



2008 Minerals Yearbook

BRAZIL

THE MINERAL INDUSTRY OF BRAZIL

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In 2008, Brazil was a leading producer of minerals in the world and marketed about 80 mineral commodities. The country was the world's leading producer of key steel and feed stocks, such as high-content iron ore and niobium, and the second ranked producer of bauxite and manganese. Brazil's recent discoveries of pre-salt natural gas and petroleum deep offshore present both opportunities and challenges for its mineral fuels sector. In 2008, Brazil's leading mineral exports were, in order of value, iron ore, nickel, bauxite, tantalum, and manganese, and its leading imports were coal, potassium, copper, and zinc (Departamento Nacional de Produção Mineral, 2009c; Bray, 2009b; Jorgenson, 2009; Olson, 2009b; Papp, 2009a, b).

Brazil's mineral sector—which included metals, industrial minerals, and mineral fuels, biofuels, and ethanol—continued to experience a phase of real growth owing to new mineral projects and expansions. Consequently, Brazil was expected to remain among the global leaders in the production of mineral commodities and to continue to attract domestic and transnational investors into the country's mineral industry (Banco Central do Brasil, 2009a; Departamento Nacional de Produção Mineral, 2009a, p. 9-11; Economic Commission for Latin America and the Caribbean, 2009).

Minerals in the National Economy

Brazil had record growth in 2007 and the first half of 2008. The global financial crisis affected Brazil beginning in September 2008, however. Brazil's currency and stock market experienced considerable swings as some foreign investors pulled out of Brazil. The country had two quarters of recession as global demand for Brazil's commodity-based exports decreased and external credit dried up. Brazil was one of the first emerging markets to begin a recovery, however. Consumer and investor confidence revived, and Brazil's real gross domestic product (GDP) growth returned to positive by the end of 2008. Brazil's Banco Central expected growth of 5% by 2010. In 2008, Brazil's GDP based on purchasing power parity was \$2.024 trillion compared with \$1.924 trillion in 2007 (Banco Central do Brasil, 2009a, b; Meirelles, 2009a).

For 2008 as a whole, Brazil's GDP increased by 5.1% compared with 5.7% in 2007. The mining and mineral processing industries represented almost 4.3% of the GDP in 2008 compared with 2.8% in 2007, which was reflected mostly in the high international prices of several commodities, such as, in order of value, iron ore, petroleum, lead, tin, and soybeans. Brazil had a total labor force of more than 95.2 million. The minerals (metal, industrial minerals, and fuels) sector employed almost 6% (800,000) of the industry total (13.3 million, or almost 14% of the total labor force); this percent did not include the nearly 250,000 active placer miners, or garimpeiros. In 2008, according to the monthly employment survey, 1.8 million jobs were created in the country and employment in the mining sector increased by 90,000 (Banco Central do Brasil, 2009a, b;

Departamento Nacional de Produção Mineral, 2009a; Meirelles, 2009b; U.S. Central Intelligence Agency, 2009).

Government Policies and Programs

The Mining Code [Decree-law (Act) No. 227, of February 27, 1967], as amended, governs all aspects of the mineral industry, from exploration to production and use of mineral resources, and establishes the rights and duties of the holders of mining rights. The Ministry of Mines and Energy's (MME) National Department of Mineral Production (DNPM) has competence in the management of mineral resources and in the inspection of the mineral activity in the country. Decree-law (Act) No. 227 was amended by law No. 9314 of November 14, 1996, to provide greater flexibility for investment in the Brazilian mining sector. Article 7 stipulates that the production of minerals will depend upon the exploration authorization permit granted by the General Director of the DNPM and the development concession issued by the Minister of the MME. Licensing is a restricted system applicable exclusively to the production of industrial minerals. The DNPM is responsible for enforcing the Mining Code and for implementing its legal provisions (Departamento Nacional de Produção Mineral, 2009b, d; Instituto Brasileiro de Mineração, 2009).

Article 20 of Brazil's Constitution (enacted on October 5, 1988) and Constitutional Amendments nos. 6 and 9, dated August 15, 1995, allow the participation of the private sector by means of joint ventures and privatization investment in the mining, natural gas, and petroleum sectors. The Government allows *Petróleo Brasileiro S.A. (Petrobrás)* (a state-owned firm) to enter into joint ventures with foreign investors and to invest overseas. The *Agência Nacional do Petróleo* issues exploration and production licenses and regulates the petroleum industry (Departamento Nacional de Produção Mineral, 2009b; Instituto Brasileiro de Mineração, 2009).

According to the Instituto Brasileiro de Mineração (IBRAM), the long lead times and uncertain process of obtaining environmental licenses represent a serious challenge to Brazil's mineral industry. The environmental licensing system is divided into three steps—a preliminary license, which is required during the planning stage; an installation license, which is required prior to any construction being done; and an operational license, which is required before beginning mining or processing operations (Instituto Brasileiro de Mineração, 2009).

Brazil's import tax rates for minerals vary from 3% to 9%; the rate of ores and concentrates is 5% and that for other mineral derivatives is 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 of corporate income taxes is the net profit for the fiscal year; the corporate tax rate ranges between 10% and 15% and is levied on the net profit. Profits can be expatriated. Equity ownership, which is allowed by means of privatization or by direct acquisition, can be as high as 100%.

Since early 2007, the Concessions Law created additional opportunities for the private sector in public utilities previously reserved for the Government (Departamento Nacional de Produção Mineral, 2009d; Instituto Brasileiro de Mineração, 2009).

The Government proposed a Regulatory Framework for Minerals that would replace the current mining code and provide more Government control of mineral resources. The Government posted the proposal's key points on the MME Web site and solicited public comment. According to the MME, the primary objective of the proposed code was to strengthen the Government's participation in the regulatory process and increase its sovereignty over Brazil's mineral resources. In addition to changes to the terms of concession contracts, the proposal would create a National Council of Mineral Resources to function both as a minerals regulator and advisor, with the purpose of increasing the royalties on mineral production. According to IBRAM, the regulatory framework for the pre-salt crude oil and natural gas reserves was influencing the proposed minerals framework agreement. IBRAM expected the Government to introduce the bill in the near future (2010-11) owing to the October 2010 Presidential and Congressional elections (Instituto Brasileiro de Mineração, 2009).

In 2008, the DNPM reported an investment of \$346 million in mineral exploration compared with \$251 million in 2007. The MME's Companhia de Pesquisa de Recursos Minerais (CPRM) (the Brazilian Geological Survey) was developing programs for basic geologic mapping; geophysical, metallogenetic, and hydrogeologic mapping; and prospecting in areas of potential development. The CPRM was also creating programs for environmental geology, hydrogeology, and geologic hazards and maintaining the country's geologic database and the corresponding economic analyses (particularly for coal, copper, diamond, gold, kaolin, nickel, peat, and zinc) to assist domestic and foreign investors in the mining sector (Companhia de Pesquisa de Recursos Minerais, 2009; Departamento Nacional de Produção Mineral, 2009a).

The Brazilian Financial Compensation for Exploiting Mineral Resources—Federal Royalty (CFEM), was established by the Brazilian Constitution in 1988 and instituted by law No. 7990 in 1989 to compensate municipalities, States, and the Federal Government. The CFEM prevailing rates are 3% for bauxite, manganese ore, potassium, and rock salt; 2% for coal, fertilizers, iron ore, and other minerals; 1% for gold (gold produced during prospecting is exempt); and 0.2% for other precious minerals and precious stones. The collected royalties are allocated among the municipalities, States, and the Federal Government in the proportion of 65%, 23%, and 12%, respectively. The Federal Government shares 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 increased to \$240 million in 2008 from \$220.6 million in 2007, or by almost 9% (Banco Central do Brasil, 2009b; Departamento Nacional de Produção Mineral, 2009d).

Production

The total value of minerals produced in 2008 was \$103.1 billion, or almost 5.1% of the GDP, compared with \$109.7 billion, or 5.7% of the GDP, in 2007. The value of crude oil and natural gas amounted to almost \$40.6 billion. Brazil continued to be the leading producer in the world of aluminum, bauxite, cement, ferroalloys, gold, iron ore, kaolin, lead, manganese, nickel, steel, and tin. Brazil's reportedly large mineral reserves and other identified resources help make it one of the leading mining countries in the Americas and the world (Banco Central do Brasil, 2009a, b; Departamento Nacional de Produção Mineral, 2009a).

Brazil's major integrated steel operations have the capacity to produce 41 million metric tons per year (Mt/yr) of crude steel from 25 steel plants and 10 integrated steelmakers. In 2008, Brazil was the eighth ranked producer of raw steel in the world and the leading producer in Latin America. In 2008, Brazilian crude steel production amounted to 33.7 million metric tons (Mt). Brazil was the second ranked iron ore producer in the world after China with an output of 352 Mt; Vale S.A. produced 293.4 Mt, or 83% of Brazil's iron ore production (Departamento Nacional de Produção Mineral, 2009c; Instituto Aço Brasil, 2009; Vale S.A., 2009).

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 18.1 Mt in 2008, which was more than 64% of the country's total bauxite production of 28.1 Mt. Brazil produced 35.3 Mt of pig iron in 2008 compared with 35.6 Mt in 2007 (table 1; Departamento Nacional de Produção Mineral, 2009c; Instituto Aço Brasil, 2009; Vale S.A., 2009).

In 2008, Petrobrás continued to operate in an integrated fashion in the segments of crude oil and natural gas exploration and production; refining, trade, and transportation; petrochemicals; and the distribution of, in order of value, petroleum derivatives, natural gas, biofuels, and electricity. Petrobrás indicated that Brazil would achieve self-sufficiency in crude oil and natural gas production by 2010-12 and that, of the \$174.4 billion in investments budgeted in its strategic plan for 2009-13, about \$17.0 billion was allocated for exploration. Also between 2009 and 2013, Petrobrás was planning to make international investments of about \$15.9 billion.

