

# BRAZIL mineral

MINING - METALLURGY

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## THE RACE FOR STRATEGIC MINERALS



# BRASIL PDAC 2025

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# AN OPPORTUNITY FOR BRAZIL

Is Brazil really set to become a global player in the supply of minerals considered strategic for the energy transition? For some of those minerals, the answer seems to be in the affirmative, to judge by the opinions expressed by experts and industry leaders in this issue of *Brasil Mineral*. Most of them agree that Brazil truly has the potential to emerge, within a few years, as a major producer of rare earths, lithium, and graphite.

In rare earths, the market is currently dominated by China, which produces more than 90 percent of the world total. Brazil became a producer in 2024, when Serra Verde brought its Pela Ema project on stream; the company is already planning a capacity expansion. In addition, several other projects are now at varying stages, ranging from mineral exploration to engineering, including feasibility studies. Some of them are due to become operational within the next three years.

The experts we spoke to are categorical in stating that Brazil's geology is clearly favourable to the occurrence of rare earth deposits, especially in ionic clays, which offer the great advantage that mining is both low-cost — in capital expenditure and operating costs alike — and environmentally friendly, conferring a clear competitive advantage.

In the case of lithium, specifically of hard-rock lithium, Brazil has been producing chemical-grade material for many years, mainly for applications unrelated to electric vehicle batteries. Recently, however, Brazil has also begun to produce battery-grade lithium and now even hosts a regional hub for the production of this material, the so-called "Lithium Valley" in the state of Minas Gerais.

In fact a lithium race has begun in Brazil, in which several junior mining companies are now competing, largely companies listed on the

Australian and Canadian stock exchanges. This race is the subject of an article in this issue. It should be noted that in several other regions, unconnected to the Lithium Valley, there are occurrences of pegmatites, a lithium-containing mineral. Significantly, the sharp drop in lithium prices over the last year has not discouraged the new arrivals, who are going ahead with their exploration programs and their productive ventures.

In graphite, which Brazil has now been producing for several years — it has one of the largest reserves in the world, behind China — at least two new projects have been brought into production recently, with the expectation that other projects will follow in the next few years.

The list of minerals for the energy transition also includes copper, nickel sulfide, and niobium. In the case of the first two, Brazil already produces both, though it is hardly likely to become a prominent player on a global level.

Niobium, however, is in a different category. We are already playing a leading role, supplying more than 85 percent of the total world output.

The government, acting through several different agencies, is seeking to create support mechanisms for projects aimed at producing these minerals, partly by providing new financing mechanisms, partly by tax incentives, and partly, too, by fostering technological development.

Unless the Trump administration's actions in pursuit of its energy transition policy should have an unforeseen impact causing a market disruption of some kind, Brazil may, in fact, become a production hub for these minerals. This would help the country to diversify its mineral production, which still today remains overdependent on iron ore. ▢



*Francisco Alves, Editor*

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*Iron ore to be shipped*

# BRAZIL'S MINING OUTPUT GROWS AGAIN, BUT REMAINS DEPENDENT ON IRON ORE

*Francisco Alves*

**O**n the basis of statistics released by the National Mining Agency (ANM), a **Brasil Mineral** estimate shows that Brazil's mining output grew to R\$ 270.8 billion in 2024, an increase of approximately 9.1 percent in value terms in the year, up from R\$ 248.2 billion in 2023. As usual, iron ore led with a 2024 figure of R\$ 160.7 billion, or 59.3 percent of the total. Iron ore was produced at 160 mining operations, located mainly in two states, Minas Gerais and Pará. In second place was gold, with 486 mines (including artisanal operations, which are the vast majority), and account-

ing for 8.8 percent of last year's output with R\$ 23.8 billion. Copper retained its third place among mining products in 2024, at R\$ 20.3 billion, obtained from 17 operations. Granite, both for use as ornamental rock and in aggregates for the construction industry, ranked fourth with R\$ 7.33 billion, arising from 831 operations. Limestone, used mainly in the production of cement and lime and as an agricultural corrective, placed fifth with R\$ 7.23 billion in 481 operations. The ten products with the highest output, in value terms, in 2024 also include bauxite (aluminium ore) with R\$ 5.71 bil-



