentoxide, and columbium (niobium) pentoxide. The metallurgical plant processed potassium fluorotantalate and produced tantalum metal powder. The metal powder is further upgraded by a heat treatment to produce more than 10 grades of tantalum metal powder to meet the specifications of the manufacturers of capacitors.

In 1979, Thai Tantal International Corp. (TTIC) was established on the island of Phuket and built a chemical plant to produce tantalum intermediates by using H.C. Starck's technology. The chemical plant was completely destroyed in a fire in 1986. In 1992, a new chemical plant was built by the owners of the former TTIC in Map Ta Phut, Rayong Province, to produce tantalum potassium fluoride and tantalum metal powder under the name Thai Tantalum Co. Ltd. In 1996, H.C. Starck acquired a majority holding in Thai Tantalum and renamed the company H.C. Starck (Thailand) Co. Ltd. (2002§).

Domestic consumption of tantalum metal powder was 92 t in 2001 compared with 83 t in 2000. Exports of tantalum metal powder decreased to 91 t in 2001 from 155 t in 2000, of which 54 t went to the United States and 37 t went to Japan. Thailand also exported 350 t of columbium hydroxide powder, 53 t of tantalum pentoxide powder, and 47 t of tantalum hydroxide powder all to Germany in 2001 (Department of Mineral Resources, 2002b, p. 59-60).

**Tin.**—Mine production increased slightly from that of 2000 with a small increase from Dulang Washing (retreatment plants). Of the total mine output in 2001, 52% was produced by dredging offshore; 21%, by open pit; 19%, by Dulang washing; and 8%, by gravel pumping. More than 92% of the total mine output was produced from the Southern Region mainly in the Provinces of Phangnga, Phuket, Songkhla, and Yala. The total number of active tin mines has remained at 30 for the past 3 years, and the total number of tin miners remained almost constant with 1,098 workers in 2001 compared with 1,069 in 2000 (Department of Mineral Resources, 2002b, p. 61-62, 73, 75).

In response to a proposal by the Mining Industry Council to reduce the burden on the tin mining industry and to revive Thai tin mining, the MOI planned to eliminate buffer stock fees and to reduce royalty fees. In 2001, Thai tin mining companies

were required to pay the DMR about \$90 per metric ton of buffer stock they held and a certain amount of royalty fees on their tin production. According to the Mining Industry Council, the DMR had agreed in August to waive buffer stock fees and to collect only royalty fees at a flat rate of 2.5% of the market price. If implemented, then the overall production costs for Thai tin mining companies would be reduced by about 11%. The proposal, however, would not be implemented before final approval by the Cabinet following a review and consideration by the Ministry of Finance (Metal Bulletin, 2001d).

Production of refined tin increased by 31% and reached a record high in 2001, which was sustained by record-high exports of refined tin. Thailand Smelting & Refining Co. Ltd. (Thaisarco), which ran a 30,000-t/yr tin smelter near the port of Phuket at the southeastern tip of Phuket Island, operated at about 75% of its capacity in 2001. According to Thaisarco (oral commun., 2002), the smelter's feed in 2001 consisted of 10% domestic ore and concentrate at an average ore grade of 74% tin and 90% imported ore and concentrate at a grade of about 50% tin. The major suppliers of imported tin ore and concentrate were Australia (40%) and Peru (25%); the other important overseas suppliers of tin ore and concentrate were Bolivia, Laos, and Portugal. Thaisarco Brand refined tin contains 99.9% tin. The smelter also produced between 100 and 300 t/yr of tantalum-bearing tin slags during the past 2 years. The smelter's feed, which contains tantalum, was mainly from domestic ore and imported ore from Africa. The tin slags were sold through auction to the highest bidder (Graham Williams, managing director, Thaisarco, oral commun., 2002).

Domestic consumption of refined tin decreased by 6% to 4,115 t in 2001. Exports of refined tin, however, increased by 45% to 18,575 t in 2001. The major buyers of Thai refined tin in 2001 were Japan (17%), Spain (16%), the United Kingdom and Belgium (15% each), the Netherlands (12%), Australia and Singapore (8% each), and South Africa and the Republic of Korea (3% each). Exports of tin slags totaled 254 t, of which 154 t went to China, 71 t to Singapore, and 29 t to Hong Kong in 2001 (Department of Mineral Resources, 2002b, p. 63-65).

