



# 2007 Minerals Yearbook

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**VIETNAM [ADVANCE RELEASE]**

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# THE MINERAL INDUSTRY OF VIETNAM

By John C. Wu

Vietnam's identified mineral resources included antimony, barite, bauxite, bismuth, carbonate rocks (limestone and marble), chromium, coal, copper, fluorite, gemstones (ruby and sapphire), gold, graphite, iron ore, lead, manganese, natural gas, nickel, crude petroleum, phosphate rock (apatite), rare earths, silica sand, silver, tin, titanium (ilmenite and rutile), tungsten, zinc, and zircon. Among those, resources of bauxite and tungsten had been assessed as significant by world standards (Ministry of Industry, 2002).

For the past 3 years, Vietnam was the world's leading exporter of anthracite coal. In 2007, the country produced between 1% and 2% of the world's barite, cement, kaolin, tin, and zircon and ranked sixth in the production of crude petroleum in the Asia and the Pacific region. Vietnam also was one of the important producers of ilmenite and phosphate rock in the region (Oil & Gas Journal, 2007; Wood Mackenzie, 2007; Carlin, 2009; Gambogi, 2009; Miller, 2009; van Oss, 2009; Virta, 2009).

According to an official of Vietnam Steel Corporation (VSC), the development of Vietnam's second largest iron ore mine at Qui Sa (Quy Xa) in Lao Cai Province reportedly had been delayed because of a lack of demand for the iron ore and underdeveloped infrastructure. The Chinese partner in the project, nonetheless began construction of a 2-million-metric-ton-per-year (Mt/yr)-capacity steel plant in late 2006 near the border of Lao Cai Province. Development of a 5-Mt/yr-capacity iron ore mine at Thach Khe in Ha Tinh Province was expected to be approved by the Government following the completion of a feasibility study by Russia's Giprotruda Institute in December 2007 (Vietnam Investment Review, 2007b; VietnamNet Bridge, 2007; Vietnam Business Finance, 2009).

In 2007, Vietnam moved forward with plans for the proposed joint-venture development of a 4.5-Mt/yr integrated steel complex with a major steelmaking investor from India. Another joint-venture project with investors from Thailand and Taiwan reportedly started construction of the country's largest steel plant at the Dung Quat Economic Zone in central Quang Ngai Province. The plant would have the capacity to produce 3 Mt/yr of steel ingots (Manufacturing.Net, 2007).

In 2007, Vietnam started construction of a nickel-copper mine in joint venture with an investor from New Zealand at Ban Phuc in Son La Province and of a tungsten-fluorite mine in joint venture with a foreign investor from China at Nui Phao in Thai Nguyen Province in northern Vietnam. In the central highlands region of Vietnam, several large-scale bauxite mining and alumina refining projects that would include investment from Australia, China, Japan, and the United States were expected to begin during the 2008-10 period.

## Minerals in the National Economy

The mining and quarrying sector was important to the Vietnamese economy because of its considerable contribution to Vietnam's gross domestic product (GDP) and its substantial

share of the country's overall mineral trade. According to the General Statistics Office of Vietnam, the output of the mining and quarrying sector (which included mineral fuels and nonfuel minerals) accounted for 5.4% (preliminary) of Vietnam's GDP; the output value of the mining and quarrying sector (in 1994 constant dollars) was estimated to be \$1.44 billion<sup>1</sup> in 2006 (the latest year for which data were available). The GDP (in 1994 constant dollars) was estimated to be \$26.60 billion (General Statistics Office of Vietnam, 2008b).

## Government Policies and Programs

All minerals, which included coal, natural gas, petroleum, and all nonfuel minerals located within the land, islands, internal waters, sea territory, exclusive economic zones, and continental shelf of Vietnam, are owned by the people and managed by the state. The Ministry of Natural Resources and the Environment (MONRE) administered all aspects of the country's mining activities. The Department of Geology and Minerals of Vietnam, under the supervision of the MONRE, managed the country's mineral resources. In Vietnam, all aspects of mining, which include onshore and offshore surveys, exploration, mining, and mineral-processing, are governed by the Law on Minerals of 1996 (Mineral Law) and amendments such as Decree No. 76/2000/ND-CP, Decree No. 160/2005/ND-CP, Directive No. 10/2005/CT-TTG, and Law No. 46/2005/QH11. In January 2006, the MONRE enacted Circular No. 012006/TT-BTNMT, which provides guidance on the implementation of some of the articles of Decree No. 160/2005/ND-CP. The main content of the circular was on guiding the formulation and evaluation of mineral prospecting and exploration projects (Department of Geology and Minerals of Vietnam, 2006).

In 2007, the Prime Minister approved Decision No. 116/2007/QD-TTg (Approval of the master plan for basic geologic investigation on mineral resources to the year 2015, with orientation to the year 2020) and Decision No. 167/2007/QD-TTg (To approve the zoning master plan for exploration, mining, processing and use of bauxite ore in 2007-2015 period, with vision to 2025 taken into consideration) (Department of Geology and Minerals of Vietnam, 2007a).

In October 2007, the Department of Geology and Minerals of Vietnam and the Japan Oil, Gas, and Metals National Corp. of Japan signed a memorandum of understanding to conduct a joint basic geologic investigation for rare-earth elements associated with copper, gold, and iron ore mineralization in Lai Chau, Lao Cai, and Yen Bai Provinces in Vietnam (Department of Geology and Minerals of Vietnam, 2007b).

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<sup>1</sup>Where appropriate, values have been converted from Vietnamese dong (D) to U.S. dollars (US\$) at the rate of D15,983=US\$1.00 for 2006.

## Production

Vietnam's production of major mineral commodities included barite, chromite, coal, ilmenite, limestone, crude petroleum, phosphate rock, tin, and zinc. Virtually all chromite, ilmenite, and crude petroleum production was exported. Barite, limestone, and zinc production was mostly consumed domestically, but notable volumes of barite and zinc concentrates were exported. In 2006, Vietnam began to mine its copper using modern mining and mineral-processing technologies. Copper concentrate was delivered to a nearby, newly built copper smelter and refinery for further processing. According to the International Copper Study Group (2008, p. 17), Vietnam produced 4,800 metric tons (t) of refined copper in 2006 and 11,000 t in 2007.

Vietnam's major processed minerals were cement, refined copper, fertilizer materials (ammonia, urea, and phosphate), rolled steel, refined tin, and zinc. For cement manufacturing, Vietnam still needed to import some amount of cement clinker annually. Cement, fertilizer materials, and rolled-steel production was for domestic consumption.

