



2005 Minerals Yearbook

BRAZIL

THE MINERAL INDUSTRY OF BRAZIL

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In 2005, Brazil occupied a leading position in the global production of the following mineral commodities: bauxite (second after Australia), columbium (niobium), graphite (third after China and India), iron ore (second after China), manganese (third after South Africa and Australia), and tantalum (third after Australia and Mozambique) (Departamento Nacional de Produção Mineral, 2006, p. 10; Corathers, 2006; Jorgenson, 2006; Magyar, 2006a, b; Olson, 2006b; Plunkert, 2006).

Brazil's total land area is 8,511,965 square kilometers, which is smaller than the United States, and its population was almost 186.4 million in 2005. Brazil was the leading economy in Latin America and a member of the Mercado Común del Cono Sur (MERCOSUR), which is the second largest trade association in the Americas and the eighth worldwide. Its gross domestic product (GDP) based on purchasing power parity was \$1.536 trillion.¹ The per capita income increased to \$4,319 in 2005 from \$3,324 in 2004. In 2005, Brazil's GDP grew by 2.3% (Departamento Nacional de Produção Mineral, 2006b²; International Monetary Fund, 2006§; U.S. Central Intelligence Agency, 2006§; World Bank, The, 2006§). The country has undergone significant change during the past decade on the macroeconomic front and, at the end of 2005, Brazil was on the threshold of a positive macroeconomic cycle in both domestic consumption and exports because of increased global trade, a high level of liquidity of international financial resources, higher confidence of foreign and domestic investors, and economic recovery in 2005. The country's foreign exchange reserves increased slightly to \$53.8 billion from \$52.9 billion in 2004. Brazil's total debt burden decreased to \$169.5 billion from \$201.4 billion in 2004. Exports were valued at \$118.3 billion, and imports, \$73.6 billion compared with \$96.5 billion and \$62.8 billion, respectively, in 2004. Brazil's minerals sector had a trade surplus of \$9.7 billion compared with a revised \$4.2 billion in 2004 (Banco Central do Brasil, 2006§; Departamento Nacional de Produção Mineral, 2006b§, c§).

In 2005, Brazil's economic turnaround was positive owing to floating exchange rates and increased interest rates by the Banco Central do Brasil to fight inflationary pressures. The International Monetary Fund supported Brazil's move to a system of inflation targets and currency devaluation to guide its monetary policy. This action allowed the country to restore confidence in the Government's macroeconomic management and created conditions for lower inflation and interest rates. Inflation was 5.7% compared with 7.6% in 2004. The financial system benefited from foreign direct investment (FDI) inflows, high capitalization, and the strengthening of fiscal and monetary discipline, which helped maintain the country's positive

economic growth in 2005 (Banco Central do Brasil, 2006§; International Monetary Fund, 2006§; World Bank, The, 2006§).

While FDI inflows increased in Latin America and the Caribbean to \$68.0 billion in 2005 from \$61.5 billion in 2004, or by 10.6%, inflows in South America increased to \$44.5 billion from \$37.7 billion in 2004, or by 18.0%, and in the Andean Community, to \$16.9 billion from \$7.7 billion in 2004, or by 119.5%. FDI inflows in MERCOSUR, however, decreased to \$20.4 billion in 2005 from \$22.8 billion in 2004, which represented a decrease of almost 17%. Nevertheless, Brazil maintained a large share (74%) of MERCOSUR's FDI as reflected mainly in the high international prices of several commodities, such as, in order of value, petroleum, copper, gold, and soybeans (Banco Central do Brasil, 2006§; Economic Commission for Latin America and the Caribbean, 2006§; World Bank, The, 2006§).

In 2005, Brazil produced 46 industrial minerals, 30 metals, and 4 fuel minerals and exported them to the global marketplace. Among those produced were bauxite, chromite, coal, columbium (niobium), copper, gemstones, gold, iron ore, kaolin, manganese, tantalum, and tin from large deposits. In Latin America, and particularly within MERCOSUR, Brazil continued to be the leading producer of aluminum, cement, ferroalloys, gold, iron ore, manganese, steel, and tin. Brazil's reportedly large mineral reserves and other identified resources help make it one of the most dynamic markets in the world. Brazil represents 65% of the South American economy (Departamento Nacional de Produção Mineral, 2006, p. 10-11; 2006a§).

In 2005, Brazil continued with its petroleum exploration program to expand reserves and reduce its dependence on oil imports. Nearly 15% of Brazil's demand for crude oil was met by oil imports in 2005. To achieve self-sufficiency for the country, Brazil's Petróleo Brasileiro S.A. (Petrobrás) budgeted about \$54 billion in investments to 2010; about 90% this capital would be invested in Brazil. Brazil's petroleum and mining industries and utilities attracted investors' interest because of the country's diversified mineral endowment, the Government's macroeconomic policies, and the country's skilled labor force. Major international mining, petroleum, and steel companies were notably interested in, in order of importance, oil and gas, iron ore, steel, coal, gold, copper, and diamond. Brazil's Companhia Vale do Rio Doce (CVRD) and China's Metal Company of Baoshan, which were leading companies in Brazil and the city of Shanghai, respectively, continued to explore for, in order of value, iron ore, manganese, bauxite, gold, and other mineral commodities in Brazil (Petróleo Brasileiro S.A., 2006, p. 7, 59-61; Departamento Nacional de Produção Mineral, 2006c§).

More than 500 transnational corporations (TNC) established operations in Brazil between 1990 and 2005 via mergers, joint ventures, and privatizations. Since 1990, the TNCs brought in about \$150 billion in registered investment through the Banco

¹Where necessary, values have been converted from Brazilian reais (R\$) to U.S. dollars (US\$) at the rate of R\$2.340=US\$1.00.

²References that include a section mark (§) are found in the Internet References Cited section.

Central do Brasil; of that total, about \$36 billion, or almost 25%, was invested by such major companies as Anglo American plc, BHP Billiton plc, De Beers Group, and Gencor Ltd. In 2005, CVRD and the TNCs invested \$500 billion; of that total, about \$227 billion, or about 45%, was invested by TNCs BHP Billiton and Rio Tinto plc of the United Kingdom and Anglo American and Alcoa Inc. of the United States. The Banco Central do Brasil (2006§) also reported that, since 1996, the accumulated net FDI amounted to more than \$151 billion equity capital, of which \$35 billion was used for acquisitions of state-owned assets and more than \$116 billion was used for direct investment and joint ventures with the private sector (Banco Central do Brasil, 2006§; Departamento Nacional de Produção Mineral, 2006b§).

As of December 2005, the active international mining and oil companies in Brazil included Alcan Aluminum Ltd., Barrick Gold Corp., INCO Limited, and Teck Cominco Inc. of Canada; Shanghai Baosteel Corp. of China; Royal Dutch/Shell Group of the Netherlands; EDP Limited of Portugal; Iberdrola S.A. and Repsol YPF of Spain; BHP Minerals International Exploration Inc. (BHP Billiton, 100%), Anglo American, and Rio Tinto of the United Kingdom; and Chevron Corp. (ChevronTexaco Brasil S.A.), Dow Chemical Co., Exxon Mobil Corp. (Esso Brasileira de Petróleo Ltda.), Newmont Mining Corp., Placer Dome U.S. Inc., and Phelps Dodge Co. of the United States (Departamento Nacional de Produção Mineral, 2006b§).

Government Policies and Programs

The fundamental principles governing the use of mineral resources in Brazil are defined and consolidated in the current Federal Constitution (Article 20), which was enacted on October 5, 1988, and in Constitutional Amendments Nos. 6 and 9 dated August 15, 1995, which allow the participation of the private sector by means of joint ventures and/or privatization investment in the sectors of mining, natural gas, and petroleum and in the deregulated sectors of coastal and river shipping, telecommunications, and transportation. The Government monopolies of the oil and gas industries and fuel price subsidies were rescinded in 1999 after 45 years; this allowed Petrobrás to enter into joint ventures with foreign investors. The Agência Nacional do Petróleo regulates the petroleum industry (Departamento Nacional de Produção Mineral, 2006a§-c§).

Since 2001, the Government reduced the Brazilian import tax for minerals; the rates vary from 3% to 9%—ores and concentrates are 5%, and other mineral derivatives, 7%. The export tax does not apply to exported mineral products, although there is a value-added tax. In most cases, the basis for assessment for corporate income taxes is the net profit for the fiscal year; the tax rate ranges between 10% and 15% and is levied on net gross profit. Profits can be expatriated. Equity ownership, which is allowed by means of privatization or by direct acquisition, can be as high as 100%. The Concessions Law created additional opportunities for the private sector in public utilities previously reserved for the Government. All the above actions, which were undertaken by the Government to open the Brazilian economy to international competition, have continued to create an environment that attracts domestic

and foreign investments equally (Departamento Nacional de Produção Mineral, 2006a§).

The exploration and exploitation of mineral resources in Brazil are defined and regulated by the 1967 Mining Code (Executive law No. 227 of February 28, 1967). The Brazilian Constitution and the amended Mining Code, law No. 9314 of January 1997, provide greater flexibility for investment in the Brazilian mining sector. Article 7 of the amended law stipulates that the exploitation of mineral deposits will depend upon an Exploration Authorization Permit granted by the General Director of the Departamento Nacional de Produção Mineral (DNPM) and a Development Concession issued by the Ministro do Minas e Energia. Licensing is a restricted system applicable exclusively to the exploitation of industrial minerals. The DNPM is responsible for enforcing the 1997 Mining Code and implementing its legal provisions (Departamento Nacional de Produção Mineral, 2006a§).

The DNPM reported an investment of \$162 million in mineral exploration compared with \$200 million in 2004. The Companhia de Pesquisa de Recursos Minerais (CPRM) (the Brazilian Geological Survey) is developing programs for basic geologic mapping, metallogenetic and hydrogeologic mapping, and prospecting in areas of potential development. The CPRM is also creating and maintaining geologic and economic databases (particularly for coal, copper, diamond, gold, kaolin, nickel, peat, and zinc) to assist investors in the minerals sector (Departamento Nacional de Produção Mineral, 2006b§).

The Brazilian Financial Compensation for Exploiting Mineral Resources—Federal Royalty (CFEM), which was established by the Brazilian Constitution of 1988, was instituted by law No. 7990 in 1989 to compensate municipalities, States, and the Federal Government. The CFEM rate is no more than 3% of the net revenue of mineral sales. The prevailing rates are 3% for bauxite, manganese ore, potassium, and rock salt; 2% for coal, fertilizers, iron ore, and other minerals; 1% for gold (gold produced during prospecting is exempt); and 0.2% for other precious minerals and precious stones. The collected royalties are allocated among the municipalities, States, and the Federal Government in the proportion of 65%, 23%, and 12%, respectively. In July 2000 (law No. 9993/2000), the Federal Government decided to share its 12% CFEM fund with the DNPM (9.8%); the Fondo Nacional de Desarrollo Científico y Tecnológico (FNDCT), which is an instrument for technological innovation for the benefit of all Brazil's productive sectors (2%); and the Brazilian Environment Agency (IBAMA) (0.2%). The CFEM collection was very successful and increased to \$173.5 million in 2005 from \$139.4 million in 2004, or by 24.5% (Departamento Nacional de Produção Mineral, 2006a§-c§).

In 2005, the States of Minas Gerais (50.1%), Para (29.6%), and Goiás (3.7%) were the major collectors of CFEM; the main municipalities were Parauapebas (56.5%) and Oriximina (8.5%) in the State of Para and Itabira (10.8%), Nova Lima (6.5%), and Mariana (6.2%) in the State of Minas Gerais. Both States and their respective municipalities were the main producers of iron ore. The main mineral contributors to the CFEM were iron ore (49.9%), aluminum (8.9%), kaolin (4.2%), calcite (3.7%), and gold (3.2%). The State of Minas Gerais produced mainly, in order of value, iron ore, nickel, gold, and zinc, and the State of

Para produced mainly bauxite, iron ore, kaolin, copper, and others (Departamento Nacional de Produção Mineral, 2006b§, c§).

Environmental Issues

In Brazil, the fundamental principles governing the compatibility of the mining sector with environmental protection are outlined by the following Federal laws and decrees, and respective resolutions and regulations:

- Federal law No. 6938 of August 31, 1981, and its amendments (Acts Nos. 7804 of July 18, 1989, and 8028 of April 12, 1990) provide the purpose and mechanism for formulation of the National Environmental Policy,
- Federal law No. 9605 of February 12, 1998, provides sanctions against harmful activities to the environment,
- Federal Decree No. 97632 of April 10, 1989, deals with rehabilitation of areas degraded by mining,
- Federal Decree No. 99274 of June 6, 1990, regulates law No. 6938, and
- Resolutions of the National Council for the Environment (CONAMA): (1) Resolution No. 1 of January 23, 1986, provides basic criteria and general guidelines for the Report on Environmental Impact (RIMA); (2) Resolution No. 009 of December 6, 1990, regulates environmental licenses for mineral extraction; (3) Resolution No. 010 of December 6, 1990, regulates environmental licenses for mineral extraction used in civil construction; (4) Resolution No. 2 of April 18, 1996, provides for compensation for environmental damages; and (5) Resolution No. 237 of December 19, 1997, provides the procedures and guidelines used in environmental licensing.

The Brazilian Environmental Policy (BEP) is executed at three levels—Federal, State, and municipal. The coordination and formulation of the BEP is the responsibility the municipal governments. The coordination and formulation of the BEP is the responsibility of the Ministério de Meio Ambiente (MMA). Linked to the MMA is the Conselho Nacional de Meio Ambiente, which grants the environmental licenses that are required for all mining activities in Brazil. Law No. 88351 of 1986 established the National System for the Environment, which is made up of representatives of the Federal, State, and municipal governments and private foundations involved in environmental protection and improvement. Article 225 of the Brazilian Constitution of 1988 stipulates that mining operators must reclaim areas that they have environmentally degraded.