**Zinc.**—Mine production of zinc ore was mainly by Padaeng Industry Public Co. Ltd. at its Padaeng deposit, which is located 12 km southeast of Mae Sot in Tak Province. According to the company, the Padaeng Mine produced 139,050 t of zinc silicate ore at a grade of 17.45% zinc, and the metal content of mined ore was estimated to be 24,000 t in 2001. Padaeng Industry (Laos) Co. Ltd. (a subsidiary of the company) was granted a mining lease by the Laos' Government and mined 15,935 t of zinc ore at a grade of 32.39% zinc from the Kaiso deposit in Laos in 2001. All zinc ore and concentrate, which included that of Laos' ore, were delivered to Tak smelting and refining facilities in Tak Province for zinc metal production (Padaeng Industry Public Co., Ltd., 2002a§).

Padaeng Industry Public's zinc plant in Tak consumed 343,000 t of ore and concentrate, of which about 78% was imported. The major suppliers of imported ore and concentrate were Australia, Peru, and the United States. In 2001, the overall zinc production was 104,797 t, of which 74,129 t was ingot and 30,668 t (zinc content) was zinc alloy (Padaeng Industry Public Co. Ltd., 2002b§).

In 2001, domestic demand for zinc decreased by 1.8% to 72,645 t, of which 51,990 t was zinc ingot and 20,655 t was zinc alloy. Exports of zinc ingot and alloy increased by 49% to 24,317 t because of increased exports to Hong Kong, Indonesia, Taiwan, and Vietnam. The major buyers of zinc ingot were Taiwan (62%), Hong Kong (10%), Burma (8%), and Indonesia (7%). The principal buyers of zinc alloy were Hong Kong (80%) and China (13%) (Department of Mineral Resources, 2002b, p. 69-70).

In May 2000, Union Miniere of Belgium signed an agreement to subscribe to an increase in equity that represented a 33% stake in Padaeng Industry Public and to become a strategic partner of Padaeng Industry Public. In 2001, Umicore SA (formerly Union Miniere) reportedly had increased its stake in Padaeng Industry Public to 46% and became the largest shareholder in the company (Metal Bulletin, 2002b; Padaeng Industry Public Co. Ltd., 2000§).

Heral Resources Ltd. of Australia (a subsidiary of International Annax Ventures Inc.) reportedly had a cooperation agreement with the Pands (Choosak) Industrial Minerals Group of Thailand to explore and develop a zinc-barite deposit at the Bo Hin Khao prospect in Loei Province. Exploration activities in 2000 included detailed pit mapping, mapping of the survey gridded area at a scale of 1:100, and the metallurgical test work by Chiangmai University for selected zinc-oxide- and zinc-sulfide-bearing material. At yearend 2000, the test results showed that high commercial grade barite concentrate could be produced at a high recovery rate, but poorer results were obtained for zinc sulfates and carbonate. A proposed drilling program in 2001 was postponed (Herald Resources Ltd., 2000§).

### **Industrial Minerals**

**Cement.**—Thailand's clinker output increased by 14.2% to 33.6 Mt, and cement production increased by 9.5% to about 28 Mt owing to increased domestic demand and exports in 2001. According to the Thailand Fellowship of Cement Manufacturers [the cement industry association in Thailand], the industry comprised 7 companies that operated 13 plants and 35 kilns and employed 11,000 worker at the plants. The industry's kiln capacity was 47.2 Mt/yr, and cement capacity, about 55 Mt/yr in 2001. Domestic demand increased to 18.3 Mt in 2001 from 17.8 Mt in 2000. Exports of clinker and cement were 9.45 Mt and 7.20 Mt, respectively, in 2001 compared with 8.11 Mt and 6.25 Mt, respectively, in 2000. Thailand's per capita cement consumption rose to 294 kilograms (kg) in 2001 from 285 kg in 2000. The association estimated that cement production was expected to increase during the next 2 years mainly because of continuing increases in Government spending on public works and major infrastructure projects (Thailand Fellowship of Cement Manufacturers, 2000, p. 2; Somthida Piyapana, Office Manager, Thailand Fellowship of Cement Manufacturers, oral commun., 2002).