Brazil's diversified mineral endowment, competent labor force, and macroeconomic policies continued to attract investor interest in the country's mining and petroleum industries in spite of the global economic crisis during 2008 and 2009. Leading international mining, petroleum, and steel companies were notably interested in, in order of value, oil and gas, iron ore, steel, coal, gold, copper, and diamond (Departamento Nacional de Produção Mineral, 2009a; Petróleo Brasileiro S.A., 2009b).

Structure of the Mineral Industry

Brazilian corporations, which included private Brazilian and foreign investors and Government-owned companies, partially or wholly owned the major portion of the mineral and petroleum

sectors. According to DNPM, more than 500 transnational corporations (TNCs) established operations in Brazil between 1990 and 2008 owing to the country's favorable policies on mergers, joint ventures, and privatization. The competitiveness of Brazil's mineral industry resulted because of the investments in new technologies to improve efficiencies and productivity, particularly in the mining, oil and gas, and steel sectors (Departamento Nacional de Produção Mineral, 2009c).

In 2008, Petrobrás continued to be an integrated energy company, which was composed of various related business units, such as Petrobrás Química, S.A., which was the integrated refining-petrochemical operations company; Petrobrás Distribuidora S.A. distributed petroleum products in Brazil; Petrobrás International Finance Co. facilitated the import of crude oil and derivatives; Petrobrás Gás S.A. was responsible for trading Brazilian and imported natural gas and fertilizers; Petrobrás Transporte S.A. constructed and operated the pipelines, terminals, vessels, and facilities needed for the transportation and storage of crude oil and derivatives, natural gas, and bulk products; Downstream Participações S.A. facilitated asset exchange between Petrobrás and Repsol YPF S.A. of Argentina; and Petrobrás Energia Participaciones S.A. had a controlling interest in Petrolera Perez Companac S.A. of Brazil (60% of the capital stock). In 2008, Petrobrás operated in Angola, Argentina, Nigeria, the United States, and other countries. In addition, 39 cement plants operated in eight Brazilian States and accounted for more than 75% of the national output of 46.5 Mt. Among these cement plants, 12 were located in the State of Minas Gerais and 9 were located in the State of Sao Paulo (table 2; Departamento Nacional de Produção Mineral, 2009c; Petróleo Brasileiro S.A., 2009b).

Since 2000, TNCs had brought in about \$330 billion in registered investment with the Banco Central do Brasil; of that total, \$35 billion was invested in 2008. Among the major companies were Anglo American plc, BHP Billiton plc, and BP p.l.c. of the United Kingdom; De Beers Group of South Africa; and Glencore International AG of Switzerland (Banco Central do Brasil, 2009b; Departamento Nacional de Produção Mineral, 2009a).

In 2008, the active international mining and oil companies in Brazil included Yacimientos Petroleros Fiscales (YPF) of Spain and Argentina; BHP Minerals International Exploration Inc. (BHP Billiton Ltd, 100%), Anglo American, and Rio Tinto Ltd. of the United Kingdom; Alcan Aluminum Ltd., Barrick Gold Corp., and Teck Cominco Inc. of Canada; Shanghai Baosteel of China; Energia de Portugal; Iberdrola S.A. of Spain; Chevron Corp. (ChevronTexaco Brasil S.A.), Dow Chemical Co., ExxonMobil Corp. (Esso Brasileira de Petróleo Ltda.), Newmont Mining Corp., Placer Dome U.S. Inc., and Phelps Dodge Co. of the United States; and Royal Dutch/Shell Group (Shell) of the Netherlands (table 2; Departamento Nacional de Produção Mineral, 2009a).

Three international cement companies—Cimentos de Portugal, SGPS, S.A. (Cimpor) of Portugal; Lafarge S.A. of France; and Holcim Ltd. of Switzerland were active in 2008. Also, according to the DNPM, 36 iron ore mining companies were operating 53 mines and 54 processing plants in Brazil, and there were nearly 2,500 mineral mines in Brazil, which were

classified conforming to their run-of-mine (ROM) outputs: large mines—between 1 Mt/yr and 3 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, 2009a, c).

In 2008, Brazil produced 438,800 gigawatthours of electric power and consumed 404,300 gigawatthours. Brazil's primary domestic energy supply encompassed the following: hydroelectric (83%); petroleum and natural gas (8%); nuclear energy (4%); and others (5%) (Departamento Nacional de Produção Mineral, 2009c; U.S. Central Intelligence Agency, 2009).

Mineral Trade

Brazil was the leading economy in Latin America and a member of the Mercado Común del Cono Sur (MERCOSUR), which is the second largest trade association in the Americas and the eighth worldwide. In 2008, exports were valued at almost \$198 billion, and imports, \$173.1 billion compared with \$160.6 billion and \$120.6 billion, respectively, in 2007. Brazil's mineral sector had a trade surplus of \$8.9 billion compared with \$11.8 billion in 2007 (Banco Central do Brasil, 2009a; Departamento Nacional de Produção Mineral, 2009a, c).

The economic benefits that Brazil received from its mineral industry included the significant contribution the industry made to the country's trade balance. In 2008, Brazil exported iron ore and concentrates (\$16.5 billion); gasoline and petroleum (\$15.2 billion); flat-rolled products (\$6 billion); pig iron (\$3.1 billion); aluminum and aluminum products (\$3 billion); ferroalloys (\$2.3 billion); and tubes and cast iron (\$859 million) (Banco Central do Brasil, 2009b; Departamento Nacional de Produção Mineral, 2009a).

Commodity Review

Metals

Aluminum and Bauxite and Alumina.—Alumina production increased to almost 7.9 Mt in 2008 from 6.9 Mt in 2007, or by almost 14.5%. Exports of alumina totaled almost 4.6 Mt compared with more than 3.8 Mt in 2007. Primary aluminum production increased to almost 1.9 Mt in 2008 from almost 1.7 Mt in 2007, or by almost 11.8%. Companhia Brasileira de Alumínio (CBA) produced 28% of Brazil's primary aluminum; Alumínio Brasileiro S.A. (Albras), 27.7%; Alcoa Inc., 22.3%; BHP Billiton plc, 10.9%; Vale, 5.2%; and others, 5.9%. In 2008, exports of aluminum totaled 964,000 metric tons (t) and were valued at almost \$4.8 billion. Brazil's imports of all forms of aluminum totaled 209,000 t and were valued at more than \$1.0 billion. Bauxite production increased to 28.1 Mt in 2008 from 25.5 Mt in 2007, or by almost 10.2%. MRN accounted for more than 64% (18.1 Mt) of the total bauxite production for 2008. Exports amounted to more than 6.2 Mt of bauxite compared with almost 5.8 Mt in 2007. According to Associação Brasileira do Alumínio, Brazil's consumption of aluminum products by end use were as follows: packaging (28.7%), transports (25.8%), electrical

(11.6%), construction (11.3%), consumer durables (8.7%), machinery (4.0%), and others (9.9%). Brazil was the sixth ranked aluminum producer in the world after China, Russia, Canada, the United States, and Australia (Associação Brasileira do Alumínio, 2009; Bray, 2009a, b; Departamento Nacional de Produção Mineral, 2009c; Vale S.A., 2009).

Copper.—Brazil's copper production in concentrate increased to 219,676 t in 2008 from 205,728 t in 2007, or by almost 7%. The leading producers were Vale, with 126,000 t of the concentrate from its Sossego Mine in Carajas, State of Para, and Mineração Caraíba S/A, with 22,700 t from its deposit in Jaguarari, State of Bahia. In 2008, Caraíba Metais S/A (CMSA) of Camacari, State of Bahia, which was the only electrolytic copper producer in Brazil, produced almost 220,000 t of primary copper metal compared with 218,367 t in 2007. To meet Brazil's demand for copper metal of 358,000 t/yr, CMSA imported 216,900 t of copper cathode mostly from Chile (75%) and Peru (25%) in 2008. CMSA was planning to produce between 450,000 and 500,000 t/yr of electrolytic copper in D'Avila, State of Bahia, by 2010 (Departamento Nacional de Produção Mineral, 2009c; Vale S.A., 2009).

In 2008, Vale's copper project portfolio included the sulfide ore resources of, in order of resources, the Sossego, the Salobo, the Alemao, and the Cristalino deposits, and the oxidized ore deposit of Project 118; all these projects were located in the mineral province of Carajas, State of Para. Vale's subsidiary Salobo Metais S/A was conducting a feasibility study for the Salobo copper project, which was to be completed by 2011; its development would require an investment of \$1.2 billion. Salobo was expected to produce 127,000 t/yr of copper in concentrate by 2011. Salobo's expansion was planned to produce 254,000 t/yr of copper in concentrate by 2013, which would require an additional investment of \$855 million. The Salobo project was Brazil's largest copper deposit and contained an estimated ore resource of 928.5 Mt at grades of 0.77% copper and 0.46 grams per metric ton (g/t) gold. Salobo is located in Maraba, State of Para, and it could support a mill of 140,000-t/yr capacity. Vale was also planning to produce 10,000 t/yr of copper cathode from the Project 118 at an estimated cost of \$235 million by the first half of 2009. Vale's subsidiary Usina Hidrometalúrgica de Carajás S/A (UHC) was constructing a \$58 million semi-industrial-scale plant for copper processing. UHC would produce copper cathode at its Sossego Mine using hydrometallurgical technology based on pressure oxidation followed by heap leaching, solvent extraction, and copper electrowinning by early 2009 (Departamento Nacional de Produção Mineral, 2009c; Vale S.A., 2009).

A feasibility study for the Cristalino deposit (Vale, 100%) estimated reserves of 312 Mt grading 0.77% copper and 0.13 g/t gold and was expected to produce 90,000 t of copper concentrate by 2011. Vale continued conducting intensive geologic prospecting to identify new copper areas in the Carajas District. Mineração Maracá S/A completed a feasibility study for the Chapada copper-gold-silver project in Alto Horizonte, State of Goias. The estimated ore reserves amounted to 434.5 Mt containing 1.3 Mt of copper and 9.6 t of gold. The Chapada Mine was projected to produce 51,000 t/yr of copper concentrate, 2.8 t/yr of gold, and 6.1 t/yr of silver by 2012

(Departamento Nacional de Produção Mineral, 2009c; Vale S.A., 2009).

