AN OVERVIEW OF

CRITICAL AND STRATEGIC MINERALS POTENTIAL OF BRAZIL

2025 EDITION

SGB GEOLOGICAL SURVEY OF BRAZIL

President of Brazil
Luiz Inácio Lula da Silva

Minister of Mines and Energy
Alexandre Silveira de Oliveira

National Secretary of Geology, Mining and Mineral Transformation
Vitor Eduardo de A. Saback

Geological Survey of Brazil

President-Director
Inácio Cavalcante Melo Neto

Director of Geology and Mineral Resources
Francisco Valdir Silveira

Director of Hydrology and Territorial Management
Alice Silva de Castilho

Director of Geoscientific Infrastructure
Sabrina Soares de Araújo Góis

Director of Administration and Finance
Cassiano de Souza Alves

Organizers
Ioná de Abreu Cunha
Rogério Celestino de Almeida
Emanuela Reis Brod
Nivia Pina de Souza Santos
Izaac Cabral Neto
Lila Costa Queiroz
Guilherme Ferreira da Silva
Anderson Dourado Rodrigues da Silva
Sulsiene Machado de Souza Gaia

Technical Content
Ana Paula Justo
Anderson Dourado R. da Silva
Eduardo Soares de Rezende
Emanuela Reis Brod
Evilarde Carvalho Uchôa Filho
Felipe Grandjean da Costa
Geysson de Almeida Lages
Guilherme Ferreira da Silva
Hugo José de Oliveira Polo
Iago Sousa Lima Costa
Ioná de Abreu Cunha
Izaac Cabral Neto
Jocilene dos Santos Santana
Jonatas de Sales Macedo Carneiro
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Marcelo Esteves Almeida
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Said Abdallah
Stella Bijos Guimarães
Sulsiene Machado de Souza Gaia
Tamara Reginatto Manfredi
Vinícius José de Castro Paes

Reviewers
Anderson Dourado Rodrigues da Silva
Guilherme Ferreira da Silva
Maísa Bastos Abram

Publishing
Luiz Silvestre
Heber Oliveira

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DISCLAIMER

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FOREWORD

Alexandre Silveira
Minister of Mines and Energy

It is impossible to talk about energy transition without considering mining, especially considering the growing challenges caused by climate change. In this context, Brazil stands out with its vast availability of natural resources and its significant potential in critical minerals, which are essential for developing clean energy technologies.

This Critical and Strategic Minerals Report, produced by the Geological Survey of Brazil, highlights the country's ability to position itself as a key player in the global supply chain of strategic inputs for a fair and inclusive global energy transition.

Currently, Brazil holds 12% of the world's freshwater, an electricity matrix composed of 89% renewable sources, and an annual increase in biofuel production. These numbers reinforce Brazil's commitment to environmental sustainability.

The Brazilian government, led by the Ministry of Mines and Energy, remains committed to developing policies aimed at fostering the growth of the mining sector safely and responsibly.

Vitor Saback
National Secretary of Geology, Mining and Mineral Transformation

Brazil is the best country in the world to invest in the mineral sector. The country holds a privileged position in the global ranking of critical mineral reserves essential for a low-carbon economy. Our industry is constantly modernizing, supported by a skilled workforce and a government committed to sustainability.

This publication by the Geological Survey of Brazil highlights the potential of the Brazilian mining sector, emphasizing the country's strengths in critical minerals such as lithium, niobium, graphite, and rare earth elements.

The information provided not only expands and strengthens geological knowledge but also fosters research, mineral production, and the development of the mineral processing industry.

Inácio C. Melo Neto
President-Director of the Geological Survey of Brazil

Brazil is in a privileged position to lead the global energy transition, with vast geological potential. In this context, the Geological Survey of Brazil plays a fundamental role by providing detailed information on critical and strategic minerals essential for green technologies, such as electric vehicle batteries and renewable energy systems. Our research helps ensure the security of global supply chains and guide sustainable investments in the mineral sector, always upholding the highest environmental, social, and governance standards. This combination of natural resources, infrastructure, legal security, and clean energy strengthens Brazil as a competitive destination for responsible mining development, driving economic growth and job creation.

Francisco Valdir Silveira
Director of Geology and Mineral Resources

The Geological Survey of Brazil (SGB) is pleased to present the 2025 edition of An Overview of Critical and Strategic Minerals Potential of Brazil. This updated publication reinforces Brazil's significant potential in supplying essential minerals for the energy transition, technological advancements, and food security.

In this edition, SGB has expanded the range of commodities covered, aligning them with the official list of strategic minerals published by the Brazilian government. This broader scope enhances the geoscientific data available to industry and policymakers, further strengthening Brazil's position in the global critical minerals supply chain.

Through continuous geological research and mineral assessments, SGB remains committed to generating high-quality data that support sustainable mineral development and international collaboration. We hope this publication serves as a valuable resource for guiding strategies and investments in this vital sector.

SUMMARY

BRAZIL`S MINERAL PRODUCTION

In the first half of 2024, revenue in Brazil's mining sector increased by 8% compared to the same period in 2023, solidifying the country's position as a global mining leader. This growth reflects not only the appreciation of commodities but also improvements in the sector’s competitiveness and innovation.

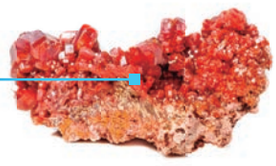
1st Niobium
90%
Share

2nd Iron
17%
Share

4th Graphite
4.3%
Share

4th Aluminium
7.3%
Share

4th Vanadium
5%
Share



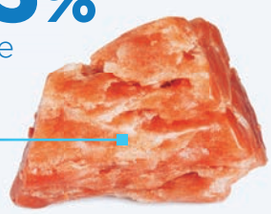
6th Lithium
4.2%
Share

BRAZIL`S ORE RESERVES

1st Niobium
94%
Share

2nd Graphite
26%
Share

2nd REE
23%
Share



2nd Iron
17%
Share

3th Nickel
12%
Share

5th Aluminium
9%
Share

https://pubs.usgs.gov/periodicals/mcs2025/

INTRODUCTION

Brazil has vast geological potential and holds significant reserves of critical and strategic minerals essential for the energy transition and the development of advanced technologies. Examples of critical and strategic minerals in which Brazil plays an important role are lithium, indispensable for electric vehicle batteries and energy storage systems; rare earth elements, vital for the manufacturing of permanent magnets used in wind turbines and various electronic devices; graphite/graphene, materials with exceptional properties holding promise for applications across numerous fields; and niobium, a strategic element for the production of high-strength superalloys.

The output of these critical minerals in Brazil is concentrated in different regions, reflecting the country's geological heterogeneity. While some areas exhibit high-concentration deposits, others require significant investments in prospecting and exploration to enable commercial production.

Brazil is the world's leading producer of niobium, accounting for approximately 90% of global production. The production of strategic minerals such as iron ore, lithium, copper, and nickel has increased due to ongoing exploration, regulatory stability, and investments in technological innovation and sustainability. Iron ore, the flagship of Brazil's mining industry, accounted for 62% of the sector's revenue in the first half of 2024 and remained the leading export product, responsible for 71.6% of exports (a 5% increase compared to the same period in 2023) (IBRAM, 2024). This appreciation was driven by increased Asian demand, particularly China. Concurrently, lithium has gained prominence both internationally and nationally, reflecting the growing demand for critical minerals in the energy transition.

The Brazilian mineral sector demonstrated strong performance in the first half of 2024, driven by global demand for commodities and significant advances in the operational efficiency of sector companies. The results for the first half of 2024 show that the Brazilian mineral sector's revenue increased by 8% compared to the same period in 2023, solidifying the country's position as a major player in the international mineral market (IBRAM, 2024). This growth reflects not only the increase in commodity values but also improvements in the competitiveness and innovation of companies in the industry. There were over 218,000 direct jobs in the sector, with 5,447 new jobs were created between January and May 2024.

Sustainability advancements were also a highlight of the period. Research and development of clean and sustainable technologies are essential for the responsible production of critical minerals in Brazil. Sustainable mining, which prioritizes reducing environmental impacts, ensuring worker safety, and fostering the development of local communities, is increasingly important in a global context that requires greater socio-environmental responsibility from companies. Initiatives promoting circularity in the economy, such as battery recycling and rare earth element recovery, are fundamental to ensuring the long-term security of the supply of these resources. The ESG agenda has become a determining factor in attracting investments and expanding global competitiveness of Brazilian mining.

Attracting foreign investment and forming public-private partnerships are crucial strategies to boost the production of critical minerals in Brazil. Promoting research and innovation projects, along with modernizing transport and logistics infrastructure, is essential for establishing the efficiency of the production chain and enhancing the competitive edge of Brazilian companies in the international market. The integration of various stakeholders — governments, companies, universities, and research centers — is key to overcoming challenges and fully leveraging the country's potential in this strategic field.

Challenges persist; however, the outlook for the coming years remains positive, with new projects under development and a favorable environment for innovation and sustainable growth. Brazil, therefore, reaffirms its strategic role in the mining sector, combining the strength of its mineral sector with advancements to meet the demands of a constantly evolving world.

GEOSCIENTIFIC DATA DENSITY INDEX OF BRAZIL

The availability of geoscientific knowledge is a key factor for strategic planning in areas such as land use, infrastructure, environment, energy, and mining. In a country as vast as Brazil, measuring the extent of this knowledge is essential for identifying regions with varying levels of Earth sciences data coverage.

To address this need, the Geoscientific Knowledge Density Map for Brazil was developed. This map uses the Geoscientific Knowledge Index (GKI), a metric ranging from 1 to 10, to measure the depth and quality of geoscientific information across different regions. The GKI provides a practical and visually intuitive way to evaluate the distribution of georeferenced data throughout the country.

The map integrates layers representing different knowledge spheres:

A. Geological Cartography Knowledge Level Map (GecK): this layer includes all the geological mapping data produced by the Geological Survey of Brazil (SGB) with scales ranging from 1:25,000 to 1:250,000;

B. Geological Knowledge Level Map (GeK): contains thematic map data, such as geological integration maps and state-level maps;

C. Geophysical Knowledge Level Map (GpK): represents the weighting of geophysical prospecting data, considering spatial resolution and data quality. It includes airborne geophysical data, ground gravity, and seismic data;

D. Geochemical Knowledge Level Map (GcK): includes data from the total geochemical surveys (rock, stream sediment, pan concentrate, and soil); and

E. Mineral Resources Knowledge Level Map (GmrK): includes reports and research on mineral exploration conducted by the SGB.

The formula for calculating the GKI is:

$$\mathbf{GKI = (2 * GecK) + (0.5 * GeK) + GpK + GcK + GmrK}$$

This index reflects both the quantity and quality of available data, with geological cartography weighted twice as heavily as the other types of information due to its importance in all stages of mineral exploration. To account for the thematic nature of the geological data, and to avoid overrepresentation, the index value derived from this map was reduced by half (multiplied by 0.5).

The GKI offers a clear and intuitive way to assess the availability of geoscientific data across Brazil. Quantifying the knowledge of mineral resource-producing regions, it aids in optimizing strategic planning for the mining sector. When combined with other tools, it supports the growth and development of Brazil's mining industry, encouraging targeted investments and informed decision-making.

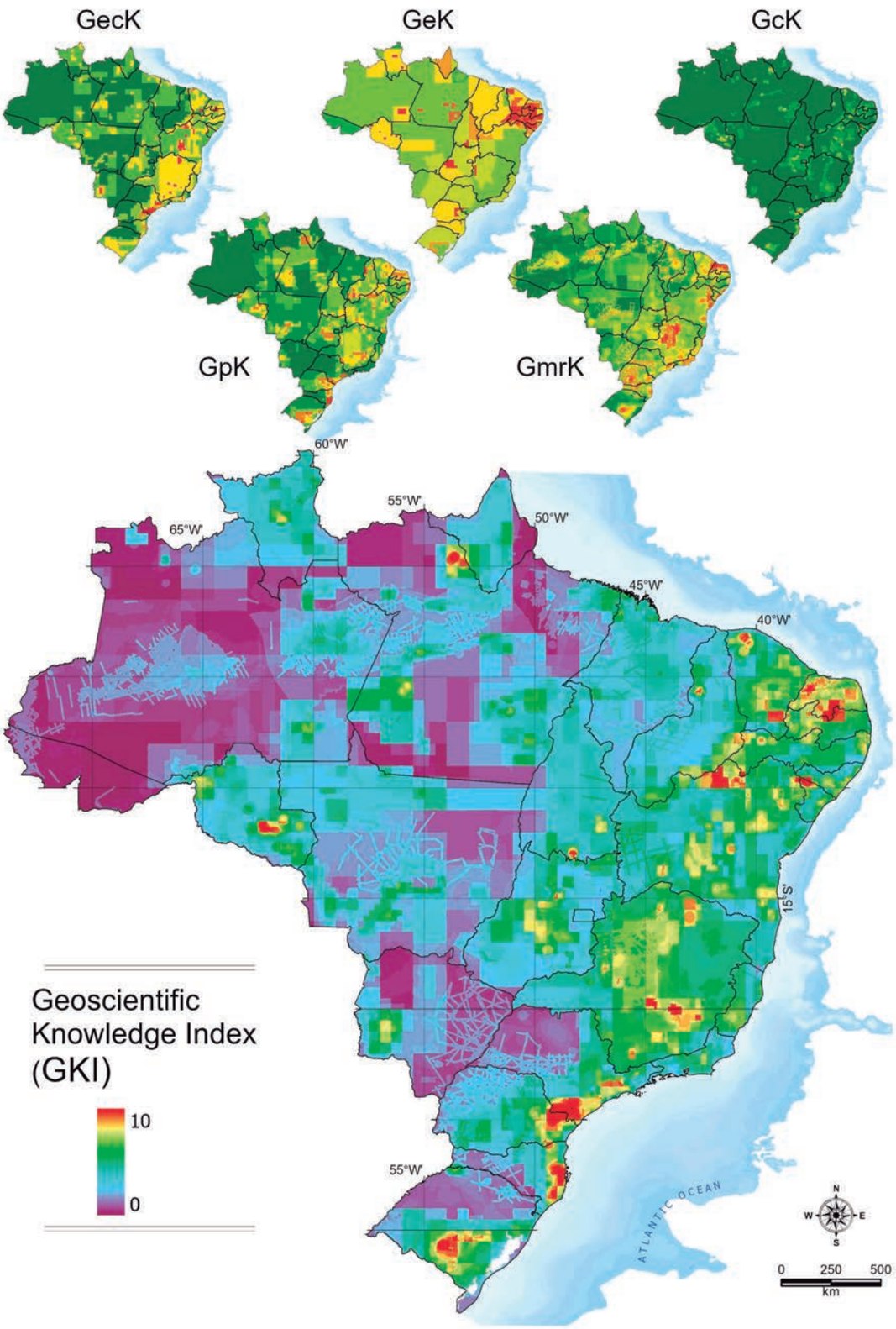


FIGURE 1: Map locating Geoscientific Knowledge levels across Brazil.

ALUMINUM

The Pará State, in the north of Brazil, holds the largest bauxite reserves in the country, historically accounting for over 90% of the Brazilian's production. The state of Minas Gerais follows with 7% of the production, while the states of São Paulo, Santa Catarina and Goiás collectively hold 3%.

BAUXITE RESERVES[1]
2.7 Gt

OPERATING MINES	PRODUCTION[1]
13	33 Mt

WORLD RANKING[1]	
Reserves	4th (9%)
Production	4th (7.3%)

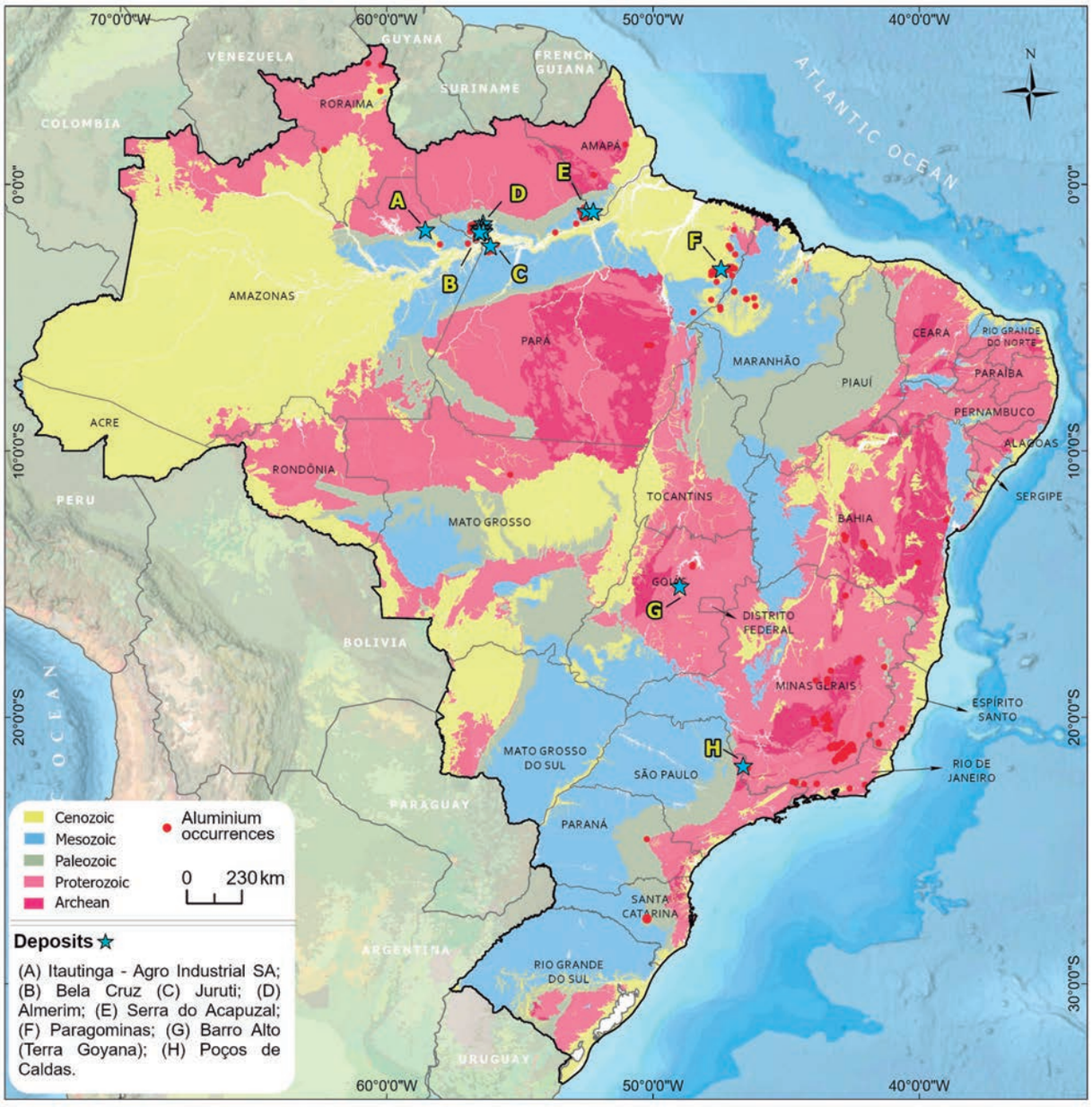


FIGURE 2: Brazilian aluminium deposits and occurrences, 2024.

1 U.S. Geological Survey, 2025, Mineral commodity summaries 2025: https://abal.org.br/estatisticas/nacionais/bauxita/

HIGHLIGHTS

- Relevant bauxite occurrences are also found in the states of Bahia, Maranhão and Amapá. In Pará, key extraction and processing companies include Mineração Rio do Norte, Mineração Paragominas and Alcoa. In the Center of Brazil, Companhia Brasileira de Alumínio (CBA) and Terra Goyana are significant players.
- The bauxite formation found in Pará state is characterized by thick lateritic profiles on siliciclastic rocks of the Cretaceous period. In Minas Gerais state, bauxite occurrences are associated with metasedimentary rocks in the Quadrilátero Ferrífero and granulitic rocks in the southeast. Bauxite in the state of Goiás originates from the alteration of Neoproterozoic anorthosites of the Barro Alto Mafic-Ultramafic Layered Complex.
- The evolution of the lateritic/bauxite cover of the Amazon was polyphase and controlled by chemical and physical processes in humid equatorial climates. São Paulo hosts bauxite deposits over amphibolites, dolerites and granites, while the deposits in the southern region come from alkaline rocks, basalts, diabase, and syenites in a subtropical climate.
- Before the discovery of deposits in northern Brazil, bauxite in alkaline rocks, especially in Poços de Caldas (Minas Gerais), was the primary source of aluminum, accounting for 65% of national production until the 1970s. Pará's state dominance in bauxite production reflects changes in the industry and the allocation of resources over time.

Selected aluminum deposits and resource estimates

Deposit	Commodity	Owner	Estimated Resources	Grades (Al)	Status
Almeirim	Al (Bauxite)	MSL Minerais S.A.	46 Mt	57.4%	Closed/Exhausted
Barro Alto	Al (Bauxite)	Terra Goyana	180 Mt	56%	Operating
Bela Cruz	Al (Bauxite)	Mineração Rio do Norte S.A.	55.86 Mt	50.2%	Operating
Juruti	Al (Bauxite)	Alcoa Alumínio S.A.	558.1 Mt	34.25%	Operating
Paragominas	Al (Bauxite)	Norsk Hydro do Brasil Ltd.	249.7 Mt	82.4%	Operating
Poço de Caldas	Al (Bauxite)	Alcoa Alumínio S.A.	50 Mt	46%	Operating
Porto Trombetas	Al (Bauxite)	Mineração Rio do Norte S.A.	600 Mt	49.5%	Operating

CHROMIUM

Global chromite resources exceed 12 billion tons, with approximately 95% concentrated in Kazakhstan and South Africa. This concentration of resources in only two countries, classifies chromium as a critical mineral due to potential supply risks. Brazil holds about 0.55% of the world's mineable reserves with approximately 6.6 million tonnes of Cr_2O_3, and is the sole chromium-producing country in the Americas.

CHROMIUM CONTENT RESERVES[1]
6.6 Mt

OPERATING MINES	PRODUCTION[1]
5	1.4 Mt

WORLD RANKING[1]	
Reserves	7th (0.55%)
Production	6th (3%)

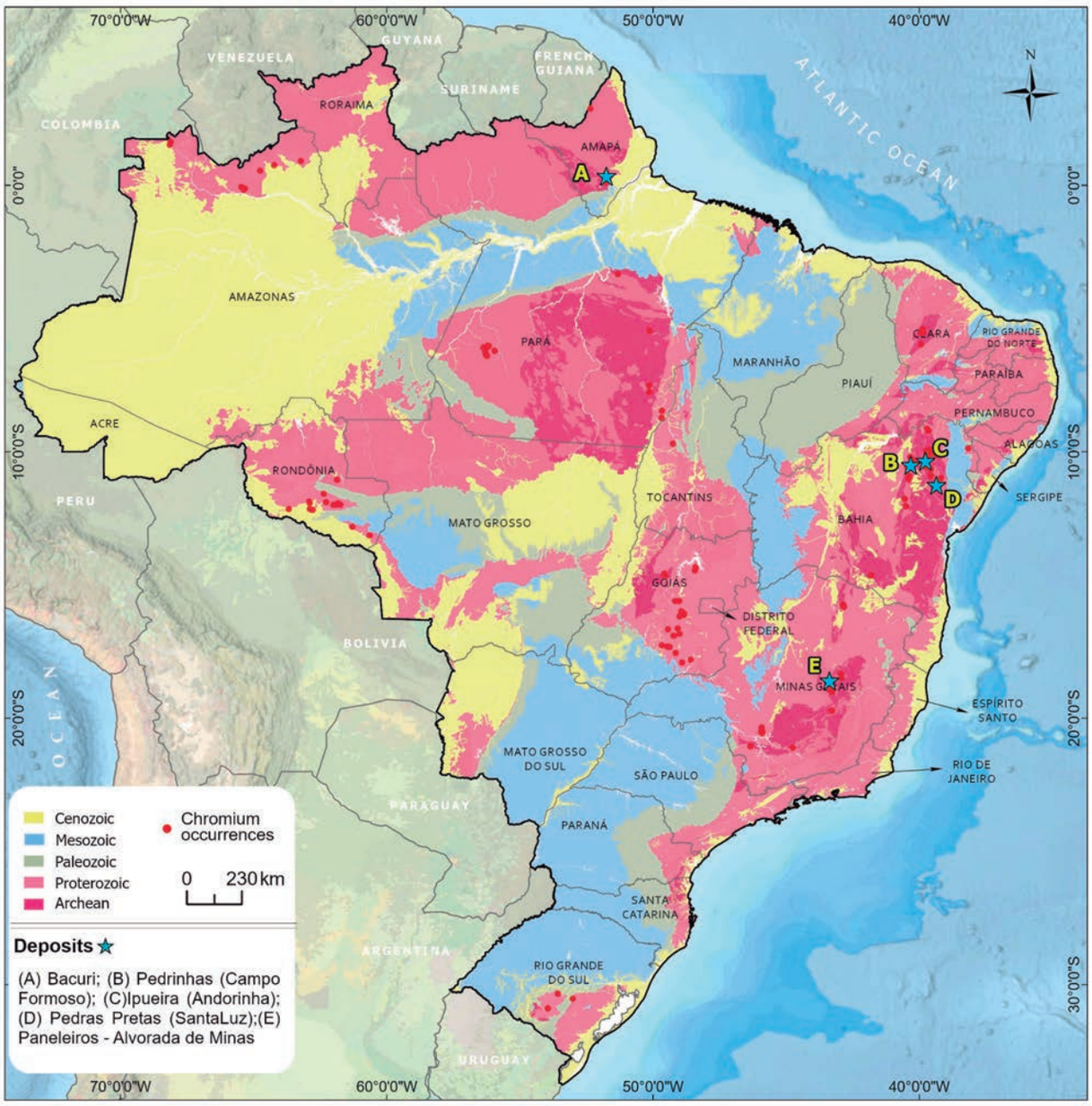


FIGURE 3: Brazilian chromium deposits and occurrences, 2024.

