An overview of

Critical Minerals Potential of Brazil

SGB GEOLOGICAL SURVEY OF BRAZIL - CPRM

MINISTRY OF MINES AND ENERGY

FEDERAL GOVERNMENT BRASIL UNION AND RECONSTRUCTION

Organizers
Guilherme Ferreira da Silva
Ioná de Abreu Cunha
Iago S. Lima Costa

Contributors
Anderson Dourado R. da Silva
Débora Rabelo Matos
Gilmar José Rizzotto
Hugo José de Oliveira Polo
Izaac Cabral Neto
Leandro Guedes Bertossi
Maisa Bastos Abram
Marcelo de Souza Marinho
Marcelo Esteves Almeida
Marco Antônio G. Advíncula e Silva
Maurício Pavan Silva
Nívia Pina de Souza Santos
Rafael Bittencourt Lima
Rogério Celestino de Almeida
Tamara Reginatto Manfredi

Reviewers
Maisa Bastos Abram
Evandro Luiz Klein

Publishing
Guilherme Pinheiro
Ana Laura Barros
Heber Oliveira

Acknowledgement
Michelle Araújo

An overview of

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Foreword

"Recognizing the importance of the mining sector for the economic and social development of the country and aiming to contribute to a sustainable future, the Federal Government of Brazil, through the Ministry of Mines and Energy and the Secretariat of Geology, Mining, and Mineral Transformation are acting to boost the mining industry in Brazil. This effort focuses on creating a favorable environment for investments, ensuring regulatory stability and legal certainty, and increasing geological knowledge of the Brazilian territory. As a result of these positive actions, we present this publication containing essential information for the sector and the country's development."

Alexandre Silveira
Ministry of Mines and Energy

"Result of the high quality and excellent work carried out by the technical staff of the Directorate of Geology and Mineral Resources of the Geological Survey of Brazil, this document publication presents relevant information on the mineral deposits and main occurrences of Copper, Graphite, Lithium, Nickel, Phosphate, Potassium and Uranium. Information on these selected commodities' location, geological framework, reserves, and mineral status is presented here, contributing to a growing potential or summarizing the strength of consolidated mineral industries in the Brazilian territory. There is also information about the company's mining assets which, since 2019, have been up for auction for the private mining sector. The Geological Survey of Brazil fulfills its institutional role of providing pre-competitive geoscientific information in the hope that it may be helpful for its work. This document is available in a printed version and can be downloaded from the website www.sgb.gov.br."

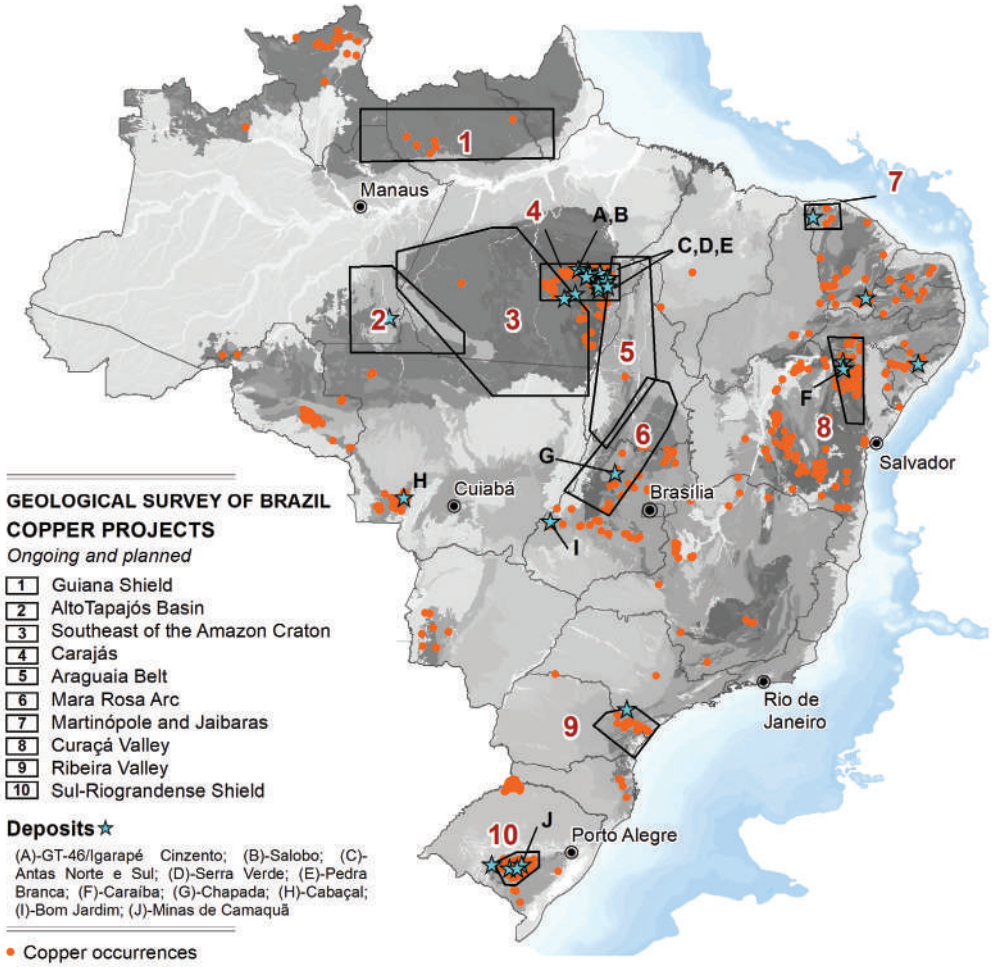
Cassiano de Souza Alves
Director-President of the Geological Survey of Brazil

"A relevant part of mineral production is intended for applications in the high technology industry, the clean energy generation industry, manufacturing of electric vehicles, robots, and electronic appliances and devices. In this scenario, Brazil is a recognized producer and exporter of several mineral commodities, being a global player in Nb, Fe, Mn, Ta, Al, and graphite, and a significant exporter of Ni, Mg, Sn, Cr, Au, Cu, and kaolin. Given this, following the mission of generating and disseminating geoscientific knowledge with excellence, it is with great satisfaction that the Geological Survey of Brazil, which is also a Scientific, Technological, and Innovation Institution (ICT), makes this report available with a brief Overview of the country's Critical Minerals Potential, addressing technical aspects on the subject, with information that also contributes a lot to the mineral sector."

Paulo Afonso Romano
Director of Geology and Mineral Resources

Summary

Copper



Mineral Royalties: 2%

1,6% world's mined copper[1]

Exported US$ 4.43 billion FOB[2]

US$ 68.5 millions in collected taxes[2]

99.5 Mt of producted ore (ROM)[2]

US$ 63.1 millions invested in exploration programs[2]

2246 Full-time Employments[2]

4503 Indirect Employments[2]

8th exporter world ranking[3]

11th importer world ranking[3]

[1]U.S. Geological Survey – USGS (2023). Mineral commodity summaries 2023. Data refers to 2022.

[2]National Mining Agency - ANM (2023). Anuário Mineral Brasileiro - 2022. Data refers to 2021.

[3]Fundação Gorceix (2022). Estudos para o Plano Nacional de Mineração 2050. Data refers to 2020.

Highlights

• Unlike the rest of the world, where copper is exploited mainly from porphyry-type deposits, Brazil has about 30 copper deposits and advanced prospects distributed, mostly, in the Magmatic Segregation / IOCG (36%), IOCG (26%) and VMS (13%), which add up to 74% of the total. Added to the deposits of magmatic segregation of mafic-ultramafic complexes, the total reaches 85%. Only one porphyry-type deposit has been described in Brazil, the Chapada deposit, in Alto Horizonte, GO (Sousa, 2021).

• The mineral potential of Brazilian copper is, almost entirely, in Precambrian domains. Most of the Brazilian copper deposits are located in the Mineral Province of Carajás, which also corresponds to the mineral province with the largest amount of metallic copper in the country, with an estimated total of 27.34 Mt contained metal. In Carajás, most of the deposits are of the IOCG type, but the Brazilian copper deposits are also classified as Volcanic Massive Sulfides, Porphyries, SEDEX, and Sediment-hosted.

• The Juruena – Teles Pires Mineral Province has the second greatest potential. It comprises 7.23% of copper contained in two VMS-type deposits; the biggest one is named Cabaçal, and it is a province with potential for discoveries for this mineral good in the porphyry copper and VMS models.