Gold.—Gold production increased to 54 t in 2008 from 50 t in 2007, or by 8%; mining companies produced 48.4 t (89.6%), and garimpeiros produced 5.6 t (10.4%). In 2008, Yamana Gold Inc. was the leading gold producer and contributed 27.4% of the country's total; AngloGold Ashanti Mineração Ltda. and Mineração Serra Grande S/A each produced 25.5%; Rio Paracatu Mineração S/A contributed 16.8%; and others produced 30.3%. The leading States with garimpeiros' gold operations were, in order of production, Para, Mato Grosso, Amazonas, Amapa, and Roraima (Departamento Nacional de Produção Mineral, 2009c).

Iron and Steel.—*Ferroalloys.*—Ferroalloys production remained at about the same level as that of 2007 (almost 1.5 Mt). The partnership between Brazil's Prometal Produtos Metalúrgicos S.A. and Norway's Elkem A/S produced 681,500 t of ferromanganese in 2008 compared with 687,000 t in 2007; the prometal project, in which Elkem held a 40% share, was located in Maraba, State of Para. The manganese was supplied by the nearby Prometal Mine, and the iron ore was from the Carajas District (Departamento Nacional de Produção Mineral, 2009c).

Pig Iron.—Brazil produced 35.3 Mt of pig iron compared with 35.6 Mt in 2007. Brazil was the sixth ranked producer, and its nearly 6 Mt of exports, which were valued at almost \$1.7 billion, represented approximately one-third of the pig iron traded in the world (Departamento Nacional de Produção Mineral, 2009c; Fenton, 2009).

Steel.—Raw steel production was 33.7 Mt in 2008 compared with 33.8 Mt in 2007. Brazil exported 9.2 Mt of steel valued at \$8.0 billion in 2008 compared with 10.4 Mt of steel valued at \$6.7 billion in 2007. The major recipients of Brazil's exports were the United States (40%); the Republic of Korea, Mexico, Thailand, and Taiwan (5% each); and Argentina, Chile, Colombia, and Spain (3% each). Brazil imported almost 2.7 Mt of steel valued at \$4.0 billion compared with more than 1.6 Mt of steel valued at almost \$2.0 billion in 2007. The apparent domestic consumption of steel (production + imports – exports) in Brazil was more than 27.6 Mt, which represented an increase of 10.4% compared with that of 2007 (25 Mt). The Brazilian steel industry's investments were \$3.6 billion in 2008, or 140% higher than in 2007 (\$1.5 billion). The steel industry was planning to invest \$17.2 billion by 2012 to increase the installed capacity to 59 Mt/yr from the current 36.5 Mt/yr. New steel facilities could be added, which would represent an additional capacity of 6 Mt/yr and an investment of \$4.5 billion (Departamento Nacional de Produção Mineral, 2009c; Fenton, 2009; Instituto Aço Brasil, 2009, p. 22-25, 28).

Iron Ore.—Brazil produced 351.7 Mt of beneficiated iron ore in 2008 compared with 354.7 Mt in 2007. Of that production, almost 85% was from the four major iron ore producers—Vale, 221.8 Mt; Minerações Brasileiras Reunidas S/A (MBR), 61.7 Mt; SAMARCO Mineração S/A., 16.2 Mt; and Companhia Siderúrgica Nacional (CSN), 14.9 Mt. In 2008, Brazil exported 219.5 Mt of iron ore valued at almost \$7.4 billion. The leading importers of Brazilian iron ore were China (33%), Japan (13%), Germany (10%), and France and

the Republic of Korea (5% each) (Departamento Nacional de Produção Mineral, 2009c). Vale was planning an investment of \$1.8 billion to produce 450 Mt/yr of beneficiated iron ore in 2011. Engineering studies for expansion of the Serra dos Carajas iron ore mine output to 130 Mt/yr in 2010 from 100 Mt in 2008 were completed. Vale was also planning to inject more than \$18 billion into the mining sector during the period of 2009-13 to consolidate its leading position in the global iron ore markets (Vale S.A., 2009).

Manganese.—Manganese production in concentrate (MnO_2) increased to more than 3.5 Mt in 2008 from almost 1.9 Mt in 2007. Rio Doce Manganês S.A.'s (RDM) (Vale, S.A., 100%) manganese mines in the States of Minas Gerais (Morro da Mina) and Para (Azul) produced 2.4 Mt of manganese ore and 308,000 t of ferroalloys (ferromanganese). In 2008, domestic consumption of manganese was as follows: manganese ferroalloys, 85%; electrical batteries, 10%; and chemicals, 5% (Departamento Nacional de Produção Mineral, 2009c; Vale S.A., 2009).

Nickel.—Brazil produced 54,060 t of nickel content in ore in 2008 compared with 58,317 t in 2007; production of electrolytic nickel was 20,056 t in 2008 compared with 21,635 t in 2007; nickel in ferronickel alloys decreased to 9,194 t in 2008 from 9,918 t in 2007; nickel in matte decreased to 3,153 t in 2008 from 3,401 t in 2007; and nickel in carbonates decreased to 19,278 t in 2008 from 20,796 t in 2007 (table 1; Departamento Nacional de Produção Mineral, 2009b).

Anglo American approved an investment of \$1.5 billion for its Barro Alto nickel project in the State of Goiás. The company planned to produce 36,000 t/yr of nickel as concentrate content from a deposit with 117 Mt of reserves at a grade of 1.5% nickel by 2011. Vale intended to invest \$1.5 billion to use a high-pressure acid leaching technology to produce 46,000 t/yr of nickel and 2,800 t/yr of cobalt metal from its Vermehlo project in Carajas, State of Para, which contained reserves of 123.6 Mt of laterite (limonitic) ores at a grade of 1.25% nickel and 0.06% cobalt. Vale was focused on the development of the Onca Puma nickel laterite project in the State of Para, which contained reserves of 82.7 Mt at a grade of 1.73% nickel, and was planning to invest \$2.3 billion to produce 58,000 t/yr of nickel metal. The Onca Puma and the Vermehlo projects were expected to be commissioned in June 2010, depending on market conditions (Departamento Nacional de Produção Mineral, 2009b; Vale S.A., 2009).

Zinc.—Brazil produced 173,933 t of zinc content in concentrates in 2008, which was 10.3% less than in 2007 (193,887 t). Primary metal production decreased to 248,874 t in 2008 from 265,126 t in 2007 and represented 90.5% of the installed annual metal capacity of 275,000 t. Grupo Votorantin (GV) was the only producer of zinc in Brazil. Production was through GV's two subsidiaries—Companhia Mineira de Metais S/A., which was located in Vazante, State of Minas Gerais, and Companhia Paraibuna de Metais S/A, which was located at the Juiz de Fora complex in Minas Gerais. Companhia Mineira de Metais produced 182,500 t of metal zinc (73.3% of the total) mainly from domestic concentrates treated at the Tres Marias metallurgical plant, which had the capacity to produce 180,000 t/yr of metal zinc. Companhia Paraibuna de Metais

produced 88,200 t of metal zinc (35.4% of the total) and relied entirely on imported concentrates (Departamento Nacional de Produção Mineral, 2009c).

Industrial Minerals

Asbestos.—In 2008, Brazil produced 287,673 t of asbestos (fiber content), which was almost 13.2% more than in 2007 (254,204 t). Brazil's significant asbestos deposits were located in Cana Brava, Minacu, State of Goiás; Goiás was the only producing State in the country. Sociedade Anônima Mineração de Amianto supplied 80% of Brazil's asbestos for the manufacture of specialized cement products, which were, in order of economic importance, ceiling tiles, protective screens, water and sewer pipes, water tanks, and molded electrical insulators. Other uses were, in order of value, thermal insulators, paper and cardboard, slabs, decorations, insecticide, asphalt for highways and airport runways, and automobiles (Departamento Nacional de Produção Mineral, 2009c).

Asbestos mining and consumption have been highly regulated in most industrialized nations, thus forcing the countries to reduce production and consumption. Industry experts expected asbestos use in the industrialized nations to continue to decline owing to health hazards. In contrast, the world's developing economies, mainly Brazil and China, were expected to increase their collective asbestos consumption by significant margins. Brazil's asbestos reserves (15 Mt) were considered to be adequate to meet demand in the short to medium term; the average grade of ore from the Cana Brava Mine in Minacu was 5.2%; it had reserves (fiber content only) of 3 Mt, which, at a production rate of about 200,000 t/yr, represented a 15-year mine life (Departamento Nacional de Produção Mineral, 2009c).

Gemstones.—In the Americas, Brazil followed Canada as the leading producers and traders of mostly alluvial diamond followed by Guyana and Venezuela. The country continued to be one of South America's leading gemstone producers and exporters. Many different varieties of gemstones are found in the Araxa, the Bambui, and the Canastra geologic groups; these include, in order of value (U.S. dollars per 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 Paraíba tourmaline. In 2008, 55% of the diamond and gemstones were mined by garimpeiros, and 45%, by the private sector. According to the DNPM's Mineral Summary Statistics for 2003-08, Brazil's diamond production from year to year has been uncertain, and annual production has been declining since 2003. In both 2007 and 2008, Brazil produced 182,000 carats. The leading producers were Mineradora S/A, which was located in Juina, State of Mato Grosso, and produced 92,100 carats; and Mineração Rio Novo S/A, which was located in Diamantina, State of Minas Gerais, and produced 20,500 carats. The carats produced and reported conformed to the Kimberley Process Certification Scheme's (KPCS) guidelines (table 1; Departamento Nacional de Produção Mineral, 2009c; Olson, 2009a).

In 2008, Brazil exported 171,980 carats valued at \$19.6 million; the major markets for Brazilian rough diamond

were the European Union (51%), Israel (20%), the United Arab Emirates (17%), and the United States (9%). Imports of uncut stones amounted to 17,850 carats valued at \$1.9 billion; the main sources were the India (40%), Belgium (25%), the United States (15%), and the European Union (10%) (Departamento Nacional de Produção Mineral, 2009c).