1 U.S. Geological Survey, 2025, Mineral commodity summaries 2025: https://pubs.usgs.gov/periodicals/mcs2025/mcs2025.pdf

HIGHLIGHTS

- Major Brazil's economic primary stratiform chromite deposits are located in the mafic-ultramafic complexes of Campo Formoso (FERBASA), Vale do Jacurici, and Pedras Pretas (RHI Magnesita; LSE: RHIM) in Bahia state, encompassing areas such as Campo Formoso, Andorinha, Ipueira, Medrado, Santa Luz, and Piritiba. These account for approximately 80% of national reserves, with an estimated 4.84 million tons of contained metal.
- The Bacuri (Mazagão) mafic-ultramafic stratiform complex in Amapá state has estimated reserves of 3.3 million tons of chromite ore (ROM), representing about 7% of Brazil's resources.
- In Minas Gerais, which holds about 3% of national reserves, notable stratiform deposits include those in Serro, Alvorada de Minas (including Paneleiros), and Piumhi (Lavapés).
- Other geological provinces with chromite deposits associated with platinum group elements (PGE) mineralization include the Carajás Province (Luanga and Cateté mafic-ultramafic complexes) and the Borborema Province (Tróia).
- Podiform chromite is found in deposits such as Morro Feio, Cromínia, and Abadiânia in Goiás; Araguaia Belt at Morro Grande and in the Complexo Quatipuru, and in various minor mineral occurrences in other provinces, like the Gararu project in the state of Sergipe.
- FERBASA (B3:FESA3 and FESA4) controls approximately 95% of Brazil's chromite resources and is the only integrated producer of ferrochrome in the Americas and the leading producer of ferroalloys in Brazil. In 2022, the company mined a total of 513,788 tons and produced 301.6 thousand tons of ferroalloys, including high-carbon ferrochrome, low-carbon ferrochrome, ferrosilicon chrome, ferrosilicon 75, and inoculants.

Selected chromium deposits and resource estimates

Deposit	Commodity	Owner	Estimated Resources	Grades (Cr_2O_3)	Status
Bacuri (Mazagão)	Cr	Mineração Vila Nova Ltda.	3.39 Mt	34.74 %	Operating
Ipueira (Andorinha)	Cr	Ferbasa S.A	2.70 Mt	37.82 %	Operating
Paneleiros- Alvorada de Minas	Cr	Cromita iumhiuense Ltda.	0.87 Mt	20.07 %	Operating
Pedras Pretas (SantaLuz)	Cr	RHI Magnesita	1.89 Mt	40.01 %	Operating
Pedrinhas (Campo Formoso)	Cr	Ferbasa S.A	10.31 Mt	29.8 %	Operating
Fazenda Caxambu- Serra do Lavapés	Cr	Fazenda Caxambu Serra do Lavapés	Not available	Not available	Unexploited

COPPER

According to Brazil's Ministry of Mines and Energy's "Mineral Sector Bulletin," published in the first half of 2022, Brazil possesses estimated copper reserves of 17 million tonnes, representing approximately 1.9% of world reserves. Based on this data, the country ranks 10th globally in copper reserves.

COPPER CONTENT RESERVES[1]
17,000 kt

OPERATING MINES	PRODUCTION[1]
14	527 kt Cu

WORLD RANKING[1]	
Reserves	10th
Production	18th

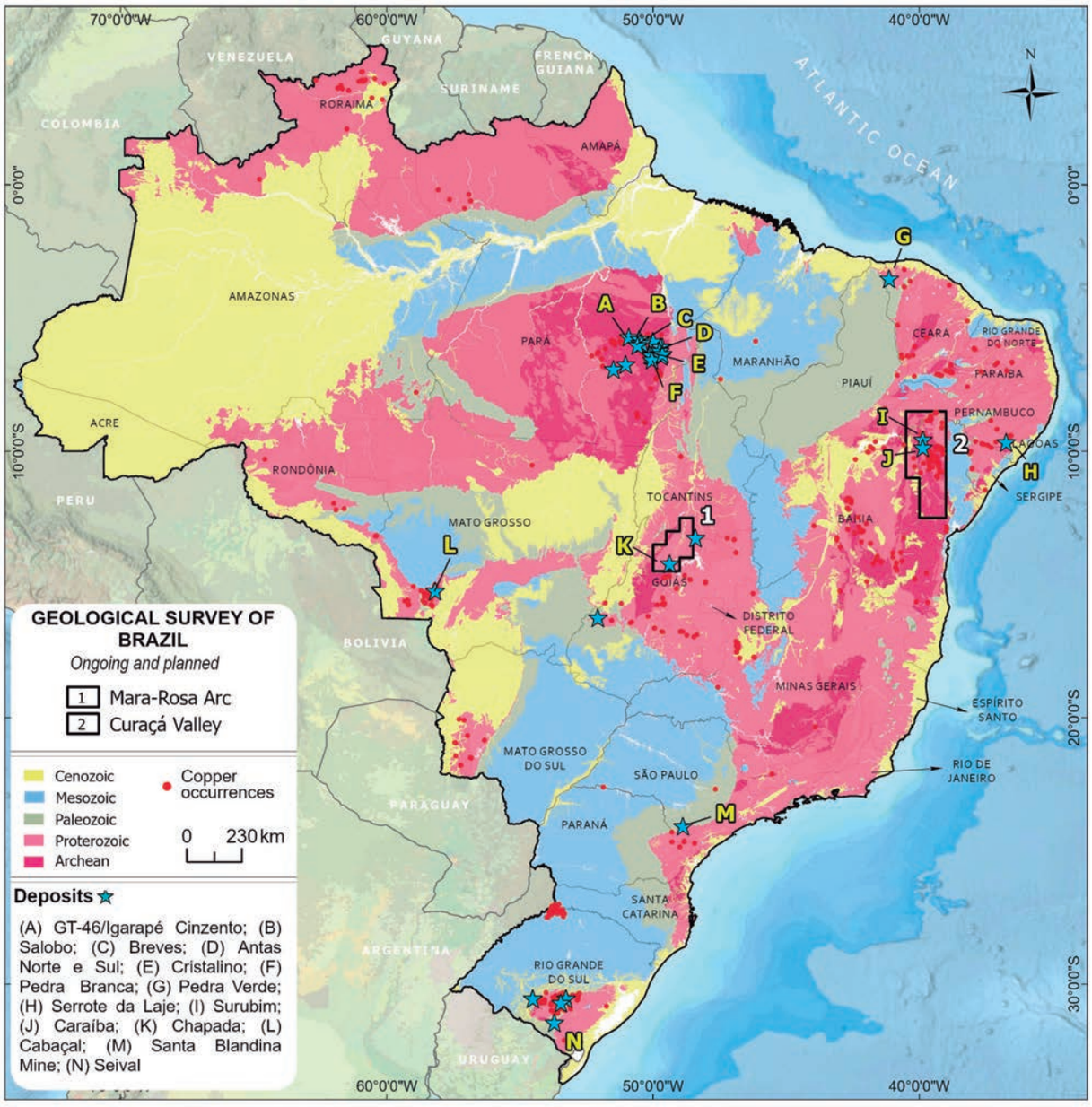
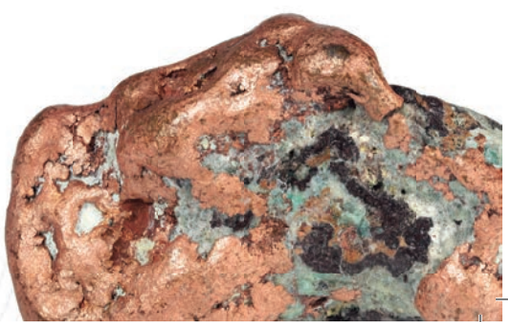


FIGURE 4: Brazilian copper deposits and occurrences, 2024.



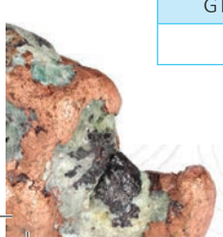
1 Panorama Nacional do Cobre - https://rigeo.sgb.gov.br/handle/doc/25334

HIGHLIGHTS

- Unlike the rest of the world, where copper is mainly exploited from porphyry-type deposits, Brazil has around 46 copper deposits and advanced prospects, mostly distributed in the Magmatic Segregation / IOCG (36%), IOCG (26%) and VMS (13%), which account for 74% of the total. Added to the magmatic segregation deposits of mafic-ultramafic complexes, the total reaches 85%. One main porphyry-type deposit has been described in Brazil, the Chapada deposit, in northern Goiás State.
- Brazil's copper mineral potential lies almost entirely in Precambrian domains. Most of the Brazilian copper deposits are located in the Carajás Mineral Province, which is also the mineral province with the largest amount of metallic copper in the country, with an estimated total of 27.34 Mt endowment. 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 highest potential. It comprises 7.23% of copper contained in two VMS-type deposits; the largest of which is called Cabaçal. The province has the potential for discoveries associated with porphyry and VMS models.
- The Goiás Magmatic Arc has an active copper mine and potential for discoveries of medium to small metamorphosed porphyry copper, as well as VMS deposits.
- The Vale do Curaçá Cupriferous District has cataloged deposits of magmatic segregation. Recent work has identified alterations and characteristics of IOCG-type mineralization in this province, which tends to increase the potential for discoveries of medium to large deposits.
- Brazil consumes around 3% of the world's copper concentrate production.

Selected copper deposits and resource estimates

Deposit	Commodity	Owner	Estimated Resources	Grades (Cu)	Status
Alemão/Igarapé Bahia	Cu-Au	Vale S.A.	230 Mt	1.4%	Operating
Alvo 118	Cu-Au	Vale S.A.	170 Mt	1%	Operating
Antas Norte e Sul	Cu-Au	OZ Minerals	1.5 Mt	0.5%	Operating
Boa Esperança	Cu-Co	Ero Copper	59.3 Mt	0.81% Cu	Feasibility
Breves	Cu-Au-Ag	Vale S.A.	50 Mt	1.22%	Operating
Cabaçal	Cu-Au-Ag	Meridian Mining	52.9 Mt	0.3%	Feasibility
Caraíba	Cu	Ero Copper	34.60 Mt	0.60%	Interrupted
Chapada	Cu-Au	Lundin Mining Corp	1101.1 Mt	0.23%	Operating
Cristalino	Cu-Au	Vale S.A.	379 Mt	0.66%	Operating
Furnas	Cu-Au	Ero Copper	550 Mt	0.71%	Unexploited
Gameleira (Pojuca, Grota Funda)	Cu-Au	Vale S.A.	535 Mt	0.57%	Unexploited
Pantera	Cu-Au	OZ Minerals	20.0 Mt	1.2%	Feasibility
Pedra Branca	Cu-Au	OZ Minerals	19 Mt	1.6%	Operating
Pedra Verde	Cu	Pedra Verde	44.2 Mt	0.9% Cu	Interrupted
Pojuca- Corpo Quatro	Cu-Zn	Vale S.A.	58 Mt	0.87	Operating
Salobo	Cu-Au	Vale S.A.	1148.4 Mt	0.61%	Operating
Saúva	Cu-Au	Lundin Mining Corp.	179 Mt	0.32%	Exploration
Seival	Cu-Ag	Seival	0.2 Mt	Not available	Operating
Serrote da Laje	Cu-Au	Mineração Vale Verde Ltda	119.2 Mt	0.5%	Operating
Sossego	Cu-Au	Vale S.A.	345.6 Mt	0.80%	Operating
Surubim	Cu	Ero Copper	8.7 Mt	0.88% Cu	Operating
GT-46/Igarapé Cinzento	Cu-Au	GT-46/Igarapé Cinzento	Not available	Not available	Operating
Maravaia (Celesta)	Cu-Au	Maravaia (Celesta)	Not available	Not available	Operating



DIAMOND

Brazil has a long-standing tradition of diamond production and was among the world's first major producers in the 18th century. Currently, its national production is modest compared to global leaders like Russia, Canada, and Botswana, but it remains a relevant activity in the country's mineral sector. Brazil has resources and growth potential, especially with appropriate exploration strategies, technology investments, and sustainability policies.

ORE RESERVES
Not available

OPERATING MINES	PRODUCTION[1]
1	76,700 ct

WORLD RANKING	
Reserves	Not available
Production	Not available

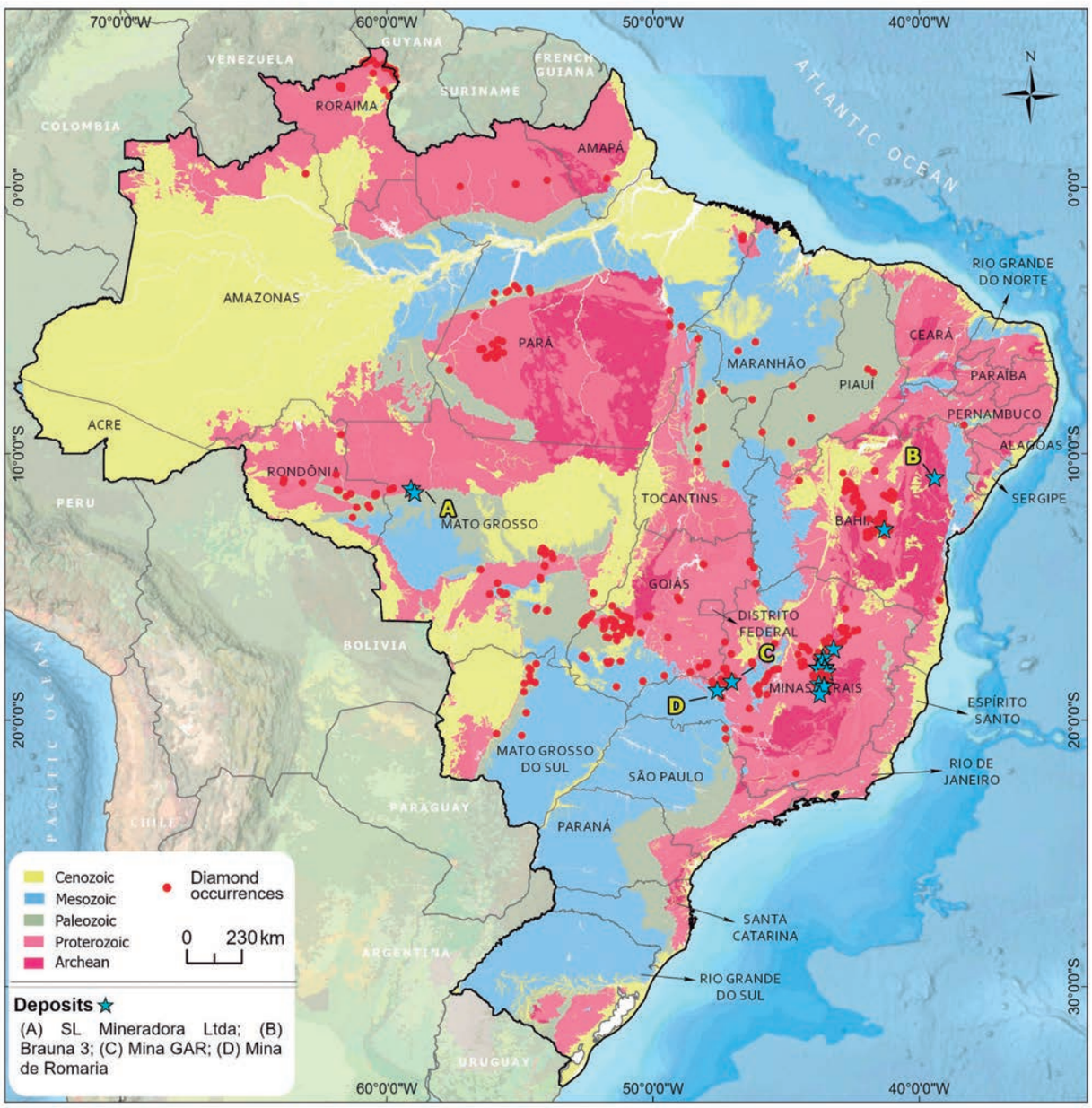


FIGURE 5: Brazilian diamond deposits and occurrences, 2024.

1 National Mining Agency, 2025, Interactive Brazilian Mineral Yearbook 2025: https://bit.ly/4hcMdl4

HIGHLIGHTS

- The main diamond-producing regions in Brazil are concentrated in the states of Bahia, Mato Grosso, and Minas Gerais, and to a lesser extent in Pará, Paraná, and Piauí. The vast majority of sources are secondary placer-type deposits, except for the Braúna kimberlite-hosted mine, whose discovery marks a significant milestone in Brazilian diamond mining.
- The Braúna mine is located in the municipality of Nordestina, Bahia, approximately 350 kilometers from the capital Salvador. This enterprise developed from the Braúna 3 kimberlite deposit, which is one of 22 kimberlite occurrences within the mining rights area of Lipari Mineração Ltda. The mine is part of a Mining Concession covering 1,875 hectares, with the company holding 100% rights to four adjacent mining processes.
- The diamond industry faces challenges such as the need to modernize many mining operations, legal and environmental issues, and the growing importance of sustainability and environmental impact, leading to a greater focus on responsible practices.
- Future prospects indicate growth potential in the primary exploration of kimberlites, which the Brazilian government encourages through investment and geological research to discover new deposits, with technological and regulatory improvements that can benefit the sector.
- In 2024, the Geological Survey of Brazil (SGB) published calls for tenders for the transfer of diamond mineral resources in Santo Inácio, Bahia, containing about 245 million tons of diamondiferous gravel, with research investments expected to reach R$ 5 million. This action stimulates and diversifies the regional economy and fosters investments for the country's socioeconomic growth.

GOLD

Gold mining activities in Brazil, carried out by small and large national and multinational companies over the past few decades, have played a key role in positioning the couunty as a leading global producer.

GOLD CONTENT RESERVES[1]
2.4 kt

OPERATING MINES	PRODUCTION[1]
8	70 t

WORLD RANKING[1]	
Reserves	9th (4%)
Production	14th (2%)

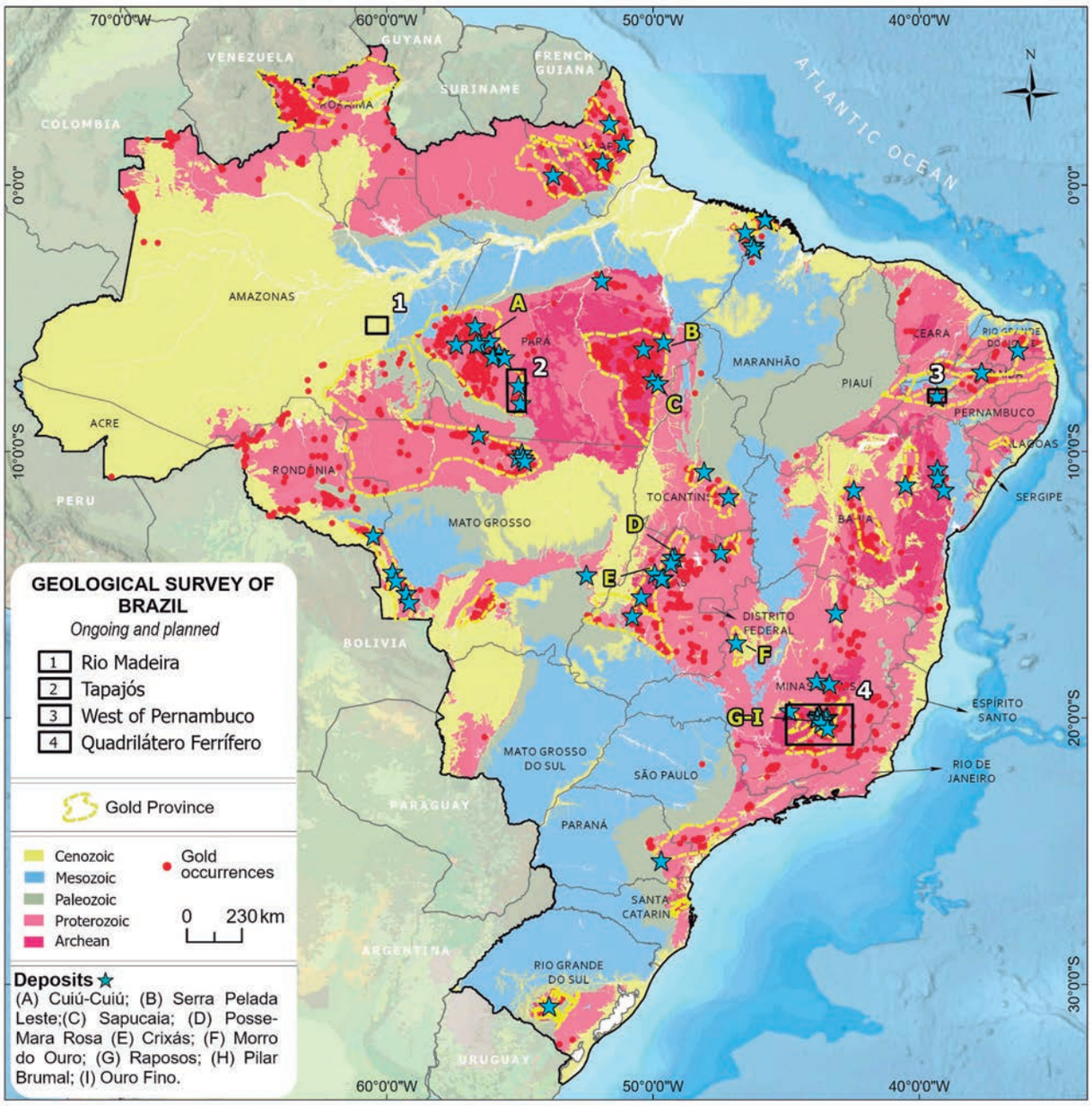
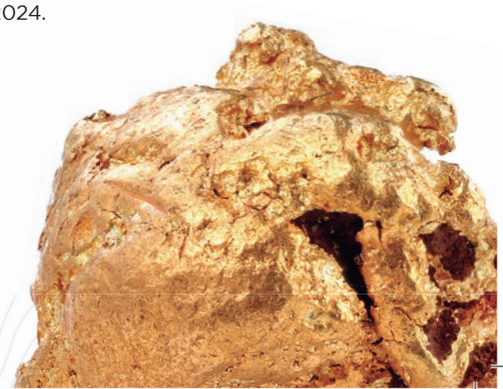


FIGURE 6: Brazilian diamond deposits and occurrences, 2024.



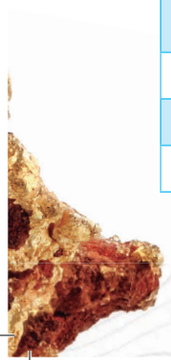
1 U.S. Geological Survey, 2025, Mineral commodity summaries 2025: https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-gold.pdf

HIGHLIGHTS

- Over the past 120 years, industrial mining projects have rapidly expanded across Brazil, leading to the operation of over 80 mines and the production of approximately 2,000 tons of gold.
- Brazil is home to four world-class gold mines: Cuiabá, Morro do Ouro, Crixás, and the now-closed Morro Velho mine, which remains an important benchmark for global mining.
- While Minas Gerais remains the nation's primary gold producer, housing Brazil's two largest gold mines, the Amazon region has emerged as a new frontier, rapidly solidifying its role as a significant player in the gold industry.
- The Amazonian Craton—particularly the Carajás, Tapajós, and Juruena-Teles Pires provinces—the Gurupi Belt, and the Goiás Magmatic Arc represent key frontiers for discoveries, offering tremendous potential for the future growth of industrial gold mining.
- Advances in remote sensing and geological mapping technologies have enabled the identification of new exploration targets in Pará, Amazonas, and Roraima, which hold substantial potential for uncovering undiscovered gold deposits.
- The primary gold deposits being explored by major industrial and artisanal mining companies are located in Minas Gerais, Bahia, Mato Grosso, Goiás, and Maranhão.
- Furthermore, expanding operations and modernization efforts in regions such as Tocantins (Monte do Carmo, Almas) and Amapá (Tucano) highlight the vast potential for sustainable exploration and future growth.