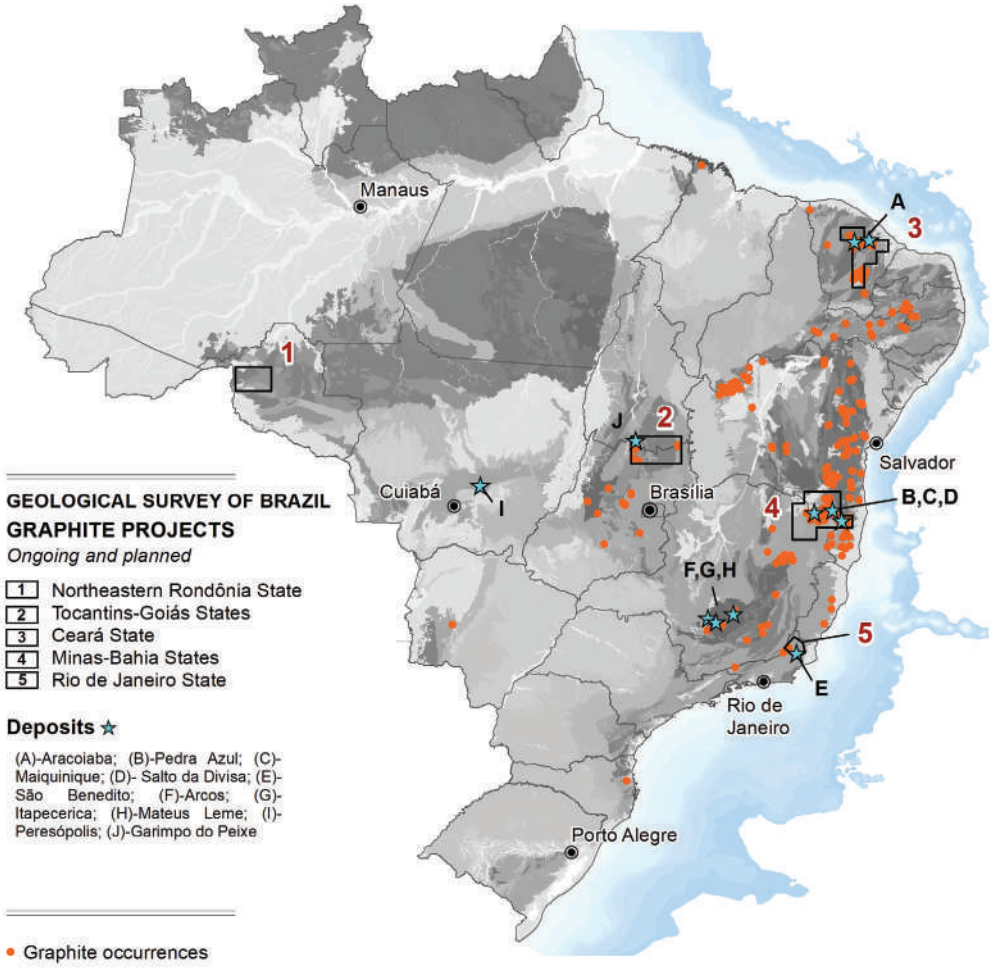
• The Goiás Magmatic Arc has an active copper mine, and potential for discoveries of medium to small metamorphosed porphyry copper deposits, as well as VMS deposits.

• The Cupriferous District of Vale do Curaçá has cataloged deposits of magmatic segregation. In recent works, alterations and characteristics of IOCG-type mineralization were identified in this province, which tends to increase the potential for discoveries of medium to large deposits.

• Brazil consumes around 3% of the world production of concentrated copper.

Deposit (Copper as main commodity)	Commodity	Owner	Estimated Resources	Grades (P205)	Status
Salobo	Cu-Au	VALE	1148.4 Mt	0.61% Cu; 0.34 g/t Au	Operating
Chapada	Cu-Au	Lundin Mining	754.9 Mt	0.23% Cu; 0.14 g/t Au	Operating
Furnas	Cu-Au	VALE	550 Mt	0.71% Cu; 0.28 g/t Au	Operating
Gameleira	Cu-Au	VALE	535 Mt	0.57% Cu; 0.12 g/t Au	Operating
Cristalino	Cu-Au	VALE	379 Mt	0.66% Cu; 0.3 g/t Au	Operating
Alemão	Cu-Au	VALE	230 Mt	1.26% Cu; 0.83 g/t Au	Operating
Igarapé Bahia	Cu-Au	VALE	219 Mt	1.4% Cu; 0.85 g/t Au	Closed
Alvo 118	Cu-Au	VALE	170 Mt	1% Cu; 0.3 g/t Au	Operating
Sossego	Cu-Au	VALE	99 Mt	0.69% Cu; 0.19 g/t Au	Operating
MCSA (Formerly Caraíba)	Cu	Ero Copper	60 Mt	1.6% Cu	Operating
Boa Esperança	Cu	Ero Copper	59.3 Mt	0.81% Cu	Operating
Pojuca - Corpo Quatro	u-Zn	VALE	58 Mt	0.87% Cu; 0.9 % Zn	Operating
Cabaçal	Cu-Au-Ag	Meridian Mining	52.9 Mt	0.3% Cu; 0.6 g/t Au; 1.4 g/t Ag	Feasibility
Breves	Cu-Au-Ag	VALE	50 Mt	1.22% Cu; 0.75 g/t Au; 2.4 g/t Ag	Operating
Pedra Verde	Cu	Pedra Verde	44.2 Mt	0.9% Cu	Interrupted
Tucumã	Cu	Ero Copper	47.7 Mt	0.86% Cu	Feasibility
Pantera	Cu-Au	BHP	20.8 Mt	1.7% Cu; 0.2 g/t Au	Feasibility
Surubim	Cu	Ero Copper	8.7 Mt	0.88% Cu	Operating
Santa Lucia	Cu-Au-Ag	BHP	5.8 Mt	2.1% Cu, 0.35 g/t Au, 4.8 g/t Ag	Exploration
Bom Jardim	Cu	Axia Resources	4.5 Mt	0.92% Cu	Exploration
Minas do Camaquã	Cu	Minas do Camaquã	2.2 Mt	0.97% Cu	Interrupted
Maravaia	Cu-Au	Celesta Mineração	2.1 Mt	4.2% Cu; 0.66 g/t Au	Operating
Antas Norte e Sul	Cu-Au	BHP	1.9 Mt	0.8% Cu; 0.3 g/t Au	Operating
Serrote da Laje	Cu-Au	Appian Capital Advisory	0.14 Mt	0.5% Cu; 0.11 g/t Au	Operating

Graphite



Mineral Royalties: 2%

US$ 1.3 million in collected taxes[1]

3rd world's biggest reserve (70Mt Cg)[2]

2nd world's largest producer (64 kt Cg)[2]

US$ 800 thousand invested in exploration programs[1]

More than 500 Full-time Employments[2]

More than 1000 Indirect Employment[2]

[1]National Mining Agency - ANM (2023). Anuário Mineral Brasileiro - 2022. Data refers to 2021.

[2]Fundação Gorceix (2022). Estudos para o Plano Nacional de Mineração 2050. Data refers to 2020.

Highlights

• Brazil has a significant potential to produce graphite, a mineral widely used in various industries, such as the production of batteries world-classing, and in the manufacture of electronic components. Brazil has many graphite-producing regions, particularly in the Bahia-Minas Province, which is considered one of the largest graphite-producing regions in the world[1].

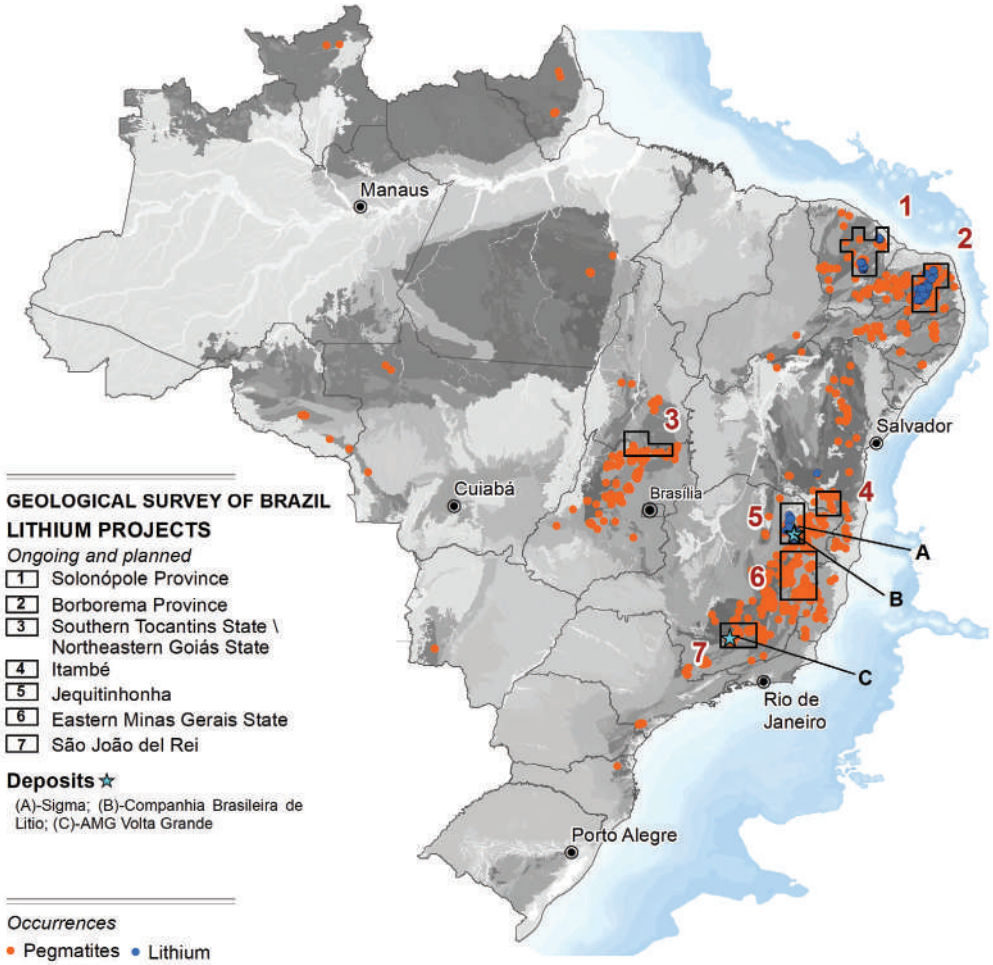
• Brazilian graphite occurrences are mainly confined to metamorphosed environments. Metamorphism (and consequently the rock-forming temperature and pressure) is considered the primary variable when analyzing graphite potential because it regulates the degree of crystallization and ore grade.

