



# 2005 Minerals Yearbook

---

## VIETNAM

---

# THE MINERAL INDUSTRY OF VIETNAM

By John C. Wu

Vietnam, which is located north of the Gulf of Thailand, west of the Gulf of Tonkin and the South China Sea, east of Cambodia and Laos, and south of China in Southeast Asia, was a low-income developing country. Its per capita gross domestic product (GDP) and GDP based on purchasing power parity were estimated to be \$3,024.82 and \$251.6 billion, respectively, in 2005. The country's total area is about 329,560 square kilometers (km<sup>2</sup>), or slightly larger than the size of New Mexico. As of July 2005, Vietnam had a population of about 84.4 million (U.S. Central Intelligence Agency, 2005<sup>1</sup>; International Monetary Fund, 2006<sup>2</sup>).

Vietnam's identified mineral resources were antimony, barite, bauxite, bismuth, carbonate rocks (limestone, and marble), chromium, coal, copper, natural gas, fluorite, gemstones (ruby and sapphire), gold, graphite, iron ore, lead, manganese, nickel, crude petroleum, phosphate rock (apatite), rare earths, silica sand, silver, tin, titanium (ilmenite and rutile), tungsten, zinc, and zircon (Le, Van De, 1996; Lai Hong Thanh, 2002<sup>3</sup>; Truong Duc Chinh, 2002<sup>4</sup>). Vietnam was one of the world's leading producers of anthracite coal and one of the region's important producers of ilmenite and phosphate rock. In 2005, Vietnam ranked sixth in production of crude petroleum in the Asia and the Pacific region (Oil & Gas Journal, 2005).

With the exception of carbonate rocks, coal, and hydrocarbons, most mineral resources were largely unexploited owing to Vietnam's outdated mining equipment and technology, poor infrastructure, and uncompetitive Government policy to attract foreign investors in mining. Several foreign mining companies from Australia, Canada, and China, which had began mineral exploration projects in the northern and central parts of Vietnam in the early 1990s, discovered some economically viable deposits of bauxite, copper, fluorspar, gold, nickel, and tungsten during the past 3 years. In 2005, these foreign companies continued their exploration activities by conducting feasibility studies mainly for developing resources of bauxite, bismuth (byproduct), copper, fluorite (byproduct), gold, nickel, and tungsten. The development of gold, copper, nickel, and tungsten resources was expected to begin in the next 2 years, and development of a large-scale bauxite-alumina complex was expected to begin in the next 2 to 4 years. In 2005, Vietnam Coal and Mineral Industries Group (formerly Vietnam National Minerals Corp.) was about to complete its development of the Sin Quyen Copper Complex in Lao Cai Province and was expected to begin the production phase in the first half of 2006. Olympus Pacific Minerals Inc., which had completed development of its Bong Mieu Gold Project, started mining, milling, and processing operations in December 2005.

In 2005, Vietnam's real GDP grew by 8.4% compared with 7.7% in 2004. The higher economic growth in 2005 was the result of a 17.2% increase in industrial sector output, which

included construction, manufacturing, mining, and utilities compared with a 10.2% increase in 2004. In 2005, growth in the private industrial sector was 24.6% compared with 20% in the foreign-invested sector and 9% in the state-run sector. The country's inflation rate, however, was also higher at 8.4% compared with 7.7% in 2004 (U.S. Central Intelligence Agency, 2005<sup>5</sup>; Vietpan.com, 2006<sup>6</sup>).

The output of the mining and quarrying sector (mostly crude petroleum and natural gas production) accounted for 6.3% of Vietnam's GDP in 2004 (the latest year for which data were available). In 2004, the output value of the mining and quarrying sector at 1994 constant prices was estimated to be \$1.46 billion, and Vietnam's GDP at 1994 constant prices was estimated to be \$23 billion<sup>7</sup> (International Monetary Fund, 2006).

All minerals, which include 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 (MNRE) had taken over the management of mining activities from the Ministry of Industry in 2004. In Vietnam, all aspects of mining, which include onshore and offshore surveys, exploration, mining, and mineral-processing, are governed and administered by the Law on Minerals of 1996 (Mineral Law) and Decree No. 76/2000/ND-CP of 2000.

Vietnam's production of major mineral commodities included that of barite, chromite, coal, ilmenite, crude petroleum, phosphate rock, tin, and zinc. Most chromite, crude petroleum, and zinc concentrate was exported. Most barite and coal (anthracite) was consumed domestically, but some of the barite and coal production was exported. A Chinese-Vietnamese joint venture company began gold production at the Tan An gold mine in Bac Can Province in February 2004, and Olympus Pacific Minerals Inc. of Canada brought onstream its open pit gold mine and Vietnam's first modern gold processing plant at the Bong Mieu gold property in Quang Nam Province in central Vietnam in December 2005.

The major processed minerals produced were cement, fertilizer materials (ammonia and urea), steel, and refined tin. Cement, fertilizer materials, and steel were for domestic consumption, but some refined tin was exported to Malaysia for further refining to upgrade its tin purity to more than 99%.

In 2005, Vietnam's merchandise trade deficit was reduced by 22.4% to \$4.5 billion owing to a 21.6% increase in exports to \$32.4 billion and a smaller (15.4%) increase in imports to \$37.0 billion. In 2005, despite the large export earnings from crude petroleum, Vietnam remained a net minerals importer because of its large import bill for refined petroleum products, iron and steel products, and nonferrous metal products. The major exports of mineral commodities were crude petroleum (\$7.4

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

<sup>2</sup>Value has been converted from Vietnamese Dong (D) to U.S. dollars (US\$) at a rate of D15,745=US\$1.00 for 2004.

billion), coal (\$670 million), and tin (\$13 million). Exports of crude petroleum alone accounted for 22.7% of Vietnam's total export earnings. The major imports of mineral commodities were refined petroleum products (\$5.0 billion), iron and steel products (\$2.9 billion), nonferrous metals (\$797 million), fertilizer materials (\$641 million), and cement clinker (\$127 million). Imports of refined petroleum products and iron and steel products accounted for 13.5% and 7.9%, respectively, of Vietnam's total import bills (Ven Online, 2006a\$, c\$).

## Commodity Review

### Metals

**Bauxite and Alumina and Aluminum.**—According to Vietnam's geological agencies, the country's estimated bauxite resources, which are concentrated in the Provinces of Dak Lak, Dak Nong, Dong Nai, Kon Tum, and Lam Dong in Vietnam's central highlands, totaled about 8 billion metric tons (Gt). BHP Billiton Aluminium of Australia, which established a representative office in Hanoi, was ready to invest \$40 million in the initial exploration program to assess the feasibility of undertaking a \$1.6 billion bauxite mine and alumina refinery project in Dak Nong Province. In April 2005, BHP Billiton Aluminium reportedly encountered some difficulties in obtaining an exploration license from MNRE. Dak Nong Province reportedly has seven bauxite deposits, which include the 1-5, the Quang Son, the Gia Nghia, and four other deposits, with a preliminary bauxite ore reserves estimate of about 2.7 Gt. In 2005, the Government reportedly agreed to allow Vietnam National Coal Corp. (VINACOAL) to work on an exploration and mining project at the Gia Nghia deposit where ore reserves were estimated to be 300 million metric tons (Mt) (Vn-style.com, 2005a\$).

The state-owned Vietnam National Chemical Corp., through its affiliate, Southern Basic Chemical Co. (SBCC), was expected to undertake a \$25 million project in the Bao Loc District, Lam Dong Province. SBCC was to develop a 200-hectare complex to mine bauxite ore and to refine ore into aluminum hydroxide for water-filtering plants and into alumina for aluminum smelters. The aluminum hydroxide project in Lam Dong Province was expected to start operations by the end of 2005 with the capacity to produce 100,000 metric tons per year (t/yr) of aluminum hydroxide mostly for export to China, Japan, and the Republic of Korea (Vn-style.com, 2005b\$).

