

THE MINERAL INDUSTRY OF BRAZIL

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In 2004, Brazil continued to be an industrial powerhouse in South America and a leading world producer of such mineral commodities as bauxite (after Australia), columbium (niobium) (followed by Canada), graphite (after China and India), iron ore (after China), manganese (after Australia, South Africa, and Gabon), tantalum (after Australia), and tin (after China, Indonesia, and Peru) (Carlin, 2005; Corathers, 2005; Cunningham, 2005a, b; Jorgenson, 2005; Olson, 2005b; Plunkert, 2005).

Brazil's land area is 8,514,877 square kilometers, which is smaller than that of the United States, and its population was almost 184 million inhabitants. Brazil was the leading economy in Latin America and a member of the Mercado Común del Cono Sur (MERCOSUR), which is the second leading trade association in the Americas and the eighth worldwide. Its gross domestic product (GDP) based on purchasing power parity was \$1.492 trillion.¹ Brazil's GDP grew by 4.9% in 2004, which was the highest rate of growth since 1994 (International Monetary Fund, 2005a§, ² b§; U.S. Central Intelligence Agency, 2005§; World Bank Group, 2005a§). The country, which has undergone significant change during the past decade on the macroeconomic front, maintained a current account surplus and a policy of fiscal austerity at a time when inflation, once the bane of the economy, was under control. At the end of 2004, Brazil's position with respect to domestic consumption and exports had improved owing to increased global trade, a high level of liquidity of international financial resources, higher confidence of foreign and domestic investors, and strong economic recovery in 2004. The country's foreign exchange reserves increased to about \$58.5 billion from a revised \$56.5 billion in 2003. Brazil's total debt burden decreased to \$212.6 billion from a revised \$235.4 billion in 2003. Exports were valued at \$96.5 billion, and imports, \$62.8 billion compared with \$73.1 billion and \$48.3 billion, respectively, in 2003. Brazil's mineral sector had a surplus of \$4.2 billion compared with a revised \$4.7 billion in 2003. Imports of mineral fuels such as coal (\$1.4 billion), natural gas, and petroleum and its derivatives (\$6.8 billion) affected Brazil's minerals trade negatively (Departamento Nacional de Produção Mineral, 2005b, p. 17-23; c, p. 53; Banco Central do Brasil, 2005§).

Brazil's economic turnaround was positive after the country absorbed a series of domestic and international economic shocks during 2003-04; the Banco Central do Brasil, to fight inflationary pressures, floated exchange rates and increased interest rates. 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 reduce its account deficit to \$11.5 billion

from \$26.2 billion in 2003, which was equivalent to 1.9% of the current GDP, thus helping to restore confidence in the Government's macroeconomic management and creating conditions for lower inflation and interest rates. Inflation was 7.6% compared with 9.3% in 2003. The financial system benefited from foreign direct investment (FDI) inflows, high capitalization, and strengthening of fiscal and monetary discipline, which helped moderate the downturn in economic growth from 2003 (Banco Central do Brasil, 2005§; International Monetary Fund, 2005b§; U.S. Department of State, 2005§; World Bank Group, 2005a§, b§).

South America's and the Caribbean's FDI inflows increased to \$56.4 billion in 2004 from \$39.1 billion in 2003. Of this total, the FDI inflows into South America increased to \$34.1 billion from a revised \$23.4 billion in 2003. In the Andean Community, inflows decreased to \$6.2 billion from \$7.5 billion in 2003. MERCOSUR's FDI inflows increased to \$20.3 billion from \$11.5 billion in 2003, but the steepest increase was in Brazil to \$18.2 billion from \$11.4 billion in 2003 (Economic Commission for Latin America and the Caribbean, 2004§; Banco Central do Brasil, 2005§; World Bank Group, 2005a§).

The Brazilian Government continued with the privatization process and to establish joint ventures with the private sector in the hydrocarbons industry. In 2004, Brazil formed a joint venture in the iron ore sector mainly with China to encourage new capital flows into the country's economy (Banco Central do Brasil, 2005§; Departamento Nacional de Produção Mineral, 2005§; International Monetary Fund, 2005b§).

Brazil produced 46 industrial minerals, 22 metals, and 4 fuel minerals and exported them to the global marketplace. Among those produced were bauxite, copper, coal, columbium (niobium), chromite, 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 one-third of the Latin American economy (Departamento Nacional de Produção Mineral, 2005c, p. 11-12; d, p. 58; f, p. 34).

Brazil continued with its petroleum exploration program to expand reserves and reduce its dependence on oil imports, which satisfied almost 15% of its crude oil requirements. Petróleo Brasileiro S.A. (Petrobrás) management indicated that Brazil will achieve self-sufficiency in 2006 and that of the about \$54 billion in investments budgeted in Petrobrás' strategic planning to 2010, about 90% will be invested in the country. 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 a skilled labor force. Major international mining, petroleum, and steel companies were notably interested in, in order of

¹Where necessary, values have been converted from Brazilian real (R\$) to U.S. dollars (US\$) at the rate of R\$2.925=US\$1.00.

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

importance, oil and gas, iron ore, steel, coal, gold, copper, and diamond (Departamento Nacional de Produção Mineral, 2005f, p. 103; *Petróleo Brasileiro S.A.*, 2005, p. 9, 55).

Petrobrás continued to view the joint-venture oil-gas projects with BP Amoco p.l.c., Exxon Mobil Corp., ChevronTexaco Corp., and others as significant because of the expected improvements and strengthening of economies of scale, competitiveness, and operational synergy that will affect future oil-gas joint ventures between Petrobrás and the private investors. Equally important to Brazil were the Sistema Sul's Quadrilátero Ferrífero (Itabira, Mariana, Minas Centrais, and Minas do Oeste) iron ore joint venture between Companhia Vale do Rio Doce (CVRD) and China's Shanghai Baosteel Group Corp. and the Sossego copper-gold joint venture between CVRD and Phelps Dodge Corp. of the United States (Ferraz, 2004, p. 1-2; *Latin Trade*, 2004; *Petróleo Brasileiro S.A.*, 2005, p. 9-11; *Companhia Vale do Rio Doce*, 2005a§). Since 1991, the more than 500 transnational corporations that have established operations in Brazil have brought in about \$250 billion in registered investment with the Banco Central do Brasil; of that total, about \$60 billion was received by the minerals sector. The Banco Central do Brasil (2005§) also reported that since 1996, the accumulated net FDI amounted to more than \$151 billion as equity capital, of which \$35 billion was used for acquisitions of state-owned assets, and more than \$116 billion (not including privatizations), for direct investment and joint ventures with the private sector.

Active international mining and oil companies in Brazil included Yacimientos Petroleros Fiscales SA (YPF) de Argentina; BHP Minerals International Exploration Inc. and Western Mining Corp. Holdings Ltd. of Australia; Barrick Gold Corp., Inco Limited, and TVX Gold Inc. of Canada; Shanghai Baosteel of China; Energias de Portugal S.A. (EDP) of Portugal; Anglo American plc, BHP Billiton Plc, and Rio Tinto plc of the United Kingdom; Iberdrola S.A. of Spain; and ChevronTexaco Corp. (ChevronTexaco Brasil S.A.), Dow Chemical Co., Exxon Mobil Chemical (Esso Brasileira de Petróleo Ltda.), Newmont Mining Corp., and Placer Dome U.S. Inc. of the United States; and Royal Dutch Shell Group of the Netherlands (Departamento Nacional de Produção Mineral, 2005c, p. 103; 2005§).

Government Policies and Programs

The fundamental principles governing the use of mineral resources in Brazil are defined and consolidated in the current Federal Constitution, which was enacted on October 5, 1988, and in the 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. After 45 years, the Government monopolies of the oil and gas industries and fuel price subsidies were rescinded in 1999. Petrobrás was allowed to enter into joint ventures with foreign investors in 2004. The Agência Nacional do Petróleo, however, regulates the petroleum industry (Ferraz, 2004, p. 9; Pimentel, 2004a, p. 3-5; Departamento Nacional de Produção Mineral, 2005§).

Since 2001, the Government has 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 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 (Pimentel, 2004b, p. 10-15; Departamento Nacional de Produção Mineral, 2005e, p. 5-8; 2005§).

The exploration and exploitation of mineral resources in Brazil are regulated by the 1967 Mining Code (Executive Law No. 227 of February 28, 1967). The Brazilian Constitution and the Mining Code, law No. 9314 of January 1997, provide greater flexibility for investment in the Brazilian mining sector. Article 7 of this 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 this mining code and its complementary legal provisions (Departamento Nacional de Produção Mineral, 2005§).

The DNPM reported an investment of \$300 million in mineral exploration compared with \$200 million in 2003. 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 potential investors in the minerals sector (Departamento Nacional de Produção Mineral, 2005c, p. 10, 61; 2005§).

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. 7,990 in 1989 to compensate the municipalities', States', and Federal Governments' direct administrative departments in the proportion of 65%, 23%, and 12%, respectively. The CFEM is no more than 3% on the net revenue of mineral sales. The prevailing rates are 3% for bauxite, manganese ore, rock salt, and potassium; 2% for iron ore, fertilizers, coal, and other minerals; 1% for gold (gold produced during prospecting is exempt); and 0.2% for other precious minerals and precious stones. In July 2000 (law No. 9,993/2000), 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 \$122.6 million from \$92.8 million in 2003, or by 32.1% (Departamento Nacional de Produção Mineral, 2005d, p. 31-34; 2005§).

In 2004, the States of Minas Gerais (46.9%) and Para (29.2%) were the major collectors of CFEM; the main municipalities were Parauapebas (56.0%) and Oriximina (8.4%) in the State of Para and Itabira (9.8%), Nova Lima (5.5%), and Mariana (5.2%) 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 (51.8%), aluminum (8.9%), copper and kaolin (3.5% each), and gold (3.0%) (Departamento Nacional de Produção Mineral, 2005c, p. 54; e, p. 33; 2005§).

Environmental Issues

In Brazil, the fundamental principles governing the compatibility of the mining sector with environmental protection are outlined by the following legal statutes:

- 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) provide the following: (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 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 comprises representatives of the Federal, State, and local governments and private foundations involved in environmental protection and improvement. Article 225 of the 1988 Brazilian Constitution 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 under the systems of mining concession or licensing; 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, 2005c, p. 35-38; 2005§).

The Ministério de Minas e Energia enforces the 1989 decree, 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 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 and mercury use in gold placers, in situ leaching, and underground acidic water discharges, antipollution measures have been enacted to eliminate the sources of pollutants and mitigate their effects on the environment.

Production

In 2004, the total value of minerals produced (gas and crude oil included) was almost \$28.0 billion, or about 4.2% of the GDP. The minerals-based industries amounted to almost \$70 billion, or about 10.5% of the GDP. Crude oil and natural gas amounted to almost \$6 billion. Mineral extraction contributed 2.1% of the GDP in 2004 compared with 2.9% in 2003. Depletion of shallow gold and tin deposits and environmental constraints on garimpeiros affected their output of gold and tin (Departamento Nacional de Produção Mineral, 2005b, p. 11; f, p. 11-12; Banco Central do Brasil, 2005§).