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Corporate Presentation



# 50 LARGEST MINING COMPANY IN BRAZIL - 2024

| RANKING | COMPANY                                           | NUMBER OF OPERATIONS | PRODUCT                 | PRODUCTION IN 2024 (IN R\$) | % OF TOTAL PRODUCTION | CFEM IN 2024 (IN R\$) |
|---------|---------------------------------------------------|----------------------|-------------------------|-----------------------------|-----------------------|-----------------------|
| 1       | VALE S.A.                                         | 32                   | Iron ore                | 117,004,960,673.29          | 43.2013%              | 4,074,258,991.58      |
| 2       | SALOBO METAIS S/A                                 | 2                    | Copper                  | 15,175,137,283.85           | 5.6031%               | 304,532,111.98        |
| 3       | ANGLO AMERICAN MINERIO DE FERRO BRASIL S/A        | 2                    | Iron ore                | 11,269,852,254.02           | 4.1611%               | 394,444,828.89        |
| 4       | CSN MINERACAO S.A.                                | 2                    | Iron ore                | 10,557,718,182.10           | 3.8982%               | 367,997,617.20        |
| 5       | KINROSS BRASIL MINERACAO S/A                      | 1                    | Gold                    | 6,511,021,440.57            | 2.4040%               | 97,801,022.78         |
| 6       | ANGLOGOLD ASHANTI CORREGO DO SITIO MINERACAO S.A. | 6                    | Gold                    | 3,255,401,014.21            | 1.2020%               | 48,365,697.80         |
| 7       | JACOBINA MINERACAO E COMERCIO LTDA                | 1                    | Gold                    | 2,373,823,080.78            | 0.8765%               | 35,607,346.21         |
| 8       | MOSAIC FERTILIZANTES P&K LTDA.                    | 6                    | Phosphate and potassium | 2,351,962,245.10            | 0.8684%               | 47,474,396.54         |
| 9       | SAMARCO MINERACAO S.A. EM RECUPERACAO JUDICIAL    | 2                    | Iron ore                | 2,212,693,516.63            | 0.8170%               | 83,920,236.73         |
| 10      | MINERACAO PARAGOMINAS S.A.                        | 2                    | Bauxite                 | 2,183,325,699.20            | 0.8061%               | 65,499,770.99         |
| 11      | MINERACAO USIMINAS S.A.                           | 1                    | Iron ore                | 2,150,706,415.65            | 0.7941%               | 73,020,040.84         |
| 12      | MINERACAO RIO DO NORTE SA                         | 1                    | Bauxite                 | 2,076,712,756.76            | 0.7668%               | 56,826,689.27         |
| 13      | MINERACAO MARACA INDUSTRIA E COMERCIO S/A         | 2                    | Copper and Gold         | 1,976,030,069.47            | 0.7296%               | 39,520,601.40         |
| 14      | NEXA RECURSOS MINERAIS S.A.                       | 8                    | Zinc, copper and lead   | 1,754,725,568.09            | 0.6479%               | 35,747,342.03         |
| 15      | VALLOUREC TUBOS DO BRASIL LTDA.                   | 1                    | Iron ore                | 1,499,720,926.96            | 0.5537%               | 49,324,159.69         |

|    |                                                        |    |                             |                  |         |               |
|----|--------------------------------------------------------|----|-----------------------------|------------------|---------|---------------|
| 16 | LHG MINING CORUMBA S.A                                 | 3  | Iron ore                    | 1,459,964,714.10 | 0.5391% | 46,178,844.81 |
| 17 | MINERACAO CARAIBA S/A                                  | 3  | Copper                      | 1,355,738,119.90 | 0.5006% | 27,114,436.21 |
| 18 | FERRO + MINERACAO S.A.                                 | 1  | Iron ore                    | 1,338,619,808.07 | 0.4943% | 45,872,125.77 |
| 19 | ARCELORMITTAL BRASIL S.A.                              | 2  | Iron ore                    | 1,290,779,068.88 | 0.4766% | 45,144,343.61 |
| 20 | VOTORANTIM CIMENTOS S.A.                               | 49 | Limestone, clay and gypsum. | 1,285,490,990.74 | 0.4746% | 23,310,268.73 |
| 21 | CMOC BRASIL MINERACAO, INDUSTRIA E PARTICIPACOES LTDA. | 5  | Phosphate and niobium       | 1,230,095,037.00 | 0.4542% | 31,655,971.46 |
| 22 | Alcoa World Alumina Brasil Ltda.                       | 1  | Bauxite                     | 1,079,392,826.23 | 0.3985% | 31,874,436.61 |
| 23 | BEMISA HOLDING S.A.                                    | 3  | Iron ore and Gold           | 1,069,063,776.66 | 0.3947% | 35,070,469.21 |
| 24 | Cia de Mineração Serra da Farofa                       | 3  | Iron ore                    | 1,044,960,262.60 | 0.3858% | 36,435,950.10 |
| 25 | ANGLO AMERICAN NIQUEL BRASIL LTDA                      | 2  | Nickel                      | 1,036,202,583.07 | 0.3826% | 20,724,051.67 |
| 26 | MINERACAO SERRA GRANDE S A                             | 3  | Gold                        | 983,663,061.01   | 0.3632% | 14,872,611.76 |
| 27 | GERDAU ACOMINAS S/A                                    | 2  | Iron ore                    | 982,797,057.72   | 0.3629% | 34,527,674.73 |
| 28 | EXTRATIVA MINERAL S/A                                  | 1  | Iron ore                    | 962,909,976.69   | 0.3555% | 31,110,837.52 |
| 29 | MINERACAO CONEMP LTDA                                  | 2  | Iron ore                    | 921,078,822.89   | 0.3401% | 31,144,509.26 |
| 30 | MINERACAO VALE VERDE DO BRASIL LTDA.                   | 1  | Copper                      | 917,999,292.86   | 0.3389% | 18,359,985.86 |
| 31 | MINERACAO AURIZONA S/A                                 | 2  | Gold                        | 911,400,197.46   | 0.3365% | 13,671,002.96 |
| 32 | NX GOLD S.A.                                           | 1  | Gold                        | 859,228,579.70   | 0.3172% | 11,341,817.26 |
| 33 | MINERACAO SERRAS DO OESTE LIMITADA                     | 2  | Gold                        | 803,146,493.87   | 0.2965% | 12,058,734.15 |
| 34 | MINERACAO TABOCA S A                                   | 1  | Tin,tantalum and niobium    | 756,234,457.64   | 0.2792% | 16,604,902.88 |
| 35 | FAZENDA BRASILEIRO DESENVOLVIMENTO MINERAL LTDA        | 3  | Gold                        | 753,563,272.80   | 0.2782% | 11,303,449.11 |

