



# 2013 Minerals Yearbook

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## BRAZIL

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# THE MINERAL INDUSTRY OF BRAZIL

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In 2013, Brazil was estimated to be the world's leading producer of niobium (accounting for 90% of world production), the third-ranked producer of asbestos and vermiculite (accounting for 15% of world production each) and iron ore (accounting for 10% of world production), the fourth-ranked producer of bauxite (accounting for 11% of world production) and tantalum (accounting for 12% of world production), the fifth-ranked producer of manganese (accounting for 6% of world production), and the seventh-ranked producer of nickel (accounting for 5% of world production). According to the Instituto Aço Brasil, the country was the ninth-ranked producer of crude steel in the world, accounting for about 2% of the world's production, and the leading producer in Latin America, accounting for about 52% of Latin America's production (Instituto Aço Brasil, 2014, p. 14–15; Bray, 2015b; Corathers, 2015; Kuck, 2015; Papp, 2015a, b; Tanner, 2015; Tuck, 2015; Virta, 2015).

According to the World Bank Group, in 2013, Brazil was the seventh-ranked economy in the world based on gross domestic product (GDP) (purchasing power parity). In 2013, Brazil's real GDP was about \$2.05 trillion<sup>1</sup> compared with a revised \$2.31 trillion in 2012. The mining and mineral-processing industries contributed 4.1% of the GDP in 2013 compared with 4.3% in 2012. According to the Instituto Brasileiro de Mineração (IBRAM), mineral exports accounted for about 17% of the country's exports. Brazil's leading mineral exports were, in order of value, iron ore, gold, niobium, and copper. Its leading mineral imports were coal, potassium, and copper (Departamento Nacional de Produção Mineral, 2013, p. 2; 2014b, p. 3, Instituto Brasileiro de Mineração, 2015b, p. 2; Banco Central do Brasil, 2015; World Bank Group, The, 2015).

According to the U.S. Energy Information Administration, Brazil was ranked 10th among the world's leading producers of oil, 10th among the world's leading energy producers, and 8th among the world's energy consumers. Government-owned Petróleo Brasileiro S.A. (Petrobras) was the leading participant in Brazil's petroleum sector, holding important positions in upstream, midstream, and downstream operations. In 2013, Petrobras continued to operate in an integrated fashion by engaging in exploration and production, refining, crude oil and natural gas trade and transportation, petrochemicals and derivatives, electrical energy, and biofuel and other renewable energy source distribution. Petrobras had a presence in 17 countries (Petróleo Brasileiro S.A., 2014b, p. 2; U.S. Energy Information Administration, 2014a, b).

Brazil's proven oil reserves (onshore and offshore) were estimated to be 15.6 billion barrels (Gbbl) and natural gas reserves were estimated to be 458 billion cubic meters, which ranked the country second in reserves in South America after Venezuela. About 94% of the total proven oil reserves and 85%

of the total proven natural gas reserves were located offshore. In 2013, massive pre-salt areas discovered in the country accounted for 15% of the total oil production. The pre-salt area measured about 800 kilometers (km) in length and 200 km in width and was located off the coast between the States of Santa Catarina and Espírito Santo (table 3; National Agency of Petroleum, Natural Gas and Biofuels, 2014, p. 31–33; U.S. Energy Information Administration, 2014a; Petróleo Brasileiro S.A., 2015b).

## Minerals in the National Economy

Brazil's mineral sector included industrial minerals, metals, and mineral fuels, as well as biofuels and ethanol. Of the 51 mineral commodities surveyed by the Departamento Nacional de Produção Mineral (DNPM), mineral production decreased for 17 commodities, including production of potassium, which decreased about 10%; aluminum, 9%; and iron ore, 4%. According to the IBRAM, Brazil's mineral production in 2013 was valued at \$44 billion compared with \$48 billion (revised) in 2012. In 2013, 229,145 workers were employed in the mining industry compared with 223,997 in 2012. Employment in the mining industry accounted for about 0.6% of the total workforce in the country in 2013. Employment in the extraction of coal increased by 5.6% to 5,365 workers in 2013 compared with 5,082 in 2012; followed by clay, sand, and stone, which increased by 3% to 73,546 workers compared with 71,598 in 2012; and iron ore, which increased by 1% to 52,568 workers compared with 52,061 in 2012. Employment in the extraction of nonferrous metallic minerals decreased by 2% to 33,715 workers compared with 34,373 workers in 2012 (Departamento Nacional de Produção Mineral, 2014b, p. 3, 20–21; Instituto Brasileiro de Mineração, 2015a).

According to the DNPM and Ministério de Minas e Energia (MME), in 2013, exploration permits (autorizações de pesquisa) increased by 53% to 13,562 compared with 8,860 in 2012; however, mining concession titles (Concessões de Lavra) decreased by about 46% to 177 compared with 331 in 2012, and small-scale mining permits (Permissões de Lavra Garimpeira) decreased by 33% to 212 compared with 316 in 2012 (Departamento Nacional de Produção Mineral, 2014a, p. 10).

Investment prospects in Brazil's mineral sector were compiled for a 5-year period by IBRAM. Planned investments during 2013 through 2017 amounted to about \$64 billion, which represented a decrease of about 15% compared with the period 2012 through 2016, which amounted to about \$75 billion. Investors continued to wait for the legal and regulatory definitions of the proposed new regulatory framework for mining, which was submitted to the Brazilian Congress in 2013, to validate planned investments (Instituto Brasileiro de Mineração, 2014, p. 25).

<sup>1</sup>Where necessary, values have been converted from Brazilian reals (BRL) to U.S. dollars (US\$) at an average rate of BRL2.04=US\$1.00 for 2012 and BRL2.86=US\$1.00 for 2013.

## Government Policies and Programs

The Mining Code [Decree-law (Act) No. 227 of February 28, 1967] 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 DNPM, which is part of the MME, has the responsibility for managing the country's mineral resources, for the inspection of the mineral activity in the country, and for enforcing the Mining Code and implementing its legal provisions. 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 of the Mining Code of 1967 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. A draft bill for a new regulatory framework for mining (PL No. 5807/13) was under revision in 2013. The proposed regulatory framework, which would modify the Mining Code, included the creation of the Conselho Nacional de Política Mineral (National Mineral Policy Council) and the Agência Nacional de Mineração (National Agency of Mining), and an increase in royalties on minerals (Instituto Brasileiro de Mineração, 2013a, p. 23; Departamento Nacional de Produção Mineral, 2015a).

The MME's Companhia de Pesquisa de Recursos Minerais (CPRM) (Geological Survey of Brazil) is responsible for geologic, geophysical, geochemical, hydrologic, and hydrogeologic mapping and the dissemination and management of geologic and hydrological information. The Agência Nacional do Petróleo, Gás Natural e Biocombustíveis (ANP, National Agency of Petroleum, Natural Gas and Biofuels), which is part of the MME, has the responsibility for regulating activities that integrate the oil, natural gas, and biofuels industries in the country and for issuing exploration and production licenses (Ministério de Minas e Energia, 2015a, b).

In 2010, the Government passed legislation instituting a new regulatory framework for the country's pre-salt reserves. The framework authorized the creation of Government-owned Pre-Sal Petróleo S.A. (PPSA), which was established by Decree No. 8.063 of August 1, 2013, and allowed the Government to capitalize Petrobras by granting the company 5 Gbbl of unlicensed pre-salt oil reserves in exchange for a larger ownership share. PPSA is responsible for managing new pre-salt production and trading contracts in the oil and gas industry. The framework also established a new development fund to manage Government revenues from pre-salt oil and laid out a new production-sharing agreement (PSA) system for pre-salt reserves. Petrobras is to be the sole operator of each PSA and is to hold a minimum 30% stake in all pre-salt projects (U.S. Energy Information Administration, 2014b; Ministério de Minas e Energia, 2015c).

Brazil's mining royalties are collected by Compensação Financeira pela Exploração de Recursos Minerais (Financial Compensation for Exploiting Mineral Resources, CFEM), which is part of the DNPM. The prevailing royalty rates are 3% for bauxite, manganese ore, potassium, and rock salt; 2% for coal, fertilizers,

iron ore, and other minerals; 1% for gold; and 0.2% for other precious minerals and precious stones. The collected royalties are allocated among the municipalities (65%), States (23%), and the Federal Government (12%), of which the DNPM receives 9.8% (Instituto Brasileiro de Mineração, 2013a, p. 9; Departamento Nacional de Produção Mineral, 2015b).

Brazil continued to be a member of the Mercado Común del Cono Sur (MERCOSUR), which is a trade association that promotes free trade; member countries include Argentina, Bolivia, Brazil, Paraguay, Uruguay, and Venezuela. In 2013, MERCOSUR received about 12% of Brazil's exports and supplied about 8% of Brazil's imports. The country also continued to participate in the BRICS (Brazil, Russia, India, China, and South Africa) economic forum, whose member countries, combined, represented a significant share of the world's GDP and population (Mercado Común del Cono Sur, 2015; Ministry of External Relations, 2015).

## Production

In 2013, Brazil's monazite concentrate production increased by 191% to 600 metric tons (t) from 206 t in 2012; columbite and tantalite production increased by 57% to 185 t from 118 t in 2012; vermiculite, by 31% to 68,014 t from 51,986 t; tungsten content of mine output, by 30% to 494 t from 381 t; primary refined copper, by 26% to 234,150 t from 186,000 t; beneficiated diatomite, by 25% to 2,475 t from 1,987 t; and crude talc and pyrophyllite, by 24% to 737,950 t from 593,140 t (revised). Tin content of mine output increased by 23% to 16,830 t in 2013 from 13,667 t in 2012; primary smelter tin, by 23% to 14,721 t from 11,955 t; mine output of cobalt, by 21% to 3,500 t from 2,900 t; copper content of mine output, by 21% to 270,979 t from 223,141 t; beneficiated feldspar, by 19% to 294,357 t from 247,152 t; and mine output of gold, by 19% to 79,573 kilograms (kg) from 66,773 kg. Other notable production increases included acid-grade fluorspar and metallurgy sulfur, which increased by 18% each; beneficiated magnesite, by 16%; lead content of mine output, by 15%; ferrochromium, ferronickel, and metallurgical-grade fluorspar, by 14% each; ilmenite concentrate, lithium concentrate, and run-of-mine bituminous coal, by 13% each; secondary refined copper, by 12%; beneficiated bituminous coal, by 12%; and nickel content in ferronickel, by 10%. Production of crude barite decreased by 81% to 34,943 t in 2013 from 186,134 t in 2012; quartz, by 34% to 10,696 t from 16,254 t; nickel content in ore, by 25% to 104,829 t from 139,230 t; crude diatomite, by 43% to 1,947 t from 3,427 t; nickel content in matte, by 19% to 11,641 t from 14,345 t; beneficiated bentonite, by 15% to 434,000 t from 512,975 t; and mine output of nickel ore, by 12% to 13.0 million metric tons (Mt) from 14.7 Mt. Production of crude magnesite decreased by 12%; crude gypsum and anhydrite, by 11%; and potash, potassium, and pyrochlore concentrate (Nb<sub>2</sub>O<sub>5</sub> content), by 10% each. Data on mineral production are in table 1.