• Considering the potential, Brazil's graphite production still needs to be improved, and there is room for growth in the industry. The Brazilian government has shown interest in developing the country's graphite production, and investment in the sector is expected to increase in the coming years.

• Long-term, Brazil offers enticing prospects for graphite exploration and growth due to increasing market demand for the mineral, coupled with its position as the third-largest producer of graphite globally and the second-largest producer of high-quality flake graphite utilized in Electric Vehicles.

Deposits	Texture	Owner	Estimated Resources	Grades	Status
Salto da Divisa	Flake (>1mm)	Nacional de Grafita	52 Mt	10-15% Cg	Operating
Peresopolis	Amorphous	Lucra Minerals LTDA	40 Mt	12% Cg	Advanced Exploration
Maiquinique	Flake	Grafite do Brasil	33.3 Mt	9.6% Cg	Operating
Itapecerica	Flake	Nacional de Grafita	209.6 Kt	9.79% Cg	Operating
Mateus Leme	Flake	Grafita MG	91.7 Kt	14% Cg	Operating
São Benedito	Flake	São Benedito	2.1 Kt	57.43% Cg	Interrupted
Pedra Azul	Flake (>1mm)	Nacional de Grafita	19.1 Kt	12.29% Cg	Operating

Lithium



Mineral Royalties: 2%

US$ 1 million in collected taxes[1]

7th world's biggest reserve (505 kt LCE)[2]

5th world's largest producer (1.4 kt LCE)[2]

US$ 500 thousand invested in exploration programs[1]

890 Full-time Employments[2]

1180 Indirect Employments[2]

[1]National Mining Agency - ANM (2023). Anuário Mineral Brasileiro - 2022. Data refers to 2021.

[2]Fundação Gorceix (2022). Estudos para o Plano Nacional de Mineração 2050. Data refers to 2020.

Highlights

• In Brazil, lithium occurs in lithium-cesium-tantalum (LCT) pegmatite deposits.

• The most important ore mineral is spodumene, followed subordinately by amblygonite, petalite, and lepidolite.

• The lithium concentrate production in 2021 reached 112,779 t @5.51% Li2O contained[1].

• Active mines and advanced exploration projects concentrate in the Minas Gerais state.

• The Companhia Brasileira de Lítio – CBL, pioneer in the underground mining of Li-bearing pegmatite and processing of spodumene in Brazil, reported a 4 Mt mineral reserve and capacity to produce 36,000 t/year of spodumene concentrate (@5.5% Li2O) in its operating Cachoeira Mine in the Middle Jequitinhonha region, Minas Gerais.

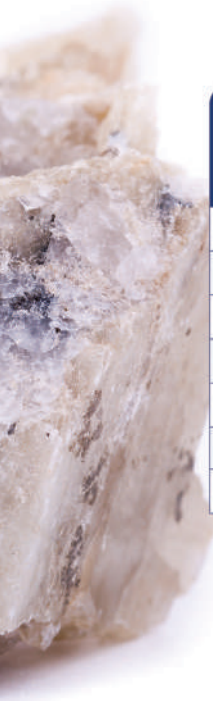
• In the same region, Sigma Lithium reported mineral resource (measured + indicated) estimates of 77 Mt from five deposits (Nezinho do Chicão, Xuxa, Barreiro, Murial, and Lavra do Meio) on its Grota do Cirilo property.

• The collected taxes by Li-mining operations in Brazil jumped from US$195,725 in 2020 to US$5,723,786 in 2022, mainly due to mine processes developed in the Nazareno region by AMG Brazil, southern Minas Gerais. However, the forecast is for significant growth soon with the entry of production of Sigma Lithium's Grota do Cirilo deposits and the expansion of AMG Brazil's business in the Nazareno region.

• Although Minas Gerais state is the primary player for lithium exploration, there are also potential areas in northeastern Brazil (e.g., Ceará, Rio Grande do Norte, and Paraíba states) with more than a hundred Li-bearing pegmatite bodies identified.

• Also, greenfield areas comprise southern Tocantins-northern Goiás and Itambé (southern Bahia) regions. The Geological Survey of Brazil – CPRM has developed research projects in the main lithium areas in Brazil to promote mineral industry development in the national territory. So far, projects have been concluded in the Middle Jequitinhonha (Minas Gerais) and Borborema Pegmatite Province areas in northeastern Brazil, resulting in new targets identified for lithium mineralization.

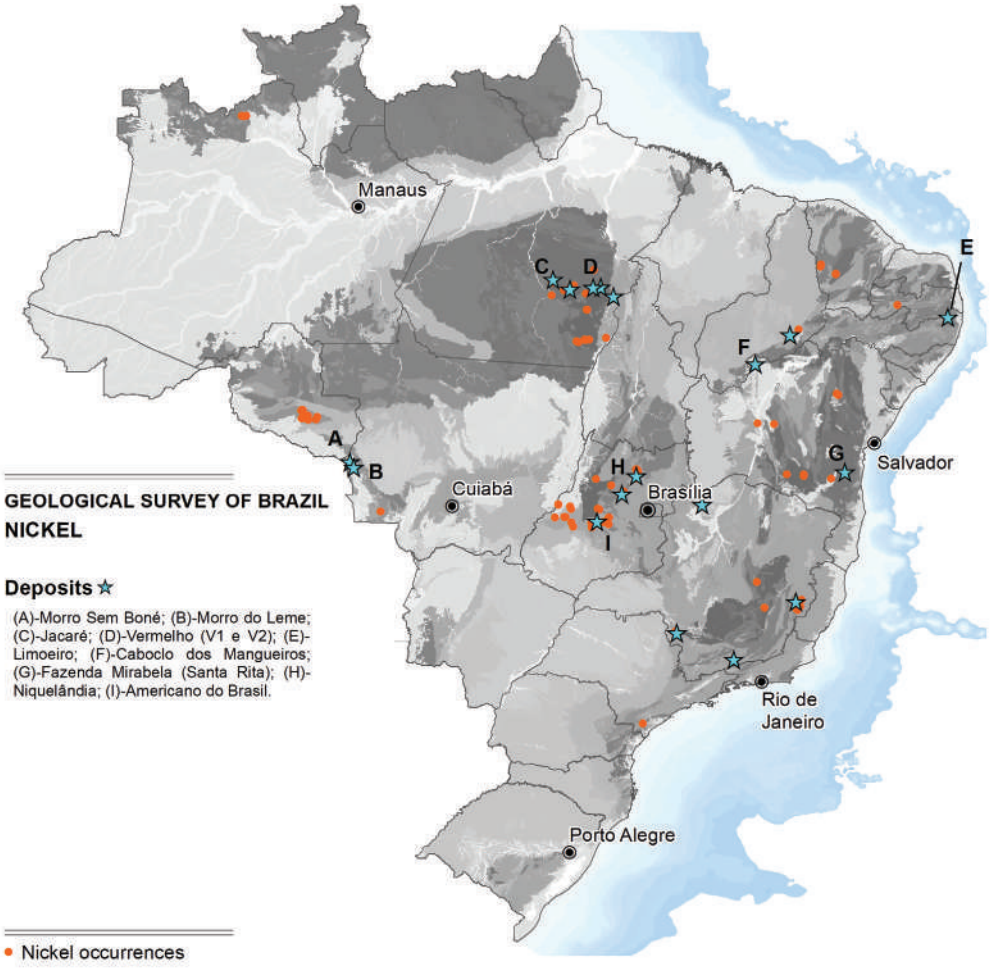
• The products of the concluded projects include maps, charts, technical reports, and scientific papers in the public domain (available at https://rigeo.cprm.gov.br and http://www.sgb.gov.br/litio/index.html). Also, two other projects are currently active in the following areas: Eastern Minas Gerais and Solonópole Province (Ceará).