Selected gold deposits and resource estimates

Deposit	Commodity	Owner	Estimated Resources	Grades (Au)	Status
Águas Claras	Au-Cu	Vale S.A.	23.09 Mt	2.43 g/t	Interrupted
Amapari- Tucano	Au	Tucano Gold	56.66 Mt	1.06 g/t	Interrupted
Aurizona Mineração	Au	Equinox Gold	46.18 Mt	2.1 g/t	Operating
Cachoeira	Au	Gold Mining Inc.	41.83 Mt	1.12 g/t	Intermittent Operation
Castelo dos Sonhos	Au	Tristar Company	78.0 Mt	1.03 g/t	Feasibility
Cipoeiro	Au	Jaguar Mining	52.87 Mt	1.9 g/t	Exploration
Córrego do Sítio	Au	AngloGold Ashanti	35.91 Mt	3.11 g/t	Operating
Crixás (Serra Grande)	Au	AngloGold Ashanti	38.35 Mt	2.95 g/t	Operating
Cuiabá	Au	AngloGold Ashanti	25.62 Mt	6.45 g/t	Operating
Cuiú-Cuiú (Moreira Gomes, Central)	Au	Cabral Gold	37.1 Mt	0.90 g/t	Operating
Fazenda Maria Preta (C1 Santa Luz)	Au	Equinox Gold	12.59 Mt	2.35 g/t	Interrupted
Jacobina (Canavieiras Sul, Norte e Central, Morro do Vento, João Belo, Serra do Córrego)	Au-U	Pan American Silver	208.93 Mt	1.55 g/t	Operating
Montes Áureos- CentroGold	Au	Oz Minerals	28 Mt	0.69 g/t	Operating
Morro do Ouro	Au-Ag	Kinross Gold	138.11 Mt	0.4 g/t	Operating
Posse-Mara Rosa	Au	Hochschild Mining	33.1 Mt	1.14 g/t	Feasibility
São Jorge	Au	Gold Mining Inc.	44.42 Mt	1.55 g/t	Intermittent Operation
Suruca	Au-Zn	Lundin Mining Corp.	160.01 Mt	0.53 g/t	Feasibility
Tocantinzinho	Au	G Mining Ventures Corp.	47.47 Mt	1.36 g/t	Exploration
Volta Grande (norte e sul)	Au	Belo Sun	202.01 Mt	0.95 g/t	Feasibility



GRAPHITE

The Bahia-Minas Province in Brazil is recognized as one of the largest graphite-producing regions in the world. However, Brazil has several other regions with untapped potential for graphite production, including the Central Ceará Graphite Province, the Amazon Craton, the Araguaia Belt, the Paraguay Belt, and the Brasília Belt.

ORE RESERVES[1]
74 Mt

OPERATING MINES	PRODUCTION[1]
5	68,000 t

WORLD RANKING[1]	
Reserves	2nd (26.4%)
Production	4th (4.3%)

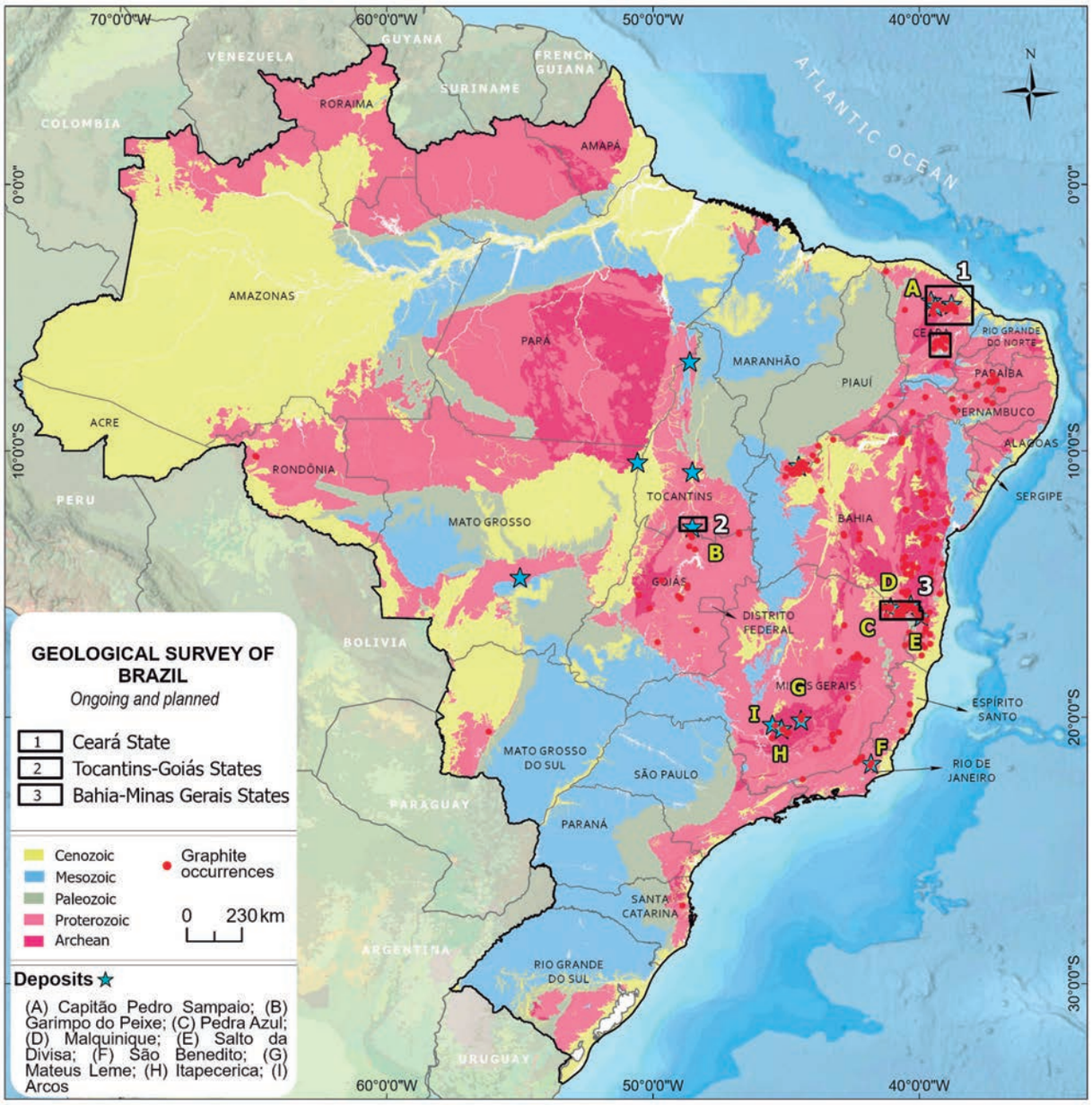


FIGURE 7: Brazilian graphite deposits and occurrences, 2024.

1 U.S. Geological Survey, 2025, Mineral commodity summaries 2025: https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-graphite.pdf

HIGHLIGHTS

- Brazil has significant potential for producing graphite, a mineral widely used in various industries, such as producing world-class batteries and manufacturing electronic components.
- Graphite occurrences in Brazil are mainly found in metamorphic environments, primarily within Proterozoic Orogenic Belts. Metamorphism, along with the resulting temperature and pressure conditions, is the primary factor in analyzing graphite potential because it influences the degree of crystallization and the quality of the ore.
- Another important factor to consider is the presence of metasedimentary rocks that originated from protoliths formed during oxidation events, particularly in the Paleoproterozoic and Neoproterozoic. During these eras, some of the atmospheric CO_2 was converted into organic matter, which later underwent metamorphism into graphite during orogenic events.
- Considering its potential, Brazil's graphite production still needs to be improved, and the industry has significant room for growth. The Brazilian government has shown interest in developing the country's graphite production, with investment in the sector expected to increase in the coming years.
- In the long term, Brazil offers attractive prospects for graphite exploration and growth due to the increasing demand for the mineral, coupled with its position as the world's third-largest graphite producer and the second-largest producer of high-quality flake graphite used in electric vehicles.

Selected graphite deposits and resource estimates

Deposit	Commodity	Owner	Estimated Resources	Grades (CG)	Status
Itapecerica Mine	Graphite	Nacional Grafite Ltd.	209.59 Mt	9.79%	Operating
Mateus Leme Mine	Graphite	Grafita MG Ltd.	91.67 Mt	14%	Operating
Mina Maiquinique	Graphite	Extrativa/Grafite do Brasil	33.3 Mt	9.6%	Operation
Pedra Azul Mine	Graphite	Nacional de Grafite Ltd.	19.07 Mt	12.59%	Operating
Peresópolis Deposit	Graphite	Lucra Minerals Ltd.	40 Mt	12%	Early exploration
Porto Nacional Deposit	Graphite	Di Castro's Construtora Ltda	49.7 Mt	5.3%	Early exploration
Salto da Divisa Mine	Graphite	Nacional de Graphite Ltd.	232.6 Mt	25%	Operating
Santa Cruz	Graphite	South Star Mining Group	14.9 Mt	2.29%	Exploration
Santa Terezinha Deposit	Graphite	Mineração de Calcário Montevidiu LTDA	7.50 Mt	6.33%	Early exploration
São Benedito Mine	Graphite	São Benedito	2.09 Mt	57.43 %	Interrupted

IRON

Iron ore is the most abundant and economically relevant mineral in Brazil. The 148 billion tons of iron ore mined in 2023 represent approximately 66% (R$ 154.8 billion) of Brazilian Mineral Production for the period. The Financial Compensation for the Exploration of Mineral Resources (CFEM) collected in the same period on iron ore totaled approximately R$ 5.1 billion, distributed to the States, Federal District, municipalities and federal government agencies.

ORE RESERVES[1]
34,000 Mt (Crude Ore) 15,000 Mt (Iron Content)

OPERATING MINES	PRODUCTION[1]
33	440 Mt

WORLD RANKING[1]	
Reserves	3rd (Crude Ore) 2nd (Iron Content)
Production	2nd (17%)

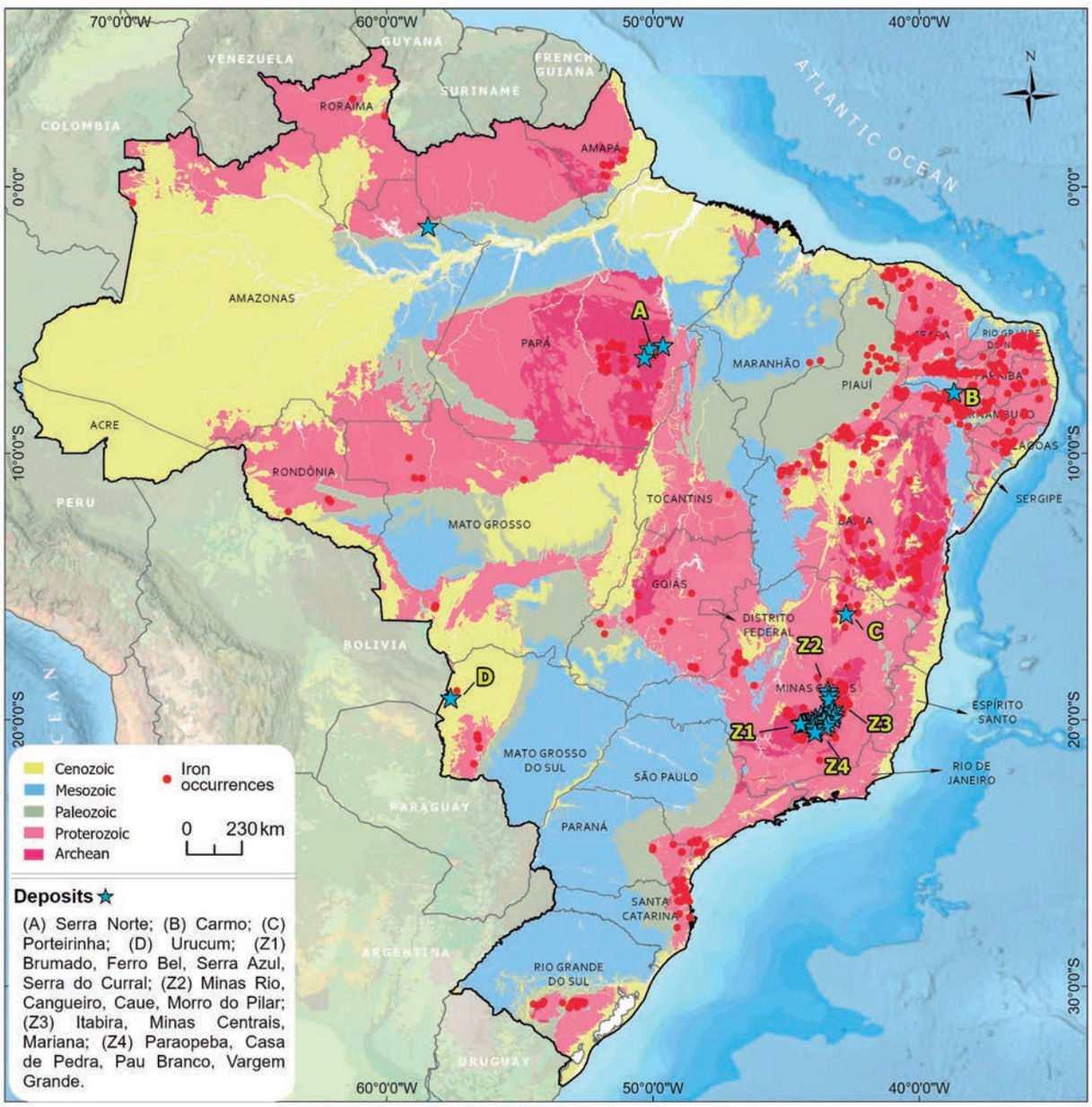


FIGURE 8: Brazilian iron deposits and occurrences, 2024.

1 U.S. Geological Survey, 2025, Mineral commodity summaries 2025: https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-iron-ore.pdf

HIGHLIGHTS

- Brazil holds the world's third-largest reserves of crude iron ore, estimated at around 34 billion tons, behind Australia (58 billion tons) and Russia (35 billion tons). However, in terms of iron content, the Brazilian reserves rise to the global second position, totalling approximately 15 billion tonnes, behind only to Australia, with its 27 billion tonnes of iron content.
- Vale S.A. is the country's largest operator and owns the main iron mines, all of which are open pit, and their related operations are concentrated in three systems: the Southeastern (Itabira, Mariana, Minas Centrais) and Southern (Vargem Grande, Paraopeba) in the Quadrilátero Ferrífero and, the Northern System, in the Carajás Mineral Province (Serra Norte, Serra Sul and Serra Leste). Each system has its own transportation and shipping capabilities.
- The Serra Norte Mining Complex is currently the largest iron ore mining operation in the world, followed by the Serra Sul S11D Project, which is the second largest mine in Brazil and the world. In 2023, these operations reached production of 102.8 and 76.7 million tons, respectively.
- In addition to Vale S.A., which operates in the production of iron ore in the states of Minas Gerais and Pará, the list of large iron ore mining companies in Brazil, which produced more than 1 billion tons each in 2023, includes, from the largest to the smallest production: CSN Mineração, Anglo American Minério de Ferro Brasil S.A., Mineração Usiminas S.A., Vallourec Tubos do Brasil LTDA, Samarco Mineração S.A. Mineração Corumbaense Reunida S.A., Cia de Mineração Serra da Farofa, Arcelormittal Brasil S.A., Gerdau Açominas S.A. and Ferro + Mineração S.A. Their operations are distributed mainly across the states of Minas Gerais, Bahia and Mato Grosso do Sul.
- The main iron resources in Brazil are associated with oxide facies of the banded iron formations of the large dimensions Superior type deposits, followed by Algoma and Rapitian iron deposits types, with considerably smaller dimensions.
- Iron formations are chemical rocks, generally banded, with an iron (Fe) content ranging from ca. 20 to 40%, predominantly composed of chert and iron minerals, and occurring in Precambrian marine successions associated with pelitic and carbonate rocks, or volcano-sedimentary sequences.
- Their presence of iron formations is linked to the oxygenation of the atmosphere, being continuous in the geological record between the Archean and Mesoproterozoic periods (Algoma and Superior-types), and reappearing only for a short time in the Neoproterozoic (Rapitian-type).
- Hypogene and supergene mineralization processes led to their enrichment to levels between 60 and 68% in Fe, constituting a mineral of high economic and strategic value for the Brazilian economy due to the large number of deposits in its extensive cratonic areas.
- The very high production volumes involved and the low added value per ton require that the deposits, in addition to containing large quantities of ore, have the availability of structured transport logistics, demanding high investments in railways and ports.
- In the Quadrilátero Ferrífero region, Precambrian metamorphic processes superimposed on the banded iron formations of the Superior and Algoma types transformed them into itabirites. According to the intensity of weathering, these iron-bearing lithologies are physically classified as friable itabirite, semi-friable itabirite and itabirite, whose iron contents vary between 25 and 60% Fe, but rarely exceeding 60% in rocks defined as hematite.
- In the Carajás Mineral Province, it predominates oxide facies banded iron formations preserved from metamorphism, with dimensions typical of the Superior type, but in association with volcano-sedimentary environments characteristics of the Algoma type iron formations.
- The different iron ores commercially mined in Brazil have high iron content and small amounts of elements that are undesirable in steelmaking processes, such as sulfur, aluminum, phosphorus and carbonates.

Selected iron deposits and resource estimates

Deposit		Commodity	Owner	Estimated Resources	Grades (Fe)	Status
Southeastern System	Itabira (Conceição, Minas do Meio)	Fe	Vale S.A.	1539.54 Mt	46.58%	Operating
	Minas Centrais (Brucutu, Morro Agudo, Apolo)	Fe	Vale S.A.	4073.6 Mt	44.04%	Operating
	Mariana (Fazendão, Alegria, Capanema, Fábrica Nova)	Fe	Vale S.A.	6777.1 Mt	48.56%	Operating
Southern System	Vargem Grande (Sapecado, Galinheiro, Tamanduá, Capitão do Mato, Abóboras)	Fe	Vale S.A.	8385.6 Mt	42.61%	Operating
	Paraopeba (João Pereira, Segredo, Mar Azul, Capão Xavier)	Fe	Vale S.A.	4836.5 Mt	49.18%	Operating
Northern System	Serra Norte	Fe	Vale S.A.	2746.1 Mt	65.65 %	Operating
	Serra Sul	Fe	Vale S.A.	4504.1 Mt	65.75 %	Operating
	Serra Leste	Fe	Vale S.A.	817 Mt	56.85 %	Operating
Casa de Pedra e Engenho		Fe	CSN Mineração	6 Bt	Not available	Operating
Minas-Rio: Serra do Sapo, Itapanhoacanga (Conceição do Mato Dentro)		Fe	Anglo American Minério de Ferro Brasil S.A.	5846.2 Mt	35.17%	Operating
Andrade		Fe	Arcelormittal Brasil S.A.	Not available	Not available	Operating
Mina de Alegria Complexo de Germano		Fe	Samarco Mineração S.A (in judicial recovery)	Not available	Not available	Operating
Mina de Serra Azul		Fe	Arcelormittal Brasil S.A.	Not available	Not available	Operating
Mina Leste, Mina Central e Mina Oeste		Fe	Mineração Usiminas S.A.	Not available	Not available	Operating
Mina Urucum e Mina Santa Cruz		Fe	Lhg Mining (old Mineração Corumbaense Reunida S.A.)	Not available	Not available	Operating
Minas Tico-Tico e Ipê		Fe	Mineração Morro do Ipê S.A.	Not available	Not available	Operating
Pau Branco		Fe	Vallourec Tubos do Brasil LTDA	Not available	Not available	Operating
Várzea do Lopes e Miguel Burnier		Fe	Gerdau Açominas S.A.	Not available	Not available	Operating
Ferro Mineração S.A.		Fe	Ferro Mineração S.A.	Not available	Not available	Operating

LITHIUM

In Brazil, lithium is mainly found in the form of lithium-cesium-tantalum (LCT, mainly spodumene rich) pegmatite deposits. The primary ore mineral is spodumene, followed by amblygonite, petalite, and lepidolite. In 2024, the estimated production reached 10,000 tonnes of contained lithium, a 90% increase over 2023 production[1] .

LITHIUM CONTENT RESERVES[1]
390 kt

OPERATING MINES	PRODUCTION[1]
5	10 kt

WORLD RANKING[1]	
Reserves	8th (1.3%)
Production	6th (4.2%)

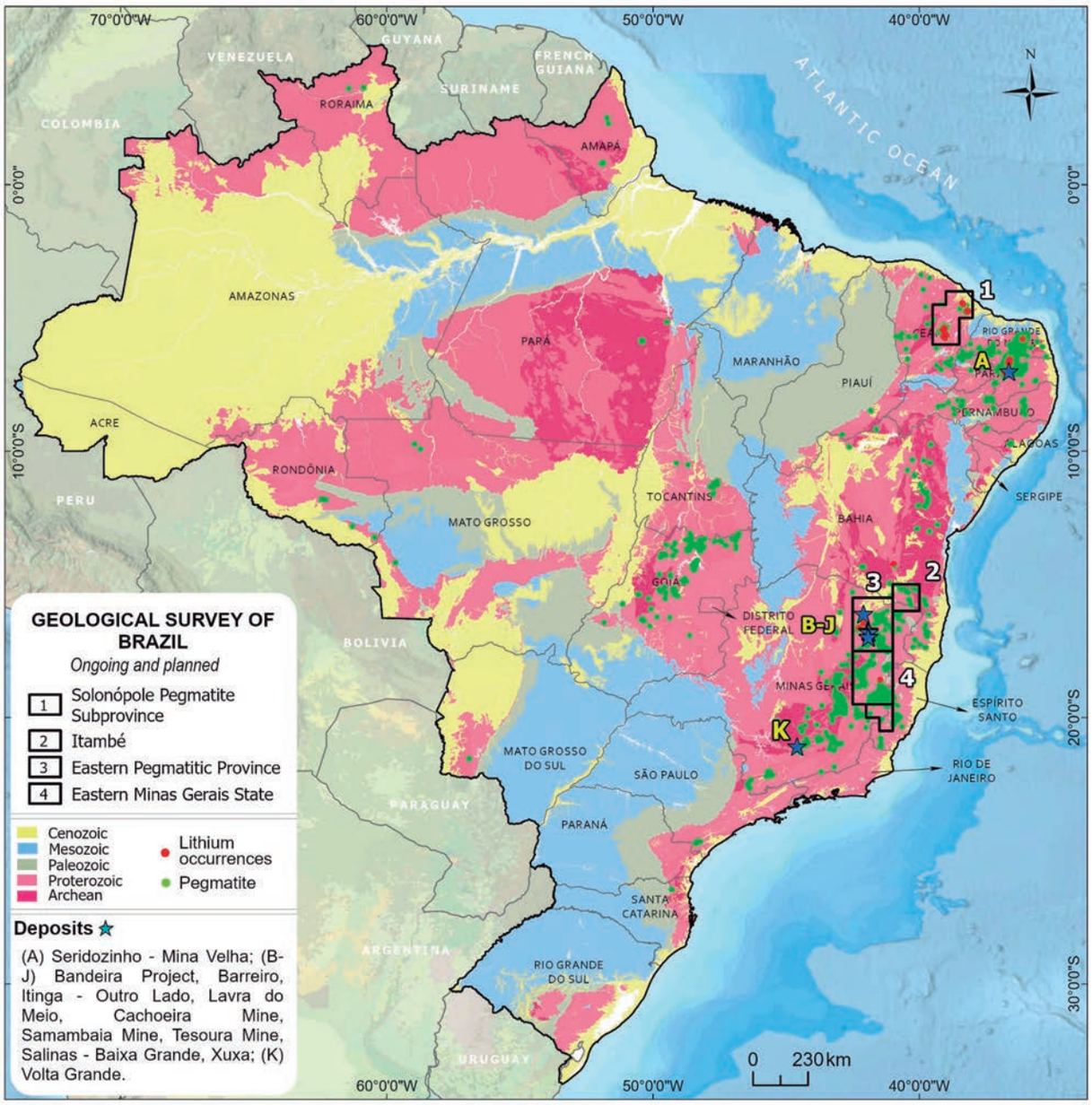


FIGURE 9: Brazilian lithium deposits and occurrences, 2024.

1 U.S. Geological Survey, 2025, Mineral commodity summaries 2025: U.S. Geological Survey, 212 p., https://doi.org/10.3133/mcs2025.

HIGHLIGHTS

- Active mines and advanced exploration projects are concentrated in the state of Minas Gerais. The launch of Minas Gerais' "Lithium Valley Brazil" initiative in May 2023 has caught the attention of the market. The initiative aims to accelerate project development for the lithium supply chain and demonstrates a receptive approach to global investment.
- Companhia Brasileira de Lítio – CBL announced[2] 4.5 Mt of mineral resources (measured + indicated) and a capacity to produce 45 ktpa (kilotonnes per annum) of high-quality spodumene concentrate @5.5% Li_2O at its operating Cachoeira Mine in the Middle Jequitinhonha region, Minas Gerais.
- In the same region, Sigma Lithium reported[3] mineral resource (measured + indicated) estimates of 94.3 Mt @1.40% Li_2O and reserves (proven + probable) of 54.8 Mt @1.44% Li_2O on its Grota do Cirilo property. Sigma achieved its first production in 2023, with five shipments. The annual runrate production reached 270 kt (37 kt Lithium Carbonate Equivalent, LCE), with plans to expand to 766 kt (104 kt LCE) over the next two years.
- Atlas Lithium announced[4] that it has received all necessary permits to assemble its processing plant and operate the Neves project in the Middle Jequitinhonha region, with an expected Phase 1 production of approximately 150 ktpa.
- Lithium Ionic reported[5] mineral resources (measured + indicated) of 23.68 Mt @1.34% Li_2O at the Bandeira Project, with a 20-year mine life producing 220 ktpa of SC5.5.
- On February 4, 2025, Pilbara Minerals Limited, a leading Australian lithium producer, announced[6] the successful acquisition of Latin Resources, including its Colina Lithium Project in the Salinas region, Minas Gerais, Brazil. The JORC Mineral Resource Estimate (MRE) reported[7] for the Colina Lithium Project indicates a total of 70.3 Mt at 1.27% Li_2O. Production is expected to commence in the second half of 2026, with an expected output of 405 to 525 ktpa of SC5.5 and 159 ktpa of 3% Li_2O spodumene tails concentrate products.
- Although the state of Minas Gerais is the main player in lithium exploration, there are also potential areas in northeastern Brazil (e.g., the states of Ceará, Rio Grande do Norte and Paraíba) where more than a hundred Li-bearing pegmatite bodies have been identified.
- On June 30, 2024, Oceana Lithium reported[8] the integration of soil sample results with geophysics, geological mapping, trenching, and RC drilling data, confirming multiple pegmatite swarms and identifying high-priority areas with more than one lithium-bearing pegmatite.
- Greenfield areas include the regions of Southern Tocantins-Northern Goiás and Itambé (Southern Bahia).
- The Geological Survey of Brazil – SGB-CPRM has conducted research projects in key lithium areas to promote the development of the mineral industry. Completed projects in the Middle Jequitinhonha (Minas Gerais) and Borborema Pegmatite Provinces in northeastern Brazil have identified new targets for lithium mineralization. The results, including maps, charts, technical reports and scientific papers, are available to the public (https://rigeo.sbg.gov.br and http://www.sgb.gov.br/litio/index.html). Two ongoing projects are located in Eastern Minas Gerais and Solonópole Province (Ceará).