Phosphate Rock.—Production of phosphate rock amounted to more than 6.3 Mt in 2008 compared with almost 6.2 Mt in 2007, which was an increase of 1.6%. The leading mining companies—which were, in order of production, Fosfertil S.A., Ultrafertil S.A., and Bunge Fertilizantes S.A. in Minas Gerais, and Copebras S.A. in Sao Paulo—contributed 97.5% of the total production in 2008. The reported domestic consumption of concentrates was about 8.0 Mt in 2008 compared with 7.8 Mt in 2007. 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 2007 (Departamento Nacional de Produção Mineral, 2009c).

Mineral Fuels

In 2008, Brazil produced more than 18.9 billion cubic meters of natural gas and 876 million barrels (Mbbbl) of petroleum, which was 4.3% and almost 37.3% higher than that of 2007, respectively. In 2008, Petrobrás' average production of crude oil, which included condensate and liquid natural gas, was about 2.4 million barrels per day (Mbbbl/d) compared with 2.3 Mbbbl/d in 2007. Brazil's total energy consumption included crude oil (60%, including ethanol), hydroelectricity (35%), and natural gas (5%). In coming years, attempts to diversify electric generation from hydropower to natural gas powerplants could increase the consumption of natural gas (Departamento Nacional de Produção Mineral, 2009c; Petróleo Brasileiro S.A., 2009a, b).

Coal.—In 2008, Brazil produced almost 6.5 Mt of bituminous coal compared with more than 6.4 Mt in 2007. The Brazilian coal industry's mine operations were concentrated in the three southernmost States of Rio Grande do Sul (52%), Santa Catarina (46%), and Parana (2%). Coal demand increased mainly because the thermoelectric plants were operating at full capacity in these three States (Departamento Nacional de Produção Mineral, 2009c).

To meet Brazil's coal demand, 19 Mt was imported in 2008 compared with 18.4 Mt in 2007. Imports came from Australia (35%), the United States (30%), Canada (10%), China (8%), South Africa (5%), and other countries (12%). Brazil's usage of coal was 65% as metallurgical coal and 35% as thermal coal in 2008. The steel industry consumed 100% of metallurgical coal. The energy coal was consumed by thermoelectric generation, 85%, and the industrial sector, 15% (including petrochemical, 4%; food industry, 3%; cellulose, 3%; and others, 5%) (Departamento Nacional de Produção Mineral, 2009c).

Natural Gas.—In 2008, Brazil's natural gas sources were 18.9 billion cubic meters of domestic natural gas and 10.3 billion cubic meters of natural gas imported from Bolivia (95%) and Argentina (5%). Brazil produced 18.9 billion cubic meters, or 64.7% of the domestic natural gas supply. The

leading producers of natural gas were the State of Rio de Janeiro (8 billion cubic meters), the State of Amazonas (3.5 billion cubic meters), and the State of Bahia (2.6 billion cubic meters). Petrobrás was planning to develop the Campo de Mexilhão in the Santos Basin to produce 15 million cubic meters per day of natural gas by 2010. Total Brazilian natural gas proven reserves were estimated to be 365 billion cubic meters. The Campos and the Santos Basins hold the majority of reserves (Departamento Nacional de Produção Mineral, 2009c; Petróleo Brasileiro S.A., 2009a, p. 58).

Petroleum.—In 2008, according to the DNPM, Brazil had 15.1 billion barrels of proven crude oil reserves, which were the second largest ones in South America after Venezuela. Production of crude oil increased to 876 Mbbbl in 2008 from 638 Mbbbl in 2007, or by 37%. Imports of crude oil increased to 231 Mbbbl in 2008 from 159.1 Mbbbl in 2007, or by 45.2%. The main import sources were Nigeria (42.5%), Algeria (14.3%), and Saudi Arabia (13%). In 2008, Petrobrás' total production of domestic and international crude oil and natural gas liquid, condensate, and natural gas amounted to 2,400 Mbbbl/d; 91.1% was from domestic sources and 8.9% was from international sources compared with 2.300 Mbbbl/d; 87.8% was from domestic sources and 12.2% was from international sources in 2007. Petrobrás' exports of crude oil and derivatives amounted to 620,000 barrels per day (bbl/d) in 2008 compared with 619,000 bbl/d in 2007, and imports of crude oil and derivatives amounted to 715,000 bbl/d in 2008 compared with 709,000 bbl/d in 2007. Petrobrás had also started numerous ethanol pipeline projects, including one that runs from the State of Goias to the State of Sao Paulo. BP Brasil Ltda. announced its involvement in the Edia ethanol project in the State of Goias, which would produce 7,500 bbl/d of ethanol by 2008; ethanol is produced from sugar cane that grows in Brazil's tropical climate. According to Petrobrás, exploration and production of fuels took place in Angola, Argentina, Bolivia, Colombia, Ecuador, Nigeria, Peru, Venezuela, and the United States (BP Brasil Ltda., 2009; BP p.l.c., 2009; Departamento Nacional de Produção Mineral, 2009c; Petróleo Brasileiro S.A., 2009a, b).

The pre-salt Tupi project in the Santos Basin, which was the largest oil deposit discovered by Petrobrás in 2008, is located offshore about 300 kilometers from the coast below a water depth of 2,140 meters (m) and another 3,000 m below the sea bed, going through a layer of salt 2,000 m thick. According to Petrobrás, the Tupi pilot project was planned to produce 100,000 bbl/d and 5,000,000 cubic meters per day of gas during 2010-12. Tupi was expected to enter into its final development phase by 2017. The Tupi project was a joint venture of Petrobrás (65%), the British Gas Group (BG) (25%), and the Brazilian Galp Energia S.A. (10%) (Petróleo Brasileiro S.A., 2009b).

In 2008, the partnership of Shell (80%) and Petrobrás (20%) on the Bijupira and the Salema Projects in Campos Basin produced a combined 50,000 bbl/d of crude oil and more than 480,000 cubic meters per day of gas; the fields have reserves of about 190 Mbbbl of oil and 1.8 billion cubic meters of natural gas. Other companies involved in exploration included Chevron, ExxonMobil, Repsol YPF, Shell, and Statoil ASA of Norway (BP Brasil Ltda., 2008; U.S. Energy Information Administration, 2009).

Reserves and Resources

Brazil was among the world leaders in reserves of some mineral commodities (table 3). According to the DNPM, the country's world ranking for reserves of mineral commodities was as follows: first, niobium and tantalum; second, graphite; third, bauxite, tin, and zinc; fourth, magnesite and manganese; and fifth, iron ore (Departamento Nacional de Produção Mineral, 2009c).

Outlook

Brazil's mineral sector, which includes metals, industrial minerals, and fuels, continued to experience a phase of real growth. The main vehicles for FDI inflows in the short and medium terms are expected to be joint ventures and acquisitions in new projects with Petrobrás, Vale, and others. Investments in hydroelectric and thermoelectric powerplants coming onstream are expected to meet Brazil's future energy needs. As an exporter of mineral commodities, the country is poised to gain from the continued FDI inflows into its economy, which represented an almost 82% share (\$45.1 billion) of MERCOSUR's total FDI (\$55.2 billion) in 2008. New mineral projects and expansions in progress are expected to ensure that Brazil retains its position among the global leaders in mineral commodities production for the foreseeable future. Brazil's renewed economic growth and its associated financial innovation are supporting the increase in domestic and international investors in Brazil's mineral industry and, in particular, in the metals, natural gas and petroleum, and biofuels and ethanol industries. According to the Banco Central do Brasil and the Economic Commission for Latin America and the Caribbean, more than 400 leading TNCs were planning to invest worldwide; these investments could position Brazil behind, in order of investment volume, China, the United States, and India. Brazil is expected to continue to be a strong economy in Latin America and MERCOSUR, and, as one of the world's leading producers of bauxite, crude oil, graphite, iron ore, manganese, niobium, tantalum, and tin, to attract additional FDI inflows in the near future (Banco Central do Brasil, 2009a, b; Economic Commission for Latin America and the Caribbean, 2009).

By the end of 2008, MERCOSUR had undergone dramatic changes in the natural gas and power markets owing to the increase in cross-border energy investment opportunities, increasing domestic gas consumption, and regionalization of the energy sector. Brazil had become the center of an increasingly rapid process of energy integration in South America owing to the country's gas market, which was evolving rapidly owing to an unsatisfied energy demand and a great potential for growth (Petróleo Brasileiro S.A., 2009b).

In spite of the global economic crisis during 2008-09, Brazil will likely continue to be the world's leading producer of key steel and feed stocks, such as high-content iron ore and niobium, and the second ranked producer of bauxite and manganese. Brazil's recent discoveries of pre-salt natural gas and petroleum deep offshore present opportunities and challenges for its economy. According to the Geological Survey of Brazil (CPRM), there are substantial mineral deposits to

be discovered in Brazil. With only one-third of the country's territory mapped, CPRM is planning to map the entire country's geologic formations. CPRM indicated that the chances were high of finding first class polymetallic deposits, similar to the massive Carajas deposit, especially in the Amazon region. The world's largest iron ore mine, Carajas in the State of Para, holds an estimated 7.2 billion metric tons of iron ore resources (proven + probable) and produces about 100 Mt/yr. Vale was planning to increase Carajas' production to 130 Mt/yr by 2012. The deposit also holds high content of copper, gold, manganese, and nickel (Companhia de Pesquisa de Recursos Minerais, 2009; Vale S.A., 2009).

Vale is planning to invest about \$14.2 billion by 2009 to sustain existing operations and to foster growth through research and development and the execution of Vale's diverse fuels projects in spite of the global financial downturn in 2008 and its spillover into the Brazilian economy. Vale is still confident of its long-term minerals and metals markets, which could increase Vale's market capitalization to \$70 billion from its current (2008) level of about \$62 billion (Banco Central do Brasil, 2009a, b; Vale S.A., 2009).