The major integrated steelworks were the structure and rail producer Aço Minas 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 2004, these companies produced about 20.1 million metric tons (Mt), or about 61% of the total Brazilian steel production of 33.0 Mt; Brazil was the second ranked iron ore producer in the world after China with a flat (gross weight) output of 270.5 Mt; CVRD produced almost 81.0% of Brazil's iron ore (Brasil Mineral, 2005, p. 124; Companhia Vale do Rio Doce, 2005a§). 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 85.0% of the country's total bauxite production, which amounted to about 19.8 Mt in 2004. The four major aluminum smelters, Albras-Alumínio Brasileiro S.A. (Albras) (29.8%), Companhia Brasileira de Alumínio (CBA) (23.7%), Alcoa Alumínio S.A. (Alcoa) (20.3%), and Billiton Metais S.A. (Billiton) (12.1%), produced 85.9% of the primary aluminum production of 1.4 Mt in 2004 (table 1; Departamento

Nacional de Produção Mineral, 2005f, p. 36, 70-72; Instituto Brasileiro de Mineração, 2005, p. 25-27; Minérios & Minerales, 2005, p. 41-50).

Trade

Brazil's trade balance increased substantially to a new peak level of \$33.7 billion surplus compared with almost \$25.0 billion in 2003, or an almost 35% increase. Brazil was the leading open market in the economic center of MERCOSUR. In 2004, 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 78.5% of South America's total purchasing power parity. Brazil accounted for almost 74% of MERCOSUR's population and about 67.8% of its purchasing power parity (Departamento Nacional de Produção Mineral, 2005d, p. 23-25; International Monetary Fund, 2005b§; U.S. Central Intelligence Agency, 2005§). Most multinational companies considered this growing trade bloc, which followed the North America Free Trade Agreement (NAFTA) and the European Union, to be extremely important because of its size and the amount of trade that takes place in the region. In 2004, NAFTA had an impact on Latin America and Caribbean Basin trade, which increased to about \$110 billion, or by almost 75% compared with that of 1991 (\$63 billion). MERCOSUR had an impact on intraregional trade, which increased to about \$35 billion in 2004 from \$7 billion in 1983. Intra-MERCOSUR trade amounted to \$25 billion, and mineral trade amounted to almost \$3.0 billion (Departamento Nacional de Produção Mineral, 2005d, p. 12-13; f, p. 23-25; Instituto Brasileiro de Mineração, 2005, p. 36-48).

Brazil's trade with MERCOSUR amounted to almost \$3.0 billion compared with \$2.1 billion in 2003. The bilateral trade between Argentina and Brazil amounted to almost \$2.6 billion, or 38.8% higher than that of 2003, as a result of Argentina's robust economic recovery. Total minerals trade between the major players of MERCOSUR—Brazil (\$1.1 billion), Chile (\$508 million), and Argentina (\$192 million)—amounted to \$1.8 billion. Trade of Brazil's mineral sector registered a surplus of \$4.2 billion, or about 10% of the total (\$42.3 billion), which included exports and imports of \$23.3 billion and \$19.0 billion, or 34.3% and 50.5% higher than those of 2003, respectively (Departamento Nacional de Produção Mineral, 2005d, p. 23-25; Instituto Brasileiro de Mineração, 2005, p. 35-36). The values of the principal mineral exports were \$11.3 billion for iron ore and pellets; \$4.4 billion, crude oil; \$3.2 billion, steel products; and \$2.5 billion, aluminum. Other mineral exports were dimension stone (\$597 million), copper (\$445 million), gold (\$414 million), columbium-tantalum (\$303 million), manganese (\$275 million), nickel (\$256 million), kaolin (\$233 million), asbestos (\$142 million), and others (\$1.7 billion). The values of the leading mineral imports were \$9.0 billion for crude oil; \$1.7 billion, natural gas; \$1.5 billion, coal; \$1.2 billion, phosphate; \$1.1 billion, copper; and \$1.0 billion, potash. Other mineral imports were iron ore (\$664 million), bauxite (\$365 million), salt (\$225 million), titanium (\$186 million), and others (\$811 million) (Ferraz, 2004, p. 11;

Departamento Nacional de Produção Mineral, 2005c, p. 25-26; f, p. 26, 28; Instituto Brasileiro de Mineração, 2005, p. 44-46).

In 2004, Brazil recorded a total trade surplus of \$15.1 billion; the surpluses with its leading trade partners were, in order of value, the United States (\$4.3 billion), China (\$1.4 billion), Japan (\$1.1 billion), the Republic of Korea (\$711 million), Belgium (\$495 million), Italy (\$460 million), and Holland (\$452 million). Brazil's trade surplus with the United States represented 28.5% of the total (\$15.1 billion) and was almost 2.4% higher than the net surplus of its minerals sector (\$4.2 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 mineral 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 machinery (Departamento Nacional de Produção Mineral, 2005f, p. 27, 29; Instituto Brasileiro de Mineração, 2005, p. 38-42).

Brazil's CVRD and China's Metal Company of Baoshan, which were leading companies in Minas Gerais and Shanghai, continued exploring for, in order of importance and value, iron ore, manganese, bauxite, gold, and other mineral commodities in Brazil. Brazil's wealth of mineral resources and China's need for raw materials appeared to be strengthening the Sino-Brazilian trade partnership (Latin Trade, 2004; Departamento Nacional de Produção Mineral, 2005c, p. 23; Instituto Brasileiro de Mineração, 2005, p. 35; Companhia Vale do Rio Doce, 2005a§).

Structure of the Mineral Industry

The mineral industry of Brazil was large by world standards. Brazilian corporations, private Brazilian investors, and/or 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., 2005, p. 10-29).

The structure of the Brazilian mineral industry continued to change to a privately owned/Government-regulated regime from one that was Government-owned/Government-operated. In addition, 40 cement companies were operating 64 cement plants and 7 grinding plants with a clinker capacity of 45 Mt

in 22 States, and 30 iron ore mining companies were operating 80 mines and 43 processing plants. According to the DNPM, there are 1,862 mines in Brazil, which are 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, 2005f, p. 52-70; Minérios & Minerais, 2005, p. 40-51).

Brazil's total labor force was nearly 89 million. Of this total, services represented 66%; agriculture, 20%; and industry, 14%. According to the Banco Central do Brasil's (2005§) 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 700,000 active garimpeiros. In 2004, 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, 2005§).

Commodity Review

Metals

Aluminum and Bauxite and Alumina.—Alumina production increased to 5.3 Mt from 5.1 Mt in 2003, or by almost 4.0%. 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 were 1.9 Mt valued at \$417 million. In 2004, CBA invested \$700 million to produce 500,000 t/yr of alumina and expanded its aluminum capacity to 340,000 t/yr from 220,000 t/yr. The Alunorte alumina refinery, which was operated by a consortium led by Vale do Sul Alumínio S.A. (Aluvale) (57.03%), Norsk Hydro Comercio e Industria (34.03%), Nippon Amazon Aluminum Co. (4.05%), CBA (3.62%), and others (1.27%), was planning to expand its alumina production capacity to 4.2 Mt/yr from 2.4 Mt/yr with an investment of \$583 million (Departamento Nacional de Produção Mineral, 2005f, p. 29-30; Instituto Brasileiro de Mineração, 2005, p. 27, 33; Associação Brasileira do Alumínio, 2005a§, d§).

Primary aluminum production increased to 1.46 Mt from 1.38 Mt in 2003, or by about 5.8%. Primary aluminum producers were Albras (CVRD, 51%, and Nippon Amazon, 49%), which produced 30%; CBA, 23%; Alcoa, 21%; BHP Billiton, 12%; Alcan, 8%; and Aluvale, 6%. Alcoa's Alumar Consortium smelter (Alcoa, 53.66%, and BHP Billiton, 46.34%) at Sao Luis produced 264,000 t; the Aluvale plant (CVRD, 54.5%, and BHP Billiton, 45.5%) at Santa Cruz, State of Rio de Janeiro, 52,000 t; the Alcoa plant at Pocos de Caldas, State of Minas Gerais, 94,000 t; the Aratu facilities in the State of Bahia, 58,000 t; and Alcan's plant at Ouro Preto in State of Minas Gerais, 51,000 t. In 2004, Brazil imported 122,000 t of all forms of aluminum

valued at \$323,000 million; exports were 1.04 Mt and had a value of \$1.8 billion (Departamento Nacional de Produção Mineral, 2005f, p. 29-30; Instituto Brasileiro de Mineração, 2005, p. 33; Associação Brasileira do Alumínio, 2005d§).

Bauxite production increased to 19.7 Mt from 17.4 Mt in 2003. 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 2004. Exports amounted to 7.3 Mt of bauxite at a value of \$189 million (Departamento Nacional de Produção Mineral, 2005f, p. 29-30; Instituto Brasileiro de Mineração, 2005, p. 33; Associação Brasileira do Alumínio, 2005b§).

MRN planned to open a new mine, which has bauxite reserves of 800 Mt and a capacity of 2 Mt/yr, in the Papagalo plateau, Trombetas, State of Para. The Papagalo and Jabuti Mines will maintain MRN's bauxite ore production capacity at about 6.5 Mt/yr. CVRD was planning to invest \$320 million in the Paragominas bauxite mine, which contains 878 Mt of reserves, to produce 4.5 Mt/yr by 2006. The Albras facility at Vila do Conde, State of Para (CVRD, 51%, and Nippon Amazon, 49%), produced 346,000 t of primary metal, which was expanded to 440,000 t/yr capacity at a cost of about \$100 million in 2004. Alcan invested \$370 million in expansions of its complex facility at Laminacao de Pindamonhangaba in the State of Sao Paulo to increase its production capacity to 280,000 t/yr in 2004 from 120,000 t/yr in 2003. Alcoa was planning a new operating hub, with an investment of \$1.6 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 may invest an additional \$1.0 billion in the construction of the required hydroelectric plant to produce aluminum in Belomonte, State of Para. Alcan expanded its aluminum sheet production capacity to 120,000 t/yr from 100,000 t/yr in 2003 as a part of a \$380 million investment program and increased its primary capacity to 150,000 t/yr in Saramenha, State of Minas Gerais. Investments in the aluminum sector could reach up to \$1.6 billion within the next few years. Latapack-Ball S.A., which produced aluminum cans, invested \$5 million to increase its plant capacity in Jacarei, State of Sao Paulo, to 2 billion aluminum cans from 1.7 billion. Brazil recycled 89% of all the aluminum cans, which was equivalent to 123,900 t of aluminum cans, or about 9.2 billion units; this was an increase of 2.3% compared with that of 2003. During 2004-05, China MinMetals and China Aluminum Group were planning to invest \$3 billion in joint ventures, mostly with CVRD and others in the aluminum and bauxite and alumina sectors (Departamento Nacional de Produção Mineral, 2005f, p. 29-30; Instituto Brasileiro de Mineração, 2005, p. 33-34; Associação Brasileira do Alumínio, 2005a§-d§; Companhia Vale do Rio Doce, 2005a§).