2 https://www.cblitio.com.br/
3 https://ir.sigmalithiumresources.com/wp-content/uploads/2024/03/Sigma-Lithium-NI-43-101-March-2024-vFinal-19.03.pdf
4 https://www.atlas-lithium.com/wp-content/uploads/2025/01/Brief-Corporate-Overview-January-2025.pdf
5 https://lithiumionic.com/_resources/reports/Bandeira-Lithium-Project-Mineral-Resource-Estimate.pdf?v=112704
6 https://pls.com/news-stories/pls-completes-acquisition-of-latin-resources/
7 https://api.investi.com.au/api/announcements/lrs/19629c02-e62.pdf
8 https://app.sharelinktechnologies.com/announcement/asx/5f65a86fc3ab34cbcb0530eb7db21496
9 https://lithiumionic.com/_resources/reports/NI-43-101-Technical-Report.pdf?v=112905
10 https://lithiumionic.com/projects/salinas-baixa-grande/
11 http://hugin.info/138060/R/2092860/796776.pdf

Selected lithium deposits and resource estimates

Deposit	Commodity	Owner	Resource estimates	Grades (% Li_2O)	Status
Bandeira Project[5]	Li	Lithium Ionic Corp	23.68 Mt	1.34	Feasibility
Barreiro[3]	Li	Sigma Lithium Resources	25.6 Mt	1.36	Feasibility
Itinga- Outro Lado[9]	Li	Lithium Ionic Corp	2.97 Mt	1.46	Unexploited
Lavra do Meio[3]	Li	Sigma Lithium Resources	4.2 Mt	1.17	Unexploited
Mina da Cachoeira	Li	Companhia Brasileira de Lítio	4.5 Mt	1.4	Producing
Murial[3]	Li	Sigma Lithium Resources	13.5 Mt	1.25	Unexploited
Nezinho de Chicão[3]	Li	Sigma Lithium Resources	33.6 Mt	1.45	Feasibility
Salinas Baixa Grande[10]	Li	Lithium Ionic Corp	5.86 Mt	1.09	Unexploited
Volta Grande[11]	Li	AMG	20.3 Mt	1.06	Producing
Xuxa[3]	Li	Sigma Lithium Resources	17.4 Mt	1.55	Producing
Mina da Samambaia	Li	Sigma Lithium Resources	Not available	Not available	Closed/ Exhausted
Mina da Tesoura	Li	Mina da Tesoura	Not available	Not available	Closed/ Exhausted
Seridozinho- Mina Velha	Li	Miranda Mineracao Ltda	Not available	Not available	Intermittent Production

MAGNESIUM

Brazil holds a prominent position in the global magnesite reserves and production, with estimated reserves exceeding 412 million tons. The country ranks third in production and fourth in global reserves of magnesite. In the state of Bahia, Brumado is renowned for its high-quality magnesite deposits, making it a strategic area for both domestic supply and export. Sento Sé also contains significant deposits.

MAGNESIUM OXIDE CONTENT RESERVES[1]
200 Mt

OPERATING MINES	PRODUCTION[1]
5	1.8 Mt

WORLD RANKING[1]	
Reserves	6th (2.6%)
Production	3rd (8.2%)

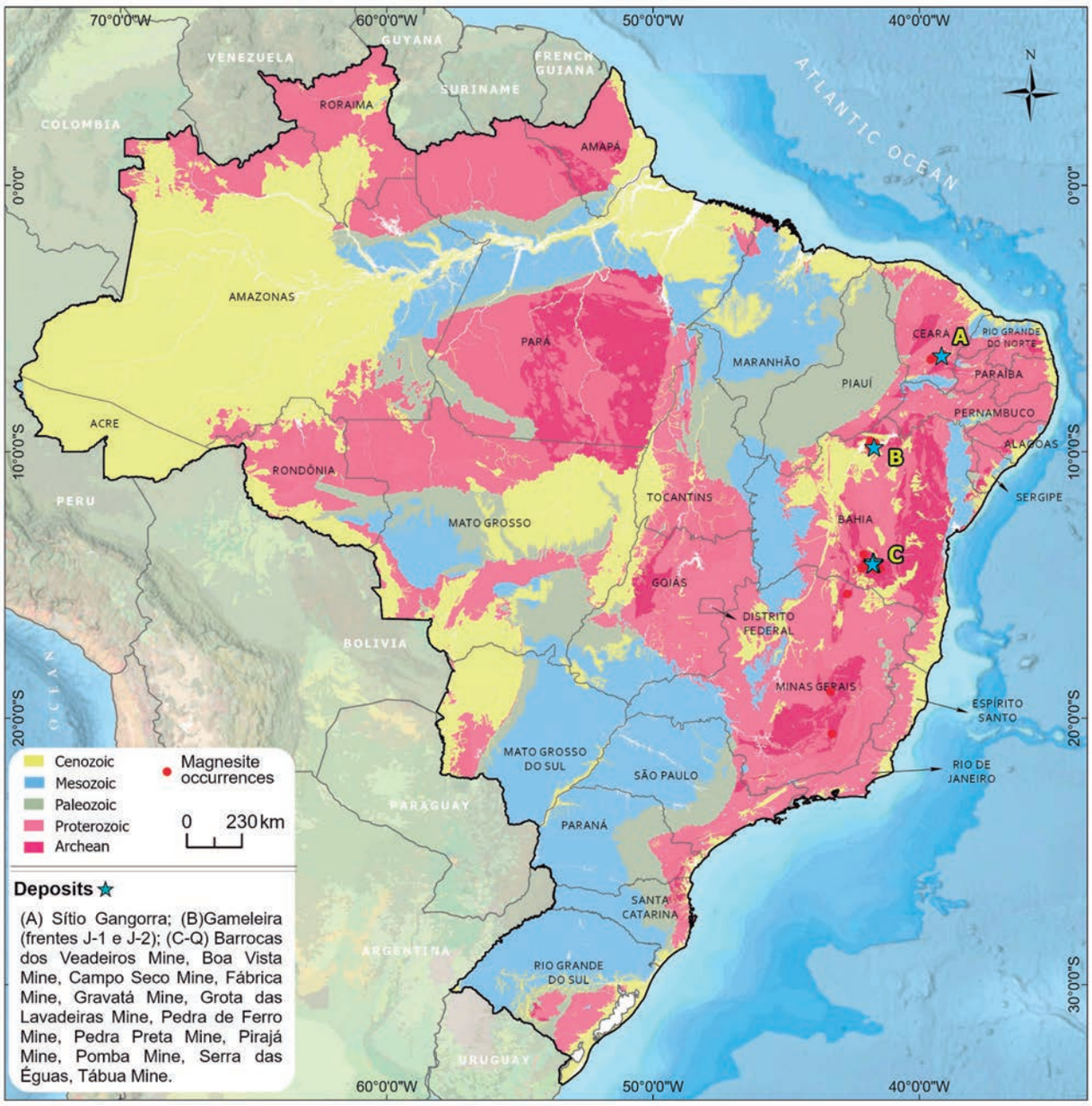


FIGURE 10: Brazilian magnesite deposits and occurrences, 2024.

1 U.S. Geological Survey, 2025, Mineral commodity summaries 2025: https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-magnesium-compounds.pdf

HIGHLIGHTS

- The Serra das Éguas deposit in Brumado is the largest magnesite deposit in Brazil, and the leading producer of high-quality sintered magnesite and talc in the country. The lithology of this unit includes magnesitic and dolomitic marbles, actinolite marbles, and calc-silicate rocks.
- Ceará is the second most strategic state for magnesite production, particularly in the municipalities of Iguatu, Orós, and Jucás, which are part of the Orós Mobile Belt. In 2024, Brazil produced approximately 1.8 million tons of magnesite (USGS 2025).
- Four major companies dominate Brazil's magnesite industry: Magnesita S.A. (RHI Magnesita), the leading producer, responsible for more than 90% of national production; Ibar Nordeste S.A. (specialized in magnesium oxide products); Refranor; and Xilolite S.A.
- Magnesite and its derivatives are essential for the manufacture of heat-resistant materials critical to the steel, cement, and glass industries. Magnesite Sinter is widely used due to its high thermal stability and resistance to corrosion. Acquisitions in the cement, non-ferrous metals, foundry, glass, and petrochemical sectors are significant. Magnesium is also employed as a soil additive and supplement in animal feed and fertilizers.
- Despite robust domestic production, Brazil faces trade deficits in processed magnesite products, which are mainly imported from China. Strategic investments in technology and development of higher-value-added products could strengthen Brazil's position in the global magnesite trade. The country's geological conditions offer significant long-term growth potential in this sector.

Selected magnesite deposits and resources estimates

Deposit	Commodity	Owner	Estimated Resource	Grades	Status
Barrocas dos Veadeiros Mine	Magnesite	RHI Magnesite	Not available	45.36%	Producing
Gravatá Mine	Magnesite	RHI Magnesite	Not available	44.85%	Producing
Pedra de Ferro Mine	Magnesite	RHI Magnesite	Not available	44.80%	Producing
Pedra Preta Mine	Magnesite	RHI Magnesite	Not available	45.60%	Producing
Pomba Mine	Magnesite	RHI Magnesite	Not available	44.65 %	Producing

MANGANESE

Brazil holds 270 million metric tons of manganese reserves, representing 15.8% of global reserves. This positions the country as the fourth-largest holder of reserves worldwide, behind South Africa (560 Mt), Australia (500 Mt) and China (280 Mt). In 2024, Brazil produced 590 thousand metric tons of manganese content, ranking as the seventh-largest global producer.

ORE RESERVES
270 Mt

OPERATING MINES	PRODUCTION[1]
2	590 kt

WORLD RANKING[1]	
Reserves	4th (15.8%)
Production	7th (2.95%)

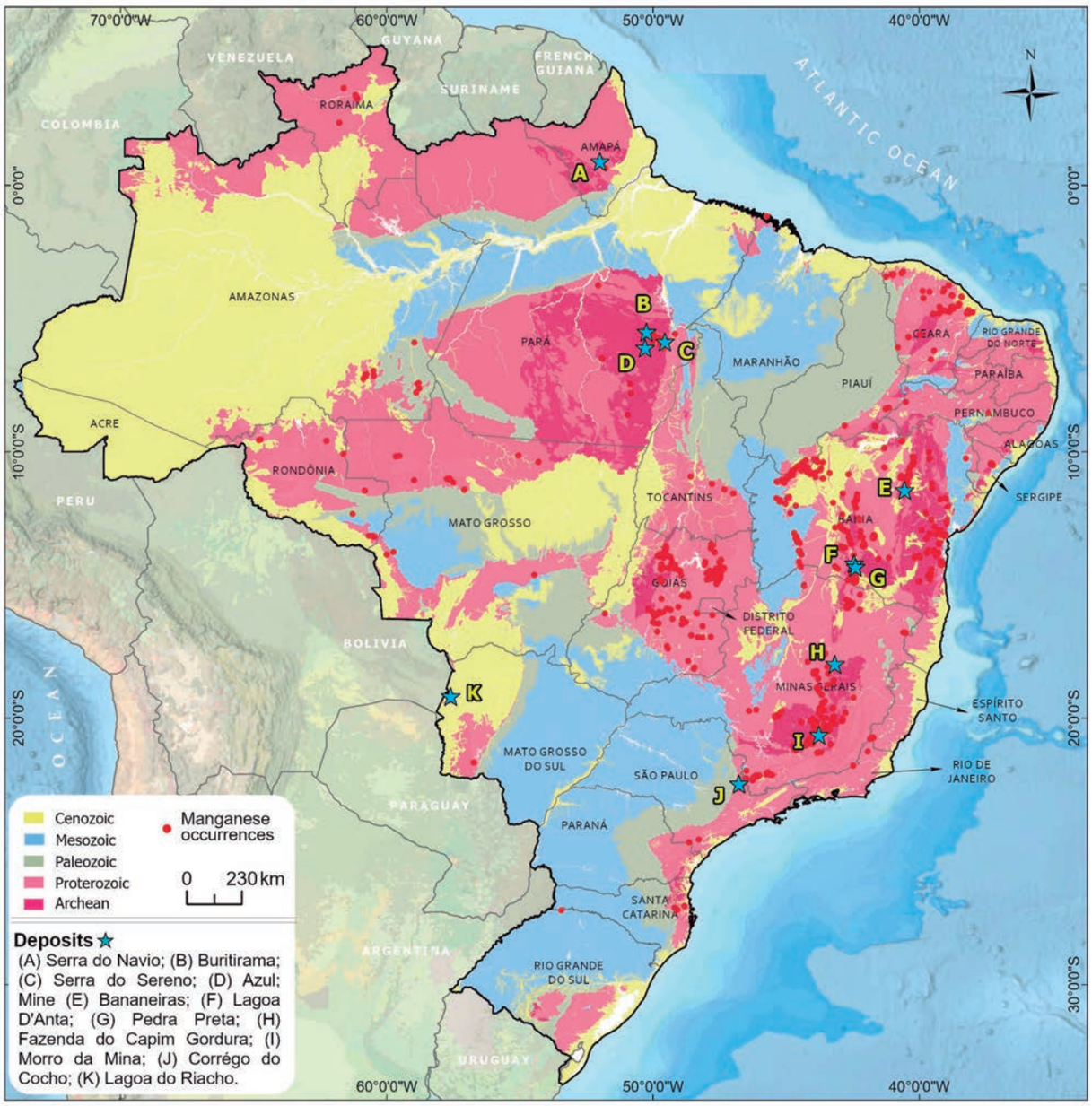


FIGURE 11: Brazilian manganese deposits and occurrences, 2024.

1 U.S. Geological Survey, 2025, Mineral commodity summaries 2025: https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-manganese.pdf

HIGHLIGHTS

- Brazil's manganese reserves are primarily concentrated in Pará, Mato Grosso do Sul, Minas Gerais, and Amapá. The Carajás Mineral Province in Pará stands out for hosting the Azul and Buritirama mines, which account for a significant share of the country's manganese production and reserves. The Azul Mine, located in Pará, is the largest manganese-producing mine in Brazil. It is renowned for its high-grade ore (>40% Mn) and estimated reserves of 65 Mt. The Buritirama Mine, also in Pará, holds reserves of approximately 18.5 Mt, with manganese grades ranging from 40% to 54%, underscoring its importance for national production. The Urucum Mine in Mato Grosso do Sul has reserves of 34.5 Mt and an average grade of 46% Mn, making it a strategic asset for manganese production in Brazil.
- Brazil's manganese deposits are found in diverse geological contexts, predominantly Paleoproterozoic in age: Paleoproterozoic greenstone belts (e.g., Serra do Navio deposit), banded iron formations (e.g., Morro da Mina deposit), continental shelf siliciclastic-carbonate sequences (e.g., Azul and Buritirama deposits), black shale-hosted Mn-carbonate deposits (e.g., Lagoa do Riacho deposit), and Neoproterozoic siliciclastic-carbonate sequences (e.g., Urucum deposit). Supergene enrichment processes that concentrate high-grade manganese minerals are crucial for the economic viability of these deposits, with Azul, Buritirama, and Urucum as key examples.
- The steel industry consumes a significant portion of Brazil's manganese production, primarily for alloy manufacturing. However, due to the global transition to sustainable energy sources, demand for manganese in electric battery applications is increasing. Additionally, there is a growing demand for manganese in agricultural applications, such as fertilizers. With abundant high-grade reserves, advanced mining infrastructure, and rising global demand, Brazil is strategically positioned to expand as a key player in the worldwide manganese market.

Selected manganese deposits and resources estimates

Deposit	Commodity	Owner	Estimated Resource	Grades	Status
Buritirama	Mn	Mineração Buritirama SA	28 Mt	54%	Interrupted
Corrégo do Cocho	Mn	Mineração Itapira LTDA	20 Mt	23%	Unexploited
Morro da Mina	Mn	Morro da Mina	30 Mt	Not available	Interrupted (temporarily)
Serra do Navio	Mn	Indústria e Comércio de Minérios SA (ICOMI)	18.5 Mt	Not available	Closed/ Exhausted
Serra do Sereno	Mn	Vale SA	6.5 Mt	40%	Unexploited
Bananeiras	Mn	Zeus Mineração LTDA	Not available	Not available	Early Exploration
Fazenda do Capim Gordura	Mn	Fazenda do Capim Gordura	Not available	Not available	Unkown
Fazenda São José da Serra	Mn	Fazenda São José da Serra	Not available	Not available	Unknown
Lagoa D'Anta	Mn	Zeus Mineração LTDA	Not available	Not available	Closed/ Exhausted
Lagoa do Riacho	Mn	Libras Ligas do Brasil SA	Not available	Not available	Producing
Mina do Azul	Mn	Vale SA	Not available	47%	Producing
Pedra Preta	Mn	BAMIN	Not available	Not available	Closed/ Exhausted

MOLYBDENUM

Molybdenum occurrences in Brazil are associated with different types of mineral deposits: skarn deposits – located in the states of Rio Grande do Norte and Paraíba; uranium mineralizations – found in Minas Gerais and Santa Catarina; byproducts in pegmatites – present in Bahia; deposits in granites – identified in Santa Catarina, Rio Grande do Sul, and Roraima; and epithermal deposits – located in Pará, with occurrences highlighted in the Salobo and Breves copper deposits.

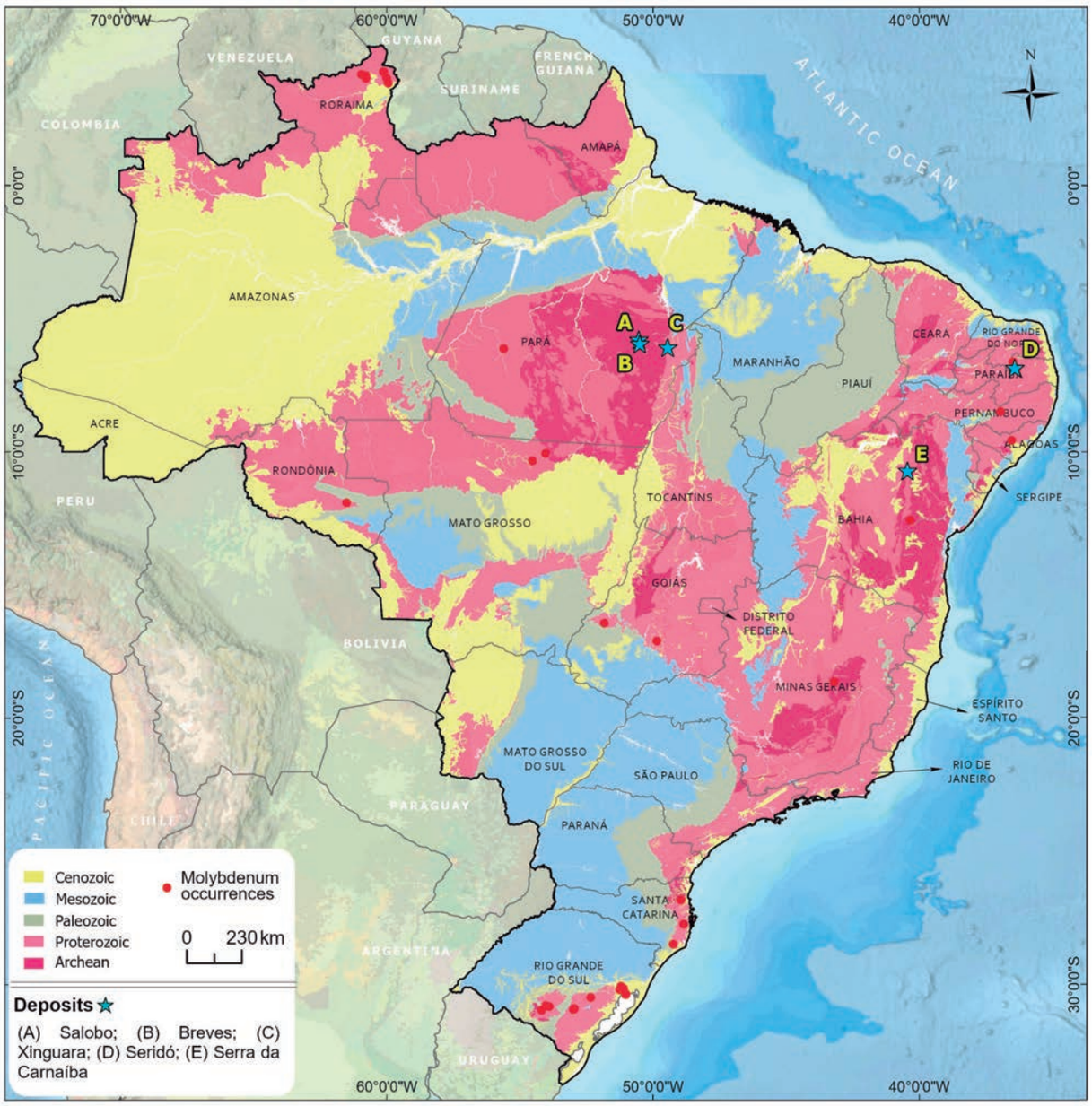


FIGURE 12: Brazilian molybdenum deposits and occurrences, 2024.

HIGHLIGHTS

- Currently, Brazil has no official molybdenum production recorded from 2010 to 2023, and its reserves are considered limited. However, there are records of informal molybdenite concentrate production, particularly in the Carnaíba region of Campo Formoso, Bahia, where molybdenite is recovered artisanally as a byproduct of emerald and green beryl extraction.
- In terms of mineral projects, the Geological Survey of Brazil (SGB) has conducted studies in the Seridó Mineral Province, covering areas in the states of Rio Grande do Norte and Paraíba. These studies have identified deposits of gold, scheelite, molybdenum, bismuth, copper, and iron, indicating the region's mineral potential.

NICKEL

Brazil ranked among the top 10 global nickel producers in 2024, supported by four active mining operations (Onça-Puma, CODEMIN, Barro Alto, and Santa Rita) and several prospects in different exploratory stages. Mining takes place from both sulfide and laterite projects, and the operations produce both class I and Class II nickel, with three mines operating at costs below the global average.

NICKEL CONTENT RESERVES[1]
16 Mt

OPERATING MINES	PRODUCTION[1]
4	77 kt

WORLD RANKING[1]	
Reserves	3rd (12%)
Production	8th (2%)

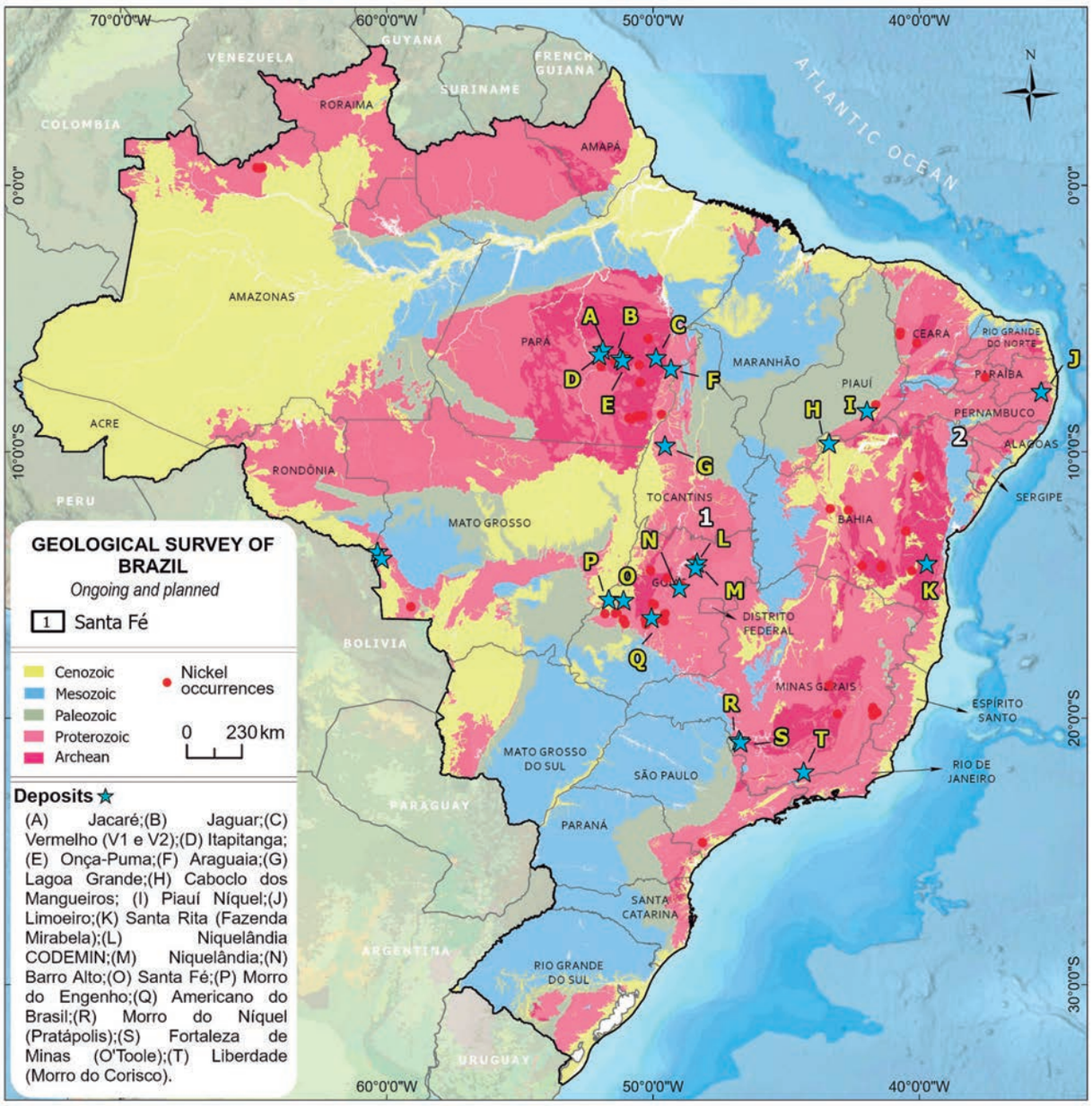


FIGURE 13: Brazilian nickel deposits and occurrences, 2024.

