

THE MINERAL INDUSTRY OF

BRAZIL

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During 1994, Brazil produced bauxite, columbium, gemstones, gold, iron ore, kaolin, manganese, tantalum, and tin from world-class deposits and exported them to the global marketplace. In Latin America, particularly within the "Mercado Comun del Cono Sur" (MERCOSUR), Southern Cone Common Market, Brazil continued to be the leading producer of aluminum, cement, ferroalloys, gold, iron ore, manganese, steel, and tin. The country was engaged in an ambitious petroleum exploration program to expand reserves and reduce its dependence on oil imports, which were approximately 60% of its crude oil requirements during 1994.

In 1994, the country of continental dimensions with a population of nearly 160 million, had a gross domestic product (GDP) of \$531 billion.² Foreign exchange reserves were about \$34 billion. Its tremendous known and potential natural resources helped make it one of the most dynamic markets in the world, ranking ninth in the global economy and constituting one-third of the Latin American economy.

Brazil, the largest debtor nation in the developing world, completed an agreement with its creditor banks to reduce its \$49-billion foreign debt with lower interest rates and longer-term loans. This accord was crucial to Brazil's efforts to liberalize further its economy, attract more foreign investment, and stabilize prices. Brazil's total debt burden, including loans from banks and from other governments, amounted to \$93.4 billion at the end of 1994.

The Government continued to utilize tight monetary policy and high interest rates with the objective of curbing inflation from the current 45% per month (5,000% for 1993 alone) to 1.5%, preventing price explosion and indicating, in part, a successful Governmental economic plan, known as the "Plano Real."

Government Policies and Programs

Brazil's efforts to make revisions to its 1988 Constitution by both houses of Congress began in 1994. Significant measures were undertaken by the Brazilian Government, reducing import duties from an average of 42% to 14% during 1993 and 1994, and eliminating governmental red tape affecting trade. In September 1993, Presidential Decrees were signed with the intent of reducing taxes and tariffs, and allowing 100% of equity ownership via privatization and expatriation of profits. These significant measures were

undertaken by the Government to create a favorable and positive environment to attract equally both domestic and foreign investments.

Privatization of State-owned firms led to lower employment levels and more efficiency. Since yearend 1991, the State has sold 30 companies worth \$5.25 billion, mostly in the chemical, fertilizer, and steel sectors. Another \$13 billion was expected from the remaining 35 corporations of the first phase of Brazil's privatization process. Sales of Government minority holdings would provide an additional \$2.5 billion. The auctioning of the large State-owned mining, telephone, and petroleum firms was expected to bring in an additional \$20 billion, raising a total revenue of about \$40 billion. The realization of this revenue, however, would require the removal of all trade barriers and a constitutional ruling to privatize Brazil's monopolies in the petroleum, telecommunication, and energy sectors. The Brazilian privatization program was also considering concessioning of public utilities as an alternative, and building and managing railroads, ports, and hydroelectric powerplants in joint ventures with the private sector.

In October 1994, the current Administration was elected and three-fifths of the members of the elected Brazilian Congress was expected to support the Government's "Plano Real," based on strict control of the domestic deficit, issuance of a new currency, stable foreign exchange rates, renegotiation of its foreign debt on favorable terms, and reduction of tariffs. Also, Brazil's efforts to review its 1988 Constitution by both houses of Congress was expected to change the state's monopoly powers by allowing private companies to generate electricity and to build and operate highways; privatize the state-owned mining giant, Companhia Vale do Rio Doce (CVRD); end the monopoly held by Petróleo Brasileiro S.A. (PETROBRÁS) in the country's oil and gas industries; and approve the concept of what constitutes a Brazilian company. The latter was expected to benefit Brazilian firms with foreign shareholders, which means that they would be considered Brazilian when they are managed or have their headquarters in Brazil. Historically, only Brazilian corporations are allowed to exploit the country's minerals endowment or to operate hydroelectric power stations. In the near future, two additional amendments are expected to be passed: the first to end the state monopoly over telecommunications, and the second to allow foreign ships to handle Brazilian cargoes. It

was expected that the Government would agree that privatization should be done through Congress instead of by Executive Decree.

The country's mining industry appeared to be on the verge of an investment boom in exploration and mine development, particularly in gold. The Government's aggressive economic policies, coupled with Brazil's diversified minerals endowment, and skilled professionals, scientists, and labor base, have stimulated a return of the major international mining companies to Brazil. Several firms, which fled Brazil after the promulgation of the 1988 Constitution, began acquiring exploration properties and mining prospects, particularly for gold. Companies active in Brazil included Newmont and Barrick Gold of the United States; Placer Dome, INCOLimited, and TVX Gold Inc. of Canada; Anglo-American and General Mining Union Corp. Ltd. (GENCOR) of South Africa; Rio Tinto Zinc Mineração Ltd. (RTZ) of the United Kingdom; and BHP Minerals and Western Mining Company of Australia.

The four MERCOSUR nations—Argentina, Brazil, Paraguay, and Uruguay—were seeking to eliminate import duties for trade and to harmonize trade policies and tariffs from nonmember countries. MERCOSUR is an extension of an Argentina-Brazil integration that began in 1986. On March 26, 1991, the Treaty of Asunción was signed, including Paraguay and Uruguay in MERCOSUR, thus forming a trade bloc with 200 million people and a combined GDP of \$550 billion. When fully implemented, the treaty would allow unrestricted movement of labor, goods, and services among the four countries. Already, MERCOSUR has had its impact on the Latin intraregional trade, which has increased from \$7 billion in 1983 to about \$26 billion in 1994. Internal MERCOSUR trade amounted to \$12 billion and mineral trade amounted to \$2.9 billion in 1994.

The Ministry of Mines and Energy was no longer part of the Ministry of Infrastructure, and the National Department of Mineral Production (DNPM-Departamento Nacional da Produção Mineral) became an autonomous Federal agency by early 1994. DNPM continued to have specific responsibility for mining.

Environmental Issues

In 1983, Brazil enacted Law No. 6938 that established the National Environmental Council (CONAMA-Conseho Nacional de Meio Ambiente) as an advisory agency in the executive branch. Under CONAMA's resolution 001/86, an environmental license was required for all mining activities in Brazil. In 1986, Law No. 88351 established the National System for the Environment, composed of representatives of the Federal, State, and local governments and private foundations involved in environmental protection and improvement.

The 1988 Constitution, Article 225, stipulated that mining operators reclaim environmentally degraded areas. Later,

detailed legislation was passed with a goal of harmonizing mining activities with the environment included the Plan for Recovery of Degraded Areas and the Environmental Control Plan. In February 1989, the President of Brazil signed a decree prohibiting the use of mercury and cyanide in the mining of gold unless approved by Brazilian State environmental agencies. The States most affected were those in the Pantanal and Amazon regions.

Resolution 010 of December 6, 1990 dictated that all mining operations required environmental licenses leading to the granting of mineral rights by the DNPM. As environmental problems increased, antipollution measures were enacted to eliminate the sources of pollutants and mitigate their effects on the environment.

In early 1994, the Minas Gerais Environment Policy Commission closed a *garimpo* (cooperative of independent miners) alluvial gold mining operation on the Paracatu River. Health checks on the 2,000 *garimpeiros* (independent miners) that worked there revealed an excessive exposure to mercury. Many had absorbed mercury into their bloodstreams at more than 200 times the permissible levels.

Production

The total value of minerals produced in 1994 was about \$9.4 billion, or almost 2% of GDP. Brazilian minerals production increased approximately 4% compared with that of 1993, caused mostly by iron ore output increase of about 4%. Increases also were recorded in production of chromium, 17%; kaolin, 15%; manganese, 26%; nickel, 5%; and to a lesser extent asbestos, phosphate, and zinc. Gold production increased by almost 1.5%; however, depletion of shallow gold deposits and environmental constraints on *garimpeiros* would affect future output. (*See table 1.*)

Trade

In 1994, the total value of exports was approximately \$44.5 billion versus the total value of \$33 billion for imports. The trade surplus amounted to about \$11 billion. During 1994, Brazil sold 13% of its exports to the other MERCOSUR members and 8% to the other countries in South America. Brazil's mineral imports were valued at \$4.5 billion, while total exports were \$2.6 billion, or about 1.2% below the 1993 mineral exports, mostly because of the decrease in exports of iron ore, gold, and dimension stone. The negative trade balance in the minerals sector for 1994 was heavily influenced by the value (\$2.7 billion) of petroleum imports. In addition to petroleum, other major mineral imports, in alphabetical order, were coal, copper, lead, natural gas, potash, sulfur, and zinc.