Columbium (Niobium) and Tantalum.—Brazil continued to be the world's leading producer and main supplier of columbium (niobium) to the global markets followed by, in order of output, Canada, Australia, and Nigeria. In 2004, Brazil produced more than 91.0% of the world's total output, or 39,741 t of pyrochlore (Nb₂O₅ content) in concentrates, 25,169 t of columbium (niobium) in alloys, and 2,529 t of columbium

(niobium) in oxides from three open pits located in Araxa, State of Minas Gerais and Ouvidor, State of Goiás. In 2004, Mineração Catalao de Goiás Ltda. (MCGL) (a joint venture of Bozzano Simonsen S.A. of Brazil, 68.5%, and Anglo American, 31.5%) and Companhia Brasileira de Metalurgia e Mineração (CBMM) (a joint venture of Grupo Moreira Sales S.A. of Brazil, 55%, and Molycorp, Inc. of the United States, 45%) accounted for 61.5% and 38.5%, respectively, of Brazil's 84,000-t/yr pyrochlore production capacity. The columbium (niobium) plants of CBMM in Araxa and MCGL in Ouvidor accounted for about 88% of Brazil's pyrochlore production and supplied about 79% of the world demand for ferrocolumbium. The Araxa, the Catalao, and the Ouvidor columbium (niobium) ore deposits contained 97.0% (4.3 Mt) of the world's pyrochlore reserves. In 2004, Araxa produced 34,368 t and Ouvidor, 5,373 t (Nb_2O_5 content) in concentrates (Departamento Nacional de Produção Mineral, 2005f, p. 90; Instituto Brasileiro de Mineração, 2005, p. 34).

In 2004, tantalum production totaled 277 t (Ta_2O_5 content) in concentrates. The Pitinga Mine, which was owned by Mineração Taboca/AM and considered to be one of the world's leading and most economically viable ore body, had reserves of 88,760 t of Ta_2O_5 and produced 247 t, or 89.2%, of Brazil's tantalum output; the Garimpeiros Mine in the State of Para produced 30 t, or 10.8%. The upward trend in tantalum supply to 1,146 t (Ta_2O_5 content) in 2004 from 200 t in 2003, will continue in response to increased world demand (Departamento Nacional de Produção Mineral, 2005f, p. 107-108).

Copper.—Copper concentrate production amounted to about 103,153 t from 26,275 t in 2003, which was an increase of 292.6%. The concentrate was produced by CVRD's Sossego Mine in Canaa dos Carajas, State of Para (77,400 t) and Mineração Caraíba S/A's deposit in Jaguarari, State of Bahia (25,800 t), which were Brazil's current (2004) open pit and underground copper mines. In 2004, Caraíba Metais S/A (CMSA) of Camacari, State of Bahia, which was the only electrolytic copper producer in Brazil, produced 208,000 t of primary copper metal; this was an increase of about 20.0%. This electrolytic copper output included 740,046 t of copper concentrates (247,915 t of contained metal) imported from Chile (81%), Peru (10%), and Argentina (9%). To meet Brazil's metal copper demand of 324,810 t/yr, CMSA imported 177,990 t of copper cathode mostly from Chile (85%) and Peru (15%) in 2004. CMSA was planning to produce 450,000 to 500,000 t/yr of electrolytic copper in D'Ávila, State of Bahia, by 2010 (Departamento Nacional de Produção Mineral, 2005f, p. 54-55; Instituto Brasileiro de Mineração, 2005, p. 32, 34; Companhia Vale do Rio Doce, 2005a§).

In 2004, CVRD's copper project portfolio included the sulfide ore resources of, in order of importance, Salobo, Chapada, Cristalino, Sossego, Alemão, and the oxidized ore deposit of Corpo 118, which is located in the mineral province of Carajas, State of Para. The feasibility studies for the Salobo deposit [Salobo Metais S/A (CVRD, 100%)], which was the leading copper project in Brazil, estimated copper resources to be 986 Mt at grades of 0.82% copper and 0.49 grams per metric ton (g/t) gold for a cutoff of 0.5% copper and associated molybdenum and silver. The Cobre Salobo, which is located

in Marabá, State of Para, could support a 140,000-t/yr-capacity mill. A feasibility study of Mineração Maracá S.A.'s Chapada copper project in Alto Horizonte, State of Goiás, estimated Chapada's ore reserves to be 434.5 Mt at grades of 1.3 Mt copper and 9.6 t gold. This project will start operations in early 2008. A prefeasibility study for Cristalino (CVRD, 50.0% and BNDES, 50.0%) estimated reserves to be 312 Mt at grades of 0.77% copper and 0.13 g/t gold. The Sossego (CVRD, 100%) copper mine, with 200 Mt of sulfide ore that contains 1.0% copper, started operations in January 2004 at an annual production rate of 140,000 t in concentrates. The Alemão deposit (CVRD, 67.0% and BNDES, 33.0%) contained 161 Mt of ore at grades of 1.3% copper and 0.86 g/t gold. CVRD continued conducting intensive geologic work to identify new copper areas in the Carajas region (Departamento Nacional de Produção Mineral, 2005f, p. 54-55; Instituto Brasileiro de Mineração, 2005, p. 32-33; Companhia Vale do Rio Doce, 2005b§).

Brazil's refined copper production was used primarily in the automobile and construction industries. Exports amounted to 85,200 t of copper metal at a value of \$243.7 million, which went to the United States (64%) and Argentina and Chile (18% each). By 2010, should the positive market conditions continue, Brazil might become self-sufficient and diminish its external dependency on copper (Departamento Nacional de Produção Mineral, 2005f, p. 54-55; Instituto Brasileiro de Mineração, 2005, 36-37).

Ferroalloys.—Ferroalloys production increased slightly to 1,290,000 t in 2004 from 1,218,000 t in 2003. 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 to produce a projected 500,000 t of ferromanganese by 2005; the project, in which Elkem will hold a 40% share, was in Marabá, State of Para. The manganese will come from the nearby Prometal Mine, and the iron ore will come from the Carajas District. Nova Era Silicon S.A. [a joint venture among CVRD (49%), Mitsubishi Corp. and Kawasaki Steel Corp., both of Japan (25.5%, each)] was building a silicon ferroalloy plant with an installed capacity of 48,000 t/yr in Nova Era, State of Minas Gerais. About two-thirds of its output will be exported mainly to Japan between 2004 and 2010 (Departamento Nacional de Produção Mineral, 2005f, p. 83).

Gold.—Gold production was reported by the DNPM to be 47.6 t; mining companies produced 28.5 t, and garimpeiros, 19.1 t; the total gold output was 7.2 t higher than that of 2003; this was an increase of 17.8% (table 1). Gold production from the companies and garimpeiros increased because of higher prices and in spite of higher production costs and much higher environmental standards. Refined gold from the São 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 and 1.9 t/yr of gold from the São Francisco and the São Vicente projects in the State of Mato Grosso, respectively, by 2005. Similar investment was planned for CYG's projects the Fazenda Nova and the Chapada, in the State of Goiás, to produce 1.2 t/yr and 3.7 t/yr of gold,

respectively, by 2007; and the project Cumaru with reserves of 17 t and a grade of 4.8 g/t gold, in Carajas, State of Para, was in the feasibility stage. Mineração AngloGold SA intended to invest \$150 million to produce 9.3 t/yr of gold from the Cuiabá Mine in Sabara, State of Minas Gerais, by 2006. By September 2004, the Canadian companies Desert Sun Mining Ltd. and Williams Resources Ltd. spent \$40 million to resume gold production from the Jacobina Mine, State of Bahia, and to produce 3.1 t/yr. The Canadian company Wheaton River Ltd. acquired the Amapari gold project in the State of Amapa from EBX Gold SA for \$112 million. The Amapari's reserves amounted to 43.5 t; the project will require an investment of \$50 million to start operations by 2005 (Departamento Nacional de Produção Mineral, 2005f, p. 95; Instituto Brasileiro de Mineração, 2005, p. 30, 34).

Iron Ore.—Brazil produced 262.0 Mt of beneficiated iron ore compared with 234.5t in 2003. Almost 97% of that production was from the four major iron ore companies: CVRD, 180.7 Mt; Minerações Brasileiras Reunidas S/A (MBR) (BHP Billiton, 50%, and Mitsui & Co. Ltd. of Japan, 50%), 42.2 Mt; SAMARCO Mineração S/A. and Cia. Siderúrgica Nacional (CSN), 15.5 Mt each. In 2004, Brazil exported 157.5 Mt of iron ore and 47.2 Mt of pellets valued at \$3.1 billion and \$1.7 billion, respectively (Departamento Nacional de Produção Mineral, 2005f, p. 64-65; Instituto Brasileiro de Mineração, 2005, p. 26, 34; Companhia Vale do Rio Doce, 2005a§).

The total iron ore exports were 17.1% higher than those of 2003 and were shipped to 40 countries worldwide. Total export revenues increased by almost 40% to \$4.8 billion from \$3.0 billion in 2003. The leading importers of Brazilian iron ore were China (22%), Japan (14%), Germany (12%), and France and the Republic of 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, 2005f, p. 64; Instituto Brasileiro de Mineração, 2005, p. 38).

CVRD and Pohang Iron and Steel Co. of the Republic of Korea invested \$220 million to produce 4 Mt/yr of pellets. The facility was in the Port of Tubarao, State of Espirito Santo. CVRD was planning a new \$400 million pelletizing plant with railroad and port facilities in Sao Luiz, State of Maranhao. MBR opened three new mines—Capao Xavier, Capitao do Mato, and Tamandua—in the State of Minas Gerais to increase capacity to 32 Mt/yr and to offset the iron ore depletion at the Aguas Claras and Matuca Mines after 40 years of operation. Mineração Corumbaense S.A. (a subsidiary of Rio Tinto) was planning a \$200 million plant at Corumba in the State of Matto Grosso to produce 1 Mt/yr of hot-briquetted iron to supply steel plants in Argentina. This facility will use natural gas from the 3,150-kilometer (km) pipeline between Bolivia and Brazil that connects the Santa Cruz de la Sierra, Bolivia, to Campinas, State of Sao Paulo (Departamento Nacional de Produção Mineral, 2005f, p. 65; Companhia Vale do Rio Doce, 2005a§).

CVRD consolidated the following sequential acquisitions: 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) (50%), for \$279 million. Caemi was a nonoperational holding firm; MBR controlled 85%. CVRD started up its 12th iron ore pellet plant in the Port of Ponta de Madeira, State of Maranhao, with a capacity to produce 6 Mt/yr. CVRD will inject about \$6 billion in the mining sector by 2007 to consolidate its leading position in the global iron ore market (Ferraz, 2004, p. 7; Companhia Vale do Rio Doce, 2005a§).