In December 2005, Aluminum Corporation of China (CHALCO) signed a memorandum of understanding (MOU) with VINACOAL for the joint development of a bauxite and alumina project in Dak Nong Province. According to the MOU, CHALCO proposed to invest about \$2 billion for the development of a bauxite mine and alumina refinery. According to CHALCO, the alumina refinery will have the capacity to produce 1.9 million metric tons per year (Mt/yr) in the first phase, and the capacity will be expanded to 4 Mt/yr in the second phase. CHALCO also proposed to conduct a feasibility study for constructing a power generation plant and an integrated aluminum smelter. However, the Vietnamese Government had not yet approved the proposal submitted by CHALCO.

CHALCO initially proposed to have the Vietnam National Minerals Corp. (VIMICO) as its partner in the joint development project, but the Vietnamese Government assigned VINACOAL to replace VIMINCO as CHALCO's partner (CNMN.com.cn, 2005\$; Platts.com, 2005\$).

**Copper.**—The state-owned Vietnam Coal and Mineral Industries Group (a company formed from the merger of two formerly state-owned companies, VINACOAL and VIMICO, on December 26, 2005), which was the investor in the complex, announced that the Sin Quyen Copper Complex in Lao Cai Province was expected to be completed and to begin commercial operations during the first half of 2006. The construction works for the mining and milling facilities was awarded to Vietnam Industrial Construction General Corporation as primary contractor. The mining and milling complex would have the capacity to mine and process between 1.1 and 1.2 Mt/yr of ore to produce 42,000 t/yr of copper concentrate at an average grade of 25% copper, more than 113,000 t/yr of iron ore concentrate, and about 20,000 t/yr of pyrite ore (sulfur) as coproducts, and gold, silver, and sulfuric acid as byproducts. The total capital investment of the project was about \$81.6 million (Vietpartners.com, 2006\$).

**Gold.**—In October 2005, Olympus Pacific Minerals Inc. of Canada completed construction of its Bong Mieu gold mine on budget and on schedule and began its gold production in December 2005 (Olympus Pacific Minerals Inc., 2005b\$, c\$). Earlier in 2004, a joint venture of Bac Can Mineral Co. and Jin Ping Steel of China reportedly announced that its gold production had begun at the Tan An gold mine in Bac Can Province (Mining Journal, 2005c).

Other foreign companies, such as Anh Kim Joint Venture Co. of Malaysia in Ea Ba Commune of Phu Yen Province, Archipelago Resources PLC of the United Kingdom in the Cam Thuy-Ba Thuoc gold district, and Kim Binh Zinc Co. Ltd. of China in Lang San Commune of Na Ri District, continued their active gold exploration in 2005.

In March 2005, Triple Plate Junction Ltd., which was owned by Triple Plate Junction Plc (TPJP) of the United Kingdom (51%) and Newmont Vietnam Pty Ltd. (49%), was granted two exploration licenses for the core area of 154 km<sup>2</sup>, which covers six identified targets at the promising Pu Sam Cap gold prospect in Lai Chau Province. These two exploration licenses reportedly were the first new exploration licenses issued by the Government of Vietnam since 2001. By September, TPJP had established an operational base in Lai Chau Province and a logistics-support network for field teams at Pu Sam Cap, reviewed existing geologic data of Pu Sam Cap, and conducted infill reconnaissance sampling (Triple Plate Junction Plc, 2005a\$, b\$).

In September 2005, Amanta Resources Ltd. of Canada reportedly had applied for exploration licenses for two gold prospecting areas at Lang Alao and Haroon in An Khe Province in Vietnam Central Highlands (Amanta Resources Ltd., 2005\$).

Olympus Pacific Minerals, which completed construction of an open pit gold mine at the Ho Gan deposit and Vietnam's first modern gold processing plant (a pilot plant) at the Bong Mieu Mines in October 2005, started gold production in December 2005. The initial mining and ore-processing operations in

December and the following 6 months would be at a rate of 500 metric tons per day (t/d) of low-grade feedstock until the plant settled in; then, the amount of higher-grade feedstock would be increased gradually to achieve the 800-t/d design capacity during the first half of 2006. As a result of a diamond-drilling program carried out in November 2004, the updated Ho Gan open pit proven and probable resource estimates increased by 29.6% to 1,111,900 metric tons (t) at a grade of 2.36 grams per metric ton (g/t) gold or about 2,622 kilograms (kg) or 84,300 troy ounces (oz) of gold, which is about 27% more than the previous estimate of 66,550 oz in 2004 (Olympus Pacific Minerals Inc., 2005a§-d§).

Olympus Pacific Minerals' 85% owned Phuoc Son gold property, which is located 90 kilometers (km) southwest of Danang in Quang Nam Province, has 34 known areas of outcropping gold mineralization; of these 34, the Dak Sa and the Northern sectors are the most advanced prospects. According to Olympus Pacific Minerals, a prefeasibility/feasibility study for developing an underground mine with pilot-scale gold production from the Bai Dat and the Bai Go deposits in the Dak Sa sector was completed by Micon International Ltd. in May 2005, the Environmental Impact Assessment (EIA) report had been approved by the MNRE in December 2004, and Olympus Pacific Minerals was anticipating Government approval of the mining license in early 2006. As of January 2004, measured and indicated mineral resource estimates for the Bai Dat and the Bai Go deposits totaled 318,000 t at a grade of 14.32 g/t and contained 4,570 kg or 147,000 oz of gold (Olympus Pacific Minerals Inc, 2005e§).

**Iron and Steel.**—Vietnam's iron ore deposits totaled about 200, according to Vietnam Government sources, and the country's estimated iron ore reserves totaled about 1.2 Gt. Of the 200 deposits, 13 have iron ore reserves of more than 1 Mt each. Most iron ore deposits in Vietnam are located in the northern part of the country and have an average ore grade of 50% iron. Iron ore mines in Vietnam were controlled by the Vietnam Mining Corp. and state-owned Vietnam Steel Corp. (VSC), which hold the right to explore and exploit iron ore. In 2005, Thai Nguyen Iron and Steel Corporation (TISCO), which was a subsidiary of VSC, operated two mines at the Trai Cau and the Tien Bo in Thai Nguyen Province. The iron ore production capacity of the Trai Cau Mine was about 300,000 t/yr, and the Tien Bo Mine had the capacity to produce about the same quantity. In 2005, VSC reportedly was negotiating with Essar Group of India to jointly explore for iron ore at the Thach Khe Mine in Ha Tinh Province. The Thach Khe Mine and the Quy Xa Mine in Lao Cai Province are two of the country's leading iron ore mines with iron ore reserves of about 544 Mt and 112 Mt, respectively (Southeast Asia Iron and Steel Institute, 2005a§).

A Chinese-Vietnamese joint venture agreement was signed in September 2004 for the development of an iron ore mine at Qui Sa (Quy Xa) and construction of a 500,000 t/yr steel billet plant in Lao Cai. The total capital investment for the two projects would be between \$240 million and \$260 million, of which between \$40 and \$60 million would be for the development of the Qui Sa Mine, and \$200 million, for the construction of a steel billet plant. The Qui Sa Mine, which has iron ore

reserves estimated to be about 120 Mt, would have the capacity to produce from 2.5 to 3 Mt/yr, of which between 1 and 1.5 Mt/yr would be exported to China in exchange for fat coal (high-volatile coal used for the manufacture of coke) and coke; 500,000 t/yr would be delivered to a steel plant in Thai Nguyen Province; and the remaining 1 Mt would go to the 500,000 t/yr steel plant to be built in Lao Cai Province. The iron ore project was scheduled to start in early 2006 with an initial production of 1.5 Mt/yr. The joint venture is owned by VSC and the Lao Cai Mineral Co. (51% combined) and by Kunming Iron and Steel Co. of Yunnan Province, China (49%), which was expected to provide capital, technology, and equipment for mine development (Chinadaily.com.cn, 2004§).