During 1994, Brazilian exports of steel were 13.6 million metric tons (Mmt), up from 12.2 Mmt in 1993. Exports of steel, mostly semifinished, were valued at \$3.7 billion, an increase of about \$100 million from 1993. Imports of steel

products were about 193,900 metric tons (mt), at a value of \$211 million, representing an increase from 177,900 mt, valued at \$208 million in 1993.

Structure of the Mineral Industry

The major portion of the mineral industry of Brazil was partially or wholly owned by private Brazilian investors, Brazilian corporations, and foreign companies in 1994. The few exceptions were the natural gas and petroleum industry, which was 100% Government-owned through PETROBRÁS, and the five large majority State-owned steel companies. In 1994, PETROBRÁS was composed of five subsidiaries: (1) Petrobrás Distribuidora, S.A., the petroleum products distribution company; (2) Petrobrás Química, S.A., the petrochemical company; (3) Petrobrás Internacional, S.A. (BRASPETRO), the foreign operating company; (4) Petrobrás Fertilizantes, S.A., the agricultural fertilizer company; and (5) Petrobrás Mineração, S.A., the mining company. PETROBRÁS is the domestic operator. The Government-owned steel holding company, Siderúrgica Brasileira, S.A., was sold in 1990. The Government was determined to proceed with the privatization of its steel industry and had pledged since January 1991 to sell all of its mills by 1994. Brazil began the privatization effort on October 24, 1991, when it sold 75% of the common stock in Brazil's second largest steel mill, Usinas Siderúrgicas de Minas Gerais, S.A. (USIMINAS), to a variety of stockholders for \$1.2 billion. The share auction for Cía. Siderúrgica do Nordeste took place on November 24, 1991, and specialty steelmaker Aços Finos Piratini, S.A. was auctioned on January 28, 1992. Additional mills were privatized: Cía. Siderúrgica de Tubarão (CST), a slab producer, in March 1992; Aços Minas Gerais, S.A. (AÇOMINAS), a structural and rail producer, in mid-1992; Cía. Siderúrgica Nacional (CSN), Brazil's largest mill, the second half of 1992; and Cía. Siderúrgica Paulista (COSIPA), a carbon steel sheet and plate producer, was sold during the first half of 1993. CVRD, the huge mining conglomerate, is 51% Government-owned. There are several smaller companies engaged in the mineral industry that are partially or wholly Government-owned.

The mineral industry of Brazil is large by world standards. In 1994, there were 42 cement companies operating 51 cement plants and 7 grinding plants with a clinker capacity of 36.6 Mmt and an utilization rate of 65.3%. In the same year, there were 34 separate iron ore mining companies operating 80 mines.

The five major integrated steel works (AÇOMINAS, CSN, COSIPA, CST, and USIMINAS), which were privatized between 1991 and 1993, produced about 17.5 Mmt of the total Brazilian steel production of 25.2 Mmt during 1994. CVRD produced approximately 60% of the iron ore. Mineração Rio do Norte, S.A. (MRN), which is majority privately owned, produced approximately 65% of the total

bauxite production. The five major aluminum smelters, all predominantly private Brazilian or foreign owned, produced approximately 77% of the primary aluminum production of 1.25 Mmt in 1994.

Brazil's total labor force was nearly 60 million in 1994. Of the total, services comprised 42%; agriculture 31%; and industry, 27%. The minerals sector comprised approximately 4% (650,000) of the industry total of 16 million. This did not include the 500,000 to 1 million *garimpeiros* active in Brazil. Employment in the mining sector continued its downward trend in 1994 as Brazil's economic was impacted by privatization, particularly of the steel sector. (See table 2.)

Commodity Review

Metals

Alumina, Aluminum, and Bauxite.— In 1994, primary aluminum production amounted to 1.25 Mmt of metal, which remained near at the same level as in 1993, and bauxite production decreased by 12% from 9.41 in 1993 to 8.28 Mmt in 1994. Also, alumina production increased from 1.85 Mmt in 1993 to 1.87 Mmt in 1994.

CVRD announced plans to construct a 1.1-million-metric-ton-per-year (Mmt/a) alumina refinery near Paragominas, Pará, to process the bauxite from the 850-Mmt deposit there. It will be known as the Jabuti Project at a cost of \$875 million and was scheduled to begin production in 1995. In 1994, about 25% of primary aluminum was produced by Albras-Aluminio Brasileiro S.A. (ALBRAS), a joint venture of CVRD (51%) and Japan's Nippon Amazon Aluminum Corp., (49%). ALCOA accounted with 24% of total primary aluminum output.

Other producers included Billiton Metais S.A. with 18.1%, Companhia Brasileira de Alumínio (CBA) with 17.9%, ALCAN with 10%, and ALUVALE with 0.5%. Valesul Alumínio, S.A. (VALESUL), a joint venture of ALUVALE (49.7%), Billiton Metais (41.5%), and Companhia Força e Luz Cataguazes (8.8%), produced 92,600 mt.

MRN, the world's third largest bauxite producer and exporter, decreased its production during 1994 by about 14.4% to 7.3 Mmt compared with 8.5 Mmt in 1993. MRN was planning to invest \$60 million to open a new mine in Trombetas, Pará in 1997, with a capacity of 2 Mmt/a; thus, MRN's total bauxite production capacity will increase from 8 to 10 Mmt/a. Brazil's second largest aluminum smelter, ALBRAS, planned to increase its plant capacity from 160,000 to 345,000 metric tons per year (mt/a) by 1995 at a cost of approximately \$650 million.

Reynolds Internacional do Brasil was expected to triple its output of aluminum cans to 750,000 mt/a and begin to export them to Latin American markets. This was announced in 1993 by Reynolds Metals of the United States, the holding company. Alto Brazil Mineração is a joint venture of Alcoa Alumínio, S.A. (60%) and Billiton Metais, S.A. (40%) set

up to mine their bauxite deposit in the Amazon region. It proposed to mine the Oriximina deposit near the Trombetas River and the MRN mine in Pará. When in operation, it will supply the feed to the Alcoa Alumínio, S.A. refinery at São Luís, Maranhão. Brazilian exports of primary aluminum increased to 816,000 mt, or 3.7% compared with those of 1993. These exports represented about 70% of total Brazilian production.

Columbium and Tantalum.—Brazil was the world's most significant producer and principal supplier of columbium to global markets. In 1994, Brazil produced about 79% of the world's total with approximately 14,400 mt of columbium concentrate; 10,700 mt of columbium alloys; and 600 mt of columbium oxides. Brazil's most important columbium plant was in Barreiro, Minas Gerais, operated by the Brazilian Metallurgy and Mining Company (CBMM-Cía. Brasileira de Metalurgia e Mineração). CBMM is owned by Moreira Sales Group of Brazil, 55%; and Molycorp of the USA, 45%. CBMM accounted for approximately 80% of Brazil's production capacity and supplied approximately 65% of the world demand for ferrocolumbium. In midyear, CBMM began construction of a new ferrocolumbium unit at Araxá, Minas Gerais. The plant would have a capacity of 22,800 mt/a and cost \$15 million. Columbium also was produced in Ovidor, Goiás.

Early in the year the Mining Resources and Research Co. of Amazonas announced the discovery of what may be the largest columbium-bearing deposit in the world. It was found in the São Gabriel da Coxoeira, Amazonas, and contained approximately 2.9 billion mt of columbium ore.

Tantalum production in Brazil was 460 mt compared with 450 mt in 1993. Brazil was third in tantalum concentrate production in 1994, following Australia and Malaysia. The Araxá deposit, considered to be the world's largest and the most economically viable ore body, contains columbite and tantalite. The upward long-term trend in production that had been forecast continued in response to increased world demand for tantalum, but Brazil continued to import tantalum oxide and metal products. Brazilian tantalum producers requested Government investment in research and development to help the domestic industry to compete with tantalum producers and processors in Japan and the United States.

Copper.—Brazilian copper production amounted to 119,495 mt of concentrate containing 39,674 mt of copper in 1994. Total primary metal production amounted to 170,027 mt, which was produced by Caraíba Metais from the Caraíba deposit in Jaguari, Bahia (84.6%), and the Brazilian Copper Company's operations in Camaquã, Rio Grande do Sul (15.4%). Secondary copper metal production increased from 53,700 mt in 1993 to 54,000 mt in 1994. CVRD and its partners, Mineração Morro Velho, S.A. (MMV), a company controlled by the South African group Anglo American and

the Brazilian group Bozano Simonsen, concluded feasibility studies for the Salobo deposit in Carajás, Pará, proving 1.4 billion mt of reserves having a grade of 0.80% copper with associated gold, molybdenum, and silver. Production is planned at the rate of 200,000 mt/a of copper metal. The expected production of gold and silver is about 8 mt/a and 20 mt/a, respectively. CVRD announced plans to build a \$345 million, 225,000-mt/a copper refinery near its Salobo Mine. The estimated investment for this operation will be \$1 billion and it was expected to go on-line in 1998. This would make Brazil self-sufficient in copper production.