Iron and Steel.—*Pig Iron.*—Brazil produced 34.6 Mt of pig iron, which was about 8.1% higher than that of 2003. The almost 5.0 Mt of exports, which was valued at \$515 million, was approximately one-third of the pig iron traded in the world (Departamento Nacional de Produção Mineral, 2005f, p. 65; Instituto Brasileiro de Mineração, 2005, p. 46).

Steel.—For the year, raw steel production amounted to 32.9 Mt, which represented an increase of 5.7% compared with that of 2003. Brazil was the ninth ranked producer and exporter of steel worldwide (Instituto Brasileiro de Siderurgia, 2004, p. 8; Departamento Nacional de Produção Mineral, 2005f, p. 66). Brazil exported 12 Mt of steel valued at \$5.3 billion, which represented a decrease of 7.7% in volume (13 Mt) and an increase of almost 36% in value (\$3.9 billion) compared with exported steel in 2003. The major recipients of Brazil's exports were the United States (14%), China (13%), Mexico (6%), Chile (5%), and Argentina (5%). Apparent domestic consumption of steel was about 21.5 Mt, which represented an increase of 14.8% compared with that of 2003. 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 the auctions (Instituto Brasileiro de Siderurgia, 2004, p. 16; Departamento Nacional de Produção Mineral, 2005f, p. 66-67). CVRD and Nucor Corp. signed a nonbinding memorandum of cooperation to advance their own 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 of steel slabs (Latin Trade, 2004; Instituto Brasileiro de Mineração, 2005, p. 44; Companhia Vale do Rio Doce, 2005a§).

Manganese.—In 2004, Brazil produced 3.1 Mt of manganese concentrate, which was about 23.5% higher than that of 2003. Rio Doce Manganês S.A.'s (RDM) manganese mines in the States of Bahia, Mato Grosso do Sul, Minas Gerais, and Para accounted for 75% of metallurgical manganese production. CVRD's RDM, which was the leading producer of manganese concentrate (2.4 Mt), in conjunction with Urucum Mineração S.A., Sociedade Mineira de Mineração Ltda., and Minérios Metalúrgicos do Nordeste S/A, accounted for 95% of Brazil's manganese concentrate production in 2004. Exports of manganese ore accounted for 1.9 Mt at a value of \$99.4 million; this was almost 76% higher than that of 2003 and was owing to a higher demand for steel in Brazil and by MERCOSUR. Manganese ferroalloys exports increased by almost 16%,

which amounted to 204,000 t at a value of \$92.3 million (Departamento Nacional de Produção Mineral, 2005f, p. 82-83; Instituto Brasileiro de Mineração, 2005, p. 34; Companhia Vale do Rio Doce, 2005a§).

Nickel.—Brazil produced about 3.795 Mt of nickel ore in 2004 compared with 3.893 Mt in 2003. Production of electrolytic nickel increased to 19,742 t in 2004 from 18,155 t in 2003; nickel in ferronickel alloys increased to 6,493 t in 2004 from 6,409 t in 2003; nickel in matte increased to 6,708 in 2004 from 5,950 t in 2003; and nickel in carbonates increased to 19,897 t in 2004 from 18,406 t in 2003 (table 1). Mineração Serra da Fortaleza, which was located in Fortaleza de Minas, State of Minas Gerais, and was acquired by Grupo Votarantim (GV) from Rio Tinto, produced 405,543 t of nickel ore, 6,691 t nickel content, and 6,708 t of nickel contained in matte. Companhia Niquel Tocantins, which was owned by GV in Niquelandia, State of Goiás, produced 3.3 Mt of nickel ore and 42,244 t of nickel contained in carbonates obtained by ammoniacal leaching (a hydrometallurgical process). In the same district, CODEMIN S.A. (owned by Anglo American) produced 20,326 t of nickel contained in ferronickel alloy (Departamento Nacional de Produção Mineral, 2005f, p. 81; Instituto Brasileiro de Mineração, 2005, 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 Vermehlo project in Carajas, State of Para, which contained reserves of 100 Mt at a grade of 1.5% nickel. Anglo American will 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 with 117 Mt at a grade of 1.5% nickel by 2007. Companhia Niquel Tocantins was planning to increase its electrolytic production capacity in Niquelandia, State of Goiás, to 30,000 t/yr in 2005 from 10,000 t/yr in 2003 at a cost of \$200 million (Departamento Nacional de Produção Mineral, 2005f, p. 81-82; Companhia Vale do Rio Doce, 2005a§, b§).

Tin.—Brazil was the world's fifth ranked tin producer after China, Indonesia, Peru, and Bolivia (Carlin, 2005; Departamento Nacional de Produção Mineral, 2005f, p. 66). Tin production was 12,468 t of tin contained in concentrate compared with 12,217 t in 2003, and 11,512 t of metal compared with 10,761 t in 2003. During the past 5 years, production cuts were made at the Pitinga Mine in the State of Amazonas, which was operated by Mineração Taboca S/A (MTSA) and owned by the Grupo Paranapanema S/A (GPSA), and by the COOPERSANTA (Garimpo do Bom Futuro) cooperative operations in the State of Rondonia. The States of Amazonas (72%) and Rondonia (25%) continued to be the major producers of tin in the country. MTSA's mine produced 9,900 t compared with 9,800 t in 2003; byproducts were, in order of importance, columbium (niobium), tantalum, zirconium, hafnium, thorium, and cryolite. MTSA was planning to develop its polymetallic Rocha-Sa project near to the Pitinga Mine to produce in the order of 9,000 t/yr by 2008. Exports increased to 5,774 t valued at \$46.2 million from 3.861 t valued at \$17.2 million in 2003. Manufactured goods were shipped to Argentina (74%), and semimanufactured goods, to the United States (80%) (Departamento Nacional de Produção Mineral, 2005f, p. 66-67; Instituto Brasileiro de Mineração, 2005, p. 34).

Zinc.—Brazil produced 158,962 t of zinc content in concentrates, which was about 4.0% higher than that of 2003. GV's Companhia Mineira de Metais S.A. (CMM), which was the only producer of zinc ore in Brazil, produced 124,831 t of zinc silicate in Vazante, compared with 124,847 t in 2003, and 34,131 t of zinc sulfide concentrates in Paracatu compared with 30,232 t in 2003 (Departamento Nacional de Produção Mineral, 2005f, p. 119-120).

The concentrates were processed in CMM's plant in Três Marias and GP's Juiz de Fora Complex, both of which are located in the State of Minas Gerais. These zinc refineries produced 265,987 t of primary metal, which was about 3.3% higher than that of 2003. CMM produced 175,407 t, which was 4.6% higher than that of 2003, and GP's Companhia Paraibuna de Metais S.A. produced 90,580 t (34% of the total), which was almost 1.0% higher than that of 2003 (Departamento Nacional de Produção Mineral, 2005f, p. 119; Instituto Brasileiro de Mineração, 2005, p. 34).

To meet Brazil's demand for zinc, which was 242,862 t of metal compared with 217,600 t in 2003, the country imported 261,861 t of zinc concentrates (valued at \$89.7 million), which was slightly higher, in volume, than that of 2003 (260,586 t valued at \$65.8 million), and 37,137 t of metal (valued at \$38.9 million), which was 32.6% higher, in volume, than that of 2003 (28,017 t valued at \$23.5 million). Peru supplied 86% of the concentrates and 41% of the metal; additional zinc metal was supplied by Argentina (47%) and Spain (4%). GV's Paraibuna de Metais was the only metal producer from imports of zinc concentrates at its Três Marias zinc refinery (Departamento Nacional de Produção Mineral, 2005f, p. 119; Instituto Brasileiro de Mineração, 2005, p. 36).

Industrial Minerals

Asbestos.—In 2004, Brazil produced 252,067 t of asbestos fiber, which was about 9.1% higher than that of 2003. Brazil's significant asbestos deposits were 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, 2005f, p. 56-57; Instituto Brasileiro de Mineração, 2005, p. 34).

Brazil exported almost 65.0% of its 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 2003. 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 them 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 (15.4 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%, and its reserves (fiber content only) were 3 Mt, which, at a production rate of about 200,000 t/yr, represented a 15-year mine life (Departamento Nacional de Produção Mineral, 2005f, p. 56-57; Instituto Brasileiro de Mineração, 2005, p. 34).

Cement.—The country produced 34.4 Mt of cement, which was slightly (1.2%) higher than that of 2003 (34 Mt). Among the 27 State producers, Minas Gerais was the most important with 22.2% of the total followed by Sao Paulo (15.1%), Parana (11.8%), Rio de Janeiro (6.9%), Brasilia (6.1%), Sergipe (5.4%), Rio Grande do Sul (4.6%), Paraiba (4.3%), and other States (27.9%). The main producers were GV's Companhia Cimento Portland Itau (40.4%) and Grupo João Santos (13%); other producers included Companhia Cimento Portland Rio Branco (10.1%), Grupo Swiss Holderbank's Holder Cimento S.A. (8.4%), Camargo Correia Cimentos S.A. (7.8%), and Grupo Lafarge's Companhia Cimento Portland Paraíso (6.5%). The exported cement (949,456 t valued at \$24.8 million) went mainly to the United States (50%), Paraguay (20%), and Bolivia (20%). Brazil imported 441,117 t of cement valued at \$24.2 million from the United States (36%), Cuba (22%), Thailand (17%), and other countries (25%). Camargo Correia Cimentos invested \$200 million to build a 1.6-Mt/yr cement plant in Ijaci, State of Minas Gerais. Grupo Cimentos Portland S/A invested \$180 million to build two cement plants in the State of Paraiba to produce 1.7 Mt/yr of cement. Brazil has an installed capacity of 60 Mt/yr and current (2004) production equaled more than 57% of that capacity (Departamento Nacional de Produção Mineral, 2005f, p. 52-53).

Clays.—*Kaolin.*—In 2004, Brazil produced 2.2 Mt of beneficiated kaolin compared with 2.1 Mt in 2003; kaolin consumption decreased by about 76.2% from 234,725 t in 2003. Kaolin was used mainly in the ceramics and paper industries and, to a lesser degree, in the manufacture of animal feed, fertilizers, food supplements and pharmaceuticals, paint, pesticides, plastics, and rubber. In 2004, according to DNPM's Anuário Mineral Brasileiro 2005, Brazil had 8.34 Mt of kaolin reserves (measured + indicated) and 7.52 Mt were minable (Departamento Nacional de Produção Mineral, 2005a, p. 83). In 2004, Ymerys Rio Campin Caulim S.A. accounted for 41.5% of the country's total output followed by Caulim da Amazônia S.A. (CADAM) (33%) and Pará Pigmentos S.A. (PPSA) (23%); the remainder was produced by small producers in the States of Minas Gerais, Rio Grande do Sul, and Sao Paulo. Brazilian kaolin exports were about 2.1 Mt valued at \$230 million compared with those of 2003, which were 1.9 Mt valued at \$205 million. Exports were made to Belgium (26%), the United States (16%), Japan (15%), the Netherlands (12%), Finland (11%), and other countries (20%). CADAM increased its production of coating kaolin to 850,000 t in 2004 and was expected to increase it to 1 Mt/yr by 2005 with an investment of \$30 million. PPSA initiated expansions that would increase its capacity to 600,000 t/yr at a cost of \$22.5 million (Departamento Nacional de Produção Mineral, 2005f, p. 43-44; Instituto Brasileiro de Mineração, 2005, p. 34).