In Brazil, the environmental legislation that is applied to mining is basically consolidated in the following environmental requirements: an environmental impact study (EIA), environmental licensing (LA), and a plan for recovery of degraded areas (PRAD). An EIA applies to mining projects of any mineral substance; an LA is mandatory for the installation, expansion, and operation of any mining activity in Brazil; and a PRAD requires suitable technical solutions to rehabilitate the soil and other aspects of the environment that might be degraded by mining operations (Departamento Nacional de Produção Mineral, 2006a§, b§).

The Ministério de Minas e Energia enforces Decree No. 97632 of April 10, 1989, which prohibits the use of cyanide and mercury in the mining of gold unless approved by local

Brazilian environmental agencies and offers technical assistance on producing gold without affecting the environment to small-scale independent miners (garimpeiros), in particular. Environmental impacts are expected to be reduced in the long run. Resolution No. 010 of December 6, 1990, requires that all mining operations obtain LAs prior to the granting of mineral rights by the DNPM. As environmental problems have increased because of cyanide use in in situ leaching, mercury use in gold placers, and underground acidic water discharges, antipollution measures have been enacted to eliminate the sources of pollutants and mitigate their effects on the environment (Departamento Nacional de Produção Mineral, 2006a§).

Production

In 2005, the total value of minerals produced was about \$36.0 billion, or more than 4.3% of the GDP. The value of minerals-based industries amounted to almost \$90 billion, or about 10.9% of the GDP. That of crude oil and natural gas amounted to almost \$6.1 billion. Mineral extraction contributed 2.3% of the GDP in 2005 compared with 2.1% in 2004. Depletion of shallow gold and tin deposits and environmental constraints on garimpeiros affected their output of gold and tin (Departamento Nacional de Produção Mineral, 2006, p. 9-10, 65, 91; Banco Central do Brasil, 2006§).

The major integrated steelworks were the structural steel and rail producer Gerdau Açominas Gerais, S.A.; Latin America's leading integrated steelmaker, Companhia Siderúrgica Nacional (CSN); the carbon steel sheet and plate producer Companhia Siderúrgica Paulista; the slab producer Companhia Siderúrgica de Tubarão; and Brazil's second ranked steel mill, Usinas Siderúrgicas de Minas Gerais, S.A. In 2005, these companies produced about 25.6 million metric tons (Mt), or about 81% of the total Brazilian steel production of 31.6 Mt; Brazil was the second ranked iron ore producer in the world after China with a flat (gross weight) output of 281 Mt; CVRD produced almost 87.5% of Brazil's iron ore (Departamento Nacional de Produção Mineral, 2006, p. 57-62; Companhia Vale do Rio Doce, 2006§). Mineração Rio do Norte S.A. (MRN), the majority of which was privately owned, was the world's third ranked bauxite producer and exporter; it produced almost 83% of the country's total bauxite production, which amounted to about 21 Mt in 2005. The four major aluminum smelters—Albras-Alumínio Brasileiro S.A. (Albras) (30%), Companhia Brasileira de Alumínio (CBA) (23%), Alcoa Alumínio S.A. (Alcoa) (21%), and Billiton Metais S.A. (Billiton) (12%), produced 86% of the primary aluminum production of 1.5 Mt in 2005 (table 1; Departamento Nacional de Produção Mineral, 2006, p. 21-22; Instituto Brasileiro de Mineração, 2006, p. 25-27).

Trade

Brazil's trade balance increased substantially to a new peak level of \$44.8 billion surplus compared with \$33.7 billion in 2004, or by almost 32.9%. Brazil was the leading open market in the economic center of MERCOSUR. In 2005, the member countries of MERCOSUR had about 250 million people, or 27.6% of the Western Hemisphere's population, and a combined

purchasing power parity of more than \$2.2 trillion, or about 79% of South America's total purchasing power parity. Brazil accounted for almost 70% of MERCOSUR's population and about 65% of its purchasing power parity (Banco Central do Brasil, 2006§; Departamento Nacional de Produção Mineral, 2006b§, c§; International Monetary Fund, 2006§; U.S. Central Intelligence Agency, 2006§). Most multinational companies considered this growing trade bloc, which followed the North America Free Trade Agreement (NAFTA) and the European Union (EU) in size and the amount of trade that takes place, to be extremely important. In 2005, Brazil's total trade with NAFTA increased to \$43.5 billion from \$38.6 billion in 2004. Most of this trade was with the United States, trade with which increased to \$35.6 billion from \$31.9 billion in 2004. MERCOSUR had an impact on intraregional total trade, which increased to about \$37 billion in 2005 from \$29.7 billion in 2004; intra-MERCOSUR total trade increased to \$24.1 billion in 2005 from \$19.2 billion in 2004 (Banco Central do Brasil, 2006§; Departamento Nacional de Produção Mineral, 2006b§).

The exports of the Brazilian minerals sector were valued at \$31.6 billion in 2005, which was an increase of 34.5% from the value of \$23.5 billion in 2004. Exports of primary products were valued at \$13.1 billion, which was a significant increase of 11% compared with the value in 2004. The minerals having the highest export values in 2005 were iron ore, \$7.2 billion; copper, \$303 million; and aluminum, \$229 million. Exports of semimanufactured commodities were valued at \$7.9 billion in 2005, which was an increase of 20% compared with the value of \$6.6 billion in 2004; the most valuable exports were iron pellets, \$4.4 billion; aluminum, \$1.9 billion; gold, \$458 million; and columbium (niobium), tantalum, and vanadium, \$423 million. Exports of manufactured products were valued at \$9.9 billion in 2005, which was an increase of almost 29% from the value of \$7.7 billion in 2004; the most important export was iron commodities, which increased in value by 17% to \$4.2 billion from the value of \$3.6 billion in 2004. Petroleum exports also increased in value to \$2.9 billion in 2005, which was an increase of 53% from the value of \$1.9 billion in 2004. Exports of chemical products were valued at \$612 million in 2005, which was an increase of almost 6% from the value of \$580 million in 2004; the most valuable export was phosphate rock, which increased in value by 1% to \$240 million in 2005 from the value of \$239 million in 2004. In 2005, the Brazilian minerals sector recorded a trade surplus of \$9.7 billion compared with a surplus of \$4.2 billion in 2004 (a very significant increase of 131%) and \$2.8 billion in 2002 when the surpluses started. The total bilateral trade between Argentina and Brazil (which were the major players of MERCOSUR) increased to \$16.2 billion in 2005 from \$12.9 billion in 2004. Total minerals trade between Brazil (\$3.5 billion) and Argentina (\$3.0 billion) amounted to \$6.5 billion (Banco Central do Brasil, 2006§; Departamento Nacional de Produção Mineral, 2006b§).

In 2005, Brazil's total trade surplus amounted to \$20.9 billion; the surpluses with its leading trade partners were, in order of value, the United States (\$4.7 billion), China (\$2.6 billion), Japan (\$1.3 billion), the Republic of Korea (\$1.1 billion), the Netherlands (\$784 million), Italy (\$576 million), and Belgium (\$466 million). Brazil's trade surpluses with the United States

represented 22.5% of the total surplus of \$20.9 billion and almost 48.5% of the surplus of Brazil's minerals sector (\$9.7 billion). Exports to Europe and Japan consisted mostly of raw materials, which were, in order of volume, iron ore, crude oil, manganese, marble, granite, and agricultural commodities. Brazil's leading raw materials trading partners were China (\$781 million), Germany (\$411 million), Japan (\$392 million), France (\$212 million), the Republic of Korea (\$175 million), and Belgium (\$159 million). Bilateral trade between Brazil and China included exports of, in order of value, soybean, iron ore, steel, airplanes, buses, auto parts, pulp, tobacco, and timber. China's main exports to Brazil included, in order of value, coke, coal, electronic parts, equipment for energy transmission, and products and material for audiovisual equipment (Banco Central do Brasil, 2006§; Departamento Nacional de Produção Mineral, 2006b§).

Brazil's wealth of mineral resources and China's needs for raw materials appeared to be strengthening the Sino-Brazilian trade partnership (Departamento Nacional de Produção Mineral, 2006, p. 57-58, 76-77; 2006a§, b§; Instituto Brasileiro de Mineração, 2006, p. 35; Companhia Vale do Rio Doce, 2006§).

Structure of the Mineral Industry

The mineral industry of Brazil was large by world standards. Brazilian corporations, private Brazilian investors, and foreign companies partially or wholly owned the major portion of the industry. The exceptions were the natural gas and petroleum industries, which were 100% Government owned through Petrobrás, which comprised five subsidiaries. Petrobrás Distribuidora S.A. distributed petroleum products; Petrobrás Gás S.A. produced, traded, and distributed natural and liquefied natural gas and fertilizers; Petrobrás Internacional, S.A. operated in foreign countries; Petrobrás Química, S.A. was the integrated refining-petrochemical operations company; and Petrobrás Transporte S.A. constructed and operated the pipelines, terminals, vessels, and facilities needed for the transportation and storage of oil and derivatives, natural gas, and bulk products (Petróleo Brasileiro S.A., 2006, p. 10-29). The structure of the Brazilian mineral industry continued to transition to a privately owned, Government-regulated regime from one that was Government owned and Government operated. In the country, 40 cement companies operated 64 cement plants and 7 grinding plants with a clinker capacity of 45 Mt in 22 States, and 28 iron ore mining companies operated 53 mines and 44 processing plants. According to the DNPM, there were nearly 2,000 mines in Brazil; these were classified according to their run-of-mine (ROM) outputs: large mines—between 1 million and 3 million metric tons per year (Mt/yr) or higher; medium mines—between 100,000 metric tons per year (t/yr) and 1 Mt/yr; and small mines—between 10,000 and 100,000 t/yr (Departamento Nacional de Produção Mineral, 2006, p. 37-38, 52, 70; Instituto Brasileiro de Mineração, 2006, p. 25).

In 2005, Brazil's total labor force was more than 90 million. Of this total, services represented 66%; agriculture, 20%; and industry, 14%. According to the Banco Central do Brasil's (2006§) monthly employment survey (MES), the unemployment rate remained at 10.5%. The minerals sector employed about

5% (1,000,000) of the industry total (20 million); this did not include the nearly 500,000 active garimpeiros. In 2005, according to the MES, 1.8 million jobs were created in the country and employment in the mining sector (90,000) also continued its upward trend as a result of Brazil's economy recovery and the increases of efficiencies and productivities in the private sector that resulted from capital flows into new technologies, expansions, and joint ventures and mergers, particularly in the mining, oil and gas, and steel sectors (table 2; Banco Central do Brasil, 2006§).

Commodity Review

Metals

Aluminum and Bauxite and Alumina.—Alumina production remained at about the same level as that of 2004 (5.3 Mt). Alumínio do Norte do Brasil S.A. (Alunorte) produced 51%; Alcoa Alumínio S.A. (Alcoa), 21%; Companhia Brasileira de Alumínio (CBA), 12%; BHP Billiton, 11%; and Alcan Alumínio do Brasil S.A., 5%. Exports of aluminum totaled 964,000 metric tons (t) and were valued at \$1.9 billion. Exports of alumina totaled 2.3 Mt and were valued at \$563 million. Primary aluminum production increased slightly to 1.50 Mt in 2005 from 1.46 Mt in 2004, or by about 2.7%. Albras (CVRD, 51%, and Nippon Amazon, 49%) produced 30% of the primary aluminum; CBA, 23%; Alcoa, 21%; BHP Billiton, 12%; Alcan, 8%; and Aluvale, 6%. In 2005, CBA was planning to invest an additional \$350 million to produce 470,000 t/yr of aluminum by 2007. In 2005, Brazil's imports of all forms of aluminum totaled 185,000 t and were valued at \$394 million; exports were 964,000 t and had a value of \$1.9 billion. Bauxite production remained at about the same level as that of 2004 (21.0 Mt). The MRN joint venture, which was owned by CVRD (40%), BHP Billiton (14.8%), Alcoa (13.2%), Alcan (12%), CBA (10%), Norsk Hydro (5%), and Reynolds Alumínio do Brasil (5%), accounted for about 83% of the total bauxite production for 2005. Exports amounted to 7.5 Mt of bauxite and were valued at \$229 million (Departamento Nacional de Produção Mineral, 2006, p. 21-22; Instituto Brasileiro de Mineração, 2006, p. 33; Associação Brasileira do Alumínio, 2006§).

Mineradora Vera Cruz S/A (CVRD, 100%) was planning to initiate bauxite operations at the Paragominas Mine in 2006 and to produce 4.5 Mt/yr in 2007 with an investment of \$271 million. Alcoa was planning a new operating hub, with an investment of \$1.4 billion, in Juruti, State of Para, where it was carrying out a geologic study of a bauxite resource of 350 Mt. The annual production would be 4 Mt of bauxite, 2 Mt of alumina, and 1 Mt of aluminum. To implement this hub, Alcoa could invest an additional \$1 billion in the construction of the required hydroelectric plant to produce aluminum in Belomonte, State of Para. Latapack-Ball Embalagens, Ltda. (Ball Corporation, 100%) invested \$5 million to increase its aluminum cans plant capacity in Jacarei, State of Sao Paulo, to 2 billion aluminum cans in 2005 from 1.7 billion 2004. Brazil recycled 93% of all the aluminum cans, which was equivalent to 136,080 t of aluminum cans, or about 10.1 billion units; this was an increase of 2.3% compared with that of 2004. During

2005-06, China Aluminum Group and China MinMetals, both, were planning to invest a combined total of \$3 billion in joint ventures, mostly with CVRD and others, in the aluminum and bauxite and alumina sectors (Departamento Nacional de Produção Mineral, 2006, p. 22; Instituto Brasileiro de Mineração, 2006, p. 33; Associação Brasileira do Alumínio, 2006§; Companhia Vale do Rio Doce, 2006§).