The country's largest cement producer Siam Cement Industry Co. Ltd. produced about 13 Mt of cement in 2001; this 14% increase compared with that of 2000 was mainly the result of increased exports. The company's cement exports rose sharply by 40% to 4.2 Mt; clinker exports, however, dropped by 4% to

2.6 Mt in 2001. The company's exports of cement were mainly to Asia (32%) and North America (37%), and exports of clinker were mostly to Asia (84%). The company reportedly had penetrated new export markets in South Asia, Africa, Europe, North America, and Latin America. In 2001, the company entered into a 10% stake in a joint venture with Siam City Cement Public Co. Ltd. and Holcim Group of Switzerland to purchase the largest cement grinding plant in Bangladesh. The company also entered into a 50-50 joint venture with Aalborg Portland White of Denmark and established Aalborg Siam White Cement Pte. Ltd. to market white cement in Asia (Siam Cement Public Co. Ltd., 2001).

The country second largest cement producer Siam City Cement Public Co. Ltd. produced about 10 Mt in 2001 compared with 9 Mt in 2000. It exported 4.9 Mt in 2001 compared with 4.3 Mt in 2000. The third largest cement producer in Thailand TPI Polene Co. Ltd. (TPIPL), which planned to restructure its debt, reportedly was seeking merger with other major local and international cement companies. Siam City Cement and CEMEX, S.A. de C.V., of Mexico, which acquired 99% interest in Saraburi Cement Co. through CEMEX Asia Holdings Ltd. (its subsidiary) in May 2001, reportedly were negotiating with TPIPL in late 2001 (FT.com, 2001§). Jalapathan Cement Co. Ltd., which sold 37% interest to Ciments Français S.A. of France, had successfully completed debt restructuring (Ciments Français, 2001§).

**Gemstones.**—Thailand has resources of 17 different gemstones from amethyst and aquamarine to ruby and sapphire. In terms of quantity and value, ruby and sapphire, however, are more important than the other gemstones. Ruby and sapphire had been produced mainly from the Provinces of Chanthaburi, Kanchanaburi, and Trat. The important ruby and sapphire deposits were in the Khao Phloi Waen, Khao Wua, Khao Saming, Phulu Yang, and Pong Nam Ron areas of Chanthaburi Province; in the Bo Phloi area of Kanchanaburi Province; in the Bo Rai area of Trat Province; and in the Nam Yuen area of Ubon Ratchathani Province (United Nations, Economic and Social Commission for Asia and the Pacific, 2001, p. 97-99; Sawadee.com, 2002§).

In 2001, gemstones (mostly blue sapphires) were produced only from Kanchanaburi Province (Department of Mineral Resources, 2002b, p. 22). About 98% of raw gemstones was sold to the domestic jewelry manufacturers. Thailand was one of the world's leading gem and jewelry exporters. The gem and jewelry industry had been a regional hub for diamond and precious stonecutting with its low-cost skilled craftsmen in Chantaburi and its proximity to such major precious stone-producing countries as Cambodia, Burma, India, Laos, Sri Lanka, and Vietnam. Thailand imported \$600 million to \$700 million per year of diamond and precious stones for processing and export. In 2000 (the last year for which data are available), Thailand's exports of gems and jewelry amounted to \$1.7 billion. The top 10 importers, in terms of value, were the United States (30.3%), Israel (15.5%), Belgium (13.1%), Japan (7.2%), Germany (4.9%), Hong Kong (4.6%), the United Kingdom (4.0%), France (3.6%), Switzerland (3.4%), and Italy (1.7%) (Thailand.com, 2002§).

**Gypsum.**—Thailand was one of the world's leading producers and exporters of gypsum and gypsum products. Production, which continued the upward trend that began in 2000, reached about 6.2 Mt in 2001. Gypsum was produced from the Provinces of Surat Thani (49%), Nakhon Si Thammarat (21%) in the South region and from the Provinces of Nakhon Sawan (24%) and Phichit (6%) in the North region. The number of productive gypsum mines remained unchanged at 36 in 2001; and the number of gypsum miners increased to 1,161 in 2001 from 1,126 in 2000. Exports of gypsum remained steady at about 4.2 Mt because of the continued implementation of export control by the DMR in 2001. In 2001, gypsum was exported mainly to Indonesia (23%), Japan (17%), Malaysia (16%), Vietnam (12%), the Republic of Korea (10%), Taiwan (8%), and Bangladesh and the Philippines (4% each). Domestic consumption of gypsum increased to 1.7 Mt in 2001 compared with 1.6 Mt in 2002 (Department of Mineral Resources, 2002b, p. 28-29, 72, 74). In Thailand, gypsum was consumed by the manufacturers of cement, gypsum board, plaster, wall adhesive, and soil conditioners.