Vietnam's steel industry continued to have an imbalance between upstream (production of crude steel) and downstream (rolled steels) in 2005. Domestic crude steel production was by three subsidiaries of VSC (Danang Steel Company, Southern Steel Co., and Thai Nguyen Iron and Steel) and the Hoa Phat Company (a private billet producer). Vietnam produced about 780,000 t of crude steel in 2005. To meet the domestic requirements for steel ingot and billet in 2005, Vietnam imported 2.23 Mt of steel billet valued at \$837 million (Ven Online, 2006c§). In 2005, Vietnam consumed about 3.5 Mt of steel billet, of which 71.4% was met by imports. According to the Vietnam Steel Association (VSA), Vietnam had seven steel billet producers with combined annual capacity of about 1.5 Mt. Imports of steel billet were mainly from China, Malaysia, Russia, and Ukraine. Southern Steel and Thai Nguyen Iron and Steel, which held a combined local market share of about 40%, were two major steel billet producers that used domestic iron ore and scraps. Five other steel billet producers relied heavily on imports of higher-priced steel scrap (Southeast Asia Iron and Steel Institute, 2005b§).

According to the VSA, Vietnam imported about 200,000 t of steel scrap in 2005. Vietnam's steel scrap imports were projected to increase to 1 Mt in 2006 and to 2 Mt in 2007 because several new steel plants that use steel scraps for making steel billet were expected to be brought onstream in 2006 and 2007. In 2006, Vietnam's steel billet requirements were expected to increase to 4 Mt, domestic billet production was expected to increase to 1.5 Mt, and steel billet imports were expected to reach 2.5 Mt (Southeast Asia Iron and Steel Institute, 2006a§, b§).

To reduce import reliance on steel, VSC focused on eight projects to be implemented between 2006 and 2010 to boost steel-production capacity, especially production of those steel products currently imported. VSC planned to launch three projects in 2006 that would be completed in 2008. These projects were the second-phase expansion of Thai Nguyen Iron and Steel to raise steel billet production capacity by an additional 500,000 to 800,000 t/yr; the initial production of 1.5 Mt/yr of iron ore at Qui Sa in Lao Cai Province by the joint venture of Qui Sa (Quy Xa) Mine Exploitation Company and China's Kunming Iron and Steel Co.; and the production by the same joint venture of between 1.5 and 2 Mt/yr of hot-rolled coil and plate at a plant to be located in the south in Ba Ria-Vung Tau Province (Southeast Asia Iron and Steel Institute, 2006c§).

According to the VSA, Vietnam's steel consumption was projected to grow by 10% in 2006. Vietnam's demand for



finished steel products was estimated to be 6.1 Mt in 2005 compared with 5.7 Mt in 2004. For the first 11 months of 2005, long products (for construction) produced by VSA members totaled 2.35 Mt, and that of non-VSA members, about 500,000 t. For the first 11 months of 2005, imports of finished steel products (mostly flat products) totaled 2.5 Mt (Southeast Asia Iron and Steel Institute, 2005c§). In 2005, imports of steel (excluding steel billet) totaled 3.3 Mt valued at \$2.1 billion. The major suppliers of steel to Vietnam were, in decreasing order, China, Japan, Russia, Taiwan, the Republic of Korea, Thailand, Malaysia, and Ukraine (Ven Online, 2006b§, c§).

**Nickel.**—Asian Mineral Resources Ltd. (AMR) of New Zealand, completed a feasibility study in 2005 for the development of copper and nickel at its 90% owned Ban Phuc Nickel property in the 150-km<sup>2</sup> Ta Khoa concession, which is located about 180 km west of Hanoi in the Province of Son La. The study was completed by a group of consultants led by Ausenco Ltd. The feasibility study supported the development of a 200,000-t/yr underground mining operation and conventional sulfide flotation plant to produce about 4,000 t/yr of nickel and 2,000 t/yr of copper in a bulk concentrate. Under the base case mine plan, the mine was expected to produce 21,201 t of nickel and 9,915 t of copper in concentrate during the 5.25-year mine life. The preliminary startup capital cost estimate for the project was \$33.6 million inclusive of contingencies.

The updated massive sulfide vein resources at the Ban Phuc nickel property included 0.61 Mt of measured resources at grades of 2.66% nickel, 1.09% copper, and 0.09% cobalt; indicated resources of 0.62 Mt at grades of 2.88% nickel, 1.16% copper, and 0.09% cobalt; and inferred resources of 0.26 Mt at grades of 2.43% nickel, 1.16% copper, and 0.09% cobalt. The estimated total massive sulfide vein resources, which included only measures and indicated estimates at a 0.4% nickel cutoff grade, were 1.23 Mt at grades of 2.77% nickel, 1.13% copper, and 0.09% cobalt. The updated massive sulfide vein reserves at the Ban Phuc nickel property included 0.46 Mt of proven reserves at head grades of 2.5% nickel and 1.0% copper and 0.55 Mt of probable reserves at head grades of 2.3% nickel and 1.0% copper. The estimated total massive sulfide vein reserves were 1.01 Mt at head grades of 2.4% nickel and 1.0% copper (Asian Mineral Resources Ltd., 2005§).

According to AMR, the company expected that a mining license for the mine development of the Ban Phuc property could be approved by the Vietnamese Mineral Resources Evaluation Council of the MNRE by mid-2006, which would allow production to start in 2007. In July 2005, AMR signed an agreement with state-owned Mineral Development Co. Ltd. to purchase an additional 20% equity interest and increased AMR's holding in the Ban Phuc project to 90%. The remaining 10% interest was held by Son La Engineering and Construction Co. Ltd., which was owned by the Son La Provincial Government (Mining Journal, 2005a, b).

**Titanium, Ilmenite.**—Estimated production of ilmenite held steady within a narrow range of from 180,000 t to 200,000 t during the past 5 years. In 2005, about 156,000 t of ilmenite was exported to Japan. According to Xinhua News Agency of China, Vietnam was planning to cease exports of ilmenite with titanium dioxide content of from 53% to 57% beginning in

2008. According to Vietnam News Brief Service, Vietnamese enterprises are not allowed to export raw materials, which included ilmenite, rutile, and zircon. Under a regulation announced and published by the Ministry of Industry in August 2005 as a guide for minerals exports during 2005 to 2010, local enterprises are allowed to export only processed minerals that meet Vietnam Laboratory Accreditation Scheme (VILAS) standards and must abide by export regulations for each type of mineral. Contracts for the exports of raw materials signed before the enforcement of this regulation were allowed to continue until September 20, 2005 (Tzmi.com, 2005a§, b§).

The Government of Vietnam had approved a \$25 million project proposed by Altair Nanotechnologies Inc. in 2004 to produce, process, and export titanium oxide pigment. Lidisco, which is a subsidiary of Vietnam Mineral Resource Department, was to develop the project, which would be capable of producing about 10,000 t/yr of titanium oxide pigment. Altair reportedly had an agreement with Avirco USA, LLC to evaluate Altair's technology for the project. Under the project plan, Altair would select an engineering and construction management contractor to design and manage the construction of operational modular facilities for the production of titanium oxide pigment using Altair's patented process. The new facilities would have an initial capacity of 5,000 t/yr and would later expand to 10,000 t/yr or more for export (Industrial Minerals, 2004).

**Tungsten.**—In 2005, Tiberon Minerals Ltd. of Canada made significant progress toward the development of its 77.5% owned Nui Phao tungsten/fluorspar project, which is located about 80 km north of Hanoi in Thai Nguyen Province.