Copper.—Brazil's copper concentrate production increased to 133,325 t from 103,153 t in 2004, or by 29.2%. CVRD produced 106,692 t of the concentrate, or 80%, in Carajas, State of Para; Mineração Caraíba S/A, 23,985 t, or 18%, at its deposit in Jaguarari, State of Bahia; Companhia Niquel Tocantins S/A, 2,008 t, or 1.5%, in Niquelandia, State of Goiás; and Mineração Santa Blandina S/A, 640 t, or 0.5%, in Itapeva, State of Sao Paulo. In 2005, Caraiba Metais S/A (CMSA) of Camacari, State of Bahia, which was the only electrolytic copper producer in Brazil, produced 199,043 t of primary copper metal; this was a decrease of about 4.3% from the 208,020 t produced in 2004. The feed for this electrolytic copper output included 402,366 t of copper concentrates (132,780 t of contained metal) imported from Chile (86%), Argentina (8%), and Portugal (6%). To meet Brazil's metal copper demand of 311,933 t/yr, CMSA imported 160,461 t of copper cathode mostly from Chile (85%) and Peru (15%) in 2005. CMSA was planning to produce between 450,000 and 500,000 t/yr of electrolytic copper in D'Avila, State of Bahia, by 2010 (Departamento Nacional de Produção Mineral, 2006, p. 39-40; Instituto Brasileiro de Mineração, 2006, p. 32, 34; Companhia Vale do Rio Doce, 2006§).

In 2005, CVRD's copper project portfolio included the sulfide ore resources of, in order of resource amount, Sossego, Salobo, Alemão, and Cristalino, and the oxidized ore deposit of Corpo 118, all of which are located in the mineral province of Carajas, State of Para. The Sossego copper mine (CVRD, 100%), which contained 200 Mt of sulfide ore grading 1.0% copper, started operations in January 2004 at a rate of 140,000 t/yr of copper in concentrates. The feasibility studies for the Salobo project [Salobo Metais S/A (CVRD, 100%)], which was Brazil's leading copper project, estimated copper resources to be 986 Mt at grades of 0.82% copper and 0.49 gram per metric ton (g/t) gold, at a cutoff grade of 0.5% copper and associated molybdenum and silver. The Cobre Salobo, which is located in Marabá, State of Para, could support a mill of 140,000-t/yr capacity. The Alemão deposit [CVRD, 67.0% and Banco Nacional de Desenvolvimento Econômico e Social (BNDES), 33.0%] contained 161 Mt of copper resources at grades of 1.3% copper and 0.86 g/t gold. A prefeasibility study for Cristalino (BNDES and CVRD, 50.0% each) estimated reserves of 312 Mt grading 0.77% copper and 0.13 g/t gold. CVRD continued conducting intensive geological prospecting to identify new copper areas in the Carajas region. Also, a feasibility study for Mineração Maracá S.A.'s Chapada copper project in Alto Horizonte, State of Goiás, estimated that its ore reserves amounted to 434.5 Mt containing 1.3 Mt of copper and 9.6 t of gold. This project would start operations in early 2008 (Departamento Nacional de Produção Mineral, 2006, p. 39-40; Instituto Brasileiro de Mineração, 2006, p. 32-33; Companhia Vale do Rio Doce, 2006§).

Brazil's refined copper production was used primarily in the automobile and construction industries. Exports amounted to 112,520 t of copper metal at a value of \$413.6 million, which went to the United States (56%), Argentina (16%), Canada (12%), and others (16%). By 2010, should the positive market conditions continue, Brazil could become self-sufficient and diminish its external dependency on copper (Departamento Nacional de Produção Mineral, 2006, p. 40; Instituto Brasileiro de Mineração, 2006, 36-37).

Gold.—Gold production decreased by 19.5% to 38.3 t from 47.6 t in 2004; mining companies produced 29.9 t (78.1%), and garimpeiros, 8.4 t (21.9%). Gold production by companies increased by 1.4 t and that by garimpeiros decreased by 10.7 t compared production in 2004; the garimpeiros' output decreased because of higher production costs and more stringent environmental standards. In 2005, AngloGold Ashanti Mineração Ltda. was the leading producer and accounted for 5.8 t, or 19.4% of the country's total (38.3 t); Mineração Serra Grande S.A. (AngloGold Ashanti and Kinross Gold Corp., 50% each) produced almost 6 t, or 15.6%; Rio Paracatu Mineração S/A (Kinross, 100%) produced 5.6 t, or 14.7%; and others produced 12.5 t, or 32.6%. The States with garimpeiros gold operations were Para (with 41.2% of the garimpeiros' operations), Mato Grosso (17.5%), Amapa (15.9%), Rondonia (14.8%), and others (10.6%) (Departamento Nacional de Produção Mineral, 2006, p. 88-90).

Refined gold from the Sao Bento Mine was extracted by a combination of pressure oxidation and bioleaching (the Biox process, which had been developed by Gold Fields Ltd. and Mintek Ltd. of South Africa). The Canadian group Yamana Gold Inc. (CYG) intended to invest \$120 million to produce 3.1 t/yr of gold from the Sao Francisco project and 1.9 t/yr of gold from the Sao Vicente project (both of which are located in the State of Mato Grosso) by 2006. Similar investment was planned for CYG's Chapada and Fazenda Nova projects, which are located in the State of Goias; the projects would produce a combined 1.2 t/yr of gold by 2007 and 3.7 t/yr of gold by 2008. CYG's Cumarú project, which is located in Carajas, State of Para, has reserves of 17 t at a grade of 4.8 g/t gold and was in the feasibility stage. AngloGold Ashanti intended to invest \$150 million to produce 9.3 t/yr of gold from the Cuiaba Mine in Sabara, State of Minas Gerais, by 2006 (Departamento Nacional de Produção Mineral, 2006, p. 89-90; Instituto Brasileiro de Mineração, 2006, p. 30, 34).

Iron Ore.—Brazil produced 280.9 Mt of beneficiated iron ore in 2005 compared with 261.7 t in 2004. Almost 96.1% of that production was from the following four major iron ore companies: CVRD, 203.3 Mt; Minerações Brasileiras Reunidas S/A (MBR) (BHP Billiton, 50% and Mitsui & Co. Ltd. of Japan, 50%), 48.8 Mt; SAMARCO Mineração S/A., 15.1 Mt; and Cia. Siderúrgica Nacional (CSN), 13.7 Mt. In 2005, Brazil exported 177.0 Mt of iron ore and 47.2 Mt of pellets valued at \$7.2 billion and \$4.4 billion, respectively (Departamento Nacional de Produção Mineral, 2006, p. 57-58; Instituto Brasileiro de Mineração, 2006, p. 26, 34; Companhia Vale do Rio Doce, 2006§).

Total iron ore exports increased by 9.5% from those of 2004 and were shipped to 40 countries worldwide. Total export

revenues increased by 53.3% to \$7.3 billion from \$4.8 billion in 2004. The leading importers of Brazilian iron ore were China (24%), Japan (13%), Germany (12%), and France and South Korea (6% each). The customized (varied chemical characteristics) commercial products sold were sinter feed and pellet feed (69%), pellets (22%), and lump ore (9%) (Departamento Nacional de Produção Mineral, 2006, p. 57; Instituto Brasileiro de Mineração, 2006, p. 38).

CVRD acquired the following companies, listed here by order in which the acquisition was completed (percentage): Mineração Socoimex Ltda. (100%), which had the capacity to produce 7 Mt/yr of iron ore, for \$48 million; SAMITRI (51%), for \$711 million; Gulf Industrial Company of Brazil (50%), which was the owner of a pellet plant in Bahrain with a 4-Mt/yr capacity, for \$92 million; and Caemi Mineração e Metalurgia S.A. (Caemi and CVRD, 50% each), for \$279 million. Caemi was a nonoperational holding firm. CVRD started up its 12th iron ore pellet plant in the Port of Ponta de Madeira, State of Maranhao, which had a capacity to produce 6 Mt/yr. CVRD planned to inject about \$6 billion into the mining sector by 2007 to consolidate its leading position in the global iron ore market (Departamento Nacional de Produção Mineral, 2006, p. 58; Companhia Vale do Rio Doce, 2006§).

Iron and Steel.—*Ferroalloys.*—Ferroalloys production increased slightly to 1,250,000 t in 2005 from 1,240,000 t in 2004. Brazil's Prometal Produtos Metalúrgicos S.A. took Norway's Elkem A/S, which was one of the world's leading manganese alloy producers, as a partner and produced 480,000 t of ferromanganese in 2005; the project, in which Elkem will hold a 40% share, was located in Maraba, State of Para. The manganese came from the nearby Prometal Mine, and the iron ore came from the Carajas District (Departamento Nacional de Produção Mineral, 2006, p. 60).

Pig Iron.—Brazil produced 34.4 Mt of pig iron, which was about the same amount as that of 2004 (34.6 Mt). The almost 7.1 Mt of exports, which was valued at \$1.8 billion, was approximately one-third of the pig iron traded in the world (Departamento Nacional de Produção Mineral, 2006, p. 60; Instituto Brasileiro de Siderurgia, 2006, p. 46).

Steel.—Raw steel production decreased by 3.9% to 31.6 Mt in 2005 from 32.9 Mt in 2004. Brazil was the eighth ranked producer and exporter of steel worldwide (Departamento Nacional de Produção Mineral, 2006, p. 60; Instituto Brasileiro de Siderurgia, 2006, p. 8). Brazil exported 12.5 Mt of steel valued at \$6.5 billion, which represented an increase of 4.2% in volume (0.5 Mt) and an increase of almost 22.6% in value (\$1.2 billion) compared with exported steel in 2004. The major recipients of Brazil's exports were the United States (14%), China (13%), and Argentina, Chile, and Mexico (5% each). Apparent domestic consumption of steel was about 20.0 Mt, which represented a decrease of almost 7.0% compared with that of 2004. The Instituto Brasileiro de Siderurgia (IBS) stressed that the Brazilian steel industry had become more efficient because privatization and the inflow of new investments had fundamentally improved efficiency levels in the Brazilian steel industry. The IBS believed that vertical integration was evident as customers and suppliers of the steel companies participated in direct acquisitions and joint-venture processes

(Departamento Nacional de Produção Mineral, 2006, p. 59-60; Instituto Brasileiro de Siderurgia, 2006, p. 16). CVRD and Nucor Corp. signed a nonbinding memorandum of cooperation to advance their interests in potential iron and steel business opportunities in the Americas, which may become available as a result of the restructuring of the North American steel industry. Baovale Company (Baosteel of China, 50% and CVRD, 50%) was planning to invest \$1.4 billion in an integrated mill that would produce 4 Mt/yr of steel slabs (Instituto Brasileiro de Mineração, 2006, p. 44; Companhia Vale do Rio Doce, 2006§).

Manganese.—In 2005, Brazil produced 3.2 Mt of manganese concentrate, which was about 3.2% more than in 2004. Rio Doce Manganês S.A.'s (RDM) manganese mines in the States of Bahia and Minas Gerais, accounted for 75% of metallurgical manganese production. CVRD's RDM, which was the leading producer of manganese concentrate (2.5 Mt), in conjunction with Minérios Metalúrgicos do Nordeste S/A, Sociedade Mineira de Mineração Ltda., and Urucum Mineração S.A. accounted for 95% of Brazil's manganese concentrate production in 2005. Exports of manganese high grade ore amounted to 1.8 Mt at a value of \$139.7 million; this was almost 40.5% more than that of 2004 and was due to a higher demand for steel in Brazil and by MERCOSUR. Manganese ferroalloys exports increased by almost 13%, which amounted to 175,000 t at a value of \$122.8 million (Departamento Nacional de Produção Mineral, 2006, p. 76-77; Instituto Brasileiro de Mineração, 2006, p. 34; Companhia Vale do Rio Doce, 2006§).

Nickel.—Brazil produced about 4.8 Mt of nickel ore in 2005 compared with 3.9 Mt in 2004. Production of electrolytic nickel increased to 20,714 t in 2005 from 19,742 t in 2004; production of nickel in ferronickel alloys increased to 9,596 t in 2005 from 6,493 t in 2004; that of nickel in matte decreased to 6,005 t in 2005 from 6,708 t in 2004; and that of nickel in carbonates increased to 21,116 t in 2005 from 19,897 t in 2004 (table 1). Mineração Serra da Fortaleza, which was owned by Grupo Votarantim (GV) in Fortaleza de Minas, State of Minas Gerais, produced 603,406 t of nickel ore, 7,657 t of nickel content, and 6,005 t of nickel contained in matte. Companhia Niquel Tocantins, which was owned by GV and located in Niquelandia, State of Goiás, produced 3.3 Mt of nickel ore and 44,785 t of nickel contained in carbonates obtained by ammoniacal leaching (a hydrometallurgical process). In the same district, CODEMIN S.A., which was owned by Anglo American, produced 26,340 t of nickel contained in ferronickel alloy (Departamento Nacional de Produção Mineral, 2006, p. 86-87; Instituto Brasileiro de Mineração, 2006, p. 34).

Owing to the increase in world consumption of stainless steel and to higher nickel prices, CVRD intended to invest \$600 million to produce 40,000 t/yr of nickel metal from its Vermelho project in Carajas, State of Para, which contained reserves of 290 Mt at a grade of 0.8% nickel. Anglo American planned to develop the Barro Alto nickel project in the State of Goiás by investing \$750 million to produce 40,000 t/yr of nickel from a deposit that contained 117 Mt of reserves at a grade of 1.5% nickel by 2007. In December, CVRD acquired Canico Resources Corporation, which was a Canadian junior resource company focused on the development of the Onca Puma nickel laterite project in the State of Para, and was planning to invest

\$1.1 billion (Departamento Nacional de Produção Mineral, 2006, p. 86-87; Companhia Vale do Rio Doce, 2006§).

Zinc.—Brazil produced 171,434 t of zinc content in concentrates, which was about 7.8% more than that of 2004. GV's Votarantim Metais Zinco S/A (VMZ), which was located in Vazante, Minas Gerais, was the only producer of zinc ore in Brazil. Primary metal production increased to 267,374 t in 2005 from 265,987 t in 2004, and represented 97.2% of the installed annual metal capacity of 275,000 t. The concentrates were processed in VMZ's refineries in Tres Marias (180,000 t) and GV's Juiz de Fora Complex (95,000 t), both located in the State of Minas Gerais (Departamento Nacional de Produção Mineral, 2006, p. 119-120; Instituto Brasileiro de Mineração, 2006, p. 34).