Thailand's gypsum board (plasterboard) industry comprised only two companies—Siam Gypsum Industry Co. Ltd. (SGIC) and Thai Gypsum Products Pcl. (TGPP). SGIC was the largest manufacturer of gypsum board in Thailand and in Southeast Asia. SGIC, which had no productive gypsum mine, bought raw gypsum from local mining companies to manufacture gypsum board and other gypsum products. In 2001, SGIC sold 71% of its interest to the Lafarge Boral Gypsum in Asia Ltd. [a joint venture of France's Lafarge S.A. (56.4%) and Australia's Boral Ltd. (43.6%)] (Boral Ltd., 2001§). The remaining 29% equity interest was owned by Siam Cement.

The second largest producer, TGPP owned five gypsum mines, of which three were operated in 2001. One of the three operating mines was operated by Lan Xang Gypsum Co. Ltd. [a joint venture of TGPP (70%) and Laos Government (30%)] in Laos' southwestern Province of Savannakhet (Reywod Manawatao, senior mining engineer, Thai Gypsum Products Plc., oral commun., 2002).

The Phuket-based Vanich Gypsum Co. Ltd., which was one of the largest exporters of gypsum, operated three mines at the Khlong Prab, Mai Riang, and Thoong Yai Mai areas in the Provinces of Nakhon Si Thammarat and Surat Thani in the South region. It had a mine capacity of 2 Mt/yr of gypsum. Its gypsum production has been less than 50% of its capacity since 1998 because of implementation of the Government's export quota system (Kovit Virochpokha, Marketing Director, Vanich Gypsum Co. Ltd., oral commun., 2002).

**Potash.**—Although Thailand was not a potash producer in 2001, it could become an important producer in the Asia and Pacific region within the next 4 years. In June 2001, Asian Pacific Potash Corp. Ltd. (APPC), which was owned by Canada's Asia Pacific Resources Ltd. (90%) and the Government of Thailand (10%), reportedly had obtained Special Atchayabats (Special Prospecting Licenses) for the 192-square-kilometer area that covers the Somboon and the Udon potash resources. APPC reportedly would focus on the development of a single, unified, and highly competitive Thai potash producing company and actively encourage the participation of partners

with the interest and strength to finance, build, and operate the Somboon Project (Asia Pacific Resources Ltd., 2001a§).

In 2001, APPC reportedly completed most of the steps to apply for the necessary mining licenses but was waiting for the approval of Thailand's House and Senate on the proposed amendment to the Mineral Act on the right to mine underground at depths of more than 50 meters without the permission of the landowner. APPC continued its exploration and development under the approved Environmental Impact Assessment for the Somboon potash mines and under the Special Atchayabats with ongoing baseline environmental monitoring by the Bangkok-based International Environmental Management Consultants (Asia Pacific Resources Ltd., 2001b§).

To obtain project financing to develop the 2-Mt/yr Somboon potash mine near Udon Thani, APPC signed a Mandate Letter to appoint Byaerische Hypo-und Verinsbank AG as advisor and lead arranger for the Somboon potash project debt financing. In February 2001, APR signed an interim Mandate Letter with International Finance Corp. (IFC) for the proposed project. IFC was to complete a comprehensive appraisal of the project to confirm whether APPC and the other sponsors would meet IFC investment criteria for consideration of loans and an equity investment in the project (Asian Journal of Mining, 2001). The Japanese Government reportedly had agreed to a \$350 million loan. The Thai Government, however, had not been able to provide the necessary guarantees to underwrite the loan. In March 2001, Norsk Hydro ASA of Norway reportedly placed its financial and managerial participation on hold pending the resolution of certain issues that related to financing and implementation of the project. Earlier, Norsk Hydro had agreed to acquire 20% of the project and to provide 20% of the equity requirement for development (Mining Journal, 2001a; Northern Miner, 2001).