## Structure of the Mineral Industry

In 2013, bauxite was produced by Alcoa Alumínio S.A., Alcoa World Alumina Brasil Ltda. (AWAB), Companhia

Brasileira de Alumínio S.A. (CBA), Mineração Paragominas S.A., and Mineração Rio do Norte S.A. (MRN). MRN, which is located in Porto Trombetas in the State of Para, had the capacity to produce 18.1 million metric tons per year (Mt/yr) of bauxite.

According to the Sindicato Nacional da Indústria do Cimento, the country had about 88 cement plants. On January 31, Cimentos de Portugal, SGPS, S.A. of Portugal (Cimpor) announced the merger of Cimpor Cimentos do Brasil S.A. and InterCement Brasil S.A., both owned by Camargo Correa S.A. through its subsidiary Cimpor. After the merger, InterCement was the operator of 16 cement plants located in the States of Alagoas, Bahia, Goiás, Mato Grosso do Sul, Minas Gerais, Paraíba, Pernambuco, Rio Grande do Sul, and Sao Paulo. InterCement had the capacity to produce about 17.9 Mt/yr of cement. Cement was also produced by Companhia de Cimento Itambé, Cimento Nacional, Cimento Nassau, Cimento Planalto S.A., Cimento Tupi S.A., Holcim (Brasil) S.A., Lafarge Brasil S.A., Mizu Cimentos Especiais, and Votorantim Cimentos S.A. (Cimentos de Portugal, SGPS, S.A., 2013; Sindicato Nacional da Indústria do Cimento, 2014b, p. 7). Table 2 is a list of major mineral industry facilities.

Caraíba Metais S/A, which was located in the State of Bahia, was the only electrolytic copper producer in the country and had a production capacity of about 280,000 metric tons per year (t/yr). Votorantim, which was the only producer of zinc in the country, owned two mines (Vazante and Morro Agudo) and two metallurgy operations (Juiz de Fora and Tres Marias) located in the State of Minas Gerais. The Juiz de Fora and Tres Marias operations had production capacities of about 95,000 t/yr and 180,000 t/yr of zinc, respectively. Eternit Group, through its subsidiary Sociedade Anônima Mineração de Amianto S.A. (SAMA), owned Cana Brava, which was the only asbestos operation in the country. Cana Brava is located in Minacu in the State of Goiás and had the capacity to produce about 300,000 t/yr of concentrates. According to the DNPM, Cana Brava was expected to produce an average of about 284,000 t/yr between 2014 and 2016. Petrobras operated refineries located in the States of Amazonas, Bahia, Ceara, Minas Gerais, Parana, Rio de Janeiro, Rio Grande do Sul, and Sao Paulo with the combined capacity of about 804 million barrels per year (Departamento Nacional de Produção Mineral, 2014b, p. 59).

## Mineral Trade

In 2013, the total value of Brazil's exports was about \$242.0 billion compared with about \$242.6 billion in 2012. The total value of Brazil's imports in 2013 was about \$239.7 billion compared with about \$223.2 billion in 2012. The country's major export trade partners were, in descending order of value, China, which received 19% of Brazil's exports, the United States (10%), Argentina (8%), and the Netherlands (7%). Its major import partners were, in descending order of value, China, which supplied 16% of Brazil's imports, the United States (15%), Africa and Argentina (7%, each), and Germany (6%). In 2013, mineral exports were valued at about \$41.2 billion compared with about \$39.3 billion in 2012 and imports, about \$8.7 billion compared with about \$9.2 billion in 2012. The mineral trade surplus was about \$32.5 billion in

2013 compared with \$30.1 billion (revised) in 2012. Iron ore accounted for about 79% of the mineral exports, followed by gold (6%), copper (4%), and ferroniobium (4%). Potassium accounted for about 39% of the primary minerals imports, followed by coal (34%), copper (12%), and sulfur (3%). According to the Associação Brasileira do Alumínio (ABAL), in 2013, exports of aluminum totaled 530,400 t compared with a revised 646,400 t in 2012. The country's imports of aluminum totaled 332,900 t compared with a revised 331,300 t in 2012 (Associação Brasileira do Alumínio, 2014a, b, d; Banco Central do Brasil, 2015; Instituto Brasileiro de Mineração, 2015b).

Brazil's exports of crude oil totaled about 139 million barrels (Mbbl) in 2013 compared with 200 Mbbl in 2012. Its major exports partners were, in descending order of volume, China, which received 30% of Brazil's crude oil exports, the United States (28%), India (13%), and Chile (8%). The country's crude oil imports increased to 148 Mbbl in 2013 from 114 Mbbl in 2012. The leading import sources were Nigeria (53%), Saudi Arabia (19%), and Algeria (8%). In 2013, imports of natural gas and liquefied natural gas (LNG) totaled about 17 million cubic meters compared with 13 million cubic meters in 2012. Bolivia supplied 70% of Brazil's natural gas imports and Trinidad and Tobago supplied about 45% of the country's LNG imports (National Agency of Petroleum, Natural Gas and Biofuels, 2014, p. 48, 56).

Brazil's exports to the United States were valued at about \$27.6 billion in 2013 compared with about \$32.1 billion in 2012. Crude oil accounted for \$4.2 billion of exports; iron and steel mill products, about \$2.0 billion; fuel oil, about \$1.3 billion; coal and related fuels, about \$940 million; petroleum products, about \$820 million; and bauxite and aluminum, about \$179 million. Imports from the United States were valued at \$44.1 billion in 2013 compared with \$43.8 billion in 2012; these included nearly \$3.1 billion in fuel oil, \$2.2 billion in petroleum products, \$946 million in metallurgical-grade coal, \$683 million in natural gas liquids, and \$642 million in excavating machinery (U.S. Census Bureau, 2014a, b).

## Commodity Review

### Metals

**Aluminum and Bauxite and Alumina.**—In 2013, the country was estimated to rank eighth among the world's leading aluminum producers. Alumina production increased by 2% to about 10.5 Mt in 2013 compared with 10.3 Mt (revised) in 2012. Exports of alumina totaled about 7.1 Mt in 2013 compared with more than 7.3 Mt in 2012. Primary aluminum production decreased by 9% to about 1.3 Mt from about 1.4 Mt in 2012. Bauxite production was about 33 Mt, which was about the same level as that of 2012. The State of Para continued to be the leading State producer of bauxite and accounted for about 90% (29 Mt) of the nation's production in 2013. Bauxite exports totaled about 8.4 Mt compared with 6.9 Mt in 2012. According to the ABAL, Brazil's consumption of aluminum products by end use was as follows: packaging (which accounted for 29.5% of aluminum consumption), transportation (20.4%),

electrical (10.4%), construction (16.2%), consumer durables (10.1%), machinery (4.4%), and others (9.0%). In 2013, the leading aluminum producers were Alumínio Brasileiro S.A., which produced about 35% of Brazil's primary aluminum, followed by CBA (32%) and Consorcio de Alumínio do Maranhão (26%) (Associação Brasileira do Alumínio, 2014c, 2015; Bray, 2015a; Departamento Nacional de Produção Mineral, 2014b, 30–31).

In January, Votorantim, through its subsidiary Votorantim Metais, announced that it would invest about \$2.9 billion in the development of the Alumina Rondon project, which was located in Rondon do Para in the State of Para. The project would include a bauxite mine and an alumina refinery with the capacity to produce more than 7.7 Mt/yr of bauxite and 3 Mt/yr of alumina. The company submitted its environmental impact study (EIS) for Alumina Rondon in 2012. Votorantim reported that the project was at the stage of obtaining an environmental license and was expected to begin operations by 2017; however, the startup date of operations would depend on the approval of the environmental license (Votorantim Group, 2013a, b; 2014, p. 119; Departamento Nacional de Produção Mineral, 2014b, p. 30–31).

**Copper.**—In 2013, the leading State for copper concentrate production was Para, which accounted for about 68% of the nation's total, followed by the States of Goiás (24%) and Bahia (8%).

In 2013, Brazil exported 242,750 t of metal content in concentrates compared with 157,650 t in 2012 and imported 152,292 t of metal content in concentrates compared with 76,072 t in 2012. In 2013, exports and imports of metal (primary and secondary) were 118,700 t and 280,600 t, respectively. Caraiíba Metais S.A. (a subsidiary of Paranapanema S.A.) accounted for about 95% of Brazil's refined copper production. The refinery had the capacity to produce about 280,000 t/yr of refined copper and was located in Camacari in the State of Bahia (Departamento Nacional de Produção Mineral, 2014b, p. 56).

Vale produced copper concentrates at its Salobo and Sossego open pit mines located in Carajas in the State of Para. In 2013, the Sossego Mine produced about 119,000 t of copper compared with 110,000 t in 2012, and the Salobo Mine, which began operation in 2012, produced about 65,000 t of copper compared with 13,000 t in 2012. In 2013, total proven and probable reserves at Sossego were reported as about 137.5 Mt at an average grade of 0.77% copper compared with 150.7 Mt at an average grade of 0.79% in 2012. Total proven and probable reserves at Salobo increased to about 1,136 Mt at an average grade of 0.71% copper compared with 1,123 Mt at an average grade of 0.72% copper in 2012, which was attributed to cutoff grade changes and an improvement in the pit design. Vale continued with its Salobo expansion project, which was expected to increase Salobo's capacity to 200,000 t/yr of copper in concentrate. The company expected to complete the project in mid-2014 and to reach full capacity by 2016 (Vale S.A., 2014, p. 45, 47, 66, 70, 72).

**Gold.**—In 2013, the leading gold-producing companies included AngloGold Ashanti Ltd. of South Africa, Kinross Gold Corp. of Canada, Troy Resources Ltd. of Australia, Vale, and Yamana Gold Inc. of Canada. The leading producing States were Minas Gerais (46%), Goiás (12%), Mato Grosso and

Para (11% each), Amapá (8%), Bahia (7%), and Maranhão (4%) (Departamento Nacional de Produção Mineral, 2014b, p. 98).

Troy Resources, through its subsidiary Reinarda Mineração Ltda, held 100% interest in the Andorinhas project, which is located in the State of Para. The project included the Mamão and Lagoa Seca gold concessions. The company reported that Andorinhas was about to reach the end of its operational life and expected to close operations in 2014. In 2013, Andorinhas produced about 885 kg of gold compared with 1,165 kg in 2012. Troy Resources continued with its plans for the development of the Coruja pit deposit, which is located within the Andorinhas project and expected the approval of a mining license in 2014. Probable reserves at the Coruja pit were reported as 86,000 t at an average grade of 5.8 grams per metric ton (g/t) gold (Troy Resources Ltd., 2012a–c; 2013a–d, 2014a, p. 9, 17, 21; 2014b).

Vale recovered gold as a byproduct from its Salobo and Sossego Mines. Salobo had an estimated capacity of about 4,000 kilograms per year and a mine life of 53 years. In 2013, Salobo's gold production increased by about 485% to 3,640 kg compared with 622 kg in 2012, which was attributed to the mine rampup during the year. In February, Vale entered into an agreement with Silver Wheaton Corp. of Canada to sell 25% of the gold produced at Salobo during the life of the mine. Gold production at Sossego increased by about 4% to 2,430 kg in 2013 compared with 2,330 kg in 2012. As of 2013, proven and probable mineral reserves at Salobo and Sossego were estimated to be 1,136 Mt at an average grade of 0.4 g/t and 137 Mt at an average grade of 0.2 g/t, respectively (Vale S.A., 2014, p. 20, 48, 66–67, 95).