Deposit	Owner	Resource estimates (Mt)	Av. grade Li O (%)	Status
Cachoeira	CBL	4	1.6	Operating
Nezinho do Chicão	Sigma Lithium	26.70	1.49	Feasibility
Xuxa	Sigma Lithium	17.41	1.55	Feasibility
Barreiro	Sigma Lithium	25.08	1.38	Feasibility
Murial	Sigma Lithium	5.56	1.14	Feasibility
Lavra do Meio	Sigma Lithium	2.27	1.09	Feasibility
Volta Grande	AMG	-	-	Operating

Sigma Lithium (2023). (https://www.sigmalithiumresources.com/project/)
http://www.sgb.gov.br/litio/index.html

Nickel



Mineral Royalties: 2%

US$ 9.4 million in collected taxes[1]

3rd world's biggest reserve (16 Mt - 17% of global reserves)[2]

8th world's largest producer (77 kt Ni)[2]

Low carbon footprint compared to the market average[3]

US$ 1.5 million invested in exploration programs[1]

More than 4,664 Full-time Employments[2]

More than 9,328 Indirect Employments[2]

[1]National Mining Agency - ANM (2023). Anuário Mineral Brasileiro - 2022. Data refers to 2021.

[2]Fundação Gorceix (2022). Estudos para o Plano Nacional de Mineração 2050. Data refers to 2020.

[3]Deloitte (2022). Nickel – Market Analysis and Competitiveness Report. Technical Assistance on Brazil Mineral Resources.

Highlights

• Brazil has significant nickel reserves and is a major player in the global nickel market. The country has around 17% of declared reserves and 6% of all nickel resources in the world. Nickel deposits in Brazil are both Laterite and Sulfide types, with predominance of the first.

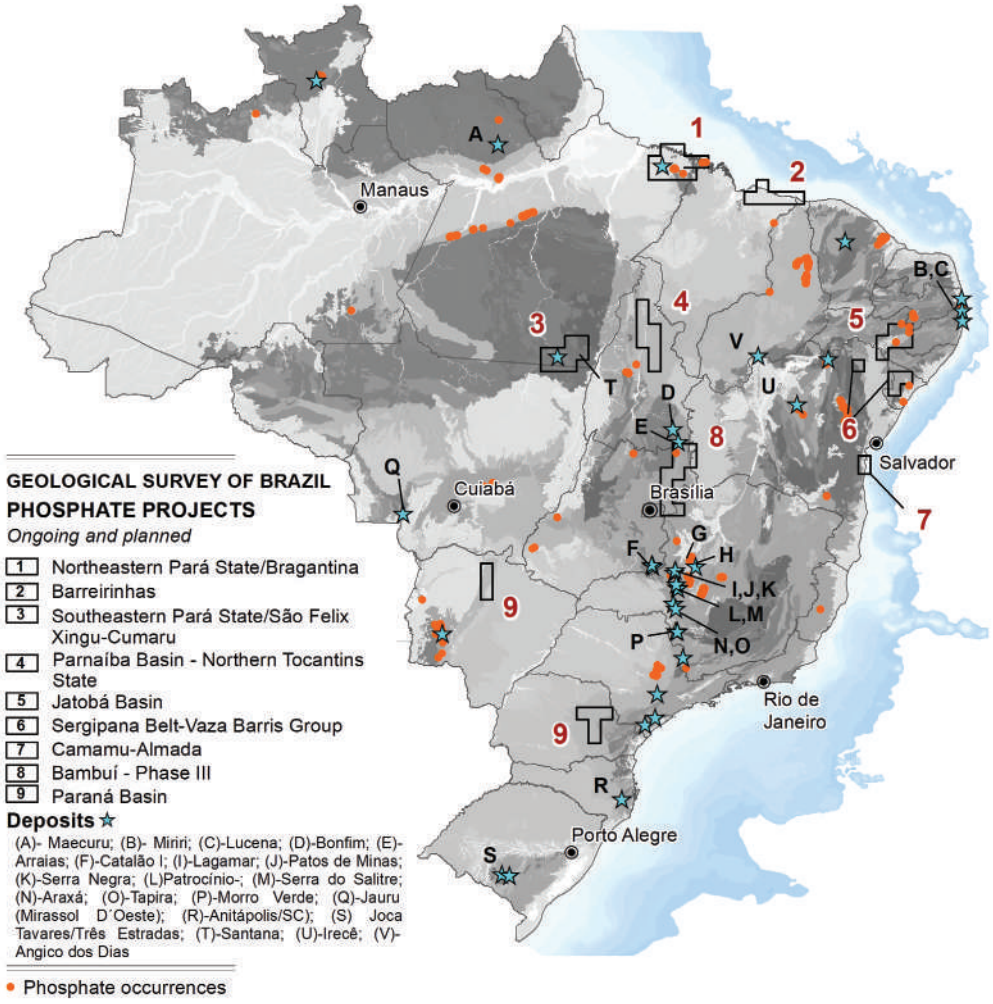
• Brazil has a strong nickel industry, with five mining operations and several projects in different exploration stages (see table below). Additionally, three mining operations in Brazil operate with costs lower than the global average (Barro Alto, Niquelândia, and Santa Rita mines)[3].

• Cobalt is commonly an essential by-product in many Ni deposits. Brazil has not produced Cobalt since 2016, but the production registered from 2010 to 2016, which account for 408 tons, originated from Nickel Sulfide Ores[1]. However, Cobalt is reported as a secondary commodity in at least 8 Ni deposits in Brazil, distributed among both lateritic and sulfide operations and projects.

• Nickel-Cobalt projects in Brazil have access to low-cost and low-emissions hydroelectricity power supply, which gives producers advantages relative to the global market, considering both the operating costs and low-carbon emissions/footprint.

Deposit (Nickel as main commodity)	Commodity	Type	Owner	Estimated Resources	Grades	Status
Jacaré	Ni	Lateritic	Anglo American	171.2 Mt	1.24% Ni	Feasibility
Araguaia (Serra do Tapa, Pau Preto)	Ni-Co	Lateritic	Horizonte Minerals	132.3 Mt	1.25% Ni, 0.06% Co	Construction
Vermelho (V1 e V2)	Ni-Co	Lateritic	Horizonte Minerals	148.0 Mt	1.05% Ni, 0.05% Co	Operating
Fazenda Mirabela (Santa Rita)	Ni-Cu-Co	Sulfide	Atlantic Nickel	159.3 Mt	0.52% Ni, 0.13% Cu, 0.01% Co	Operating
Morro do Engenho	Ni-Co	Lateritic	CPRM	136 Mt	0.90% Ni, 0.04% Co	Early Exploration
Onça-Puma	Ni	Lateritic	VALE	33.0 Mt	2.2% Ni	Operating
Jaguar	Ni-Cu-Co	Sulfide	Centaurus Metals	58.9 Mt	0.96% Ni, 0.07% Cu, 0.02% Co	Operating
Morro Sem Boné	Ni	Lateritic	Anglo American	29.0 Mt	1.92% Ni	Target Outline
Caboclo dos Mangueiros	Ni-Cu-Co	Sulfide	CBPM	200.0 Mt	0.2% Ni, 0.13% Cu, 0.016% Co	Target Outline
Morro do Leme	Ni	Lateritic	Anglo American	17.7 Mt	1.73% Ni	Target Outline
Barro Alto	Ni	Lateritic	Anglo American	8.0 Mt	1.1% Ni	Operating
Limoeiro	Ni-Cu-Pt	Sulfide	Grupo Votorantim	35.0 Mt	0.25% Ni, 0.27% Cu, 0.16g/t Pt	Target Outline
Niquelândia	Ni	Lateritic	Grupo Votorantim	4.1 Mt	1.24% Ni	Interrupted
Fortaleza de Minas (O'Toole)	Ni-Cu-Co	Sulfide	Grupo Votorantim	2.1 Mt	2.5% Ni, 0.4% Cu, 0.05% Co	Interrupted
Americano do Brasil	Ni-Cu-Co	Sulfide	Prometalica Mineração	3.1 Mt	1.12% Ni, 1.02% Cu	Interrupted

Phosphate



Mineral Royalties: 2%

3rd world's biggest reserve (317 Mt P2O5)[2]

3rd world's largest producer (3,3 kt P2O5)[2]

US$ 10.4 million in collected taxes[1]

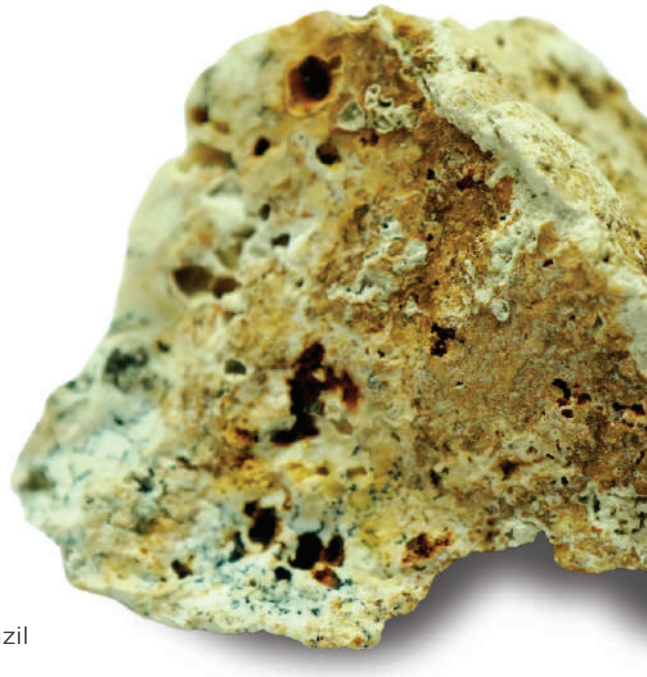
29th exporter world ranking[2]

1th importer world ranking[2]

US$ 1.8 million invested in exploration programs[1]

9,671 Full-time Employments[2]

19,528 Indirect Employments[2]



[1]National Mining Agency - ANM (2023). Anuário Mineral Brasileiro - 2022. Data refers to 2021.