### **Mineral Fuels**

**Coal.**—In 2001, coal (lignite) production increased by 10.7% to about 19.7 Mt. About 80% of the lignite was produced by EGAT, which operated mines in the Provinces of Lampang and Krabi; 8%, by Lanna Resources Public Co. Ltd. (formerly Lanna Lignite Public Co. Ltd.), which operated mines in the Provinces of Lamphun and Phetchaburi; and the remaining 12% by several other coal mining companies in the Provinces of Lampang, Phayao, and Phetchaburi. In 2001, lignite produced from Lampang Province accounted for more than 89% of the total production; from Lamphun Province, 8%; and the remaining 3% from the Provinces of Krabi, Phayao, and Phetchaburi. The total number of operating coal mines decreased by 1 to 22, and the total number of coal miners also decreased by 17 to 3,673 in 2001. To meet the overall coal demand, Thailand imported about 4.9 Mt of coal in 2001, of which 4.7 Mt was bituminous, which rose by 18.2% from 3.9 Mt in 2000, and 235,000 t was anthracite (National Energy Policy Office, 2002a§).

Demand for domestically produced lignite totaled 19.9 Mt in 2001, of which about 15.7 Mt was consumed by EGAT in power generation and 4.2 Mt was consumed as energy by the manufacturers of cement, paper, fiber, and lime; tobacco curers; and other users. Demand for imported coal (mostly anthracite,

bituminous, and coking coal), which totaled 4.9 Mt, was consumed by the manufacturers of cement and ferrous and nonferrous metals and by other users.

**Natural Gas and Petroleum.**—Thailand's natural gas production decreased by 2.5% to an average of 53.8 million cubic meters per day in 2001 from an average of 55.2 million cubic meters per day in 2000. In 2001, natural gas was produced from 17 gasfields. About 83% of Thailand's natural gas was produced by Unocal Thailand Ltd. (UT) from 10 offshore gasfields (Baanpot, Erawan, Funan, Gomin, Jakarawan, Pailin, Platong, Satun, South Satun, and Trat); the remaining natural gas was by other companies from other gasfields and oilfields (National Energy Policy Office, 2002c§).

Despite a slight decline in natural gas production in 2001, natural gas production was expected to increase considerably during the next 4 years because of the ongoing development of new gasfields by UT in the Arhit, the Pakarang, the Pailin (the second phase), and the Plamuk gasfields; by Chevron Offshore (Thailand) Ltd. (COT) in the Maliwan Gasfield and the North Jarmjuree Gasfield in block B8/32; and by Malaysia-Thailand Joint Authority in the Cakerawala Gasfield (in block A-18) in the Gulf of Thailand (American Association of Petroleum Geologists, 2001; Oil and Gas Journal, 2001a).

To meet Thailand's overall natural gas requirements, the country imported about 14.1 million cubic meters per day of natural gas from the Yadanon (15%) and the Yetagun (5%) gasfields in the Gulf of Martaban offshore Burma. The imports accounted for about 20% of total natural gas supply in 2001.

Consumption of domestic and imported natural gas increased by 13.4% in 2001 to 430,562 barrels per day (bbl/d) of oil equivalent mainly because of increased consumption by the utility sector, which accounted for 91.4% of Thailand's natural gas consumption in 2001. About 70% of Thai electricity was generated by natural gas in 2001. Thailand's power generation was expected to rely more on natural gas than on coal and fuel oil in the coming years (Kositchotethana, 2001§).

Production of crude petroleum increased by 6.9% to an average of 61,914 bbl/d, and that of condensate decreased by 0.7% to an average of 47,188 bbl/d in 2001. In 2001, crude petroleum was produced from 12 oilfields. The newly developed offshore Benjamas, which was the largest offshore oilfield and gasfield operated by COT, produced 46.7% of the total; the Sirikit, which was Thailand's largest onshore oilfield and gasfield, was operated by Thai Shell Exploration and Production Co. Ltd. and produced 34.3%; the Tantawan, which was Thailand's second largest offshore oilfield and gasfield, was operated by Thaipo Ltd. and produced 12.8% in 2001; and the remaining 6.2% was produced from nine small oilfields and gasfields. In August, UT started its first crude petroleum production in the Gulf of Thailand. Crude petroleum production from UT's Plamuk Oilfield, which ranged between 2,500 bbl/d and 3,000 bbl/d in August and November 2001, was expected to increase to 15,000 to 18,000 bbl/d in the first quarter of 2002. As the operator, UT had 71.25% working interest; other partners in the field included Mitsui Oil Exploration with 23.75% and PTT Exploration and Production with 5% (Oil and Gas Journal, 2001b). Production of condensate was produced from 12 offshore gasfields operated by UT and TOTAL

Exploration and Production (Thailand). UT's condensate production accounted for 98% of the total (National Energy Policy Office, 2002b§, c§).