Fluorspar.—Production of beneficiated fluorspar totaled 57,772 t, which was 2.5% higher than that of 2003 (56,346 t). The beneficiated fluorspar was either acid or metallurgical grade. Crude ore/ROM production was 181,991 t, which was 10.8% higher than that of 2003 (164,208 t). The ROM production, by mine, in the State of Santa Catarina was Morro de Fumaça (29.2%), Santa Rosa de Lima (27.1%), and Rio Fortuna (17%) and in Rio de Janeiro State, Tanguá (14%). MNSCL was planning to acquire Mineração Del Rey Ltda.'s Cerro Azul Mine in the State of Parana to increase domestic production in 2005 (Departamento Nacional de Produção Mineral, 2005f, p. 56-57; Instituto Brasileiro de Mineração, 2005, p. 34).

Gemstones.—Brazil continued to be one of the world's leading gemstone producers and exporters. In the Americas, Brazil was the leading producer and trader of mostly alluvial diamond, followed by Guyana and Venezuela and behind of Canada. 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, Canastra, and Bambui Groups; these include, in order of value (\$/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 (Departamento Nacional de Produção Mineral, 2005f, p. 42-44; Oliveira, 2005).

According to the DNPM's Mineral Summary Statistics for 2000-04, Brazil's diamond production from year to year has been uncertain, and annual production has been declining since 2000. In 2004, Brazil produced 300,000 carats valued at about \$26.4 million compared with 400,000 carats in 2003 valued at \$38.1 million; 500,000 carats in 2002 valued at almost \$31 million; 700,000 carats in 2001 valued at \$43.8 million; and 1,000,000 carats in 2000 valued at \$56 million. In 2000, the entrepreneurial sector produced 8% of the total, or 80,000 carats, compared with almost 3.3%, or 23,000 carats, in 2001; 8%, or 40,000 carats, in 2002; 5%, or 20,000 carats, in 2003; and almost 10%, or 30,000 carats, in 2004 (table 1; Departamento Nacional de Produção Mineral, 2005f, p. 42-44; Olson, 2005a).

Garimpeiros' production, however, continued to decline because garimpos' reserves were depleting and environmental restrictions were increasing. In 2004, the Government continued closing high-content gem placers in indigenous reserves to exploration, the jewelry industry's gemstone consumption was unknown, taxation on domestic sales of jewelry was high, and the private sector faced severe competition from its black-market counterparts. 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 grade between 0.01 and 0.1 carat per cubic meter, or about 26 million carats; this represented about 2.1% of the world's diamond reserve base (Departamento Nacional de Produção Mineral, 2005a, p. 68; Instituto Brasileiro de Mineração, 2005, p. 32, 34; Olson, 2005a).

In 2004, total exports of uncut gemstones were 243,298 carats valued at \$21.8 million compared with 244,925 carats valued at

\$23.4 million in 2003. The major markets for Brazilian rough diamond were Belgium (48%), the United States (33%), Ireland (9%), and others (10%). Imports of uncut stones amounted to only 10,222 carats and the main sources were Ireland (59%), the United States (32%), and Hong Kong and Italy (2% each) (Departamento Nacional de Produção Mineral, 2005f, p. 42-44; Instituto Brasileiro de Mineração, 2005, p. 32, 34; Olson, 2005a).

Graphite.—In 2004, Brazil's beneficiated natural graphite output amounted to 76,332 t, or 7.9% higher than that of 2003. This production was mainly of products that ranged in grade from 89% to 94% carbon. The leading producer was the Nacional de Grafite Ltda. (NGL). NGL mined natural graphite in the State of Minas Gerais' municipalities of Pedra Azul (35,041 t), Itapeçerica (10,530 t), and Salto da Divisa (8,736 t). Grafita MG Ltda. produced about 17,307 t of natural graphite, which was consumed domestically after simple grinding (Departamento Nacional de Produção Mineral, 2005f, p. 82-83; Instituto Brasileiro de Mineração, 2005, p. 34).

Three types of beneficiated graphite products (fines, lump, and medium-grained) were processed by NGL in Itapeçerica and Pedra Azul. Brazil's demand for natural flake-type crystalline graphite was met by the Itapeçerica, Pedra Azul, and Salto da Divisa beneficiation plants. Exports amounted to 13,301 t valued at \$11.8 million in 2004 compared with 13,291 t valued at about \$12.3 million in 2003. Growth of the domestic consumption of natural graphite in the 2000s was related to that of the iron and steel industries, which absorbed about 80% of the natural graphite consumed in Brazil; demand in 2004 (61,100 t) increased by 24.7% compared with that of 2003. Other consumers included battery manufacturing (6.5%), refractories (6%), paint and varnishes (2%), and other uses (5.5%) (Departamento Nacional de Produção Mineral, 2005f, p. 82; Instituto Brasileiro de Mineração, 2005, p. 34; Olson, 2005b).

Gypsum.—Production of gypsum decreased slightly to 1.47 Mt from 1.53 Mt in 2003. In Brazil, renewed housing and infrastructure construction activities increased the consumption of cement and plasters, but deficiencies in transportation continued to be a bottleneck on the supply side (Departamento Nacional de Produção Mineral, 2005f, p. 80-81).

Magnesium Compounds.—The most important magnesite mine in Brazil was the Pedra Preta Mine, which was owned and operated by Magnesita S.A. (MSA); the mine is located in the Eguas Mountain region of Brumado, State of Bahia, about 610 km from the Port of Salvador. Brazil produced 366,174 t of beneficiated magnesite, which was 19.5% higher than that of 2003; MSA produced 97%, or 355,190 t. Exports of processed magnesite totaled 98,440 t at a value of \$14.9 million and were shipped mostly to Paraguay (33%), Poland (27%), Argentina (11%), Chile (10%), and Germany (7%). Imports of processed magnesite totaled 8,013 t at a value of \$5.4 million and were imported mostly from Canada (63%), China (12%), and Israel, Mexico, and the United States (6% each). By yearend (2004), about 630 Mt of resources with 345 Mt of magnesium oxide (MgO) content and 180 Mt of magnesium content had been identified (Departamento Nacional de Produção Mineral, 2005f, p. 75-76; Instituto Brasileiro de Mineração, 2005, p. 34).

Phosphate Rock.—Production of phosphate rock concentrate amounted to about 6.1 Mt, which was almost 9% higher than

that of 2003. The three leading mining companies—Fosfertil S.A. (Grupo Fertifós) (44.8%), Fertilizantes Serrana S.A. (Bunge International Group) (24.7%), and Copebras S.A. (Anglo American) (20.2%) contributed 89.7%, or 5.5 Mt of output in 2004. The reported domestic consumption of concentrates was about 7.6 Mt; this was an increase of 14.2% compared with that of 2003. 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 2003. Brazil's demand for fertilizers increased to a record of 22.8 Mt in 2004; this was an increase of 16.9% compared with that of 2003. Although domestic production of fertilizers increased to 8.0 Mt from 7.0 Mt in 2003, Brazil continued its dependency on imports. Imports of phosphates were valued at \$1.2 billion compared with \$777.1 million in 2003 (Departamento Nacional de Produção Mineral, 2005f, p. 77-78; Instituto Brasileiro de Mineração, 2005, p. 28, 34).

Potassium.—Potassium (KCl) production decreased to 638,020 t from 657,750 t in 2003. Brazil imported 4.1 Mt of potash (K₂O) valued at \$980.7 million mainly from Canada (25%), Russia (20%), Germany (18%), Israel (17%), and others (20%) (Departamento Nacional de Produção Mineral, 2005f, p. 104-105).

Quartz.—Brazil produced 18,116 t of quartz, which was 144.2% higher than that of 2003. Quartz was exported mostly to the European Union (73%), Asia (21%), and others (6%). Quartz powder was shipped mainly to Germany (67%), the United Kingdom (18%), and the United States (11%). Telequartzo Exportação S.A. and others produced quartz powder, which is an important constituent in the production of, in order of volume, optic fibers, crucibles, oscillators, solar cells, wafers and integrated circuit packing, and ceramic materials of exceptional purity. Brazil's reserves were estimated to be 55 Mt (Departamento Nacional de Produção Mineral, 2005f, p. 109-110).

Salt.—The reported domestic production of salt was 6.65 Mt, which was slightly higher 1.3% than that of 2003 (6.56 Mt). The State of Rio Grande do Norte continued to be the major producer of marine salt (4.81 Mt) with 92.5% followed by the States of Rio de Janeiro (2.1%) and Ceará (1.3%). The domestic consumption of salt was 6.2 Mt. Brazil also produced 1.44 Mt of rock salt. Salgema Mineração e Química S.A. in Maceio, State of Alagoas, produced 730,000 t (52%) of rock salt, and Dow Química do Nordeste Ltd. (a subsidiary of Dow Chemical Co. of the United States) produced 670,000 t (48%) of salt from the Vera Cruz Mine in the State of Bahia (Departamento Nacional de Produção Mineral, 2005f, p. 111-114).

In 2004, marine salt imports increased to 8,407 t from 2,476 t and rock salt imports decreased to 3,000 t from 112,000 t, or by 97.3%, in 2003. Marine salt imports came from France (59%), China (25%), and Hong Kong and the United States (8% each). Rock salt imports came from Chile (99%) and other countries (1%). Marine salt exports decreased to 486,539 t from 571,249 t in 2003; they included table salt (3,000 t), bulk without aggregates (481,000 t), and other types of salt, such as sodium chloride (3,000 t). These exports went to Nigeria (61%), the United States (24%), Belgium and Denmark (4%

each), and others (7%). Rock salt exports included caustic soda (93,485 t) and bulk without aggregates (169,600 t); these exports were shipped to Argentina (86%) and the United States (14%). Salt was consumed by the chemical industry (chlorine and sodium manufacture) (85%) and others (caustic soda) (15%) (Departamento Nacional de Produção Mineral, 2005f, p. 111, 113-114).

Talc.—Production of talc increased to 400,975 t from 369,000 t in 2003 or 8.7% higher. The State of Bahia was Brazil's major talc producer with 53% of the national output followed by the States of Parana (23%), Sao Paulo (20%), Rio Grande do Sul (3%), and Minas Gerais (1%) (Departamento Nacional de Produção Mineral, 2005f, p. 115-116).