Brazil's Federal tax exemptions on imports of equipment for minerals prospecting, exploration, development, and production are expected to continue in the medium and long term. The Agência Nacional do Petróleo was planning to extend these exemptions for the fuels sector into 2020. Petroleum companies and other investors have shown confidence in the country, which could support continued economic growth and FDI in new technologies well into the next decade. Investments in the Brazilian mining industry are expected to continue to increase exploration and mine development activities, particularly in, in order of value, iron ore, gold, copper, diamond, and emerald. This trend is expected to continue because several TNCs have joined consortiums and acquired exploration properties, mining prospects, and permits particularly for, in order of value, crude oil and ethanol, natural gas, iron ore, gold, diamond, copper, lead, and zinc (Departamento Nacional de Produção Mineral, 2009b, d).

Brazil's gold production could increase significantly in the foreseeable future because of the growth of Brazil's 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. During 2008-09, Brazil's investment in mineral exploration, such as for, in order of economic value, bauxite, copper, iron ore, and nickel, amounted to \$10.5 billion (Departamento Nacional de Produção Mineral, 2009c).

The aluminum, automobile, petrochemical, pulp and paper, and steel industries, which depend heavily on energy and exports, would likely benefit most from the new power-generating infrastructure. Increased consumption of fossil fuels will be a result of the 52 powerplants to be built in the foreseeable future (49 based on natural gas and 3 on coal). Since 2002, the Government eliminated all import tariffs and price controls 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., 2009a, b).

The Amazon region contains considerable natural gas resources that remain nonproductive as yet, especially the Urucu field, which contains Brazil's largest onshore natural gas reserves. There is also the potential for major undiscovered mineral resources in addition to the large reserves of, in order of value, iron ore, manganese, bauxite, gold, and tin. There is, however, a concern over biodiversity in the Amazon Rainforest, which comprises 30% of the world's remaining tropical forests, and which provides shelter to 10% of Earth's plant and animal species and removes excess carbon dioxide from the atmosphere. Much of future minerals production, therefore, will also depend on the approaches and new technologies to be used for economic and social development that protects the environment in a responsible and sustainable way (Departamento Nacional de Produção Mineral, 2009a-d).

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TABLE 1
BRAZIL: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	2004	2005	2006	2007	2008 ^p
METALS					
Aluminum:					
Bauxite, dry basis, gross weight	20,950,000 ^r	22,034,000	23,236,300 ^r	25,460,700 ^r	28,097,500
Alumina	5,300,000	5,300,000	6,793,000	6,890,000	7,889,000
Metal:					
Primary	1,457,000	1,498,000	1,605,000	1,655,000	1,895,000
Secondary	246,000	251,000	253,000	255,000	292,000
Total	1,703,000	1,749,000	1,858,000	1,910,000	2,187,000
Beryllium, beryl concentrate, gross weight	6	--	--	--	--
Cadmium, metal, primary ³	187	200	200 ^e	200 ^e	200 ^e
Chromium:					
Crude ore	593,476	616,534	562,739	627,772	753,326
Concentrate and lump, Cr ₂ O ₃ content	253,002	253,082	228,721	253,254	256,300
Marketable product ^{e,3}	12,000	12,000	12,000	12,000	12,000
Cobalt:					
Mine output, Co content of hydroxide ^e	1,400 ⁴	1,500	1,500	1,500	1,500
Metal, electrolytic ⁵	1,155	1,200	1,200 ^e	1,200 ^e	1,200
Copper:					
Mine output, Cu content	103,153	133,325	147,836	205,728	219,676
Metal, refined:					
Primary	208,020	199,043	219,700	218,367	220,000
Secondary	24,000	25,000	27,000	24,000	25,633
Total	232,020	224,043	246,700	242,367	245,633
Gold:					
Mine output kilograms	28,508	29,942	37,907	44,790 ^r	48,373
Garimpeiros, independent miners do.	19,088	8,351	5,175	5,210 ^r	5,627
Total do.	47,596	38,293	43,082	50,000 ^r	54,000
Iron and steel:					
Iron ore and concentrate, marketable product:⁶					
Gross weight thousand metric tons	261,675	281,462	317,800	354,674	351,677
Fe content do.	173,752	186,891	211,020	235,504	233,514
Metal:					
Pig iron do.	34,579	33,884	32,452	35,571	35,286
Ferroalloys, electric arc furnace:					
Chromium metal	NA	NA	NA	NA	NA
Ferrocilcium silicon	NA	NA	NA	NA	NA
Ferrochromium	216,277	197,653	166,577	195,890	194,323
Ferrochromium silicon	11,560	11,600	11,600 ^e	11,600 ^e	11,507
Ferrocolumbium	25,169	38,819	38,800 ^e	38,800 ^e	38,490
Ferromanganese	466,000	480,000	573,000 ^e	687,000	681,500
Ferromolybdenum	NA	NA	NA	NA	NA
Ferronickel	19,900 ^e	38,819	41,566	52,442	52,022
Ferrophosphorus	NA	NA	NA	NA	NA
Ferrosilicon	146,000	146,000	146,000 ^e	146,000 ^e	144,832
Ferrosilicon magnesium ^e	14,600	14,600	14,600 ^e	14,600 ^e	14,483
Ferrosilicon zirconium	NA	NA	NA	NA	NA
Ferrotitanium	NA	NA	NA	NA	NA
Ferrotungsten	NA	NA	NA	NA	NA
Ferrovandium	NA	NA	NA	NA	NA
Inoculant ^e	11,100	11,100	11,100	11,100	11,011
Silicomanganese	180,000 ^e	180,200	180,000 ^e	180,000 ^e	178,560
Silicon metal	133,000 ^e	133,400	133,000 ^e	133,000 ^e	131,940
Other ferroalloys	19,054	19,500	19,500 ^e	19,500 ^e	19,344
Total ^e	1,240,000	1,270,000	1,340,000	1,490,000	1,478,012 ⁴
Crude steel, excluding castings thousand metric tons	32,918	31,631	30,900	33,782	33,716
Semimanufactures, flat and nonflat ^e do.	17,500	17,500	17,500	17,500	17,500

See footnotes at end of table.

TABLE 1—Continued
BRAZIL: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	2004	2005	2006	2007	2008 ^p
METALS—Continued					
Lead:					
Mine output, Pb content in concentrate	14,737	23,616	25,764	24,574	24,600
Metal, secondary	137,121	104,904	142,653	142,450	142,500
Manganese:					
Ore and concentrate, marketable: ³					
Gross weight	3,143,000	3,200,000	3,128,000	1,866,000	3,545,400
Metal content	1,346,000	1,370,000	1,845,000	2,214,000	2,091,200
Metal:					
Primary	13,460	13,700	18,450	22,140	20,910
Secondary ^c	1,600	1,600	1,600	1,600	1,600
Nickel:					
Mine output, ore	3,794,868	4,845,695	5,503,211	5,927,554	5,494,843
Ni content in ore	51,886	74,198	82,492	58,317	54,060
Ni content in carbonate	19,897	21,116	21,630	20,796	19,278
Ni content in matte	6,708	6,005	5,416	3,401	3,153
Ni, electrolytic	19,742	20,714	21,339	21,635	20,056
Ferronickel, Ni content	6,493	9,596	9,814	9,918	9,194
Niobium (columbium)-tantalum ores and concentrates, gross weight:					
Columbite and tantalite ^c	277 ⁴	456	456	456	456
Djalmaite concentrate ^c	10	10	10	10	10
Pyrochlore concentrate, Nb ₂ O ₅ content	23,779	56,023	68,850	81,922	82,000
Rare-earth metals, monazite concentrate, gross weight	731	958	958	1,173	1,200
Silver ⁷					
Primary kilograms	35,497	38,134	30,000	36,000	36,500
Secondary ^c do.	45,000 ⁴	43,000 ⁴	39,000	32,000	32,500
Total do.	80,497	81,134	69,000	68,000	69,000
Tin:					
Mine output, Sn content	12,202	11,739	9,528	11,835	13,000
Metal, smelter:					
Primary	11,512	8,986	8,780	9,384 ^r	10,308
Secondary ^c	250	250	250	250	250
Total	11,762	9,236	9,030	9,634 ^r	10,558
Titanium:					
Ilmenite:					
Gross weight	133,000	127,142	127,200	130,000	130,000
TiO ₂ content	90,000	77,571	89,195	95,559	96,600
Rutile, TiO ₂ content	2,117	2,069	2,100	3,000	3,000
Tungsten, mine output, W content	262	577	525	537	550
Zinc:					
Mine output, Zn content	158,962	170,659	185,211	193,887 ^r	173,933
Metal, smelter:					
Primary	265,987	267,374	272,311 ^r	265,126	248,874
Secondary ^c	NA	NA	NA	NA	NA
Total	265,987	267,374	272,311 ^r	265,126	248,874
Zirconium, zircon concentrate, gross weight ⁸	25,263	25,657	25,120	26,739	26,739
INDUSTRIAL MINERALS					
Asbestos:					
Crude ore	3,950,000 ^e	3,950,000 ^e	3,541,000 ^r	3,528,000 ^r	4,154,000
Fiber	252,067	236,047	227,304	254,204	287,673
Barite:					
Crude	72,320	42,924	47,611	37,000 ^r	41,070
Beneficiated	59,612	39,545	19,151	13,311	7,321
Marketable product ^{e,3}	65,000	45,000	45,000	45,000	45,000
Calcite ^e	35,000	35,000	35,000	35,000	35,000
Cement, hydraulic thousand metric tons	34,413	36,673	39,540	46,406	46,500

See footnotes at end of table.