To meet its overall demand for crude petroleum, Thailand imported 678,210 bbl/d of crude petroleum in 2001 compared with 643,063 bbl/d in 2000. As of 2001, Thailand's petroleum refining industry had a total crude capacity of 681,750 bbl/d. The Refinery Company had a 275,000-bbl/d-crude-capacity refinery in Map Ta Phut, Rayong; Thai Oil Co. Ltd. had a 185,000-bbl/d-crude-capacity refinery in Sriracha, Chonburi; Esso Standard Thailand Ltd. had a 160,000-bbl/d-crude-capacity refinery in Sriracha, Chonburi; and Petroleum Authority of Thailand had a 61,750-bbl/d-crude-capacity refinery in Bang Chak, Bangkok (Oil and Gas Journal, 2001c).

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

(Metric tons unless otherwise specified)

Commodity	1997	1998	1999	2000	2001
<b>METALS</b>					
<b>Antimony:</b>					
<b>Ore:</b>					
Gross weight	125	442	130	178	40
Sb content	53	199	59	84	18
Metal, smelter	782	242	40	16	12
Cadmium	238	238	238	238	238
Gold kilograms	--	--	--	--	320
<b>Iron and steel:</b>					
<b>Iron ore:</b>					
Gross weight	43,840	90,700	122,633	100	50
Fe content e/	22,000	45,000	61,000	50	25
Crude steel thousand tons	2,101	1,814	1,532 r/	2,100	2,127
<b>Lead:</b>					
<b>Ore:</b>					
Gross weight	12,438	15,346	23,783	24,760	800
Pb content	5,400	6,700	11,900	15,600	500
<b>Metal, refined:</b>					
Primary	4,112	3,219	3,025	3,390	3,500
Secondary	14,968	18,906	23,741	23,803	26,500
Total	19,080	22,125	26,766	27,193	30,000
<b>Manganese ore:</b>					
Battery- and chemical-grade, 75% MnO <sub>2</sub>	208	26	46	225	45
Metallurgical-grade, 46% to 50% MnO <sub>2</sub>	291	26	675	--	--
Total, gross weight	499	52	721	225	45
Total Mn content e/	260	25	360	110	23
Rare earths, monazite, gross weight	12	--	--	--	--
Silver kilograms	--	--	--	--	1,159
Tantalum, metal and oxide powder	70	56	98	210	150
<b>Tin:</b>					
<b>Concentrate:</b>					
Gross weight	756	2,028	3,400	2,363	2,383
Sn content	746	1,656	2,712	1,930	1,950
Metal, smelter, primary	11,984	15,353	17,306	17,076	22,387
<b>Tungsten concentrate:</b>					
Gross weight	54	61	54	54	92
W content e/	30	35	30	30	53
<b>Zinc:</b>					
<b>Ore:</b>					
Gross weight	91,132	195,122	185,752	159,093	139,050
Zn content e/	15,000	25,000	24,000	27,000	24,000
Metal, primary	72,035	75,904	75,639	77,525	74,129
Alloy, Zn content	12,018	15,076	21,653	23,617	30,668
Zirconium concentrate, gross weight	--	--	--	100	--
<b>INDUSTRIAL MINERALS</b>					
Barite	54,817	105,221	76,092	56,180	23,559
Cement, hydraulic thousand tons	37,115	22,722	25,354	25,499	27,913
<b>Clays:</b>					
Ball clay	288,406	206,349	317,877	394,154	341,272
<b>Kaolin, marketable:</b>					
Beneficiated (washed)	296,510	248,461	113,005	201,226	168,063
Nonbeneficiated (unwashed)	205,560	154,511	243,213	286,912	125,133
Filler	18,588	14,398	14,765	19,836	13,520
Diatomite	91	912	2,332	390	720
Feldspar	611,789	440,288	626,415	542,991	710,543
Fluorspar, crude, metallurgical-grade	7,826	3,743	13,005	4,745	3,020
Gemstones thousand carats	962	1,010	1,267	928	1,071
Gypsum thousand tons	8,558	4,334	5,005	5,830	6,191
Mica	3	18	78	107	72
Perlite	700	3,600	5,800	6,000	9,915
Phosphate rock, crude	3,818	3,029	3,880	3,260	2,359

See footnotes at end of table.