[2]Fundação Gorceix (2022). Estudos para o Plano Nacional de Mineração 2050. Data refers to 2020.

Highlights

• Brazil has a great potential for the occurrence of phosphate deposits, both of igneous and sedimentary origin. Only 20% of Brazilian reserves are associated with sedimentary rocks, despite having numerous different potential basins. Most deposits are associated with residual enrichment processes of carbonatite-alkaline bodies with the development of thick weathering cover (almost 80%). Brazil also has an unexplored potential for Anorthosite-Mangerite-Charnockite-Granite (AMCG) related deposits.

• Only seven igneous deposits (Tapira, Araxá, Catalão I, Catalão II, Salitre, Cajati, and Angico dos Dias) are in production. The main mines are in the Alto Paranaíba Province, comprising world-class igneous deposits. The Santana (State of Pará) and Três Estradas (State of Rio Grande do Sul) projects, which are more recent igneous deposits discoveries, are in the pre-operation phase.

• Sedimentary reserves under production are associated with the Neoproterozoic deposits of Patos de Minas (State of Minas Gerais), Arraias (Tocantins and Goiás States), Irecê (State of Bahia), Ressaca (State of Mato Grosso do Sul) and Pratápolis (State of Minas Gerais), some with inconclusive expansion potential. The Neoproterozoic Jauru deposit (State of Minas Gerais) is a sedimentary potential resource revealed by the government and is now under feasibility studies by BEMISA.

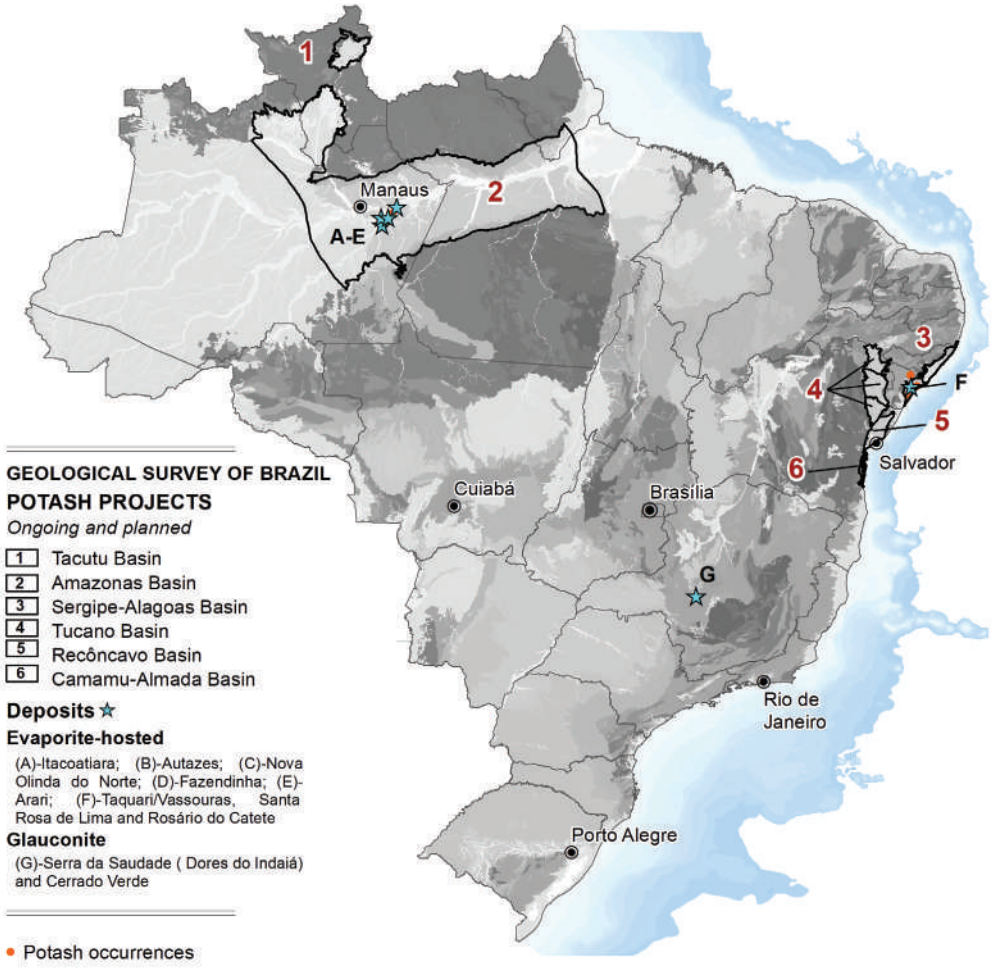
• The Miriri project (Paraíba and Pernambuco States) is a Cretaceous sedimentary deposit opportunity that the Geological Survey of Brazil offers by auction. It corresponds to a phosphate deposit in an area of 7,752.84 hectares and 114.7 million tons with an average grade of 4.19% P2O5.

• The phospate-uranium deposit of Itataia is the second largest uranium reserve in Brazil, associated with a complex geological evolution within metasedimentary rocks, hydrothermal influence, and a paleokarst stage.

• Brazil also has aluminous phosphates reserves, such as the Sapucaia mine (State of Pará), with a calcination process to favor the solubility of phosphorus and used as a thermophosphate fertilizer. In addition to this mine, five new nearby targets with potential for expansion are indicated: Boa Vista, Serrote, Serrotinho, Caeté, and Tracuá.

Deposit	Commodity	Owner	Estimated Resources	Grades (P2O5)	Status
Tapira	P, Nb, Ti, REE	Mosaic	619.5 Mt	7.6%	Operating
Serra do Salitre	P, Ti, Nb	Yara Brasil	609.4 Mt	8.56%	Operating
Mata da Corda	Ti, P, REE	Nexon Mineração/Terra Brasil	520 Mt	3.5%	Exploration
Beberibe	P	Lepanto Mineração	390 Mt	15%	Exploration
Anitápolis	P	Mosaic	320 Mt	6.41%	Without feasibility
Jauru (Mirassol D´Oeste)	P	BEMISA	314 Mt	5%	Feasibility studies
Serra Negra	P,Ti	Mosaic	228 Mt	10%	Exploration
Rocinha (Patos de Minas)	P	Mosaic	226 Mt	13%	Interrupted
Catalão II	Nb, P, REE	CMOC / Mosaic	203.7 Mt	12.16%	Operating
Maecuru	P, Ti, REE	Mosaic	200 Mt	15%	Without feasibility
Ipanema (Iperó)	P, vermiculite	-	120 Mt	6.07%	Without feasibility
Três Estradas	P	Aguia Resources	83.21 Mt	4.11%	Pre-operation
Itataia (Santa Quitéria)	U, P	Galvani / INB	79.5 Mt	11%	Feasibility
Arraias	P	Itafos	79 Mt	4.9%	Operating
Catalão I	P, Nb, Ti, REE, vermiculite	Mosaic	71.4 Mt	11.1%	Operating
Cajati(Jacupiranga)	P, Ca, Fe, Ni	Mosaic	70.8 Mt	5.1%	Operating
Serra da Capivara (Santana)	P	Itafos	60.4 Mt	12%	Pre-operation
Lucena	P	Aguia Resources	55 Mt	6%	Exploration
Bonfim	P	Gefoscal	18 Mt	6%	Feasibility sudies
Juquiá (Registro)	P,Fe	Socal Mineração	18 Mt	10%	Feasibility sudies paralyzed
Araxá	P, Nb, REE	Mosaic	15.6 Mt	11.8	Operating
Pratápolis	P	Morro Verde	15 Mt	11%	Operating
Ressaca (Bonito)	P	EDEM Agrominerais	11,5 Mt	15%	Operating
Miriri	P	CPRM	9.6 Mt	11%	Exploration
Irecê	P	Fosnor Galvani	8.7 Mt	14.5%	Operating
Serrote da Batateira	P	-	8.2 Mt	10%	Without feasibility studies
Angico dos Dias	P	Fosnor Galvani	7.6 Mt	5.7%	Operating
Sapucaia (Bonito)	P	Grupo Schefflar	4 Mt	21%	Operating
Repartimento	P,REE	-	3,5 Mt	3 to 5%	Without feasibility
Joca Tavares	P	Aguia Resources	2,41Mt	11,27%	Feasibility
Olinda-Igarassu-Goiana	P	Nitrofértil	2,3 Mt	Not reported	Interrupted
Lagamar	P	Fosnor Galvani	0	30 to 35%	Exhausted
Poços de Calças	U, Th, Mo, Zr, REE, Al, P	Curimbaba	Not reported	Not reported	Operating

Potash



Mineral Royalties: 2%

12th world's biggest reserve (2 Mt K2O)[2]

12th world's largest producer (255 kt K2O5)[2]

US$ 2.4 million in collected taxes[1]

1th importer world ranking[2]

US$ 1.3 million invested in exploration programs[1]

640 Full-time Employments[2]

860 Indirect Employments[2]

[1]National Mining Agency - ANM (2023). Anuário Mineral Brasileiro - 2022. Data refers to 2021.