Yamana held 100% interest in the Chapada gold and copper mine located in the State of Goiás and the Jacobina Mine located in the State of Bahia. In 2013, gold production from Chapada was about 3,000 kg compared with 3,400 kg in 2012. The company attributed the decrease in gold production at Chapada to anticipated lower grades and recovery rates. Yamana planned the development of a new gold and copper ore body, Corpo Soul, by the fourth quarter of 2014. Corpo Soul, which is located at the southwestern end of the main ore body of Chapada, was expected to increase future production to at least 3,700 kg of gold equivalent. The company expected to produce about 2,900 kg of gold equivalent in 2014. As of December 31, total proven and probable mineral reserves at Chapada were reported as 480 Mt at an average grade of 0.25 g/t gold. Gold production at Jacobina was about 2,100 kg in 2013 compared with about 3,300 kg in 2012. The decrease in production was attributed to lower throughput, lower feed grade, and higher dilution at the mine. As of December 31, total proven and probable mineral reserves at Jacobina were estimated to be about 24 Mt at an average grade of about 2.80 g/t gold. Yamana expected gold production at Jacobina to be about 2,500 kg in 2014 (Yamana Gold Inc., 2014, p. 14, 46, 142).

Yamana Gold also owned 100% interest in the C1 Santa Luz (Santa Luz) and the Pilar Mines, which are located in the State of Goiás, and the Ernesto/Pau-a-Pique Mine in the State of Mato Grosso. The company began the commissioning (no commercial production) at Santa Luz and Ernesto/Pau-a-Pique in 2013. As of 2013, total proven and probable mineral reserves at Santa Luz were reported as about 26.7 Mt at an average grade of

1.57 g/t gold, and at Ernesto/Pau-a-Pique they were reported as 4.7 Mt at an average grade of 3.47 g/t gold. Ernesto/Pau-a-Pique was initially planned as an open pit operation at Ernesto and an underground operation at Pau-a-Pique with a common plant. During the year, Yamana Gold developed a new plan, which continued to include the development of Pau-a-Pique as an underground operation and the evaluation of a near-to-surface underground operation at Ernesto. The company also continued the evaluation of several satellite open pit deposits, previously identified, that could further contribute to the Ernesto/Pau-a-Pique operations. Exploration work was underway at Pilar, which included the development of the Caimar and Maria satellite deposits. Proven and probable reserves at Pilar were reported as 10.8 Mt at an average grade of 4.03 g/t gold. The company planned to complete the commissioning of Pilar in the third quarter of 2014 (Yamana Gold Inc., 2014, p. 18, 26, 30, 54, 60–63, 142).

In April, Beadell Resources Ltd. of Australia began commercial production at its 100%-owned Tucano gold mine, which is located in the State of Amapa. The company extracted high-grade oxide for its carbon-in-leach (CIL) gold plant with the capacity to process about 3.5 Mt/yr of ore. The Tucano Mine included the Duckhead deposit and Tap AB, Tap C, and Urucum pits. The company began operations at Duckhead in early August and it became the focus of the project owing to the high grades available from the deposit. During the year, Tucano processed about 3.6 Mt of oxide ore at a recovery rate of 92% and produced about 5,180 kg of gold. The company expected to produce between 5,700 and 6,200 kg of gold in 2014. As of December 31, reserves at Tucano were estimated to be 36.1 Mt at an average grade of 1.44 g/t gold and total mineral resources were estimated to be 111.0 Mt at an average grade of 1.39 g/t. Beadell Resources conducted a 10,000-meter (m) reverse-circulation drilling program at the Tartaruga project, which is located about 120 km northeast of Tucano. Inferred mineral resources at Tartaruga were estimated to be 6.5 Mt at an average grade of 1.63 g/t gold. The company reported that metallurgical tests showed that the quartzite gold at Tartaruga is highly leachable using conventional CIL methods with recoveries of 99.1% in oxide and 97.1% in fresh rock. Additional exploration work was underway at Duckhead and Tartaruga (Beadell Resources Ltd., 2014, p. 2, 7, 9, 16, 19, 20).

**Iron and Steel.—Pig Iron.**—Brazil produced more than 30.0 Mt of pig iron in 2013 compared with 30.7 Mt in 2012, which was a decrease of about 2.2%. In 2013, Brazil was the world's ninth-ranked pig iron producer, accounting for 2.4% of world production (Departamento Nacional de Produção Mineral 2014b, p. 72–73; Fenton, 2015).

**Steel.**—Brazil's major integrated steel operations consisted of 29 mills managed by 11 business groups; combined, the mills had an installed capacity of 48.4 Mt/yr of crude steel. Raw steel production decreased to 34.2 Mt in 2013 from about 34.5 Mt (revised) in 2012, or by almost 1.0%. Brazil exported 8.1 Mt of steel valued at \$5.6 billion in 2013 compared with 9.7 Mt of steel valued at \$6.9 billion in 2012. The major recipients of Brazil's steel exports were the United States (49.0%), Argentina (8.6%), Peru (4.5%), Colombia (3.3%), Bolivia (2.7%), Chile (2.1%), and Germany and Mexico

(2.0% each). Brazil imported about 4 Mt of steel valued at \$4.3 billion in 2013, which was similar to the amount imported in 2012. The apparent domestic consumption of steel in Brazil was about 26.5 Mt compared with 25.4 Mt in 2012 (Departamento Nacional de Produção Mineral, 2014b, p. 26–27; Instituto Aço Brasil, 2015).

**Iron Ore.**—In 2013, iron ore production decreased by about 4% to 386.3 Mt compared with 400.8 Mt in 2012, and iron content decreased by 5% to 245.7 Mt compared with 258.1 Mt in 2012. The decrease in iron ore production was attributed to adverse weather conditions in the northern and eastern regions of the country at yearend and the delay in the acquisition of an environmental license for the mines, which prevented the mines from operating at full capacity. Leading State producers of iron ore were Minas Gerais (which accounted for about 69% of the iron ore production), Para (27.3%), Mato Grosso do Sul (2.0%), and Amapa (1.6%). Leading iron ore producers included Companhia Siderúrgica Nacional S.A., Itaminas Comércio de Minérios S.A.; Mineração Usiminas S.A., MMX Sudeste Mineração Ltda., Samarco Mineração S.A, Vale, and Zamin Ferrous Ltd. of the United Kingdom. These companies accounted for about 90% of the iron ore production in the country. In 2013, Brazil exported about 282.2 Mt of iron ore valued at more than \$25.9 billion compared with 275.4 Mt of iron ore valued at more than \$23.8 billion, which was an increase of about 2% in volume and 9% in value. Brazil's major export partners for iron ore were China, which accounted for 51% of the country's iron ore exports, followed by Japan (10%), the Republic of Korea and the Netherlands (5% each), and Germany (3%) (Departamento Nacional de Produção Mineral, 2014b, p. 72–73).

In November, Anglo American plc of the United Kingdom sold its 100% interest in the Amapa iron ore mine to Zamin Ferrous. Amapa is located in the State of Amapa and had the capacity to produce about 6.0 Mt/yr of iron ore. During the year, Vale completed the construction of the Carajas plant 2 in the State of Para, with a nominal capacity of about 40 Mt/yr, and the construction of a concentration plant in Conceição Itabiritos in the State of Minas Gerais, which would provide an additional nominal capacity of 12 Mt/yr of pellet. Vale expected to begin operations at Carajas and Itabiritos in mid-2014. Samarco Mineração was a joint venture between BHP Billiton Ltd. (50% interest) and Vale (50%). The joint venture owned the Alegria and the Germano Mines, which are located in the State of Minas Gerais and had the capacity (combined) to produce about 22.0 Mt/yr of iron ore, and three pellet plants, which are located in the State of Espírito Santo and have a combined capacity of about 22.3 Mt/yr. The joint venture planned to begin production at its new fourth pellet plant in 2014. The new plant would have a capacity of 8.3 Mt/yr, which would increase Samarco's nominal pellet capacity to about 30.5 Mt/yr (Zamin Ferrous Ltd., 2013; Vale, 2014, p. 19, 26, 28, 71, 78).

**Manganese.**—Vale produced manganese through its subsidiaries Vale Manganês S.A., which operated the Morro de Mina open pit mine located in the State of Minas Gerais; Vale Mina do Azul S.A., which operated the Azul open pit located in the State of Para; and Mineração Corumbaense Reunida S.A., which operated the Urucum underground mine

located in the State of Mato Grosso do Sul. In 2013, the mines produced about 2.4 Mt of manganese ore, which was about the same as that of 2012. In 2013, total proven and probable manganese ore reserves at Azul, Morro da Mina, and Urucum were reported as about 63.9 Mt at an average grade of about 37.9% manganese compared with 62.5 Mt at an average grade of about 37.1% manganese in 2012. The State of Para continued to be the leading State producer of manganese and accounted for 70% of the nation's production, followed by Minas Gerais (15%) and Mato Grosso do Sul (14%) (Departamento Nacional de Produção Mineral, 2014b, p. 86; Vale S.A., 2014, p. 35, 63).

**Nickel.**—In 2013, the leading State producers of nickel ore were Goiás, which produced about 73% of the nation's production, Bahia (22%), Para (4%), and Minas Gerais (1%). The State of Goiás produced about 6.0 Mt of ore and 69,532 t of nickel content, and the leading municipalities within the State were Niquelândia (62%), Barro Alto (33%), and Americano do Brasil (5%) (Departamento Nacional de Produção Mineral, 2014b, p. 96).

Vale produced ferronickel using the rotary kiln-electric furnace process at its Onça Puma location in Ourilândia do Norte in the State of Para. In November, the company resumed ferronickel production at Onça Puma, which was suspended in mid-2012 owing to damages to the operation's two furnaces. The company rebuilt one of the furnaces with a nominal capacity of 25,000 t/yr and was evaluating the opportunity to restart its second furnace, which would depend on the market outlook and the performance of its operating furnace. The Onça Puma open pit mine was built on lateritic nickel deposits of saprolitic laterite ore. As of 2013, total proven and probable reserves at the mine were reported as 95.3 Mt at an average grade of 1.61% nickel compared with 82.4 Mt at an average grade of 1.52% nickel in 2012. The increase in reserves was attributed to improvement work at the mine, which included a new mine dilution strategy. In 2013, nickel ore production was about 263,000 t at an average grade of 2.28% nickel compared with about 2.0 Mt at an average grade of 1.87% nickel in 2012. Production of nickel contained in ferronickel was about 1,900 t in 2013 compared with 6,000 t in 2012 (Vale S.A., 2013; 2014, p. 22, 40, 42–43, 65).