TABLE 1--Continued  
THAILAND: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity	1997	1998	1999	2000	2001	
<b>INDUSTRIAL MINERALS--Continued</b>						
Salt:						
Rock	554,891	546,096	739,502	792,250	852,565	
Other e/	100,000	100,000	100,000	100,000	100,000	
Sand, silica (glass)	515,859	323,937	531,588	471,547	513,880	
Stone:						
Calcite	29,550	12,250	72,130	87,100	159,050	
Dolomite	803,511	520,826	485,393	625,127	871,308	
Granite	cubic meters	24,017	9,493	6,190	7,595	6,659
Industrial rock	thousand tons	1,517	2,480	2,139	2,154	2,546
Limestone:						
For cement manufacture only	do.	58,757	36,593	48,306	43,492	46,984
Construction and other uses	do.	28,932	19,068	35,853	37,017	38,130
Marble, dimension stone and fragment	cubic meters	332,839	394,419	294,337	270,036	314,445
Marl for cement manufacture only		9,543	6,995	32,044	7,290	7,755
Quartz		5,133	3,730	3,760	5,177	48,908
Shale for cement manufacture only	thousand tons	5,387	2,704	3,223	3,110	3,364
Talc and related materials:						
Pyrophyllite		304,524	40,241	38,053	46,011	59,602
Talc		7,139	2,172	4,960	7,390	6,838
<b>MINERAL FUELS AND RELATED MATERIALS</b>						
Coal, lignite	thousand tons	23,443	20,162	18,266	17,714	19,617
Natural gas (gross production)	million cubic meters	16,165	17,550	19,307	20,134 r/	19,638
Petroleum:						
Crude	thousand 42-gallon barrels	10,024	10,738	12,412	21,147 r/	22,599
Natural gas condensate	do.	16,352	16,914	18,115	19,066 r/	18,924
Refinery products:						
Liquefied petroleum gas	do.	26,613	25,962	28,853	32,511	37,067
Gasoline	do.	59,247	55,353	54,290	50,862	52,376
Jew fuel	do.	23,969	22,438	25,908	27,347	26,651
Kerosene	do.	772	723	2,181	3,090	3,693
Distillate fuel oil	do.	54,733	49,351	49,242	43,970	40,669
Residual fuel oil e/	do.	24,000	22,000	22,000	22,000	22,000
Unspecified e/ 3/	do.	3,500	3,500	3,500	3,500	3,500
Total e/	do.	193,000	179,000	186,000	183,000	186,000

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

1/ Includes data available through August 30, 2002.

2/ Estimated data are rounded to no more than three significant digits; may not add to totals shown.

3/ Includes refinery fuel and refinery gains or losses.

Sources: Department of Mineral Resources, Mineral Statistics of Thailand, 1997-2001 and Metal Statistical Yearbook, 2001; Ministry of Commerce, National Energy Policy Office, Energy Data Notebook, 1988-2001, 14-year series report.