## Structure of the Mineral Industry

Vietnam's mineral industry comprised (1) several large state-owned or state-controlled companies that produced, distributed, and traded mineral commodities, such as cement, coal, fertilizer materials, ferrous and nonferrous metals, oil and gas, and salt; (2) several foreign companies that worked in joint venture with the state-owned companies or local governments to manufacture cement, mine gold, and produce oil and gas; and (3) several foreign companies from Australia, Canada, China, and New Zealand that were undertaking mine development projects for copper, gold, iron ore, nickel, and tungsten. The major state-owned companies were Vietnam National Cement Corp. (VNCC), which controlled all state-owned cement plants; Vietnam National Chemical Corp., which controlled all state-owned fertilizer-minerals mining and processing companies; Vietnam National Coal Corp. (VINACOAL), which controlled all state-owned coal mining and coal processing companies; Vietnam National Minerals Corp. (VIMICO), which controlled all state-owned nonferrous minerals mining and processing companies; Vietnam National Salt Corp., which controlled all state-owned salt producing companies; and Vietnam Steel Corp. (VSC), which controlled all state-owned iron ore mining and steelmaking companies. In 2005, a state-owned holding company called Vietnam National Coal-Mineral Industries Group (VINACOMIN) was established through the merger of VINACOAL and VIMICO; these two state-owned companies became wholly owned subsidiaries of VINACOMIN (Platts.com, 2006a, b).

According to the latest available Government statistics, the number of employees in the mining and quarrying sector, which totaled 249,321, accounted for about 5% of the total number of employees (4,932,217) in the industrial sector in 2004. Of the total number of employees in the mining and quarrying sector, about 31% (77,486) were employed by coal mining companies; about 3% (6,735), by the oil and gas companies; 6% (15,719), by metallic mining companies; and about 60% (149,381),

by other mining and quarrying (mostly industrial minerals) companies (General Statistics Office of Vietnam, 2006, p. 469).

## Trade

In 2007, Vietnam's merchandise trade deficit increased by 158% to \$12.4 billion from \$4.8 billion in 2006. This sharp increase in the trade deficit was caused mainly by increased imports of animal feed and processed material; automobiles, machinery, instruments, and associated parts; computers, electronics, and associated parts; fertilizers; plastics; refined petroleum products; steel; and wheat (Vietnam Economic News, 2007a).

In 2007, Vietnam remained a net mineral importer because of its high import bill for chemicals and chemical products, plastics, refined petroleum products, and steel. The major exported mineral commodities were crude petroleum, which amounted to about 107 million barrels (Mbbbl) [or about 15 million metric tons (Mt)] and was valued at \$8.5 billion, and coal, which amounted to about 32.5 Mt and was valued at \$1 billion. Exports of crude petroleum and coal accounted for 19.6% of Vietnam's total export earnings of \$48.4 billion in 2007. The major imported mineral commodities were refined petroleum products, which amounted to about 12.6 Mt and were valued at \$7.5 billion; iron and steel products, which amounted to about 7.7 Mt and were valued at \$4.9 billion; plastics, which amounted to 1.7 Mt and were valued at \$2.5 billion; and fertilizer materials, which amounted to about 3.8 Mt and were valued at \$996 million. Imports of refined petroleum products and iron and steel products accounted for 12.3% and 8%, respectively, of Vietnam's total import bill of \$60.8 billion in 2007 (Vietnam Economic News, 2007a).

In mid-December 2006, the Government announced that it would impose a 10% export tax on raw minerals and a 5% export tax on refined mineral commodities. The main industrial minerals that were subject to the export tax were barite, ilmenite, and zircon. According to the Ministry of Industry, the Government was also considering adjusting its resource tax on other minerals to between 2% and 3% from 0% to raise Government revenues and regulate the exportation of minerals (Industrial Minerals, 2006).

## Commodity Review

### Metals

**Bauxite and Alumina and Aluminum.**—To develop the bauxite resources of the central highlands region of Vietnam, Aluminum Corporation of China Ltd. (Chalco) signed an agreement with state-owned VINACOMIN in November 2006 to invest about \$1.6 billion in a development project to mine bauxite and refine alumina in Dak Nong Province. The proposed plant was expected to produce 1.9 Mt/yr of alumina in the first phase of the project. In 2007, according to People's Daily Online, Chalco was still waiting for the licenses to be issued by the Government before implementing its bauxite mining and alumina refining project. Under a joint-venture agreement, Chalco had agreed to fund 40% of the bauxite mining project by investing

\$300 million, and VINACOMIN would arrange financing for the remaining 60%. Chalco would also acquire 60% interest in the alumina refinery project, which was expected to require a \$1.1 billion investment. According to Chalco, the alumina refinery capacity would be expanded to 4 Mt/yr in the second phase of the project (Thanh Nien News, 2006; Xinhua, 2007).

In November, VINACOMIN obtained a license to build a \$483 million bauxite-alumina complex in the central highland Province of Lam Dong. VINACOMIN reportedly started construction of a smaller bauxite-alumina complex in the Province of Dak Nong to produce 300,000 metric tons per year (t/yr) of alumina with an investment of about \$205 million. VINACOMIN planned to raise 3 trillion dong (about \$188 million) by issuing bonds by early 2008 to fund its bauxite and power projects (Reuters UK, 2007).

**Copper.**—VINACOMIN, through its subsidiary VIMICO, began commercial production of copper at the copper facility at Sin Quyen in the Bat Sat District of Lao Cai Province in mid-April 2006. VIMICO had established a subsidiary, which was named Lao Cai Copper Complex, in 2006 to run the copper mining, milling, smelting, and refining operations, which had a nominal rated capacity of 10,000 t/yr of refined copper. In 2007 according to the International Copper Study Group (2008), the Sin Quyen copper mine produced 11,000 t of copper in copper ore and concentrate and 11,000 t of refined copper and Vietnam's refined copper consumption increased by 5% to 79,000 t. According to a local press report by Vietnam Business Finance (2008), however, the Lao Cai copper refinery produced its first batch of copper (20 t with 99.5% purity) in June 2008. The report pointed out that this was Vietnam's first copper metal production. The refinery (a solvent extraction-electrowinning plant, which was built at a cost of \$56.25 million) was said to be capable of producing 10,000 t/yr of copper, 341 kilograms per year (kg/yr) of gold, and 146 kg/yr of silver from electrolysis of copper mud (Metals Insider, 2008).

**Ferroalloys.**—In July 2007, the Ministry of Industry approved a master plan for the exploration, drilling, processing, and use of chromite and manganese ores during the 2007-15 period. According to the master plan, about 190,000 t/yr of chromite and manganese was expected to be mined initially; this amount would gradually be increased to 530,000 t/yr by 2015. During the plan period, two new chromite processing plants in Thanh Hoa Province would be built to process 30,000 t/yr of ore. Two older processing plants were located in the Provinces of Ninh Binh and Thai Nguyen. Jindal Nong Cong Ferro Chrome Company Ltd. planned to build a 60,000-t/yr-capacity ferrochromium that could be expanded to 200,000-t/yr. The country also planned to build one small-scale manganese processing (ferromanganese) plant in Ha Giang Province and two larger plants in the Provinces of Cao Bang and Thai Nguyen to produce about 40,000 t/yr of ferromanganese by 2015. The country's estimated reserves of chromite were about 25 Mt, mainly in Thanh Hoa Province, and its estimated reserves of manganese were about 11.1 Mt, mainly in the three northern mountainous Provinces of Cao Bang, Ha Giang, and Tuyen Quang (Chrome World, 2007; Thanh Nien News, 2007c).