1 U.S. Geological Survey, 2025, Mineral commodity summaries 2025: https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-nickel.pdf

HIGHLIGHTS

- Brazilian nickel reserves represent approximately 12% of the world's declared reserves (16 Mt) and 6% of global nickel resources (USGS, 2023). Three companies produce stainless steel using nickel in Brazil: Aperam, Villares Metals, and Gerdau, contributing to domestic nickel demand.
- Three nickel exploration projects are at relatively advanced stages: Araguaia, Piauí, and Jaguar. Additionally, the recent discovery of the Lagoa Grande prospect (Ni, Cu, Co) by CBPM, located on the border of Bahia and Piauí States, stands out with an estimated 405 Mt of unexploited resources. The unconventional hydrothermal Jaguar prospect, which hosts resources of approximately 138 Mt of nickel, has drawn attention for its ability to produce high-quality concentrates due to ore enriched with millerite—one of the highest-grade nickel sulfides.
- Although cobalt production ceased in Brazil in 2016, it remains an important by-product of nickel mining. Cobalt is reported as a secondary element in at least nine nickel deposits, including those in both laterite and sulfide operations.
- Access to low-cost, low-emissions hydroelectric power continues to offer Brazilian nickel producers a unique advantage, reducing both operating costs and the carbon footprint of production.

Selected nickel deposits and resources estimates

Deposit	Commodity	Owner	Resource estimates	Grades (Ni)	Status
Americano do Brasil	Ni, Cu, Co	Prometálica Mineração Centro Oeste S/A	3.09	Not available	Interrupted
Araguaia	Ni, Co, Fe, MgO, SiO_2, Al_2O_3, Cr_2O_3	Horizonte Minerals	119	1.27	Feasibility
Barro Alto	Ni	Anglo American	23.8	1.21	Producing
Caboclo dos Mangueiros	Ni, Cu, Co	Bahia Nickel	200	Not available	Unexploted
CODEMIN (Niquelândia)	Ni	Anglo American	2.5	1.25	Producing
Fortaleza de Minas (O'Toole)	Ni, Cu, Co	Not available	45.45	Not available	Interrupted
Itapitanga	Ni, Co , Sc	Centaurus	40	0.95	Unexploted
Jacaré	Ni, Co	Anglo American	99.7	1.31	Feasibility
Jaguar	Ni, Cu, Co	Centaurus	112.6	0.87	Feasibility
Lagoa Grande	Ni, Cu, Co	CBPM	405	0.16	Unexploted
Liberdade (Morro do Corisco)	Ni	Not available	1	Not available	Closed
Limoeiro	Ni, Cu, Pt	CBA	35	Not available	Feasibility
Luanga	PGM+Au+Ni	Bravo	191.2	0.1	Unexploted
Morro do Engenho	Ni, Co, Sc	SGB-CPRM	67.24	1.07	Unexploted
Morro do Leme	Ni, Fe, SiO_2, MgO	Anglo American	18	1.73	Feasibility
Morro do Níquel	Ni	Not available	2.3	1,5	Interrupted
Morro Sem Boné	Ni, Fe, SiO_2, MgO	Anglo American	40.287	1.79	Feasibility
Mundial Carapanã	Ni	Not available	30	1.4	Unexploted
Niquelândia	Ni, Co	CBA	55	0.94	Interrupted
Onça-Puma	Ni, Co, Fe, SiO_2, MgO	Vale Base Metals	134	Not available	Producing
Piauí Níquel	Ni, Co	Brazilian Nickel Ltda.	98.8	0.84	Feasibility
Santa Fé	Ni, Co, Sc	SGB-CPRM	39.73	1.14	Unexploted
Santa Rita (Fazenda Mirabela)	Ni, Cu, Co	Atlantic Nickel/ CBPM	255.1	0.5	Producing
Vermelho (V1 e V2)	Ni, Co, Fe_2O_3, MgO_2, SiO_2	Horizonte Minerals	145.7	1.05	Feasibility
Santa Maria e Santa Cruz	Ni, Co	Not available	Not available	Not available	Interrupted

NIOBIUM

Niobium is a strategic metal widely used in metal alloys for industries such as steel, aerospace, construction, and electronics. Brazil, through companies like CBMM (Companhia Brasileira de Metalurgia e Mineração) and CMOC, dominates the international export market for this resource.

NIOBIUM CONTENT RESERVES[1]
16 Mt

OPERATING MINES	PRODUCTION[1]
5	100 kt

WORLD RANKING[1]	
Reserves	1st (94%)
Production	1st (90%)

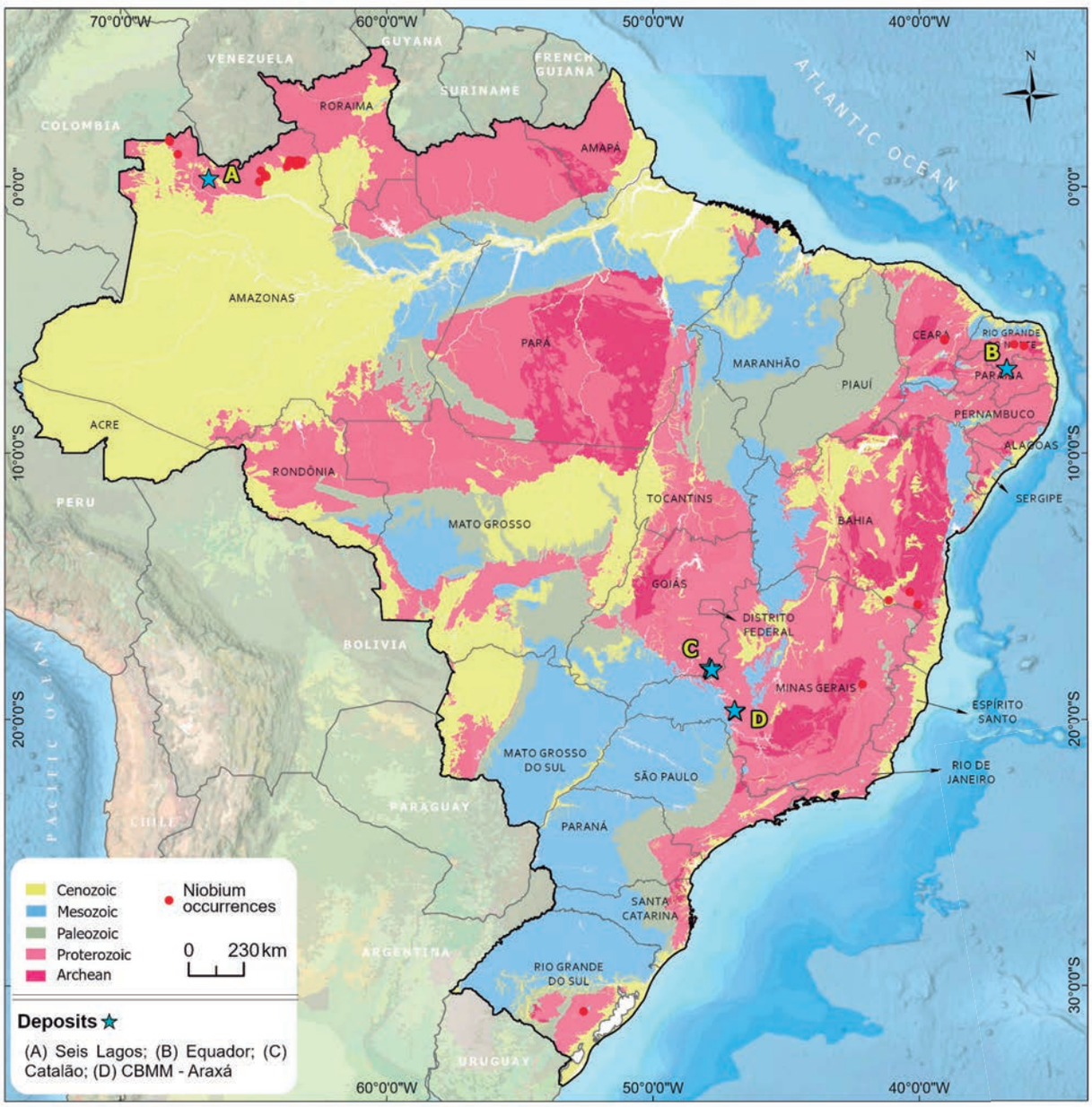


FIGURE 14: Brazilian niobium deposits and occurrences, 2024.

1 U.S. Geological Survey, 2025, Mineral commodity summaries 2025: https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-niobium.pdf

HIGHLIGHTS

- Brazil accounts for 90% of the world's Niobium production.
- The main Niobium deposits in Brazil are associated with carbonatite complexes in the states of Goiás and Minas Gerais. Some minor production comes from byproducts of cassiterite mining, such as in Amazonas State (Mineração Taboca). Niobium production in Rondônia and Pará States is associated with byproducts of cassiterite-digging.
- Pyrochlore is the primary Niobium ore in carbonatite complexes of Goiás and Minas Gerais. Although it is magmatic in origin, metallurgical processes are effective only in the supergene part of these complexes.
- In 2024, CMOC Brazil reported a record production of 10,024 tonnes of niobium, solidifying its position as the world's second-largest producer of the metal and accounting for 11% of global production.

Selected niobium deposits and resources estimates

Deposit	Commodity	Owner	Resource estimates	Grades	Status
Araxá	Nb (pyrochlore)	CBMM	896 Mt	1.49 %	Operating
Boa Vista (Catalão II)	Nb (pyrochlore)	CMOC	26 Mt	0.95 %	Operating
Mine I (Catalão I)	Nb (pyrochlore)	CMOC	13 Mt	0.95 %	Operating
Mine II (Catalão I)	Nb (pyrochlore)	CMOC	5.9 Mt	1.13 %	Operating
Pitinga	Nb (pyrochlore and columbite) byproduct of Sn (cassiterite)	Mineração Taboca	515 Mt	0.20 %	Operating
Seis Lagos	Nb (pyrochlore)	SGB-CPRM	Not available	Not available	Unexploited

PHOSPHATE

Brazil imports about 86% of the phosphorus required for its agricultural production due to the natural deficiency of these nutrients in Brazilian soil and the country's low fertilizer production, which cannot supply domestic demand. Therefore, phosphorus is considered a critical element. Brazil has several important phosphate deposits and significant potential for new discoveries. Most of the deposits are associated with residual enrichment processes of carbonatite-alkaline bodies, forming of thick weathering cover (almost 80%). In contrast to this trend, only 20% of Brazil's reserves are related to sedimentary rocks, despite the existence of numerous potential basins.

ORE RESERVES
1.6 Gt

OPERATING MINES	PRODUCTION[1]
15	5.3 Mt

WORLD RANKING[1]	
Reserves	7th (2.2%)
Production	7th (2.2%)

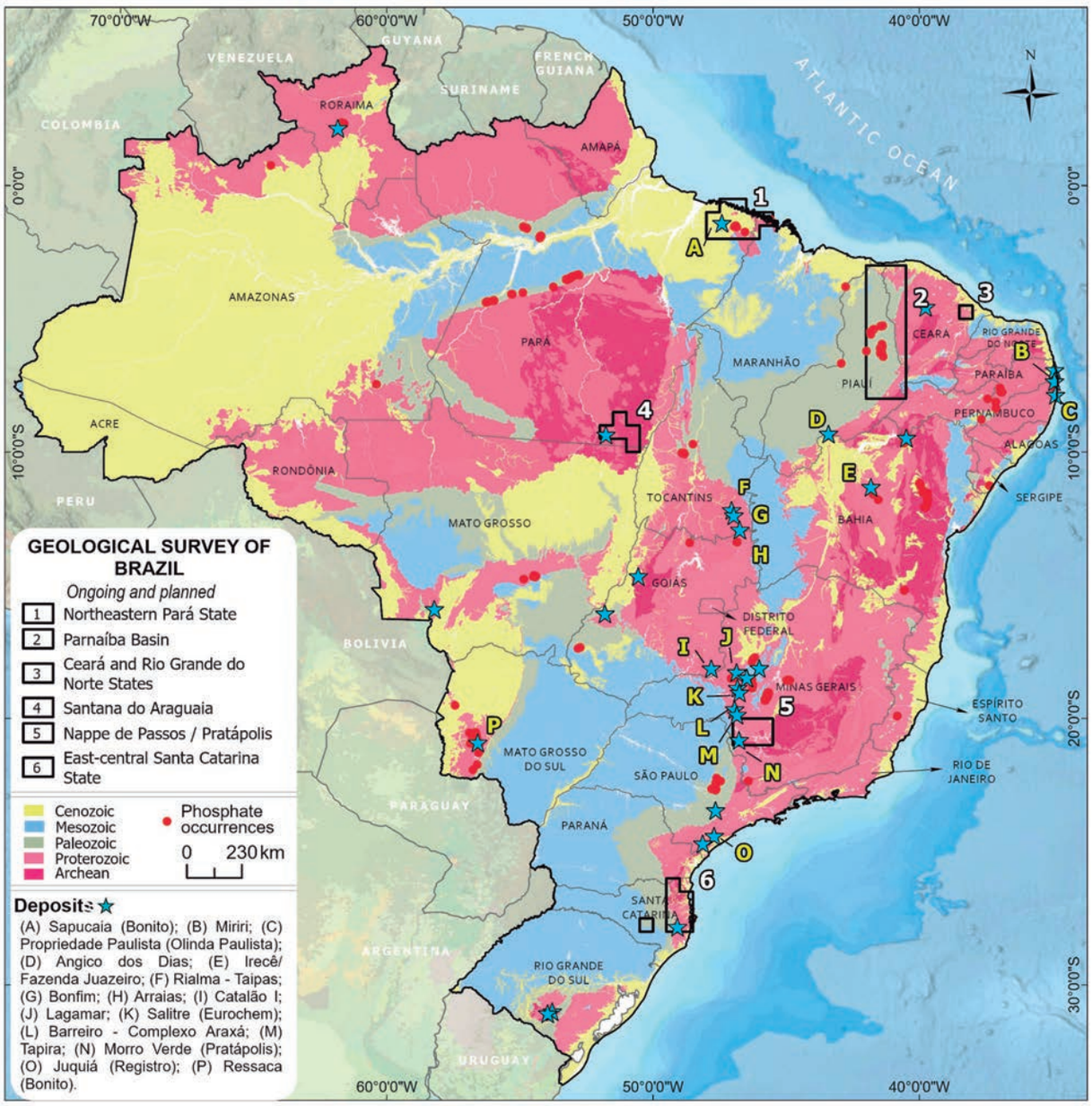


FIGURE 15: Brazilian phosphate deposits and occurrences, 2024.

1 U.S. Geological Survey, 2025, Mineral commodity summaries 2025: https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-phosphate.pdf

HIGHLIGHTS

- The main world-class phosphate deposits in Brazil are of igneous origin. Most of them are located in the Alto Paranaíba Alkaline Province, including Tapira, Araxá, Catalão I and II, Serra Negra, and Salitre. Other significant igneous deposits in production include Cajati, Juquiá, and Angico dos Dias. Brazil also has aluminous phosphate reserves, such as the Sapucaia mine, which uses a calcination process to enhance phosphorus solubility and is used as a thermophosphate fertilizer.
- Brazil has several sedimentary origin deposits, with the majority of the phosphate mines formed during the Neoproterozoic Era, such as Patos de Minas, Arraias, Irecê, Ressaca, and Pratápolis.
- The Neoproterozoic Jauru deposit is a sedimentary potential currently in the development phase in partnership with the Mineral Technology Center (CETEM).
- In Irecê, a new Galvani mine has been reopened, with an investment of R$340 million in partnership with Companhia Baiana de Pesquisa Mineral (CBPM) and the support of the Financier of Studies and Projects (Finep), with a production capacity of up to 350 kt/year of phosphate concentrate.
- In 2024, EuroChem started operating the Salitre complex. This production could lower Brazil's reliance by 15%, with investments around US$1 billion. The Santana Project, from Itafós, is still in the pre-operation phase, with an expected capacity of 500 kt/year.
- The company Aguia Fertilizantes is awaiting an environmental court decision to develop the Três Estradas phosphate project, after which it will be capable of supplying up to 300 kt of natural phosphate per year.
- The Itataia phosphate-uranium deposit is the second-largest uranium reserve in Brazil. It is in the pre-operation phase, with investments expected at $390 million. The project has yet to receive all necessary authorizations before completion.

Selected phosphate deposits and resources estimates

Deposit	Commodity	Owner	Resource estimates	Grades (P_2O_5)	Status
Angico dos Dias	P_2O_5-REE	Galvani	7,6 Mt	5.4 %	Producing
Anitápolis	P_2O_5	Anitápolis	320 Mt	8.05 %	Unexploited
Arraias	P_2O_5	Itafos	79.0 Mt	4.9 %	Producing
Barreiro- Complexo Araxá	P_2O_5-Nb-REE-U	Mosaic	15.6 Mt	13.4%	Producing
Bonfim	P_2O_5	FENGRO/DuSolo	18 Mt	6.00%	Interrupted
Catalão I	P_2O_5-Nb-Ti-U	Mosaic + CMOC	162.3 Mt	10.5 %	Producing
Fazenda Ipanema	P_2O_5-Fe	Fazenda Ipanema	117 Mt	6.07 %	Unexploited
Fazenda Itataia	U-P_2O_5	Industrias Nucleares do Brasil	81 Mt	11%	Feasibility
Fosfato Gavião	P_2O_5	MGC Pesquisa Mineral e Valter Mônaco Conceição Filho	40 Mt	Not available	Prefeasibility
Irecê/Fazenda Juazeiro	P_2O_5	Galvani	40 Mt	15	Producing
Jauru (Mirassol D´Oeste)	P_2O_5-Fe	BEMISA	314 Mt	5%	Planned
Joca Tavares	P_2O_5	Aguia Resources Limited	2.41 Mt	11.27 %	Unexploited
Juquiá (Registro)	P_2O_5	Socal Mineração S.A.	18 Mt	16%	Producing
Lucena	P_2O_5	Aguia Resources Limited	55 Mt	4.11 %	Unexploited
Maecuru (Maicuru)	Ti-P_2O_5-REE	Mosaic	200 Mt	28%	Unexploited
Mata da Corda	P_2O_5-Ti	Nexon Mineração S.A. (grupo Buritipar/Terra Brasil Fertili)	520 Mt	3.5 %	Unexploited
Mina Cajati	P_2O_5	Mosaic	40,4 Mt	5.45 %	Producing
Miriri	P_2O_5	Elephant	114.73 Mt	4.19 %	Unexploited
Morro Verde (Pratápolis)	P_2O_5	Morro Verde (Ore Investiments)	50.6 Mt	9.25 %	Producing
Mundo Novo	P_2O_5	EDEM	2.5 Mt	8.78 %	Feasibility
Repartimento	P_2O_5-REE	SGB-CPRM	3.5 Mt	3 a 5 %	Unexploited
Ressaca (Bonito)	P_2O_5	Edem	40 Mt	14%	Producing
Rocinha	P_2O_5	Galvani	415 Mt	12.5 %	Producing
Salitre (Patrocínio Mosaic)	Ti-P_2O_5-Nb	Mosaic	478.4 Mt	12.1 %	Producing
Sapucaia (Bonito)	P_2O_5	Viso Fertilizantes (Grupo Scheffler)	4 Mt	21%	Producing
Serra da Capivara (Santana)	P_2O_5	Itafos	86.95 Mt	12.0 %	Planned
Serra do Salitre (Eurochem)	P_2O_5	Eurochem	131 Mt	4.5 %	Producing
Serra Negra	P_2O_5-Ti	Mosaic + Eurochem	228 Mt	29%	Unexploited
Serrote da Batateira	P_2O_5	Serrote da Batateira	8.2 Mt	15%	Unexploited
Taipas	P_2O_5	Rialma Fertilizantes	25 Mt	5%	Producing
Tapira	P_2O_5-Nb-Ti	Mosaic	457.3 Mt	9.2 %	Producing
Três Estradas	P_2O_5	Aguia Resources Limited	83.21 Mt	4.11 %	Planned
Lagamar	P_2O_5	Galvani	exhausted	Not available	Exhausted
Morro Preto	P_2O_5-Nb-REE	CMOC	Not available	Not available	Feasibility
Propriedade Paulista (Olinda Paulista)	P_2O_5-U	Propriedade Paulista (Olinda Paulista)	Not available	Not available	Producing

PLATINUM GROUP ELEMENTS

The platinum group elements (PGE) consist of platinum (Pt), palladium (Pd), rhodium (Rh), ruthenium (Ru), osmium (Os) and iridium (Ir). These are very rare metals (30 times rarer than gold) and because of their excellent physical and chemical behavior as catalysts, they are essential to low carbon emission energy technologies, such as green hydrogen production. However, since 1900, about 90% of PGE production has come from South Africa and Russia, making PGE part of many countries' critical minerals strategy.

ORE RESERVES
Not available

OPERATING MINES	PRODUCTION
0	0

WORLD RANKING	
Reserves	Not available
Production	0

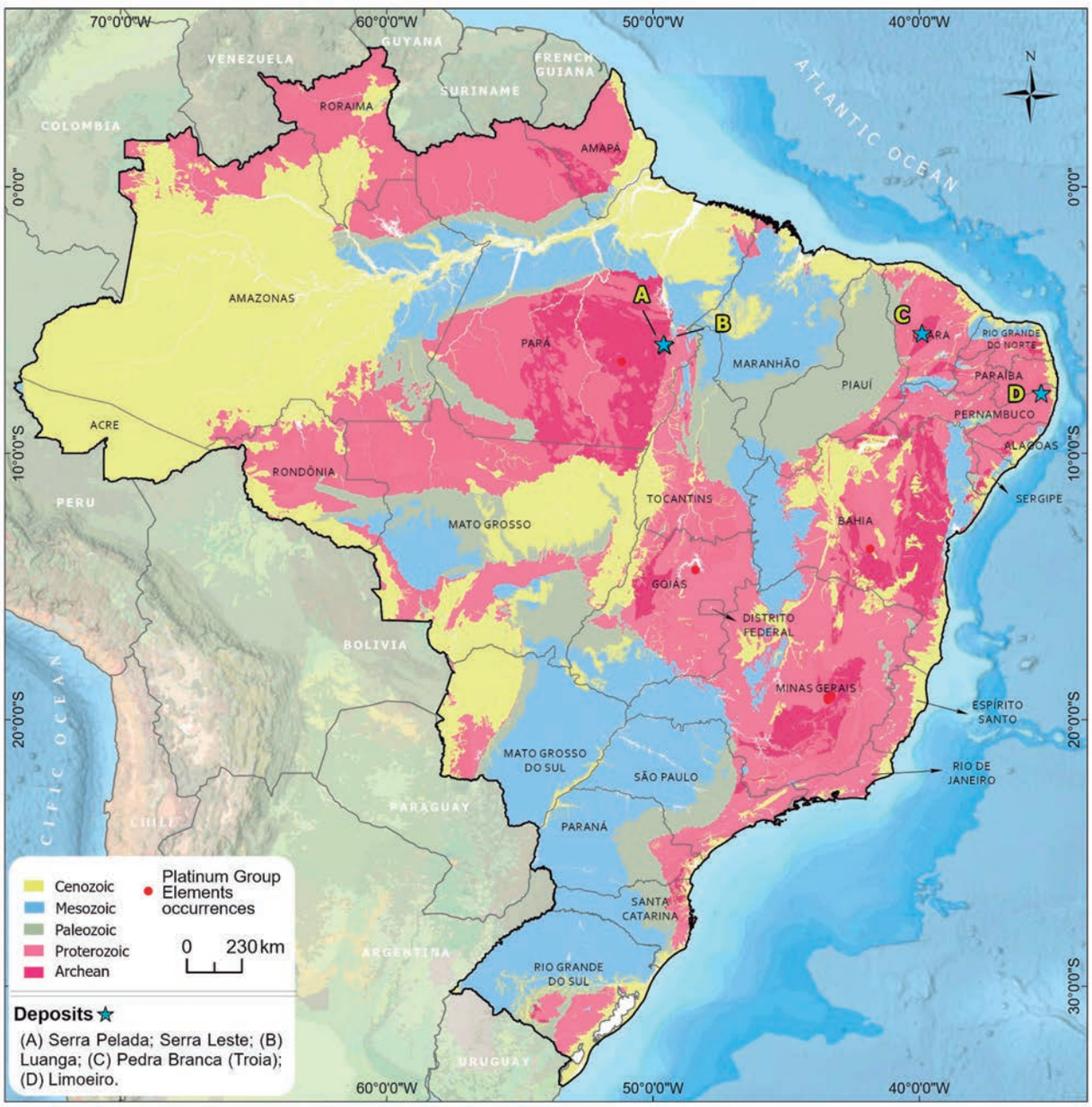


FIGURE 16: Brazilian PGE deposits and occurrences, 2024.