To meet Brazil's demand for zinc, which was 220,404 t of metal, the country imported 122,165 t of zinc concentrates (valued at \$102.6 million) and 24,683 t of metal (valued at \$33.4 million). Peru supplied 98.5% of the concentrates and 48% of the metal; additional zinc metal was supplied by Argentina (42%) (Departamento Nacional de Produção Mineral, 2006, p. 119-120; Instituto Brasileiro de Mineração, 2006, p. 36).

Industrial Minerals

Asbestos.—In 2005, Brazil produced 236,047 t of asbestos fiber, which was about 6.4% less than that of 2004. Brazil's significant asbestos deposits are located in Cana Brava, Minacu, State of Goiás; Goiás was the only producing State in the country. Sociedade Anônima Mineração de Amianto supplied 73.4% of Brazil's asbestos to manufacture specialized cement products, which were, in order of importance, ceiling tiles, protective screens, water and sewer pipes, water tanks, and molded electrical insulators. Other uses were, in order of importance, thermal insulators, paper and cardboard, slabs, decorations, insecticide, asphalt for highways and airport runways, and the automobile industry (Departamento Nacional de Produção Mineral, 2006, p. 41-42; Instituto Brasileiro de Mineração, 2006, p. 34).

Brazil exported almost 65.0% of its zinc production mainly to Thailand (31.4%), India (18.2%), Indonesia (14.2%), and Iran (11.5%); these exports increased by 13.3% compared with those of 2004. The State of Sao Paulo was the country's leading consumer followed by the States of Parana and Rio Grande do Sul. Asbestos mining and consumption have been highly regulated in most industrialized nations, thus forcing the countries to reduce production and consumption. Industry experts expected asbestos use in the industrial nations to continue to decline. In contrast, the world's developing economies were expected to increase their collective asbestos consumption by large margins. Brazilian asbestos reserves (15.1 Mt) were considered to be adequate to meet demand in the short to medium term; the average grade of ore from the Cana Brava Mine in Minacu was 5.2%; it had reserves (fiber content only) of 3 Mt, which, at a production rate of about 200,000 t/yr, represented a 15-year mine life (Departamento Nacional de Produção Mineral, 2006, p. 41-42; Instituto Brasileiro de Mineração, 2006, p. 34).

Cement.—The country produced 36.7 Mt of cement in 2005 compared with 34.4 Mt in 2004. Among the 26 Brazilian States

and Brasilia, DF, only five of them (Acre, Amapa, Rondonia, Roraima, and Tocantins) were not producers. Thirty-nine facilities in 7 states and Brasilia, DF, produced 75% of Brazil's total output. Minas Gerais was the most important with 23.9% of the total followed by Sao Paulo (14.4%), Parana (10.9%), Rio de Janeiro (6.3%), Brasilia (6.2%), Sergipe (5.2%), Paraiba (4.4%), Rio Grande do Sul (4%), and other States (24.7%). The leading producers were GV's Companhia Cimento Portland Itau (39.5%) and Grupo João Santos (13.6%); other producers included Companhia Cimento Portland Rio Branco (10.4%), Camargo Correia S.A. (8.1%), Grupo Swiss Holderbank's Holder Cimento S.A. (8.0%), and Grupo Lafarge's Companhia Cimento Portland Paraiso (6.8%). The exported cement (1.32 Mt valued at \$42.8 million) went mainly to the United States (43%), Paraguay (14%), and Bolivia (11%). Brazil imported 323,494 t of cement valued at \$20.7 million from the United States (27%), Cuba (24%), Uruguay (19%), Thailand (12%), China (6%), and other countries (12%). Brazil has an installed capacity of 60 Mt/yr and current (2005) production equaled more than 61% of that capacity (Departamento Nacional de Produção Mineral, 2006, p. 37-38).

Gemstones.—In the Americas, Canada and Brazil (in order of the amount produced) were the leading producers and traders of mostly alluvial diamond followed by Guyana and Venezuela. The country continued to be one of South America's leading gemstone producers and exporters. Many different varieties of gemstones are found in the Araxa, the Bambui, and the Canastra Groups; these include, in order of value (US\$/carat), diamond, emerald, aquamarine, topaz, tourmaline, opal, chrysoberyl, amethyst, citrine, and agate. Brazil is the world's only source of some quality gemstones, such as imperial topaz and Paraiba tourmaline (Instituto Brasileiro de Mineração, 2005, p. 5, 8).

According to the DNPM's Mineral Summary Statistics for 2002-05, Brazil's diamond production from year to year has been uncertain, and annual production has been declining since 2000. In both 2005 and 2004, Brazil produced 300,000 carats valued at about \$30.0 million compared with 400,000 carats valued at \$38.1 million in 2003; 500,000 carats valued at almost \$31 million in 2002; 700,000 carats valued at \$43.8 million in 2001; and 1,000,000 carats valued at \$56 million in 2000. In 2005, the entrepreneurial sector produced almost 37% of the total, or 110,643 carats compared with almost 10%, or 30,000 carats, in 2004; 5%, or 20,000 carats, in 2003; 8%, or 40,000 carats, in 2002; almost 3.3%, or 23,000 carats, in 2001; and 8%, or 80,000 carats, in 2000. The leading producers were Mineradora S/A, which was located in Juina, Mato Grosso, and which produced 92,062 carats, and Mineração Rio Novo S/A, which was located in Diamantina, Minas Gerais, and which produced 18,581 carats. These data (carats produced and reported) conform to the Kimberley Process Certification Scheme's (KPCS) guidelines (table 1; Departamento Nacional de Produção Mineral, 2006, p. 46-47; Olson, 2006a).

Production by garimpeiros (189,000 carats) continued to decline because garimpos' reserves were depleting and environmental restrictions were increasing. Since 2004, when the Government closed high-content gem placers in indigenous reserves to exploration, the jewelry industry's gemstone consumption has been unknown, and the high taxation rate has

affected the domestic sales of jewelry. Taking into consideration these factors, Brazil's gemstone reserves were almost impossible to quantify. Brazil, however, may have great potential because it has 1,000 million cubic meters of sedimentary rocks that contain diamond that grades between 0.01 and 0.1 carat per cubic meter, or about 44.6 million carats (Departamento Nacional de Produção Mineral, 2005, p. 46; Instituto Brasileiro de Mineração, 2006, p. 32, 34; Olson, 2006a).

In 2005, total exports of uncut gemstones totaled about 280,000 carats valued at \$19.1 million compared with 243,298 carats valued at \$21.8 million in 2004 and 244,925 carats valued at \$23.4 million in 2003. The major markets for Brazilian rough diamond were the EU (61.2%), the United Arab Emirates (20.9%), the United States (11.2%), and Ireland (6.7%). According to the DNPM and conforming to the KPCS' guidelines, 75 certificates were provided in 2005 of which the EU received 38 certificates; the United States, 24; the United Arab Emirates, 8; Israel, 4; and Canada, 1. Imports of uncut stones amounted to 16,475 carats valued at \$287,647 and the main sources were the EU (39.8%), India (36.7%), and the United Arab Emirates (7.4%) (Departamento Nacional de Produção Mineral, 2006, p. 46).

Phosphate Rock.—Production of phosphate rock concentrate decreased by 3.5% to about 5.5 Mt in 2005 from 5.7 Mt in 2004. The three leading mining companies—Fosfertil S.A. (Grupo Fertifós) (44.8%) in Minas Gerais, Fertilizantes Serrana S.A. (Bunge Ltd.) (24.7%) in Goiás, and Copebras S.A. (Anglo American) (20.2%) in Sao Paulo contributed almost 90% of the total production in 2005. The reported domestic consumption of concentrates was about 5.5 Mt in 2005 compared with 6.6 Mt in 2004. Of the total phosphoric acid produced, 73% was used in the fertilizer industry; 25%, in the chemical industry; and 2%, for other uses; these usages remained almost unchanged from those of 2004. Imports of phosphates were 1.2 Mt valued at \$60 million in 2005 compared with 1.6 Mt valued at \$75 million in 2004 (Departamento Nacional de Produção Mineral, 2006, p. 63-64; Instituto Brasileiro de Mineração, 2006, p. 28, 34).

Mineral Fuels

In 2005, Brazil produced almost 17.7 billion cubic meters of natural gas and 628.8 million barrels of petroleum, which was 4.3% and almost 11.4% higher, respectively, than that of 2004. The country produced, in order of economic importance, crude oil, natural gas liquid, natural gas, coal, and shale oil; production totaled 630 million barrels of oil equivalent. In 2005, Petrobrás' average production of crude oil, which included condensate and liquid natural gas, was about 2.217 million barrels per day (Mbbbl/d), and was 9.8% higher than that of 2004. Petrobrás was planning to increase its daily output rate to 2.3 Mbbbl by 2010 and to produce about 75% of this output from deepwater zones (Departamento Nacional de Produção Mineral, 2006, p. 91-92; Petróleo Brasileiro S.A., 2006, p. 59). In 2005, the supply of natural gas totaled about 64.1 million cubic meters per day, of which 24.2 million cubic meters per day, or almost 37.8%, was imported from Bolivia. Of the total daily supply, 32.1 million cubic meters, or 50.1%, was used by Petrobrás; 21.1 million cubic meters, or 32.9%, was consumed in Brazil; and the remaining

10.9 million cubic meters, or 17%, was used by thermoelectric powerplants. Gas usage grew by about 1.8% per year during the period 1980-2005 (Departamento Nacional de Produção Mineral, 2006, p. 66; *Petróleo Brasileiro S.A.*, 2006, p. 58).

Coal.—In 2005, Brazil produced 6.0 Mt of energy-generation-type coal compared with 5.4 Mt in 2004. The Brazilian coal industry's mine operations were concentrated in the three southernmost States of Santa Catarina (64.9%), Rio Grande do Sul (32.8%), and Parana (2.3%). The leading producers of ROM coal were Copelmi Mineração Ltda. (15%), Carbonífera Circúma S.A. (14%), and Indústria Carbonífera Rio Deserto Ltda. (13%). Coal demand increased mainly because the thermoelectric plants were operating at full capacity in these three States (Departamento Nacional de Produção Mineral, 2006, p. 31-32).

To meet Brazil's coal demand, 17.3 Mt was imported in 2005 compared with 18.5 Mt in 2004. Imports came from Australia (28%), the United States (21%), China (19%), Canada (9%), South Africa (5%), and other countries (18%). The steel industry consumed 64% of metallurgical-grade coal; thermoelectric generation, 33%; and the petrochemical and pulp and paper industries, 3% (Departamento Nacional de Produção Mineral, 2006, p. 32).

Brazil was planning a priority thermoelectric generating program based mostly on natural gas and coal that would involve 49 new power stations based mainly on natural gas. Three new coal-fired powerplants would be built in the State of Rio Grande do Sul. These new powerplants were part of the Government's 17-gigawatt emergency plan (supplied largely by Electrobrás S.A.) to cope with the increased demand for electricity. Most Brazilian coals have a lower content of carbon and a higher content of ash compared with the Colombian coals in the Guajira area. Total Brazilian coal reserves were estimated to be 10,113 Mt (table 3; Departamento Nacional de Produção Mineral, 2006, p. 31).

Natural Gas and Petroleum.—Brazil produced natural gas at a rate of 48.5 million cubic meters per day in 2005, which was an increase of 4.3% from that of 2004. The gas pipeline that links the Enchova platform in the offshore Campos Basin to Macae, State of Rio de Janeiro, added 5 million cubic meters per day of gas flow to the Rio de Janeiro and the Sao Paulo markets; offshore gas production accounted for 57% of the total. Petrobrás signed two agreements, one with Repsol YPF of Spain's subsidiary in Argentina and the other one with YPF de Bolivia, to supply natural gas to Brazil. The Argentina-Brazil gas pipeline linked Aldeia Brasileira in Argentina to Porto Alegre in the State of Rio Grande do Sul. In 2005, the \$2 billion, 3,150-kilometer (km) Bolivia-Brazil gas pipeline started operation and it could increase the flow of natural gas along the 1,970 km of pipeline between Santa Cruz de la Sierra, Bolivia, and Porto Alegre, Brazil, to supply, in order of volume, the States of Mato Grosso do Sul, Sao Paulo, Parana, Santa Catarina, and Rio Grande do Sul with 24 million cubic meters per day in 2005 and 30 million cubic meters per day starting in 2010—nearly 40% of domestic demand. The natural gas share of the country's energy mix was 6% in 2004 and could conceivably be 12% in 2010. Petrobrás continued to produce natural gas in the Gulf of Mexico and recovered gas from the Frederick Field, which

is located 27 km off the Louisiana coast. In 2004, Petrobrás discovered the Mexilhao gasfield in the Santos Basin off the coast of Sao Paulo State; the gasfield contained 72 billion cubic meters of natural gas. Brazil's potential for offshore gas supply has improved because of expected new discoveries in the Santos Basin (Departamento Nacional de Produção Mineral, 2006, p. 66; *Petróleo Brasileiro S.A.*, 2006, p. 46).

In 2005, Petrobrás's total international production of oil and liquid natural gas amounted to 35,800 barrels per day, and natural gas output was almost 4.2 million cubic meters per day, which totaled 58,900 barrels per day of oil equivalent. According to Petrobrás, exploration and production took place in, in order of economic importance, Angola, Argentina, Bolivia, Venezuela, Colombia, Peru, Ecuador, and the United States (*Petróleo Brasileiro S.A.*, 2006, p. 58). According to Petrobrás, Brazil produced 1.8 Mbbl/d of petroleum, which was almost 6.0% more than in 2004 (1.6 Mbbl/d). Imports of crude oil and derivatives were valued at \$10.6 billion compared with almost \$6.9 billion in 2004. The main sources were Nigeria (48.7%), Algeria (22.3%), Saudi Arabia (14.0%), Iraq (7.9%), and Argentina (3.5%) (Departamento Nacional de Produção Mineral, 2006, p. 91-92; *Petróleo Brasileiro S.A.*, 2006, p. 58).