In October 2007, a proposal by Archipelago Resources PLC (AR) of the United Kingdom to establish a joint venture

with state-owned VINACOMIN to develop a chromite mine was approved by the Government. The joint venture proposed to explore and develop a chromite deposit in a 16.6-square-kilometer (km<sup>2</sup>) area in Thanh Hoa Province in northern Vietnam. The chromite would be used exclusively for the domestic production of ferrochromium (Pertambangan, 2007).

**Gold.**—Vietnam's first licensed gold mining company [Bong Mieu Gold Mining Company Ltd. (BMGM)], which was a joint venture of Canada's Olympus Pacific Minerals Inc. (through its 100% owned subsidiary Bong Mieu Holdings Ltd.) (80%) and two Vietnamese companies, Mineral Development Co. (10%) and Quang Nam Mineral JS Co. (10%), started gold mining operations at the Ho Gan open pit in the southeastern corner of Quang Nam Province in 2006. To raise the ore processing capacity of the Bong Mieu Mine to 800 metric tons per day (t/d) from 500 t/d, BMGM started infill and resource expansion drilling programs in 2007, as well as commercial mining at the Nui Kem underground mine. The company planned to begin mining the Ho Ray-Thac Trang deposits in the next 2 years. The proven ore reserves at the Nui Kem Mine were estimated to be 858,000 t at a grade of 2.42 grams per metric ton (g/t) gold. According to BMGM, about 180,000 t of ore at a grade of 2.5 g/t gold had been mined at the Ho Gan open pit, and about \$25 million had been invested for exploration and mine development in the Bong Mieu mining area, which included the Ho Gan, the Ho Ray-Thac Trang, and the Nui Kem deposits (Saigon Times Daily, 2007).

In September 2007, the Vietnamese Government approved and granted an exploration license to AR and its Vietnamese partners—state-owned VINACOMIN and the Provincial Bac Kan Minerals Joint Stock Company (Bac Kan)—to explore for gold and associated minerals at the Pac Lang gold project in the Ngan Son District of Bac Kan Province, which is located about 160 kilometers (km) north of Hanoi, in northern Vietnam. The Pac Lang was AR's first approved exploration license in Vietnam, and the vein system was thought to have commercial potential. According to AR, at least 15 gold mineralized mesothermal quartz veins, generally less than 2 meters (m) wide had been identified with a combined outcropping and inferred strike length of 3,300 m. The 1999 preliminary sampling assayed between 0.4 and 0.9 g/t gold. The Pac Lang gold project was 65% owned by AR and 35% owned by VINACOMIN and Bac Kan (Metals Place, 2007; Archipelago Resources PLC, 2008).

Axiom Mining Ltd. of Australia, which was a subsidiary of Triple Plate Junction Plc of the United Kingdom (TPJ), in joint venture with the Newmont Mining Corp. focused on drilling high-grade bulk tonnage alkali porphyry copper-gold mineralization at the Pu Sam Cap in Lai Chau Province of northwestern Vietnam. According to TPJ, its mapping had delineated a structurally controlled zone of high copper-silver mineralization with elevated gold values exposed discontinuously through scree over a length of at least 100 m and a width of 2 to 4 m. Channel samples of the zone yielded an average of 6.96% copper, 72 g/t silver, 44 g/t tellurium, and 0.20 g/t gold. TPJ was granted a new license in 2007, which increased the ground holding of its two previous exploration licenses at Pu Sam Cap to 369 km<sup>2</sup>. TPJ owned 51% and was the manager of the Pu Sam Cap project (Triple Plate Junction plc, 2007).

**Iron and Steel.**—In late December 2007, Russia's Giproruda Institute (GI) made public its final report on the feasibility study of the Thach Khe iron ore mining project in Ha Tinh Province. The Thach Khe deposit, which is the largest reported iron ore deposit in Vietnam, was discovered by Soviet (Russian) and Vietnamese geologists in the 1960s. At that time, the iron ore reserves at the Thach Khe deposit were estimated to be between 500 and 600 Mt, of which at least 300 Mt was thought to be commercially exploitable. According to the 2007 feasibility study, the Thach Khe iron ore reserves were estimated to be 370 Mt with an average iron content of 60%. The project was expected to produce 5 Mt/yr of iron ore during the first 4 years of operation and gradually increase to 10 Mt/yr of iron ore in the second phase. The total investment to be made by VSC was estimated to be between \$327 million and \$378 million. In April 2007, according to a cover story published by Vietnam Investment Review, the ground-breaking ceremony of the Thach Khe Iron Ore Investment Company (TIC) was scheduled to take place in the first half of May 2007. The TIC ownership comprised nine domestic companies, which included VINACOMIN (30%); Ha Tinh Mining and Trading Corp. (MITRACO) (24%); VSC (20%); Song Da, B IDC, and Vinashin (5% each); VNPT and Bitexco (4% each); and Thang Long Mineral (3%). TIC indicated that it would welcome foreign investment but that the combined equity interest of foreign investors would not be allowed to exceed 30% of the company's total equity (AsiaFinest.com, 2007; Vietnam Investment Review, 2007a).

Vietnam's first large-scale iron ore mine development project reportedly started production at Quy Sa in Lao Cai Province in early 2007, according to an official of Kunming Iron & Steel Co. (KISCO) of China. Sino-Vietnam Mining and Metallurgical Corp., which was the joint-venture company owned by VSC and KISCO (45% each) and Lao Cai Mineral Company (10%), was to transport most of the iron ore from the mine to southern China to supply Honghe Iron & Steel Company Ltd. (in which KISCO was the major shareholder). Conflicting information from the VSC staff, however, reported that the Quy Sa iron ore development project had remained idle for years (Metal Bulletin, 2007; Vietnam Investment Review, 2007b).

The initial study of the Quy Sa project, which was Vietnam's second largest iron ore deposit, indicated that the deposit could have up to 120 Mt of iron ore reserves. Proposed mine production capacity was expected to be between 1.5 and 2.5 Mt/yr of iron ore, which would be used for domestic steel production and for export. The project's required capital investment was estimated to be between \$40 million and \$60 million. VSC officials indicated that money was not the reason for the delay in the development of the mine; rather it was the lack of demand for the iron ore and underdeveloped infrastructure. To help with the development of the Quy Sa Mine, VSC had proposed increasing the transport capacity of the Hanoi-Lao Cai railway system, which would require an estimated investment of \$120 million to \$150 million. In February 2007, a local newspaper reported that construction of infrastructure for the Quy Sa Mine had begun. Construction of a 2-Mt/yr-capacity steel plant reportedly began in China near Lao Cai Province. The new steel plant was expected to require

a large amount of imported iron ore, which was a reason for the development of the Quy Sa iron ore mine to proceed (Thanh Nien News, 2007b; Vietnam Investment Review, 2007b).