Anglo American produced nickel at its Barro Alto and Codemin operations, which were located in the State of Goiás and had an annual capacity of 36,000 t and 10,000 t, respectively. In 2013, nickel production at Barro Alto increased by 16% to 25,100 t of nickel, which was attributed to operational improvements in the second half of the year. Codemin produced 9,300 t of nickel in 2013, which was slightly less than in 2012, as a result of a planned decrease in grade. A recovery plan at Barro Alto was underway, which included the rebuilding of two furnaces. The company planned to rebuild one of the furnaces by late 2014 and the second furnace by late 2015. Vale expected nickel production at Barro Alto and Codemin to be between 20,000 t and 25,000 t in 2015 and between 35,000 t and 38,000 t in 2016 (Anglo American plc, 2014a, p. 75; 2014b).

**Niobium (Columbium) and Tantalum.**—Anglo American, through its Anglo American Niobio Brasil Ltda., owned Boa Vista open pit mine, which was located in the State of Goiás. Anglo American reported that with the end of the Boa Vista's weathered ore reserves approaching, the company would

continue with the development of the Boa Vista fresh rock project. The project included the construction of a new upstream plant that would adapt the existing Catalao plant to process fresh rock instead of oxide ore. The company expected to begin production in 2014 and to increase its production capacity to about 6,500 t/yr of niobium from about 4,500 t/yr (Anglo American plc, 2014a, p. 41, 77).

In April, Advanced Metallurgical Group N.V. (AMG) of the Netherlands, through its subsidiary AMG Mineração S.A., announced an updated mineral resources estimate for its Volte Grande project, which is located in Nazareno in the State of Minas Gerais. Measured and indicated resources were reported as 14.7 Mt at average grades of 3,388.6 parts per million (ppm) lithium, 325.8 ppm tin, 318.3 ppm tantalum, and 57.8 ppm niobium using a cutoff of 69 ppm tantalum. The company also reported that Volte Grande had an estimated mine life of about 20 years based on current tantalum concentrate production levels, extraction and processing costs, and current economic conditions (Advanced Metallurgical Group N.V., 2013; Departamento Nacional de Produção Mineral, 2014b, p. 113).

### *Industrial Minerals*

**Cement.**—In 2013, cement production increased by about 1% to about 70 Mt from 69 Mt (revised) in 2012. In 2013, the companies Cimento Nassau, InterCement, and Votorantim accounted for about 64% of Brazil's cement production. The southeast region of the country accounted for about 45% of the country's cement production, followed by the northeast (20%), south (17%), central-west (10%), and north (8%) (Departamento Nacional de Produção Mineral, 2014b, p. 52; Sindicato Nacional da Indústria do Cimento, 2014a; 2014b, 7, 17).

In 2013, Holcim Ltd., through its subsidiary Holcim (Brasil), completed the installation of a second kiln line at the Barroso cement plant, which was expected to come online by June 2015 and to add 2.3 Mt/yr of cement to the company's combined annual capacity. Lafarge completed the construction of its new cement plant, which is located in Santa Cruz in the State of Rio de Janeiro, that was expected to produce 500,000 t/yr of cement by 2015 and to reach full capacity of 750,000 t/yr after 2015. Cimento Nacional, which is a subsidiary of Brennand Group, continued with the construction of a new cement plant at Pitumbu in the State of Paraíba with the capacity to produce about 1.5 Mt/yr. The new plant was expected to be completed by 2017. Cimentos da Bahia S.A. (a subsidiary of Cimento Portland Participações S.A.) planned the construction of a new cement plant in Paripiranga in the State of Bahia. The cement plant would have a production capacity of about 2.0 Mt/yr of cement (Departamento Nacional de Produção Mineral, 2014b, p. 53; Holcim Ltd., 2014, p. 157, 250; Cimento Bravo, 2015; Cimento Nacional, 2015).

**Diamond.**—In 2013, the country produced about 49,000 carats of diamond, of which 61% was mined by garimpeiros (independent miners). The leading State producers were Mato Grosso (88%), Minas Gerais (11%), and Bahia (1%). Based on statistics reported by the Kimberley Process Certification Scheme, a total of 55,520 carats of diamond worth \$6.7 million were exported in 2013. In terms of quantity, this

indicated an increase of 47% compared with diamond exports in 2012; the value of the exports increased by 68%. In 2013, the country's major rough diamond export partners were, in order of value, the United States (45%), China (25%), Switzerland (20%), the United Arab Emirates (5%), Belgium (3%), and Israel (1%) (Kimberley Process Rough Diamond Statistics, 2013, 2014; Departamento Nacional de Produção Mineral, 2014b, p. 62).

Lipari Mineração Ltd. held 100% interest in the Braúna diamond project, which is located in Nordestina in the State of Bahia. Lipari planned the development of the B3 kimberlite deposit, which was the largest of the 22 kimberlite occurrences. The project was expected to become South America's first diamond mine developed in kimberlite rock. A mineral resource estimate of the B3 deposit was completed in January. Indicated mineral resources were estimated to be 1.8 million carats and inferred mineral resources were estimated to be more than 926,000 carats. The company expected the approval of its EIS in early 2014 and to begin commercial production by the first quarter of 2016. The company also expected to produce an average of about 225,000 carats per year during a mine life of 7 years (Instituto Brasileiro de Mineração, 2013a; Departamento Nacional de Produção Mineral, 2014b, p. 53; Lipari Mineração Ltd., 2014; 2015a, b).

**Phosphate Rock.**—Brazil produced more than 6.7 Mt of phosphate rock (concentrates), which was about the same amount as that produced in 2012. The State of Minas Gerais accounted for about 49% of the country's phosphate production followed by the States of Goiás (36%), São Paulo (10%), and Bahia (4%). Imports of phosphate rock concentrates increased to 1.6 Mt in 2013 compared with almost 1.3 Mt in 2012, and domestic consumption of concentrates increased to 8.3 Mt in 2013 compared with 8.0 Mt in 2012. According to DNPM, Vale accounted for about 71% of Brazil's total production, followed by Copebrás S.A. (21%). Vale, through its subsidiary Vale Fertilizantes S.A., produced phosphate rock from its Araxa, Patos de Minas, and Tapira open pit mines, which are located in the State of Minas Gerais; the Cajati open pit mine in the State of São Paulo; and the Catalao open pit mine in the State of Goiás. In 2013, Araxa produced 1.1 Mt of phosphate rock, which was about the same amount as that produced in 2012, and proven and probable reserves were reported as 132.1 Mt at an average grade of 11.7%  $P_2O_5$  compared with 138.6 Mt at an average grade of 11.6%  $P_2O_5$  in 2012. Phosphate rock production from Tapira decreased by about 10% to 1.9 Mt in 2013 compared with 2.1 Mt in 2012, and reserves were reported as 680.9 Mt at an average grade of 6.8%  $P_2O_5$ . The Catalao and the Cajati Mines produced about 1.1 Mt in 2013 compared with 1.0 Mt in 2012 and 640,000 t compared with 550,000 t, respectively. In 2013, reserves at Catalao were reported as 52.8 Mt at an average grade of 10.4%  $P_2O_5$  compared with 57.9 Mt at an average grade of 10.6%  $P_2O_5$  in 2012, and Cajati reserves were reported as 114.4 Mt at an average grade of 5.2%  $P_2O_5$  compared with 120.0 Mt at an average grade of 5.2%  $P_2O_5$  in 2012 (Departamento Nacional de Produção Mineral, 2014b, p. 76–77; Vale S.A., 2014, p. 49, 68).

**Vermiculite.**—In 2013, the State of Goiás produced about 85.5% of the total vermiculite production in the country,

followed by the States of Pernambuco (4.2%), Paraíba (7.8%), and Bahia (2.5%). Vermiculite exports increased by 11% to 40,700 t in 2013 compared with 36,615 t in 2012 and major vermiculite export partners were the European Union (38%), the United Arab Emirates (10%), and Mexico (9%). The apparent domestic consumption of vermiculite in Brazil increased by about 77% to 27,259 t in 2013 compared with 15,388 Mt in 2012, and was mainly used for agriculture and civil construction. Brasil Minérios Ltda., located in São Luiz dos Montes Belos in the State of Goiás, had the capacity to produce about 100,000 t/yr of vermiculite concentrate. The company expected to increase its production to about 60,000 t/yr in 2014 and to 100,000 t/yr by 2020 (Departamento Nacional de Produção Mineral, 2014b, p. 122–123; Brasil Minérios Ltda., 2015).

### *Mineral Fuels and Other Sources of Energy*

**Coal.**—In 2013, Brazil produced more than 7.4 Mt of beneficiated coal compared with 6.6 Mt in 2012. The Brazilian coal industry's mine operations were concentrated in the three southernmost States of Paraná, Rio Grande do Sul, and Santa Catarina. Coal was consumed by electricity generation (81.1%), and by the production of pulp and paper (4.9%), petrochemicals (3.3%), food (2.9%), cement and metallurgy (1.3%), and other (2.7%). To meet Brazil's coal (coke, metallurgical) demand, 20.3 Mt valued at \$2.9 billion was imported in 2013 compared with 18.4 Mt valued at \$3.6 billion in 2012. Imports came from the United States (38%), Australia (17%), Colombia (16%), Canada (9%), and Russia (6%). Copelmi Mineração Ltda. (Copelmi) produced coal from the Mina do Butia Leste, Mina do Cerro, Mina Charqueadas, and Mina do Recreio, which were located in Rio Grande do Sul. The company's main operation was Mina do Recreio with an annual capacity of about 2 Mt of coal (Departamento Nacional de Produção Mineral, 2014b, p. 46; Copelmi Mineração Ltda., 2015a, b).

**Natural Gas.**—In 2013, Brazil's gross natural gas production increased by 9.1% to about 28.2 billion cubic meters compared with a revised 25.8 billion cubic meters in 2012. The increase in production was attributed to an increase in the production of natural gas from the pre-salt fields, which increased to about 78% in 2013. In 2013, offshore natural gas production accounted for about 73% of the national natural gas production. Brazilian natural gas operations were concentrated in the States of Rio de Janeiro (36%), Espírito Santo (16%), Amazonas (15%), Bahia (11%), São Paulo (10%), Maranhão (5%), Sergipe (4%), and Alagoas and Rio Grande do Norte (2% each). In 2013, proven offshore reserves were reported as 388 billion cubic meters, which accounted for about 85% of the total natural gas proven reserves. The State of Rio de Janeiro accounted for 56% of the total proven reserves and 66% of the total offshore reserves (National Agency of Petroleum Natural Gas and Biofuels, 2014, p. 32, 34, 36)

**Petroleum.**—Brazil's offshore deposits hold the vast majority of Brazil's proven reserves, which are estimated to be 14.7 Gbbl, or 94% of the country's proven reserves. In 2013, offshore crude oil production accounted for about 91% of the total crude oil production. The State of Rio de Janeiro accounted for about 80% of the total proven reserves and 72% of the total crude oil



production. In 2013, Brazil's oil production decreased by 2% to 738.7 Mbbbl compared with 754.4 Mbbbl (revised) in 2012. Pre-salt areas accounted for 15% of total crude oil production and, in 2013, production from pre-salt areas increased by 77% to 110.5 Mbbbl compared with 62.5 Mbbbl in 2012 (National Agency of Petroleum Natural Gas and Biofuels, 2014, p. 31, 33).