[2]Fundação Gorceix (2022). Estudos para o Plano Nacional de Mineração 2050. Data refers to 2020.

Highlights

• Brazil's main potential is associated with evaporite-hosted potash deposits of the Lower Cretaceous and Permo-Carboniferous period. Currently, the only national productive plant is concentrated in the Taquari/Vassouras mine (Sergipe State), producing around 250,000 t of K2O, operated by Mosaic.

• The main reserves and resources are in the Sergipe (Northeastern Brazil) and Amazonas Basins (Northern Brazil).

• In the Sergipe Basin, it is located in the regions of Taquari/Vassouras, Santa Rosa de Lima (both silvinite, with a remaining reserve of 2.3 Mt of K2O) and Rosário do Catete (carnalite, 12 Bt of ore with 2.5 Bt of KCl, 8.3% content, and 1.5 Bt of K2O "in situ"), all in the Sergipe State and owned by Mosaic.

• In the Amazonas Basin, the delineated reserves are located in the regions of Itacoatiara, Nova Olinda do Norte, and Autazes (silvinite), Amazonas State, owned by Potássio do Brasil. The reserves of the three deposits located in the State of Amazonas add up to 1.71 B t of KCl (average content 30.43%), that is, approximately 1.1 Bt of K2O. Studies prove the technical, economic, legal, environmental and social feasibility of the project. Currently, it is in a stage of consultation with the indigenous people.

• Three other targets with potential resources evaluated by Potássio do Brasil, indicates more 1.2 Bt of KCl (30% content), that is, approximately 739.8 Mt of K2O.

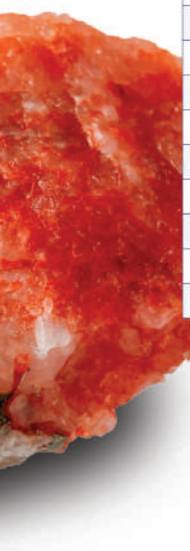
• PETROBRAS has started to sell its mining assets that include Fazendinha-Arari and Maués-Boa Vista dos Ramos, englobing the cities of Nova Olinda, Autazes, Itacoatiara, Silves, Itapiranga, Maués e Boa Vista dos Ramos.

• The Geological Survey Brazil-CPRM carried out a reassessment of resources and reserves based on ANP data. It outlined four areas that may contain more than 1.5 Bt of KCl (inferred content of 30%) or 900 Mt of K2O.

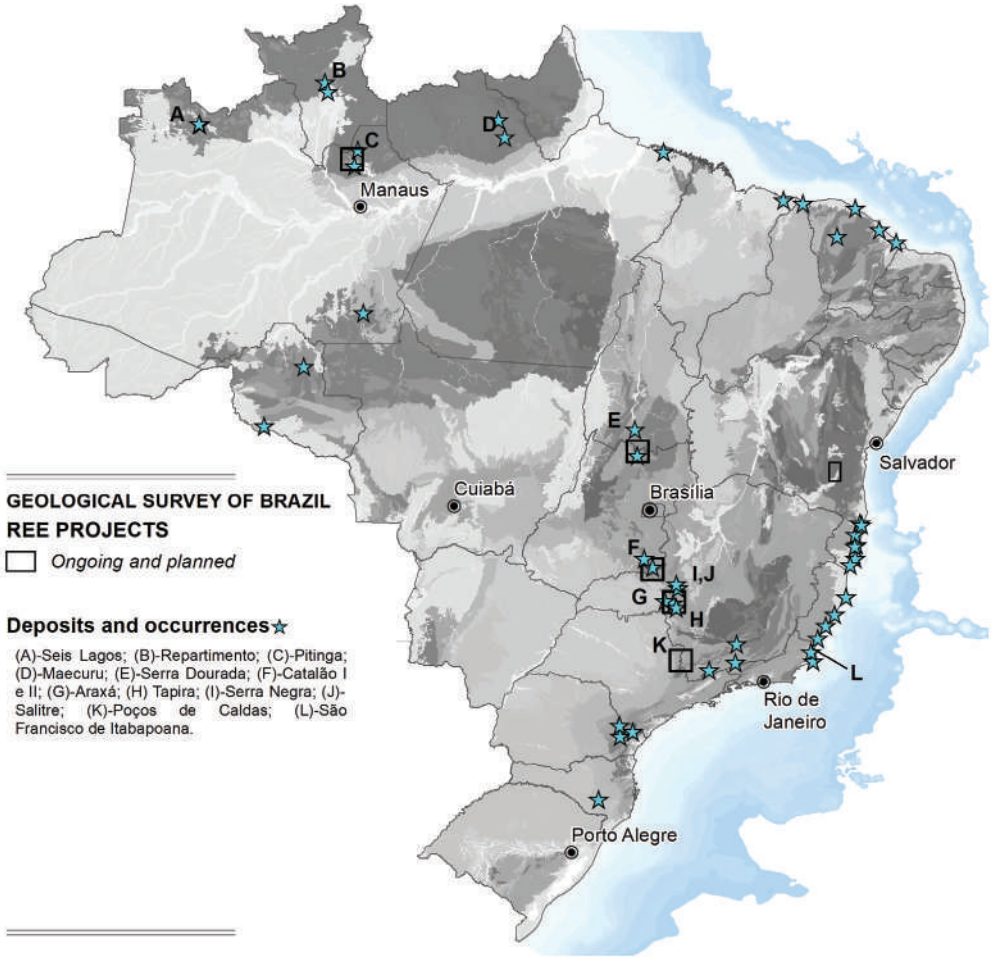
• Other potential basins with similar evaporite-aged sections are still unexplored for this commodity. Twenty-four basins have evaporite units cited in their sedimentary sequences. Among the emerged basins, 11 were mentioned in a promising way for presenting evaporites, such as Acre, Solimões, Amazonas, Tacutu, Parnaíba, Paraná, Recôncavo, Araripe, Potiguar, Sergipe-Alagoas, and Parecis. Among the offshore basins, 13 stand out: Santos, Pelotas, Campos, Espírito Santo, Mucuri, Cumuruxatiba, Jacuípe, Jequitinhonha, Almada, Camamu, Pernambuco/Paraíba, Ceará and Bragança Viseu, São Luís and Ilha Nova.

• Other sources of potash are being developed in Brazil, like glauconite-hosted potash as an alternative source of potash for the production of a slow-release fertilizer appropriated to Brazil's tropical climate. Promises to be a booming business source, where grades vary from 6 to 10% K2O. Kalium Mineração, Harvest Minerals, Verde Agritech, and Terra Brasil are mining companies focused on this market share in Brazil.

Deposit	Commodity	Owner	Estimated Resources	Grades	Status
Autazes	K (Silvinite)	Potássio do Brasil	767 Mt	30.71 % KCl	Feasibility studies
Nova Olinda do Norte	K (Silvinite)	Potássio do Brasil	693.3 Mt	16.79 % K2O	Feasibility studies
Itacoatiara	K (Silvinite)	Potássio do Brasil	263 Mt	16,4 to 21.57 % K2O	Feasibility studies
Fazendinha	K (Silvinite)	PETROBRAS	487	33 %KCl	Exploration
Arari	K (Silvinite)	PETROBRAS	545	27 % KCl	Exploration
Taquari/Vassouras	K (Silvinite)	Mosaic	9,5 Mt	14,9 % K2O	Operating
Santa Rosa de Lima	K (Silvinite)	Mosaic	55,20 Mt	24,26 % K2O	Operating
Rosário do Catete	K (Carnalite)	Mosaic	12,9 Bt	8,3 % K2O	Feasibility studies
Dores do Indaiá	K (Glauconite)	Kalium Mineração	200.0 Mt	10,56 % K2O	Exploration
Projeto Cerrado Verde, São Gotardo	K (Glauconite)	Verde Agritech	17.7 Mt	9,2 % K2O	Exploration



Rare Earth Elements



Mineral Royalties: 2%

3rd world's biggest reserve (21 Mt OxTR)[2]

US$ 1 million invested in exploration programs[1]

Total Produced REE 903t[2]

[1]National Mining Agency - ANM (2023). Anuário Mineral Brasileiro - 2022. Data refers to 2021.

[2]Fundação Gorceix (2022). Estudos para o Plano Nacional de Mineração 2050. Data refers to 2020.