TABLE 1—Continued
BRAZIL: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	2004	2005	2006	2007	2008 ^p
INDUSTRIAL MINERALS—Continued					
Clays:					
Bentonite, beneficiated	226,874	221,300	235,481	238,746	238,800
Kaolin:					
Crude	5,958,057	6,150,000	6,200,000	6,382,000	6,881,000
Beneficiated	2,381,000	2,410,000	2,455,000	2,480,000 ^r	2,674,000
Marketable product ³	2,149,000	2,072,000	2,404,000	2,428,000 ^r	2,618,000
Diamond: ^c					
Gem and industrial:					
Private sector	thousand carats	111	96	84	84
Garimpagem	do.	189	112	97	98
Total ⁹	do.	300	208	181	182
Diatomite:					
Crude	8,847	7,549	10,753	9,638	9,640
Beneficiated	7,200	7,670	8,968	5,555	5,560
Marketable product ^{e,3}	13,100	13,100	13,100	13,100	13,100
Feldspar:					
Crude ^e	280,293	196,419	166,418	182,168	182,200
Marketable product: ³					
Feldspar	115,952	117,387	71,785	166,089 ^e	166,100 ^e
Leucite ^e	5,000	5,000	5,000	5,000	5,000
Sodalite, crude ^e	500	500	500	500	500
Total	121,452	122,887	77,285	171,589	171,600
Fluorspar:					
Crude ore	181,991	201,435	192,628	198,449	191,600
Concentrates, marketable product:					
Acid-grade	40,948	42,043	41,373	45,342 ^r	44,559
Metallurgical-grade	16,824	24,469	22,231	20,582 ^r	19,014
Total	57,772	66,512	63,604	65,924 ^r	63,573
Graphite:					
Crude ^e	650,000	650,000	650,000	650,000	650,000
Marketable product: ³					
Direct-shipping ore	NA	NA	NA	NA	NA
Concentrate	76,332	77,494	76,194	76,194	76,200
Total	76,332	77,494	76,194	76,194	76,200
Gypsum and anhydrite, crude	1,474,911	1,582,248	1,711,671	1,923,119	1,923,200
Kyanite: ^c					
Crude	750	750	750	750	750
Marketable product ³	600	600	600	600	600
Lime, hydrated and quicklime	thousand metric tons	6,900	6,500	7,057	7,393
Lithium, concentrates	9,064	8,924	8,950	8,950	9,000
Magnesite:					
Crude	1,339,441	1,342,754	1,163,422	1,301,827	1,301,850
Beneficiated	366,174	386,759	382,718	399,314	399,320
Mica, all grades ^c	4,000	4,000	4,000	4,000	4,000
Nitrogen, N content of ammonia	1,077,400	950,000	950,000 ^e	950,000 ^e	950,000 ^e
Phosphate rock, including apatite:					
Crude:					
Mine product	thousand metric tons	35,000	34,000	36,700	38,265
Of which sold directly ^e	do.	35	35	35	35
Concentrate:					
Gross weight	do.	5,690	5,631	5,932	6,185
P ₂ O ₅ content	do.	2,181	2,005	2,111	2,185
Pigment, mineral, other, crude ^e	2,000	2,000	2,000	2,000	2,000
Potash, marketable (K ₂ O)	403,080	404,871	403,080	423,897 ^r	383,257
Potassium (KCl)	638,020	638,020	635,200	636,500	575,480

See footnotes at end of table.

TABLE 1—Continued
BRAZIL: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	2004	2005	2006	2007	2008 ^P
INDUSTRIAL MINERALS—Continued					
Precious and semiprecious stones except diamond, crude and worked: ^e					
Agate	3,000	3,000	3,000	3,000	3,000
Amethyst	1,000	1,000	1,000	1,000	1,000
Aquamarine	20	20	20	20	20
Citrine	100	100	100	100	100
Emerald	90	90	90	90	90
Opal	500	500	500	500	500
Ruby value	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
Sapphire do.	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000
Topaz	50	50	50	50	50
Tourmaline	80	80	80	80	80
Other	500	500	500	500	500
Quartz crystal, all grades	18,116	17,860	14,195	22,561	22,600
Salt:					
Marine thousand metric tons	5,206	5,520	5,122	5,365	5,370
Rock do.	1,442	1,559	1,622	1,621	1,650
Silica, silice ^e	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: ^e					
Dimension stone:					
Marble, rough-cut cubic meters	200,000	200,000	200,000	200,000	200,000
Of which sold directly	50,000	50,000	50,000	50,000	50,000
Crushed and broken stone:					
Basalt cubic meters	1,200,000	1,200,000	1,200,000	1,200,000	1,200,000
Calcareous shells	450,000	450,000	450,000	450,000	450,000
Dolomite thousand metric tons	3,500	3,500	3,500	3,500	3,500
Gneiss cubic meters	1,100,000	1,100,000	1,100,000	1,100,000	1,100,000
Granite thousand cubic meters	60,000	60,000	60,000	60,000	60,000
Limestone thousand metric tons	60,000	60,000	60,000	60,000	60,000
Quartz ¹⁰	250,000	250,000	250,000	250,000	250,000
Quartzite:					
Crude	400,000	400,000	400,000	400,000	400,000
Processed	200,000	200,000	200,000	200,000	200,000
Sand, industrial	2,700,000	2,700,000	2,700,000	2,700,000	2,700,000
Sulfur:					
Frasch	20,000	19,618	20,954	22,336	22,400
Byproduct:					
Metallurgy	286,000	266,817	297,539	321,707	321,750
Petroleum	90,400	112,093	117,203	135,623	135,650
Total	396,000	398,528	435,696	479,666	479,800
Talc and related material:					
Talc:					
Crude	417,716	413,340	389,471	401,204	401,210
Marketable product ^{e,3}	2,000	2,000	2,000	2,000	2,000
Pyrophyllite, crude ^e	200,000	200,000	200,000	200,000	200,000
Vermiculite:					
Concentrate	25,103	24,191	19,279	18,952	20,089
Marketable product ^{e,3}	3,100	3,100	3,100	3,100	3,100
MINERAL FUELS AND RELATED MATERIALS					
Coal, bituminous:					
Run-of-mine thousand metric tons	5,077	6,000	5,981	6,440 ^r	6,474
Marketable ³ do.	5,370 ^e	6,480 ^e	6,220	6,697 ^r	6,732
Coke, metallurgical, all types do.	294	300	300 ^e	300 ^e	300 ^e
Natural gas, gross million cubic meters	16,971	17,699	17,706	18,152	18,941
Natural gas liquids million 42-gallon barrels	4,667	4,700	4,700 ^e	4,700 ^e	4,904 ^e

See footnotes at end of table.

TABLE 1—Continued
BRAZIL: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	2004	2005	2006	2007	2008 ^p	
MINERAL FUELS AND RELATED MATERIALS—Continued						
Petroleum:						
Crude	thousand 42-gallon barrels	544,799	596,255	628,797	638,018	876,000
Refinery products: ^{11, 12}						
Liquefied petroleum gas (LPG)	do.	13,652	13,757	13,891	14,175	15,675
Gasoline	do.	139,975	141,332	142,703	145,673	161,091
Jet fuel	do.	582	587	592	605	670
Kerosene	do.	27,196	27,460	27,727	28,304	31,300
Distillate fuel oil	do.	215,052	217,114	219,228	223,580	247,241
Lubricants	do.	6,109	6,168	6,228	6,357	7,030
Residual fuel oil	do.	123,327	124,523	125,731	128,348	141,932
Other	do.	104,827	105,879	106,906	109,131	120,681
Refinery fuel and losses	do.	NA	NA	NA	NA	NA
Total	do.	630,720	636,820	643,006	656,173	725,620

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

¹Table includes data available through December 31, 2009.

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

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

⁴Reported figure.

⁵Source: Cobalt Development Institute.

⁶Includes sponge iron, in metric tons, as follows: 2004-08—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: 2004-06—50,000 and 2007-08—45,000.

⁸Includes baddeleyite-caldasite.

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

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

¹¹Data are those officially reported to the United Nations by the Ministry of Mines and Energy of Brazil. Source: Energy Statistics Yearbook.

¹²Departamento Nacional de Produção Mineral, 2008-09; and Petróleo Brasileiro S.A.: Annual Report 2008 and Magazine 2009.

TABLE 2
BRAZIL: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(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) [Vale S.A., 51%, and Nippon Amazon Alumínio Co. (NAAC), 49%]	Belem and Vila do Conde, Para State (two smelters)	455 (metal).
Do.	Alcan Alumínio do Brasil S.A. [Alcan Aluminum Ltd. (Alcan), 100%]	Saramenha, Minas Gerais State (smelter and refinery)	100 (metal).
Do.	do.	do.	150 (alumina).
Do.	Alcan Empreendimentos Ltda. (Alcan Alumínio do Brasil S.A., 100%)	Lamininação de Pindamonhangaba, Sao Paulo State (smelter)	280 (metal).
Do.	Alcan Alumínio Poços de Caldas (Alucaldas) (Alcan Alumínio do Brasil S.A., 100%)	Poços de Caldas, Minas Gerais State (mine)	1,000 (bauxite).
Do.	Alcoa Alumínio S.A. (Alcoa Inc., 54%; BHP Billiton plc, 36%; Alcan Aluminum Ltd., 10%)	do.	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. (Alcoa Inc., 54%; BHP Billiton plc, 36%; Alcan Aluminum Ltd., 10%)	Sao Luis, Maranhao State (refinery)	2,000 (alumina).
Do.	Alumar Consortium S.A. (Alcoa Inc., 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 S.A., 57%, and Hydro Aluminium, Nippon, Japan Alunorte, 43%)	Barcarena, Para State (refinery)	6,300 (alumina).
Do.	Companhia Brasileira de Alumínio (CBA) (Votorantim Group, 100%)	Poços 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)	400 (metal).
Do.	Companhia Geral do Minas (Aluminum Co. of America, 79%, and others, 21%)	Poços de Caldas, Minas Gerais State (refinery)	275 (alumina).
Do.	do.	Poços de Caldas, Minas Gerais State (smelter)	95 (metal).
Do.	Mineração Rio do Norte S.A. (MRN) (Vale S.A., 40%; BHP Billiton plc, 14.8%; Alcoa Inc., 13.2%; Alcan Empreendimentos Ltda., 12%; Companhia Brasileira de Alumínio, Norsk Hydro Comercio e Industria, 5%; Reynolds Alumínio do Brasil, 5%)	Oriximina, Para State (mine)	18,000 (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. (Valesul) (Vale S.A., 100%)	Santa Cruz, Rio de Janeiro State (smelter)	95 (metal).
Do.	Reynolds Internacional do Brasil, 42.5%; Bradesco Bank, 42.5%; J.P. Morgan, 15%)	Sorocaba, Sao Paulo State (smelter)	5.4 million (cans).
Do.	Vale S.A. (private, 100%)	Paragominas, Para State (mine)	9,900 (bauxite).
Do.	do.	Jabuti, Para State (alumina)	1,860 (alumina).
Chromite	Coitezeiro Mineração S.A. (COMISA) (private, 75.4%, and Bayer do Brasil S.A., 24.6%)	Campo Formosa, Bahia State (mine)	50 (ore).
Do.	Companhia de Ferro Ligas da Bahia (FERBASA) (private, 100%)	do.	370 (ore).
Do.	do.	Campo Formoso, Bahia State (beneficiation plant)	292 (concentrate).
Copper	Vale S.A. (private, 100%)	Serra dos Carajas, Para State	110 (ore).
Do.	Mineração Caraíba S/A (Grupo PARANAPANEMA, 100%)	Jaguari, Bahia State (mine)	130 (ore).
Do.	do.	Jaguari, Bahia State (beneficiation plant)	90 (concentrate).
Do.	Caraíba Metais S/A (CMSA) (Grupo PARANAPANEMA, 100%)	Camaçari, Bahia State (refinery)	220 (metal).
Do.	Yamana Gold Inc. (YGI) (private, 100%)	Chapada, Alto Horizonte in Goias State (mine)	200 (concentrate).
Do.	Companhia Brasileira Carbureto de Calcio (private, 100%)	Santos Dumont, Minas Gerais State (plant)	54.