According to the ANP, at least 363 onshore and offshore fields were in the production phase and 73 fields were in the development phase, and were located in the States of Alagoas, Amazonas, Bahia, Espirito Santo, Maranhao, Parana, Rio Grande do Norte, Rio de Janeiro, Santa Catarina, Sergipe, and Sao Paulo. Also, 339 onshore and offshore fields were in the exploration phase and were located in the Alagoas, Amazonas, Barreirinhas, Camamu, Campos, Ceara, Espirito Santo, Foz do Amazonas, Jequitinhonha, Para-Maranhao, Parecis-Alto Xingu, Parnaiba, Pelotas, Pernambuco-Paraiba, Potiguar, Reconcavo, Santos, Sao Francisco, Sergipe, Solimoes, and Tucano Sul sedimentary basins. Companies engaged in exploration included Petrobras; Ecopetrol S.A. of Colombia; Total S.A. of France; Statoil ASA of Norway; United Kingdom companies BG Group plc, BP p.l.c., and Chariot Oil and Gas Ltd.; and U.S. companies Anadarko Petroleum Corp. and Exxon Mobil Corp. (National Agency of Petroleum Natural Gas and Biofuels, 2014, p. 19–31, 33).

Petrobras's offshore and onshore fields had the capacity to produce about 28.2 Mbbbl of crude oil and were located in the States of Alagoas, Amazonas, Bahia, Ceara, Espirito Santo, Rio de Janeiro, Rio Grande do Norte, Sao Paulo, and Sergipe. The company's business and management plans for 2014 through 2018 estimate investments on the order of \$220.6 billion, of which about 70% would be invested in exploration and production and \$82 billion of that would be used for the pre-salt oil fields. The company planned to produce 3.2 million barrels per day (Mbbbl/d) of crude oil by 2018 and 4.2 Mbbbl/d by 2020, and pre-salt fields were expected to account for about 52% of the total production by 2018 (Petróleo Brasileiro S.A., 2014b, p. 13).

During 2013, Petrobras completed nine new platforms (Cidade de Itajaí, Cidade de Paraty, Cidade de Sao Paulo, P–55, P–58, P–61, P–62, P–63, and SS–88 TAD), which would add 1 billion barrel per day of oil production capacity. In January, Cidade de São Paulo began production in the Santos Basin pre-salt region (Sapinhoá Field) with the daily capacity to process 120,000 barrels per day (bbl/d) of oil and 5 million cubic meters per day of natural gas. In February, Cidade de Itajaí began production with the capacity to process 80,000 bbl/d of light oil and 2 million cubic meters per day of natural gas. The Cidade de Itajaí was located in the Santos Basin post-salt region (Baúna and Piracicaba fields), about 210 km off the coast. In June, Cidade de Paraty began production in the Santos Basin pre-salt region; about 300 km off the coast at a depth of 2,120 m and had the capacity to process 120,000 bbl/d of oil and 5 million cubic meters per day of natural gas. The P–55 began production later in 2013 and was located at the Roncador field, Campos Basin (depth 1,800 m). P–55 had the capacity to process 180,000 bbl/d of oil and 4 million cubic meters per day of natural gas. P–63 began operation in November with the capacity to process 140,000 bbl/d of oil and 1 million cubic meters per day of natural gas. P–63 was the first production

system at Papa-Terra (Campos Basin and included P–61 and SS–88 TAD). P–61 was expected to begin operations in mid-2014. The P–58 was located about 85 km off the coast of Espirito Santo, in water depths of 1,400 m, and had the capacity to process about 180,000 bbl/d of oil and 6 million cubic meters per day of natural gas from pre-salt and post-salt reservoirs. The P–58 was expected to begin operations in early 2014. The P–62 was located about 125 km offshore in the Campos Basin at water depths of 1,600 m; it was expected to begin operation in mid-2014. The P–62 had the capacity to process 180,000 bbl/d of oil and 6 million cubic meters per day of natural gas from post-salt reservoirs (Petróleo Brasileiro S.A., 2014a).

In October 21, the Government through the ANP opened its first bidding round for the Libra pre-salt block. The block, which was located in the Santos Basin, covers an area of about 1,548 square kilometers, and reserves were estimated to be between 3.7 to 15 Gbbl. The ANP awarded to the consortium made up of Petrobras (40% interest), Royal Dutch Shell plc of the United Kingdom (20%), Total S.A. of France (20%), and China National Offshore Oil Corp. and China National Petroleum Corp. (10% each) the rights and obligation for the pre-salt block. The consortium's exploration program included three-dimensional seismic studies for the entire area, two exploratory wells, and one extended well test. Petrobras would be the operator of the Libra (Agência Nacional do Petróleo, Gás Natural e Biocombustíveis, 2013; Petróleo Brasileiro S.A., 2014b, 2015a).

**Renewable Energy.**—In 2013, sources of primary energy in Brazil included nonrenewable energy sources, such as petroleum (which accounted for about 41% of the total primary energy production), natural gas (11%), and steam coal and uranium (1% each), and renewable energy, which accounted for about 46% of the total primary energy production. Renewable sources included hydraulic sources, firewood, and sugar cane products. Brazil's total energy consumption increased by 3% compared with that of 2012. Brazil's total energy consumption sources included oil products, which included diesel oil, fuel oil, gasoline, kerosene, liquefied petroleum gas, and naphtha (about 44%), and natural gas (7%). Domestic electricity supply by sources included hydraulic (71%), natural gas (11%), biomass (8%), oil products (4%), carbon (3%), nuclear (2%), and wind (1%) (Empresa de Pesquisa Energética, 2014, p. 16, 19–24).

In 2013, ethanol production in the country increased by 18%, and biodiesel, by 7%. The southeast region of the country was the leading producer of ethanol and accounted for 62% of the total production. In 2013, Brazil exported about 2.9 billion cubic meters of ethanol compared with about 3.1 billion cubic meters in 2012 and imported about 131.7 million cubic meters of ethanol compared with 553.9 million cubic meters in 2012. The United States received about 60% of the country's ethanol exports in 2013. Brazil had 64 biodiesel plants with a combined capacity of about 22,000 cubic meters per year. Petrobras, through its subsidiary Petrobras Biocombustíveis, owned three plants located in the States of Bahia, Ceara, and Minas Gerais with a combined capacity of about 1,300 cubic meters per year. Petrobras planned to invest about \$2.3 billion in Petrobras Biocombustíveis for the period between 2014 and 2018. The company expected to

increase by 24% its share in the biodiesel market and by 15% in the ethanol market by 2030 (National Agency of Petroleum Natural Gas and Biofuels, 2014, p. 62–67; Petróleo Brasileiro S.A., 2014b, p. 14; Petrobras Biocombustíveis, 2015).

## Reserves and Resources

Brazil was among the world leaders in its reserves of some mineral commodities (table 3). According to the DNPM, the country's world rankings for reserves of mineral commodities were as follows: first, barite, graphite, and niobium; second, tantalum and rare earths; third, nickel and tin; and fourth, iron ore, magnesite, manganese, talc, vanadium, and zirconium (Departamento Nacional de Produção Mineral, 2014b, p. 3).

## Outlook

According to the International Monetary Fund, Brazil is recovering gradually from the slowdown in growth that started in mid-2011, but the recovery remains uneven and inflation elevated. Output is estimated at potential with supply-side constraints linked to tight labor market conditions and protracted weak investment since 2011, which is limiting near-term growth. The recovery is likely to continue during 2014, supported by investment and consumption. The country forecasted an increase in the GDP of 0.1% in 2014. According to the Economic Commission for Latin America and the Caribbean, Brazil is likely to post slower growth in 2014. Foreign trade in goods is likely to decrease in 2014—exports by 3.0% and imports by 3.2% (International Monetary Fund, 2013, p. 2; 2015, p. 3; Economic Commission for Latin America and the Caribbean, 2014, p. 27, 48).

Leading sources of investments in the mineral sector were likely to be consortia, joint ventures, and acquisitions in new projects with Petrobras, Vale, and other domestic companies. Brazil is likely to increase the number of domestic and foreign investors in the country, if proposed developments in the mineral industry, in particular, in the metals, natural gas and petroleum, and biofuels and ethanol industries come to fruition. In the short term, investors will continue waiting for the legal and regulatory definitions of the new proposed regulatory framework for mining and improvement in the global mineral commodities market to validate planned investments. In the long term, new projects, such as the development of the Boa Vista fresh rock, the Braúna diamond, and the Rondon Alumina projects; the commissioning of Ernesto/Pau-a-Pique, Pilar, and Santa Luz gold mines; the possibility of developing the Corpo Soul and Coruja gold deposits; the expansion of the Salobo copper project; and the construction of the Carajas plant, the Conceição Itabirito's concentration plant, and Samarco Mineração's fourth pellet plant are likely to increase interest in nonfuel mineral prospecting and to attract investments. If the development of the Brauna project comes to fruition, the diamond mine is likely to become the first in South America. In the longer term, increasing the country's crude oil and natural gas production from the large pre-salt crude oil deposits could transform Brazil into one of the leading crude oil producers in the world. Also, Petrobras's investments in biofuels indicate

its commitment to the development of renewable energy sources, along with creating and improving technologies that ensure global leadership in the production of biofuels through consortiums with foreign investors.

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

(Metric tons unless otherwise specified)

Commodity <sup>2,3</sup>	2009	2010	2011	2012	2013
<b>METALS</b>					
<b>Aluminum:</b>					
Bauxite, dry basis, gross weight	28,060,000	29,000,000	31,768,000	33,260,000	32,867,000
Alumina	7,800,000	9,433,000	10,306,000 <sup>r</sup>	10,320,000 <sup>r</sup>	10,517,000
<b>Metal:</b>					
Primary	1,536,000	1,536,000	1,440,000	1,436,000	1,304,000
Secondary	250,000	252,000	240,000	230,000	208,000
Total	1,786,000	1,788,000	1,680,000	1,666,000	1,512,000
<b>Chromium:</b>					
Crude ore	365,210	520,129	542,512	472,501	485,951
Concentrate and lump, Cr <sub>2</sub> O <sub>3</sub> content	246,900	258,308	217,198	187,070	189,088
<b>Cobalt:</b>					
Mine output	2,075	3,139	3,623	2,900	3,500
Metal	1,012	1,369	1,614	1,750	1,871
<b>Copper:</b>					
Mine output, Cu content	211,692	213,548	213,760	223,141	270,979
<b>Metal, refined:</b>					
Electrowon	6,500	4,497 <sup>r</sup>	4,500 <sup>r</sup>	4,374 <sup>r</sup>	4,000
Primary	193,899	222,297	222,550	186,000	234,150
Secondary	31,000	23,000	22,800	24,700	27,800
Total	231,399	249,794 <sup>r</sup>	249,850 <sup>r</sup>	215,074 <sup>r</sup>	265,950
<b>Gold:</b>					
Mine output					
	kilograms				
Garimpeiros, independent miners					
	do.				
Total					
	do.				

See footnotes at end of table.