HIGHLIGHTS

- Brazil does not yet have a PGE mine, but the Pedra Branca and Luanga deposits have very advanced exploration work and are likely to become PGE mines in the near future;
- Similar to other PGE deposits worldwide, the Brazilian PGE deposits are hosted by layered mafic-ultramafic complexes;
- The Luanga deposit in the Carajás Mineral Province is the largest PGE deposit in South America with 118 Mt at 1.24 g/t PGE+Au, 0,06 s/t Rh and 0.10% Ni. The high-grade PGE zones of the Luanga mafic-ultramafic intrusion consist of sulfide-rich harzburgites, orthopyroxenites and minor chromitites;
- The Luanga mafic-ultramafic intrusion is of Neoarchean age (ca. 2.76 Ga), similar to many other medium- to small-sized mafic-ultramafic intrusions in the Carajás Mineral Province, all of which are attractive to PGE exploration (e.g., Lago Grande, Serra da Onça, Puma, Fafá, etc.);
- In the northeast of Brazil, the Pedra Branca PGE deposit is another well-explored mineralization (since the 1980s) with an inferred mineral resource of 63.6 Mt with 1.08 g/t of PGE+Au. The PGE are mainly hosted in tectonically disrupted chromitite layers of the Troia-Pedra Branca mafic-ultramafic complex. The age of this mafic-ultramafic intrusion is approximately 2.04 Ga, which is very similar to the age of the world-class PGE-bearing Bushveld igneous complex, in South Africa;
- There is no hope of finding new large igneous complexes in Brazil, but a number of small Precambrian mafic-ultramafic intrusions occur in the northeast of Brazil (Borborema Province and northern São Francisco craton), that are waiting to be explored (conduit type intrusions? e.g., Limoeiro Ni-Cu-PGE deposit);
- Despite the Pedra Branca and Luanga PGE deposits, economic grades of PGE are also found in many Brazilian Ni–Cu sulfide deposits (e.g., Limoeiro, Mirabela) of mafic-ultramafic intrusions and komatiites (Fortaleza de Minas). In addition, some Brazilian gold deposits may also host unconventional (hydrothermal) PGE mineralization (Serra Pelada, Buraco do Ouro);
- The PGE mineralization in Brazil is all Precambrian in age and no PGE occurrences have been found in the Mesozoic basaltic sills of the Brazilian intracratonic basins. However, following the Norilsk-type deposit model, it may represent an exploration frontier;
- The geology of Brazil's major mineral provinces is quite favorable for the discovery of new PGE resources, and the increasing importance of PGE in supporting the transition to clean energy may spur new PGE exploration programs by private and governmental companies.

Selected PGE deposits and resources estimates

Deposit	Commodity	Owner	Estimated Resource	Grades	Status
Limoeiro	Ni-Cu-Pt	Nexa Resources SA	35 Mt	0.16 g/t (Pt)	Feasibility
Luanga	Pd-Pt-Rh-Au-Ni	Bravo Mining	118 Mt	0.61g/t (Pd) 0.59g/t (Pt) 0.06 g/t (Rh)	Exploration
Pedra Branca	Pd-Pt-Au	ValOre Metals	63.6 Mt	0.68g/t (Pd) 0.36g/t (Pt)	Exploration
Serra Pelada; Serra Leste	Au-Pt	Colossus Minerals	12.37 Mt	0.25 g/t (Pt)	Feasibility

POTASH

Brazil has estimated resources of 2.730 billion tons (Gt) of ore, with 575.2 million tons (Mt) of K_2O at an average grade of 21.12% K_2O. Inferred reserves total 430 Mt, with approximately 99 Mt of equivalent K_2O (average grade of 23.0% K_2O).

The Brazilian potential for potassium is mainly hosted in evaporitic deposits genetically related to the Lower Cretaceous and the Permo-Carboniferous. Since 1985, the Taquari/Vassouras mine, currently operated by Mosaic, has been the only productive plant in the country, located in the state of Sergipe, which produced 343,818 thousand tons (kt) of K_2O in 2023 and 258,301 kt of K_2O up to the 3rd quarter of 2024.

POTASSIUM OXIDE EQUIVALENT RESERVES[1]
2.3 Mt

OPERATING MINES	PRODUCTION[1]
1	343,818 kt

WORLD RANKING[1]	
Reserves	minor
Production	minor

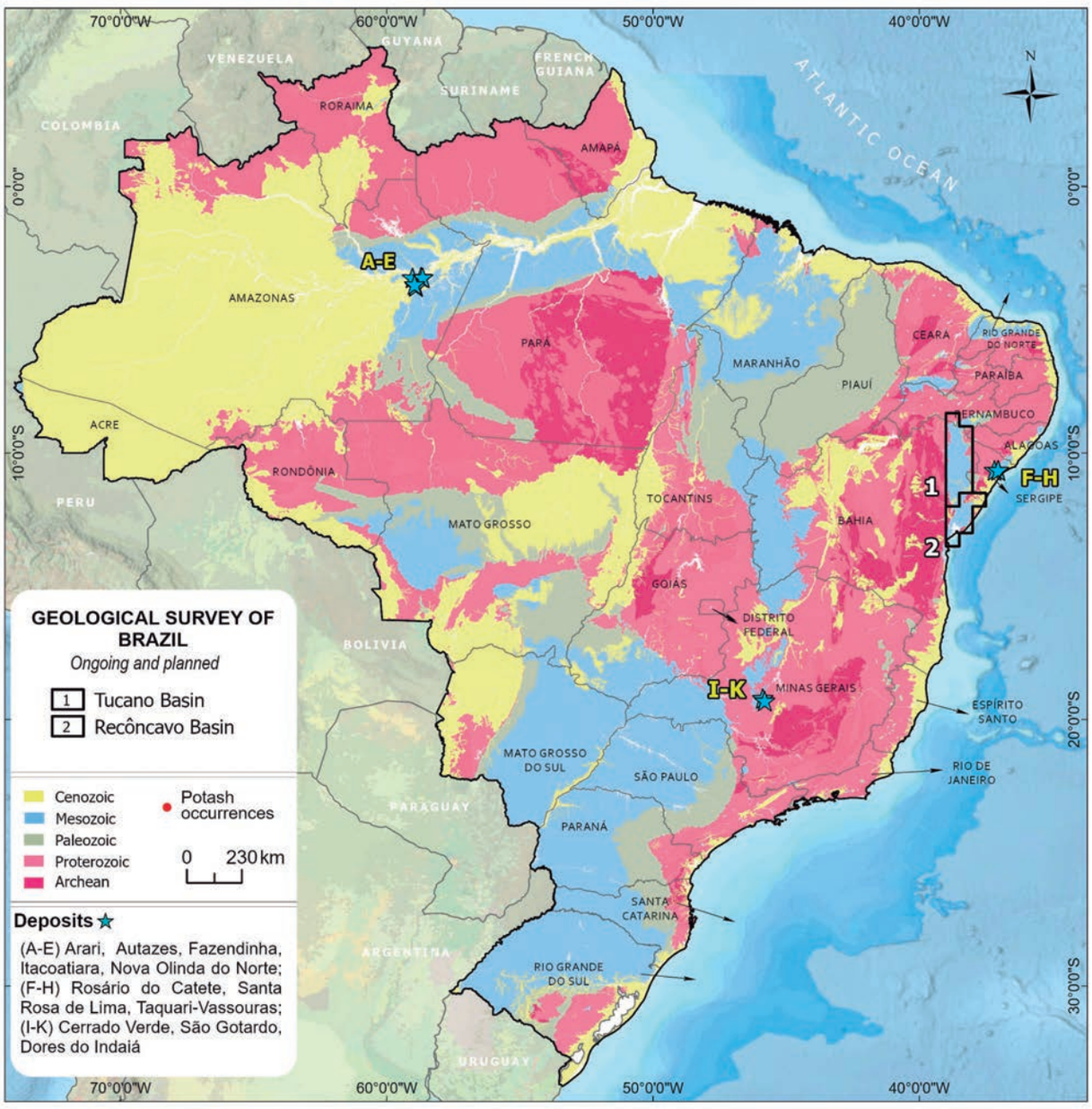


FIGURE 17: Brazilian potash deposits and occurrences, 2024.

1 U.S. Geological Survey, 2025, Mineral commodity summaries, 2025: https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-potash.pdf

HIGHLIGHTS

- Evaporitic rocks located in the sedimentary basins of Sergipe (Northeast Brazil) and Amazonas (North Brazil) constitute the main potassium reserves. However, siliciclastic deposits located in the central brazil region are emerging as new alternatives.
- In the Sergipe Basin, the deposits explored by Mosaic are located in the municipality of Rosário do Catete at the Taquari/Vassouras mine (sylvinite, with probable reserves of approximately 25.5 Mt and 15.03% K_2O). Petrobras' Santa Rosa de Lima deposit has 55.2 Mt of probable reserves with 24.56% K_2O. The Sub-Taquari Vassouras Carnallite deposit, operated by Petrobras/Mosaic, has 14.4 Bt with a K_2O grade of 6.57%.
- In the Amazonas Basin, Amazonas State, Petrobras' Arari and Fazendinha deposits have estimated resources of 545 Mt with 32.7% K_2O and 478 Mt with 27.8% K_2O, respectively. Potássio do Brasil's Autazes and Itacoatiara deposits have estimated resources of 767 Mt with 30.71% K_2O and 263 Mt with an average grade of 19.05% K_2O, respectively. Currently, Potássio do Brasil has obtained 12 licenses and authorizations for the installation of an industrial plant that will process 8.5 Mt of ore to produce up to 2.2 Mt of KCl annually, equivalent to 1.74 Mt of K_2O.
- Potássio do Brasil, which holds other research permits in addition to Autazes, has identified three more potential targets with resources estimated at over 1.2 Gt of KCl (30% grade), or approximately 950 Mt of K_2O.
- Petrobras resumed the bidding process for its 34 mining titles in August 2022, which include the Fazendinha and Arari deposits, as well as the areas of Nova Olinda do Norte, Autazes, Itacoatiara, Silves, Itapiranga, Maués, and Boa Vista dos Ramos. Of these, 8 are mining concessions, 4 are mining request applications, and 22 are in the research authorization process.
- Recently, the Geological Survey of Brazil (SGB) delineated the evaporitic sub-basins of Tauari, Faro-Juruti, Uatumã, and Abacaxis in the Amazonas Basin, areas with a combined potential of 2.4 Gt of ore, which may contain 1.5 Gt of KCl at a grade of 30% (inferred), or 947.5 Mt of K_2O. In the evaporitic sub-basin of Abacaxis, two probable evaporitic layers were detected, each measuring 5 m in thickness and extending for several kilometers, indicating the potential of this world-class basin.
- The evaporitic sequences in some sedimentary basins of Brazil with ages similar to those in Amazonas and Sergipe-Alagoas remain unexplored for potassium salts. Besides those mentioned, promising onshore basins for evaporites include the basins of Acre, Solimões, Tacutu, Parnaíba, Paraná, Recôncavo, Araripe, Potiguar, and Parecis. Among the offshore basins, the prominent ones are Santos, Pelotas, Campos, Espírito Santo, Mucuri, Cumuruxatiba, Jacuípe, Jequitinhonha, Almada, Camamu, Pernambuco/Paraíba, Ceará, and Bragança Viseu, São Luís, and Ilha Nova.
- Alternative potassium sources are being studied in Brazil, such as glauconite, used in the production of slow-release nutrient fertilizers suitable for the Brazilian tropical climate. With K_2O contents ranging from 6% to 10%, these deposits are proving to be a rapidly expanding business opportunity. Kalium Mineração, Harvest Minerals, Verde Agritech, Terra Brasil, and FASA – Fertilizantes da Amazônia are some of the mining companies focused on this market share in Brazil. Verde Agritech, in addition to its authorization to mine 2.8 Mt of this product, has submitted applications for an additional 2.5 Mt.

Selected potash deposits and resource estimates

Deposit	Commodity	Owner	Estimated Resource	Grade (K_2O)	Status
Arari	K	Petrobrás	545Mt	32.70%	Feasibility
Autazes	K	Potássio do Brasil	767Mt	30.71%	Installation Permits
Cerrado Verde, São Gotardo	K	Verde Agritech	253Mt	9.2%	Exploration
Dores do Indaiá	K	Kalium Mineração	220Mt	10.56%	Exploration
Fazendinha	K-SALT	Petrobrás	478Mt	27.80%	Feasibility
Itacoatiara	K	Potássio do Brasil	263Mt	19.05%	Feasibility
Santa Rosa de Lima	K	Petrobrás	55.2Mt	24.56%	Exploration
Sub-bacia Taquari Vassouras Carnalita	K	Petrobrás/Mosaic	14.4Gt	6.57%	Exploration
Taquari-Vassouras	K	Mosaic	25.5Mt	15.03%	Operating

Notes: Taquari-Vassouras Mine - Probable Reserves (Mosaic, 2024).

RARE EARTH ELEMENTS

Brazil holds the second-largest Rare Earth Elements (REE) reserves in the world, estimated at 21 Mt (USGS, 2025). Despite this significant potential, Brazil was a major exporter of monazite until the mid-20th century but has had no significant REE production in recent decades. In 2020, 708 tonnes of monazite, produced as a by-product of heavy mineral sands, were sold on the international market (Brazil Nuclear Industry, 2020).

RARE-EARTH-OXIDE EQUIVALENT RESERVES[1]
21 Mt

OPERATING MINES	PRODUCTION[1]
1	20 t

WORLD RANKING[1]	
Reserves	2nd (23%)
Production	minor

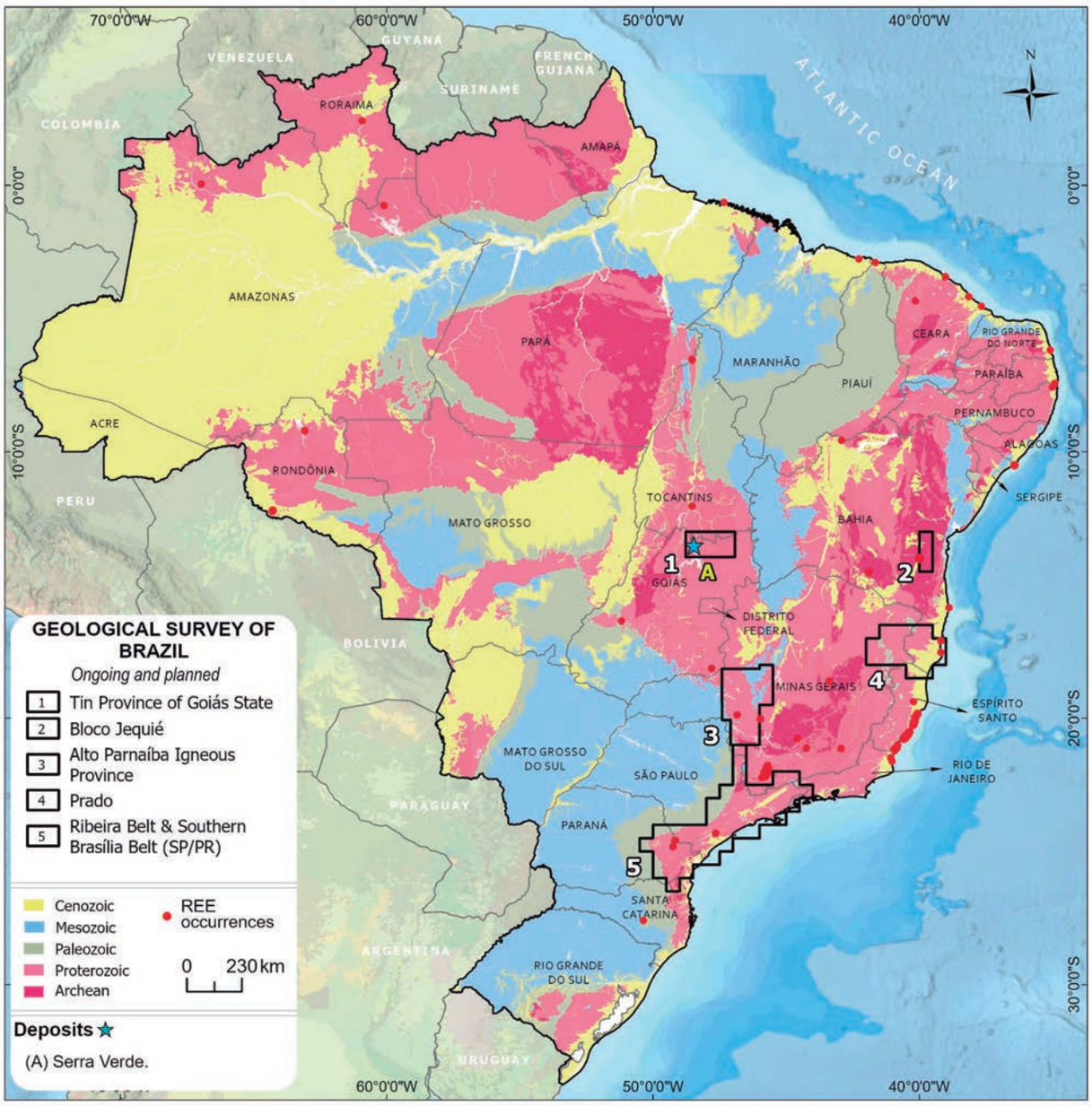


FIGURE 18: Brazilian REE deposits and occurrences, 2024.

1 U.S. Geological Survey, 2025, Mineral commodity summaries 2025: https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-rare-earths.pdf

HIGHLIGHTS

- Most of Brazil's REE reserves are associated with alkaline-carbonatite rocks, including deposits in Araxá, Poços de Caldas, Catalão, Tapira, Seis Lagos, and others. Additional REE sources include granitic formations, such as those found in Pitinga and Serra Dourada, as well as sedimentary deposits located in São Gonçalo do Sapucaí and São Francisco do Itabapoana (Takehara, 2015). However, exploration in areas like Seis Lagos and Repartimento (Serra do Repartimento) has been hindered by legal restrictions in environmentally protected zones.
- In late 2023, Serra Verde Mining Company, located in the Minaçu-GO region, became Brazil's first operation producing rare earth oxides from ion-adsorbed clays. The company plans to produce 5,000 tons of Total Rare Earth Oxides (TREO) during Phase I, with further expansion planned for Phase II (Mineração Serra Verde, n.d.). The reserves, officially documented, consist of approximately 300 Mt of ionic clays with a REEO+Y content of 0.15%.
- Brazil's largest carbonatite-hosted REE deposit is Araxá, with measured reserves of approximately 20 Mt and REE concentrations of 3.02% and 2.30%. Araxá is also the world's largest producer of niobium. CBMM, which operates in the area, previously recovered REEs as a by-product of niobium production but has since discontinued these activities. Currently, mines in Catalão, Poços de Caldas, Tapira, and Pitinga are conducting feasibility studies to assess the recovery of REEs from their primary mineral extraction operations.
- Smaller REE deposits are associated with paleoplacers, particularly heavy mineral sands where monazite is produced as a by-product of ilmenite exploitation. These sands are typically rich in Light Rare Earth Elements (LREE). Continental deposits, such as mixed heavy mineral concentrates from tin deposits in Rondônia, are also noteworthy. For instance, mining waste from the Bom Futuro deposit is sold to a Canadian rare earth company (Canada Rare Earth Corporation, 2023).
- Looking forward, Brazil is aiming to vertically integrate its REE production chain, supported by government initiatives and financial backing (Agência BNDES de Notícias, 2025). These efforts include the strategic development of the country's mineral resource chain to enhance its global competitiveness in the REE sector.

Selected REE deposits and resource estimates

Deposit	Commodity	Owner	Estimated Resource	Grades (TREO)	Status
Caldeira- Capão do Mel	REE	Meteoric Resources	409 Mt	0.27 %	Exploration
Carina	REE	Aclara Resources	168.1 Mt	0.15 %	Exploration
Catalão II	P-REE-Nb	CMOC / Mosaic	25 Mt	0.98%	Operating
Minaçu (Pela-Ema)	REE-Sn-W-Nb-Ta	Serra Verde	910 Mt	0.15%	Producing
Poços de Caldas	REE-U-Th-Mo-Zr-Al	Mineração Terras Raras S/A	3.55 Mt	3.9%	Exploration
Tapira	P-Ti-Nb-REE	Mosaic	5.8 Mt	1-10%	Operating
Seis Lagos	REE-Nb-P-Fe-Mn-Ti	SGB- CPRM	43.5 Mt	1.5%	Without feasibility

SILICON

Brazil stands out globally for its abundance of large natural crystals and the production of natural flakes, establishing itself as an important player in both the production chain and the trade balance of the sector. Based on silicon metal production in 2022, it is estimated that quartz production in Brazil reached approximately 3,178,000 tons.

ORE RESERVES
Not available

OPERATING MINES	PRODUCTION
3	3,178,000 t

WORLD RANKING	
Reserves	Not available
Production	Not available

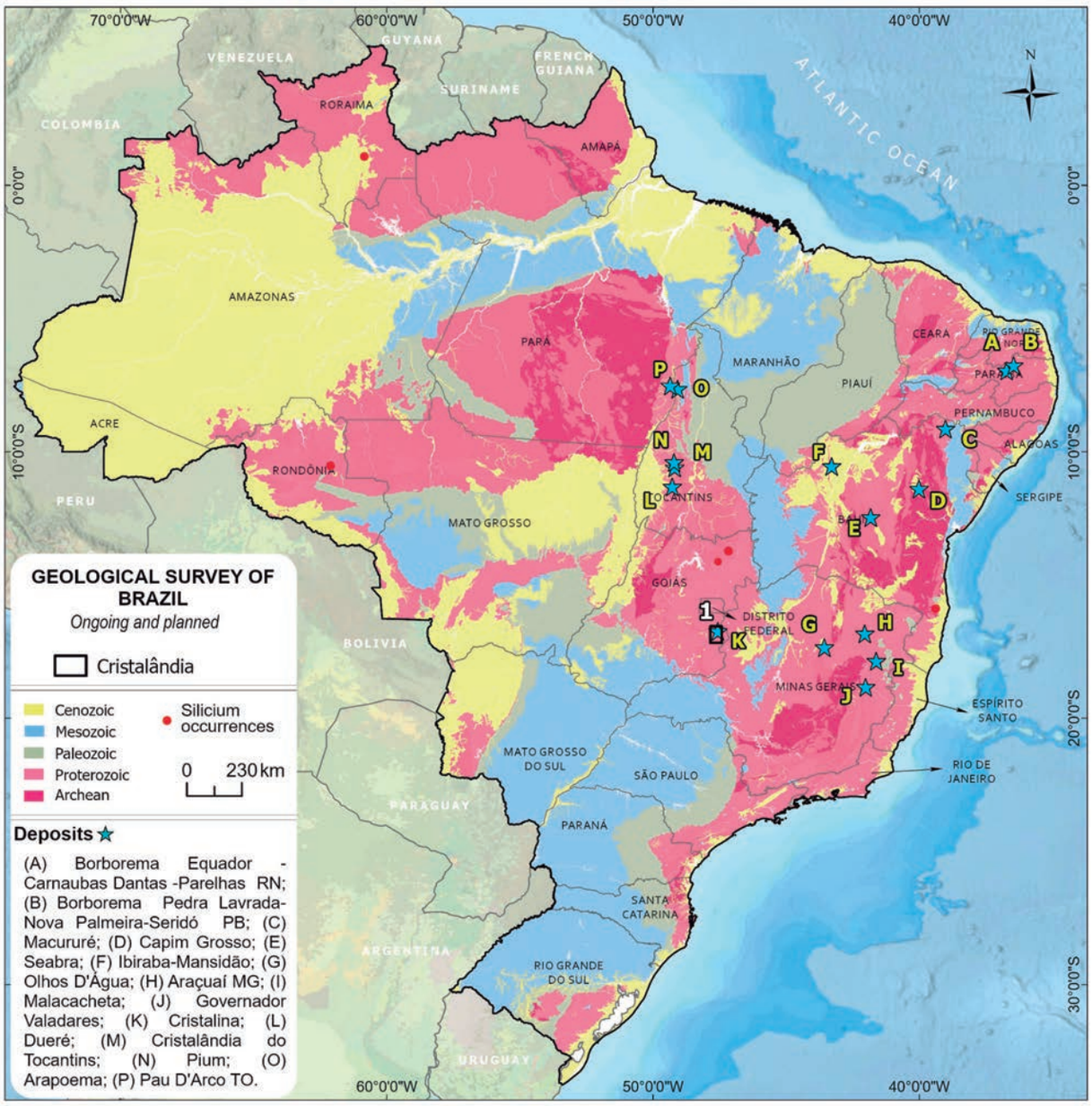


FIGURE 19: Brazilian silicon deposits and occurrences, 2024.