Highlights

• Brazil is the third country with the largest REE reserve of 21 Mt. However, Brazil is less relevant in REE production on a world scale. The REE production in Brazil comes mainly from monazite concentrated in sands from paleo beach. In 2020, 708 t of monazite were produced and sold on the international market (Brazil Nuclear Industry, 2020).

• Most of the REE reserves in Brazil are located in alkaline-carbonatitic rocks such as Araxá (Minas Gerais State), Poços de Caldas (Minas Gerais State), Catalão (Goiás State), Tapira (Minas Gerais State), Jacupiranga (São Paulo State), and Itapirapuã (São Paulo State); in the granites like Pitinga (Amazonas State), Minaçu and Montividio do Norte (Goiás State) and, to a lesser extent, in sedimentary deposits in the region of São Gonçalo do Sapucai (Minas Gerais State) and São Francisco do Itabapoana (Rio de Janeiro State). Studies in the region of Seis Lagos (Amazonas State) and Serra do Repartimento (Roraima State) are paralyzed due to legal barriers in areas of environmental preservation.

• In 2015, measured reserves were approved in the Minaçu region, totaling approximately 300 Mt contained in ionic clays, with a content of 0.15% REEO+Y. The operation will be carried out by the mining company Serra Grande. Construction of the mine infrastructure is well advanced, and all necessary licenses have been received.

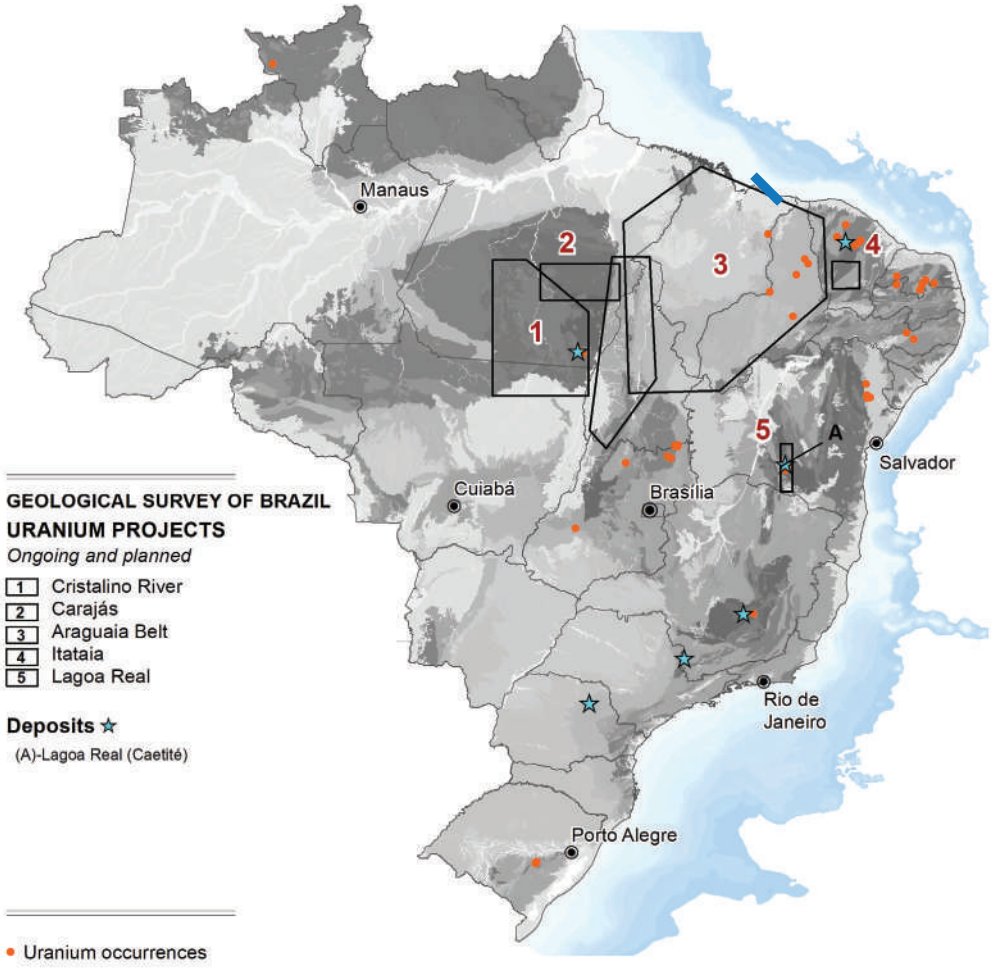
• The largest REE deposit in Brazil in carbonatites is Araxá, with measured reserves of approximately 20 Mt, with 3.02% and 2.30% LREE and HREE contents. Araxá is the main Nb producer in the world and is currently developing projects for the recovery and improvement of REE as a by-product. The mines of Catalão, Poços de Caldas, Tapira, Pitinga, and Mata da Corda are also conducting recovery research of REE as a by-product of the main ore.

• REE concentrations in paleoplaceres (monazite and ilmenite association) form smaller deposits, with predominance for LREE. Continental placers (cassiterite associated) such as in Rondônia or in southern Pará are potential deposits of HREE-minerals. At the Bom Futuro (Rondônia State) deposit, for example, the waste from the cassiterite mining is being sold to a Canadian company in the rare earth sector (Canada Rare Earth Corporation, 2021).

• In the coming years, a possible verticalization of the REE production lines in Brazil is expected, with the start of operations in Serra Verde (Goiás State) and Morro do Ferro/Poços de Caldas (Minas Gerais State), in addition to the implementation of a REE extraction plant from xenotimes, in Pitinga mine.

Deposit	Commodity	Owner	Estimated Resources	Grades (TREO)	Status
Tapira	P,Ti, Nb, REE	Mosaic	5,8 Mt	1 a 10%	Operating
Catalão II	P,REE, Nb	CMOC / Mosaic	25 Mt	0,98%	Operating
Maicuru	REE, P, Ti	Mosaic	Not reported	0,49 to 4,79%	Without feasibility
Catalão I	P2O5, Nb, Ti, REE	Mosaic	78,9Mt	8,67%	Operating
Araxá	P2O5, Nb, REE	Mosaic	0.546 Mt	4,40%	Operating
Repartimento	REE, P, Ti	Repartimento	Not reported	5%	Without feasibility
Poços de Caldas	REE, U, Th, Mo, Zr, Al	Mineração Terras raras	3,55 Mt	3,90%	Exploration
Barra do Itapirapuã	REE, P,F, Pb	Barra do Itapirapuã	44,8 Mt	0,70%	Exploration
Mato Preto	F, REE, Ba, Pb	Nossa Senhora do Carmo Ltda.	Not reported	7,70%	Operating
Seis Lagos	REE, Nb, P, Fe, Mn, Ti	CPRM	43,5 Mt	1,50%	Without feasibility
Minaçu (Serra Dourada)	REE, Sn, W, Nb, Ta	Mineração Serra Verde	300 Mt	0,15%	Exploration
Pitinga	REE, Sn, Ta,	Mineração Taboca	2 Mt	0,16%	Operating
São Francisco do Itabapoana	LREE	VALE	2,7 Mt	60%	Operating

Uranium



Mineral Royalties: 2%

7th world's biggest reserve (276 kt)[2]

14th world's largest producer (17 t)[2]

US$ 100 thousand in collected taxes[1]

600 Full-time Employments[2]

1,800 Indirect Employments[2]

[1]National Mining Agency - ANM (2023). Anuário Mineral Brasileiro - 2022. Data refers to 2021.

[2]Fundação Gorceix (2022). Estudos para o Plano Nacional de Mineração 2050. Data refers to 2020.

Highlights

• Brazil currently has one of the most extensive uranium reserves in the world, with about 280 kt of contained uranium (U3O8). However, the country has the potential to be among the three largest reserves globally.

• The Itataia and Lagoa Real deposits were discovered in the late 1970s and were responsible for placing Brazil in seventh place among the countries with the most significant uranium resources. In 2020, Brazil had the seventh-largest uranium resource in the world, despite having made no discoveries since the late 1980s. At the end of 1982, it amounted to around 160kt.

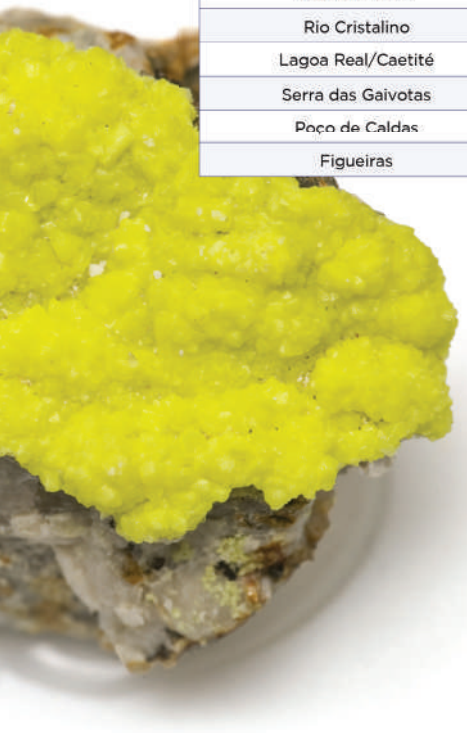
• Brazil has already identified several Uranium deposits styles in its territory, as Metassomatic deposits (Lagoa Real), Archean Paleoplacer (Serra das Gaivotas), Paleoproterozoic Unconformity (Rio Cristalino), Associated with Phosphate (Itataia) and Sedimentary/Sandstones (Figueiras).