Because of Vietnam's low level of iron ore and pig iron production, the country's crude steel production was insufficient to meet the crude steel requirements of its steel mill in 2007. As a result, imports of crude steel rose by 5.8% to 2.06 Mt despite a 43% increase in domestic production of crude steel to 2 Mt in 2007. According to the Vietnam Steel Association (VSA), Vietnam's requirement for crude steel was estimated to be between 4.6 and 4.7 Mt in 2007. To meet its domestic demand for crude steel, Vietnam's imports of crude steel and steel scrap were expected to increase to more than 2.1 Mt and 1 Mt, respectively (Minh, 2008).

To reduce reliance on imported steel, a development plan was approved by the Prime Minister in 2007. According to the plan, the country's steel sector would need \$10 billion to \$12 billion in the 2007-25 period, of which \$8 billion would be for the development of the Ha Tinh, the Lao Cai, and the Dung Quat steel complexes; several high-quality rolled-steel and zinc-plated steel plants; and the second-phase capacity expansion of the Thai Nguyen Iron and Steel Company. According to the plan's projection, Vietnam would require 10 to 11 Mt of steel by 2010 and 24 to 25 Mt by 2025 (Nhan Dan Online, 2007).

In October 2007, Vietnam started construction of the country's largest steel plant at Dung Quat Economic Zone in Quang Ngai Province, which was located about 900 km south of Hanoi. The \$1.6 billion plant was scheduled for completion in late 2010 and would be operated by Tycoons Worldwide Steel (Vietnam) Ltd., which was a joint venture of Tycoons Worldwide Group of Thailand and E United Group of Taiwan. The plant would have a capacity of 3 Mt/yr of steel ingot (crude steel). The company planned to invest an additional \$1.4 billion to expand the plant capacity to 5 Mt/yr (Manufacturing.Net, 2007).

In May 2007, VSC signed a memorandum of understanding (MOU) with Tata Steel Ltd. of India regarding the proposed Ha Tinh steel complex, which was expected to be located in Ha Tinh Province, about 340 km south of Hanoi. According to the MOU, Tata Steel, in cooperation with VSC, would undertake a feasibility study of the proposed 4.5-Mt/yr-capacity steel project. After the successful completion of the study and arranging the funding for the project, Tata Steel reportedly would have at least 65% ownership of the project and VSC would have a 35% stake in the project. Tata Steel also would take a 30% stake in Thach Khe Iron Ore Joint Stock Company, which would operate the Thach Khe iron ore mine (Reuters Ltd., 2007; Tata Steel Ltd., 2007).

Foreign investment in Vietnam's steel sector in 2007 included three other major projects. Shengli Investment and Development Ltd. Co. of China signed an MOU with the Vietnamese Government to build a \$50 million steel plant in Thai Binh Province that would have the capacity to produce 1 Mt/yr of steel; the company planned to invest an additional \$80 million to expand the plant capacity to 2 Mt/yr. Essar Vietnam Steel Corp. [which was a joint venture of Essar Steel Vietnam Holdings Pvt. Ltd. (65%), VSC (20%), and Vietnam General Rubber Corp. (15%)] proposed to build a 2-Mt/yr-capacity \$527 million hot-rolled steel mill in Ba Ria-Vung Tau Province. Also in Ba Ria-

Vung Tau Province, Pohang Iron and Steel Co. Ltd. (POSCO) began work on a cold-rolled steel facility at its \$1.13 billion complex in the Phu My 2 Industrial Zone, which is located about 100 km southeast of Ho Chi Minh City (Essar Global Ltd., 2007; Thanh Nien News, 2007a; Vietnam News, 2008).

**Nickel.**—In January 2007, Asian Mineral Resources Ltd. (AMR) of New Zealand, through its 90% owned joint-venture company Ban Phuc Nickel Mines Ltd. (BPNM), received Vietnamese Government approval for its environmental impact assessment report for the Ban Phuc nickel project, which is located about 180 km northwest of Hanoi in Son La Province. In March, the company began phase one of the project, which included the design of the mine and the processing plant, an estimation of the project's reserves and resources, and a request for bids for the construction of various infrastructure components, including the tailings dam. Construction began in mid-2007 and was expected to be completed in late 2008. Production was scheduled for early 2009. By November 2007, AMR had made substantial progress toward the mine development and the construction of related facilities, which included accommodation, administration, and communications facilities, and a mineral processing plant. AMR officially received a mining license to mine copper, nickel, and associated minerals at the Ban Phuc property in December 2007 (Asian Mineral Resources Ltd., 2007a-d).

According to AMR, proven and probable ore reserves at the Ban Phuc nickel deposit were estimated to be about 1.01 Mt with average mill head grades of 2.4% nickel and 1.0% copper. Contained nickel and copper were calculated to be 24,240 t and 10,100 t, respectively. The high-grade massive sulfide vein resources, which included measured, indicated, and inferred resources, were estimated to be about 1.23 Mt. ARM calculated that the high-grade massive sulfide vein resources contained 34,090 t of nickel, 13,850 t of copper, and 1,130 t of cobalt (Asian Mineral Resources Ltd., 2007e).

**Titanium (Ilmenite).**—The Vietnamese Government approved a new policy to regulate the country's production and exports of ilmenite concentrate in July 2007. The ultimate goal of the policy was to achieve the country's self-sufficiency in titanium dioxide pigment and to upgrade its ilmenite ore concentrate exports to titanium dioxide exports (TZ Minerals International Pty. Ltd., 2007).

According to Vietnam Maritime News, Vietnamese exports of titanium ore and concentrate (ilmenite) to China increased by 20% to about 536,000 t in 2007. To meet the domestic requirements for its production of titanium dioxide pigment, Vietnam was expected to cut its exports to China after 2008. The Vietnamese Deputy Prime Minister had asked the Ministry of Industry and Trade to issue an amended circular to limit exports of titanium ore beginning in 2009. According to the Titanium Industry Council of China Nonferrous Metal Industry Association, China's imports of ilmenite accounted for one-third of China's ilmenite requirements, and Vietnam was one of the major suppliers to China (Vietnam Maritime Social Network, 2008).

In September 2007, Binh Dinh Minerals Joint Stock Company started construction of a 40,000-t/yr-capacity titanium slag plant in the Cat Nhon industrial zone of Cat Nhon Village of

Binh Dinh Province. The plant, which would be Vietnam's first titanium slag plant, was scheduled to be completed by the end of 2008. The \$6.1 million plant would produce raw material for the production of titanium dioxide pigment. Ilmenite reserves in the Cat Thanh District of Binh Dinh were estimated to be 500,000 t. In October 2007, Binh Dinh Minerals was granted a permit to conduct a mineral sand survey south of the Degi Mine in the Phu Cat District of Binh Dinh Province (Binh Dinh Minerals Joint Stock Company, 2008a, b).