HIGHLIGHTS

- The quartz deposits and reserves in the country are associated with two main geological-genetic environments: Primary deposits – composed of quartz from hydrothermal veins and pegmatites, located in metamorphosed rocks of the Neoproterozoic and Mesoproterozoic mobile belts; Secondary environments – characterized by the presence of milky and hyaline quartz in eluvial, colluvial, and alluvial sediments. In primary deposits, the material is extracted in the form of flakes, which consist of carefully selected quartz fragments.
- The main quartz reserves and deposits in Brazil are located in the state of Pará, which hosts the largest measured reserves in the country. Next are the states of Minas Gerais, Bahia, Paraíba, Tocantins, and Goiás. In these producing regions, milky quartz and hyaline crystal predominate, mainly extracted from veins found in metamorphic and metasedimentary rocks of the Neoproterozoic mobile belts, such as those in Bahia and Tocantins. Additionally, they are also associated with Mesoproterozoic psammitic sequences, such as those found in the Cristalina region and the Chapada dos Veadeiros in Alto Paraíso de Goiás, as well as in the Espinhaço range in Minas Gerais.
- Based on silicon metal production in 2022, it is estimated that quartz production in Brazil reached approximately 3,178,000 tons. This volume considers that all silicon produced in the country is sourced from quartz, encompassing both the crystalline hyaline variety and milky quartz.
- In 2016, national quartz crystal production reached 13,830 tons, according to the Brazilian Mineral Summary, particularly highlighting the states of Bahia, Minas Gerais, and Paraíba.
- In the central-northern region of the São Francisco Craton, covering the states of Bahia and Minas Gerais, there are extensive and significant productive quartz prospects, historically explored for decades. These areas present high potential for research and development in the short term.
- The Eastern Pegmatitic Province of the Araçuaí Belt, particularly in the region of Governador Valadares, is noted for its swarms of mineralized pegmatites, which are highly relevant for mineral research and exploration.
- In the Serra do Espinhaço Meridional, known as the Central-Northern Minas System (SCEB), the area extends for about 300 km, from the Iron Quadrangle in the south to the Olhos D'Água region, passing through important locations such as Diamantina and Morro do Chapéu in the north.
- In Bahia, mineralizations associated with the Riacho do Pontal Belt, which also extend into Sergipe, cover the regions of Piauí, Pernambuco, and Bahia in the Neoproterozoic context. Other significant belts include the Rio Preto Belt in Bahia and the Sergipe Mobile Belt, which encompasses the states of Sergipe and Bahia.
- In Ceará, the Borborema-Seridó System (SBS), part of the Borborema Province of the Seridó Belt, also features relevant quartz mineralizations.
- Important quartz reserves, including high purity silica crystal and large crystals, have been identified in productive areas. These reserves are embedded in rocks of the Pequizeiro and Couto Magalhães Formations, belonging to the Tocantins Group, located in the Araguaia or Lower Araguaia Belt. These formations show promising prospects for exploitable quartz reserves.
- Finally, in the psammitic sequence of the Paranoá Group, of Mesoproterozoic origin, located in the Brasília Belt, the Cristalina region has a productive quartz history that spans several decades. This productive area also includes the Chapada dos Veadeiros, especially in the Alto Paraíso de Goiás region.

Selected silicon deposits and resource estimates

Deposit	Commodity	Owner	Estimated Resource	Grades	Status
Araçuaí MG	Silica	Araçuaí MG	Not available	Not available	Not available
Arapoema TO	Silica	Arapoema TO	Not available	Not available	Not available
Borborema Pedra Lavrada-Nova Palmeira-Seridó PB	Silica	Borborema Pedra Lavrada-Nova Palmeira-Seridó PB	Not available	Not available	Not available
Borborema Equador- Carnaubas Dantas-Parelhas RN	Silica	Borborema Equador- Carnaubas Dantas -Parelhas RN	Not available	Not available	Not available
Chapada dos Veadeiros- Alto Paraiso GO	Silica	Chapada dos Veadeiros Alto Paraiso GO	Not available	Not available	Not available
Cristalina GO	Silica	Cristalina GO	Not available	Not available	Not available
Crsitalândia do Tocantins	Silica	Crsitalândia do Tocantins	Not available	Not available	Not available
Dueré TO	Silica	Dueré TO	Not available	Not available	Not available
Espinhaço Setentrional-Chapada Diamantina Seabra Bahia	Silica	Espinhaço Setentrional Chapada Diamantina Seabra Bahia	Not available	Not available	Not available
Governador Valadares MG	Silica	Governador Valadares MG	Not available	Not available	Not available
Nordeste da Bahia-FaixaSergipana-Macururé BA	Silica	Nordeste da Bahia-FaixaSergipana-Macururé BA	Not available	Not available	Not available
Norte da Bahia- Chapada Diamantina Capim Grosso BA	Silica	Norte da Bahia- Chapada Diamantina Capim Grosso BA	Not available	Not available	Not available
Pau D'Arco TO	Silica	Pau D'Arco TO	Not available	Not available	Not available
Pium TO	Silica	Pium TO	Not available	Not available	Not available
Projeto Remedios	Silica	Projeto Remedios	Not available	Not available	Not available
Serra do Espinhaço Meridional Olhos D'agua RIMA MINERAÇÃO, MG	Silica	Serra do Espinhaço Meridional Olhos D'agua RIMA MINERAÇÃO, MG	Not available	Not available	Not available
Sistema Faixa Rio Preto divisa Bahia-Piaui Ibiraba Mansidao BA	Silica	Sistema Faixa Rio Preto divisa Bahia-Piaui Ibiraba Mansidao BA	Not available	Not available	Not available
Teofilo Otoni MG- Malacacheta	Silica	Teofilo Otoni MG-Malacacheta	Not available	Not available	Not available

SULFUR

Most of the world's sulfur production is recovered from fossil fuels, with China, the United States, Iraq, Russia, and Canada being major global producers. In Brazil, sulfur mainly comes from oil and gas refining but is also obtained as a by-product of sulfide and sulfated mineral mining, shale, and coal.

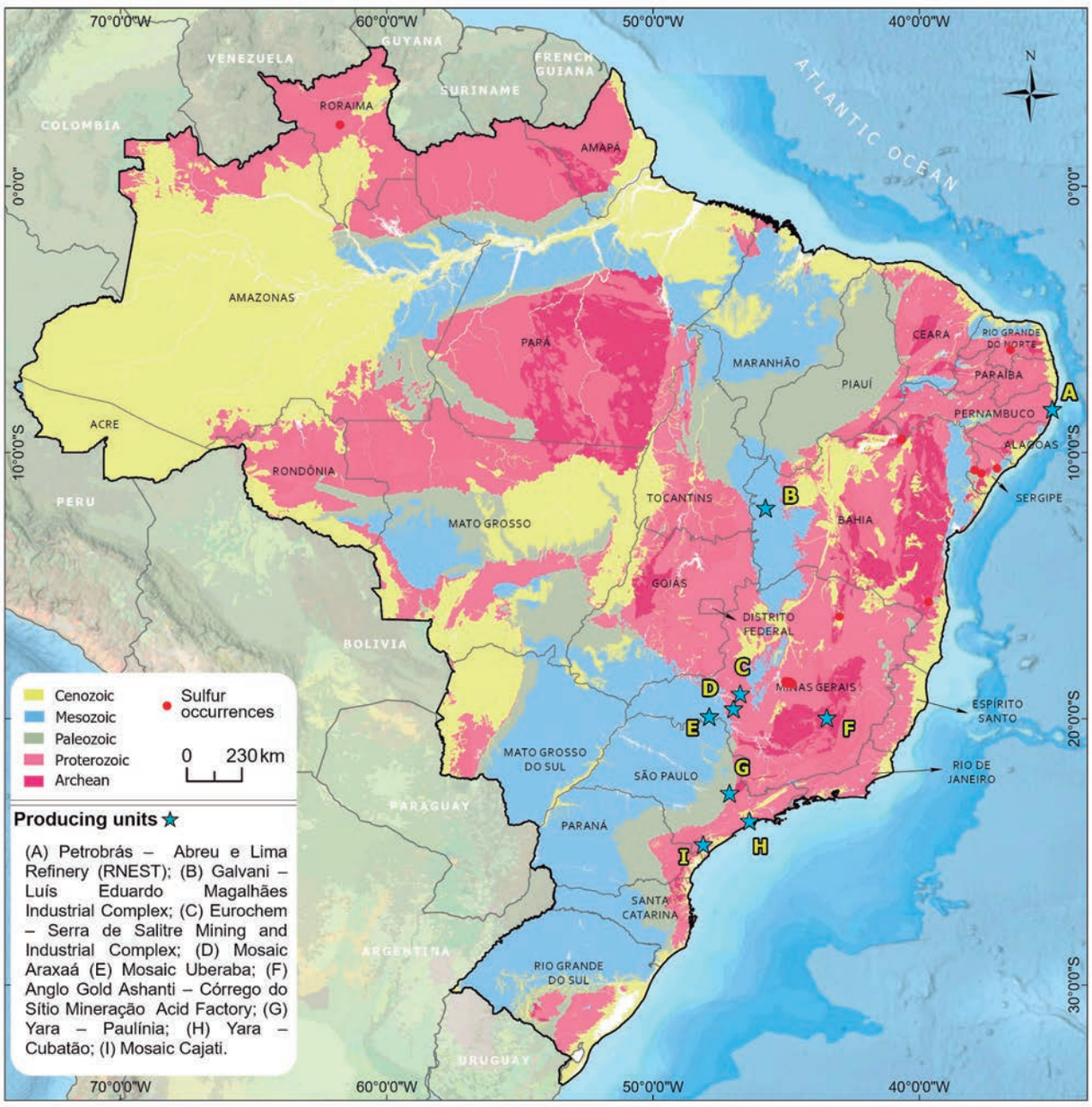


FIGURE 20: Brazilian sulfur producing units, deposits and occurrences, 2024.

HIGHLIGHTS

- Sulfur is formed by precipitation in volcanic fumaroles, salt domes, and evaporitic sequences. It also occurs as sulfates associated with carbonates and clays in evaporitic sequences and as sulfides in volcanogenic, hydrothermal, and sedimentary deposits.
- The sulfur market is segmented into two main forms: solid and liquid. Over 90% of the sulfur is used in the production of sulfuric acid, primarily for manufacturing phosphate fertilizers. It is also used in the pulp and paper industry, sugar processing, rubber vulcanization, insecticides, and fungicides, among other applications.
- Petrobrás is the only company in Brazil that produces sulfur in both liquid and solid forms, transforming acid gas from hydrodesulfurization (HDT or HDS) units. In December 2024, Petrobrás began operating the Atmospheric Emissions Reduction Unit (SNOX) at the Abreu e Lima Refinery (RNEST) in Ipojuca, Pernambuco. The SNOX is the first emission reduction unit in Brazilian and American refining capable of converting sulfur oxide and nitrogen oxide into sulfuric acid.
- In its sulfuric acid form, Brazil has several producers, including Galvani, Yara, Mosaic CMOC, Elekeiroz and Anglo Gold Ashanti. In 2024, Eurochem inaugurated the Serra de Salitre Mining and Industrial Complex, which produces phosphate concentrates and sulfuric acid, with an expected output of 1 million tons of H_2SO_4 annually.
- Measuring sulfur resources and reserves is challenging due to the lack of standardized data and the fact that production may occur far from the extraction sites, sometimes even in different countries.
- Global resources of elemental sulfur in evaporites and volcanic deposits, along with sulfur associated with natural gas, oil, tar sands, and metallic sulfides, amount to about 5 billion tons. Sulfur in gypsum and anhydrite is nearly unlimited, while approximately 600 billion tons of sulfur are contained in coal, oil shale, and organic-rich shale, though low-cost extraction methods would be necessary to tap into these sources effectively.

TITANIUM

According to the USGS, based on the year, China continued to be the leading producer and consumer of titanium mineral concentrates, accounting for approximately one-third of global production of ilmenite. Mozambique and South Africa also were leading producers of titanium mineral concentrates. China's imports of titanium mineral concentrates were about 4.4 million tons in gross weight, a 27% increase compared with those in 2022. As of September, Mozambique (49%), Norway (10%), and Vietnam (7%) were the leading sources of titanium mineral concentrates to China.

ORE RESERVES
Not available

OPERATING MINES	PRODUCTION
1	61 kt

WORLD RANKING	
Reserves	Not available
Production	Not available

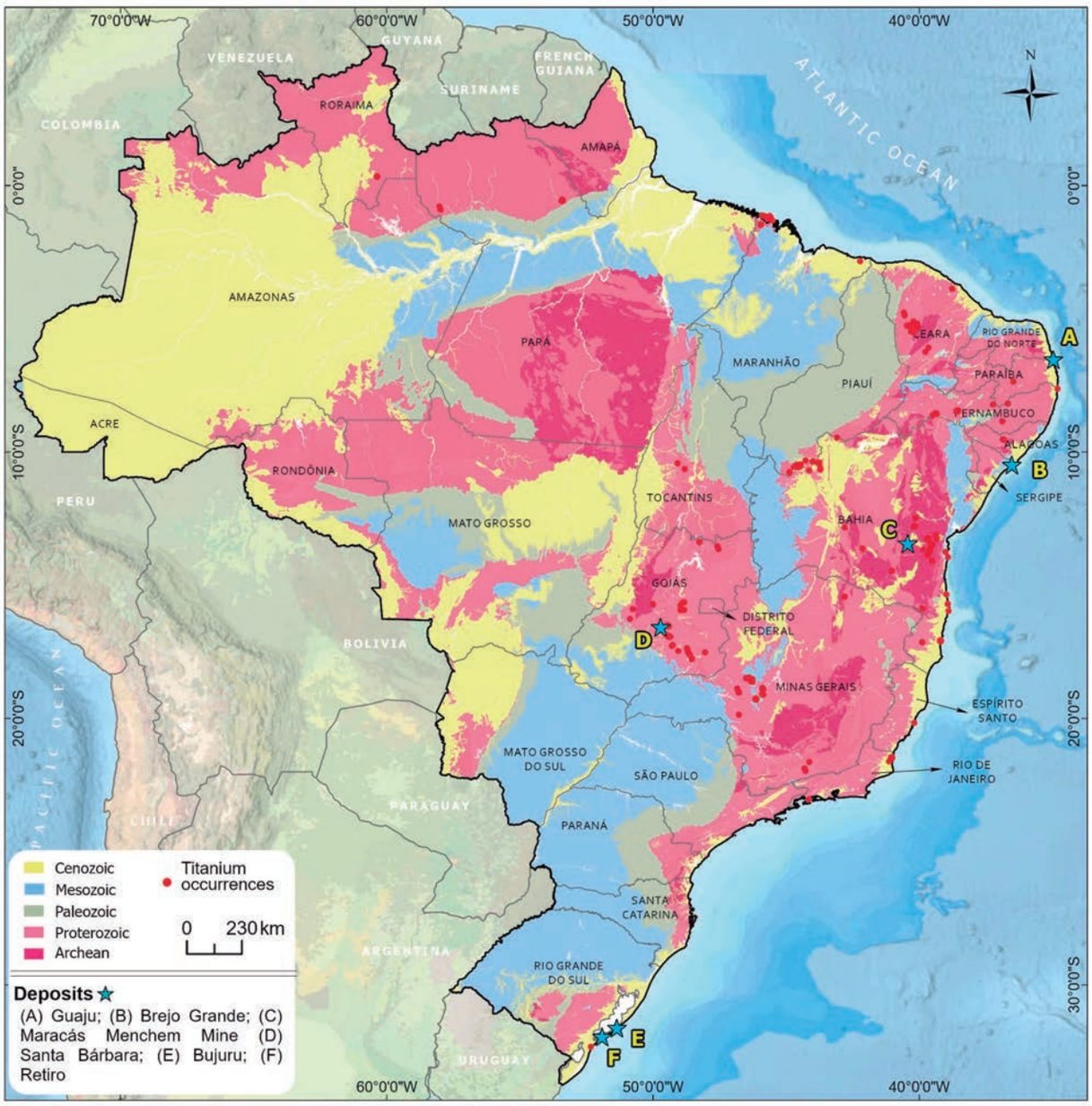


FIGURE 21: Brazilian titanium deposits and occurrences, 2024.

HIGHLIGHTS

- One major company produces ilmenite in the country, Largo Inc. with the Maracas Menchen project in Bahia. The mineralization at the Maracás Menchen mine includes magnetite layers or magnetite pyroxenite layers formed as cyclic magmatic units. The vanadium mineralization is hosted within titaniferous magnetite, which is the primary oxide phase within the Maracás Menchen deposits. The titanium mineralization is found in ilmenite, which forms a secondary oxide phase.
- The deposits at the Maracás Menchen mine are hosted in the Rio Jacaré intrusion within the Archean São Francisco craton, which comprises the Contendas-Mirante Complex and the Gavião and Jequié blocks. The Rio Jacaré mafic-ultramafic intrusion is a linear sheet-like structure, mainly comprising gabbro with an almost north-south strike, with a length of 70km and an average width of 1.2km.
- The proven and probable mineral reserves of the Maracás Menchen mine were estimated at 101 million tonnes (Mt) grading 0.56% V_2O_5 and 7.52% titanium dioxide (TiO_2), as of January 2024.
- Other geological provinces with ilmenite in the spotlight are placer deposits, like Retiro and Bujuru Projects, in São José do Norte, a municipality in Rio Grande do Sul, Saramém project at Brejo Grande municipality, at the state of Sergipe and also Prado exploration project in the State of Bahia. We have also other projects like the Fe Ti V ultramafic mafic complex of Campo Alegre de Lourdes and Lagoa Bonita, northern of the state of Bahia.
- There is also the project carried out by the Geological Survey of Brazil, which investigated the potential for ilmenite and anatase mineralization in tholeiitic basalt regolith in the extreme southwest of the state of Paraná and southern Santa Catarina.
- Mataraca, in the state of Paraíba, and Buena, in the state of Rio de Janeiro, are exhausted.

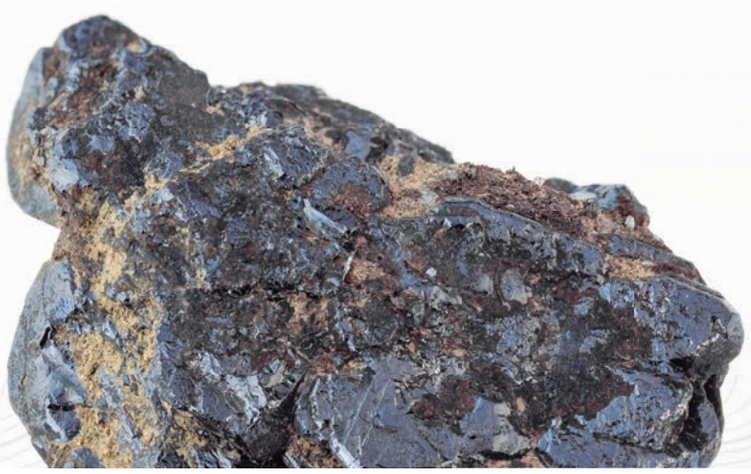
Selected titanium deposits and resource estimates

Deposit	Commodity	Owner	Estimated Resource	THM Asemblage (1)					Status
				THM (%)	ILM(%)	ZRN (%)	RT (%)	MNZ(%)	
Bojuru	Ti, Zr	Rio Grande Mineração SA.	250 Mt	4	49	5	3	Not available	Exploration
Retiro	Ti, Zr	Rio Grande Mineração SA.	250 Mt	3.9	49	5	3	Not available	Exploration
Saramém / Brejo Grande	Ti, Zr, ETR	Backshore Resources	120.7 Mt	2.6	40.9	17.4	3.2	0.6	Exploration
Prado	Ti, Zr, ETR	Energy fuels	Not available	Not available					Exploration

(1) Mineral sands- Mineral assemblage is reported as a percentage of in situ THM content.

Deposit	Commodity	Owner	Estimated Resource	Grades (TiO_2)	Status
Lagoa Bonita	Ti, V	CBPM	23.8 Mt	23.46%	Feasibiliy
Maracas Mechen	Ti,V	Largo Inc.	307.63 Mt*	7.86%	Operating

* Reserves + Resources



TUNGSTEN

The main tungsten mineralizations in Brazil are contained in scheelite and wolframite, associated respectively with skarns and greisens, with WO3 grades ranging from 0.7% to 2.0%.

ORE RESERVES
Not available

OPERATING MINES	PRODUCTION
4	500 t

WORLD RANKING	
Reserves	Not available
Production	Not available

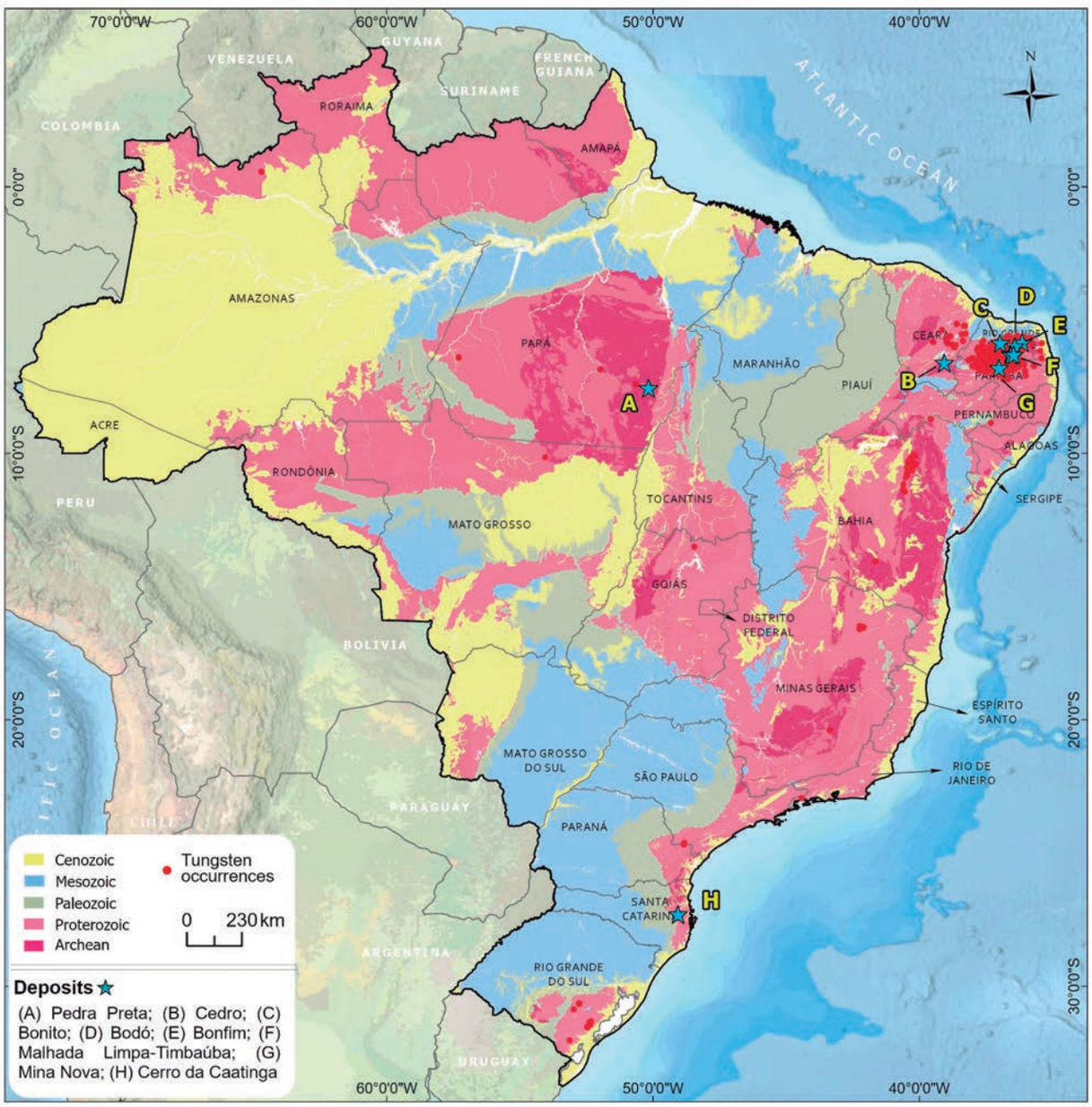


FIGURE 22: Brazilian tungsten deposits and occurrences, 2024.

HIGHLIGHTS

- The tungsten mineral deposits and artisanal mining belong to the hydrothermal magmatic system, with the majority associated with skarns, while a small portion is linked to veins in greisenized zones. Brazil's tungsten mineral potential is primarily associated with Neoproterozoic rocks of the Jucurutu Formation in the Seridó Mineral Province (RN-PB), as well as with quartz/pegmatite veins contained in the Paleoproterozoic granites of the Velho Guilherme Intrusive Suite in the Carajás Mineral Province (PA).
- Reports from various market intelligence and consulting agencies suggest that tungsten investment viability indicators will experience growth exceeding 8% from 2024 to 2029.
- The Geological Survey of Brazil (SGB) has developed prospectivity maps for tungsten in skarns associated with Cu-Au as part of the Granito do Seridó Metallogenic Potential Project (PMGS), published between 2023 and 2025. During this study, new areas for mineral research were identified in the regions of Serra da Umburana, Caicó-São Fernando-Jucurutu, Bodó, and Currais Novos-Santa Luzia.
- A significant portion of the existing tungsten mineralizations in the Seridó Mineral Province, especially those related to the main deposits of this metal, are associated with edges of sources of negative gravimetric anomalies, brittle/ductile structures, and adjacent igneous/meta-igneous bodies.
- Research conducted by the Geological Survey of Brazil (SGB) on the application of reflectance spectroscopy in the Brejuí (RN) tungsten deposit, recently published in the journal (https://doi.org/10.5382/econgeo.5085), enables efficient tracking of tungsten and molybdenum mineralized rocks in skarns. The results obtained may support new mineral exploration investigations in the Seridó Mineral Province and are also applicable to similar deposits in various regions around the world.