See footnote at end of table.

TABLE 2—Continued
BRAZIL: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
METALS—Continued			
Ferroalloys	Prometal Produtos Metalúrgicos S.A., 60%, and Elkem A/S, 40%	Maraba, Para State (plant)	500.
Do.	Nova Era Silicon S.A. (Vale S.A., 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. (Vale S.A., 100%)	Bahia, Mato Grosso do Sul, and Minas Gerais	600.
Do.	Urucum Mineração S.A. (Vale S.A., 100%)	Corumba plant, Mato Grosso do Sul State	20.
Gold	kilograms Vale S.A. (private, 100%)	Gold mines in the States of Minas Gerais, Bahia, and Para	18,000.
Do.	do. Mineração Morro Velho S.A. (AngloGold Ashanti Mineração Ltda., 100%)	Cuiaba, Novo Lima, and Sabara, Minas Gerais State; and Jacobina, Bahia State (four mines)	8,100.
Do.	do. Mineração Serra Grande S.A. (AngloGold Ashanti Mineração Ltda., 50%, and Kinross Gold Corp., 50%)	Serra Grande, Minas Gerais State (mine)	6,000.
Do.	do. São Bento Mineração S.A. (Eldorado Gold Corp., 100%)	Santa Barbara, Minas Gerais State (mine)	4,000.
Do.	do. Rio Paracatu Mineração S.A. (Kinross Gold Corp., 50%, and Mineração Serra Grande S.A., 50%)	Paracatu Mine, Minas Gerais State (mine)	7,500.
Do.	do. Yamana Gold Inc. (YGI) (private, 100%)	Chapada, Alto Horizonte in Goias State (mine)	1,200.
Do.	do. do.	Sao Francisco Mine, Mato Grosso State (mine)	3,100.
Do.	do. do.	Jacobina Mine, Bahia State (mine)	3,000.
Do.	do. do.	Fazenda Brasileiro, Goias State (mine)	3,700.
Do.	do. do.	Sao Vicente Mine, Mato Grosso State (mine)	1,900.
Iron ore	Companhia Siderúrgica Nacional (CSN) (private, 100%)	Volta Mine, Minas Gerais State	15,000.
Do.	Itaminas Comércio de Minérios S.A. (private, 100%)	Itaminas, Minas Gerais State	5,000.
Do.	Vale S.A. (private, 100%)	Serra dos Carajas Mine in Parauapebas, Para State	100,400.
Do.	do.	Itabirito, Mato, Vargem Grande, and Paraopeba, Minas Gerais State (four mines)	87,300.
Do.	do.	Itabira, Ouro Preto, Santa Barbara, Xavier, Tamandúa, Capao, and Mato, Minas Gerais State (seven mines)	134,600.
Do.	do.	Mato Grosso do Sul State (one mine)	1,500.
Do.	do.	Ponta Madeira, Sao Luis, and Tubarao, Maranhao State (pellet plants)	31,700.
Do.	Vale S.A. (Vale S.A., 50.9%, and Arcelor Mittal Co., 49.1%)	Hispanobras, Espirito Santo State (pellet plant)	3,800.
Do.	Vale S.A. (Vale S.A., 50%, and BHP Billiton plc., 50%)	SePETiba, Samarco, Rio de Janeiro State (pellet plant)	21,800.
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 plc, 50%, and Mitsui Co. Ltd., 50%)	Capao Xavier, Tamandua, and Capitaio do Mato, Minas Gerais State (three mines)	32,000.
Do.	Samarco Mineração S.A. (SAMITRI), 51%, and BHP Billiton Ltd., 49%)	Alegria, Minas Gerais State (mine)	15,000.
Do.	Mineração Corumbaense Reunida S/A (MCR) (Rio Tinto plc, 100%)	Corumba, Mato Grosso do Sul (mine)	2,000.
Lead	Companhia Mineira de Metais (CMM) (private, 100%)	Paracatu, Minas Gerais State (mine)	25 (ore).
Do.	do.	Paracatu, Minas Gerais State (plant)	15 (concentrate).

See footnote at end of table.

TABLE 2—Continued
BRAZIL: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity	
METALS—Continued				
Manganese	Rio Doce Manganês S.A. (Vale S.A., 100%)	Morro da Mina, Minas Gerais State	300.	
Do.	do.	Mina do Azul, Carajas, Para State	2,500.	
Do.	do.	Mina Mineiros, Bahia State	1,500.	
Do.	Urucum Mineração S.A. (Vale S.A., 100%)	Corumba and Ladario, Mato Grosso do Sul State (two mines and plant)	1,500 (ore), 500 (concentrate).	
Do.	Construtora Polares Ltda. (CPL) (private, 100%)	Corumba Minas Gerais State (mine)	200 (ore).	
Nickel	Companhia Níquel Tocantins (Grupo Votarantim, 100%)	Niquelandia, Goiás State (mine)	30 (ore).	
Do.	do.	Niquelandia, Goiás State (refinery plant)	25 (electrolytic).	
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, Goiás State (refinery)	20 (metal).	
Do.	Vale S.A. (private 100%)	Onca Puma and Vermelho, Para State (alloy plant)	58 (iron-nickel alloy).	
Niobium (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).	
Steel	Aço Minas Gerais S.A. (GERDAU AÇOMINAS, 100%)	Rodovia, Minas Gerais State	7,000.	
Do.	Acesita S.A. (private, 100%)	Timoteo, Minas Gerais State (specialty steel)	900.	
Do.	Companhia Siderúrgica Belgo-Mineira (private, 100%)	João Monlevade, Minas Gerais State	1,000.	
Do.	Companhia Siderúrgica de Tubarão (private, 100%)	Serra, Espírito Santo State	4,800.	
Do.	Companhia Siderúrgica Nacional (CSN) (private, 100%)	Volta Redonda, Rio de Janeiro State	5,800.	
Do.	Companhia Siderúrgica Paulista (COSIPA) (private, 100%)	Cubatao, Sao Paulo State	4,500.	
Do.	Usinas Siderúrgicas de Minas Gerais, S.A. (USIMINAS) (private, 100%)	Ipatinga, Minas Gerais State	5,500.	
Tantatum	metric tons	Mineração Taboca/AM (private, 100%)	Pitinga Mine, Amazonas State (mine)	180 (concentrate).
Do.	do.	Companhia Industrial Fluminense (private, 100%)	Fluminense Mine, Minas Gerais State (mine)	25 (concentrate).
Tin		Mineração Jacunda Ltda. (MJL) (private, 100%)	Santa Barbara, Novo Mundo, and Potosi, Rondonia State (six mines)	108 (ore).
Do.	do.	do.	Santa Barbara, Novo Mundo, and Potosi, Rondonia State (three beneficiation plants)	450 (concentrate).
Do.		Grupo PARANAPANEMA (private, 100%)	Aripuana, Mato Grosso State; Ariquemes, Rondonia State; Novo Aripuana, Pitinga, and Presidente Figueiredo, Amazonas State; and Sao Felix do Xingu, Para State (five mines and two plants)	5,420 (ore).
Do.	do.	do.	Piraporada Bom Jesus, Sao Paulo State (refinery)	1,400 (concentrate), 25 (metal).
Do.		Marmoré S.A. (Grupo PARANAPANEMA, 100%)	Juiz de Fora, Minas Gerais State (mine)	20 (ore).
Do.		Grupo PARANAPANEMA (private, 100%)	Aripuana, Mato Grosso State; Ariquemes, Rondonia State; Novo Aripuana, Pitinga, and Presidente Figueiredo, Amazonas State; and Sao Felix do Xingu, Para State (five mines and two plants)	5,420 (ore).
Do.	do.	do.	Piraporada Bom Jesus, Sao Paulo State (refinery)	1,400 (concentrate), 25 (metal).
Do.		Marmoré S.A. (Grupo PARANAPANEMA, 100%)	Juiz de Fora, Minas Gerais State (mine)	20 (ore).
Titanium		Rutilo e Ilmenita do Brasil S.A. (RIBSA), 100%	Mataraca, Paraiba State (mine)	4,200 (ore).
Do.	do.	do.	Mataraca, Paraiba State (two beneficiation plants)	120 (concentrate).
Zinc		Votorantim Metais Zinco S/A (Grupo Votorantim, 100%)	Vazante, Minas Gerais State (mine)	800 (ore).
Do.	do.	do.	Vazante, Minas Gerais State (beneficiation plant)	175 (concentrate).
Do.	do.	do.	Três Marias, Minas Gerais State (refinery)	180 (metal).
Do.		Companhia Paraibuna de Metais S/A	Juiz de Fora, Minas Gerais State (complex)	95 (metal).
Zirconium		Nuclemon Mineró-Química Ltda. (Government, 100%)	São João da Barra, Rio de Janeiro State (mine)	660 (ore).
Do.	do.	do.	Itapemirim, Espírito Santo State (mine)	90 (ore).
Do.	do.	do.	Prado, Bahia State (mine)	90 (ore).
Do.	do.	do.	Prado, Bahia State (three beneficiation plants)	123 (concentrate).
Do.	do.	do.	Prado, Bahia State (three separation plants)	90 (concentrate).