**Tungsten.**—An attempt by Tiberon Minerals Ltd. of Canada to increase its 70% stake in the Nui Phao tungsten-bismuth-fluorspar project in Thai Nguyen Province to 77.5% had been blocked by the Vietnamese Government in September 2006, when the Vietnamese Ministry of Planning and Investment indicated that the Nui Phao project would keep the original ownership ratio of 70:30 between foreign investors and Vietnamese joint-venture partners. The 7.5% equity interest was held by one of the local partners (Thai Nguyen Export-Import Investment Co.), which was later acquired by (state-owned) VINACOMIN. In March 2007, Dragon Capital Management Ltd. of China, which owned several private equity funds (including the Vietnam Enterprise Investment Ltd. and the Dragon Capital Fund Ltd.) that invested in companies that were active in Vietnam, acquired 93% of Tiberon Minerals for about \$219 million. The deal reportedly would help move forward the development of the Nui Phao project, which would likely become the world's leading primary tungsten mine. The project, which had estimated tungsten reserves of 53 Mt, also was expected to be a major producer of bismuth and acid-grade fluorspar. In May 2008, the Nui Phao Joint Venture Mining Company and foreign banks Bayerische Hypo-und Vereinsbank AG of Germany and the Fortis Group of the Netherlands were expected to sign a \$250 million credit deal to finance the Nui Phao project (Industrial Minerals, 2006; Resource Investor, 2006; Tiberon Minerals Ltd., 2006; 2007a, b; VietnamNet Bridge, 2008a).

In Ninh Thuan Province, the People's Committee of the Province reportedly clamped down on illegal tungsten mining at the Phuoc Trung Commune of Bac Ai District in Ninh Thuan Province. The Committee reportedly confiscated illegal miners' vehicles and expelled workers from the tungsten mine (Vietnam News Agency, 2008).

### ***Industrial Minerals***

**Cement.**—Vietnam's cement industry's capacity continued to grow in 2007. According to the Vietnam National Cement Association (VNCA), as of May 2006, Vietnam's cement industry had a total capacity of 24.7 Mt/yr. By June 2007, the cement industry's capacity had grown to 35 Mt/yr, with about 31 cement plants scheduled to be brought onstream in 2010. Under a new cement development plan approved by the Prime Minister in May 2007, the Ministry of Construction would not approve any new cement plant investment projects. According to Government and industry projections, Vietnam's cement supply and demand was projected to be in balance in 2009 as new cement plants come onstream. Demand for cement was projected to grow by 11% per year during the next 3 years

and could reach 50 Mt by 2010, whereas Vietnam's cement production capacity could reach 60 Mt/yr and could exceed demand by a 20% in 2010 or 2011 (Vietnam Economic News, 2007b).

Vietnam's cement production increased by 11.3% to an estimated 36.4 Mt in 2007 from 32.7 Mt in 2006. In 2007, Vietnam's demand for cement was about 36.5 Mt. To meet its clinker requirements for its growing cement production, Vietnam's imports of cement clinker increased by 8% to 4 Mt in 2007, of which 3.7 Mt was from Thailand. As a result, the Vietnamese Ministry of Finance decided to slash its import tariffs to 0% on cement clinker imported from all countries, including members of the Association of Southeast Asian Nations (ASEAN), effective June 2008. Because more new cement plants were expected to come onstream by 2009, Vietnam would have enough clinker capacity to meet its demand and could become a cement-exporting country by 2009. According to VNCA, Vietnam would no longer need to import cement by 2010 if production continues to grow at an annual rate of about 11% as forecasted and reaches 50 Mt/yr by 2010 (Intellasia.net, 2008; Vietnam National Cement Association, 2008b, c).

To raise capital and restructure its subsidiaries, state-owned Vietnam National Cement Corp. (VNCC) reportedly had completed equitizing (that is, privatizing) seven of its subsidiaries, which included Bim Son Cement Co., But Son Cement Co., Cement Materials Transport Co., Cement Plaster Enterprise, Ha Tien II Cement Co., Hai Van Cement Co., and Hoang Mai Cement Co., by the end of 2007. VNCC, which produced and sold about 12.3 Mt of cement in 2006, accounted for about 38% of the country's cement production and held about 46% of the Vietnam's cement market in 2007 (International Cement Review, 2007; Vietnam National Cement Association, 2008a).

Nghi Son Cement Corp., which was the second ranked foreign invested joint-venture cement company in Vietnam, began its construction work on the second production line at its Nghi Son plant in Thanh Hoa Province in April 2007. The second production line would cost about \$240 million and was expected to be completed by July 2009. The new production line would raise the Nghi Son cement plant capacity to 4.3 Mt/yr in 2009 from 2.15 Mt/yr in 2007 (Vietpartners, 2007).

### **Mineral Fuels**

**Coal.**—The coal industry continued on its path of robust growth in 2007. Vietnam's coal production and exports increased by 11.3% and 10.9%, respectively, in 2007 owing to the continued expansion in coal production capacity, stronger domestic coal demand for power generation, and increased exports to the Asian markets (mainly China and Japan). In 2007, coal production reached a record-high level of 43.2 Mt compared with 38.8 Mt (revised) in 2006, and coal exports rose to a record-high level of 32.5 Mt compared with 29.3 Mt (revised) in 2006. In 2007, Vietnam was a leading supplier of anthracite coal in the Asia and the Pacific region (Vietnam Economic News, 2007b; General Statistics Office of Vietnam, 2008a).

Most of the coal produced in Vietnam was anthracite mainly from Quang Ninh Province in northeastern Vietnam. The main anthracite coal mines were located in the areas of Cam Pha,

Cao Son, Coc Sau, Deo Nai, Dong Trieu, Ha Tu, Hong Gai, Khe Cham, Mao Khe, Mong Duong, and Uong Bi. Brown coal (lignite) mines were located mainly in the Province of Lang Son. VINACOAL owned and operated three main coal preparation (processing) plants that were located in Cam Pha, Hong Gai, and Uong Bi. VINACOAL also controlled a total of three main coal terminals at Cua Ong in Cam Pha, Dien Cong in Uong Bi, and Nam Cau Trang in Hong Gai. VINACOAL, which became a wholly owned subsidiary of VINACOMIN in 2005, controlled most of the mining, distribution, and export of coal.

VINACOAL controlled about 20 coal-producing subsidiaries. They were Vinacomin Cao Son Coal Joint-Stock Company, Vinacomin Coc Sau Coal Joint-Stock Company, Vinacomin Deo Nai Coal Company, Vinacomin Dong Bac Company, Vinacomin Duong Huy Coal Company, Vinacomin Ha Lam Coal Company, Vinacomin Ha Long Coal Company, Vinacomin Ha Tu Joint-Stock Company, Vinacomin Hongay Coal Company, Vinacomin Inland Coal Holding Company, Vinacomin Mao Khe Coal Company, Vinacomin Mine Construction Company, Vinacomin Minerals Corporation, Vinacomin Mong Duong Coal Company, Vinacomin Nui Beo Coal Joint-Stock Company, Vinacomin Quang Hanh Coal Company, Vinacomin South-West Da Mai Joint-Stock Company, Vinacomin Thong Nhat Coal Company, Vinacomin Uong Bi Coal Holding Co. Ltd., and Vinacomin Vang Danh Coal Company. Other coal business-related subsidiaries under VINACOMIN were Vinacomin Cua Ong Coal Preparation Company, Vinacomin Hongay Coal Preparation Company, and Vinacomin Port Company.