## OVERVIEW

|              |                                                           |    |                                  |                    |          |               |
|--------------|-----------------------------------------------------------|----|----------------------------------|--------------------|----------|---------------|
| 36           | MINERACAO RIACHO DOS MACHADOS LTDA.                       | 1  | Gold                             | 721,615,259.33     | 0.2664%  | 10,824,228.90 |
| 37           | GSM Mineração LTDA                                        | 2  | Iron ore                         | 703,803,231.18     | 0.2599%  | 22,346,235.20 |
| 38           | AMARILLO MINERACAO DO BRASIL LTDA                         | 3  | Gold                             | 698,141,649.88     | 0.2578%  | 10,472,124.73 |
| 39           | POLIMIX CONCRETO LTDA                                     | 33 | Aggregates                       | 694,906,081.49     | 0.2566%  | 6,575,541.73  |
| 40           | AVB MINERACAO LTDA.                                       | 1  | Copper                           | 664,380,058.56     | 0.2453%  | 12,720,017.96 |
| 41           | AURA ALMAS MINERACAO S/A                                  | 1  | Gold                             | 664,312,135.54     | 0.2453%  | 9,942,329.78  |
| 42           | AMG BRASIL S.A.                                           | 2  | Tantalum, tin, feldspar, lithium | 626,439,848.54     | 0.2313%  | 12,434,817.05 |
| 43           | COMPANHIA BRASILEIRA DE METALURGIA E MINERACAO            | 1  | Niobium                          | 601,912,012.25     | 0.2222%  | 18,082,532.69 |
| 44           | SAMA S.A. - MINERACOES ASSOCIADAS EM RECUPERACAO JUDICIAL | 1  | Asbestos                         | 570,698,378.06     | 0.2107%  | 11,413,967.56 |
| 45           | IMERYS RIO CAPIM CAULIM LTDA                              | 3  | China Clay                       | 558,808,182.08     | 0.2063%  | 11,061,215.22 |
| 46           | EMBU S A ENGENHARIA E COMERCIO                            | 4  | Aggregates                       | 545,510,933.02     | 0.2014%  | 4,722,192.14  |
| 47           | SIGMA MINERACAO S.A.                                      | 1  | Lithium                          | 537,212,173.00     | 0.1984%  | 12,580,311.68 |
| 48           | FERROMAR INDUSTRIA E COMERCIO S.A.                        | 1  | Iron ore                         | 527,779,844.27     | 0.1949%  | 18,621,606.98 |
| 49           | Minerita Minérios Itaúna Ltda.                            | 2  | Iron ore                         | 490,068,540.58     | 0.1809%  | 17,056,047.94 |
| 50           | MINERACAO VALE DO JACURICI S A                            | 1  | Chromite                         | 489,784,164.17     | 0.1808%  | 9,593,454.79  |
| <b>Total</b> |                                                           |    |                                  | 212,491,492,018.52 | 78.4575% |               |

lion in 69 operations; basalt (R\$ 3.79 billion and 859 operations); sand (R\$ 3.32 billion and 4,912 operations); gneiss (R\$ 3.30 billion and 293 operations); and phosphate (R\$ 3.28 billion and 24 operations).

The year's mining output resulted in a CFEM revenue (Financial Contribution on Mineral Exploitation) totalling R\$ 7.45

billion in 2024, an increase of more than 9 percent from the R\$ 6.81 billion reported in 2023. Iron ore was the product that paid the largest share of CFEM in 2024, at R\$ 5.57 billion, followed by copper (R\$ 406.7 million), gold (R\$ 358 million), bauxite (R\$ 165.7 million) and limestone (R\$ 149.7 million).



*Equinox Gold's Fazenda mine*

## Trade balance

The mining industry exported US\$ 80.9 billion in 2024, a slight increase from 2023. As a result, the industry's share in total exports increased from 23.2 percent in 2023 to 24.0 percent in 2024. The industry's main export product was iron ore and derivatives, with a total of US\$ 29.8 billion, giving an 8.9 percent share in the country's total exports in the year. That was slightly less than in 2023, when sales of iron ore and derivatives abroad totalled US\$ 30.6 billion, representing 9.0 percent of exports. In value terms, iron ore exports fell by 2.4 percent, while the average price was 5.2 percent lower than a year earlier.

Even with a 0.8 percent reduction compared with 2023, overall Brazilian exports

totalled US\$ 337 billion, which is the second highest value in the historical series. In volume terms, on the other hand, exports increased by 3 percent.

Imports grew 9 percent in the year to US\$ 262.5 billion, also the second highest annual figure in the historical series. As a result, the trade surplus in 2024 was US\$ 74.6 billion, down 24.6 percent in the year. In 2023 the surplus had been US\$ 98.9 billion. Imports increased by 17.2 percent in volume terms but by only 9 percent in value terms, as prices fell by an average 7.4 percent.