In 2005, the partnership of Royal Dutch Shell plc (RDS) of the Netherlands (80%) and Petrobrás (20%) on the Bijupira and the Salema Projects in Campos Basin produced a combined 50,000 barrels per day of crude oil and more than 480,000 cubic meters per day of gas; the fields have reserves of about 190 million barrels of oil and 1.8 billion cubic meters of natural gas. Other companies involved in exploration included Statoil ASA of Norway, Repsol YPF SA of Argentina, and Chevron Corporation of the United States (U.S. Energy Information Administration, 2006§).

Reserves

Brazil was among the world leaders in reserves of some mineral commodities. According to the DNPM, the country's world ranking in mineral reserves was as follows: first, columbium (niobium); second, iron ore, manganese, tantalum, and aluminum; third, asbestos, magnesite, graphite; fourth, vermiculite; and fifth, kaolin and tin (table 3; Departamento Nacional de Produção Mineral, 2005, p. 30-32; 2006, p. 10-12).

Infrastructure

Brazil's railroads comprised a total of 29,412 km (1,567 km electrified), of which 4,907 km was 1.600-m gauge (908 km electrified), 194 km was 1.440-m gauge (630 km electrified), and 23,915 km was 1.000-m gauge (581 km electrified). In addition, three rails had dual gauge—396 km of 1.000- and 1.600-m gauge (78 km electrified). The country had a total of almost 2 million kilometers of roads—94,871 km was paved and 1.6 million kilometers was gravel and dirt. Brazil had 50,000 km of navigable inland waterways. The major shipping ports were Belem, Fortaleza, Ilheus, Manaus, Paranagua, Porto Alegre, Recife, Rio de Janeiro, Rio Grande, Salvador, Santos, and Vitoria. Among the merchant marine's 271 ships, 82 were bulk vessels; 56, tankers; 15, chemical tankers; 14, combination

ore and oil vessels; 10, liquefied gas tankers; and 2, combination bulk vessels. Brazil had 4,136 airports; 698 had paved runways and 3,047 had unpaved runways (U.S. Central Intelligence Agency, 2006§).

In 2005, Brazil's installed electrical generating capacity was 52,865 megawatts (MW). Total production of electric power for the year was 339,000 gigawatthours, which translated into 1,370 kilowatt-hours per capita. Brazil's primary domestic energy supply encompassed the following: hydroelectric, 83%; petroleum and natural gas, 8%; nuclear energy, 4%; and others, 5% (U.S. Central Intelligence Agency, 2006§). The Bolivia-Brazil pipeline, which was owned by a consortium of Petrobrás and Royal Dutch Shell, was the leading of the various cross-border energy projects. Argentina supplied gas to the State of Rio Grande do Sul's new thermoelectric plant; two additional pipelines were to take Argentine gas to Brazil's southern market, and another project was to supply energy to Brazil from a powerplant in Uruguay. The total pipeline network was 30,346 km long, of which 12,857 km consisted of crude oil and petroleum products, and 17,489 km, of gas, which excluded the Brazilian side (2,600 km) of the Bolivia-Brazil gas pipeline. In northern Brazil, a transmission line supplied energy to the State of Roraima from Venezuela. The majority of these projects was being developed by the private sector as a result of globalization, liberalization, and privatization. State-owned corporations entered into partnerships with private domestic and foreign investors (Petróleo Brasileiro S.A., 2006, p. 58).

Negotiations were completed between the Brazilian Government and five companies, four of which were foreign subsidiaries. The companies involved were Alcan, Alcoa, BHP Billiton, Camargo Corrêa Industrial S.A. (Brazil), and Dow Chemical, USA. Brazil and the five companies planned to build a 1,200-MW dam, which would be named Tucuruí, on the Tocantins River on the border between the States of Maranhão and Tocantins. Construction of the dam would cost an estimated \$1.2 billion; BHP Billiton pledged \$350 million (Vale, 2006, p. 23).

This new dam appeared to be necessary because demand for hydroelectricity was growing at a faster rate than that of supply. The supply of subsidized electricity in the Tocantins area was exceeded by the industrial and mining activities in 2005. The 10% electrical subsidy was phased out in 2004. Alcoa acquired ownership of one concession as part of a consortium, and Alcan obtained the right to build three hydroelectric power stations (Departamento Nacional de Produção Mineral, 2006, p. 92).

The aluminum companies won the right to build new hydroelectric plants in the auction of the Agência Nacional de Energia Elétrica (ANEEL). They secured eight concessions that would demand a total investment of more than \$1 billion. In the auction of ANEEL, Alcan secured the right to build hydroelectric plants at Barra dos Coqueiros and Cacu in the State of Goiás, and at Traira II in the State of Minas Gerais. Alcan planned to invest \$180 million in their construction. Alcan will pay \$1.3 million per year for the concession of the 60-MW Traira I plant (Vale, 2006, p. 3-4).

Constran S.A. and Construção e Comércio of Grupo Itamaraty planned to construct an additional 1,718 km of railroad to be linked to the existing railroad system. The cost of the new

system was projected to be \$2.5 billion. This addition will connect to the existing system that runs through Vitória, State of Espírito Santo; Belo Horizonte, State of Minas Gerais; Santos, State of São Paulo; and Chapadao do Sul, State of Mato Grosso do Sul. This new railroad system will run from Chapadao do Sul to Cuiabá, Mato Grosso and Santarém, State of Pará, and branch from Cuiabá to Porto Velho, State of Rondônia (Vale, 2006, p. 22).

Outlook

Brazil, which has a strong economy in Latin America and MERCOSUR and is one of the world's leading producers of bauxite, columbium (niobium), graphite, iron ore, manganese, tantalum, and tin, will continue to attract FDI inflows. According to the Banco Central do Brasil (2006§) and the Economic Commission for Latin America and the Caribbean (2006§), more than 350 leading transnational companies were planning to invest worldwide, which could position Brazil behind, in order of investment volume, China, the United States, and India. In Brazil, the main vehicles for FDI inflows in the short and medium terms will be via joint ventures and acquisitions in new projects with CVRD, Petrobrás, and others. Investments in hydroelectric and thermoelectric powerplants coming onstream are expected to meet Brazil's future energy needs. As a result of the Administration's staying on course with fiscal austerity policies, reforms of the country's complex tax code, trimming of the civil service pension system, and continued fight against inflation, the Brazilian real is likely to remain strong. As an exporter of mineral commodities, the country is poised to gain from the continued FDI inflows into its economy, which represented an almost 75% share (\$15.1 billion) of MERCOSUR's total FDI (\$20.4 billion) in 2005 (Economic Commission for Latin America and the Caribbean, 2006§).

Brazil's Federal tax exemptions on imports of equipment for crude oil exploration, development, and production will continue into 2007, and the Agência Nacional do Petróleo was planning to extend them into 2020. Oil companies and other investors have shown confidence in the country, which could support continued economic growth and FDI in new technologies well into the next decade. Deferment of major investment decisions has not been reported by the Brazilian Government. Even firms that have financed with borrowed capital, such as CVRD, have the natural hedge provided by their mineral resources and exports. CVRD is planning to invest about \$13 billion in a low-cost and profitable project pipeline to be developed during 2006-10. The significance of the investment would be to increase CVRD's market capitalization to \$70 billion from its current (2005) level of about \$55 billion (Banco Central do Brasil, 2006§; Companhia Vale do Rio Doce, 2006§).

The various sectors of the Brazilian economy have recorded diverse rates of growth— industrial, 6.3 %; minerals, 4.1%; services, 3.8%; and agriculture, 3.0% (Departamento Nacional de Produção Mineral, 2006, p. 1; Banco Central do Brasil, 2006§). The positive rate of economic growth in the minerals sector is likely to be sustained into 2006 and beyond if expansion in the demand for mineral exports and fabricated steel

goods continues. MERCOSUR has undergone dramatic changes in the natural gas and power markets owing to the increase in cross-border energy investment opportunities, domestic gas consumption, and regionalization of the energy sector. Brazil has become the center of an increasingly rapid process of energy integration in South America owing to the country's gas market, which is evolving rapidly with an unsatisfied energy demand and a great potential for growth. Petrobrás will be an integrated energy company with a strong international presence and a leader in Latin America (Petróleo Brasileiro S.A., 2006, p. 31-33).

Investments in the Brazilian mining industry are expected to continue to enhance exploration and mine development activities, particularly in, in order of importance, iron ore, gold, copper, diamond, and emerald. This trend is expected to continue because several transnationals have been forming consortiums and acquiring exploration properties, mining prospects, and permits particularly for, in order of importance, oil and gas, iron ore, gold, diamond, and base metals.

Brazilian gold production could increase significantly in the foreseeable future because of the growth of Brazilian copper production and increased interest by domestic and foreign investors in largely unexplored areas. More than 2,500 gold occurrences, which are mostly Precambrian vein deposits and alluvial placers, are known (Departamento Nacional de Produção Mineral, 2006, p. 88).

Brazil's dynamic and diverse economy coupled with its sizable consuming market and its membership in MERCOSUR is expected to continue to attract the interest of domestic and international investors. Brazil's joint ventures with such growing economies of East Asia as China, Japan, and the Republic of Korea are expected to enhance its minerals trade with the United States, the EU, and Latin America. Brazil has a strong industrial base that is capable of supplying most of the required mining and oil and gas equipment; the country has modern mining and oil technologies and an efficient network of supporting services, and can provide skilled labor. Modern and reliable transportation and communication infrastructures are needed, however, because in the short and medium terms, a bottleneck could affect Brazil's ability to augment its output of minerals competitively and in a sustainable way.

The aluminum, automobile, petrochemical, pulp and paper, and steel industries, which depend heavily on energy and exports, will likely benefit most from a new power-generating infrastructure. The 52 powerplants to be built in the foreseeable future (49 based on natural gas and 3 on coal) will become the major drivers for growth in mineral fuels demand. Since 2002, the Government eliminated all price controls and import tariffs on petroleum and derivatives to motivate private investment and to increase competition that would benefit the Brazilian economy. Petrobrás is expected to build additional refineries with the participation of new partners from the private sector (Petróleo Brasileiro S.A., 2006, p. 34).

The Amazon region continued to offer potential for major undiscovered mineral resources in addition to the large reserves of, in order of value, iron ore, manganese, bauxite, gold, and tin. A factor that may place constraints on mineral development over the longer term, however, is the concern over biodiversity

in the Amazon Rainforest, which comprises 30% of the world's remaining tropical forests, provides shelter to 10% of the globe's plant and animal species, and removes excess carbon dioxide from the atmosphere. Much will depend, however, on the approaches and technologies to be used for economic and social development while protecting the environment in a sustainable way (Departamento Nacional de Produção Mineral, 2006, p. 7; U.S. Energy Information Administration, 2006§).

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Comissão Nacional de Energia Nuclear
Rua General Severiano
90 Botafogo-ZC-02
22290-Rio de Janeiro-RJ-Brasil
Companhia de Pesquisa de Recursos Minerais
Avenida Pasteur 404-Anexo, 2º Andar, Pira Vermelha
22290-Rio de Janeiro-RJ-Brasil
Conselho de Não-Ferrosos e de Siderurgia
Esplanados dos Ministerios-Bloco 6-5º Andar
70053-Brasilia-DF-Brasil
Conselho Nacional do Petróleo
SGAN-Q.603 Modulos J, I e H
70830-Brasilia-DF-Brasil
Instituto Brasileiro de Mineração
Avenida Afonso Pena, 3880 3º, 4º e 5º Andares
30000-Belo Horizonte-MG-Brasil
Instituto Brasileiro de Siderurgia
Rua Araújo Porto Alegre, 36 - 7º Andar
20030-010-Rio de Janeiro-RJ-Brasil
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Ministério da Minas e Energia
SAN-Quadra 01-Bloco "B"

70040-Brasilia-DF-Brasil
Petróleo Brasileiro S.A.
Avenida República do Chile, 65
20035-Río de Janeiro-RJ-Brasil
Rio Doce Geológica e Mineração, S.A.
Avenida President Wilson 11º Andar
22030-Rio de Janeiro-RJ-Brasil

Major Publications

Associação Brasileira dos Produtores de Ferroligas (ABRAFE),
Sao Paulo: ABRAFE Yearbook, annual.
Departamento Nacional da Produção Mineral, Brasilia: Anuario
and Sumario Mineral, annual.
Fairchild Publications, New York: American Metal Market,
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Instituto Latinoamericano del Fierro y el Acero, Santiago:
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Metal Bulletin Journals Ltd., London:
Metal Bulletin, semiweekly.
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Mining Annual Review, annual.
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TABLE 1
BRAZIL: PRODUCTION OF MINERAL COMMODITIES^{1,2}

(Metric tons unless otherwise specified)