In 2007, the Vietnamese Government authorized China Southern Grid (a Chinese electricity company) to conduct a feasibility study for a proposed 1,200-megawatt (MW) thermoelectric plant in Binh Thuan Province. Construction of the \$1 billion coal-fired powerplant was expected to begin by the end of 2007 (Xinhua, 2007).

Vietnam's coal exports had increased five-fold since 2004 and reached a record 32.5 Mt in 2007, which excluded an estimated 10 Mt/yr of illegal coal exports. To conserve coal resources for the growing domestic coal demand for power generation, the Ministry of Industry and Trade planned to cut coal exports by 5 Mt in 2008. VINACOMIN, which, as Vietnam's top coal producer, accounted for 95% of the national coal production, would need to reduce its coal exports by 11% to 19.5 Mt in 2008 to save more coal for domestic consumption by the cement and powerplants. Between 15 and 20 Mt of coal was provided to the domestic market and the remaining coal output was exported to China. Coal reserves, mainly located in Quang Ninh Province, were estimated to be 10.5 billion metric tons, according to VINACOMIN. The company also was investing in the Red River Delta, where exploitable coal reserves could be produced at an annual rate of between 9 and 10 Mt/yr for an unspecified period (Thomson Reuters, 2007; VietnamNet Bridge, 2008b).

**Natural Gas and Petroleum.**—Natural gas was produced by VietSovPetro (a joint venture of Vietnam Oil and Gas Corp. and Zarubezhneft of Russia) from the small onshore Tien Hai C Gasfield in the Hanoi Trough (which is part of the Song Hong Basin). Associated gas was produced by VietSovPetro from the larger offshore Bach Ho (White Tiger) and Rang Dong (Dawn) oilfields, which are located in the Cuu Long Basin. A consortium

led by BP p.l.c. of the United Kingdom produced natural gas and condensate from the offshore Lan Do and Lan Tay gasfields in the Nam Con Son Basin. In 2007, natural gas production increased by 4.7% to 6,820 million cubic meters from 6,788 million cubic meters (revised) in 2006. Crude petroleum production, however, decreased by 5.4% to 112.6 Mbbbl (15.9 Mt) in 2007 from 119.0 Mbbbl in 2006 (General Statistics Office of Vietnam, 2008a).

In October, state-owned Vietnam Oil and Gas Corp. (PetroVietnam) announced that it would invest \$4.5 billion in gas exploration, exploitation, and production facilities to bring ashore between 6.1 billion and 9.1 billion cubic meters per year of natural gas. According to forecasts, Vietnam would need to import about 400 million cubic meters of natural gas in 2007 and about 1.8 billion cubic meters in 2010 to meet its domestic demand. Natural gas imports were expected to be from Indonesia and Malaysia. PetroVietnam also planned to speed up the construction of its pipeline networks, including the extension of the Nam Con Son pipeline to Ho Chi Minh City from Phu My and the new 476-km Block B-O Mon natural gas pipeline from offshore Block B to Can Tho (Alexander's Gas & Oil Connections, 2007d).

In 2007, crude petroleum was produced from the Bach Ho, the Rang Dong, the Rong, the Ruby, the Su Tu Den (Black Lion), and the Su Tu Trang (White Lion) Fields in the Cuu Long Basin; the Bunga Kekwa field in the Malay-Tho Chu Basin, which is located off the southern coast of Vietnam between Vietnam and Malaysia; and the Dai Hung Field in the Nam Con Son Basin. According to PetroVietnam, the country's crude petroleum production was expected to increase by 200,000 barrels per day (bbl/d) in 2008 from the 2007 level of about 300,000 bbl/d, and the production level would stabilize at about 500,000 bbl/day after 2008 for a few years. The expected increase in crude oil production in 2008 would be from five new oilfields—Bunga Pakma, Ca Ngu Vang, Phuong Dong, Song Doc, and Su Tu Vang. The Bunga Pakma Field is located in the northern end of Block PM-3 CAA in the overlapping area between Malaysia and Vietnam; it was owned by Talisman Energy Inc. of Canada (41.44%), Petronas Carigali Sdn. Bhd. of Malaysia (Petronas) (46.06%), and PetroVietnam (12.5%). The Ca Ngu Vang Field is located in Block 9-2 in the Cuu Long Basin offshore southern Vietnam; it was operated by the Hoan Vu Joint Operating Co., which was owned by PetroVietnam (50%), PTT Exploration and Production Public Company Ltd. of Thailand (25%), and SOCO International plc of the United Kingdom (25%). The Phuong Dong Field is located in Block 15-2 in the Cuu Long Basin; it was operated by Nippon Oil Corp. and owned by Japan Vietnam Petroleum Company (which was a subsidiary of Nippon Oil) (64.5%), and PetroVietnam Exploration Production Corp. (35.5%). The Song Doc Field is located in Block 46/02 in the Malay-Tho Chu Basin offshore southern Vietnam. The field was owned by Truong Son Joint Operating Co. (the operator) (40%), Talisman Vietnam (30%), and Petronas (30%). The Su Tu Vang Field is located in Block 15-1 in the Cuu Long Basin. The field was owned by PetroVietnam (50%), ConocoPhillips Co. of the United States (23.3%), SK Energy Company Ltd. of the Republic of Korea (14.2%), and Geopetrol S.A. of France (3.5%) (Alexander's Gas & Oil Connections, 2007e).

In 2007, Vietnam's crude petroleum exports decreased by 8.1% to 106.8 Mbbbl (15.1 Mt). Export earnings from crude petroleum increased by 2.6% to \$8.5 billion because of higher export prices in 2007. The country's imports of refined petroleum products, however, increased by 12% to 88.9 Mbbbl (12.6 Mt), which was valued at \$7.5 billion and which was a 25.7% increase from its import bill for refined petroleum products in 2006 (Vietnam Economic News, 2007a).

In November 2007, PetroVietnam and Japan's state-owned Japan Oil, Gas and Metals National Corp. signed an agreement to explore for oil and gas in Vietnam. The two companies also agreed to jointly develop a gas-to-liquids (GTL) project in Vietnam. Nippon Oil, which entered into a production-sharing contract with PetroVietnam on November 16, planned to invest about \$32 million during the next 3 years for exploration and development of Block 16-2 offshore southern Vietnam in which Nippon Oil held a newly acquired 40% interest. The other partners of the block were PetroVietnam (45%) and VietSovPetro (15%). Block 16-2 was Nippon Oil's third oil and gas project in Vietnam (the others were Block 5-1b & c and Block 15-2) (Alexander's Gas & Oil Connections, 2007a, b).

Construction of the country's first oil refinery, which was located in the Dung Quat Industrial Zone in Quang Ngai Province, was begun in 2005 and in progress in 2007. The Dung Quat refinery was scheduled to begin operation in 2009; it would have a capacity of 6.5 Mt/yr or about 130,000 bbl/d, which would meet about 30% of the country's domestic demand. In October 2007, PetroVietnam had allocated \$6 billion for construction of the country's second oil refinery at Nghi Son in Thanh Hoa Province. PetroVietnam reportedly would contribute between \$1.8 billion and \$2 billion to the project. Other major investors in the project were the Bank for Foreign Trade of Vietnam, the Vietnam Bank of Agriculture and Rural Development, Vietnam National Petroleum Corp., and the Vietnam Post and Telecommunications Group. In late 2007, PetroVietnam was negotiating with Idemitsu Kosan of Japan to form a joint venture for the project (Alexander's Gas & Oil Connections, 2007c).