## Largest companies

In 2024 the fifty largest mining companies in Brazil (see table) accounted for an



*Samarco iron ore pellets yard*

overall output, in value terms, amounting to R\$ 212.5 billion. This was 78.5 percent of the total produced in the year by the mining industry as a whole.

Vale leads the list by a wide margin, with an output figure of R\$ 117 billion, which is 43.2 percent of the aggregate output of the more than 7,000 companies and individuals engaged in mining in Brazil. Vale currently produces iron ore in 32 separate operations located mainly in Minas Gerais and Pará.

The second placed company is Vale Base Metals, acting through Salobo Metais, Brazil's largest copper producer, with two operations. The output figure for Salobo Metais was R\$ 15.1 billion, or 5.6 percent of the total.

Anglo American Minério de Ferro Brasil, which has two operations, appears in third place, with a 2024 output stated as R\$ 11.3 billion, giving a 4.2 percent share of the total.

Others included among the ten largest producers are CSN Mineração (iron ore), Kinross Brasil (Kinross group – gold), AngloGold Ashanti (gold), Jacobina Mineração (Pan American Silver group – gold), Mosaic Fertilizantes (phosphate and potash), Samarco Mineração (BHP and Vale – iron ore) and Mineração Paragominas (Hydro group – bauxite).

Iron ore producers dominate the list of the fifty largest mining companies ranked by their 2024 output. In fact, seventeen of the fifty are iron ore producers, followed by gold (eleven companies), copper (five), and bauxite (three).

## Growth prospects

The growth prospects of the Brazilian mining industry in the coming years are positive, not only in markets in which Brazil is already an important and traditional player, such as iron ore and gold, but also in those markets in which the country is only now beginning its journey, such as the strategic minerals for the energy transition (see article in this issue).

## Iron ore

From the statistics listed above it clearly emerges that iron ore still remains — and is set to remain for many years to come — the flagship of the Brazilian mining industry in both volume and value terms, although over time this predominance will no doubt be put into perspective, due to the growing output of other minerals such as copper, lithium, rare earths, graphite, nickel, and others.

There are some growth projects in iron ore, mainly in the state of Minas Gerais, but also in the states of Pará, Bahia, and Mato Grosso do Sul.

In Minas Gerais, the main investments currently at the planning stage are those of CSN, Itaminas, Mineração Herculano, Cedro Mineração, SAM (Sulamericana de Metais), and Gerdau. In Bahia, the two main projects are those of BAMIN and

Santa Fé. In Mato Grosso do Sul, LHG Mining (J&F group) has a major project.

In Pará, **Vale**, which expects to reach a production level of 360 million tons of iron ore by 2030, has as its main project in Brazil the addition of 20 million tons per year to the existing capacity of its S11D unit.

In Minas Gerais, **CSN Mineração** plans to invest R\$ 13.2 billion between 2025 and 2030 to add 28.4 million tons to its current capacity, which is 33 million tons a year.

**Anglo American Minério de Ferro Brasil** is investing US\$ 758 million in a new tailings filtration plant with the capacity to process 24.5 million tons a year. The purpose is to extend the useful lifetime of the tailings dam at the Minas-Rio project.

**Cedro Mineração**, which also controls

Extrativa Mineral, plans to invest US\$ 1.6 billion in its mines. The project is scheduled for completion by August 2027.

**Herculano Mineração** has planned investments of US\$ 650 million in three projects to expand its iron ore production capacity.

**Gerdau** plans to invest R\$ 3.2 billion in its sustainable mining platform, with the aim of supplying high-quality ore at a competitive price to the company's steelmaking unit at Ouro Branco, in Minas Gerais.

**SAM** plans to invest more than US\$ 2 billion in its Block 8 Project, which aims to transform low-grade iron ore into high-quality products, having an iron content of up to 66.5 percent, contributing to the decarbonization of the steel industry.



"We celebrate with immense gratitude the 30 years of existence of our company in 2025. There are three decades of challenges, achievements and, above all, learning that made us stronger and more resilient."

Benedito Andrade - Founder



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GROUP COMPANIES

## MAIN MINERALS PRODUCED IN BRAZIL IN 2024

| RANKING      | MINERAL   | NUMBER OF OPERATIONS | PRODUCTION (IN R\$) | % OF THE TOTAL | CFEM             |
|--------------|-----------|----------------------|---------------------|----------------|------------------|
| 1            | Iron ore  | 160                  | 160,726,757,475.67  | 59.34%         | 5,578,170,961.57 |
| 2            | Gold      | 486                  | 23,858,369,234.09   | 8.81%          | 358,097,656.80   |
| 3            | Copper    | 17                   | 20,282,591,984.80   | 7.49%          | 406,701,125.30   |
| 4            | Granite   | 831                  | 7,336,742,454.44    | 2.71%          | 72,035,049.67    |
| 5            | Limestone | 481                  | 7,236,267,179.44    | 2.67%          | 149,763,293.89   |
| 6            | Bauxite   | 53                   | 4,456,544,100.83    | 1.65%          | 128,035,133.17   |
| 7            | Basalt    | 859                  | 3,798,563,479.03    | 1.40%          | 36,372,452.95    |
| 8            | Sand      | 4912                 | 3,325,214,884.84    | 1.23%          | 38,554,534.24    |
| 9            | Gnaïsse   | 293                  | 3,306,313,634.42    | 1.22%          | 33,118,886.10    |
| 10           | Phosphate | 24                   | 3,288,941,856.39    | 1.21%          | 66,481,320.99    |
| <b>Total</b> |           |                      | 237,616,306,283.95  | 87.73%         | 6,867,330,414.68 |

In the state of Bahia, **BAMIN**, which according to market rumors was being acquired by Vale, announced the expansion of planned investments, which increased from R\$ 14 billion to R\$ 20 billion, in an integrated mine-railway-port project. The projected capacity is 26 million tons of iron ore per year.