Commodity	2001	2002	2003	2004	2005
METALS					
Aluminum:					
Bauxite, dry basis, gross weight	13,032,000	12,602,000	17,363,000	20,914,000 ^r	21,000,000
Alumina	3,445,000	3,962,000	5,111,000	5,300,000 ^r	5,300,000
Metal:					
Primary	1,140,000	1,318,400	1,381,000 ^r	1,457,000 ^r	1,498,000
Secondary	200,000	215,000	235,000	246,000 ^r	253,000
Total	1,340,000	1,533,400	1,616,000 ^r	1,703,000 ^r	1,751,000
Beryllium, beryl concentrate, gross weight	--	7	6	6	6
Cadmium, metal, primary ³	120	151	189	187	200
Chromium:					
Crude ore	419,049	283,991	376,862 ^r	593,476	615,904
Concentrate and lump, Cr ₂ O ₃ content	178,013	113,811	155,063 ^r	253,002	252,102
Marketable product ³	38,472	11,186	12,000 ^c	12,000 ^c	12,000 ^c
Cobalt:					
Mine output, Co content of hydroxide ^e	1,100	1,200	1,300	1,400 ⁴	1,500 ^p
Metal, electrolytic ⁵	889	960	1,097	1,155	1,200 ^p
Columbium (niobium)-tantalum ores and concentrates, gross weight:					
Columbite and tantalite ^c	330	231 ^r	249 ^r	277 ^{r,4}	456 ^p
Djalmaite concentrate ^c	10	10	10	10	10
Pyrochlore concentrate, Nb ₂ O ₅ content	39,039	41,303	36,992 ^r	34,016 ^r	56,021
Copper:					
Mine output, Cu content	32,734	32,711	26,275 ^r	103,153	133,325
Metal, refined:					
Primary	212,243	189,651	173,378	208,020	199,043
Secondary	36,000	23,000	20,000	24,000	25,000
Total	248,243	212,651	193,378	232,020	224,043
Gold:					
Mine output kilograms	37,810	32,912	26,066	28,508	29,941 ^p
Garimpeiros, independent miners do.	5,074	8,750	14,350	19,088	8,351 ^p
Total do.	42,884	41,662	40,416	47,596	38,292 ^p
Iron and steel:					
Iron ore and concentrate, marketable product:⁶					
Gross weight thousand metric tons	210,000 ^r	214,560	230,707	261,675	280,862
Fe content do.	139,440 ^r	142,468	153,190	173,752	185,369
Metal:					
Pig iron do.	27,623	29,667	32,036	34,579	34,382
Ferroalloys, electric arc furnace:					
Chromium metal	NA	NA	NA	NA	NA
Ferrocadium silicon	NA	NA	NA	NA	NA
Ferrochromium	110,468	164,140	204,339	216,277	197,653
Ferrochromium silicon	5,899	10,522	10,500	11,560	11,600
Ferrocolumbium	37,411	36,450	24,875	25,169	38,819
Ferromanganese	276,000	339,000	438,000	466,000 ^r	480,000
Ferromolybdenum	NA	NA	NA	NA	NA
Ferronickel	17,966	19,874	19,900 ^c	19,900 ^c	21,200 ^c
Ferrophosphorus	NA	NA	NA	NA	NA
Ferrosilicon	159,345	145,910	146,000 ^c	146,000 ^c	146,000 ^c
Ferrosilicon magnesium	11,032	14,552	14,600 ^c	14,600 ^c	14,600 ^c
Ferrosilicon zirconium	--	NA	NA	NA	NA
Ferrotitanium	NA	NA	NA	NA	NA
Ferrotungsten	NA	NA	NA	NA	NA
Ferrovandium	NA	NA	NA	NA	NA
Inoculant	14,684	11,100	11,100 ^c	11,100 ^c	11,100 ^c
Silicomanganese	180,235	182,731	180,200	180,000 ^c	180,200 ^c
Silicon metal	112,123	133,390	133,400	133,000 ^c	133,400 ^c
Other ferroalloys	16,623	25,300	25,300 ^c	19,054	19,500
Total	941,786	1,082,969	1,208,214	1,240,000 ^c	1,250,000 ^c

See footnotes at end of table.

TABLE 1—Continued
 BRAZIL: PRODUCTION OF MINERAL COMMODITIES^{1,2}

(Metric tons unless otherwise specified)

Commodity	2001	2002	2003	2004	2005	
METALS—Continued:						
Iron and steel--Continued:						
Crude steel, excluding castings	thousand metric tons	26,718	29,604	31,150	32,918	31,631
Semimanufactures, flat and nonflat	do.	18,006	17,460	17,500 ^e	17,500 ^e	17,500 ^e
Lead:						
Mine output, Pb content in concentrate		10,725	9,253	10,652	14,737 ^r	16,063
Metal, secondary		47,000	50,000	128,610 ^r	137,121 ^r	104,904
Manganese:						
Ore and concentrate, marketable: ³						
Gross weight		1,970,000	2,529,000	2,544,000	3,143,000 ^r	3,200,000
Metal content		988,000	1,095,000	1,286,000	1,346,000 ^r	1,370,000
Metal:						
Primary		7,290 ^r	10,950 ^r	12,860 ^r	13,460 ^r	13,500
Secondary ^c		1,600	1,600	1,600	1,600	1,600
Nickel:						
Mine output, ore		3,916,210	3,873,474	3,893,095	3,794,868	4,845,695
Ni content in ore		45,958	45,456	44,928	51,886	74,198
Ni content in carbonate		17,063	18,100	18,406	19,897	21,116
Ni content in matte		10,183	6,274	5,950	6,708	6,005
Ni, electrolytic		17,663	17,676	18,155	19,742	20,714
Ferronickel, Ni content		5,768	6,011	6,409	6,493	9,596
Rare-earth metals, monazite concentrate, gross weight ^c		200	--	--	731 ^r	730
Silver⁷						
Primary	kilograms	46,046	33,000	31,440	35,497	38,134
Secondary ^c	do.	50,000	50,000	50,000	45,000 ⁴	43,000 ^p
Total	do.	96,046	83,000	81,440	80,497	81,134
Tin:						
Mine output, Sn content		13,016	12,023	12,217	12,202 ^r	11,739
Metal, smelter:						
Primary		12,168	11,675	10,761	11,512	8,986
Secondary ^c		250	250	250	250	250
Total		12,418	11,925	11,011	11,762	9,236
Titanium:						
Ilmenite:						
Gross weight		144,644	177,027	120,160	133,000	127,142
TiO ₂ content		68,135	71,746	94,000 ^r	90,000 ^r	90,000
Rutile, TiO ₂ content		2,270	1,878	2,303	2,117	2,069
Tungsten, mine output, W content		22	24	30	262	458
Zinc:						
Mine output, Zn content		111,432	136,339	152,822	158,962	171,434
Metal, smelter:						
Primary		197,037	247,692	262,998	265,987	267,374
Secondary ^c		7,000	7,000	NA ^r	NA ^r	NA
Total		204,037	254,692	262,998	265,987	267,374
Zirconium, zircon concentrate, gross weight ⁸		20,553	20,000	27,198 ^r	25,263 ^r	25,657
INDUSTRIAL MINERALS						
Asbestos:						
Crude ore ^c		3,950,000	3,950,000	3,950,000	3,950,000	3,950,000
Fiber		172,695	194,732	231,117 ^r	252,067 ^r	236,047
Barite:						
Crude		63,882	63,953	67,842 ^r	72,320 ^r	58,579
Beneficiated		54,790	53,098	57,452	59,612	44,041
Marketable product ^{c,3}		65,000	65,000	65,000	65,000	65,000
Calcite ^c		35,000	35,000	35,000	35,000	35,000
Cement, hydraulic	thousand metric tons	38,927	38,027	34,010	34,413	36,673
Clays:						
Bentonite, beneficiated		178,610	184,909	198,981	226,874	221,035

See footnotes at end of table.

TABLE 1—Continued
BRAZIL: PRODUCTION OF MINERAL COMMODITIES^{1,2}

(Metric tons unless otherwise specified)

Commodity	2001	2002	2003	2004	2005	
INDUSTRIAL MINERALS—Continued:						
Clays--Continued:						
Kaolin:						
Crude	4,082,024	3,924,158	5,205,513	5,958,057	6,150,000	
Beneficiated	1,734,359	1,757,488	2,081,039	2,381,000 ^r	2,410,000	
Marketable product ³	1,437,399	1,444,159	1,852,376	2,149,000 ^r	2,074,000	
Diamond, gem and industrial:^c						
Private sector	thousand carats	23	40	20	30 ^r	111
Garimpagem	do.	677	460	380	270 ^r	189
Total ⁹	do.	700	500	400	300 ^r	300
Diatomite:						
Crude	10,010	8,679	10,293	8,847	7,549	
Beneficiated	6,730	5,835	6,920	7,200	7,670	
Marketable product ^{e,3}	13,100	13,100	13,100	13,100	13,100	
Feldspar:						
Crude ^e	150,000	150,000	102,077 ^r	280,293 ^r	196,419	
Marketable product:³						
Feldspar	75,000	39,694	53,476 ^r	115,952 ^r	117,387	
Leucite ^e	5,000	5,000	5,000	5,000	5,000	
Sodalite, crude ^e	500	500	500	500	500	
Total	80,500	45,194	58,976	121,452	122,887	
Fluorspar:						
Crude ore	124,021	131,975	164,208	181,991	201,435	
Concentrates, marketable product:						
Acid-grade	31,263	32,774	34,462	40,948	42,043	
Metallurgical-grade	12,471	15,125	21,884	16,824	24,469	
Total	43,734	47,899	56,346	57,772	66,512	
Graphite:						
Crude ^e	650,000	650,000	650,000	650,000	650,000	
Marketable product:³						
Direct-shipping ore	NA	NA	NA	NA	NA	
Concentrate	70,091	60,922	70,739	76,332	75,515	
Total	70,091	60,922	70,739	76,332	75,515	
Gypsum and anhydrite, crude	1,506,619	1,633,311	1,592,015 ^r	1,474,911 ^r	1,582,248	
Kyanite:^e						
Crude	750	750	750	750	750	
Marketable product ³	600	600	600	600	600	
Lime, hydrated and quicklime	thousand metric tons	6,300 ^c	6,500	6,600	6,900	6,900
Lithium, concentrates	9,084	12,046	9,755	9,064	8,924 ^p	
Magnesite:						
Crude	1,079,207	1,084,786	1,134,385	1,339,441	1,342,754	
Beneficiated	265,749	302,230	306,444	366,174	386,759	
Mica, all grades ^e	4,000	4,000	4,000	4,000	4,000	
Nitrogen, N content of ammonia	769,400 ^r	1,021,100 ^r	938,800 ^r	1,077,400 ^r	950,000	
Phosphate rock including apatite:						
Crude:						
Mine product	thousand metric tons	26,740	31,494	34,700	35,000	34,000
Of which sold directly ^c	do.	35	35	35	35	35
Concentrate:						
Gross weight	do.	4,805	5,084	5,584	5,690 ^r	5,488
P ₂ O ₅ content	do.	1,707	1,831	2,005	2,181	2,044
Pigment, mineral, other, crude ^c	2,000	2,000	2,000	2,000	2,000	
Potash, marketable (K ₂ O)	318,585	337,266	415,549	403,080	404,871	
Potassium (KCl)	594,930	627,310	657,750	638,020	638,020 ^p	

See footnotes at end of table.

TABLE 1—Continued
 BRAZIL: PRODUCTION OF MINERAL COMMODITIES^{1,2}

(Metric tons unless otherwise specified)

Commodity	2001	2002	2003	2004	2005
INDUSTRIAL MINERALS—Continued:					
Precious and semiprecious stones except diamond, crude and worked: ^c					
Agate	3,000	3,000	3,000	3,000	3,000
Amethyst	1,000	1,000	1,000	1,000	1,000
Aquamarine	20	20	20	20	20
Citrine	100	100	100	100	100
Emerald	90	90	90	90	90
Opal	500	500	500	500	500
Ruby value	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
Sapphire do.	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000
Topaz	50	50	50	50	50
Tourmaline	80	80	80	80	80
Other	500	500	500	500	500
Quartz crystal, all grades	4,350	4,300	7,420	18,116	17,860
Salt:					
Marine thousand metric tons	4,370	4,835	5,144	5,206	5,738
Rock do.	1,208	1,274	1,420	1,442	1,559
Silica, silex ^c	1,600	1,600	1,600	1,600	1,600
Sodium compounds: ^c					
Caustic soda	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000
Soda ash, manufactured (barilla)	200,000	200,000	200,000	200,000	200,000
Stone, sand and gravel: ^e					
Dimension stone:					
Marble, rough-cut cubic meters	200,000	200,000	200,000	200,000	200,000
Of which sold directly	50,000	50,000	50,000	50,000	50,000
Crushed and broken stone:					
Basalt cubic meters	1,200,000	1,200,000	1,200,000	1,200,000	1,200,000
Calcareous shells	450,000	450,000	450,000	450,000	450,000
Dolomite thousand metric tons	3,500	3,500	3,500	3,500	3,500
Gneiss cubic meters	1,100,000	1,100,000	1,100,000	1,100,000	1,100,000
Granite thousand cubic meters	60,000	60,000	60,000	60,000	60,000
Limestone thousand metric tons	60,000	60,000	60,000	60,000	60,000
Quartz ¹⁰	250,000	250,000	250,000	250,000	250,000
Quartzite:					
Crude	400,000	400,000	400,000	400,000	400,000
Processed	200,000	200,000	200,000	200,000	200,000
Sand, industrial	2,700,000	2,700,000	2,700,000	2,700,000	2,700,000
Sulfur:					
Frasch	24,468	22,620	19,246	20,000	20,000
Byproduct:					
Metallurgy	280,079	284,184	285,821	286,000	286,000
Petroleum	80,125	77,185	90,332	90,400	91,000
Total	384,672	383,989	395,399	396,000	397,000
Talc and related material:					
Talc:					
Crude	370,500	348,000 ^r	369,000 ^r	417,716 ^r	401,124
Marketable product ^{e,3}	2,000	2,000	2,000	2,000	2,000
Pyrophyllite, crude ^e	189,500 ⁴	200,000	200,000	200,000	200,000
Vermiculite:					
Concentrate	21,464	22,577	26,055 ^r	25,103 ^r	24,191
Marketable product ^{e,3}	3,100	3,100	3,100	3,100	3,100
MINERAL FUELS AND RELATED MATERIALS					
Coal, bituminous:					
Run-of-mine thousand metric tons	13,800 ^e	5,046	4,643	5,077	6,050
Marketable ^{e,3} do.	6,000	6,000	6,000	6,000	6,000
Coke, metallurgical, all types do.	50 ^e	98	159	294	300
Natural gas, gross million cubic meters	13,988	15,525	15,792	16,971	17,699
Natural gas liquids million 42-gallon barrels	5,860	3,914	4,284	4,667	4,700

See footnotes at end of table.