Copper-consuming companies in Brazil imported 107,419 mt of copper in 1994. Exports were 67,821 mt, of which 56,451 mt was primary metal; 11,099 mt semi-finished; and 271 mt was in other forms. Brazil's 1994 metallic copper production was used primarily in construction and in automobile manufacturing. In 1994, there was a copper trade balance deficit of \$106.9 million, the largest among the nonferrous metals in Brazil.

The Brazilian Geological Survey (CPRM-Companhia de Pesquisa de Recursos Minerais) announced plans to invest \$1.5 million in an extensive survey of the national copper reserve that covers an area of 546,000 square kilometers straddling the States of Amapá and Pará. The reserve created in 1984 has never been properly surveyed.

Gold.—Gold production in 1994 was reportedly 71 mt, which represented an increase of about 1.4% with respect to 1993. The increase in gold production from the *nongarimpo* sector was due to the favorable operations at CVRD's Igarapé Bahia Mine in Pará, which produced 7 mt compared with 5.1 mt in 1993. MMV, owned by Anglo American and Bozano Simonsen, produced 12.4 mt of gold in 1994. The second largest producer of gold in Brazil continued to be CVRD with 12.3 mt. RTZ, a British concern associated with Eike Batista, produced 5.2 mt from the Paracatu Mine in Minas Gerais. Another important increase from almost 2 mt in 1993 to 2.5 mt in 1994 was that of Caraíba Metais, the largest copper producer in Brazil, which produced gold as a byproduct.

São Bento Mineração, S.A. announced plans to invest \$8.5 million to boost gold output at its mine in east-central Minas Gerais from 2,300 kilograms (kg) to 4,500 kg by early 1994. The gold will be extracted by a combination of pressure oxidation and bioleaching using GENCOR technology.

Brazilian gold production could increase significantly in the near future because the increased interest by both domestic and foreign investors in large areas with gold mineralization yet to be explored. According to DNPM, more than 2,000 gold mineral deposits are known, mostly in Precambrian vein deposits and alluvial placers.

Iron and Steel.—Ferroalloys.—In 1994, ferroalloy production increased to 1.1 Mmt or 12.2% from that of 1993. For the year, exports increased from those of 1993 and

reached 473,900 mt, while imports decreased from 25,000 mt to 16,700 mt. In 1994, Brazil was the fourth largest ferroalloy producer in the world and the third largest exporter. Apparent domestic consumption was approximately 693,000 mt.

Indústria e Comércio de Minerios (ICOMI) announced in 1994 that ferromanganese production had begun at its new plant at Porto de Santana, Amapá. The plant, with a capacity of 20,000 mt/a, was operated by Cía. Ferroligas do Amapá, S.A., a wholly owned subsidiary of ICOMI.

Norway's Elkem A/S, one of the world's largest manganese alloy producers, agreed to invest \$70 million in a joint venture with Brazil's Prometal Produtos Metalúrgicos, S.A., to build a 160,000-mt/a ferromanganese plant. The plant, to be installed in Marabá, Pará, will be a \$170 million project in which Elkem will hold a 40% share. The manganese will come from a nearby Prometal Mine, and the iron ore will come from the Carajás District.

Eletrovale, S.A. Indústria e Comércio [ELETROVALE-CVRD (44.01%), Mitsubishi (25.5%), Kawasaki Steel (25.5%), and Florestas Rio Doce, S.A. (4.99%)] was contemplating building a silicon ferroalloy plant in Nova Era, Minas Gerais, with an installed capacity of 48,000 mt/a.

Iron Ore.—Brazil's 1994 production of iron ore, reportedly 165.6 Mmt, increased by 3.9% compared with that of 1993's 159.4 Mmt. About 90% of that production was from the six major mining companies, in order of descending output, CVRD with 77.2 Mmt; Minerações Brasileiras Reunidas S/A (MBR), 23 Mmt; Samarco Mineração, S.A. (SAMARCO), 9.1 Mmt; S.A. Mineração da Trindade (SAMITRI), 8 Mmt; and Ferteco Mineração, S.A., 7.8 Mmt.

The total iron ore exports for 1994 were about 125 Mmt, which represented an increase of almost 12% compared with 1993; however, total export revenues decreased from \$2.8 billion in 1993 to \$2.3 billion in 1994. The Brazilian exports were shipped to 35 countries in 1994. The major importers of Brazilian iron ore were Japan (25%) and Germany (15%). In 1994, the United States imported 4% of Brazil's total iron ore exports. Commercial products sold were sinter-feed and pellet-feed, 70.%; pellets, 21.4%; and lump ore, 8.3%.

CVRD announced plans to invest \$30 million by yearend 1995 to begin processing low-iron-content itabirite from its Timbopeba Mine in Minas Gerais. MBR, Brazil's second largest iron ore producer, continued its long-range plans to invest \$1 billion during a 10-year period beginning in 1991. The investment program is aimed at increasing reserves and production. The target is to increase output to 35 Mmt/a from the present 23 Mmt/a by the end of the decade. MBR's Pico Mine in Minas Gerais increased its annual capacity from 3.5 Mmt to 11 Mmt during 1993-94.

SAMARCO, controlled by BHP-Utah and SAMITRI, continued its expansion plans at Mariana Mine, Minas Gerais, and at Anchieta Mine, Espírito Santo. It also opened

its \$70 million Alegria Mine in Minas Gerais with a capacity to produce 3 Mmt/a. In 1994, SAMARCO announced a \$230 million investment for a pellet plant at Ponta do Ubo, Espírito Santo, where annual capacity was being increased from 5.5 Mmt to 11 Mmt.

Pig Iron.—Brazil produced 25.2 Mmt of pig iron, which was 5.4% higher than that of 1993, and exported 2.5 Mmt valued at \$287 million; this was approximately one-third of the pig iron traded in the world. The Brazilian environmental laws stipulated that by 1992 a minimum of 50% of the charcoal used in pig iron production had to come from reforested areas rather than the virgin forests. A maximum of 20% of the charcoal usage was allowed to be purchased from third parties. It also was stipulated that the percentage of charcoal used by the pig iron producers from their own reforestation programs must grow by 10% per year until it reaches 100% by 1995.

Steel.—Brazil's 1994 steel production totaled 25.7 Mmt, which increased by 500,000 mt in comparison to 1993, ranking the country eighth worldwide. The major recipients of those exports were Asia, 5 Mmt; Latin America, 2 Mmt; and the United States, 1.4 Mmt. Steel imports were 194,000 mt valued at \$211 million. Thus, Brazil enjoyed a very positive balance in its steel trade. The Instituto Brasileiro de Siderurgia (IBS) stressed that the Brazilian steel industry no longer received subsidies or enjoyed tariff protection that it once had and that the industry had become more efficient than ever because of the major changes it has made via privatization. Brazil would be allowed to continue to sell its steel products to the United States without a Voluntary Restriction Agreement (VRA) quota or countervailing duty.

Privatization has fundamentally changed the Brazilian steel industry, both in efficiency and in reduced employment levels. Vertical integration was evident as suppliers and customers of the steel companies participated in the auctions. For instance, CVRD acquired significant minority holdings in CST, CSN, and USIMINAS. CVRD supplied iron ore to these companies and continued providing them with railroad, port, and shipping facilities.

The Government's privatization program has identified Brazil's steel industry as one of the first sectors for auction, via the stock exchanges of Rio de Janeiro and São Paulo. Beginning with USIMINAS sold in October 1991, the State-owned steel companies have been gradually privatized. The last companies sold in 1993 were COSIPA and AÇOMINAS. The decline in employment in the steel industry from 174,000 in 1989 to 133,000 in 1990 probably came about because of the economic recession in Brazil, while the employment reduction from the 1990 levels to 102,300 in 1994 reflected, in part, the effects of privatization and associated downsizing. State-owned companies expecting to be privatized, reduced employment levels in anticipation of the process.

In 1994, Brazil exported almost 50% of its steel production; however, this share could change in the foreseeable future as the Brazilian economy improves.