In January 2005, Tiberon Minerals, through Aker Kvaerner Canada Inc., completed an interim feasibility study. The study confirmed that the development would be economical and have a low operating cost. The capital cost, however, increased to \$211 million from the \$140 million estimated under a prefeasibility study conducted by a group of consultants led by AMEC E&C Services Ltd. of Canada in 2003. The plan under this interim feasibility study calls for production of 4,319 t/yr of tungsten trioxide, 222,680 t/yr of fluorite, 5,531 t/yr of copper, 912 t/yr of bismuth, and about 95 kilograms per year (kg/yr) or 2,950 troy ounces per year (oz/yr) of gold. The 2003 prefeasibility study proposed production of 6,000 t/yr of tungsten trioxide, 196,000 t/yr of fluorite, 5,600 t/yr of copper, 360 t/yr of bismuth, and about 156 kg/yr or 5,000 oz/yr of gold. Proven and probable reserves at Nui Phao were 53.1 Mt at grades of 0.21% tungsten trioxide, 8.34% fluorite, 0.19% copper, 0.10% bismuth, and 0.21 g/t gold (Tiberon Minerals Ltd., 2003§, 2005d§).

In March 2005, Tiberon Minerals received approval of the environmental impact assessment (EIA) report for its Nui Phao tungsten/fluorspar deposit by the Government of Vietnam. Three months after the approval of the EIA report, a mining license was officially granted by the Government to Tiberon Minerals to develop and mine the Nui Phao tungsten/fluorspar deposit (Tiberon Minerals Ltd., 2005e§, f§).

In May 2005, Tiberon Minerals announced that it had signed two tungsten offtake contracts with OSRAM Sylvania of the United States. Under terms of the initial (base) contract, OSRAM Sylvania agreed to purchase about 44% of Nui Phao's projected tungsten concentrate output for a minimum of 5 years

with an option to increase its offtake to 100%, subject to certain conditions. Should both the base contract and option be fully exercised, the agreement would cover 15 years and be worth about \$1.2 billion in tungsten revenue to the Nui Phao project based on the prevailing ammonium paratungstate prices. In 2005, Tiberon Mineral also signed another offtake contract with OSRAM Bruntal spol, s.r.o. of the Czech Republic. The terms of the contract with Bruntal, however, were not disclosed (Tiberon Minerals Ltd., 2005c§).

In July 2005, Tiberon Minerals announced the completion of its final feasibility study report, which was conducted and prepared by Aker Kvaerner. The study concluded that an open pit mine with total capital costs of \$229.8 million could produce a total of about 76,000 t of tungsten trioxide, 3.5 Mt of acid-grade fluorite, 90,000 t of copper, 32,000 t of bismuth, and 1,150 kg or 37,000 oz of gold over a 16.3-year mine life, generating a 23.6% after-tax internal rate of return, assuming that project financing was based on a 75:25 debt-to-equity ratio. The updated ore reserve estimate at Nui Phao was 55.7 Mt at grades of 0.21% tungsten trioxide, 8.13% fluorite, 0.19% copper, 0.09% bismuth, and 0.21 g/t gold (Tiberon Minerals Ltd., 2005a§).

In August 2005, Tiberon Minerals announced that it had successfully completed (secured) the Canadian \$80 million (US\$65 million) equity portion financing package for the development activities at the Nui Phao Project. The company was expected to complete the debt portion of the overall project financing by early 2006 and to be on track to meet its projected initial startup in the fourth quarter of 2007; commercial production was expected to begin in early 2008 (Mining Journal, 2005c; Tiberon Minerals Ltd., 2005b§).

### *Industrial Minerals*

**Cement.**—According to the Ministry of Construction, Vietnam's cement production increased by more than 14.5% to 29 Mt in 2005 because of the continued growth in the industry's capacity and strong domestic demand for cement for major infrastructure, private housing, and office building projects. Cement consumption increased by more than 14% to 29.5 Mt in 2005 and was projected to be more than 30 Mt in 2006; it was expected to continue to grow by between 10% and 12% per year and to reach 48 Mt in 2010. According to Vietnam's General Department of Customs, Vietnam imports of clinker increased by 12.7% to 4.35 Mt valued at \$126.67 million in 2005. According to the Ministry of Construction's forecast, the Vietnamese cement industry was expected to import about 5 Mt of clinker in 2006 (Cementchina.net, 2006§; Ven Online, 2006b§, c§).

Vietnam's cement industry, which had 13 reverter-furnace (rotary kiln) cement plants, 53 blast-furnace (vertical or shaft kiln) cement plants, and 33 cement-grinding plants, was projected to produce 32.5 Mt of cement in 2006, of which the state-owned Vietnam National Cement Corp. (VNCC) was projected to produce 13.3 Mt; foreign-invested companies, 10 Mt; and domestic private producers, 9.2 Mt in 2006 (Aggregate Research.com, 2006§).

During 2005, VNCC reportedly was working on eight projects to build five new cement plants and to install three new

production lines. The new cement plants are the Binh Phuoc cement plant in Binh Phuoc Province; the Ha Tien II-2 cement plant in Kien Giang Province; and the Cam Pha, the Ha Long, and the Thang Long cement plants in Quang Ninh Province. The new production lines would be installed at the Hoang Thach plant in Hai Duong Province, the Bim Son plant in Thanh Hoa Province, and the But Son plant in Ha Nam Province. These eight new projects would add 14.8 Mt/yr to VNCC's existing 18-Mt/yr capacity (table 2). According to an estimate by the Ministry of Construction, the eight cement projects would cost at least \$1.4 billion in investment capital (Vietpartners.com, 2005§).

In June 2005, Vietnam Construction Import-Export Corporation (VINACONEX) started construction work on one of the country's major integrated cement plants in the town of Cam Pha. The Cam Pha cement plant would have a design capacity of 1.89 Mt/yr of clinker and 2.3 Mt/yr of portland cement. The total capital cost of the project was estimated to be \$301.9 million (D4.74 trillion). To finance the project, VINACONEX signed a \$98.2 million (€76 million) credit agreement with three foreign banks for the procurement of equipment for the cement plant. Under the agreement reached between VINACONEX, the Japan Bank of International Cooperation (JBIC), and the two French banks, Societe Generale (SG) and BNP Paribas, the Vietnamese partners would buy equipment worth \$46.5 million (€36 million) from Japan's Kawasaki group via JBIC and would import equipment worth \$51.7 million (€40 million) from ABB Ltd. of Switzerland and FAM Magdeburger Förderanlagen und Baumaschinen GmbH, Haver & Boecker Drahtweberei und Maschinenfabrik, and Leosche GmbH of Germany via SG and BNP Parisbas banks for the Cam Pha cement plant. According to VINACONEX, the Cam Pha grinding station would start operation by April 2006 (Asia Times Online, 2005§; Cemenchina.net, 2005§).

Another announced major cement project to be undertaken between 2005 and 2008 was construction of a new production line by Nghi Son Cement Corp. [a foreign-invested joint venture of Taiheiyō Cement Corp. (45.5%), VNCC (35%), and Mitsubishi Materials Corporation (19.5%)] to double the existing capacity of 2.15 Mt/yr to 4.3 Mt/yr by 2008. The Government reportedly had issued an investment permit on the planned investment of \$240 million, and construction of the second production line was to begin in late 2005. When the construction is completed in 2008, Nghi Son cement plant would be Vietnam's largest (in terms of production capacity) cement plant (Mitsubishi Materials Corporation, 2005§).