TABLE 1—Continued  
BRAZIL: PRODUCTION OF MINERAL COMMODITIES<sup>1</sup>

(Metric tons unless otherwise specified)

Commodity <sup>2,3</sup>	2009	2010	2011	2012	2013	
METALS—Continued						
Iron and steel:						
Iron ore and concentrate, marketable product:						
Gross weight	thousand metric tons	298,528	372,120	398,131	400,822	386,270
Fe content	do.	198,771	247,772	265,091	258,129	245,668
Metal:						
Pig iron	do.	25,135	30,898	33,243	30,745	30,000
Ferroalloys, electric arc furnace:						
Ferrochromium		131,048	277,114	145,122	165,532	189,088
Ferrochromium silicon		11,506	16,020	8,378	9,556	10,200
Ferromanganese		42,317 <sup>r</sup>	92,047 <sup>r</sup>	82,271 <sup>r</sup>	93,553 <sup>r</sup>	93,273
Ferronickel		37,708 <sup>r</sup>	33,860 <sup>r</sup>	90,800 <sup>r</sup>	148,800 <sup>r</sup>	169,200
Ferroniobium (ferrocolumbium)		34,746	52,588	53,691 <sup>r</sup>	50,562 <sup>r</sup>	46,555
Silicomanganese		111,777 <sup>r</sup>	213,761 <sup>r</sup>	213,729 <sup>r</sup>	213,447 <sup>r</sup>	217,727
Silicon metal <sup>c</sup>		132,000	132,000	132,000 <sup>r</sup>	133,000 <sup>r</sup>	134,000
Other ferroalloys		25,685	32,897	34,462	33,449	33,500 <sup>e</sup>
Total <sup>c</sup>		526,800 <sup>r</sup>	850,300 <sup>r</sup>	788,100 <sup>r</sup>	874,000 <sup>r</sup>	917,500
Crude steel, excluding castings	thousand metric tons	26,500	32,928	35,220 <sup>r</sup>	34,524 <sup>r</sup>	34,163
Lead:						
Mine output, Pb content in concentrate		15,890	19,650	15,100	16,953	19,468
Metal, secondary		104,160	114,887	138,537	165,397	151,964
Manganese:						
Ore and concentrate, marketable: <sup>4</sup>						
Gross weight		2,320,000	3,125,000	2,738,000 <sup>r</sup>	2,796,000 <sup>r</sup>	2,833,000
Metal content		900,000 <sup>r</sup>	1,223,000	1,139,000 <sup>r</sup>	1,164,000 <sup>r</sup>	1,180,000
Metal: <sup>c</sup>						
Primary		19,580 <sup>5</sup>	19,600	19,600	19,600	19,600
Secondary		1,520 <sup>5</sup>	1,710	1,710	1,710	1,710
Nickel:						
Mine output, ore		4,333,069	11,128,385	13,203,844	14,749,112	13,006,961
Ni content in ore		41,059	108,983	131,673	139,230	104,829
Ni content in carbonate		16,766	18,580	19,381	19,611	19,958
Ni content in matte		8,518	14,308	13,703	14,345	11,641
Ni, electrolytic		16,598	19,111	20,521	21,437	19,823
Ferronickel, Ni content		9,427	8,465	16,750	31,342	34,501
Niobium (columbium)-tantalum ores and concentrates, gross weight:						
Columbite and tantalite		218	176	136	118	185
Pyrochlore concentrate, Nb <sub>2</sub> O <sub>5</sub> content		88,920	63,329	64,657	82,214	73,668
Rare-earth metals, monazite concentrate, gross weight <sup>6</sup>		303	249	290	206	600
Silver						
Primary	kilograms	35,000	37,000	37,600	36,400	38,200
Secondary	do.	31,000	32,000	34,000	35,500	34,300
Total	do.	66,000	69,000	71,600	71,900	72,500
Tin:						
Mine output, Sn content		9,500	10,400	10,725	13,667	16,830
Metal, smelter, primary		8,311	9,098	9,382	11,955	14,721
Titanium:						
Ilmenite:						
Gross weight		52,800	166,000 <sup>e</sup>	166,000 <sup>e</sup>	166,000 <sup>e</sup>	166,000 <sup>e</sup>
TiO <sub>2</sub> content		39,117	53,928	68,804	69,071	78,264
Rutile, TiO <sub>2</sub> content		2,737	2,331	2,350	1,881	2,021
Tungsten, mine output, W content		192	166	244	381	494
Zinc:						
Mine output, Zn content		172,688	211,203	197,840	164,258	152,147
Metal, smelter, primary		242,136	288,107	284,770	246,526	242,000 <sup>e</sup>
Zirconium, zircon concentrate, gross weight <sup>7</sup>		34,248	23,236	23,283	20,425	21,154

See footnotes at end of table.

TABLE 1—Continued  
BRAZIL: PRODUCTION OF MINERAL COMMODITIES<sup>1</sup>

(Metric tons unless otherwise specified)

Commodity <sup>2,3</sup>	2009	2010	2011	2012	2013
<b>INDUSTRIAL MINERALS</b>					
Asbestos, fiber	288,452	302,257	306,321	304,569	290,825
Barite:					
Crude	196,860	198,161	216,478	186,134	34,943
Beneficiated	49,847	41,385	7,039	3,025	--
Calcite	14,565	18,930	28,718	33,077	33,131
Cement, hydraulic	51,748	59,118	64,093	69,323 <sup>r</sup>	69,975
Clays:					
Bentonite, beneficiated	264,243	531,693	566,267	512,975	434,000
Kaolin:					
Crude	7,928,000	6,451,000	6,216,000	7,059,000	6,461,000
Beneficiated	1,987,000	2,000,000	1,927,000	2,189,000	2,139,000
Diamond, gem and industrial: <sup>c</sup>					
Private sector	11	13	18	19	19
Garimpagem	10	12	28	30	30
Total <sup>8</sup>	21	25	46	49 <sup>r</sup>	49
Diatomite:					
Crude	7,534	9,264	4,415	3,427	1,947
Beneficiated	4,350	4,082	4,224	1,987	2,475
Feldspar:					
Crude ore	160,760	363,251	416,008	328,001	320,048
Beneficiated	115,264	276,448	333,352	247,152	294,357
Fluorspar:					
Concentrates, marketable product:					
Acid-grade	28,803	6,295	6,197	5,768	6,835
Metallurgical-grade	15,161	18,152	18,843	18,380	20,886
Total	43,964	24,447	25,040	24,148	27,721
Graphite, concentrate	59,425	92,364	105,188	88,110	91,908
Gypsum and anhydrite, crude	2,348,390	2,638,096	3,228,931	3,749,860	3,332,991
Lithium, concentrates	15,929	15,733	7,820	7,084	7,982
Magnesite:					
Crude	1,234,041	1,535,052	1,576,871	1,753,067	1,542,420
Beneficiated	409,909	483,882	476,805	479,304	557,431
Phosphate rock, including apatite:					
Concentrate:					
Gross weight	6,084	6,192	6,738	6,740	6,715
P <sub>2</sub> O <sub>5</sub> content	2,163	2,179	2,374	2,388	2,504
Potash, marketable (K <sub>2</sub> O)	452,698	417,990	395,002	346,509	310,892
Potassium (KCl)	716,630	661,690	625,300	548,500	492,151
Quartz crystal, all grades	11,588	13,024	17,657	16,254	10,696
Salt:					
Marine	4,462	5,615	4,829	6,079	5,926
Rock	1,443	1,415	1,335	1,403	1,349
Total	5,905	7,030	6,164	7,482	7,275
Sulfur, byproduct:					
Metallurgy	275,593 <sup>r</sup>	286,875 <sup>r</sup>	322,120 <sup>r</sup>	274,693 <sup>r</sup>	324,405
Petroleum	143,599 <sup>r</sup>	143,147 <sup>r</sup>	170,136 <sup>r</sup>	222,561 <sup>r</sup>	218,014
Total	419,192 <sup>r</sup>	430,022 <sup>r</sup>	492,256 <sup>r</sup>	497,254 <sup>r</sup>	542,419
Talc and pyrophyllite, crude	577,935	507,085	578,954 <sup>r</sup>	593,140 <sup>r</sup>	737,950
Vermiculite, concentrate	50,438	49,976	54,970	51,986	68,014
<b>MINERAL FUELS AND RELATED MATERIALS</b>					
Coal, bituminous:					
Run-of-mine	13,578	11,837	12,306	12,704	14,376
Beneficiated/marketable <sup>4</sup>	5,818	5,743	5,614	6,635	7,407
Coke, metallurgical, all types	7,259	9,189	8,286	8,681	8,700 <sup>e</sup>

See footnotes at end of table.

TABLE 1—Continued  
 BRAZIL: PRODUCTION OF MINERAL COMMODITIES<sup>1</sup>

(Metric tons unless otherwise specified)

Commodity <sup>2,3</sup>	2009	2010	2011	2012	2013
MINERAL FUELS AND RELATED MATERIALS—Continued					
Natural gas, gross million cubic meters	21,141 <sup>r</sup>	22,938 <sup>r</sup>	24,074 <sup>r</sup>	25,832 <sup>r</sup>	28,174
Natural gas liquids million 42-gallon barrels	28,717 <sup>r</sup>	30,204 <sup>r</sup>	31,942 <sup>r</sup>	32,131 <sup>r</sup>	32,938
Petroleum: <sup>9</sup>					
Crude <sup>10</sup> thousand 42-gallon barrels	711,883 <sup>r</sup>	749,954 <sup>r</sup>	768,471 <sup>r</sup>	754,409 <sup>r</sup>	738,715
Refinery products:					
Asphalt do.	13,145	17,405	15,501	16,162	16,689
Fuel oil do.	88,394	87,396	83,077	86,113	92,844
Gasoline do.	131,297 <sup>r</sup>	145,086 <sup>r</sup>	156,528 <sup>r</sup>	170,206 <sup>r</sup>	186,934
Jet fuel do.	27,555 <sup>r</sup>	29,339 <sup>r</sup>	33,934 <sup>r</sup>	34,108 <sup>r</sup>	34,935
Kerosene do.	27,272 <sup>r</sup>	29,492 <sup>r</sup>	34,128 <sup>r</sup>	34,260 <sup>r</sup>	35,034
Liquefied petroleum gas do.	62,952 <sup>r</sup>	61,002.66 <sup>r</sup>	62,698 <sup>r</sup>	65,171 <sup>r</sup>	64,332
Lubricants do.	3,735 <sup>r</sup>	3,793.66 <sup>r</sup>	3,652 <sup>r</sup>	3,824 <sup>r</sup>	4,335
Naphtha do.	52,913	46,265.56	39,902	40,506	33,675
Solvents do.	2,906	3,199.60	2,558	1,826	2,857
Total do.	410,169 <sup>r</sup>	422,980 <sup>r</sup>	431,979 <sup>r</sup>	452,176 <sup>r</sup>	471,636 <sup>r</sup>

<sup>6</sup>Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. <sup>r</sup>Revised. do. Ditto. -- Zero.

<sup>1</sup>Table includes data available through March 10, 2015.