Manganese.—Brazilian production of manganese ore in 1994 was 2.321 Mmt, which increased by 22.2% compared with 1993. ICOMI, controlled by Caulimda Amazônia S.A. (CADAM) group, was the principal Brazilian producer with 467,000 mt. ICOMI's Serra do Navio Mine near Macapá, Amapá, was the largest producer of manganese in Brazil. CVRD continued operating its high-grade manganese mine, Igarapé Azul, in the Carajás complex. The high content of aluminum in the ore, about 8%, may be a negative factor affecting the marketability of the Igarapé Azul ore. In 1994, the major Brazilian manganese ore producers were CVRD, 512,000 mt; ICOMI, 467,000 mt; Sociedade Mineira de Mineração Ltda., 222,000 mt; SAMITRI, 172,000 mt; and Urucum Mineração S.A., 170,000 mt.

Tin.—In 1994, Brazil was the world's third largest tin producer following China and Indonesia. Tin production decreased from its highest amount at 50,200 mt in 1989 and 27,000 mt in 1993 to 26,175 mt in 1994. The reduction in Brazilian output was attributed to the closing of some high-cost operations, decrease in ore grades, and the decline in tin prices. In 1994, production cuts were made at the Pitinga Mine in Amazonas, operated by the world's largest tin firm, Paranapanema, S.A. Mineração, Indústria e Construção, at the Bom Futuro Mine in Rondônia, operated by Empresa Brasileira de Estanho, S.A. (EBESA, 49 2/3%; Paranapanema and a pool of Brazilian tin mining companies, 50 1/3%), and at the *Garimpeiros'* Bom Futuro operations, also in Rondônia. Brazilian tin exports in 1994 declined to 18,300 mt, much less than the 20,185 mt quota based on Brazil's commitment with the Association of Tin Producing Countries. Domestic consumption was stagnant at about 6,000 mt/a for the last 5 years; local sales amounted to 5,400 mt, a small increase compared with that of 1993.

Paranapanema reported 9,300 mt of tin output from its high-grade Pitinga Mine, with byproducts of columbium, tantalum, zirconium, hafnium, thorium, and chrysolite, in order of importance. *Garimpeiros* continued smuggling tin ore to Bolivia. EBESA had a \$20-million expansion plan for its Bom Futuro tin mine. The outputs of *garimpeiros* and small mines in Minas Gerais and other small mines in Rondônia and Pará were 26% and 9% of Brazilian production, respectively.

Titanium.—In 1994, CVRD invested in the production of titanium sponge and an advanced titanium compound used in the space, shipbuilding, and chemical industries. CVRD reached an agreement with the Space Technology Institute of the Brazilian Air Force, whereby the institute will receive 1% of all royalties when the compound is produced industrially in exchange for the transfer of equipment to CVRD.

The Brazilian subsidiary of E. I. du Pont de Nemours and Co. Inc. of the United States began construction of a titanium dioxide sizing and packaging facility at Uberaba, Minas Gerais, in March 1992. Since then, the plant has operated at an annual capacity of 8,000 mt/a.

Industrial Minerals

Gemstones.—For many years, Brazil has been an important producer and exporter of gemstones in the world. This ranking has applied in terms of volume as well as variety. The large proportion of gemstones produced was mined by *garimpeiros*. For this reason gemstone reserves are unknown, but Brazil appears to have high potential.

In 1994, the total value of gemstone (including diamond) exports was \$27 million, which remained at the same level as that of 1993. Exports of uncut gemstones have declined since 1990, despite the removal of some export barriers.

Quartz.—A consortium of CVRD, Nisso Iwai (Japan), and Telequartz began production of quartz powder in 1990. The powder is an important constituent in the production of optic fibers, crucibles, oscillators, solar cells, wafers and integrated circuit packing, and ceramic materials of exceptional purity.

In 1994, Brazil produced 3,468 mt valued at about \$5 million, and continued to be the largest producer of quartz in the world. Brazil is estimated to have 53 Mmt of reserves representing 95% of the known world supply.

Other Industrial Minerals.—Potassium production in 1994 increased by 32.9% to 230,400 mt compared with 1993 output. Brazil imported 57,000 mt of potash in 1994. Production of phosphate rock concentrate amounted to almost 3.5 Mmt, an increase of 3.4% compared with the 1993 output. Production was highly concentrated in three mining companies, Fertilizantes Fosfatados, S.A. (FOSFERTIL), Arafertil, S.A., and Goiasfertil, S.A. (GOIASFERTIL), representing 70% of the total domestic output. The reported domestic consumption was 3.1 Mmt/a. Seventy-three percent of the phosphoric acid was used in the fertilizer industry, 25% in the chemical industry, and the rest in other uses. The industry has changed because of the privatization of both GOIASFERTIL and FOSFERTIL and elimination of trade barriers. The import tariff for phosphate rock was set at 5%, indicating that the sector must be more efficient and cost effective to compete with foreign sources.

Mineral Fuels

According to the Brazilian Ministry of Mines and Energy, the total amount of energy produced was 158.1 Mmt of oil equivalent in 1994. The primary sources, in order of importance, were hydraulic energy, firewood, petroleum, sugarcane bagasse, natural gas, steam coal, metallurgical

coal, and uranium. Imported energy sources were 64.3 Mmt of oil equivalent. Total energy consumption was 171.1 Mmt of oil equivalent. Export, variations in inventory, nonutilized, and reinjected energy totaled 9.6 Mmt of oil equivalent. The transportation sector consumed 34.4 Mmt of oil equivalent and the industrial sector 72.9 Mmt of oil equivalent. Consumption of oil equivalent in the mineral industry, by category and in order of importance, was pig iron and steel, 18.5 Mmt; nonferrous and other metals, 9.3 Mmt; cement, 3 Mmt; mining and pelletization, 2.7 Mmt; and ferroalloys, 2.8 Mmt.

Coal.—The Brazilian coal industry is not a large component of the minerals industry. Coal production is concentrated in the southern States of Rio Grande do Sul, 56%; Santa Catarina, 41%; and Parana, 3%, with minor production from Minas Gerais. Brazil's total production of coal (run-of-mine) in 1994 was about 9.75 Mmt, which was transformed into 5.12 Mmt of marketable product, about 9% higher than the 1993 output. Coal consumption at yearend reached 16.5 Mmt. Metallurgical coal represented 67% of this total consumption and the remainder was for power generation.

Most Brazilian coal is of lower quality than Colombian coal. Total Brazilian coal reserves were estimated at 23.7 billion mt. In 1994, imports of metallurgical coal amounted to about 10 Mmt. The main sources of imports were the United States with 56%; Australia, 25%; Canada, 10%; and Poland, 10%. The remainder came from South Africa, Germany, Venezuela, and Colombia.

Natural Gas and Petroleum.—The gas pipeline linking the Enchova platform in the offshore Campos Basin to Macaé, Rio de Janeiro, has added 5 million cubic meters per day (Mm^3/d) of gas flow to the Rio de Janeiro and São Paulo markets.

BRASPETRO, the international operating subsidiary of PETROBRAS, continued producing natural gas in the Gulf of Mexico. The gas was recovered from the Frederick Field, 27 kilometers (km) offshore the Louisiana coast, by Petrobrás América Inc., a subsidiary of BRASPETRO. The natural gas was marketed mostly in the United States.

In 1994, petroleum production averaged 692,832 barrels per day (bbl/d), or 252.9 million barrels (Mbbbl), while natural gas production amounted to 7.738 Mm^3 . In 1994, Brazil's imports of petroleum were 173.2 Mbbbl at a cost of \$2.7 billion. Of this total, Saudi Arabia supplied 74% with the remaining supplied by Algeria, Argentina, Kuwait, Nigeria, and Venezuela.

Nuclear.—The National Nuclear Energy Commission (Comissão Nacional de Energia Nuclear) indicated that construction continued on a pilot powerplant that has the capability to produce 1 mt of 99.6%-pure heavy water per year. The site of the top-secret plant and the production

process have not been announced. Brazil contains the fifth largest uranium reserves in the world. Reserves in 1994 amounted to about 163,000 mt of U_3O_8 and 92,000 mt of inferred reserves. Private interests are permitted to participate in uranium exploration and production in Brazil through State-owned joint ventures; however, there is a restriction that no more than 20% of the country's uranium reserves may be exported.

Reserves

In 1994, Brazil was among the world leaders in reserves of the following mineral commodities, by rank: columbium (1); tin (3); bauxite (4); iron ore (4); talc and pyrophyllite (4); and manganese (5). (See table 3.)