### *Mineral Fuels*

**Coal.**—The Vietnamese coal industry continued the 2004 robust growth path with coal production and coal exports at a record-high level in 2005 owing to a dramatic expansion in coal production capacity and the stronger coal demand in the domestic and overseas markets, especially in China, Japan, and Thailand. Coal production reached a record-high level of 32.8 Mt in 2005 compared with 27.3 Mt in 2004, and coal exports jumped by 55% to a record-high level of 18.0 Mt compared with 11.6 Mt in 2004. In 2005, Vietnam was one of the world's

leading anthracite coal exporters and accounted for 13% of the world market (Coal Prep e-Informer, 2006§; Ven Online, 2006d§).

In 2005, the Government reported that the coal sector reached its 2005 target before the year's end. The coal sector had set a coal production target of 40 to 50 Mt by 2010 and the Red River Delta would become the primary source of coal. During the first 11 months of 2005, the industry produced more than 31.3 Mt of coal, which was 5% higher than the 2005 target and 27% more than that of the same period in 2004. Of the 31.3 Mt produced, 27.5 Mt was clean coal, which was 21% more than that of the same period in 2004. During the first 11 months, the coal industry sold more than 26.5 Mt, of which 12.8 Mt was exported and 13.7 Mt was sold in the domestic market. The state-owned VINACOAL estimated that the company would sell 29.5 Mt of coal in 2005, of which 15.3 Mt would be for domestic consumption and 14.2 Mt would be exported (Vietpan.com, 2005a§; Vietnam Economic News, 2006§).

The growth in coal demand for the generation of electricity continued to fuel the overall domestic demand for coal in 2005. The cement and fertilizer industries were two other major consumers in the domestic coal market. According to the Electricity of Vietnam (EVN), EVN planned to build a total of 52 powerplants, of which 42 would be hydroelectric plants; 6, coal-fired thermal powerplants; and 4, gas-fed plants during 2006-10. VINACOAL also planned to build eight coal-fired thermal powerplants with a total capacity of 2,900 megawatts (MW) by 2010. By 2010, the total coal-fired power generation capacity was expected to grow more than twofold to more than 4,100 MW, and more than 16 Mt of coal was expected to be consumed by coal power stations by 2020. According to a forecast by EVN, coal-fired powerplants accounted for between 13% and 15% of Vietnam's total power output in 2005, and this percentage share was expected to increase to 25% by 2010 (Vietnam Economy, 2005a§; Coal Prep e-Informer, 2006§).

In 2005, VINACOAL controlled most of the mining, distribution, and export of coal. Most of the coal produced in Vietnam was anthracite mainly from Quang Ninh Province in northeastern Vietnam. Under VINACOAL's expansion program, which was announced in 2003, it planned to open six open pit coal (anthracite coal) mines at Khe Cham in Quang Ninh Province during the 2004-10 time period. The Khe Cham No. 1 Mine (600,000-t/yr capacity) was opened in 2004, the Khe Cham No. 2 Mine was scheduled to open in 2007 with capacity to reach 1.2 Mt/yr by 2009, the Khe Cham No. 3 Mine (1.5 Mt/yr) will open by 2010; the Khe Cham No. 4 Mine (1.5 Mt/yr) opened in 2003. Other major coal mines were located in the areas of Cam Pha, Cao Son, Coc Sau, Deo Nai, Dong Trieu, Ha Tu, Hong Gai, the Mao Khe, Mong Duong, and Uong Bi. Production of brown coal was mainly from the Na Duong Mine, which is located in the Province of Lang Son. VINACOAL's three main coal preparation (processing) plants were located in Cam Pha, Hong Gai, and Uong Bi and had a total combined design capacity of 6 Mt/yr. VINACOAL also controlled three main coal terminals at Cua Ong in Cam Pha, Dien Cong in Uong Bi, and Nam Cau Trang in Hon Gai.

In December 2005, VINACOAL reportedly was in talks with Kuzbassproservice, which is a Russian Industrial Service

company, to cooperate in a coal exploration and development project in the Red River region. The Russian firm exhibited machinery and equipment for mining and tunnel construction at an international fair for the power, mining, and metal processing industries in Hanoi in 2005 (Vietpan.com, 2005b§).

In 2005, according to Government trade statistics, Vietnam's coal exports totaled 17,986,463 t, of which about 44% went to China, and 14%, to Japan. Other main buyers of Vietnamese coal were the Republic of Korea and Thailand (Ven Online, 2006a§).

**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 associated gas from the offshore Lan Tay and Lan-Do gasfields in the Nam Con Son Basin. In 2005, natural gas production increased slightly to 6.34 billion cubic meters and averaged about 17.12 million cubic meters per day (Danmarks Ambassade Vietnam, 2006§; Ven Online, 2006e§). In April 2005, state-owned PetroVietnam announced that its subsidiary PetroVietnam Investment and Development Company discovered a gasfield at the Dong Quang D-1X well in the Hon River (Red River) basin. Three of the four newly drilled holes were 1,650 meters deep and were estimated to be able to produce between 30,000 and 35,000 cubic meters per day of natural gas. The natural gas production from the well was delivered to several ceramic and glass plants at the Tien Hai Industrial Park in Thai Binh Province.

In the domestic market, natural gas was consumed as fuel by powerplants and as raw materials by a nitrogen fertilizer plant in the Phu My Industrial Zone in the Province of Ba Ria-Vung Tau; the remainder was consumed as raw materials by the liquefied-petroleum-gas (LPG)- and condensate-processing plants at Dinh Co for the production of LPG and gasoline in Vung Tau in the Province of Ba Ria-Vung Tau. In April 2005, the Phu My power center, whose capacity of 3,859 MW was equivalent to 40% of the national grid's designed capacity, was inaugurated in the Tan Thanh District of Ba Ria-Vung Tau Province in southern Vietnam. The center, which was the country's largest in terms of capacity, supplied more than 23 billion kilowatthours per year and consumed more than 4.1 billion cubic meters of natural gas. The Phu My power center has a total of six powerplants. Two of these powerplants (Phu My 3 and Phu My 2.2, which had a combined capacity of 1,435 MW) were built by foreign investors under a build-operate-transfer scheme, and four of them (Phu My 1, Phu My 2.1, extended Phu My 2.1, and Phu My, which had a combined capacity of 2,424 MW) were built by EVN (Vietnam Economy, 2005a§, b§).

Crude petroleum was produced by PetroVietnam in joint venture with partners from Canada, France, Japan, Malaysia, Russia, Sweden, and the United States. In 2005, Vietnam's crude petroleum production decreased to 18.5 Mt, or by an average of 371,500 barrels per day (bbl/d), from 20.17 Mt, or by an average of 391,400 bbl/d, in 2004. The country exported about 18 Mt



of its crude petroleum output and earned \$7.4 billion of foreign currency in 2005. The major buyers of Vietnam crude petroleum were China, Japan, Malaysia, Singapore, and the United States in 2005 (Thanhnien News, 2006§; Ven Online, 2006a§; Vietnam Economy, 2006§).

In 2005, crude petroleum was produced from the Bach Ho, the Rang Dong, the Rong, the Ruby, and the Su Tu Den (Black 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.

Construction of Vietnam's much-delayed first oil refinery—the Dung Quat oil refinery, which is located about 850 km south of Hanoi in Quang Nam Province—finally began in November 2005. The groundbreaking ceremony for the construction was held on November 28, 2005. The \$2.5 billion project involves an oil refinery, a pipeline that connects to a port in the coastal area, and storage facilities. According to PetroVietnam, the refinery was designed to process 6.5 Mt/yr or 130,000 bbl/d of crude petroleum. The plant was expected to be completed in 44 months. Technip Group of France led an international consortium of contractors, which included JGC Corporation of Japan and Tecnicas Reunidas of Spain, to construct the oil refinery (Embassy of Vietnam in the United States, 2005§).