TABLE 1—Continued
 BRAZIL: PRODUCTION OF MINERAL COMMODITIES^{1,2}

(Metric tons unless otherwise specified)

Commodity	2001	2002	2003	2004	2005	
MINERAL FUELS AND RELATED MATERIALS—Continued						
Petroleum:						
Crude	thousand 42-gallon barrels	487,640	547,135	562,137	544,799	614,697
Refinery products: ^{11, 12}						
Liquefied petroleum gas (LPG)	do.	14,112	13,274	13,503	13,652	13,889
Gasoline	do.	144,691	136,108	138,452	139,975	142,405
Jet fuel	do.	598	562	576	582	592
Kerosene	do.	28,112	26,444	26,900	27,196	27,668
Distillate fuel oil	do.	222,221	209,040	212,640	215,052	218,786
Lubricants	do.	6,315	5,941	6,043	6,109	6,215
Residual fuel oil	do.	127,482	119,920	121,985	123,327	125,468
Other	do.	108,359	101,931	103,686	104,827	106,647
Refinery fuel and losses	do.	NA	NA	NA	NA	NA
Total	do.	1,139,530	1,160,355	1,185,922	1,175,519	641,670

⁶Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. ⁴Revised. ^PPreliminary. NA Not available. -- Zero.

¹Table includes data available through July 2006.

²In addition to the commodities listed, bismuth, molybdenite, and uranium oxide are produced, but output is not reported; and available information is inadequate to make reliable estimates of output.

³Direct sales and/or beneficiated (marketable product).

⁴Reported figure.

⁵Source: Cobalt Development Institute.

⁶Includes sponge iron, in metric tons, as follows: 2001-05—270,000 (estimated).

⁷Officially reported output. Of total production, the following quantities are identified as secondary silver (the balance being silver content of other ores and concentrates), in kilograms: 2001-03—50,000 and 2004-05—45,000.

⁸Includes baddeleyite-caldasite.

⁹Figures represent officially reported diamond output plus official Brazilian estimates of output by nonreporting miners.

¹⁰Apparently includes crude quartz used to produce quartz crystal (listed separately in this table), as well as additional quantities of common quartz.

¹¹Figures represent officially reported production to the United Nations (Energy Statistics Yearbook) by the Ministry of Mines and Energy of Brazil.

¹²Minerals Questionnaire, 2001-04, and Petrobrás Magazine, 2003-06.

TABLE 2
BRAZIL: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
METALS			
Aluminum	Albras-Alumínio Brasileiro S.A. (Albras) [Companhia Vale do Rio Doce (CVRD), 51%, and Nippon Amazon Alumínio Co. (NAAC), 49%]	Belem and Vila do Conde, Para State (two smelters)	440 (metal).
Do.	Alcan Alumínio do Brasil S.A. [Alcan Aluminum Ltd. (Alcan), 100%]	Saramenha, Minas Gerais State (smelter and refinery)	100 (metal).
Do.	do.	do.	150 (alumina).
Do.	Alcan Empreendimentos Ltda. (Alcan Alumínio do Brasil S.A., 100%)	Laminacao de Pindamonhangaba, Sao Paulo State (smelter)	280 (metal).
Do.	Alcan Alumínio Poços de Caldas (Alucaldas) (Alcan Alumínio do Brasil S.A., 100%)	Pocos de Caldas, Minas Gerais State (mine)	1,000 (bauxite).
Do.	Alcoa Alumínio S.A. [Aluminum Co. of America (Alcoa), 54%; BHP Billiton plc, 36%; Alcan Aluminum Ltd. (Alcan), 10%]	Pocos de Caldas, Minas Gerais State (mine)	400 (bauxite).
Do.	do.	Sao Luiz, Maranhao State (refinery)	550 (alumina).
Do.	do.	Sao Luiz, Maranhao State (smelter)	239 (metal).
Do.	Alumínio do Brasil Nordeste S.A. [Alcan Aluminum Ltd. (Alcan), 100%]	Aratu, Bahia State (smelter)	120 (metal).
Do.	Alumar Consortium S.A. (Alcoa Alumínio S.A., 100%)	Juriti bauxite mine, Para State	4,000 (bauxite).
Do.	Alumar Consortium S.A. [Aluminum Co. of America (Alcoa), 54%; BHP Billiton plc, 36%; Alcan Aluminum Ltd. (Alcan), 10%]	Sao Luis, Maranhao State (refinery)	2,000 (alumina).
Do.	Alumar Consortium S.A. [Aluminum Co. of America (Alcoa), 53.66%; BHP Billiton plc, 46.34%]	Sao Luis, Maranhao State (smelter)	1,000 (metal).
Do.	Alumínio do Norte do Brasil S.A. (Alunorte) (private, 100%)	Barcarena, Para State (refinery)	2,400 (alumina).
Do.	Companhia Brasileira de Alumínio (CBA) (private, 100%)	Pocos de Caldas, Minas Gerais State (mine)	1,000 (bauxite).
Do.	do.	Sorocaba, Sao Paulo State (refinery)	500 (alumina).
Do.	do.	Sorocaba, Sao Paulo State (smelter)	340 (metal).
Do.	Companhia Geral do Minas (Aluminum Co. of America, 79%; Others, 21%)	Pocos de Caldas, Minas Gerais State (refinery)	275 (alumina).
Do.	do.	Pocos de Caldas, Minas Gerais State (smelter)	95 (metal).
Do.	Mineração Rio do Norte S.A. (MRN) [Companhia Vale do Rio Doce (CVRD), 40%; BHP Billiton plc, 14.8%; Aluminum Co. of America (Alcoa), 13.2%; Alcan Empreendimentos Ltda., 12%; Companhia Brasileira de Alumínio (CBA), 10%; Norsk Hydro Comercio e Industria, 5%; Reynolds Alumínio do Brasil, 5%]	Oriximina, Para State (mine)	14,500 (bauxite).
Do.	do.	Papagalo, Para State (mine)	2,000 (bauxite).
Do.	do.	Trombetas, Para State (mine)	2,000 (bauxite).
Do.	Vale do Sul Alumínio S.A. (Aluvale) (Government, 27%; private, 25%; Shell do Brasil S.A., 44%)	Santa Cruz, Rio de Janeiro State (smelter)	86 (metal).
Do.	Aluvale [Companhia Vale do Rio Doce (CVRD), 54.5%, and Billiton Metais S.A., 45.5%]	do.	93 (metal).
Do.	Reynolds Internacional do Brasil (Reynolds International Inc., 42.5%; Bradesco Bank, 42.5%; J.P. Morgan, 15%)	Sorocaba, Sao Paulo State (smelter)	5.4 million (cans).
Do.	Consortium Paragominas S.A. [Companhia Vale do Rio Doce (CVRD), 48.7%; Mineração Rio do Norte S.A. (MRN), 24.6%; Nippon Amazon Aluminum Co., 12.2%; Companhia Brasileira de Alumínio (CBA), 5.7%; others, 8.8%]	Jabuti, Para State (mine)	4,500 (bauxite).
Do.	do.	Jabuti, Para State (alumina)	1,200 (alumina).
Chromite	Coitezeiro Mineração S.A. (COMISA) (private, 75.4%, and Bayer do Brasil S.A., 24.6%)	Campo Formosa, Bahia State (mine)	50 (ore).
Do.	Companhia de Ferro Ligas da Bahia (FERBASA) (private, 100%)	Campo Formoso, Bahia State (mine)	370 (ore).
Do.	do.	Campo Formoso, Bahia State (beneficiation plant)	292 (concentrate).

TABLE 2--Continued
BRAZIL: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
METALS--Continued			
Columbium (niobium)	Companhia Brasileira de Metalurgia e Mineração (Grupo Moreira Sales S.A., 55%, and Molycorp, Inc., 45%)	Araxa, Minas Gerais State (mine)	120 (ore).
Do.	do.	Araxa, Minas Gerais State (beneficiation plant)	60 (pyrochlore).
Do.	Mineração Catalão de Goiás Ltda. (MCGL) (Bozzano Simosen S.A., 68.5%, and Anglo American plc, 31.5%)	Ouvidor and Catalao I, Goias State (mines)	70 (ore).
Do.	do.	Ouvidor, Goias State (plants)	24 (pyrochlore).
Copper	Mineração Carafba S/A (Grupo PARANAPANEMA, 100%)	Jaguari, Bahia State (mine)	130 (ore).
Do.	do.	Jaguari, Bahia State (beneficiation plant)	90 (concentrate).
Do.	Carafba Metais S/A (CMSA) (private, 100%)	Camacari, Bahia State (refinery)	220 (metal).
Do.	Companhia Vale do Rio Doce (CVRD), 100%	Sossego Mine, Carajás, Pará State	140 (concentrate).
Ferroalloys	Companhia Brasileira Carbureto de Calcio (private, 100%)	Santos Dumont, Minas Gerais State (plant)	54.
Do.	Prometal Produtos Metalúrgicos S.A., 60%, and Elkem A/S, 40%	Maraba, Para State (plant)	500.
Do.	Nova Era Silicon S.A. [Companhia Vale do Rio Doce (CVRD), 49%; Mitsubishi Corp., 25.5%; Kawasaki Steel Corp., 25.5%]	Nova Era, Minas Gerais State	48.
Do.	Companhia Ferro-Ligas de Bahia S.A. (FERBASA, 100%)	Pojuca, Bahia State (plant)	194.
Do.	Companhia Ferro-Ligas Minas Gerais (MINASLIGAS, 100%)	Pirapora, Minas Gerais State (plant)	58.
Do.	Companhia Paulista de Ferro-Ligas (CPF) (private, 100%)	Barbacena, Caxambu, Jeceaba, Passa Quatro, and Passa Vinte, Minas Gerais State;	326.
Do.	Companhia Vale do Rio Doce (CVRD) (CVRD-Companhia Siderúrgica Nacional, 100%)	Gold mines in the States of Minas Gerais, Bahia, and Para	200.
Do.	Italmagnesio S.A. Indústria e Comercio (ISAIC) (private, 100%)	Braganca Paulista, Sao Paulo State; and Varzeada Palma, Minas Gerais State (two plants)	63.
Do.	Rio Doce Manganês S.A. [Companhia Vale do Rio Doce (CVRD), 100%]	Bahia, Mato Grosso do Sul, and Minas Gerias States (six plants of manganese iron alloys)	600
Gold kilograms	Companhia Vale do Rio Doce (CVRD) (CVRD-Companhia Siderúrgica Nacional, 100%)	Gold mines in the States of Minas Gerais, Bahia, and Para	18,000.
Do.	do. AngloGold Ashanti Ashanti Mineração Ltda.	Novo Lima, Raposos, and Sabara, Minas Gerais State; and Jacobina, Bahia State (four mines)	7,000.
Do.	do. Mineração Serra Grande S.A. (AngloGold Ashanti Mineração Ltda., 50%, and Kinross Gold Corp., 50%)	Serra Grande, Minas Gerais State (mine)	6,000.
Do.	do. São Bento Mineração S.A. (Eldorado Gold Corp., 100%)	Santa Barbara, Minas Gerais State (mine)	4,000.
Do.	do. Rio Paracatu Mineração S.A. (Kinross Gold Corp., 100%)	Paracatu Mine, Minas Gerais State (mine)	7,500.
Do.	do. Mineração Maracá S.A. (MMSA) (private, 100%)	Sao Vicente Mine, Mato Grosso State (mine)	1,500.
Do.	do. Desert Sun Mining Ltd., 50%, and Williams Resources Ltd., 50%	Jacobina Mine, Bahia State (mine)	3,000.
Iron ore	Companhia Siderúrgica Nacional (CSN) (private, 100%)	Volta Mine, Minas Gerais State	12,000.
Do.	Itaminas Comércio de Minérios S.A. (private, 100%)	Itaminas, Minas Gerais State	5,000.
Do.	Companhia Vale do Rio Doce (CVRD) (CVRD-Companhia Siderúrgica Nacional, 100%)	Serra dos Carajas, Para State	70,000.
Do.	do.	Itabira, Ouro Preto, Santa Barbara, Xavier, Tamandua, Capao, and Mato, Minas Gerais State (seven mines)	100,000.
Do.	do.	Ponta de Madeira, Maranhao State (pellet plant)	6,000.
Do.	Ferteco Mineração S.A. (FERTECO) (Exploration Bergbau GmbH, 100%)	Ouro Preto and Brumadinho, Minas Gerais State (two mines)	12,800.
Do.	S.A. Mineração da Trindade (SAMITRI) (private, 100%)	Mariana, Rio Piracicaba, Itabira, Ouro Preto, and Sabara, Minas Gerais State (five mines)	9,300.
Do.	Minerações Brasileiras Reunidas S/A (MBR) (BHP Ltd., 50%, and Mitsui Co. Ltd., 50%)	Capao Xavier, Tamandua, and Capitao do Mato, Minas Gerais State (three mines)	32,000.
Do.	Samarco Mineração S.A. [S.A. Mineração da Trindade (SAMITRI), 51%, and BHP Ltd., 49%]	Alegria, Minas Gerais State (mine)	13,500.
Do.	SOCOIMEX S.A. [Companhia Vale do Rio Doce (CVRD), 100%]	Mato, Minas Gerais State (mine)	7,000.