Infrastructure

In 1994, Brazil's railroads included 25,268 km of 1.000-meter (m) gauge, 4,339 km of 1.600-m gauge, 74 km of 1.600- to 1.000-m gauge, 13 km of 0.760-m gauge, and 2,308 km electrified; totaling 32,002 km. The country contained 1,448,000 km of roads: 48,000 km paved and 1,400,000 km gravel and dirt. There were 50,000 km of navigable inland waterways. The major shipping ports were Belém, Manaus, Porto Alegre, Recife, Rio de Janeiro, Rio Grande, Salvador, and Santos. Among the 271 ships were 56 tankers, 15 chemical tankers, 10 liquefied natural gas, 14 combination ore and oil, 82 bulk, and 2 combination bulk vessels. There were 2,000 km of crude petroleum pipelines, 3,804 km of refined petroleum product pipelines, and 1,095 km of natural gas pipelines. In 1994, Brazil's installed electrical generating capacity was 52,865 megawatts (MW). Total production of electric power for the year was 202,280 gigawatt hours, which translated into 1,340 kilowatt hours per capita.

Power investment negotiations were under way between the Brazilian Government and five companies, four of which were foreign subsidiaries. The companies involved were Alcan Alumínio do Brasil, S.A. (Canada), Alcoa Alumínio, S.A. (United States), Billiton Metais, S.A. (Netherlands), Dow Química, S.A. (United States), and the Brazilian company Camargo Corrêa Industrial, S.A. The proposal submitted by the five companies was to build a 1,200-MW dam on the Tocantins River on the border between Maranhão and Tocantins States. A Billiton spokesperson stated that the dam construction would cost approximately \$1 billion and that Billiton has pledged \$350 million. The companies all have been receiving electricity from the Tucuruí Dam on the Tocantins River, but the demand has been increasing at such a rapid rate that the demand could exceed the supply in a few years. Another factor was the 10% subsidy on electricity prices that expires in the year 2004.

According to the Ministry of Transportation, from 1993 to 1998, the Federal Government planned to use funds allocated

for railroad projects for the recuperation of about 8,000 km of track that has had the greatest traffic density, and therefore demanded greater investment for restoration and maintenance. Significant rail expansion projects currently under construction were Ferronorte, which when finished in 1998, would extend 1,700 km to link Cuiabá, Mato Grosso with Santa Fé do Sul, São Paulo; and Ferroeste, with a projected extension of 420 km to link Guarapuava and Guaíra in Paraná. Under a multiyear plan that would allocate Government highway funds through 1996, about 10,000 km of Federal highways would be renovated. The Brazilian Government planned to transfer highway projects to the private sector, which would also likely be involved in state and municipal highway projects. These highway projects would be funded, almost in their entirety, by the state and municipal Governments.

According to the Brazilian Steel Institute (IBS) study, the loading of 1 mt of steel at the Port of Santos cost \$32.50. By comparison, the average cost of loading 1 mt of steel in Asian, European, and U.S. ports was \$4.50. At the Ports of Rio de Janeiro and Vitória, the costs exceeded \$10 per mt of steel.

In 1994, Brazil's main mineral export routes were tied to trade, in terms of their value, in the following minerals: iron-steel, iron ore, bauxite/alumina, tin, kaolin, and manganese ore. Together, these products accounted for about 98% of the value of Brazil's mineral exports. The most important routes, in terms of total hauling capacity, were the rail-port routes, and to a lesser degree, the Nation's waterways.

The North region's transport activities were characterized by the exports of bauxite, alumina, aluminium, iron ore, manganese ore, and kaolin through the modern Maranhão Port Complex at São Luís. Exports from the integrated activities of CVRD's Carajás Project were especially important. The southeastern region's main export route was the rail-link between the productive iron ore mines in Minas Gerais and the modern Espírito Santo Port Complex (Tubarão and Ponta de Ubú terminals). Iron ore from the region was also shipped by rail to the MBR terminal at the Sepetiba Port in Rio de Janeiro. With FERTECO Mineração S.A.'s recent decision to build a new iron ore terminal, Sepetiba Port should become Brazil's third largest port in terms of iron ore exports.

Constran, S.A. Construção e Comércio of the Itamaraty Group, of Brazil's private sector, planned to construct 1,718 km of additional railroads linked to the existing railroad system. The initial 311 km of railroad, at a cost of about \$300 million, was expected to be completed by the end of 1994. The cost of the new system was projected to be \$2.5 billion. This addition will connect to the existing system, which runs through Vitória, Espírito Santo; Belo Horizonte, Minas Gerais; Santos, São Paulo; and Chapadao do Sul, Mato Grosso do Sul. The new railroad system will run from Chapadao do Sul, Mato Grosso do Sul, to Cuiabá, Mato Grosso, and Santarem, Pará, branching from Cuiabá, Mato

Grosso, to Porto Velho, Rondônia.

Outlook

Brazil's GDP increased by 6% in 1994, which was an improvement from the 5% rate in 1993. Efforts to keep inflation under control would support continued economic growth. The public deficit needs to be reduced along with improvements in its external debt. A factor that may have a negative effect for the longer term is the environment, especially in the Amazon rain forest. Much depends on what approaches are used to protect the environment and to continue along a path of sustainable development.

On July 1, 1994, Brazil adopted a new currency, the sixth in 10 years, called the "Real." The change curbed inflation from 50% per month in 1993 to about 1.5% per month at yearend. Brazil's economic plan for stabilization "Plano Real," was based on Constitutional review and privatization of state-owned monopolies to increase capital flow into the country. It called for strict control of the domestic deficit, issuance of a new currency, stable foreign exchange rates, renegotiation of its international debt on favorable terms, and reduction of tariffs and nontariff barriers, all of which should position Brazil for a brighter future. As the barriers to foreign investments continue to fall, foreign mining interests will increase, recognizing Brazil as a country with one of the greatest mineral endowments in the world. The Amazon region alone is considered to be a vast area of the planet possessing the potential to uncover many more major discoveries of mineral wealth, as indicated by the large known reserves of iron ore, manganese, bauxite, gold, and tin in Carajás, Pará, already under production.

The improvement and additional of infrastructure projects would have a major, direct bearing on Brazilian industries in the foreseeable future. For example, the planned Ferronorte railroad system and modernization of existing ports will augment Brazil's ability to increase industrial production and competitiveness. The sectors most likely to be impacted are those that depend most heavily on electricity and transportation facilities. The aluminum, auto, steel, petrochemical, and pulp and paper industries, which depend heavily on energy and on exports, will benefit most from improved infrastructures. Most sectors of the Brazilian economy recorded positive growth during 1994, and if that positive rate of economic growth is sustained into 1995 and beyond, the steel sector, for instance, should continue its recovery as the demand for cars and other steel-intensive goods increase.

Privatization of State-owned firms has led to lower employment levels and greater efficiencies; as a result, the Brazilian economy became more competitive in the global economy. Privatization of Government monopolies, dismantling all trade barriers, and increased exports to the world markets will continue to be important, allowing continued inflow of fresh capital into the Brazilian economy.

The Constitutional Committee of the Senate approved reforms to lift restrictions on foreign investments; however, the Senate's approval is required for those reforms to become law, which would allow foreign companies, particularly in the mineral-related industries, to operate in Brazil. Also, the Government needs to address further the balance between guaranteeing the national interest and encouraging the foreign investments necessary to stimulate economic growth to allow Brazil to achieve its full potential.

¹Text prepared Aug. 1995.

²Where necessary, values have been converted from Brazilian cruzeiros (Cz\$) to U.S. dollars at the rate of R\$0.89=US\$1.00.

Major Sources of Information

Comissão Nacional de Energia Nuclear (CNEN)

Rua General Severiano

90 Botáfogo-ZC-02

22290-Rio de Janeiro-RJ-Brasil

Companhia de Pesquisa de Recurso Minerais (CPRM)

Avenida Pasteur 404-Anexo, 2º Andar, Pira Vermelha

22290-Rio de Janeiro-RJ-Brasil

Conselho de Não-Ferrosos e de Siderurgia (CONSIDER)

Esplanados dos Ministerios-Bloco 6-5º Andar

70053-Brasilia-DF-Brasil

Conselho Nacional do Petróleo (CNP)

SGAN-Q.603 Modulos J, I e H

70830-Brasilia-DF-Brasil

Instituto Brasileiro de Mineração (IBRAM)

Avenida Afonso Pena, 3880 3º, 4º e 5º Andares

30000-Belo Horizonte-MG-Brasil

Departamento Nacional de Produção Mineral (DNPM)

Ministério da Minas e Energia

SAN-Quadra 01-Bloco "B"

70040-Brasilia-DF-Brasil

Petróleo Brasileiro, S.A. (PETROBRAS)

Avenida República do Chile, 65

20035-Rio de Janeiro-RJ-Brasil

Rio Doce Geológica e Mineração, S.A. (DOCEGEO)

Avenida President Wilson 11º Andar

22030-Rio de Janeiro-RJ-Brasil

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U.S. Central Intelligence Agency (CIA), Washington, DC: World Factbook, annual.