## Outlook

For the next 4 to 5 years, the country's mining sector will continue to be dominated by the coal and oil and gas industries. In the energy sector, the coal and oil and gas industries are expected to expand their capacity during the next 2 to 4 years. The mining sector for ferrous, nonferrous, and industrial minerals also is expected to expand. Exploitation of such nonferrous minerals as copper, gold, and zinc is expected to start between 2006 and 2007 and to add new capacity to the mining sector. Development of new capacity for the production of fluorspar, iron ore, nickel, and tungsten could be completed between 2007 and 2008, but development of new capacity for alumina and bauxite may take longer. The existing capacity for production of cement is expected to be expanded by more than 14 Mt/yr during the next 3 to 5 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 a rate of slightly less than 7.5% during the next 2 years. According to a forecast by the International Monetary Fund, the Vietnamese GDP is estimated to grow at a rate of 7.4% in 2006 and 2007 (International Monetary Fund, 2006§).

## References Cited

- Industrial Minerals, 2004, Vietnamese Government approves project to produce TiO<sub>2</sub>—News at the Core/Market monitor: Industrial Minerals, April, p. 31.
- International Monetary Fund, 2006, Vietnam—Statistical appendix: International Monetary Fund, Country Report No. 06/52, February, p. 6.
- Le, Van De, 1996, A summary of mineral resources and some ideas on mineral development of Vietnam: Project and Resources, v. 1, no. 1, March, p. 2.
- Mining Journal, 2005a, Asian mineral resources—Focused on nickel, *in* Vietnam, Mining Journal special publication: Mining Journal, October, p. 6.
- Mining Journal, 2005b, Ban Phuc encouragement for Asian Mineral: Mining Journal, November 18, p. 9.

- Mining Journal, 2005c, Vietnam—Opportunities abound: Mining Journal, December 22, p. 26.
- Oil & Gas Journal, 2005, Worldwide look at reserves and production: Oil & Gas Journal, v. 103, no. 47, December 19, p. 24-25.

## Internet References Cited

- Aggregate Research.com, 2006 (February 11), Cement industry to grind out 32.5 Mt in 2006, accessed February 14, 2006, at URL <http://www.aggregate-research.com/extarticle.asp?id=7869>.
- Amanta Resources Ltd., 2005 (September 22), Amanta applies for exploration license for Vietnam gold prospects, News Release, accessed February 15, 2006, at URL <http://www.amantaresources.com/2005-09-22.htm>.
- Asian Mineral Resources Ltd., 2005 (November 14), Ban Phuc Nickel project feasibility study completed, Press Release, accessed May 18, 2006, at URL <http://www.asianminres.com/news/news.php?action=showSingle&id=49>.
- Asia Times Online, 2005, Southeast Asia—Vietnam plant to be built with foreign credit, accessed March 29, 2005, at URL [http://www.atimes.com/atimes/Southeast\\_Asia/GC30Ae04.htm](http://www.atimes.com/atimes/Southeast_Asia/GC30Ae04.htm).
- Cementchina.net, 2005, Vietnam Vinaconex to build Cam Pha cement plant, accessed April 11, 2006, at URL <http://www.cementchina.net/news/shownews.asp?id=1081>.
- Cementchina.net, 2006, Vietnam—Cement industry to grind out 32.5 million tons in 2006, accessed April 11, 2006, at URL <http://www.cementchina.net/news/shownews.asp?id=1533>.
- Chinadaily.com.cn, 2004, Vietnam, China join hands to explore iron ore, accessed May 16, 2006, at URL [http://www.chinadaily.com.cn/english/doc/2004-08/09/content\\_363595.htm](http://www.chinadaily.com.cn/english/doc/2004-08/09/content_363595.htm).
- CNMN.com.cn, 2005 (December), Chalco and Vinacoal to cooperate for building a plant in Vietnam, Company News, accessed January 4, 2006, at URL [http://www.cnmn.com.cn/News/news\\_detail\\_f.asp?id=86334&ys=2299](http://www.cnmn.com.cn/News/news_detail_f.asp?id=86334&ys=2299).
- Coal Prep e-Informer, 2006 (February 22), Market Brief Vietnam—Business opportunities in the coal fired power plant sector in Vietnam, accessed April 11, 2006, at URL <http://coalaggpreps.com/e-Informer/Issue13/vietnam.html>.
- Danmarks Ambassade Vietnam, 2006, Vietnams Olie og gas, Eksporttradegiving, accessed May 24, 2006, at URL <http://www.ambhanoi.um.dk/da/menu/Eksportraadgivning/Markedsmuligheder/Sektoranalyser/IndustriOgMaskiner/Olie+og+Gas>.
- Embassy of Vietnam in the United States, 2005, Work on Vietnam's first refinery to begin finally, News, accessed April 17, 2006, via URL <http://vietnamembassy-usa.org>.
- International Monetary Fund, 2006 (April), Vietnam, World Economic Outlook Database, accessed April 26, 2006, via URL <http://www.imf.org/external/pubs/ft/weo/2006/01/data/dbcouthm.cfm>.
- Lai Hong Thanh, 2002, Some issues on small and medium scale mining in Vietnam, accessed July 23, 2003, via URL <http://www.gemeed.org/medios/pdf/vietnamaustra.pdf>.
- Mitsubishi Materials Corporation, 2005 (May 30), Nghi Son Cement Corporation to add second production line, News, accessed February 13, 2006, at URL <http://www.mmc.co.jp/english/news/news20050530.html>.
- Olympus Pacific Minerals Inc., 2005a, Bong Mieu gold property—Ho Gan deposit, accessed May 3, 2006, via URL <http://www.olympuspacific.com/s/BongMieu.asp?ReportID=83147>.
- Olympus Pacific Minerals Inc., 2005b (December 8), Olympus' Bong Mieu gold mine commences production, News Release, accessed May 3, 2006, via URL <http://www.olympuspacific.com/s/NewsReleases.asp?>
- Olympus Pacific Minerals Inc., 2005c (October 27), Olympus commissions modern gold plant, News Release, accessed May 3, 2006, via URL <http://www.olympuspacific.com/s/NewsReleases.asp?>
- Olympus Pacific Minerals Inc., 2005d (March 23), Olympus Pacific—Bong Mieu update—Drilling increases Ho Gan resources estimates, News Release, accessed May 16, 2006, via URL <http://www.olympuspacific.com/s/NewsReleases.asp?>
- Olympus Pacific Minerals Inc., 2005e (May 18), Olympus Pacific—Independent positive preliminary assessment study for Dak Sa deposits received, News Release, accessed May 16, 2006, via URL <http://www.olympuspacific.com/s/NewsReleases.asp?>
- Platts.com, 2005 (December), Chalco signs MOU for joint development of Vietnam alumina project, accessed December 16, 2005, at URL <http://www.platts.com/Metals/News/9373022.xml?S=n>.