<sup>2</sup>In addition to the commodities listed, bismuth, crude graphite, crude sodalite, ferrosilicon, ferrosilicon magnesium, inoculant, leucite, molybdenite, precious and semiprecious stones except diamond, sand and gravel, silica (silica), sodium compounds, stone, uranium oxide, and other minerals are produced, but available information is inadequate to make reliable estimates of output.

<sup>3</sup>Source: Departamento Nacional de Produção Mineral, Sumário Mineral 2013 and 2014.

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

<sup>5</sup>Reported figure.

<sup>6</sup>Production was derived from stockpiled mineral concentrates.

<sup>7</sup>Includes baddeleyite-caldasite.

<sup>8</sup>Figures represent officially reported diamond output plus official estimates of output by nonreporting miners.

<sup>9</sup>Source: Agência Nacional do Petróleo, Gás Natural e Biocombustíveis, Oil, Natural Gas and Biofuels Statistical Mineral Yearbook 2014; Empresa de Pesquisa Energética, Ministério de Minas e Energia, Brazilian Energy Balance.

<sup>10</sup>Condensates are included.

TABLE 2  
BRAZIL: STRUCTURE OF THE MINERAL INDUSTRY IN 2013

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners		Location of main facilities	Annual capacity <sup>c</sup>
<b>METALS</b>				
Alumina	Alcoa Alumínio S.A. (Alcoa Inc., 100%)		Pocos de Caldas, Minas Gerais State (refinery)	390.
Do.	Alcoa World Alumina Brasil Ltda. (Alcoa Inc. and Alumina Ltd., 39%; BHP Billiton plc, 36%; Alcoa Alumínio S.A., 15%; Rio Tinto Alcan Inc., 10%)		Sao Luiz, Maranhao State (refinery)	3,500.
Do.	Alumina do Norte do Brasil S.A. (Norsk Hydro ASA, 91%)		Barcarena, Para State (refinery)	6,200.
Do.	Companhia Brasileira de Alumínio S.A. (CBA) (Votorantim Group, 100%)		Aluminio City, Sao Paulo State (refinery)	475.
Do.	Novelis do Brasil Ltda. (Hindalco Industries Ltd., 100%)		Ouro Preto, Minas Gerais State (refinery)	145.
Aluminum	Albras Alumínio Brasileiro S.A. (Norsk Hydro ASA, 51%, and Nippon Amazon Alumínio Co. Ltd., 49%)		Barcarena, Para State (smelter)	460.
Do.	Alcoa Alumínio S.A. (Alcoa Inc., 100%)		Pocos de Caldas, Minas Gerais State (smelter)	96.
Do.	Alcoa Alumínio S.A., 60%, and BHP Billiton plc, 40%		Sao Luiz, Maranhao State (smelter)	447.
Bauxite	Alcoa Alumínio S.A. (Alcoa Inc., 100%)		Pocos de Caldas, Minas Gerais State (mine)	1,100.
Do.	Alcoa World Alumina Brasil Ltda. (Alcoa Inc., 60%, and Alumina Ltd., 40%)		Juruti, Para State (mine)	4,400.
Do.	Companhia Brasileira de Alumínio S.A. (CBA) (Votorantim Group, 100%)		Itamarati de Minas, Mirafá, and Pocos de Caldas Mines, Minas de Gerais State (mines)	3,000.
Do.	Mineração Paragominas S.A. (Norsk Hydro ASA, 67.9%, and Vale S.A., 32.1%)		Paragominas, Para State (mine)	9,200.
Do.	Mineração Rio do Norte S.A. (Vale S.A., 40%; BHP Billiton plc, 14.8%; Rio Tinto Alcan Inc., 12%; Companhia Brasileira de Alumínio S.A. (CBA), 10%; Alcoa Alumínio S.A., 8.58%; Alcoa World Alumina, 5%; Norsk Hydro ASA, 5%; Alcoa World Alumina Brasil Ltda, 4.62%)		Porto Trombetas, Para State (mine)	18,100.
Chromite	Companhia de Ferro Ligas da Bahia (FERBASA) (private, 100%)		Pedrinhas Mine, Campo Formosa, Bahia State	120 (concentrate).
Do.	do.		Ipueira Mine, Campo Formosa, Bahia State	48 (concentrate).
<b>Copper:</b>				
Concentrate	Mineração Caraíba S/A (Glencore plc, 28.5%)		Jaguarari, Bahia State (3 mines)	30.
Do.	do.		Salobo Mine, Carajas, Para State	100.
Do.	Yamana Gold Inc. (private, 100%)		Chapada Mine, Goias State	85.
Refinery	Caraíba Metais S.A. (Paranapanema S.A., 100%)		Camacari, Bahia State (electrolytic plant)	280.
Do.	Mineração Caraíba S/A (Glencore plc, 28.5%)		Jaguarari, Bahia State (electrowinning plant)	5.
Ferroalloys	Vale Manganês S.A. (Vale S.A., 100%)		Barbacena, Minas Gerais State (plant)	74.
Do.	do.		Ouro Preto, Minas Gerais State (plant)	65.
Do.	do.		Simões Filho, Bahia, Mato Grosso do Sul (plant)	150.
Gold kilograms	Vale S.A. (private, 100%)		Sosso Mine, Carajas, Para State	3,000.
Do.	do.	do.	Salobo Mine, Carajas, Para State	4,000.
Do.	do.	Beadell Resources Ltd. (private, 100%)	Tucano Mine, Amapa State	6,200.
Do.	do.	AngloGold Ashanti Córrego do Sítio Mineração (Anglo GoldAshanti Ltd., 100%)	Sabara and Santa Barbara, Minas Gerais State	8,100.
Do.	do.	do.	Serra Grande Mines, Crixas, Goias State (3 mines)	6,000.
Do.	do.	Jaguar Mining Inc., 100%	Caeté Mines, Minas Gerais State (2 mines)	4,000.
Do.	do.	do.	Turmalina Mine, Minas Gerais State	3,000.
Do.	do.	Kinross Brasil Mineração S.A. (Kinross Gold Corp., 100%)	Paracatu Mine, Minas Gerais State	16,000.
Do.	do.	Reinarda Mineração Ltda (Troy Resources Ltd., 100%)	Andorinhas Mine, Para State	1,400.
Do.	do.	Yamana Gold Inc. (private, 100%)	Chapada Mine, Goias State	4,000.
Do.	do.	do.	Jacobina Mine, Bahia State	4,000.
Do.	do.	do.	Fazenda Brasileiro Mine, Goias State	2,000.
<b>Iron ore and steel:</b>				
Iron ore	Companhia Siderúrgica Nacional S.A. (private, 100%)		Casa de Pedra Mine, Congonhas, Minas Gerais State	21,000.
Do.	Itaminas Comércio de Minérios S.A. (private, 100%)		Itaminas, Minas Gerais State	5,000.
Do.	Mineração Usiminas S.A. (Usiminas, 70%, and Sumitomo Corp., 30%)		Quadrilátero Ferrífero, Serro Azul, Minas Gerais State (4 mines)	12,000.

See footnotes at end of table.



TABLE 2—Continued  
BRAZIL: STRUCTURE OF THE MINERAL INDUSTRY IN 2013

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity <sup>c</sup>
METALS—Continued			
Iron ore and steel:			
Iron ore—Continued	MMX Sudeste Mineração Ltda. (private, 100%)	Tico-Tico and Ipe Mines, Serro Azul, Minas Gerais State (mines)	6,000.
Do.	do.	Corumba, Mato Grosso do Sul State (mines)	1,500.
Do.	Samarco Mineração S.A. (Vale S.A., 50%, and BHP Billiton Ltd., 50%)	Alegria and Germano Mines, Minas Gerais State (2 mines)	22,000.
Do.	Vale S.A. (private, 100%)	Carajas Mine, Parauapebas, Para State (3 mines)	110,000.
Do.	do.	Itabira, Mariana, and Minas Centrais, Minas (8 mines)	120,000.
Do.	do.	Minas Itabirito, Vargem Grande, and Paraopeba, Minas Gerais State (11 mines)	80,000.
Do.	do.	Urucum and Corumba Mines, Mato Grosso do State (2 mines)	6,500.
Do.	Zamin Ferrous Ltd., 100%	Amapa Mine, Amapa State	6,000
Pellets	Companhia Hispano Brasileira De Pelotização S.A. (Vale S.A., 50.9%, and ArcelorMittal, 49.1%)	Hispanobras, Espirito Santo State (pellet plant)	4,300.
Do.	Samarco Mineração S.A. (Vale S.A., 50%, and BHP Billiton Ltd., 50%)	Ponta Ubu, Anchieta, Espirito Santo State (three pellet plants)	22,300.
Do.	Vale S.A. (private, 100%)	Tubarao I and II, Espirito Santo State (pellet	29,200. <sup>1</sup>
Do.	do.	Fabrica, Minas Gerais State (pellet plant)	4,500.
Do.	do.	Sao Luis, Maranhao State (pellet plants)	7,500. <sup>1</sup>
Do.	do.	Vargem Grande, Minas Gerais State (pellet	7,000.
Steel, crude	Gerdau Açominas S.A. (Gerdau S.A., 100%)	Rodovia, Minas Gerais State	7,600.
Do.	Aperam S.A. (private, 100%)	Timoteo, Minas Gerais State (specialty steel)	900.
Do.	ArcelorMittal Tubarão (ArcelorMittal)	Grande Vitoria, Espirito Santo	7,500
Do.	Companhia Siderúrgica Nacional (private, 100%)	Volta Redonda, Rio de Janeiro State	5,600.
Do.	Usinas Siderúrgicas de Minas Gerais, S.A. (private, 100%)	Ipatinga, Minas Gerais State and Cubatao, Sao Paulo	9,500.
Do.	Siderúrgica Norte Brasil S.A. (private, 100%)	Maraba, Para State	390.
Lead	Votorantim Metais (Votorantim Group, 100%)	Moro Agudo Mine, Paracatu, Minas Gerais State	13.
Manganese	Vale Manganês S.A. (Vale S.A., 100%)	Morro da Mina, Minas Gerais State	100.
Do.	Vale Mina do Azul S.A. (Vale S.A., 100%)	Mina do Azul, Carajas, Para State	1,900.
Do.	Mineração Corumbaense Reunida S.A. (Vale S.A., 100%)	Urucum, Mato Grosso do Sul State	400.
Nickel	Anglo American plc, 100%	Barro Alto, Goias State (refinery)	36 (metal).
Do.	CODEMIN S.A. (Anglo American plc, 100%)	Condemin, Goias State (refinery)	10 (metal).
Do.	Votorantim Metais (Votorantim Group, 100%)	Fortaleza de Minas, Minas Gerais State (mine)	19 (nickel matte). <sup>1</sup>
Do.	do.	Niquelandia, Goias State (mine)	30 (ore).
Do.	do.	Niquelandia, Goias State and Sao Miguel Paulista, Sao Paulo (refinery plants)	25 (electrolytic).
Do.	Vale S.A. (private 100%)	Onca Puma, Ourilandado Norte, Para State	25 (iron-nickel alloy).
Niobium (columbium)	Companhia Brasileira de Metalurgia e Mineração (Moreira Salles Group., 70%)	Araxa, Minas Gerais State (mine)	120 (ore).
Do.	do.	Araxa, Minas Gerais State (beneficiation plant)	6,000 (pyrochlore).
Do.	Anglo American Niobio Brasil Ltda. (Anglo American plc, 100%)	Boa Vista, Goias State (mine)	4.
Do.	do.	Ouvidor, Goias State (beneficiation plant)	1,300 (pyrochlore).
Tantalum	metric tons Mineração Taboca S.A. (Minsur, 100%)	Pitinga Mine, Amazonas State and Fundicion de Pinpora, Sao Paulo State	120 (concentrate).
Do.	do. AMG Mineração S.A. (Advanced Metallurgical Group N.V., 100%)	Volte Grande Mine, Nazareno, Minas Gerais State	25 (concentrate).
Tin	do. Estanho de Rondônia S.A. (Companhia Siderúrgica Nacional, 100%)	Santa Barbara (mine) and Ariquemes (smelter)	3,600 (concentrate).
Do.	do. Mineração Taboca S.A. (Minsur, 100%)	Pitinga Mine, Amazonas State and Fundicion de Pinpora, Sao Paulo State	5,000 (concentrate).