TABLE 1
BRAZIL: PRODUCTION OF MINERAL COMMODITIES 1/2/

(Metric tons unless otherwise specified)

Commodity	1990	1991	1992	1993	1994 4/
METALS					
Aluminum:					
Bauxite, dry basis, gross weight	9,680,000	10,400,000	9,370,000 r/	9,410,000 r/	8,280,000 6/
Alumina	1,650,000	7,420,000 r/	1,830,000 r/	1,850,000 6/	1,870,000 6/
Metal:					
Primary	931,000	1,140,000	1,190,000 r/	1,200,000	1,250,000 6/
Secondary	60,000	62,000 e/	66,000 r/	62,000	62,000
Beryllium: Beryl concentrate, gross weight	850 e/	850 e/	850	850	900
Cadmium: Metal, primary	200 e/	200 e/	200	200	300
Chromium:					
Crude ore	810,000 e/	890,000 e/	900,000	820,000	890,000
Concentrate	103,000	142,000 r/	198,000 r/	126,000	147,000
Marketable product 5/	256,000	307,000	307,000	323,000 6/	323,000
Cobalt:					
Mine output, Co content by hydroxide e/	400 r/	400 r/	400 r/	400	400
Metal, electrolytic	240 r/	240 r/	240 r/	240	240
Columbium-tantalum ores and concentrates, gross weight:					
Columbite and tantalite	310	290 e/	200 r/	180 r/	180
Djalmaite concentrate e/	10	10	10	10	10
Pyrochlore concentrate, Cb ₂ O ₅ content	29,400 r/	30,500 r/	29,600 r/	22,700 r/	30,300
Copper:					
Mine output, Cu content	36,400	37,900	39,800 r/	43,600 6/	39,700 6/
Metal:					
Primary	152,000	141,000	158,000 r/	162,000 6/	170,000 6/
Secondary	47,000 r/	37,000	52,200 r/	53,700	54,000
Gold:					
Mine output kilograms	30,100	34,100 r/	39,000 r/	40,000 r/	41,000 6/
Garimpeiros (independent miners) do.	71,800	55,500	46,800 r/	30,000 r/	30,000 6/
Total do.	102,000	89,600 r/	85,900 r/	70,000 r/	71,000 6/
Iron and steel:					
Ore and concentrate (marketable product): 5/					
Gross weight thousand tons	152,000	152,000 r/	146,000 r/	159,000 6/	166,000 6/
Fe content	99,900	98,800 r/	95,200 r/	104,000 6/	105,000 6/
Metal:					
Pig iron thousand tons	21,100	22,700 r/	23,200 r/	24,000 r/	25,200 6/
Ferroalloys, electric-furnace:					
Chromium metal	37	37	37	37	37
Ferrocadium silicon	27,500	21,700	22,800 r/	22,000	25,000
Ferromanganese	83,800	82,200	91,100 r/	83,900 r/	77,100 6/
Ferromolybdenum	4,970	4,520	6,760 r/	4,500	5,000
Ferrocolumbium	16,600	19,000	16,300 r/	19,000	19,000
Ferromanganese	171,000	169,000	179,000 r/	202,000 r/	200,000 6/
Ferromolybdenum	69	47	-- r/	47	47
Ferronickel	34,300	34,100	33,500 r/	34,000	34,000
Ferrophosphorus	1,280	864	800	800	2,000
Ferrosilicon	229,000	191,000	244,000 r/	284,000 r/	248,000 6/
Ferrosilicon magnesium	10,300	10,200	10,600 r/	10,000	15,000
Ferrosilicon zirconium	503	102	104 r/	102	1,500
Ferrotitanium	125	12	4 r/	126	500
Ferrotungsten	6	1	-- r/	1	25
Ferrovandium	44	41	-- r/	--	3,000
Inoculant	11,500	24,400	20,900 r/	24,500	25,000
Silicomanganese	262,000	272,000	300,000 r/ e/	284,000	270,000
Silicon metal	132,000	106,000	93,700 r/	106,000	110,000
Total	939,000	936,000	1,020,000 r/	937,000	1,050,000
Steel, crude, excluding castings	20,600	22,600	23,900 r/	25,200 r/	25,700 6/
Semimanufactures, flat and nonflat	29,500	25,000 e/	25,000	25,000	25,000
Lead:					
Mine output, Pb content	9,290	7,270	4,420 r/	4,000	4,000
Metal:					
Primary	30,100	22,000	24,500 r/	25,000	25,000
Secondary	45,300	42,000	38,300 r/	42,000	42,000
Manganese metal: e/					
Primary	6,500	6,500	6,500	6,500	6,500
Secondary	1,600	1,600	1,600	1,600	1,600
Manganese ore and concentrate, marketable, gross weight 4/	2,300,000	2,000,000	1,990,000 r/	1,840,000 r/	2,320,000 6/
Nickel:					
Mine output, Ni content	22,800 r/	26,400 r/	17,100 r/	15,700 r/	16,500 6/
Ferronickel, Ni content	8,850	8,620	8,740 r/	9,000	9,000
Rare-earth metals: Monazite concentrate, gross weight	911 r/	719 r/	770 r/ e/	770	770
Silver 7/ kilograms	171,000	154,000	162,000 r/	155,000	155,000
Tin:					
Mine output, Sn content	37,600	29,300 r/	27,500 r/	27,000	26,200 6/
Metal:					
Primary	37,600	26,000	27,500 r/	27,900 r/	22,500 6/
Secondary e/	250	250	250	250	250
Titanium concentrates, gross weight:					
Ilmenite	14,100	69,100	76,600 r/	70,000	70,000

See footnotes at end of table.

TABLE 1--Continued
BRAZIL: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity	1990	1991	1992	1993	1994 4/
METALS--Continued:					
Titanium concentrates, gross weight--Continued:					
Rutile	1,810	1,090	1,800 r/	1,800	1,800
Tungsten, mine output, W content	316	223	205 r/	250	250
Zinc:					
Mine output, Zn content	158,000	130,000	180,000 r/	183,000 r/	187,000 6/
Metal, smelter:					
Primary	149,000	157,000	162,000 r/	180,000 r/	183,000 6/
Secondary	4,600	5,540	7,000 r/	7,000	7,000
Zirconium: Zircon concentrate, gross weight 7/	16,900	18,600	16,900 r/	20,000	20,000
INDUSTRIAL MINERALS					
Asbestos:					
Crude ore e/	3,940,000	3,950,000	2,900,000 r/	3,950,000	3,950,000
Fiber	205,000	237,000	170,000 r/	185,000 6/	185,000
Barite:					
Crude	64,900	51,000	72,200 r/	70,000	70,000
Beneficiated	55,600	46,800	54,500 r/	50,000	50,000
Marketable product 4/	68,200	65,000 e/	65,000 e/	65,000	65,000
Calcite	13,400	45,700	45,000	45,000	45,000
Cement, hydraulic	thousand tons	25,800	27,500	24,900 r/	28,000
Clays:					
Bentonite (beneficiated)	180,000	130,000	131,000 r/	130,000	130,000
Kaolin:					
Crude	1,620,000	1,840,000	1,900,000 r/	1,850,000	2,200,000
Beneficiated	659,000	746,000	811,000 r/	830,000 r/	953,000 6/
Marketable product 4/	931,000	1,090,000	1,100,000	1,100,000	1,100,000
Diamond e/:					
Gem	thousand carats	600	600	650 r/	700
Industrial	do.	942 r/	900	665 r/	600
Total 9/	do.	1,540 r/	1,500	1,320 r/	1,300
Diatomite:					
Crude e/	34,000 r/	32,000 r/	35,000	35,000	35,000
Beneficiated	13,300	12,400	13,000 e/	13,100	13,100
Marketable product 4/	13,300	13,100 e/	13,100 e/	13,100	13,100
Feldspar:					
Crude	105,000	119,000 r/	140,000 r/ e/	120,000	120,000
Feldspar, marketable product 4/	111,000	122,000	122,000 6/	122,000	122,000
Leucite, marketable product 4/ 5/	5,000	5,000	5,000	5,000	5,000
Sodalite, crude, marketable product e/ 4/	500	500	500	500	500
Total: 4/	117,000	127,000	128,000	128,000	128,000
Fluorspar:					
Crude e/	239,000 r/	300,000 r/	250,000 r/	250,000	250,000
Concentrates, marketable product:					
Acid-grade	47,700	52,400	61,400 r/	67,400	67,400
Metallurgical-grade	22,700	28,900	22,300 r/	30,000	30,000
Total	70,400	81,300	81,000	97,400	97,400
Graphite:					
Crude e/	650,000	650,000	650,000	650,000	650,000
Marketable product:					
Direct-shipping crude ore	8,400	7,300	7,000	9,960 r/	10,000
Concentrate	28,900	27,000	29,400 r/	29,500 r/	29,000
Total	37,300	34,300	36,400 r/	39,500 r/	39,000
Gypsum and anhydrite, crude	824,000	967,000	897,000 r/	809,000 r/	877,000 6/
Kyanite: e/					
Crude	750	750	750	750	750
Marketable product 4/	600	600	600	600	600
Lime, hydrated and quicklime	thousand tons	4,900 r/	5,000 r/	5,240 r/	5,700
Lithium: Concentrates	475	1,560	1,600	1,600	1,600
Magnesite:					
Crude	1,430,000	879,000	1,000,000	1,000,000	1,500,000
Beneficiated	257,000	242,000	273,000 r/	232,000 6/	280,000
Mica, all grades e/	5,000	5,080	7,000	7,000	7,000
Nitrogen: N content of ammonia	938,000	940,000 e/	940,000 e/	940,000	940,000
Phosphate rock including apatite:					
Crude: e/					
Mine product	thousand tons	27,000	27,000	27,000	27,000
Of which, sold directly	do.	35	35	35	35
Concentrate:					
Gross weight	do.	2,970	3,280	2,850 r/	3,420 r/
P ₂ O ₅ content	do.	625	650	650	700
Pigments, mineral: Other, crude e/	3,230 r/	3,000	2,500 r/	2,000	2,000
Potash: Marketable (K ₂ O)	65,700	101,000	142,000 r/	173,000 r/	230,000 6/
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