Mineral Fuels

Brazil produced almost 17.0 billion cubic meters of natural gas, which was 7.5% higher than that of 2003, and 563.3 million barrels of petroleum, which was almost 1.0% lower compared with that of 2003. The country produced, in order of importance, crude oil, natural gas liquid, natural gas, coal, and shale oil; production totaled 625 million barrels of oil equivalent. In 2004, Petrobrás' average production of crude oil, which included condensate and natural gas liquid, was about 2.020 million barrels per day (Mbb/d), which was 18.1% higher than that of 2003 (Departamento Nacional de Produção Mineral, 2005f, p. 77-78; 101-102; *Petróleo Brasileiro S.A.*, 2005, p. 2-4).

Petrobrás was planning to increase its daily output rate to 2.3 Mbb/d by 2010 and to produce about 75% of this output from deepwater. In 2004, the supply of natural gas totaled about 65.3 million cubic meters per day, of which 19.5 million cubic meters per day, or almost 30%, was imported from Bolivia; of the total daily supply, 30.4 million cubic meters, or 46.6%, was used by Petrobrás, 27.7 million cubic meters, or 42.4%, was consumed in Brazil, and the remaining 7.2 million cubic meters, or 11.0%, was used by thermoelectric powerplants (*Petróleo Brasileiro S.A.*, 2005, p. 5; *Petroleum Economist*, 2005, p. 6).

Coal.—In 2004, Brazil produced 5.1 Mt of energy-generation-type coal and 294,000 t of metallurgical coal compared with 4.6 Mt and 159,000 t, respectively, in 2003. The Brazilian coal industry's mine operations were concentrated in the three southernmost States of Rio Grande do Sul (52.3%), Santa Catarina (46.2%), and Parana (1.5%). The main producers of ROM coal were Copelmi Mineração Ltda. (1.8 Mt), Companhia Riograndense de Mineração S.A. (CRM) (1.5 Mt), Companhia Carbonífera Metropolitana S.A. (1.1 Mt), and Carbonífera Ciriúma S.A. (1.0 Mt). In 2004, Brazilian energy-generation-type coal consumption (thermoelectric use) was almost 7.9 Mt compared with 6.6 Mt in 2003; the States of Santa Catarina, Rio Grande do Sul, and Parana used 52%, 47%, and 1%, respectively. Coal demand increased mainly because the thermoelectric plants were operating at full capacity in these three States (Departamento Nacional de Produção Mineral, 2005f, p. 45).

To meet Brazil's metallurgical coal demand, 18.5 Mt valued at \$1.4 billion was imported, which compared with 17.5 Mt valued at \$950 million in 2003. 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, 2005f, p. 46).

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. The three plants, which will be built in the State of Rio Grande do Sul, will be coal fired. 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 of electricity. Carbonífera Ciriúma S.A. and Companhia Carbonífera Metropolitana S.A. were negotiating with Usina Termoelétrica do Sul Catarinense to supply coal to produce 400 megawatts (MW). 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 930 Mt (Departamento Nacional de Produção Mineral, 2005f, p. 47).

Natural Gas and Petroleum.—Brazil produced 46.4 million cubic meters per day of natural gas, which was 7.2% higher than that of 2003. The gas pipeline that links the Enchova platform in the offshore Campos Basin to Macaé, 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 YPF de 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. The \$2 billion 3,150-km Bolivia-Brazil gas pipeline started operation and will increase the supply 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 21 million cubic meters per day in 2005 and 30 million cubic meters per day from 2010, or nearly 40% of domestic demand. The natural gas share of the country's energy mix was 6% in 2004 and will increase to 12% in 2010. Petrobrás continued producing natural gas in the Gulf of Mexico and recovered gas from the Frederick Field, which is located 27 km off the Louisiana coast. Petrobrás' discovery in 2003 of the 72 billion cubic meters Mexilhão gasfield in the Santos Basin off the coast of Sao Paulo State has led to a reevaluation of the potential for offshore gas supply (*Petróleo Brasileiro S.A.*, 2005, p. 46; *Petroleum Economist*, 2005, p. 6).

In 2004, 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 of oil equivalent per day. Exploration and production took place in Angola, Argentina, Bolivia, Colombia, Equatorial Guinea, Nigeria, Tanzania, Trinidad and Tobago, the United States, and Uruguay. As a result of the acquisition of Perez Companc in 2002, Petrobrás will start exploration and production in Ecuador, Peru, and Venezuela by 2005 (*Petróleo Brasileiro S.A.*, 2005, p. 11, 52).

Brazil produced 1.7 Mbbbl/d of petroleum, which was 6.3% higher than that of 2003. Imports of crude oil and derivatives were valued at \$6.9 billion compared with almost \$3.9 billion in 2003. The main sources were Nigeria (48.7%), Algeria (22.3%), Saudi Arabia (14.0%), Iraq (7.9%), Argentina (3.5%), and other countries (3.6%) (Departamento Nacional de Produção Mineral, 2005f, p. 103; *Petróleo Brasileiro S.A.*, 2005, p. 5).

In 2004, the partnership of Royal Dutch Shell of The Netherlands (80%) and Petrobrás (20%) on the Bijupirá and 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. Royal Dutch Shell is the only foreign company that produces oil in Brazil. Other companies in exploration include Statoil ASA of Norway, Repsol-YPF SA. of Spain, and ChevronTexaco Corporation of the United States (U.S. Energy Information Administration, 2005§).

Uranium.—In 2004, according to DNPM's Anuário Mineral Brasileiro 2005, Brazil had 175,899 t of uranium oxide (U_3O_8) (measured + indicated reserves) and 66,151 t of inferred reserves (Departamento Nacional de Produção Mineral, 2005a, p. 374).

Reserves

Brazil was among the world leaders in reserves of some mineral commodities. According to the Departamento Nacional de Produção Mineral (2005f, p. 12-14), the commodities were ranked as follows: first, columbium (niobium) and tantalum; second, graphite and tin; third, aluminum, kaolin, talc, and vermiculite; fourth, magnesite and manganese; and fifth, iron ore (table 3).

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 of which 698 had paved runways and 3,047, unpaved (U.S. Central Intelligence Agency, 2005§).

In 2004, Brazil's installed electrical generating capacity was 52,865 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, 2005§).

The Bolivia-Brazil pipeline, which was owned by a consortium of Enron Energy Corp., 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 15,772 km of which 7,920 km consisted of crude oil and petroleum products, and 5,252 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 were 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.*, 2005, p. 37).

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 will build a 1,200-MW dam, which will be named Tucuruí, on the Tocantins River on the border between the States of Maranhão and Tocantins. Construction of the dam was estimated to cost about \$1 billion; BHP Billiton pledged \$350 million (Vale, 2005, p. 23).

This new dam appeared to be necessary because demand for hydroelectricity was growing at a rate faster than that of supply. The supply of subsidized electricity in the Tocantins area was exceeded by the industrial and mining activities in 2004. 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 (Vale, 2005, p. 20).

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 will 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 Cacú in the State of Goiás, and 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, 2005, 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 Vitoria, 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 will branch from Cuiabá to Porto Velho, State of Rondônia (Vale, 2005, p. 22).

Outlook

Brazil, in the short and medium terms, with a strong economy in Latin America and as 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 Brasil Mineral (2005) and the Economic Commission for Latin America and the Caribbean (2004§), 325 leading transnational companies were planning to invest worldwide, which could position Brazil behind China (85%), the United States (55%), India (42%), and Brazil (24%). In Brazil, the main vehicles for FDI inflows during 2005-06 will be 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, reforming the country's complex tax code, trimming the civil service pension system, and continuing the fight against inflation, the Brazilian real has recovered in value. As an exporter of mineral commodities, the country is poised to gain from the continued FDI inflows into its economy, which increased to \$18.2 billion from \$10.1 billion in 2003 (Economic Commission for Latin America and the Caribbean, 2004§).

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 showed confidence in the country, which will support continued economic growth and FDIs 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 \$7 billion in mineral project developments and acquisitions into 2007. The significance of the investment would be to increase CVRD's market capitalization to \$35 billion from its current (2004) level of about \$18 billion (Banco Central do Brasil, 2005§; Companhia Vale do Rio Doce, 2005a§).

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, 2005b, p. 1; Banco Central do Brasil, 2005§). The positive rate of economic growth in the minerals sector is likely to be sustained into 2005 and beyond if expansion in the demand for mineral exports and fabricated steel goods continues. MERCOSUR has undergone dramatic changes in natural gas and power markets owing to the increase in cross-border energy investment opportunities, domestic gas consumption, and internationalization 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 in full evolutionary mode with an unsatisfied energy demand and a great potential for growth; thus, Petrobrás will be an integrated energy company with a strong international

presence and a leader in Latin America (Petróleo Brasileiro S.A., 2005, p. 1).

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 emeralds. 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, 2005d, p. 101).

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 European Union, 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, 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 term, a bottleneck will 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 has 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., 2005, p. 7).

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 (U.S. Energy Information Administration, 2005§). 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.

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90 Botafogo-ZC-02
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Avenida Pasteur 404-Anexo, 2º Andar, Pcia 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
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- Instituto Brasileiro de Mineração
Avenida Afonso Pena, 3880 3º, 4º e 5º Andares
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- Instituto Brasileiro de Siderurgia
Rua Araújo Porto Alegre, 36 - 7º Andar
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20035-Río de Janeiro-RJ-Brasil
Rio Doce Geológica e Mineração, S.A.
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22030-Rio de Janeiro-RJ-Brasil

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

(Metric tons unless otherwise specified)