See footnotes at end of table.

TABLE 2—Continued  
BRAZIL: STRUCTURE OF THE MINERAL INDUSTRY IN 2013

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity <sup>c</sup>
<b>METALS—Continued</b>			
Titanium	Indústrias Nucleares do Brasil S/A	San Francisco de Itabapoana, Rio de Janeiro State	NA.
Do.	Millenium Inorganic Chemicals Mineração Ltda. (Cristal Global Group, 100%)	Mataraca, Paraíba State (mine)	4,200 (ore).
Do.	do.	Mataraca, Paraíba State (beneficiation plants)	120 (concentrate).
Zinc	Votorantim Metais Zinco S/A (Grupo Votorantim, 100%)	Vazante Mine, Minas Gerais State	165.
Do.	do.	Moro Agudo Mine, Paracatu, Minas Gerais State	38.
Do.	do.	Tres Marias, Minas Gerais State	180 (metal).
Do.	do.	Juiz de Fora, Minas Gerais State	95 (metal).
Zirconium	Indústrias Nucleares do Brasil S/A	San Francisco de Itabapoana, Rio de Janeiro State	NA.
Do.	Millenium Inorganic Chemicals Mineração Ltda. (Cristal Global Group, 100%)	Mataraca, Paraíba State (mine)	NA.
Do.	do.	Mataraca, Paraíba State (beneficiation plants)	NA.
<b>INDUSTRIAL MINERALS</b>			
Asbestos	Sociedade Anônima Mineração de Amianto S.A. (Eternit Group, 100%)	Cana Brava Mine and plant, Minacu, Goiás State	300 (concentrate).
Cement	Companhia de Cimento Itambé (private, 100%)	Itambe plant, Balsa Nova, Parana State	2,800.
Do.	Cimento Nacional (Brennand Group, 100%)	Sete Lagoas plant, Minas Gerais State	1,000.
Do.	Cimento Nassau (John Santos Group, 100%)	States of Amazonas, Ceara, Espirito Santo, Maranhao, Para, Piaui, Pernambuco, Rio Grande do Norte, and Sergipe (10 plants)	7,000.
Do.	Cimento Planalto S.A. (private, 100%)	Sobradinho, Brasília, Distrito Federal State	1,600.
Do.	Cimento Tupi S.A. (private, 100%)	Carandai plant, Minas Gerais State; and Mogi das Cruzes, Sao Paulo State, and Volta, Redonda plant, Rio de Janeiro State;	3,500.
Do.	Holcim (Brasil) S.A. (Holcim Ltd., 100%)	Barroso, Cantagalo, Leopoldo, Sorocaba and Vitoria plants, Sao Paulo State	5,400.
Do.	InterCement Brasil S.A. (Camargo Correa S.A., 100%)	States of Alagoas, Bahia, Goiás, Minas Gerais, Paraíba, Pernambuco, Sao Paulo, Mato Grosso do Sul, and Rio Grande do Sul (16 plants)	17,900.
Do.	Lafarge Brasil S.A. (Lafarge S.A. 99.76%)	States of Bahia, Goiás, Minas Gerais, Paraíba, Rio de Janeiro, and Sao Paulo (9 plants)	7,100.
Do.	Mizu Cimentos Especiais (private, 100%)	States of Rio de Janeiro, Rio Grande do Norte, Espirito Santo, Sao Paulo, and Sergipe (6 plants)	3,000.
Do.	Votorantim Cimentos S.A. (Grupo Votorantim, 100%)	Cubatao, Ribeirao Grande, Salto de Pirapora, and Santa Helena plants Sao Paulo State Itau de Minas plant, Minas Gerais State Rio Branco do Sul plant, Parana State Laranjeiras plant, Sergipe State Candiota, Charqueadas, Esteio, and Pinheiro Machado plants, Rio Grande do Sul State Caucaia and Sobral plants, Ceara State Sobradinho plant, Distrito Federal State Edealina plant, Goiás State Cuiaba and Nobres plants, Mato Grosso State Campo Grande and Corumba plants, Mato Grosso do Sul State Barcarena and Primavera plants, Para State Mineradora Ponta da Serra, Ouricuri, and Paulista plants, Pernambuco State Cantagalo, Sepetiba, Volta Redonda plants, Rio de Janeiro State Porto Velho plant, Rondonia State Capivari de Baixo, Imbituba, and Itajai plants, Santa Catarina State Xambioa, Tocantins State	23,000 (combined).

See footnotes at end of table.

TABLE 2—Continued  
BRAZIL: STRUCTURE OF THE MINERAL INDUSTRY IN 2013

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners		Location of main facilities	Annual capacity <sup>c</sup>
<b>INDUSTRIAL MINERALS—</b>				
Continued				
Fluorspar	Mineração Nossa Senhora do Carmo Ltda. (private, 100%)		Cerro Azul, Parana State (2 mines)	180 (ore).
Graphite	Extrativa Metalquímica S/A (private, 100%)		Maiquinique, Bahia State (mine)	2 (concentrate).
Do.	JMN Mineração S/A (private, 100%)		Mateus Leme, Minas Gerais State	2 (concentrate).
Do.	Nacional de Grafite Ltda. (private, 100%)		Itapecerica, Pedra Azul, Salto da Divisa, Minas Gerais State (3 mines and 3 beneficiation plants)	90 (concentrate).
Gypsum	Companhia Brasileira de Equipamento (private, 100%)		Codo, Maranhao State, and Ipubi, Pernambuco State (2 mines)	600 (ore).
Do.	Mineradora São Jorge S.A (private, 100%)		Araripe, Pernambuco State	800.
Do.	Votorantim Cimentos S.A. (Votorantim Group, 100%)		Mateo, Ceara State (mine)	NA.
Kaolin	Imerys Rio Capim Caulim S.A. (Imerys Group, 100%)		Ipixuna, Para State (2 mines)	NA.
Do.	do.		Barcarena, Para State (beneficiation plant)	NA.
Magnesite	Ibar Nordeste S.A. (private, 100%)		Brumado, Bahia State	NA.
Do.	Magnesita Refratários S.A. (private, 100%)		do.	1,200 (ore).
Do.	Xiolite S.A. (private, 100%)		do.	NA.
Phosphate rock	Copebrás S.A. (Anglo American plc, 100%)		Ouvidor, Goiás State (mine)	1,350 (concentrate).
Do.	Vale Fertilizantes S.A. (Vale S.A., 100%)		Araxa, Patos de Minas, and Tapira Mines, Minas Gerais State	2,220.
Do.	do.		Catalao, Goiás State	1,100.
Do.	do.		Cajati, Sao Paulo State	550.
Vermiculite	Brasil Minérios Ltda. (private, 100%)		Sao Luiz dos Montes Belos, Goiás State	100 (concentrate).
<b>MINERAL FUELS AND RELATED MATERIALS</b>				
Coal	Carbonífera Circúma S.A. (private, 100%)		Verdinho Mine, Forquilha, Santa Catarina State	2,800
Do.	Companhia Carbonífera Metropolitana S.A. (private, 100%)		Esperanca and Fontanella Mines, Santa Catarina State	1,200.
Do.	Copelmi Mineração Ltda. (private, 100%)		Butia, Cachoeira do Sul, and Charqueadas, Rio Grande do Sul State (4 mines)	3,000.
Do.	Indústria Carbonífera Rio Deserto Ltda. (private, 100%)		Circúma and Urussanga, Santa Catarina State (2 mines)	2,600.
Natural gas	thousand cubic meters	Petróleo Brasileiro S.A. (Petrobras) (Government, 81.4%; private, 11.8%; public, 6.8%)	Offshore and onshore fields in the States of Alagoas, Amazonas, Bahia, Ceara, Espirito Santo, Rio de Janeiro, Rio Grande do Norte, Sao Paulo, and Sergipe	28,200.
Petroleum	thousand 42-gallon barrels	do.	Offshore and onshore fields in the States of Alagoas, Amazonas, Bahia, Ceara, Espirito Santo, Parana, Rio de Janeiro, Rio Grande do Norte, Sao Paulo, and Sergipe	740,000.
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	804,000.

<sup>c</sup>Estimated. Do., do. Ditto. NA Not available.

<sup>1</sup>Suspended.

TABLE 3  
BRAZIL: RESERVES OF MAJOR MINERAL COMMODITIES IN 2013

(Thousand metric tons unless otherwise specified)

Commodity <sup>1</sup>	Reserves
Asbestos, fiber	10,167
Bauxite	714,000
Chromite, Cr <sub>2</sub> O <sub>3</sub>	metric tons 504,000
Coal, all types	3,285,000 <sup>2</sup>
Cobalt, metal content	metric tons 77,500
Copper, metal content	11,145
Fluorspar (CaF <sub>2</sub> content)	2,086
Gold, metal content	metric tons 2,400
Graphite	72,064
Gypsum	291,807
Iron ore	23,126,000
Kaolin	7,068,000
Lead, metal content	metric tons 163,000
Lithium, metal content	do. 48,000
Magnesite	235,400
Manganese, metal content	50,029,000
Natural gas	million cubic meters 458,163 <sup>3</sup>
Nickel, metal content	10,371
Niobium, metal content	10,694
Petroleum, crude	million 42-gallon barrels 15,593 <sup>3</sup>
Phosphate rock	315,000
Rare earths, metal content	22,000
Talc and pyrophyllite	44,010
Tantalum, metal content	metric tons 35,387
Tin, metal content	do. 441,917
Titanium minerals, TiO <sub>2</sub>	2,600
Uranium, U <sub>3</sub> O <sub>8</sub>	metric tons 309,196 <sup>2</sup>
Vanadium, metal content	do. 175,000
Vermiculite	6,300
Zinc, metal content	1,783
Zirconium	2,566

do. Ditto.

<sup>1</sup>Source: Departamento Nacional de Produção Mineral, Summário Mineral 2014.

<sup>2</sup>Source: Empresa de Pesquisa Energética—Balanço Enegetico Nacional 2014.

<sup>3</sup>Source: National Agency of Petroleum Natural Gas and Biofuels, Statistical Mineral Yearbook 2014.