See footnotes at end of table.

TABLE 1--Continued
BRAZIL: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity	1990	1991	1992	1993	1994 4/
INDUSTRIAL MINERALS--Continued:					
Precious and semiprecious stones except diamond, crude and worked--Cont'd.					
Opal	500	500	500	500	500
Ruby	10,000	10,000	10,000	10,000	10,000
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 e/	500	500	500	500
Quartz crystal, all grades	2,290 r/	1,930 r/	1,620 r/	3,100	3,470 6/
Salt:					
Marine thousand tons	4,170	3,700	4,030 r/	3,700	3,700
Rock do.	1,200 r/	1,200 r/	1,230 r/	1,230	1,230
Silica (silex) do.	1,830 r/	1,600 r/	1,600 r/	1,600	1,600
Sodium compounds: e/					
Caustic soda	1,050,000 r/	1,050,000 r/	1,050,000 r/	1,050,000 r/	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	180,000 r/	200,000	200,000	200,000	200,000
Slate	50,000	50,000	50,000	50,000	50,000
Crushed and broken stone:					
Basalt cubic meters	1,250,000 r/	1,300,000 r/ e/	1,200,000 r/ e/	1,200,000	1,200,000
Calcareous shells	450,000	450,000	450,000	450,000	450,000
Dolomite thousand tons	3,500	3,500	3,500	3,500	3,500
Gneiss cubic meters	1,830,000 r/	1,100,000	1,100,000	1,100,000	1,100,000
Granite thousand cubic meters	50,300 r/	60,000	60,000	60,000	60,000
Limestone	60,000	60,000	60,000	60,000	60,000
Quartz 10/	250,000	250,000	250,000	250,000	250,000
Quartzite:					
Crude	583,000 r/	400,000	400,000	400,000	400,000
Processed	224,000 r/	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	5,640 r/	5,460 r/	18,200 r/	6,000	6,000
Pyrites	46,200 r/	66,400 r/	24,700 r/	10,000	10,000
Byproduct:					
Metallurgy	65,900 r/	164,000 r/	184,000 r/	229,000	229,000
Petroleum	58,300 r/	46,800 r/	58,500 r/	94,000	94,000
Total	276,000 r/	282,000 r/	285,000 r/	339,000	339,000
Talc and related materials:					
Talc:					
Crude	296,000	292,000	261,000 r/ e/	290,000	290,000
Marketable product 4/	1,600	1,960	1,500 r/	2,000	2,000
Pyrophyllite: Crude	174,000	186,000	169,000 r/ e/	170,000	170,000
Vermiculite					
Concentrate	23,300	11,000 r/	14,000 r/	15,000	15,000
Marketable product 4/	10,100	1,970	2,000	2,000	2,000
MINERAL FUELS AND RELATED MATERIALS					
Coal, bituminous, marketable 4/ thousand tons	4,170 r/	4,250 r/	4,680 r/	4,570	5,120 6/
Coke, metallurgical, all types do.	535	162	143 r/	200	200
Gas, natural: Gross million cubic meters	6,280	6,600	6,970 r/	7,210	7,740 6/
Natural gas liquids thousand 42-gallon barrels	13,100	12,900	13,000	13,000	13,000
Petroleum:					
Crude do.	238,000	236,000	228,000 6/	234,000	253,000
Refinery products: 11/					
Gasoline do.	146,000	146,000	146,000	134,000	126,000
Jet fuel do.	20,400	20,400	20,500	19,000	17,800
Kerosene do.	1,540	1,540	1,540	1,450	1,370
Distillate fuel oil do.	171,000	171,000	171,000	157,000	149,000
Lubricants do.	4,870	4,870	4,900	4,350	4,120
Residual fuel oil do.	90,900	90,900	90,900	83,000	79,000
Other do.	68,900	68,900	69,000	63,400	60,000
Refinery fuel and losses do.	23,700	23,700	23,700	21,800	20,600
Total	527,000	527,000	527,000	484,000 r/	458,000 6/

e/ Estimated. r/ Revised.

1/ Table includes data available through Aug. 31, 1995

2/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

3/ In 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.

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

5/ Includes sponge iron as follows, in thousand metric tons: 1990--260; and 1994--270 (estimated).

6/ Reported figure.

7/ Officially 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: 1990--52,000; 1991--40,000; 1992--42,000; 1993--42,000; and 1994--40,000 (estimated).

8/ Includes baddeleyite-caldasite.