## Outlook

For the next 3 to 4 years, Vietnam's mining sector is expected to continue to be dominated by the coal and oil and gas industries, which, in turn are expected to expand their capacities during the next 2 to 3 years. The mining sector for ferrous, nonferrous, and industrial minerals also is expected to expand. Large-scale exploitation of such metallic minerals as gold and tungsten (with bismuth and fluorspar as coproducts) is expected to start between 2008 and 2009 and to add new capacity to the mining sector. Development of new large-scale production capacity of bauxite, iron ore, and nickel could be completed between 2009 and 2010, but development of new smelter capacity for aluminum may take longer because of power supply problems. The existing capacity for production of cement is expected to be expanded by more than 14 Mt/yr during the next 2 to 4 years to meet the growing demand for cement as a result of Vietnam's rapid urbanization.



Vietnam's economy is expected to continue to grow at an annual rate of 7.3% during the next 2 years. According to a forecast by the International Monetary Fund, the Vietnamese GDP is expected to grow at a rate of 7.3% in 2008 (International Monetary Fund, 2008).

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TABLE 1  
VIETNAM: PRODUCTION OF MINERAL COMMODITIES<sup>1</sup>

(Metric tons unless otherwise specified)

Commodity <sup>2</sup>	2003	2004	2005	2006	2007 <sup>c</sup>
<b>METALS</b>					
Bauxite <sup>c</sup>	20,000	20,000	25,800	30,000	30,000
Chromium ore, gross weight	91,000	82,000	5,700 <sup>r</sup>	6,500 <sup>r</sup>	6,000
Copper:					
Mine output, Cu content	1,200	1,200	1,200	5,200	11,000
Metal, refined	--	--	--	4,800	11,000
Gold kilograms	2,000 <sup>e</sup>	2,065	2,138	2,500 <sup>e</sup>	3,000
Iron and steel:					
Iron ore, Fe content <sup>c</sup>	540,000	495,000	504,700	510,000	530,000
Metal:					
Pig iron thousand metric tons	200	187	202	583 <sup>r</sup>	790
Steel, crude do.	544	689	890	1,400 <sup>r</sup>	2,000
Steel, rolled do.	2,954	3,280	3,403 <sup>r</sup>	3,827 <sup>r</sup>	4,250
Lead, mine output, Pb content <sup>c</sup>	1,100	2,750 <sup>r</sup>	3,300 <sup>r</sup>	3,500	3,500
Manganese concentrate, gross weight <sup>c</sup>	68,000	15,000	18,000	20,000	20,000
Pyrite, gross weight <sup>c</sup> thousand metric tons	450	450	500	500	500
Tin:					
Mine output, Sn content <sup>c</sup>	2,100	3,500	3,500	3,500	3,500
Metal, smelter	1,915 <sup>r</sup>	2,356 <sup>r</sup>	1,766 <sup>r</sup>	1,830 <sup>r</sup>	2,000
Titanium:					
Ilmenite concentrate, gross weight <sup>e,3</sup>	314,000 <sup>r</sup>	550,000 <sup>r</sup>	523,000 <sup>r</sup>	605,000 <sup>r</sup>	550,000
Rutile, gross weight	--	400	500	500 <sup>e</sup>	500
Zinc:					
Mine output, Zn content <sup>c</sup>	45,000	45,000	48,000 <sup>r</sup>	45,000 <sup>r</sup>	46,000
Metal, powder	--	5,000	23,000	23,000 <sup>e</sup>	23,000
Zirconium, gross weight <sup>e,4</sup>	21,300 <sup>r</sup>	39,400 <sup>r</sup>	32,500 <sup>r</sup>	26,100 <sup>r</sup>	25,000
<b>INDUSTRIAL MINERALS</b>					
Barite	81,500	101,040 <sup>r</sup>	116,000 <sup>r</sup>	120,000 <sup>r</sup>	120,000
Cement, hydraulic thousand metric tons	24,127	26,153	30,808 <sup>r</sup>	32,690 <sup>r</sup>	36,400 <sup>p</sup>
Clays, kaolin <sup>c</sup>	650,000	650,000	650,000	650,000	650,000
Fluorspar <sup>c</sup>	3,000	4,000	4,000	4,000	4,000
Graphite <sup>c</sup>	2,000	2,000	2,000	2,000	2,000
Gypsum <sup>c</sup> thousand metric tons	5,000	5,000	5,000	5,000	5,000
Lime do.	1,384	1,464	1,737 <sup>r</sup>	1,929 <sup>r</sup>	2,120
Nitrogen, N content of ammonia	79,700	216,200	220,000	230,000	300,000
Phosphate rock:					
Gross weight thousand metric tons	821	905 <sup>r</sup>	1,066	1,215 <sup>r</sup>	1,360
P <sub>2</sub> O <sub>5</sub> content <sup>c</sup> do.	246	272 <sup>r</sup>	320	365 <sup>r</sup>	390
Pyrophyllite <sup>c</sup>	30,000	30,000	30,000	30,000	30,000
Salt thousand metric tons	909	906	898 <sup>r</sup>	955 <sup>r</sup>	960
Sand and gravel do.	133,000	145,300	166,000 <sup>r</sup>	182,700 <sup>r</sup>	195,000
Silica sand <sup>c</sup> do.	170	185	190	200	200
Stone, building stone do.	139,000 <sup>r</sup>	143,000 <sup>r</sup>	184,000 <sup>r</sup>	205,400	210,000
Sulfur <sup>c</sup>	22,000	22,000	22,000	22,000	22,000
<b>MINERAL FUELS AND RELATED MATERIALS</b>					
Coal, anthracite thousand metric tons	19,314	27,349	34,093 <sup>r</sup>	38,800 <sup>r</sup>	43,200 <sup>p</sup>
Gas, natural, gross million cubic meters	3,450	6,266	6,342	6,788 <sup>r</sup>	6,820 <sup>p</sup>
Petroleum, crude thousand 42-gallon barrels	125,351 <sup>r</sup>	142,001 <sup>r</sup>	131,017 <sup>r</sup>	118,978 <sup>r</sup>	112,600 <sup>p</sup>

<sup>c</sup>Estimated; estimated data are rounded to no more than three significant digits. <sup>p</sup>Preliminary. <sup>r</sup>Revised. do. Ditto. -- Zero.

<sup>1</sup>Table includes data available through August 25, 2008.

<sup>2</sup>In addition to the commodities listed, antimony, bentonite, refractory clay, construction aggregates, gemstones, granite, graphite, lignite, marble, rare earths, silver, and tungsten were mined but not reported. Available information is inadequate to make reliable estimates of output.

<sup>3</sup>Estimated figures based on Vietnam's inferred exports of titanium ores to China, Japan, the Republic of Korea, Malaysia, and the United States.