See footnote at end of table.

TABLE 2—Continued
BRAZIL: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
INDUSTRIAL MINERALS			
Asbestos	Sociedade Anônima Mineração de Amianto (private, 100%)	Cana Brava and Minaçu, Goiás State (mines)	9,000 (ore).
Do.	do.	Cana Brava and Minaçu, Goiás State (beneficiation plant)	230 (concentrate).
Cement	Votorantim Cimentos S.A. (Grupo Votorantim, 100%)	Itapevi and Salto de Pirapora, São Paulo State	5,000 (3 plants).
Do.	do.	Itau de Minas, Minas Gerais State	5,000 (3 plants).
Do.	do.	Rio Branco do Sul, Paraná State	5,000 (3 plants).
Do.	do.	Cipasa, Santa Elena, Sergipe State	5,000 (3 plants).
Do.	do.	Cantagalo, Esteio, Rio Grande do Sul State	5,000 (3 plants).
Do.	Companhia de Cimento Portland Paraíso (CCPP), 50% and Lafarge S.A., 50%	States of Espírito Santo, Goiás, Minas Gerais, and Rio de Janeiro (five plants)	4,000.
Do.	Companhia de Cimento Portland S.A. (CIMPOR Brazil)	States of Rio Grande do Sul, Santa Catarina, São Paulo, Goiás, and Bahia (six plants)	6,000.
Do.	Camargo Correia Cimentos S.A. (CCSA) (private, 100%)	Ijaci, Minas Gerais State (plant)	1,600.
Do.	Holcim (Brasil) S.A.	Chacara, San Antonio, São Paulo State (four plants)	5,000.
Fluorspar	Mineração Nossa Senhora do Carmo Ltda. (private, 100%)	Cerro Azul, Paraná State (two mines)	180 (ore).
Do.	Mineração Santa Catarina Ltda. (MSCL) (private, 100%)	Morro da Fumaça, Santa Rosa de Lima, Rio Fortuna, Santa Catarina State; and Tangua, Rio de Janeiro State (three mines and beneficiation plant)	100 (ore), 120 (concentrate).
Gemstones	carats Mineradora S/A (private, 100%)	Juina, Mato Grosso State	92,100.
Do.	do. Mineração Rio Novo S/A. (private, 100%)	Diamantina, Minas Gerais State (mine)	20,500.
Graphite	Nacional de Grafite Ltda. (NGL) (private, 100%)	Itapeçerica, Pedra Azul, Salto da Divisa, Minas Gerais State (three mines)	80 (ore).
Do.	do.	Itapeçerica, Pedra Azul, Salto da Divisa, Minas Gerais State (three beneficiation plants)	60 (concentrate).
Do.	Grafita MG Ltda. (GML) (private, 100%)	Mateus Leme, Zerra Azul, Minas Gerais State (two mines)	20 (ore).
Do.	Marmoré Mineração e Metalurgia Ltda. (MML) (Grupo PARANAPANEMA, 100%)	Maiquinique, Bahia State (mine)	10 (ore).
Gypsum	Companhia Brasileira de Equipamento (private, 100%)	Codo, Maranhão State, and Ipubi, Pernambuco State (two mines)	600 (ore).
Do.	Mineradora Rancharia Ltd/Supergesso S.A (private, 100%)	Ipubi, Pernambuco State (mine)	600 (ore).
Do.	Holcim Brasil S.A. (Grupo Holderbank, 100%)	Holder, Pernambuco State (mine)	600 (ore).
Do.	Mineradora São Jorge S.A (Grupo Laudenor Lins, 100%)	São Jorge, Maranhão State (mine)	110 (ore).
Do.	Votorantim Cimentos N/NE (private, 100%)	Mateo, Ceará State (mine)	70 (ore).
Kaolin	Caulim da Amazônia S.A. (CADAM) (private, 100%)	Mazagão, Amapá State (mine)	720 (ore).
Do.	do.	Mazagão, Amapá State (beneficiation plant)	360 (concentrate).
Do.	do.	Adam Mine, Rio Jari, Amazonas State	660 (concentrate).
Do.	Pará Pigmentos S.A. (PPSA) (private, 100%)	Para Mine, Pará State	500 (concentrate).
Do.	Ymerys Rio Capim Caulim S.A. (RCCSA) (private, 100%)	Rio Capim Mine, Pará State	500 (concentrate).
Do.	Empresa de Mineração Horii Ltda. (EMHL) (private, 100%)	Biritiba and Mogi das Cruzes, São Paulo State (two mines)	200 (ore).
Do.	do.	Biritiba and Mogi das Cruzes, São Paulo State (two beneficiation plants)	180 (concentrate).
Limestone	Companhia de Cimento Portland Paraíso (CCPP) (private, 100%)	States of Goiás, Minas Gerais, and Rio de Janeiro (five mines)	2,000.
Do.	Companhia de Cimento Portland Rio Branco (CCPRB), 100%	Rio Branco do Sul, Paraná State (three mines)	5,500.
Do.	S.A. Industrias Votorantim (SAIV) (private, 100%)	States of Rio de Janeiro and São Paulo (four mines)	1,000.
Magnesite	Magnesita S.A. (MSA) (private, 100%)	Brumado, Bahia State (one major mine and numerous small mines)	1,000 (ore).
Do.	do.	Brumado, Bahia State (two beneficiation plants)	280 (concentrate).

See footnote at end of table.

TABLE 2—Continued
BRAZIL: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(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	Bunge Fertilizantes S.A. (Bunge Ltd., 100%)	Araxa, Minas Gerais State (mine)	5,000.
Do.	Copebrás S.A.(Copebrás) (Anglo American plc, 100%)	Ouvidor, Goiás State (mine)	4,400.
Do.	Fosfertil S.A. (Grupo Fertifós, 81.54%; Vale S.A., 10.96%; public, 7.5%)	Tapira, Minas Gerais State (two mines)	10,500.
Do.	Ultrafertil S.A. (Grupo Fertifós, 81.54%; Vale S.A., 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, Maceio, Alagoas State (mine)	1,000.
MINERAL FUELS AND RELATED MATERIALS			
Coal	Carbonifera Circiúma S.A. (CCSA) (private, 100%)	Circiúma and Sideropolis, Santa Catarina State (two mines)	1,600.
Do.	Companhia Carbonifera Metropolitana S.A. (private, 100%)	Circiúma, 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.	Indústria Carbonifera Rio Deserto Ltda. (private, 100%)	Circiúma and Urussanga, Santa Catarina State (two mines)	2,600.
Natural gas	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	20,000.
Petroleum	do.	Fields in the States of Alagoas, Amazonas, Bahia, Ceara, Espirito Santo, Rio de Janeiro, Rio Grande do Norte, Para, Maranhao, and Sergipe	700,000.
Petroleum products	do. do.	Refineries in the States of Amazonas, Bahia, Ceara, Minas Gerais, Parana, Rio de Janeiro, Rio Grande do Sul, and Sao Paulo	650,000.
Do.	do. Refinaria de Petróleo Ipiranga S.A. (private, 100%)	Ipiranga, Rio Grande do Sul	3,400.
Do.	do. Refinaria de Petróleos de Manguinhos S.A. (private, 100%)	Manquinhos, Rio de Janeiro State	3,650.
Do., do. Ditto.			

TABLE 3
BRAZIL: RESERVES OF MAJOR MINERAL COMMODITIES IN 2008

(Thousand metric tons unless otherwise specified)

Commodity ¹	Reserves	World ranking	World percentage
Asbestos, fiber	15,400		NA
Bauxite, ore	2,700,000	3	8.4
Chromite, Cr ₂ O ₃	5,362		0.3
Coal, all types ²	930,000		1.1
Copper, metal content	14,365		1.5
Fluorspar (CaF ₂ content)	1,066		0.5
Gold, metal content	metric tons 1,800		2.0
Graphite, ore	113,000	2	28.3
Gypsum	1,233,500		NA
Iron ore, 60% to 65% Fe content	26,474	5	7.2
Kaolin	7,700,000		NA
Lead, metal content	700		0.5
Magnesite	345,000	4	8.9
Manganese, metal content	132,000	4	2.5
Natural gas ²	million cubic meters 430,000		0.2
Nickel, metal content	8,300		5.8
Niobium (columbium) (pyrochlore, and columbite ore)	3,761	1	96.4
Petroleum ²	million 42-gallon barrels 15,100		1.0
Phosphate rock	246,000		0.5
Talc and pyrophyllite	125,800		NA
Tantalum	88,388	1	46.5
Tin, metal content	777	3	12.4
Titanium, TiO ₂	7,990		NA
Uranium, U ₃ O ₈	metric tons 163,000		NA
Vermiculite	23,000	3	10.3
Zinc, metal content	6,200		1.3
Zirconium, ore	2,637		3.8

NA Not available.

¹Source: Summário Mineral 2008-09.

²Sources: Petróleo Brasileiro, S.A., Annual Report 2008; U.S. Energy Information Administration, October 2009.