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

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

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

TABLE 2
BRAZIL: STRUCTURE OF THE MINERAL INDUSTRY FOR 1994

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum	Albras-Aluminio Brasileiro S.A. (ALBRAS) [Government, 26%; private, 25%; Nippon Amazon Aluminum Co. (NAAC), 49%]	Belem, Para State (smelter)	160 (metal).
Do.	Alcan Alumínio do Brasil S.A. (Alcan Aluminum Ltd., 100%)	Saramenha, Minas Gerais State (refinery)	150 (alumina).
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. (ALUMAR) (Aluminum Co. of America, 60%; Billiton International Metals B.V., 40%)	Pocos de Caldas, Minas Gerais State (mine) Sao Luis, Maranhao State (refinery) (smelter)	400 (bauxite). 550 (alumina). 174 (metal).
Do.	Alumínio do Brasil Nordeste S.A. (Alcan Aluminum Ltd., 100%)	Aratu, Bahia State (smelter)	58 (metal).
Do.	Billiton Metais S.A. (Billiton International Metals B.V., 100%)	Sao Luis, Maranhao State (refinery)	375 (metal).
Do.	Compahnia Brasileira de Alumínio (CBA) (private, 100%)	Pocos de Caldas, Minas Gerais State (mine) Sorocaba, Sao Paulo State (refinery) (smelter)	1,000 (bauxite). 170 (alumina). 170 (metal).
Do.	Compahnia Geral do Minas (private, 21%; Aluminum Co. of America, 79%)	Pocos de Caldas, Minas Gerais State (refinery) (smelter)	275 (alumina). 90 (metal).
Do.	Mineração Rio do Norte S.A.(MRN) (Government, 24%; private, 32%; Alcan Empreendimentos Ltda, Billiton International Metals B.V., 10%; Norsk Hydro Comercio e Industria, 5%; Reynolds Alumínio do Brasil, 5%)	Oriximina, Para State (mine)	8,000 (bauxite).
Do.	Vale do Sul Alumínio S.A. (Government, 27%; private, 25%; Shell do Brasil S.A., 44%; Reynolds Metals Co., 4%)	Santa Cruz, Rio de Janeiro State (smelter)	86 (metal).
Chromite	Coitezeiro Mineração S.A. (COMISA) (private, 75.4%; 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) (beneficiation plant)	370 (ore). 292 (concentrate).
Copper	Companhia Brasileira do Cobre (CBC) (private, 100%)	Cacapava do Sul, Rio Grande do Sul State (mine) (beneficiation plant)	1,000 (ore). 1,800 (concentrate).
Do.	Mineração Caraiba Ltda. (Government, 100%)	Jaquarari, Bahia State (mine) (beneficiation plant)	3,000 (ore). 5,700 (concentrate).
Columbium	Companhia Brasileira de Metalurgia e Mineracao (CBMM) (private, 55%; Molycorp, Inc., 45%)	Araxa, Minas Gerais State (mine) (beneficiation plant)	1,200 (ore). 44.
Do.	Mineracao Catalao de Goias Ltda. (private, 68.5%; Anglo American Corp. do Brasil, 31.5%)	Ouvidor, Goias State (mine)	500 (ore).
Ferroalloys	Companhia Brasileira Carbureto de Calcio (CBCC) (private, 100%)	Santos Dumont, Minas Gerais State (plant)	54.
Do.	Companhia Ferro-Ligas de Bahia S.A. (FERBASA) (private, 100%)	Pojuca, Bahia State (plant)	194.
Do.	Companhia Ferro-Ligas Minas Gerais (MINASLIGAS) (private, 100%)	Pirapora, Minas Gerais State (plant)	58.
Do.	Companhia Paulista de Ferro-Ligas (private, 100%)	Barbacena, Caxambu, Jeceaba, Passa Quatro and Passa Vinte, Minas Gerais State; Corumba, Matto Grosso do Sul State; and Xanxere, Santa Catarina State (seven plants)	326.
Do.	Italmagnesio S.A. Indústria e Comercio (private, 100%)	Braganca Paulista, Sao Paulo State; and Varzeada Palma, Minas Gerais State (two plants)	63.
Gold	kilograms Companhia de Mineração e Participações (CMP) (private, 100%)	Lourenco, Amapa State (mine) Currais Novos, Rio Grande do Norte (mine)	1,080 (ore). 300.
Do.	do. Mineração Morro Velho S.A. (private, 50%; Anglo American Corp. do Brasil, 50%)	Novo Lima, Raposos, and Sabara, Minas Gerais State; and Jacobina, Bahia State (four mines)	2,000.
Do.	do. Sao Bento Mineração S.A. (Gencor Indústria e Comercio Ltda, 49%; Amcor S.A., 29.4%; Amcor Metals Ltd, 21.6%)	Santa Barbara, Minas Gerais State (mine)	500.
Iron ore	Companhia Vale do Rio Doce (CVRD) (Government), 51%; private, 49%)	Serra dos Carajas, Para State; and Itabira, Ouro Preto, and Santa Barbara, Minas Gerais State (four mines)	91,000
Do.	Ferteco Mineração S.A. (FERTECO) (Exploration und Bergbau GmbH, 100%)	Ouro Preto and Brumadinho, Minas Gerais State (two mines)	12,800.
Do.	Minerações Brasileiras Reunidas (MBR) (private, 85.3%; Mitsui e Co. Ltd. 14.7%)	Novo Lima and Itibrito, Minas Gerais State (two mines)	31,500.
Do.	Samarco Mineração S.A. (Samarco) (private, 51%; Broken Hill Properties Ltd., 49%)	Mariana, Minas Gerais State (mine)	11,700.
Do.	S.A. Mineração da Trindade (SAMITRI) (private, 100%)	Mariana, Rio Piracicaba, Itabira, Ouro Preto and Sabara; Minas Gerais State (five mines)	9,300.

TABLE 2--Continued
BRAZIL: STRUCTURE OF THE MINERAL INDUSTRY FOR 1994

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Lead	Mineração Boquira S.A. (private, 100%)	Boquira, Bahia State (mine) (beneficiation plant)	300 (ore). 310 (concentrate).
Manganese	Companhia Vale do Rio Doce (CVRD) (private 49%; Government 51%)	Corumba, Minas Gerais State (mine) Serra dos Carajas, Para State (beneficiation plant)	2,500 (ore). 1,000 (concentrate).
Do.	Indústria e Comercio de Minerios S.A. (ICOMI) (private, 100%)	Macapa and Mazagao, Amapa State (two mines) (beneficiation plant)	1,500 (ore). 800 (concentrate).
Nickel	Companhia Niquel Tocantins (private, 100%)	Niquelandia, Goias State (mine)	150 (ore).
Steel	Aco Minas Gerais S.A. (AÇOMINAS) (private, 100%)	Rodovia, Minas Gerais State	2,000.
Do.	Companhia Aços Especiais Itabira (ACESITA) (Government, 90.9%; 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 Tubarao (CST) (private, 100%)	Serra, Espirito Santo State	3,000.
Do.	Companhia Siderurgia Nacional (CSN) (private, 100%)	Volta Redonda, Rio de Janeiro State	4,600.
Do.	Companhia Siderurgica Paulista (COSIPA) (private, 100%)	Cubatao, Sao Paulo State	3,900.
Do.	Usinas Siderurgicas de Minas Gerais S.A. (USIMINAS) (private, 100%)	Ipatinga, Minas Gerais State	4,400.
Tin	Mineração Jacunda Ltda (private, 100%)	Santa Barbara, Novo Mundo, and Potosi; Rondonia State (six mines) (three beneficiation plants)	108 (ore). 450 (concentrate).
Do.	Parapanema S.A. Mineração, Industria e Construção (private, 100%)	Aripuana, Mato Grosso State; Ariquemes, Rondonia State; Novo Aripuana and Presidente Figueiredo, Amazonas State; and Sao Felix do Xingu, Para State (five mines) (two beneficiation plants) Piraporada Bom Jesus, Sao Paulo State (refinery)	5,420 (ore). 1,400 (concentrate). 25 (metal).
Titanium	Rutilo e Ilmenita do Brasil S.A. (RIB) (private, 100%)	Mataraca, Paraiba State (mine) (two beneficiation plants)	4,200 (ore). 120 (concentrate).
Zinc	Companhia Mineradora de Metais (CMM) (private, 100%)	Vazante, Minas Gerais State (mine) (beneficiation plant)	800 (ore). 48 (concentrate).
Do.	do.	Tres Marias, Minas Gerais State (refinery)	72 (metal).
Do.	Mineração Areense S.A.-MASA (MASA) (private, 100%)	Vazante, Minas Gerais State (mine)	400 (ore).
Zirconium	Nuclemon Minerio-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) (three beneficiation plants) (three separation plants)	90 (ore). 123 (concentrate). 90 (concentrate).
Asbestos	SAMA-Sociedade Anonima Mineração de Amianto (SAMA) (private, 100%)	Minacu, Goias State (mine) (beneficiation plant)	9,000 (ore). 230 (concentrate).
Cement	Cimento Santa Rita S.A. (private, 100%)	Itapevi, Sao Paulo State (plant) Salto de Pirapora, Sao Paulo State (plant)	1,000. 1,200.
Do.	Companhia Cimento Portland Itau (private, 100%)	Itau de Minas, Minas Gerais State (three plants)	2,400.
Do.	Companhia de Cimento Portland Paraiso (private, 100%)	States of Espirito Santo, Goias, Minas Gerais and Rio de Janeiro (five plants)	4,000.
Do.	Companhia de Cimento Portland Rio Branco (private, 100%)	Rio Branco do Sul, Parana State (two plants)	5,000.
Diamond	Mineração Tejuicana S.A. (private, 100%)	Diamantina, Minas Gerais State (mine)	100.
Fluorspar	Mineração Nossa Senhora do Carmo Ltda. (private, 100%)	Morro da Fumaca and Pedras Grandes, Santa Catarina State (four mines) (two beneficiation plants)	180 (ore). 220 (concentrate).
Do.	Mineração Santa Catarina Ltda. (private, 100%)	Morro da Fumaca and Pedras Grandes, Santa Catarina State (four mines) (beneficiation plant)	100 (ore). 120 (concentrate).
Do.	Nacional de Grafite Ltda. (private, 100%)	Itapecerica and Pedra Azul, Minas Gerais State (three mines) (two beneficiation plants)	840 (ore). 720 (concentrate).
Gypsum	CBE-Companhia Brasileira de Equipamento (CBE) (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) (beneficiation plant)	720 (ore). 360 (concentrate).
Do.	Empresa de Mineração Horii Ltda. (Horii) (private, 100%)	Biritiba and Mogi das Cruzes, Sao Paulo State (two mines) (two beneficiation plants)	200 (ore). 180 (concentrate).