- Southeast Asia Iron and Steel Institute, 2005a (October 7), Vietnam's iron ore attracts foreign interest, SEAIISI Newsletter, accessed May 16, 2006, at URL [http://www.seaisi.org/newsletter/article\\_view.asp?article\\_id=2103](http://www.seaisi.org/newsletter/article_view.asp?article_id=2103).
- Southeast Asia Iron and Steel Institute, 2005b (April 1, 2005), Vietnam's steel billet imports to slightly rise this year, SEAIISI Newsletter, accessed May 16, 2006, at URL [http://www.seaisi.org/newsletter/article\\_view.asp?article\\_id=1901](http://www.seaisi.org/newsletter/article_view.asp?article_id=1901).
- Southeast Asia Iron and Steel Institute, 2005c (December 9), Vietnam's steel consumption growing by around 10%, SEAIISI Newsletter, accessed May 16, 2006, at URL [http://www.seaisi.org/newsletter/article\\_view.asp?article\\_id=2174](http://www.seaisi.org/newsletter/article_view.asp?article_id=2174).
- Southeast Asia Iron and Steel Institute, 2006a (March 14), Vietnam to import more steel billets, SEAIISI Newsletter, accessed April 12, 2006, at URL [http://www.seaisi.org/newsletter/article\\_view.asp?article\\_id=2273](http://www.seaisi.org/newsletter/article_view.asp?article_id=2273).
- Southeast Asia Iron and Steel Institute, 2006b (February 16), Vietnam to import more steel scraps, SEAIISI Newsletter, accessed April 12, 2006, at URL [http://www.seaisi.org/newsletter/article\\_view.asp?article\\_id=2247](http://www.seaisi.org/newsletter/article_view.asp?article_id=2247).
- Southeast Asia Iron and Steel Institute, 2006c (January 9), Vietnam Steel lines up projects to boost steel capacity, SEAIISI Newsletter, accessed April 12, 2006, at URL [http://www.seaisi.org/newsletter/article\\_view.asp?article\\_id=2208](http://www.seaisi.org/newsletter/article_view.asp?article_id=2208).
- Thanhnhien News, 2006, Vietnam sees December crude output down 5.3% from November level, accessed April 12, 2006, at URL <http://www.thanhnhiennews.com/view.php?catid=2&newssid=11560>.
- Tiberon Minerals Ltd., 2003 (January 15), Tiberon releases Nui Phao prefeasibility study results, Press Release 03-02, accessed July 19, 2004, via URL <http://www.tiberon.com/pressreleases.html>.
- Tiberon Minerals Ltd., 2005a (July 12), Nui Phao final feasibility study shows significant economic improvement, Press Release, accessed May 18, 2006, via URL <http://www.tiberon.com/pressreleases.html>.
- Tiberon Minerals Ltd., 2005b, Nui Phao overview, accessed April 12, 2006, at URL <http://www.tiberon.com/nuiphaooverview.html>.
- Tiberon Minerals Ltd., 2005c (May 17), Tiberon and Osram Sylvania sign tungsten offtake contract, Press Release, accessed May 22, 2006, via URL <http://www.tiberon.com/pressreleases.html>.
- Tiberon Minerals Ltd., 2005d (January 13), Tiberon announces positive interim feasibility study for Nui Phao, Press Release 05-01, accessed June 15, 2005, via URL <http://www.tiberon.com/pressreleases.html>.
- Tiberon Minerals Ltd. 2005e (June 30), Tiberon granted long-term mining license for Nui Phao project in Vietnam, Press Release 05-10, accessed May 18, 2006, via URL <http://www.tiberon.com/pressreleases.html>.
- Tiberon Minerals Ltd., 2005f (March 1), Tiberon received approval of Nui Phao Mine environmental impact assessment, Press Release 05-03, accessed May 6, 2005, via URL <http://www.tiberon.com/pressreleases.html>.
- Triple Plate Junction Plc, 2005a (March 28), Granting of Vietnamese licenses, News, accessed May 22, 2006, at URL <http://www.tpjunction.com/news.php?newsId=14>.
- Triple Plate Junction Plc, 2005b (November 25), Interim results for the six months ended 30 September 2005, accessed May 22, 2006, at URL <http://www.tpjunction.com/news.php?newsId=21>.
- Truong Duc Chinh, 2002, VIMICO before WTO agreement implementation—Opportunities and challenges, accessed July 23, 2003, via URL <http://www.kdischool.ac.kr/international/2002/40%vietnam/industryreports.html>.
- Tzmi.com, 2005a (August 12), Vietnamese enterprises, News Bulletin, accessed April 13, 2006, via URL <http://www.tzmi.com/news/archive.cfm>.
- Tzmi.com, 2005b (March 16), Vietnam, News Bulletin, accessed April 13, 2006, via URL <http://www.tzmi.com/archive.cfm>.
- U.S. Central Intelligence Agency, 2005, Vietnam, World Factbook 2005, accessed April 17, 2006, at URL <http://www.coci.gov/cia/publications/factbook/geos/vm.html>.
- Ven Online, 2006a, Export statistics in 2005, Trade, accessed May 9, 2006, at URL [http://www.ven.org.vn/view\\_news.php?id=6840](http://www.ven.org.vn/view_news.php?id=6840).
- Ven Online, 2006b, Imports in 2005, Trade, accessed May 9, 2006, at URL [http://www.ven.org.vn/view\\_news.php?id=6944](http://www.ven.org.vn/view_news.php?id=6944).
- Ven Online, 2006c, Import statistics in 2005, Trade, accessed May 9, 2006, at URL [http://www.ven.org.vn/view\\_news.php?id=6839](http://www.ven.org.vn/view_news.php?id=6839).
- Ven Online, 2006d, Many exports exceed 2010 goals, accessed April 20, 2006, at URL [http://www.ven.org.vn/view\\_news.php?id=6303](http://www.ven.org.vn/view_news.php?id=6303).
- Ven Online, 2006e, Securing energy for our future, accessed April 11, 2006, at URL [http://www.ven.org.vn/view\\_news.php?id=6393](http://www.ven.org.vn/view_news.php?id=6393).
- Vietnam Economic News, 2006 (February 14), Coal fueling Vietnam's future, accessed February 14, 2006, at URL [http://www.ven.org.vn/view\\_news.php?id=6242](http://www.ven.org.vn/view_news.php?id=6242).
- Vietnam Economy, 2005a (February 15), US\$13.8 billion to be invested in power plants, accessed April 25, 2005, at URL [http://www.vneconomy.com.vn/eng/article\\_to\\_print.php?id=050215095217](http://www.vneconomy.com.vn/eng/article_to_print.php?id=050215095217).
- Vietnam Economy, 2005b (April 8), Vietnam's largest power center to be inaugurated, accessed April 25, 2005, at URL [http://www.vneconomy.com.vn/eng/article\\_to\\_print.php?id=050408095250](http://www.vneconomy.com.vn/eng/article_to_print.php?id=050408095250).
- Vietnam Economy, 2006 (April 13), Industries—Oil and gas, accessed April 17, 2006, at URL <http://www.vneconomy.com.vn/eng/index.php?param=article&catid=0604&id=78c8c1a35b1a38>.
- Vietpan.com, 2005a (December 16), Coal industry target \$1.3 billion revenues in 2005, accessed January 19, 2006, at URL [http://vietpan.com/categories/\\_e/8/a\\_detail.php?a\\_id=15716&lang=\\_e](http://vietpan.com/categories/_e/8/a_detail.php?a_id=15716&lang=_e).
- Vietpan.com, 2005b, Russian firm seeks to cooperate with Vinacoal, accessed January 19, 2006, at URL [http://vietpan.com/categories/\\_e/8/a\\_detail.php?id=14985&lang=\\_e](http://vietpan.com/categories/_e/8/a_detail.php?id=14985&lang=_e).
- Vietpan.com, 2006, Top ten economic events in Vietnam in 2005, Industry-Investment, News Online, accessed January 19, 2006, at URL [http://vietpan.com/categories/\\_e/8/a\\_detail.php?a\\_id=17479&lang=\\_e](http://vietpan.com/categories/_e/8/a_detail.php?a_id=17479&lang=_e).
- Vietpartners.com, 2005, Eight cement plants to come on line in 2005, accessed June 16, 2005, at URL <http://www.vietpartners.com/showdetailnews.asp?OD=413>.
- Vietpartners.com, 2006, Operation of Sin Quyen Copper Complex to start in fourth quarter, accessed April 12, 2006, at URL <http://www.vietpartners.com/showdetailnews.asp?ID=570>.
- VN-style.com, 2005a (April 18), Mega BHP plan hits new snag, Daily News on Trade, Investment, Finance, Banking and Economy in Vietnam, accessed April 28, 2005, at URL <http://www.vn-style.com/print.asp?ID=22144>.
- VN-style.com, 2005b (April 12), \$25 million bauxite processing project in the pipeline, Daily News on Trade, Investment, Finance, Banking and Economy in Vietnam, accessed April 28, 2005, at URL <http://www.vn-style.com/print.asp?PostID=22073>.