Commodity	2000	2001	2002	2003	2004 ^p
METALS					
Aluminum:					
Bauxite, dry basis, gross weight	13,846,000	13,032,000 ^r	12,602,000 ^r	17,363,000 ^r	19,700,000
Alumina	3,743,000	3,445,000	3,962,000	5,111,000 ^r	5,315,000
Metal:					
Primary	1,277,000	1,140,000	1,318,400	1,381,000 ^r	1,457,000
Secondary	210,000	200,000	215,000	235,000 ^r	246,000
Total	1,487,000	1,340,000	1,533,400	1,616,000	1,703,000
Beryllium, beryl concentrate, gross weight	13	-- ^r	7 ^r	6 ^r	6
Cadmium, metal, primary ^c	12	15	37	243	243
Chromium:					
Crude ore	550,000	419,049 ^r	283,991 ^r	404,477 ^r	593,476
Concentrate and lump, Cr ₂ O ₃ content	253,248	178,013	113,811	162,096 ^r	253,002
Marketable product ³	70,040	38,472	11,186	12,000 ^c	12,000 ^c
Cobalt:					
Mine output, Co content of hydroxide ^e	900	1,100 ^r	1,200 ^r	1,300 ^r	1,400 ⁴
Metal, electrolytic ⁵	792 ^r	889	960	1,097 ^r	1,155
Columbium-tantalum ores and concentrates, gross weight:					
Columbite and tantalite ^c	330	330	231 ^r	249 ^r	277 ⁴
Djalmaite concentrate ^c	10	10	10	10	10
Pyrochlore concentrate, Nb ₂ O ₃ content	31,190	39,039	41,303	37,707 ^r	39,741 ⁴
Copper:					
Mine output, Cu content	31,786	32,734 ^r	32,711 ^r	26,275 ^r	103,153
Metal, refined:					
Primary	185,345	212,243	189,651	173,378 ^r	208,020
Secondary	47,500	36,000	23,000	20,000 ^r	24,000
Total	232,845	248,243	212,651	193,378	232,020
Gold:					
Mine output	42,025	37,810 ^r	32,912 ^r	26,066 ^r	28,508
Garimpeiros, independent miners	8,368	5,074 ^r	8,750 ^r	14,350 ^r	19,088
Total	50,393	42,884 ^r	41,662 ^r	40,416 ^r	47,596
Iron and steel:					
Iron ore and concentrate, marketable product:⁶					
Gross weight	212,576	201,438 ^r	214,560 ^r	234,478 ^r	262,029
Fe content	141,106	133,713 ^r	142,468 ^r	155,693 ^r	174,300
Metal:					
Pig iron	27,952	27,623	29,667 ^r	32,036 ^r	34,579
Ferrous alloys, electric arc furnace:					
Chromium metal	NA	NA	NA	NA	NA
Ferrocadium silicon	NA	NA	NA	NA	NA
Ferrochromium	134,562	110,468 ^r	164,140 ^r	204,339 ^r	216,277
Ferrochromium silicon	7,790	5,899	10,522	10,500	11,560
Ferrocolumbium	27,359	37,411	36,450	34,200	34,200 ^c
Ferromanganese	121,277	276,000 ^r	339,000 ^r	438,000 ^r	508,000
Ferromolybdenum	NA	NA	NA	NA	NA
Ferronickel	19,315	17,966	19,874	19,900 ^c	19,900 ^c
Ferrophosphorus	NA	NA	NA	NA	NA
Ferrosilicon	189,935	159,345	145,910	146,000 ^c	146,000 ^c
Ferrosilicon magnesium	9,658	11,032	14,552	14,600 ^c	14,600 ^c
Ferrosilicon zirconium	--	--	NA	NA	NA
Ferrotitanium	NA	NA	NA	NA	NA
Ferrotungsten	NA	NA	NA	NA	NA
Ferrovandium	NA	NA	NA	NA	NA
Inoculant	20,232	14,684	11,100	11,100 ^c	11,100 ^c
Silicomanganese	171,304	180,235	182,731	180,200	180,000 ^c
Silicon metal	166,344	112,123	133,390	133,400	133,000 ^c
Other ferroalloys	35,190	16,623	25,300	25,300 ^c	19,054
Total	902,966	941,786 ^r	1,082,969 ^r	1,217,539 ^r	1,290,000 ^c
Crude steel, excluding castings	27,865	26,718	29,604	31,150 ^r	32,918
Semimanufactures, flat and nonflat	25,000 ^c	18,006	17,460	17,500 ^c	17,500 ^c

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	2000	2001	2002	2003	2004
METALS--Continued:					
Lead:					
Mine output, Pb content in concentrate	8,832	10,725 ^f	9,253	10,652 ^f	14,734
Metal, secondary	50,000	47,000	50,000	50,000 ^e	52,000
Manganese:					
Mine output, Mn content in concentrate	2,192,000	1,970,000 ^f	2,529,000 ^f	2,544,000 ^f	3,143,000
Metal: ^c					
Primary (37% Mn)	8,110	7,290	10,950	12,860	13,460
Secondary	1,600	1,600	1,600	1,600	1,600
Nickel:					
Mine output, ore	2,790,184 ^f	3,916,210 ^f	3,873,474 ^f	3,893,095 ^f	3,794,868
Ni content in ore	45,317 ^f	45,456 ^f	44,928 ^f	45,160 ^f	51,886
Ni content in carbonate	17,223 ^f	17,063 ^f	18,100 ^f	18,406 ^f	19,897
Ni content in matte	8,475 ^f	10,183 ^f	6,274 ^f	5,950 ^f	6,708
Ni electrolytic	16,906 ^f	17,663 ^f	17,676 ^f	18,155 ^f	19,742
Ferronickel, Ni content	6,347 ^f	5,768 ^f	6,011 ^f	6,409 ^f	6,493
Rare-earth metals, monazite concentrate, gross weight ^c	200	200	-- ^f	-- ^f	731
Silver ⁷					
Primary kilograms	41,000	46,046	33,000	31,440 ^f	35,497
Secondary ^c do.	50,000	50,000	50,000	50,000	45,000 ⁴
Total do.	91,000	96,046	83,000	81,440 ^f	80,497
Tin:					
Mine output, Sn content	14,200	13,016 ^f	12,023 ^f	12,217 ^f	12,468
Metal, smelter:					
Primary	13,825	12,168	11,675	10,761 ^f	11,512
Secondary ^c	250	250	250	250	250
Total	14,075	12,418	11,925	11,011	11,800
Titanium:					
Ilmenite:					
Gross weight	123,000	144,644 ^f	177,027 ^f	120,160 ^f	133,000
TiO ₂ content	57,940	68,135	71,746 ^f	81,983 ^f	130,000
Rutile, TiO ₂ content	3,162	2,270 ^f	1,878 ^f	2,337 ^f	3,000
Tungsten, mine output, W content	18	22	24	30 ^f	262
Zinc:					
Mine output, Zn content	100,254	111,432	136,339 ^f	152,822 ^f	158,962
Metal, smelter:					
Primary	191,777	197,037	247,692 ^f	257,530 ^f	265,987
Secondary ^c	7,000	7,000	7,000	7,000	7,000
Total	198,777	204,037	254,692	264,530	272,987
Zirconium, zircon concentrate, gross weight ⁸	29,805	20,553	20,000	29,900 ^f	34,855
INDUSTRIAL MINERALS					
Asbestos:					
Crude ore ^c	3,950,000	3,950,000	3,950,000	3,950,000	3,950,000
Fiber	209,332	172,695	194,732	231,115 ^f	252,067
Barite:					
Crude	55,462	63,882	63,953	64,000	64,000
Beneficiated	53,741	54,790	53,098 ^f	57,452 ^f	59,612
Marketable product ^{e,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	39,208	38,927	38,027	34,010 ^f	34,413
Clays:					
Bentonite, beneficiated	273,975	178,610 ^f	184,909 ^f	198,981 ^f	226,874
Kaolin:					
Crude	3,740,815	4,082,024 ^f	3,924,158 ^f	5,205,513 ^f	5,958,057
Beneficiated	1,639,673	1,734,359 ^f	1,757,488 ^f	2,081,039 ^f	2,197,920
Marketable product ³	1,390,636	1,437,399	1,444,159	1,852,376 ^f	2,147,980
Diamond, gems and industrial diamond ⁹ thousand carats	1,000 ⁴	700	500 ⁴	400 ^f	300 ⁴

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	2000	2001	2002	2003	2004
INDUSTRIAL MINERALS--Continued:					
Diatomite:					
Crude	10,164	10,010	8,679 ^r	10,293 ^r	10,709
Beneficiated	7,201	6,730 ^r	5,835	6,920 ^r	7,200
Marketable product ^{c,3}	13,100	13,100	13,100	13,100	13,100
Feldspar:					
Crude	227,215	150,000	150,000	150,000	150,000
Marketable product ³					
Feldspar	117,715	75,000	39,694 ^r	47,976 ^r	110,452
Leucite ^c	5,000	5,000	5,000	5,000	5,000
Sodalite, crude ^c	500	500	500	500	500
Total	123,215 ^r	80,500	45,194 ^r	53,476 ^r	115,952
Fluorspar:					
Crude ore	130,976	124,021	131,975	164,208 ^r	181,991
Concentrates, marketable product:					
Acid-grade	30,131	31,263	32,774	34,462 ^r	40,948
Metallurgical-grade	12,831	12,471	15,125	21,884 ^r	16,824
Total	42,962	43,734	47,899	56,346 ^r	57,772
Graphite:					
Crude ^c	650,000	650,000	650,000	650,000	650,000
Marketable product ³					
Direct-shipping ore	NA	NA	NA	NA	NA
Concentrate	71,208	70,091	60,922	70,739 ^r	76,332
Total	71,208	70,091	60,922	70,739 ^r	76,332
Gypsum and anhydrite, crude	1,497,790	1,506,619	1,633,311 ^r	1,529,015 ^r	1,471,946
Kyanite:^c					
Crude	750	750	750	750	750
Marketable product ³	600	600	600	600	600
Lime, hydrated and quicklime	6,273	6,300 ^c	6,500	6,600 ^r	6,900
Lithium, concentrates	10,875	9,084	12,046	9,755 ^r	9,064
Magnesite:					
Crude	1,006,654	1,079,207	1,084,786	1,134,385 ^r	1,339,441
Beneficiated	279,876	265,749	302,230 ^r	306,444 ^r	366,174
Mica, all grades ^c	4,000 ⁴	4,000	4,000	5,000 ^r	5,000
Nitrogen, N content of ammonia ^c	950,000	950,000	950,000	950,000	950,000
Phosphate rock including apatite:					
Crude:					
Mine product	26,300	26,740	31,494	34,700 ^r	35,000
Of which sold directly ^c	35	35	35	35	35
Concentrate:					
Gross weight	4,725	4,805	5,084 ^r	5,584 ^r	6,074
P ₂ O ₅ content	1,687	1,707	1,831 ^r	2,005 ^r	2,181
Pigment, mineral, other, crude ^c	2,000	2,000	2,000	2,000	2,000
Potassium (KCl)	654,168	594,930	627,310	657,750 ^r	638,020
Potash, marketable (K ₂ O)	351,681	318,585	337,266	415,549 ^r	403,080
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	value	value	value	value
Sapphire	\$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	3,651	4,350	4,300	7,420 ^r	18,116