• The only uranium mine currently in operation in Brazil is located in Caetité, in the state of Bahia, where mineral resources are estimated at 99.1 thousand tons of uranium. Over 38 anomalies (areas of high uranium concentration) have been identified in this area, which is why it is referred to as a uranium province. This hub can produce around 400 tons of U3O8/year, with the potential to reach 800 tons of U3O8/year.[2]

• In the only operation in the country, the uranium is concentrated by leaching process based on Sulphur acid, resulting in a concentred liquor that, after enriched, generates the yellow cake.

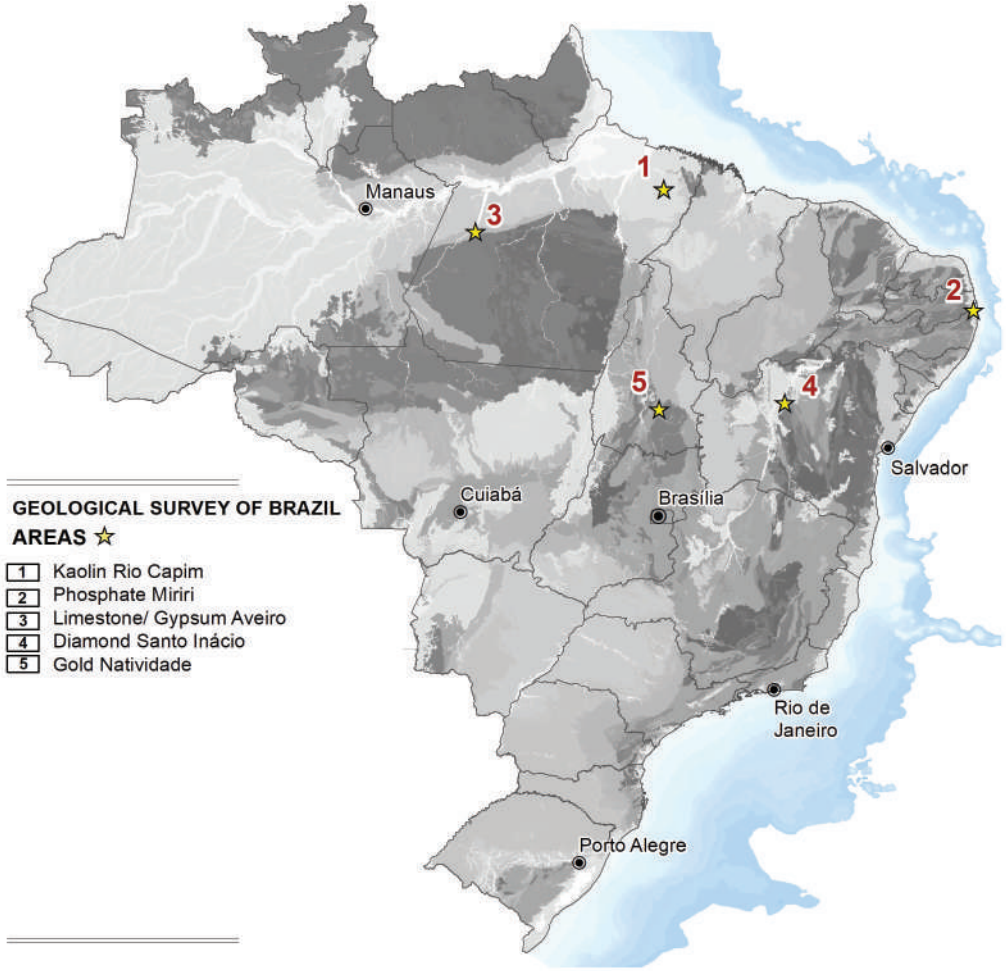
• The only state in Brazil that requires uranium for electricity production is Rio de Janeiro, where the Angra 1 and Angra 2 nuclear power plants are located. The nominal requirement is 440 tons per year. However, it remains between 310 and 340 tons of enriched uranium per year, depending on the operating history of the nuclear power plants. The INB – Indústrias Nucleares do Brasil nuclear fuel factory is also located in the state of Rio de Janeiro and provides fuel for the Brazilian nuclear power plants.[2]

Deposit	Commodity	Owner	Estimated Resources	Grades	Status
Fazenda Itataia	U-Phosphate	INB	142.5 Kt	0.05% U2O5	Feasibility
Rio Cristalino	U	INB	1.304 Kt	0.01% U2O5	Exploration
Lagoa Real/Caetité	U	INB	100.77 Kt	0.2% U2O5	Operating
Serra das Gaivotas	U-Au	INB	5.0 Kt	0.01% U2O5	Exploration
Poço de Caldas	U	INB	27.21 Kt	0.01% U2O5	Interrupted
Figueiras	U	INB	12.86 Kt	0.1% U2O5	Exploration



SBG Mining Assets for 2023 Bidding

Mineral projects to be auctioned during 2023:



The Decree-Law No. 764, of August 15, 1969, authorized the formation of the MineralResources Research Company - CPRM, in the form of a mixed economy company, withthe objective, among others, of conducting mineral research with a view to stimulating thediscovery of new deposits and the intensification of the use of the country's mineral andwater resources.

However, CPRM's activities in mineral exploration activities were practically ended in the1990s. The edition of Constitutional Amendment No. 6/1995 allowed the opening of themining sector to foreign capital, there was a substantial increase in private investments inmineral research, eliminating the performance of this function by CPRM. In addition, LawNo. 8,970, of December 28, 1994, transformed CPRM into a public company and changedits corporate objects, so that CPRM started to perform mainly the function of GeologicalService in Brazil and stopped acting in the execution of mineral research itself.

Until its transformation into a public company in 1994, CPRM developed several mineralresearch projects in order to identify and quantify new deposits in the Brazilian territory.Considering the potential economic use of these mineral resources, the FederalGovernment decided to negotiate some of these assets of CPRM by entering into a contractwith private partners, which will enable the continuation of these mining projects, with theconsequent generation of new jobs, increased income and in the collection of publicrevenues.

Mining Assets

Kaolin Rio Capim

• 10 Mining permits (10.000 ha) – 270 km southeast of Belem city (Para state);
• Resources: 792 Mt @ 79,7% of in situ whiteness,
• Preliminary processing tests indicated feasibility for paper, ceramics and coating application; possibility to develop a High Purity Alumina project;
• Preliminary Feasibility Study done by independent mining consulting.

Phosphate Miriri

• 7 mineral rights (7.572,84 ha) on Paraiba and Pernambuco state;
• 247 drill holes for 10,763.97 meters;
• Total Inferred Resource: 114,73Mt @ 4,19% P2O5;
• Cut-off 4%: 38Mt @ 8,14 P2O5.

Limestone/ Gypsum Aveiro

• Nearby Tapajós river with excellent navigability conditions, on west of Pará state;
• Limestone: 1 Mining permit (998 ha);
• Resources: Limestone - Preliminary estimate of 500 Mt.
• Gypsum: 3 Mining permits (3,000 ha);
• Resources: Gypsum - Preliminary estimate of 550 Mt with high purity degree

Diamond Santo Inácio

• 5 Mining permits (2.400 ha) – on north Bahia state;
• 9 bulk samples with diamond collected;
• Resources: 245 kt of diamond gravel @0,58cph/t

Gold Natividade

• 1 Mining permit (4.000 ha) – on south Tocantins state;
• Resources: Preliminary estimate of 725 kt @ 1,02g/t;
• Potential to increase gold resources after complementary geological research (only 3 drillholes).

Summary of mining assets for 2023 bidding

Project	State	Number of mining assets	Total area (ha)	Geological database	Infered Mineral Resources
Kaaolin Rio Capim	Pará	10	10.000	78 wells / 17 drillholes (343m)	800 Mt of kaolin ore
Phosphate Miriri	Paraíba	7	7.572	173 drillholes (6.890m)	115 Mt 4,19% P_2O_5
Limestone/Gypsum Aveiro	Pará	4	3.885	Lime - 77 drillholes (3.524m) Gypsum - 51 drillholes (1.280m)	500 Mt Limestone 550 Mt Gypsum
Ouro Natividade	Tocantins	1	4.000	3 diamond drillholes (420m)	725 kt @ 1,02g/t of Au
Diamantes Santo Inácio	Bahia	5	2.400	9 bulk samples / 190 drillholes (7.899m)	245 kt @ 0,58 ct/ht

www.sgb.gov.br/pdac

SGB
GEOLOGICAL SURVEY OF BRAZIL - CPRM

MINISTRY OF MINES AND ENERGY

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