Selected tungsten deposits and resource estimates

Deposit	Commodity	Owner	Estimated Resource	Grades (WO_3)	Status
Bodó (Bonito)	W	Bodó Mineração	9 Mt	2.00 %	Paralyzed
Bonfim	W-Au	Mineração Nosso Senhor do Bonfim	0.3 Mt	4.8 %	Paralyzed
Bonito (Pindoba e Marzagão)	W	Mhag Mineração	4.0 Mt	0.7 %	Paralyzed
Brejuí/Barra Verde/Boca de Lage	W	Mineração Tomaz Salustino	11 Mt	1.00 %	Operating
Cerro da Caatinga	W-Sn-Mo	Cerro da Caatinga	0.61 Kt	0.7 %	Exhausted
Igarapé Manteiga	W	Metalmig	0.02 Mt	1.38 %	Paralyzed
Malhada Limpa-Timbaúba	W	Malhada Limpa-Timbaúba	5.5 Mt	0.5 %	Paralyzed
Pedra Preta	W	Mineração Pará Tungstênio	0.51 Mt	1.00 %	Operating
Cedro	W	Cedro	Not available	Not available	Operating
Mina Nova	W	Mina Nova	Not available	Not available	Operating

URANIUM

Brazil currently has one of the largest uranium reserves in the world, with approximately 280 kt of contained uranium (U_3O_8), and the country has the potential to have one of the five largest reserves in the world.

URANIUM CONTENT RESERVES[1]
280 kt

OPERATING MINES	PRODUCTION[1]
1	200 t

WORLD RANKING[1]	
Reserves	8th
Production	10th

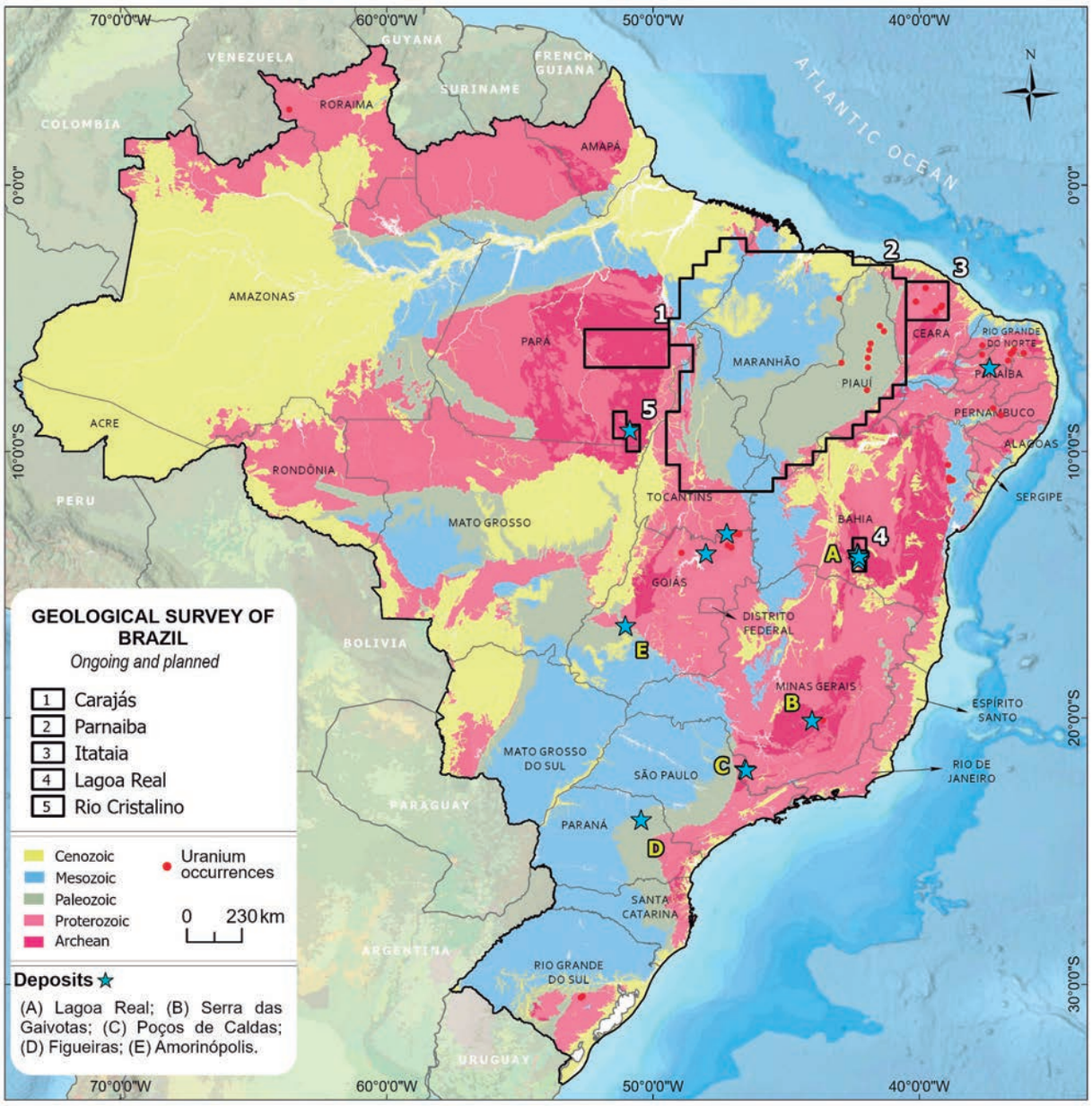


FIGURE 23: Brazilian uranium deposits and occurrences, 2024.

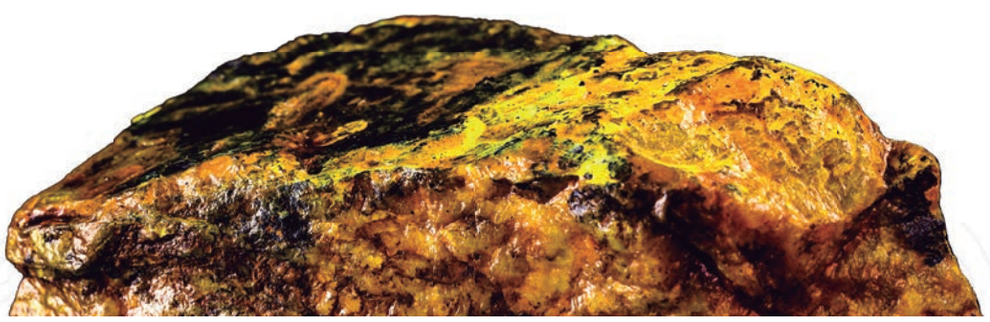
1. NEA (2023), Uranium 2022: Resources, Production and Demand, OECD Publishing, Paris https://www.oecd-nea.org/jcms/pl_79960/uranium-2022-resources-production-and-demand

HIGHLIGHTS

- The Itataia and Lagoa Real deposits were discovered in the late 1970s and were responsible for Brazil ranking seventh place among countries with significant uranium resources. In 2022, Brazil had the eighth-largest uranium resource in the world, although no discoveries had been made since the late 1980s. At the end of 1982, it amounted to about 160kt.
- Brazil has already identified several styles of Uranium deposits on its territory, such as metasomatic deposits (Lagoa Real and Espinharas), Archean Paleoplacer (Serra das Gaivotas and Gandarela), Metamorphic (Itataia) and Sedimentary/Sandstone (Figueira and Amorinópolis).
- The Rio Cristalino Deposit, located in the south of the state of Pará, is one of the areas with the greatest potential, the SGB will present a geologic model and favorability map for the area in 2026.
- The only uranium mine currently operating 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 approximately 400 tons of U_3O_8/year with the potential to reach 800 tons of U_3O_8/year.
- Recently the SGB produced the Lagoa Real Favorability Map for Uranium Deposits, which indicated a large number of potential areas for uranium in the homonym province.
- At the country's only operation, uranium is concentrated by a sulfuric acid leaching process, resulting in a concentrated liquor that, after enrichment, produces the yellow cake.
- The only state in Brazil that requires uranium for electricity generation is Rio de Janeiro, where the Angra 1 and Angra 2 nuclear power plants are located, and a new plant (Angra 3) is under construction. The nominal demand is 440 tons per year. However, between 310 and 340 tons of enriched uranium per year remain, depending on the operating history of the nuclear power plants. The INB – Indústrias Nucleares do Brasil nuclear fuel plant is also located in the state of Rio de Janeiro and provides fuel for Brazil's nuclear power plants.
- Law 14,514/2022 provides mechanisms to make the monopoly on uranium exploration in Brazil more flexible, greatly expanding the opportunities for private investment in the sector1.
- The INB, the owner of all deposits in Brazil, has established partnerships and put forward legal instruments to bid blocks for uranium research and mining, within its mining requirement areas.

Selected uranium deposits and resource estimates

Deposit	Commodity	Owner	Estimated Resource	Grades (U_3O_8)	Status
Espinharas	U	INB	10 kt	0.1 %	Early Exploration
Figueira	U- COAL	INB	8 kt	0.1 %	Early Exploration
Itataia/Santa Quitéria	U-P	INB – Galvani	142.5 Kt	0.05%	Feasibility
Lagoa Real/ Caetité	U	INB	87.089 Kt	0.2%	Operating
Poços de Caldas	U	INB	26.8 Kt	0.01%	Closed
Rio Cristalino	U	INB	150 Kt	0.1%	Early Exploration
Serra das Gaivotas / Gandarela	U-Au	INB	15 kt	0.01%	Early Exploration



VANADIUM

The municipality of Maracás, located in the state of Bahia, holds Brazil's main vanadium reserve, which is associated with iron and titanium.

VANADIUM CONTENT RESERVES[1]
120 kt

OPERATING MINES	PRODUCTION
1	10,000- 11,000 t

WORLD RANKING[1]	
Reserves	5th (0.7%)
Production	4th (5%)

FIGURE 24: Brazilian vanadium deposits and occurrences, 2024.

1 U.S. Geological Survey, 2025, Mineral commodity summaries 2025: https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-vanadium.pdf

HIGHLIGHTS

- Orthomagmatic vanadium deposits are responsible for the major sources of this metal worldwide. The Fe-Ti-V orthomagmatic deposits can be classified into two types based on the predominant oxide: ilmenite-type deposits, associated with anorthositic complexes and hosted in high-grade terrains; and titanomagnetite-type deposits, such as those found in Bushveld, Stillwater, Pansihua, Campo Alegre de Lourdes, and the Jacaré River Sill (where the Maracás Menchen mine is located), hosted in large mafic-ultramafic complexes and anorthositic gabbroic stratified sills (GROSS, 1996).
- At the Maracás mine (Bahia), the mineralizations consist of layers, lenses, and veins with disseminated to massive vanadiferous titanomagnetite (TMV), associated with layered mafic-ultramafic intrusions, gabbro-anorthositic intrusions, and anorthositic massifs, dating from the Archean to the Paleoproterozoic. The Maracás Menchen Mine has been in operation since 2014, producing between 8,000 and 11,000 tons of V_2O_5 by 2024.
- Brazil presents significant potential for vanadium research, with various gabbro-anorthositic bodies and complexes across its territory that require further detailed study. In southern Bahia, the following gabbro-anorthositic massifs are known to date: Rio Piaú (Cruz 1989), Carapussê (Macedo 2000), Samaritana (Jesus 1997), and Potiraguá (Bordini 2003). In the northeastern part of the state, the Lagoa da Vaca Complex (Paixão 1998) is noteworthy. Isotopic studies indicate that this body is the oldest anorthositic complex of the São Francisco Craton, with an estimated age of 3.160 ± 65 Ma (Paixão 1998).
- Brazil also has potential for vanadium in sedimentary environments. Uranium-vanadium deposits hosted in sandstones have been identified across all continents, with many known for their high vanadium concentrations. These vanadium and uranium-containing sandstone deposits have average resources and ore grades that range from 0.1% to 1% vanadium. The formation of uranium-vanadium ore bodies can occur in two main forms: tabular deposits or roll fronts. Additionally, there is a further association of vanadium with surface-hosted uranium deposits in calcrete. The concentration process can be summarized as the deposition of uranium-vanadium bodies at the interface between oxidizing and reducing solutions.

Selected vanadium deposits and resource estimates

Deposit	Commodity	Owner	Estimated Resource	Grades	Status
Maracás Menchem Mine (Campbell Pit + GAN)	V-Ti	LARGO	81.31 Mt	2.40 %	Producing
Maracás Menchem Mine (GAS)	V-Ti	LARGO	11.30 Mt	2.31%	Feasibility
Maracás Menchem Mine (JAC)	V-Ti	LARGO	21.16 Mt	1.74%	Feasibility
Maracás Menchem Mine (NAN)	V-Ti	LARGO	35.25 Mt	2.14%	Feasibility
Maracás Menchem Mine (NAO)	V-Ti	LARGO	11.22 Mt	1.72%	Feasibility
Maracás Menchem Mine (RIOCON)	V-Ti	LARGO	13.27 Mt	1.63%	Feasibility
Maracás Menchem Mine (SJO)	V-Ti	LARGO	33.11 Mt	1.90%	Feasibility

ZINC

Brazil has a notable potential to become a major producer of zinc and associated base metals, such as lead, associated with a variety of Precambrian mineral systems.

ORE RESERVES[1]
2,5 Mt

OPERATING MINES	PRODUCTION[1]
2	173 kt

WORLD RANKING[1]	
Reserves	Not available
Production	Not available

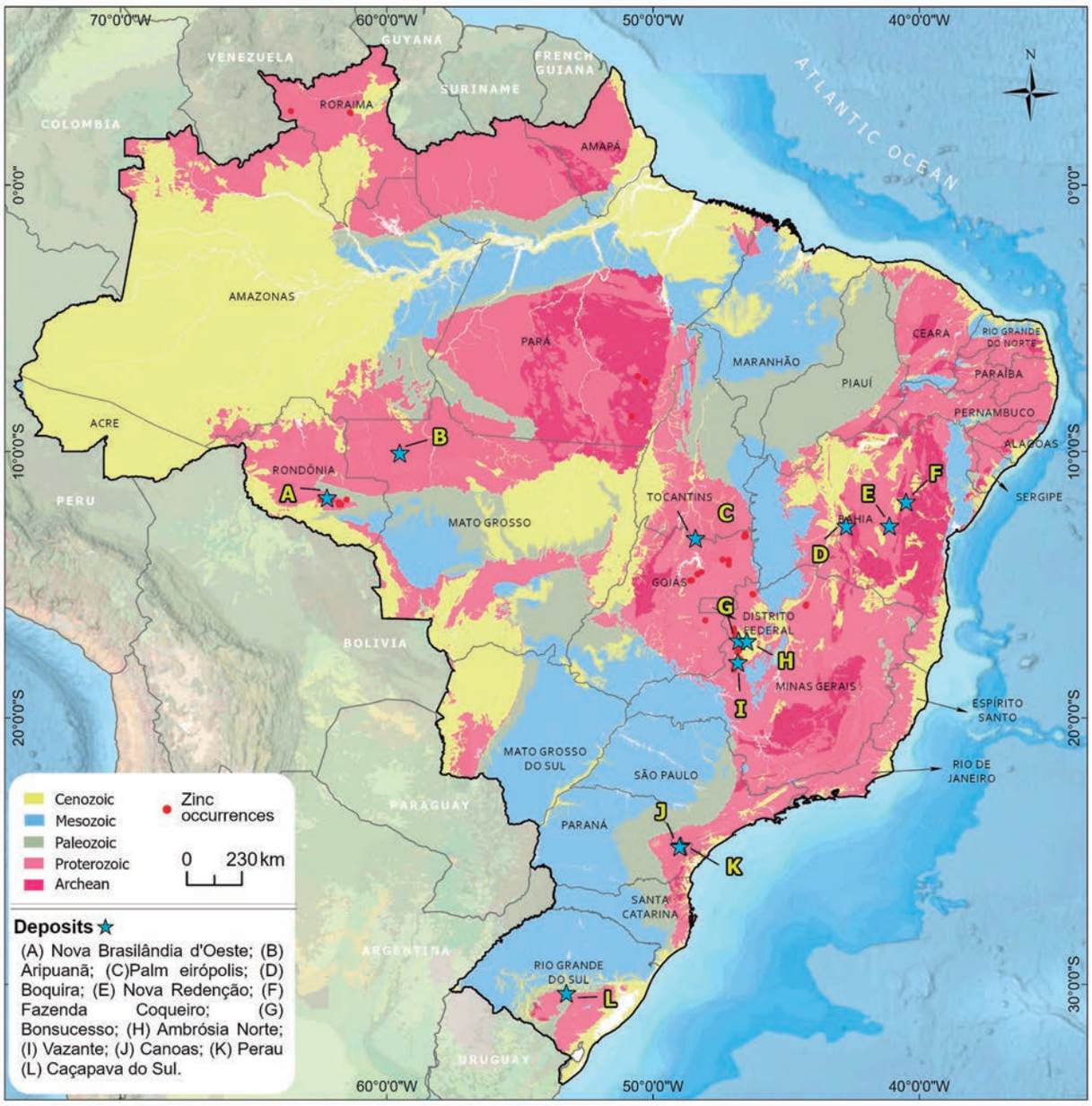


FIGURE 24: Brazilian zinc deposits and occurrences, 2024.

1 Brazilian Mineral Summary, 2021: https://www.gov.br/anm/pt-br/assuntos/economia-mineral/publicacoes/sumario-mineral/sumario-mineral-brasileiro-2021-/zinco-2021-ano-base-2020.pdf

HIGHLIGHTS

- One of Brazil's leading areas for zinc and associated metals is the Vazante-Paracatu Mineral Province, located northwest of the state of Minas Gerais, which forms a north-south trending belt approximately 250 km in length. It comprises two major zinc producing districts, the Vazante Zinc District and the Paracatu-Unaí Mineral District (Zn-Pb-Cu). The Vazante District hosts the exceptional world-class Vazante silicate zinc deposit (Vazante and Extremo Norte mines). The main ore in the deposit is willemite ($ZnSiO_4$) hosted by pelite-carbonate rocks of the Vazante Group. Total resources are estimated at 19,68Mt @ 8,79% Zn. In the Southern Ribeira Belt, located in the states of Paraná and São Paulo, significant Zn and Pb production records are associated with Lajeado Group and Perau Formation rocks. Lead production began in the 1940s and was primarily associated with Lajeado Group carbonates. Within the Perau Formation area, the Perau and Canoa Sediments hosted Zn-Pb (Cu-Ag). Despite the lack of current production, the region has a favorable geological environment for new and significant discoveries.
- Aripuanã is a typical VHMS (Volcanogenic Hosted Massive Sulfide) polymetallic deposit located in the northwestern corner of the state of Mato Grosso. It is associated with Proterozoic bimodal volcanism. The deposit contains up to 1,500 kt of Zn, 540 kt of Pb, and 160 kt of Cu. It also contains 835k oz of Au.
- The Mesoproterozoic Nova Brasilândia Belt, located in northwestern Brazil, hosts occurrences of zinc, lead, copper and gold-rich gossans. The recently discovered Nova Brasilândia deposit, classified as Clastic Sedex with Broken Hill Type (BHT) affinity and hosting Zn-Cu-Pb mineralization, opens the possibility of defining a new polymetallic mineral district in the southern part of the Amazon Craton. In addition to defining a new polymetallic district, this discovery has the potential to contribute to an increase in Brazilian zinc production.

Selected zinc deposits and resource estimates

Deposit	Commodity	Owner	Estimated Resource	Grades (Zn)	Status
Ambrósia Norte	Zn-Pb	Nexa Resources SA	2.16 Mt	3.85 %	Interrupted
Ambrósia Sul	Zn-Pb	Nexa Resources SA	2.15 Mt	5.12 %	Interrupted
Aripuanã	Zn-Pb-Cu	Nexa Resources SA	41.5 Mt	2.4 %	Planned
Bonsucesso	Zn-Pb	Nexa Resources SA	8.49 Mt	3.78 %	Feasibility
Boquira	Pb-Zn-Ag	Metal Data Ltda.	5.6 Mt	1.43 %	Interrupted
Canoas	Pb-Zn-Ag	Canoas	0.97 Mt	3.5 %	Closed
Fazenda Coqueiro	Zn-Pb	CBPM	4.2 Mt	6.12 %	Feasibility
Nova Brasilândia d'Oeste	Zn-Cu-Pb	Mineração Santa Elina	6.2 Mt	6.84 %	Producing
Nova Redenção	Pb-Zn-Ag	SGB-CPRM	5.2 Mt	0.5 %	Early exploration
Palmeirópolis	Zn-Cu-Pb	Alvo Minerals	4.6 Mt	3.9 %	Exploration
Perau	Pb-Ag-Zn-Cu	Perau	0.84 Mt	1.13%	Closed
Vazante	Zn-Pb-Ag	Nexa Resources SA	19.68 Mt	8.79 %	Producing

RELEVANT PUBLICATIONS

LITHIUM

O “Projeto Avaliação do Potencial do Lítio no Brasil” na Província Pegmatítica Orientaldo Brasil: O Serviço Geológico do Brasil fomentando a pesquisa mineral

Favorability map for lithium pegmatite of the Borborema Pegmatite Province

Avaliação do potencial de lítio no Brasil área: Província Pegmatítica da Borborema

Mapa geológico e de recursos minerais de lítio: Subprovíncia Pegmatítica de Solonópole

Geophysical characterization, as a mineral exploration tool, of lithium-rich pegmatites in the Jequitinhonha Valley, Araçuaí Pegmatite District, northeastern region of Minas Gerais, Brazil

GRAPHITE

Avaliação do Potencial da Grafita no Brasil: Fase 1

Ocorrência de Grafita na Faixa Araguaia, norte do Estado do Tocantins, municípios de Xambioá e Araguanã

Mapa de favorabilidade para grafita tporção centro-leste, Província grafítica Ceará Central

Avaliação do potencial de grafita no Brasil - área Ceará

REE

Mapa de prospectividade para ETR-Sn (F, In)-Ta-W-U Província Estanífera de Goiás

Avaliação do potencial de terras raras no Brasil

Geologia e avaliação do potencial para fosfato e elementos terras-raras da região de Campos Novos, Roraima

URANIUM

Mapa de avaliação do potencial de urânio do Brasil: escala 1:5.000.000

Avaliação da favorabiliade para depósitos de urânio no Brasil

Mapa de favorabilidade para urânio da Província Uranífera de Lagoa Real

Ocorrências de urânio na área de Rio Cristalino, sul do Pará

COPPER

Mapa de prospectividade mineral Cobre: Setor Aquiri, Província Mineral de Carajás (PA)

Mapa de prospectividade para cobre-ouro skarns- área Serra da Umburana, Província Borborema

Província mineral de Carajás, PA: controles críticos das mineralizações de cobre e ouro do lineamento Cinzento

Mapa de favorabilidade para cobre: área sudeste do Cráton Amazônico, subáreas 1 e 2

Panorama Nacional do Cobre

Província mineral de Carajás, PA: mapa de favorabilidade para cobre do cinturão sul do cobre

GOLD

Economia Mineral do Ouro

Mapa de favorabilidade para ouro orogênico: Quadrilátero ferrífero, setor central

Mapa de favorabilidade para ouro: Lineamento Tocantinzinho- Setor Oeste

Mapa de favorabilidade para ouro Oeste de Goiás

Mapa de prospectividade para cobre, chumbo e zinco- VMS região de Filadélfia-MT

Mapa de favorabilidade para ouro e cobre porção leste da Província Mineral Juruena-Teles Pires

Mapa de favorabilidade para ouro orogênico: Serra de Jacobina- BA

A design of gold-bearing metallogenic provinces and districts in Brazil

NICKEL

Reavaliação do patrimônio mineral: área níquel de Santa Fé, estado de Goiás

TUNGSTEN

Áreas de relevante interesse mineral (ARIM): evolução crustal e metalogenia da província mineral do Seridó: estados do Rio Grande do Norte e Paraíba

Mapa de prospectividade para tungstênio e ouro: área Caicó- São Fernando- Jucurutu

Mapa de prospectividade para tungstênio em skarns da área Bodó

PHOSPHATE

Avaliação do potencial de fosfato no Brasil: investigação na Formação Jandaíra, Bacia Potiguar, municípios de Areia Branca e Guamaré, estado do Rio Grande do Norte

Avaliação do potencial de fosfato no Brasil – áreas Monte Alegre (PA) e Monte Dourado (PA), borda norte da Bacia do Amazonas

Avaliação do potencial de fosfato no Brasil, fase III: centro-leste de Santa Catarina

Avaliação do potencial de fosfato no Brasil, fase III: bacia Sergipe- Alagoas, área sub-bacia Sergipe, estado de Sergipe

Avaliação do potencial de fosfato no Brasil, área sequência devoniana na bacia do Paraná (PR e MS)

POTASH

Avaliação do potencial de potássio no Brasil: área Bacia do Amazonas, setor centro-oeste, estados do Amazonas e Pará

Avaliação do potencial de potássio do Brasil – Área: Bacia Sergipe- Alagoas

AGROMINERALS

Mapa de avaliação do potencial agromineral do Brasil: área Tocantins

Avaliação do potencial agromineral do Brasil: eixo Manaus – Boa Vista

Soil Fertilization and Maize-Wheat Grain Production with Alternative Sources of Nutrients

Avaliação do potencial agromineral do Brasil: Estado de Goiás e Distrito Federal

Mapa do potencial agromineral do estado de Goiás e Distrito Federal

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Access our PDAC hotsite using the QR code or the link: sgb.gov.br/pdac

Access the full list of deposits and references: https://1sh.co/geoportal

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