**Santa Fé Mineração** plans to begin implementing the first stage of production of a high-grade pellet feed plant with a 65 percent iron content, located in southwestern Bahia, for a R\$ 2 billion investment.

**Brazil Iron** also has a project in Bahia for a mining unit and a hot briquetted iron (HBI) facility with a capacity of 5 million tons per year, for a budgeted investment of US\$ 5.7 billion. In addition to the mine itself, Brazil Iron plans a pellet feed plant in the Piaçã and Abaíra regions and two others in the port region, one for pellets

and the other for HBI. In a second stage, a third plant is to be built, to produce green hydrogen. The project is currently at the environmental licensing stage.

In Mato Grosso do Sul, **LHG Mining** (formerly J&F Mineração) has announced a R\$ 5.5 billion investment program to expand its capacity. The company's long-term goal is to reach a capacity of 50 million tons a year.

### Gold

Gold is a market segment that has recorded significant growth in Brazil and seems set to carry on growing, mainly in the light of medium-scale projects announced by companies such as Hochschild Mining, G Mining, Equinox Gold, Kinross, TriStar Mineração, and Bemisa, among others.

**Kinross**, Brazil's leading gold producer, is concluding a US\$ 30 million investment



*Ero Copper's Tucumã Project*

in a project to boost production at Paracatu, in Minas Gerais, by around 20,000 ounces per year.

**G Mining Ventures** is already producing on a commercial scale at its Tocantinzinho project, in the state of Pará, designed to produce 1.83 million ounces of gold over its 10.5-year useful lifetime. Capex for the project is stated as US\$ 481 million.

In May 2024, **Hochschild Mining** began commercial production at its Mara Rosa project, in the state of Goiás. It is the company's first gold mine in Brazil, in which it has invested R\$ 900 million. Planned output is in the range from 83,000 to 93,000 ounces. Also in the company's plans is its Monte do Carmo gold project, in the state of Tocantins, formerly the property of Cerrado Gold. The deposit holds proven reserves of approximately 1 million ounces of gold.

**Aura Minerals** has been pursuing a strong growth strategy since 2018 and plans to achieve an output of 450,000 ounces of gold in 2025 and beyond. In 2023 the company brought its Almas project on stream, in the state of Tocantins, budgeted at US\$ 73 million and scheduled to produce 51,000 ounces of gold per year during the first four years. The company also began implementing its Borborema project, in the state of Rio Grande do Norte, which it acquired from Big River and where it is investing US\$ 188 million. Another project in Aura's portfolio of new developments is Matupá, in Mato Grosso. The feasibility study, already completed, indicates that the planned investment for the project is US\$ 107 million, for an annual output capacity of 54,700 ounces in the first four years and an expected seven-year useful lifetime,



*Anglo American's Minas-Rio complex*

based on reserves estimated in accordance with Canada's National Instrument 43-101.

**Equinox Gold** intends to put an underground mine into production, by 2028, at its Aurizona mine, located in Godofredo Viana in the state of Maranhão, where it already carries out open pit mining, producing at a scale of 120,000 ounces of gold per year. Implementation of the underground mine is scheduled to begin in mid-2025, for an investment of around R\$ 900 million. The company is also planning a new project aiming to extend the Life Of Mine in Fazenda Mine, located in Bahia state. The total investment could reach US\$ 199 million, to be disbursed until 2033.

**TriStar Gold** will begin implementing its Castelo de Sonhos project, located in the municipality of Altamira, in Pará. It will be

an open pit mine with a forecast output of 125,000 ounces of gold per year, for a period of ten years. The crushing plant is designed to handle 10,000 tons of ore per day, with an average gold content of 1.12 grams per ton. Gold reserves total 1.4 million ounces, and the projected capex is US\$ 261 million.

**Bemisa** has announced an increased mineral resource of 1.73 million ounces of gold with an average grade of 1.47 g/t for the Água Azul Complex, as detailed in its independent technical report, recently prepared in accordance with National Instrument 43-101.