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	2000	2001	2002	2003	2004	
INDUSTRIAL MINERALS--Continued:						
Salt:						
Marine	thousand metric tons	4,626	4,370	4,835	5,144 ^r	5,206
Rock	do.	1,448	1,208	1,274	1,420 ^r	1,442
Silica, silice ^c		1,600	1,600	1,600	1,600	1,600
Sodium compounds:^e						
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:^c						
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		23,720	24,468	22,620	19,246 ^r	20,000
Byproduct:						
Metallurgy		217,238	280,079	284,184	285,821 ^r	286,000
Petroleum		81,762	80,125	77,185	90,332 ^r	90,400
Total		322,720	384,672	383,989	395,399 ^r	396,000
Talc and related material:						
Talc:						
Crude		300,000	370,500	348,000 ^r	369,000 ^r	400,975 ⁴
Marketable product ^{e,3}		2,000	2,000	2,000	2,000	2,000
Pyrophyllite, crude		150,000	189,500	200,000 ^e	200,000 ^e	200,000
Vermiculite:						
Concentrate		24,074	21,464	22,577	20,300 ^r	28,700
Marketable product ^{e,3}		3,100	3,100 ^e	3,100 ^e	3,100	3,100
MINERAL FUELS AND RELATED MATERIALS						
Coal, bituminous:						
Run-of-mine	thousand metric tons	14,335	13,800 ^e	5,046 ^r	4,643 ^r	5,077
Marketable ^{e,3}	do.	6,000	6,000	6,000	6,000	6,000
Coke, metallurgical, all types	do.	50	50 ^e	98 ^r	159 ^r	294
Natural gas:						
Gross	million cubic meters	13,247	13,988	15,525	15,792 ^r	16,971
Liquids	million 42-gallon barrels	3,694	5,860	3,914 ^r	4,284 ^r	4,667
Petroleum:						
Crude	thousand 42-gallon barrels	464,280	487,640 ^r	547,135	568,032 ^r	563,274
Refinery products:^{11,12}						
Liquefied petroleum gas (LPG)	do.	13,140	14,112	13,274 ^r	13,503	13,652
Gasoline	do.	134,722	144,691	136,108 ^r	138,452	139,975
Jet fuel	do.	557	598	562 ^r	576	582
Kerosene	do.	26,175	28,112	26,444 ^r	26,900	27,196
Distillate fuel oil	do.	206,885	222,221	209,040 ^r	212,640	215,052
Lubricants	do.	5,831	6,315	5,941 ^r	6,043	6,109
Residual fuel oil	do.	118,698	127,482	119,920 ^r	121,985	123,327
Other	do.	100,893	108,359	101,931 ^r	103,686	104,827
Refinery fuel and losses	do.	NA	NA	NA	NA	NA
Total	do.	606,901	651,890	613,220 ^r	623,785	630,720

See footnotes at end of table.

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

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

¹Table includes data available through November 2005.

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 levels.

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

⁴Reported figure.

⁵Source: Cobalt Development Institute.

⁶Includes sponge iron, in metric tons, as follows: 2000-04--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: 2000-03--50,000 and 2004--45,000.

⁸Includes baddeleyite-caldasite.

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

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.

¹²USGS Minerals Questionnaire, 2000-03; and Petrobrás Magazine, 2002-05.

TABLE 2
BRAZIL: STRUCTURE OF THE MINERAL INDUSTRY IN 2004

(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)	150 (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., 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%, and BHP Billiton Plc, 46.34%]	Sao Luis, Maranhao State (smelter)	1,000 (metal).
Do.	Alumínio do Norte do Brasil S.A. (Alunorte) [Vale do Sul Alumínio S.A. (Aluvale), 57.03%; Norsk Hydro Comercio e Industria, 34.03%; Nippon Amazon Aluminum Co., 4.05%; Companhia Brasileira de Alumínio (CBA), 3.62%; others, 1.27%]	Barcarena, Para State (refinery)	4,200 (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%, and 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) (Shell do Brasil S.A., 44%; Government, 27%; private, 25%)	Santa Cruz, Rio de Janeiro State (smelter)	86 (metal).
Do.	Aluvale [Companhia Vale do Rio Doce (CVRD), 54.5%; Billiton Metais S.A., 45.5%]	do.	93 (metal).
Do.	Reynolds Internacional do Brasil (Reynolds, 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	Coítezeiro 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 2004

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
METALS--Continued			
Columbium	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, Goiás State (mines)	70 (ore).
Do.	do.	Ouvidor, Goiás State (plants)	24 (pyrochlore).
Copper	Mineração Caraíba S/A (Grupo Paranapanema S/A (GPSA), 100%)	Jaguari, Bahia State (mine)	130 (ore).
Do.	do.	Jaguari, Bahia State (beneficiation plant)	90 (concentrate).
Do.	Caraíba Metais S/A (CMSA) (private, 100%).	Camacari, Bahia State (refinery)	220 (metal).
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; Corumba, Matto Grosso do Sul State; and Xanxere, Santa Catarina State	326.
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. Mineração Morro Velho S.A. (AngloGold Ltd., 100%)	Novo Lima, Raposos, and Sabara, Minas Gerais State; and Jacobina, Bahia State (four mines)	7,000.
Do.	do. Mineração Serra Grande S.A. (AngloGold Ltd., 50%, and TVX Gold Inc., 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. (Rio Tinto plc, 51%, and Autram S/A, 49%)	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 Billiton 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. (SAMITRI, 51%, and BHP Billiton Plc., 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 2004

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
METALS--Continued			
Lead	Mineração Boquira S.A. (MBSA) (private, 100%)	Boquira, Bahia State (mine)	300 (ore).
Do.	do.	Boquira, Bahia State (beneficiation plant)	310 (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 Ni).
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	2,000.
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.
Tantalum	metric tons Mineração Taboca S/A. [Grupo Paranapanema S/A (GPSA), 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, Rondônia State (six mines)	108 (ore).
Do.	do.	Santa Barbara, Novo Mundo, and Potosi, Rondônia State (three beneficiation plants)	450 (concentrate).
Do.	Grupo Paranapanema S/A (GPSA) (private, 100%)	Aripuana, Mato Grosso State; Ariquemes, Rondônia 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.	Mineração Taboca S/A. [Grupo Paranapanema S/A (GPSA), 100%]	Juiz de Fora, Minas Gerais State (mine)	20 (ore).
Do.	Grupo Paranapanema S/A (private, 100%)	Aripuana, Mato Grosso State; Ariquemes, Rondônia 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.	Mineração Taboca S/A. [Grupo Paranapanema S/A (GPSA), 100%]	Juiz de Fora, Minas Gerais State (mine)	20 (ore).
Titanium	Rutilo e Ilmenita do Brasil S.A. (RIBSA), 100%	Mataraca, Paraiba State (mine)	4,200 (ore).
Do.	do.	Mataraca, Paraiba State (two beneficiation plants)	120 (concentrate).
Zinc	Companhia Mineira de Metais S.A. (Grupo Votarantim, 100%)	Vazante, Minas Gerais State (mine)	800 (ore).
Do.	do.	Vazante, Minas Gerais State (beneficiation plant)	48 (concentrate).
Do.	do.	Três Marias, Minas Gerais State (refinery)	165 (metal).
Do.	Companhia Paraibuna de Metais S.A (CPM) (Grupo Votarantim, 100%)	Juiz de Fora, Minas Gerais State (mine)	100 (ore).

TABLE 2--Continued
 BRAZIL: STRUCTURE OF THE MINERAL INDUSTRY IN 2004

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
METALS--Continued			
Zirconium	Nuclemon Mineró-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).
INDUSTRIAL MINERALS			
Asbestos	Sociedade Anônima Mineração de Amianto (private, 100%)	Cana Brava and Minacu, Goias State (mines)	9,000 (ore).
Do.	do.	Cana Brava and Minacu, Goias State (beneficiation plant)	230 (concentrate).
Cement	Cimento Santa Rita S.A. (CSSA), 50%, and Holder Cimento S.A., 50%	Itapevi and Salto de Pirapora, Sao Paulo State (two plants)	2,200.
Do.	Companhia Cimento Portland Itau (Grupo Votarantim, 100%)	Itau de Minas, Minas Gerais State (three plants)	2,400.
Do.	Companhia de Cimento Portland Paraiso (CCPP), 50%, and Lafarge Group, 50%	States of Espirito Santo, Goias, Minas Gerais, and Rio de Janeiro (five plants)	4,000.
Do.	Companhia de Cimento Portland Rio Branco (Grupo Votarantim, 100%)	Rio Branco do Sul, Parana State (two plants)	5,000.
Do.	Camargo Correia Cimentos S.A. (CCSA) (private, 100%)	Ijaci, Minas Gerais State (plant)	1,600.
Diamond	Mineração Tejucana S.A. (MTSA), 100%	Diamantina, Minas Gerais State (mine)	100.
Fluorspar	Mineração Nossa Senhora do Carmo Ltda. (private, 100%)	Cerro Azul, Parana 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%)	Itapecerica, Pedra Azul, Salto da Divisa, Minas Gerais State (three mines)	80 (ore).
Do.	do.	Itapecerica, 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 S/A (GPSA), 100%]	Maiquinique, Bahia State (mine)	10 (ore).
Gypsum	Companhia Brasileira de Equipamento (private, 100%)	Codo, Maranhao 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%)	Mazagao, Amapa State (mine)	720 (ore).
Do.	do.	Mazagao, Amapa 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, Para State	500 (concentrate).
Do.	Ymerys Rio Capim Caulim S.A. (RCCSA) (private, 100%)	Rio Capim Mine, Para State	500 (concentrate).
Do.	Empresa de Mineração Horii Ltda. (EMHL) (private, 100%)	Biritiba and Mogi das Cruzes, Sao Paulo State (two mines)	200 (ore).
Do.	do.	Biritiba and Mogi das Cruzes, Sao Paulo State (two beneficiation plants)	180 (concentrate).
Limestone	Companhia de Cimento Portland Paraiso (CCPP) (private, 100%)	States of Goias, Minas Gerais, and Rio de Janeiro (five mines)	2,000.
Do.	Companhia de Cimento Portland Rio Branco (CCPRB), 100%	Rio Branco do Sul, Parana State (three mines)	5,500.
Do.	S.A. Industrias Votorantim (SAIV) (private, 100%)	States of Rio de Janeiro and Sao 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).

TABLE 2--Continued
BRAZIL: STRUCTURE OF THE MINERAL INDUSTRY IN 2004

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
INDUSTRIAL MINERALS--			
Continued			
Phosphate rock	Fertilizantes Serrana S.A. (Bunge International Group, 100%)	Araxa, Minas Gerais State (mine)	5,000.
Do.	Copebras S.A.(Copebras) (Anglo American plc, 100%)	Ouvidor, Goias State (mine)	4,400.
Do.	Fosfertil S.A. [Grupo Fertifós, 81.54%; Companhia Vale do Rio Doce (CVRD), 10.96%; public, 7.5%]	Tapira, Minas Gerais State (two mines)	10,500.
Do.	Ultrafertil S.A. [Grupo Fertifós, 81.54%; Companhia Vale do Rio Doce (CVRD), 10.96%; public, 7.5%]	Araxa, Minas Gerais State (mine)	5,000.
Quartz	Telequartzo Exportação S.A. (TESA) (private, 100%)	Cristal, Minas Gerais State (mine)	6.
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, Macei0, 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.
Natural gas	thousand cubic meters Royal Dutch/Shell, 80%, and Petrobrás, 20%	Bijupira and Salema Projects in Campos Basin	480.
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.
Do.	do. Royal Dutch/Shell, 80%, and Petrobrás, 20%	Bijupira and Salema Projects in Campos Basin	50.
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	503,000.
Do.	Refinaria de Petróleo Ipiranga S.A. (private, 100%)	Ipiranga, Rio Grande do Sul	3,400.
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 2004¹

(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	930,000		0.1
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 2003-2004.

²Petróleo Brasileiro S.A., Annual report 2003-04; Petroleum Economist, July 2005.