TABLE 2  
THAILAND: STRUCTURE OF THE MINERAL INDUSTRY IN 2001

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity	
Barite	Asian Mineral Resources Co. Ltd.	Loei, Mae Hong Son, Nakhon Si Thammarat, and Satun Provinces	100	
Cement	Asia Cement Co. Ltd.	Pra Phutthabath, Saraburi Province	4,800	
Do.	Jalaprathan Cement Co. Ltd. (37% owned by Cements Francais S.A., 19% by Veatprapat Holding Co. Ltd., and 44% by others)	Takli, Nakhorn, Sawarn Province; and Cha-Am, Petchburi Province	2,350	
Do.	Samukee Cement Ltd.	Pakchong, Nakhon Ratchasima Province	125	
Do.	Saraburi Cement Co. Ltd. (99% owned by CEMEX Asia Holdings Ltd.)	Chalerm Phrakiat, Saraburi Province	700	
Do.	Siam Cement Industry Co. Ltd. (30% owned by Bureau of the Crown Property, 6.94% by Thai Security Depository Co. Ltd., 5.6% by CPB Equity Co. Ltd., and 57.46% by other financial institutions and general public)	Kaeng Khoi, Phabudhabat, and Khao Wong, Saraburi Province; Chae hom, Lampang Province; Thung Song, Thammarat Province; and Ta Luang, Ayutthaya Province	23,200	
Do.	Siam City Cement Co. Ltd. (33.7% owned by Holcim Ltd. of Switzerland, 27% by Rattanak family, and 39.3% by other investors)	Kaeng Khoi, Saraburi Province	14,800	
Do.	TPI Polene Co. Ltd.	Kaeng Khoi, Saraburi Province	9,000	
Coal, lignite	Electricity Generating Authority of Thailand	Mae Moh, Lampang Province; Li, Lamphun Province	20,000	
Do.	Lanna Resources Public Co. Ltd.	Baan Pa Kha, Lampang Province; and Nong Ya Plong, Petchburi Province	1,800	
Fluorspar, concentrate	Asian Mineral Resources Co. Ltd.	Mae Hong Son Province	14	
Gas, natural	million cubic meters per day	Esso Exploration and Production Khorat Inc.	Namphong, Khon Kaen Province	4
Do.	do.	TOTAL Exploration and Production (Thailand)	Bongkot in the Gulf of Thailand	15
Do.	do.	Unocal Thailand Ltd.	Baanpot, Erawan, Funan, Kaphong, Pladang, Satun, Paili, Trat, all in the Gulf of Thailand	33
Gold	kilograms	Akara Mining Ltd. (wholly owned subsidiary of Kingsgate Consolidated N.L. of Australia)	Chatree, Pichit Province	4,000
Gypsum		Thai Gypsum Products Pcl. (40.75% owned by Thaigips Holdings Ltd., 30% by BPB Gypsum B.V., and 29.25% by others)	Nong Bau, Nakhon Sawan Province and Ban Munnak, Phichit Province	2,000
Do.		Vanich Gypsum Co. Ltd.	Khlong Prab, Mai Rieng. Thoong Yai Mai in Provinces of Nakhon Si Thammarat and Surat Thani	2,000
Lead, in concentrate		Kanchanaburi Exploration and Mining Co. Ltd.	Song Toh, Kanchanaburi Province	1
Petroleum, crude included condensate				
Do.	thousnad 42-barrels per day	Chevron Offshore (Thailand) Ltd.	Benjamas, offshore in the Gulf of Thailand	25
Do.	do.	Tah Shell Exploration and Production Co. Ltd.	Sirikit in Kamphaenghet Province	24
Do.	do.	TOTAL Exploration and Production (Thailand)	Bongkot, offshore in the Gulf of Thailand	12
Do.	do.	Unocal Thailand Ltd.	Baanpot, Erawan, Funan, Gomin, Jakrawan, Kaphong, Pailin, Platon, Satun, Surat, Trat	38
Steel, rolled		The Bangkok Iron and Steel Works Co. Ltd.	Phrapradaeng, Samutprakarn Province	120
Do.		Bangkok Steel Industry Public Co. Ltd.	do.	300
Do.		Namheng Steel Co. Ltd.	Lopburi Province	350
Do.		NTS Steel Groups Public Co. Ltd.	Chon Buri Province	408
Do.		The Siam Construction Steel Co. Ltd.	Muang Rayong Province	540
Do.		The Siam Iron and Steel Co. Ltd.	Ban Moh, Saraburi Province	375
Do.		Sahaviriya Group Corp. Ltd.	Bang Saphan, Prachuap Khiri Khan Province	2,400
Do.		Siam United Steel Co. Ltd.	Rayong Province	1,000
Do.		Siam Yamato Steel Co. Ltd.	Muang, Rayong Province	600
Tantalum, metal powder and oxides	metric tons	H.C. Starck (Thailand) Co. Ltd. (94.98% owned by H.C. Starck GmbH, and 5.02% by others)	Map Ta Phut, Rayong Province	250
Tin:				
Concentrate		Numerous small companies	Nakhon Si Thammarat, Phangnga, Phuket, and Ranong Provinces	3
Refined		Thailand Smelting and Refining Co. Ltd. (75.25% owned by Amalgamated Metal Corp., and 24.75% by others)	Phuket, Phuket Province	30
Zinc:				
In concentrate		Padaeng Industry Public Co. Ltd. (46% owned by Umicore SA of Belgium and 54% by others)	Mae Sot, Tak Province	30
Refined		do.	Tak, Tak Province	105