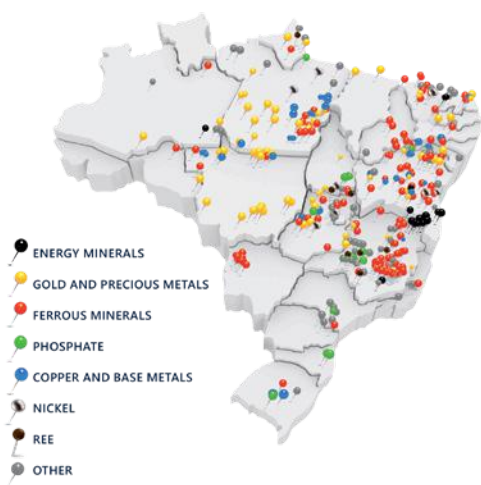
The project is located at Água Azul do Norte, a small municipality approximately 180 km southwest of Parauapebas, close to the Carajás polymetallic district. The Água Azul Complex consists of four mining rights



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*Galvani's phosphate fertilizer complex in Bahia*

covering 6,500 hectares (25 square miles), which hosts gold mineralization. Bemisa has invested in geological and metallurgical research over more than six years, with the aim of ensuring the technical, economic, and socio-environmental viability needed to operate. The company notes that the resource estimate considers surveys carried out solely in six of the project's twelve targets, indicating that there is high unexplored geological potential for expanding mineral resources. A reserves report is to be concluded before the end of the first quarter of 2025. One of the project's key strengths is that the Água Azul ore has low sulfidation and is practically free from contaminating metals, particularly environmentally harmful elements like arsenic and lead. These characteristics allow for processing with low cyanide consumption and high metallurgical recovery, in addition to a safe waste disposal operation, with low

potential for acid drainage. The pilot plant in operation has the capacity to process 150,000 tons of ore per year. The company has applied for licensing for a production scale of 200,000 tons a year. The processing utilizes a filtration and dry stacking system, eliminating the need for a tailings dam. The open pit mine is operated selectively, targeting ore-rich zones while minimizing barren rock and reducing dilution rates.

**Cabral Gold** has completed a positive pre-feasibility study for its Cuiú-Cuiú project in Pará, showing that it could yield 19,700 ounces in each of the first two years. The project has a low development capex of US\$ 37.4 million.

**Belo Sun** is resuming the permits procedure for its Volta Grande project, located in the municipality of Senador José Porfírio, in Pará. With an originally forecast capex of US\$ 298 million, the project is planned

to produce 268,000 ounces a year in the first ten years and a total of 3.53 million ounces over its lifetime. Recently, La Mancha acquired a 17.1 percent equity stake in Belo Sun.

## Copper

Copper production in Brazil has been gaining in importance year by year, as can be seen from its growing share in overall mining output. Although there are still only five companies producing copper in Brazil — Salobo Metais-VBM, Mineração Maracás-Lundin Mining, Mineração Caraíba-Ero Brasil, Mineração Vale Verde-Appian Capital Brazil, and AVB-BHP — there is a strong possibility that other players will enter the market in the not-too-distant future.

Among the companies that are already active in the market, several have announced investment plans to expand production, the most significant being those of Vale Base Metals and Ero Brasil.

**Vale Base Metals**, a Vale unit acting exclusively in the field of the energy transi-

tion minerals, operates Salobo and Sossego, both in the state of Pará, which in 2024 jointly produced 265,200 tons, roughly two-thirds of the company's overall copper output. In the near future, VBM production is expected to increase significantly, as investments in the range from US\$ 25 billion to US\$ 30 billion are planned to increase overall copper production from 350,000 to 900,000 tons per year.

Vale recently completed a new expansion, Salobo III, which includes a new plant, already operating on a commercial scale and bringing an additional 40,000 to 50,000 tons a year to the unit's previous capacity. The investment in Salobo III was of the order of US\$ 1.1 billion. VBM is now considering various alternatives for the further expansion of Salobo, including the possible introduction of underground mining. The company is also studying the option of implementing its Salobo IV project, which would add another 30,000 tons per year of copper contained in concentrate to the unit's present capacity.



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*Vale's Salobo copper complex*

VBM is also studying the future development of Sossego, through the Southern Hub, which includes projects such as Bacaba, Cristalino, Visconde and Barão. With the Southern Hub, the expectation is that Sossego's useful lifetime could be extended beyond 2050. Another project in the company's portfolio is Alemão, in the Carajás region, whose projected capacity is 60,000 tons of copper per year.

**Ero Brasil** has now fully implemented its Tucumã project, in Pará, where it invested US\$ 310 million. With its 55,000 tons a year, Tucumã brings the company's overall capacity in Brazil to 100,000 tons, placing Ero Brasil in second place among copper producers in the country, behind Vale. The company also has another project in the

state of Bahia, named Deepening, which involves digging a shaft to access deep-lying ore. The project is budgeted at around R\$ 1.4 billion and the implementation schedule is three years.

### Fertilizers

Despite being one of the largest agricultural producers in the world, Brazil is still heavily dependent on imports to meet its fertilizer consumption. This external dependence, mainly on potassium and phosphate, currently stands at around 85 percent.

In a move aimed at alleviating the imbalance between domestic supply and demand, the government has approved a National Fertilizer Plan, which aims to reduce Bra-

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zil's external dependence and provide greater competitiveness and sustainability to local producers, contributing to food security. The target is to increase output year by year, so as to reach 2050 with domestic production meeting between 45 and 50 percent of demand.

On the private-sector side, there are several projects in the pipeline. In 2024, **EuroChem** brought on stream its Serra do Salitre complex, in Minas Gerais, producing phosphates with an installed capacity of 1.2 million tons per year. It invested around US\$ 1 billion in the project.