<sup>4</sup>Estimated figures based on Vietnam inferred exports of zirconium ore to China.

TABLE 1--Continued  
VIETNAM: STRUCTURE OF THE MINERAL COMMODITIES<sup>1</sup>

Sources: Vietnam's General Statistics Office, Statistical Yearbook, 2007; British Geological Survey, World Mineral Statistics, 2002-06; World Metal Statistics, April 2008; South East Asia Iron and Steel Institute, Crude Steel Production, Annual Statistics, 2001-05; The Barytes Association, World Barytes Production 2001-05; International Lead and Zinc Study Group, Lead and Zinc Statistics, Monthly Bulletin of the International Lead and Zinc Study Group, February 2007; Copper Bulletin of the International Copper Study Group, May 2008; U.S. Geological Survey, Minerals Questionnaire, 2004-07.

TABLE 2  
VIETNAM: STRUCTURE OF THE MINERAL INDUSTRY IN 2007

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement	Chinfong Hai Phong Cement Corp. [Chingfong Group of Taiwan, 70%; Hai Phong Municipal Government, 15.56%; Vietnam National Cement Corp. (VNCC), 14.44%]	Min Duc near Hai Phong City	1,400
Do.	Morning Star Cement Ltd. [Holcim Group, 65%, and Vietnam National Cement Corp. (VNCC), 35%]	Hon Chong, Kien Giang Province	4,500
Do.	Nghi Son Cement Corp. [Taiheiyu Cement Corp., 45.5%; Mitsubishi Materials Corp. of Japan, 19.5%; Vietnam National Cement Corp. (VNCC), 35%]	Nghi Son, Thanh Hoa Province	2,150
Do.	Vietnam National Cement Corp. (VNCC) (100% state-owned)	Bim Son, But Son, Da Nang, Ha Tien I, Ha Tien II, Hai Phong, Hai Van, Hoang Mai, Hoang Thach, and Tam Diep	18,000
Chromite, gross weight	Thai Nguyen Nonferrous Metal Co. [wholly owned subsidiary of state-owned Vietnam National Minerals Corp. (VIMICO)]	Nui Nua, Thanh Hoa Province	10
Coal, anthracite	Vietnam National Coal Corp. (VINACOAL) (100% state-owned)	Cam Pha, Cao Son, Coc Sau, Vang Danh, Dong Trieu, Ha Lam, Ha Tu, Hong Gai, Khe Cham, Mao Khe, Mong Duong, Deo Nai, Cua Ong, Uong Bi in Quang Ninh Province	42,000
<b>Copper:</b>			
Concentrate, Cu content	Lao Cai Copper Complex [wholly owned subsidiary of Vietnam National Minerals Corp. (VIMICO)]	Sin Queyen, Lao Cai Province	11
Refined	Tang Loong Lao Cai Copper Smelting Enterprise [wholly owned subsidiary of Vietnam National Minerals Corp. (VIMICO)]	Tang Loong Long Commune, Bao Tang District, Lao Cai Province	11
<b>Fertilizer:</b>			
Nitrogen, ammonia	Vietnam National Chemical Corp. (100% state-owned) Phy My Nitrogenous Fertilizer and Chemical Joint Stock Corp.	Ha Bac, northern Vietnam Phu My, Ba Ria-Vung Tau Province	375
Superphosphate	do.	Lam Thao, Phu Tho Province	800
Gas, natural	million cubic meters per day VietSovPetro (a joint venture of Vietnam Oil and Gas Corp. and Zarubezhneft), and the joint venture of PetroVietnam, BP p.l.c., Oil and Natural Gas Co., and ConocoPhillips Co.	Offshore Bach Ho oilfield, Rang Dong oilfield, and Lan Tay/Lan Do gasfields	20
Gold, gold content of mine output	kilograms Bong Mieu Gold Mining Company Ltd. (Bong Mieu Holdings Ltd., 80%; Mineral Development Co., 10%; Quang Nam Mineral Joint Stock Co., 10%)	Ho Gan open pit and Nui Kem underground mines	400
Iron ore, gross weight	Thai Nguyen Iron and Steel Corp. [wholly owned subsidiary of Vietnam Steel Corp. (VSC)]	Trai Cau and Tein Bo in Thai Nguyen Province; Thach Khe in Ha Tinh Province	850
Petroleum, crude	thousand 42-gallon barrels per day VietSovPetro (a joint venture of Vietnam Oil and Gas Corp. and Zarubezhneft, a Russian oil company)	Offshore Bach Ho, Rong, Rang Dong, Ruby, Bunga Kekwa, Dai Hung, and SuTu Trang oilfields	320
Phosphate rock, gross weight	Vietnam Apatite Limited Co. (Vietnam National Chemical Corp., 100%)	Cam Duong and Tang Loong, Lao Cai Province	1,250

TABLE 2--Continued  
 VIETNAM: STRUCTURE OF THE MINERAL INDUSTRY IN 2007

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Salt	Vietnam National Salt Corp.	Nam Dinh, Nghe An, and Hai Tin Provinces	12,000
Steel, crude	Vietnam Steel Corp. (VSC)	Cai Lan, Thai Nguyen Province, and Phu My, Ba Ria-Vung Tau Province	2,000
Tin, concentrate, Sn content	Cao Bang Nonferrous Metal Co. and Nghe Tinh Nonferrous Metal Co. [wholly owned subsidiaries of state-owned Vietnam National Minerals Corp. (VIMICO)]	Pia Oac, Cao Bang Province; Quy Hop, Nghe An Province; and Tam Dao, Tuyen Quang Province	4
Refined	Thai Nguyen Nonferrous Metal Co.	Thai Nguyen, Bac Thai Province	2
Titanium, ilmenite	Bimal Minerals Co. Ltd. (Malaysia Mining Corp. and Syarikat Pendorong Sdn. Bhd., 60%, and Binh Dinh Minerals Co., 40%)	Cat Khanh, Qui Nhon, and Binh Dinh Provinces	70
Do.	Ha Tinh Minerals and Trading Co.	Cam Hoa, Ky Annh-Cam, Xuyen, Ky Khan, and Ky Ninh, Ha Tinh Province	450
Do.	Mineral Development Co. No. 4 and No. 5 [wholly owned subsidiaries of Vietnam National Minerals Corp. (VIMICO)]	Vinh City, Nghe An Province; Tuy Hoa, Dong Xuan in Phu Yen Province; and Quang Ngan, Vinh My in Thua Thien-Hu Province	50
Zinc, concentrate, Zn content	Thai Nguyen Nonferrous Metal Co. [wholly owned subsidiary of state-owned Vietnam National Minerals Corp. (VIMICO)]	Cho Dien, Bac Can Province	50
Refined	The Ta Pan Zinc-Lead Plant (a Chinese private firm, 70.2%, and Ha Giang Mineral Exploiting and Engineering Company, 29.8%)	Lung Vay, Bac Me District, Ha Giang Province	6
Do.	Thai Nguyen Zinc Refinery [wholly owned subsidiary of state-owned Vietnam National Minerals Corp. (VIMICO)]	Thai Nguyen City, Thai Nguyen Province	10