TABLE 2--Continued
BRAZIL: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
METALS--Continued			
Lead	Companhia Mineira de Metais (CMM) (private, 100%)	Paracatu, Minas Gerais State (mine)	25 (ore).
Do.	do.	Paracatu, Minas Gerais State (plant)	15 (concentrate).
Manganese	Rio Doce Manganês S.A. [Companhia Vale do Rio Doce (CVRD), 100%]	Morro da Mina, Minas Gerais State	1,500.
Do.	do.	Mina do Azul, Carajas, Para State	1,500.
Do.	do.	Mina Mineiros, Bahia State	1,500.
Do.	Urucum Mineração S.A. [Companhia Vale do Rio Doce (CVRD), 100%]	Corumba and Ladario, Mato Grosso do Sul State (two mines and plant)	1,500 (ore), 800 (concentrate).
Do.	Construtora Polares Ltda. (CPL) (private, 100%)	Corumba Minas Gerais State (mine)	200 (ore).
Nickel	Companhia Niquel Tocantins (Grupo Votarantim, 100%)	Niquelandia, Goias State (mine)	20 (ore).
Do.	do.	Niquelandia, Goias State (refinery plant)	10 (electrolytic nickel).
Do.	Mineração Serra da Fortaleza (Grupo Votarantim, 100%)	Fortaleza, Minas Gerais State (mine)	19 (nickel matte).
Do.	CODEMIN S.A. (Anglo American plc, 100%)	Niquelandia, Goias State (refinery)	20 (metal).
Steel	Aço Minas Gerais S.A. (AÇOMINAS) (private, 100%)	Rodovia, Minas Gerais State	3,900.
Do.	Companhia Aços Especiais Itabira (Government, 90.9%, and private, 9.1%)	Timoteo, Minas Gerais State (stainless steel plant)	600.
Do.	Companhia Siderúrgica Belgo-Mineira (private, 100%)	Joao Monlevade, Minas Gerais State	1,000.
Do.	Companhia Siderúrgica de Tubarão (private, 100%)	Serra, Espirito Santo State	3,000.
Do.	Companhia Siderúrgica Nacional (CSN) (private, 100%)	Volta Redonda, Rio de Janeiro State	4,600.
Do.	Companhia Siderúrgica Paulista (COSIPA) (private, 100%)	Cubatao, Sao Paulo State	3,900.
Do.	Usinas Siderúrgicas de Minas Gerais, S.A. (USIMINAS) (private, 100%)	Ipatinga, Minas Gerais State	4,400.
Tantatum	metric tons Mineração Taboca/AM (private, 100%)	The Pitinga Mine, Amazonas State (mine)	180 (concentrate).
Do.	do. Companhia Industrial Fluminense (private, 100%)	Fluminense Mine, Minas Gerais State (mine)	25 (concentrate).
Tin	Mineração Jacunda Ltda. (MJL) (private, 100%)	Santa Barbara, Novo Mundo, and Potosi, Rondonia State (six mines)	108 (ore).
Do.	do.	Santa Barbara, Novo Mundo, and Potosi, Rondonia State (three beneficiation plants)	450 (concentrate).
Do.	Grupo PARANAPANEMA (private, 100%)	Aripuana, Mato Grosso State; Ariquemes, Rondonia State; Novo Aripuana, Pitinga, and Presidente Figueiredo, Amazonas State; and Sao Felix do Xingu, Para State (five mines and two plants)	5,420 (ore).
Do.	do.	Piraporada Bom Jesus, Sao Paulo State (refinery)	1,400 (concentrate), 25 (metal).
Do.	Marmoré S.A. (Grupo PARANAPANEMA, 100%)	Juiz de Fora, Minas Gerais State (mine)	20 (ore).
Do.	Grupo PARANAPANEMA (private, 100%)	Aripuana, Mato Grosso State; Ariquemes, Rondonia State; Novo Aripuana, Pitinga, and Presidente Figueiredo, Amazonas State; and Sao Felix do Xingu, Para State (five mines and two plants)	5,420 (ore).
Do.	do.	Piraporada Bom Jesus, Sao Paulo State (refinery)	1,400 (concentrate), 25 (metal).
Do.	Marmoré S.A. (Grupo PARANAPANEMA, 100%)	Juiz de Fora, Minas Gerais State (mine)	20 (ore).
Titanium	Rutilo e Ilmenita do Brasil S.A. (RIBSA) (private, 100%)	Mataraca, Paraiba State (mine)	4,200 (ore).
Do.	do.	Mataraca, Paraiba State (two beneficiation plants)	120 (concentrate).
Zinc	Votarantim Metais Zinco S.A (Grupo Votarantim, 100%)	Vazante, Minas Gerais State (mine)	800 (ore).
Do.	do.	Vazante, Minas Gerais State (beneficiation plant)	175 (concentrate).
Do.	do.	Paracatu, Minas Gerais State (mine)	400 (ore).
Do.	do.	Tres Marias, Minas Gerais State (refinery)	180 (metal).
Do.	do.	Juiz de Fora, Minas Gerais State (refinery)	95 (metal).
Zirconium	Nuclemon Minero-Química Ltda. (Government, 100%)	Sao Joao da Barra, Rio de Janeiro State (mine)	660 (ore).
Do.	do.	Itapemirim, Espirito Santo State (mine)	90 (ore).
Do.	do.	Prado, Bahia State (mine)	90 (ore).
Do.	do.	Prado, Bahia State (three beneficiation plants)	123 (concentrate).
Do.	do.	Prado, Bahia State (three separation plants)	90 (concentrate).

TABLE 2--Continued
BRAZIL: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
INDUSTRIAL MINERALS			
Asbestos	Sociedade Anônima Mineração de Amianto (private, 100%)	Cana Brava and Minacu, Goiás State (mines)	9,000 (ore).
Do.	do.	Cana Brava and Minacu, Goiás State (beneficiation plant)	230 (concentrate).
Cement	Cimento Santa Rita S.A. (CSSA) (private, 50%, and Holder Cimento S.A., 50%)	Itapevi and Salto de Pirapora, São Paulo State (two plants)	2,200.
Do.	Companhia Cimento Portland Itau (Grupo Votorantim, 100%)	Itau de Minas, Minas Gerais State (three plants)	2,400.
Do.	Companhia de Cimento Portland Paraiso (CCPP) (CCPP, 50%, and Lafarge Group, 50%)	States of Espírito Santo, Goiás, Minas Gerais, and Rio de Janeiro (five plants)	4,000.
Do.	Companhia de Cimento Portland Rio Branco (Grupo Votorantim, 100%)	Rio Branco do Sul, Paraná State (two plants)	5,000.
Do.	Camargo Correia Cimentos S.A. (CCSA) (private, 100%)	Ijaci, Minas Gerais State (plant)	1,600.
Diamond	Mineração Tejuçana S.A. (MTSA, 100%)	Diamantina, Minas Gerais State (mine)	100.
Fluorspar	Mineração Nossa Senhora do Carmo Ltda. (private, 100%)	Cerro Azul, Paraná State (two mines)	180 (ore).
Do.	Mineração Santa Catarina Ltda. (MSCL) (private, 100%)	Morro da Fumaca, Santa Rosa de Lima, Rio Fortuna, Santa Catarina State; and Tangua, Rio de Janeiro State (three mines and beneficiation plant)	100 (ore), 120 (concentrate).
Graphite	Nacional de Grafite Ltda. (NGL) (private, 100%)	Itapeçerica, Pedra Azul, Salto da Divisa, Minas Gerais State (three mines)	80 (ore).
Do.	do.	Itapeçerica, Pedra Azul, Salto da Divisa, Minas Gerais State (three beneficiation plants)	60 (concentrate).
Do.	Grafita MG Ltda. (GML) (private, 100%)	Mateus Leme, Zerra Azul, Minas Gerais State (two mines)	20 (ore).
Do.	Marmoré Mineração e Metalurgia Ltda. (MML) (Grupo PARANAPANEMA, 100%)	Maiquinique, Bahia State (mine)	10 (ore).
Gypsum	Companhia Brasileira de Equipamento (private, 100%)	Codo, Maranhão State, and Ipubi, Pernambuco State (two mines)	100.
Do.	Companhia de Cimento Portland Paraiso (private, 100%)	Ipubi, Pernambuco State (mine)	50.
Kaolin	Caulim da Amazônia S.A. (CADAM) (private, 100%)	Mazagão, Amapá State (mine)	720 (ore).
Do.	do.	Mazagão, Amapá State (beneficiation plant)	360 (concentrate).
Do.	do.	Adam Mine, Rio Jari, Amazonas State	660 (concentrate).
Do.	Pará Pigmentos S.A. (PPSA) (private, 100%)	Para Mine, Pará State	500 (concentrate).
Do.	Ymerys Rio Capim Caulim S.A. (RCCSA) (private, 100%)	Rio Capim Mine, Pará State	500 (concentrate).
Do.	Empresa de Mineração Horii Ltda. (EMHL) (private, 100%)	Biritiba and Mogi das Cruzes, São Paulo State (two mines)	200 (ore).
Do.	do.	Biritiba and Mogi das Cruzes, São Paulo State (two beneficiation plants)	180 (concentrate).
Limestone	Companhia de Cimento Portland Paraiso (CCPP) (private, 100%)	States of Goiás, Minas Gerais, and Rio de Janeiro (five mines)	2,000.
Do.	Companhia de Cimento Portland Rio Branco (CCPRB) (private, 100%)	Rio Branco do Sul, Paraná State (three mines)	5,500.
Do.	S.A. Industrias Votorantim (SAIV) (private, 100%)	States of Rio de Janeiro and São Paulo (four mines)	1,000.
Magnesite	Magnesita S.A. (MSA) (private, 100%)	Brumado, Bahia State (one major mine and numerous small mines)	1,000 (ore).
Do.	do.	Brumado, Bahia State (two beneficiation plants)	280 (concentrate).
Phosphate rock	Fertilizantes Serrana S.A. (Bunge International Group, 100%)	Araxá, Minas Gerais State (mine)	5,000.
Do.	Copebras S.A. (Copebras) (Anglo American plc, 100%)	Ouvidor, Goiás State (mine)	4,400.
Do.	Fosfértil S.A. [Grupo Fertifós, 81.54%, and Companhia Vale do Rio Doce (CVRD), 10.96%]	Tapira, Minas Gerais State (two mines)	10,500.
Do.	Ultrafértil S.A. [Grupo Fertifós, 81.54%; Companhia Vale do Rio Doce (CVRD), 10.96%; public, 7.5%]	Araxá, Minas Gerais State (mine)	5,000.

TABLE 2--Continued
 BRAZIL: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
INDUSTRIAL MINERALS--			
Continued			
Quartz	Telequartzo Exportação S.A. (TESA) (private, 100%)	Cristal, Minas Gerais State (mine)	6.0.
Salt, rock	Frota Oceânica Brasileira S.A. (FOBSA) (private, 100%)	Jacupiranga, Sao Paulo State (mine)	6,000.
Do.	Dow Química do Nordeste Ltd. (DQNL) (Dow Chemical Co., 100%)	Vera Cruz, Bahia State (mine)	1,000.
Do.	Cia. Nacional de Alcalis S.A. (CNA) (private, 100%)	Alcalis Grupo, Rio Grande do Norte State	1,500.
Do.	Salgema Mineração e Química S.A. (SMQ) (private, 100%)	Salgema, Maceio, Alagoas State (mine)	1,000.
MINERAL FUELS			
Coal	Carbonífera Circuíma S.A. (CCSA) (private, 100%)	Circiuma and Sideropolis, Santa Catarina State (two mines)	1,600.
Do.	Companhia Carbonífera Metropolitana S.A. (private, 100%)	Circiuma, Sideropolis, and Urussanga, Santa Catarina State (three mines)	1,200.
Do.	Copelmi Mineração Ltda. (COPELMI) (private, 100%)	Arroio dos Ratos, Butia, and Charqueadas, Rio Grande do Sul State (four mines)	4,600.
Do.	Companhia Riograndense de Mineração S.A. (private, 100%)	Circiuma and Urussanga, Santa Catarina State (two mines)	2,600.
Petroleum thousand 42-gallon barrels	Petróleo Brasileiro, S.A. (Petrobrás) (Government, 81.4%; private, 11.8%; public, 6.8%)	Fields in the States of Alagoas, Amazonas, Bahia, Ceara, Espirito Santo, Rio de Janeiro, Rio Grande do Norte, Para, Maranhao, and Sergipe (99)	220,000.
Petroleum products	do. do.	Refineries in the States of Amazonas, Bahia, Ceara, Minas Gerais, Parana, Rio de Janeiro, Rio Grande do Sul, and Sao Paulo	608,000.
Do.	do. Refinaria de Petróleo Ipiranga S.A. (private, 100%)	Ipiranga, Rio Grande do Sul	3,400.
Do.	do. Refinaria de Petróleos de Manguinhos S.A. (private, 100%)	Manquinhos, Rio de Janeiro State	3,650.

TABLE 3
BRAZIL: RESERVES OF MAJOR MINERAL COMMODITIES IN 2005¹

(Thousand metric tons unless otherwise specified)

Commodity	Reserves	World ranking	World percentage
Asbestos, fiber	15,400		NA
Bauxite, ore	2,730,000	3	8.3
Chromite, Cr ₂ O ₃	7,100		0.1
Coal, all types	10,113,000		1.1
Columbium (niobium), pyrochlore, and columbite ore	4,300	1	97.0
Copper, metal content	17,400		1.8
Fluorspar, ore	3,100		1.0
Gold, metal	metric tons 2,000		2.0
Graphite, ore	95,000	2	26.0
Gypsum	1,269,000		NA
Iron ore, 60% to 65% Fe content	21,000	5	6.5
Kaolin	4,050,000	3	29.0
Lead, metal content	1,000		0.7
Magnesite	180,000	4	8.2
Manganese, metal content	152,000	4	3.0
Natural gas ²	million cubic meters 220,000		0.1
Nickel, metal content	6,000		4.0
Petroleum ²	million 42-gallon barrels 12,000		0.9
Phosphate rock	260,000		0.8
Talc and pyrophyllite	156,000	3	17.0
Tantalum	89,000	1	52.0
Tin, metal content	2,500	2	22.0
Titanium, TiO ₂	7,200		0.7
Vermiculite	23,000	3	10.0
Uranium, U ₃ O ₈	metric tons 163,000		NA
Zinc, metal content	5,200		1.2
Zirconium, ore	2,000		2.8

NA Not available.

¹Summário Mineral 2004-2005.

²Petróleo Brasileiro, S.A., Annual Report 2004-05; Petroleum Economist, July 2006.