**Fosnor/Galvani** has two projects in the state of Bahia, the first being the duplication of the Luís Eduardo Magalhães plant, where it is investing R\$ 500 million, and the second a new mining unit at Irecê, where it will mine primary ore in a partnership with state government owned CBPM (Companhia Baiana de Pesquisa Mineral). In this project, the planned investment is also R\$ 500 million. The new Irecê project, to start this year, should be completed in 2026. At Luís Eduardo Magalhães, the project started in 2023 with the installation of a new sulfuric acid plant. A new granulation line and two more fertilizer storage facilities are now being set up. Production capacity is being doubled from 650,000 to 1.3 million tons per year. Both projects are scheduled for completion in 2026.

The company also has its Santa Quitéria project in the pipeline. It hopes to complete the permits procedure by mid-2025, with the expectation of fully implementing the project by 2028, with a production target of 1.2 million tons a year of phosphate rock

and 200,000 tons of dicalcium phosphate, plus liquid fertilizer and technical grade phosphoric acid.

The venture will also produce 2,300 tons per year of uranium concentrate (yellow cake), to be handed over to the federal government's Indústrias Nucleares do Brasil (INB), which will reimburse Galvani for the production costs. With this new development, Brazil may become one of the ten largest uranium producing countries.

**Morro Verde** operates a mine in Pratápolis, in Minas Gerais, where proven reserves are 50 million tons of phosphate having an average concentration of 10 percent — which is twice the Brazilian average. The company has plans to almost quadruple its output capacity from 400,000 to 1.5 million tons per year. At this level of production, the company holds reserves for sixty years. Morro Verde's plan is to invest more than R\$ 500 million over the next five years to increase production and launch new products on the market.

In potash, of which Brazil is a large importer, **Potássio do Brasil** finally obtained an installation permit for the potash processing plant at its Potássio Autazes project, in the state of Amazonas. The aim is to produce 2.2 million tons a year of potassium chloride, which amounts to around one-fifth of the country's consumption at present-day levels. The company expects to invest a further US\$ 2.5 billion to construct an underground mine, a processing plant, and the logistics side, including a road and a port facility. At the end of 2024 Brazil Potash Corp., which holds Potássio do Brasil, went public with an IPO on New York's Nasdaq. □



*Sigma Lithium facility in Minas Gerais*

# THE RACE IS ON IN BRAZIL FOR LITHIUM AND RARE EARTHS

*Francisco Alves*

**B**razil has become the arena for a highly competitive race for energy transition minerals, above all those needed for electric vehicles and clean energy generation, such as lithium and rare earths, while there are also ventures aimed at boosting the output of copper, nickel, and graphite — all this in addition to niobium, of which Brazil is already by far the leading producer, accounting for more than 85 percent of the total world output.

This race has brought to Brazil a number of companies listed on the Australian Stock Exchange (ASX), ranging from newly listed

junior companies having a low market value to major corporations such as Pilbara Minerals, the world's largest producer of hard-rock lithium. The number of Australian companies operating in Brazil is now approaching thirty, with their main focus on rare earths and lithium, while also including copper, gold, titanium, and nickel projects.

It is not only Australians, however, that have their eye on Brazil. Minerals for the energy transition are also attracting the attention of companies listed in Canada and the United States, which until now had been more focused on gold and copper.

# Developing mineral opportunities in Brazil



**Bemisa will be present at another edition of PDAC (Prospectors & Developers Association of Canada).**

With 22 projects in seven states and more than 250,000 meters of drilling carried out since its foundation, the company highlights the Bambuí Project in Minas Gerais, with over 1 billion tons of rare-earth oxides, the Novo Mundo Complex in Mato Grosso, with high potential for open-pit mining, and the Baratinha Complex in Minas Gerais, with an active iron ore operation.

Another key project is the Água Azul Complex in Pará, where a recent Independent Resource Report confirmed 1.73 million ounces of gold with an average grade of 1.47 g/t. Covering 6,500 hectares and four mining rights, the project has shown significant potential, with only half of its targets drilled so far. By November 2024, 541 drill holes had been completed, totaling 64,500 meters, and a Reserve Report is expected in the first quarter of 2025. The ore, with low levels of sulfide and free of environmentally harmful contaminants, allows efficient and safe processing, with a pilot plant capable of processing 150,000 tons per year.



In the case of lithium, projects are largely concentrated in the north of Minas Gerais, specifically in the Jequitinhonha River Valley, now rechristened the Lithium Valley, having its epicenter in the municipalities of Araçuaí and Itinga while extending as far as the Salinas region. The Minas Gerais state government forecasts that, by 2030, some R\$ 30 billion (around US\$ 5 billion) will have been invested in lithium projects in the state, considering that in 2023 alone investments amounted to over R\$ 5.5 billion (almost US\$ 1 billion).

At this moment five companies stand out in lithium projects in Minas Gerais, with three of them (Sigma Lithium, AMG Brasil, and CBL) already in production. A fourth, Atlas Lithium, is currently installing its plant and about to start operations, while Lithium Ionic has had its project duly licensed and is now beginning engineering work.