## Major Sources of Information

Vietnam National Minerals Corp.

Mr. Nguyen Van Chung, Director  
International Cooperation and Marketing  
105 Nguyen Van Cu Road  
Gia Lam, Hanoi  
Vietnam  
Telephone: 84-4-8770016  
Fax: 84-4-8770034  
E-mail: vimico@hn.vnn.vn

Vietnam National Coal Corp.

Mr. Le Tri Hung, Deputy General Manager  
Investment and International Cooperation Department  
108 Le Duan Street, Hanoi  
Vietnam  
Telephone: 84-4-8519927  
Fax: 84-4-8510724  
E-mail: htqt@fmail.vnn.vn

## Major Publication

General Statistics Office, Hanoi, Vietnam: Statistical Yearbook, annual.

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

(Metric tons unless otherwise specified)

Commodity <sup>2</sup>	2001	2002	2003	2004 <sup>e</sup>	2005 <sup>e</sup>	
Barite <sup>e</sup>	71,100	60,300	81,500	101,000 <sup>3</sup>	116,000	
Bauxite <sup>e</sup>	20,000	20,000	20,000	20,000	20,000	
Cement, hydraulic	thousand metric tons	16,073	21,121	24,127 <sup>f</sup>	25,320 <sup>3</sup>	29,000 <sup>3</sup>
Chromium ore, gross weight <sup>e</sup>	70,300 <sup>3</sup>	80,000	120,000	150,000	85,000	
Clays, kaolin <sup>e</sup>	600,000	600,000	650,000	650,000	650,000	
Coal, anthracite	thousand metric tons	13,397	16,347	19,590	27,330 <sup>f,3</sup>	32,800 <sup>3</sup>
Copper concentrate, gross weight <sup>e</sup>	1,600	1,100	1,200	1,500	2,000	
Fluorspar <sup>e</sup>	3,000	3,000	3,000	3,000	3,000	
Gas, natural, gross	million cubic meters	1,724	2,260	3,450	6,250 <sup>3</sup>	6,340 <sup>3</sup>
Gold <sup>e</sup>	kilograms	3,000	2,000	2,000	2,000	3,000
Iron ore <sup>e</sup>	400,000	430,000	540,000	650,000	700,000	
Lead, mine output, Pb content <sup>e</sup>	900	1,100	1,100	1,100	1,200	
Lime	thousand metric tons	1,351	1,426	1,450 <sup>e</sup>	1,500	1,500
Manganese concentrate, gross weight <sup>e</sup>	67,000	68,000	68,000	70,000	70,000	
Nitrogen, N content of ammonia	52,600	58,400	79,700	216,200 <sup>3</sup>	220,000 <sup>3</sup>	
Petroleum, crude	thousand 42-gallon barrels	119,212	117,753	125,281	142,844 <sup>3</sup>	135,578 <sup>3</sup>
Phosphate rock:						
Gross weight	thousand metric tons	677	680	823	800	800
P <sub>2</sub> O <sub>5</sub> content	do.	204	204	247	240	240
Pyrite, gross weight <sup>e</sup>	do.	300	400	450	450	500
Pyrophyllite <sup>e</sup>	30,000	30,000	30,000	30,000	30,000	
Salt	thousand metric tons	669	1,089	1,275 <sup>e</sup>	1,300	1,400
Sand and gravel	do.	92,200	95,000	98,000 <sup>e</sup>	98,000	100,000
Silica sand <sup>e</sup>	do.	62,000	62,000	63,000	63,000	63,000
Steel:						
Crude	do.	319	409	544	658 <sup>3</sup>	780
Rolled	do.	1,914	2,503	2,954 <sup>f</sup>	2,929 <sup>f</sup>	3,570
Stone, building stone	do.	80,400	83,700	85,000 <sup>e</sup>	90,000	100,000
Sulfur <sup>e</sup>	22,000	22,000	22,000	22,000	22,000	
Tin: <sup>e</sup>						
Mine output, Sn content	1,700	1,700	2,100	3,500	3,500	
Metal, smelter	1,700	1,700	2,100	3,500	3,500	
Titanium, ilmenite, gross weight <sup>e</sup>	180,000	180,000	200,000	200,000	180,000	
Zinc, mine output, Zn content <sup>e</sup>	32,000	42,000	45,000	30,000 <sup>f</sup>	32,000	
Zirconium, gross weight <sup>e</sup>	8,000	11,000	13,000	13,000	13,000	

<sup>e</sup>Estimated; estimated data are rounded to no more than three significant digits. <sup>f</sup>Revised.

<sup>1</sup>Table includes data available through May 26, 2006.

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

<sup>3</sup>Reported figure.

Sources: Vietnam's General Statistics Office, Statistical Yearbook, 2002; British Geological Survey, World Mineral Statistics, 2001-03; World Metal Statistics, May 2005; South East Asia Iron and Steel Institute, Crude Steel Production, Annual Statistics, 2001-04; 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 2006.

TABLE 2  
VIETNAM: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity		Major operation 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., 14.44%)	Min Duc near Hai Phong City	1,400
Do.		Morning Star Cement Ltd. (Holcim Group of Switzerland, 65%, and Vietnam National Cement Corp.—Ha Tien I, 35%)	Hon Chong, Kien Giang Province	2,400
Do.		Nghi Son Cement Corp. (Taiheiyō Cement Corp., 45.5%; Mitsubishi Materials Corp. of Japan, 19.5%; Vietnam National Cement Corp., 35%)	Nghi Son, Thanh Hoa Province	2,150
Do.		Vietnam National Cement Corp. (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		Thai Nguyen Nonferrous Metal Co. (wholly owned subsidiary of state-owned Vietnam National Minerals Corp.)	Nui Nua, Thanh Hoa Province	200
Coal, anthracite		Vietnam National Coal Corp. (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, Cua Ong, Uong Bi in Quang Ninh Province	33,000
<b>Fertilizer:</b>				
Apatite		Vietnam National Chemical Corp. (100% state-owned)	Lao Cai, Lao Cai Province	900
Nitrogen, ammonia		do.	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, a Russian oil company), and joint venture of PetroVietnam, BP p.l.c. of the United Kingdom, Oil and Natural Gas Co. of India, and ConocoPhillips Co. of the United States	Offshore Bach Ho Oilfield, Rang Dong Oilfield, and Lan-Tay/Lan-Do Gasfield	18
Iron ore		Thai Nguyen Iron and Steel Corporation (wholly owned subsidiary of Vietnam Steel Corp.)	Trai Cau and Tein Bo in Thai Nguyen Province Thach Khe in Ha Tinh Province; and Quy Xa in Lao Cai 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	390
Salt		Vietnam National Salt Corp.	Nam Dinh, Nghe An, and Hai Tin Provinces	14,000
Steel, crude		Vietnam Steel Corp.	Cai Lan, Thai Nguyen Province, and Phu My, Ba Ria-Vung Tau Province	800
<b>Tin:</b>				
Concentrate		Cao Bang Nonferrous Metal Co. and Nghe Tinh Nonferrous Metal Co. (wholly owned subsidiaries of state-owned Vietnam National Minerals Corp.)	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	4
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	130
Do.		Mineral Development Co. No. 4 and No. 5 (wholly owned subsidiaries of Vietnam National Minerals Corp.)	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		Thai Nguyen Nonferrous Metal Co. (wholly owned subsidiary of state-owned Vietnam National Minerals Corp.)	Cho Dien, Bac Can Province	45