**Sigma Lithium**, which is already producing 270,000 tons of lithium concentrate per year, has obtained financing from BNDES, the National Development Bank, in the amount of R\$ 486.7 million (approximately US\$ 80 million) to expand its output capacity to 520,000 tons per year. However, the company is aiming higher still: its target is 920,000 tons per year, to be achieved by 2027, despite the drop in lithium prices over the last two years, shrinking more than 85 percent. From an average of around US\$ 80,000 per tonne, by the end of 2023 it had fallen to US\$ 10,000 a ton in 2024. Producers expect prices to stabilize in 2025 and then to start recovering from 2026 onward. Sigma is the third lowest-cost producer of

lithium concentrate, thanks to its low operating costs. The company also claims to be carbon neutral, thanks to its Greentech process. It is now planning to start producing lithium sulfate ( $\text{Li}_2\text{SO}_4$ ), hopefully as soon as 2027.

Another major lithium producer in Brazil is **AMG Brasil**, which has been operating a concentrates plant since 2018. In the first half of 2024 it began work on the first phase of its lithium project, expanding output capacity at its operation located at Nazareno and São Tiago, neighbouring municipalities in southern Minas Gerais. As a result, capacity grew from 90,000 to 130,000 tons per year at the close of the first quarter of 2024, for a US\$ 50 million



*Spodumene ore at Atlas Lithium*

investment. Another AMG project involves the installation of a lithium carbonate conversion plant. Begun in 2022, the project is scheduled for completion in the second quarter of 2028. Once the new plant is brought on stream, AMG Brasil expects an annual output of approximately 15,000 tons. The investment budget for the project is in the range from US\$ 250 million to US\$ 270 million.

**CBL** (Companhia Brasileira de Lítio), in operation since 1991, currently has a small output (1,500 tons a year) of lithium carbonate equivalent (LCE), used in battery manufacture. The company also produces 42,000 tons a year of spodumene concentrate with a 5.5 percent Li<sub>2</sub>O content. In addition to mining spodumene, a mineral containing lithium, the company processes part of the raw material into lithium carbonate and lithium hydroxide, both used in batteries.

The next lithium producer to begin operations in Brazil is expected to be **Atlas Lithium**, now nearing completion of the first stage of its Neves Project in Minas Gerais, where it holds the lithium mining rights to fifty-four areas in the munici-

palities of Araçuaí, Itinga, Coronel Murta, Rubelita, Taiobeiras, and Virgem da Lapa. Budgeted at US\$ 49.5 million, this stage calls for an output level of 150,000 tons of battery-grade spodumene concentrate. The second stage of the project, yet undefined in terms of timing and budget, will increase annual capacity to 300,000 tons. The company also has two further projects, named Clear and Salinas, now at the exploration stage. Both are located in the same state of Minas Gerais.

**Lithium Ionic** is preparing to start work on its Bandeira lithium project, located in the Lithium Valley region, where it holds areas totalling 157 hectares. This is barely 1 percent of Lithium Ionic's extensive 14,182-hectare (nearly 55 square miles) mining rights package in the Lithium Valley, a region now seen to be of global importance for the production of hard-rock lithium. The project envisages an underground mine with a useful lifetime of 14 years, producing an average 178,000 tons a year of high-quality spodumene concentrate having a 5.5 percent Li<sub>2</sub>O content. The programmed capex for the project is US\$ 266 million, with maintenance costs, over



*Geological exploration at Lithium Ionic*

the useful lifetime of the mine, amounting to US\$ 81 million.

**PLS** (former **Latin Resources**), in which Pilbara Minerals holds control interest, reports that its Salinas project (now Colina project) in Minas Gerais has reached an advanced stage of mineral exploration. According to Pilbara, Salinas has the potential to become one of the top ten hard-rock lithium operations globally, excluding Africa. Colina project accounts for approximately 20 percent of the overall mineral resources currently held by Pilbara Minerals and could provide up to 30 percent of its output. A Preliminary Economic Assessment (PEA) announced by Latin Resources in 2023 outlined the potential for Salinas to be developed in two stages to deliver a combined average annual output of approximately 499,000 tons of spodumene concentrate having a 5.2 percent Li<sub>2</sub>O content, over an eleven- year initial productive lifetime, based on resources then estimated at 45.2 million tons with a 1.32 percent Li<sub>2</sub>O content. That estimate was later increased. The project could become operational as early as 2026, requiring investments of US\$ 253 million in the first stage followed by US\$ 55 million in the second stage. Output could be as much as 525,000 tons per year of spodumene concentrate with a 5.5 percent Li<sub>2</sub>O content, plus an additional 159,000 tons with a lower 3 percent content.

In addition to those mentioned so far, several other companies are taking part in the race for lithium, in Minas Gerais and elsewhere. Australia's **Perpetual** has announced plans to invest R\$ 400 million (approximately US\$ 66 million) in Minas

Gerais in research, development, and operation of its Raptor, Isabella, and Itinga projects, focusing on the extraction of lithium and rare earths, in five areas: Araçuaí, Salinas, Itaobim, Governador Valadares, and Poços de Caldas. In Minas Gerais, the company holds mineral exploration permits for areas adding up to approximately 12,500 hectares (48 square miles), all located in the Lithium Valley area.

**Foxfire Metals Ltda.** is conducting a mineral exploration campaign in the Lithium Valley, where it has discovered rare earth elements with anomalous values and high levels of lithium, rubidium, niobium and zirconium.

Australia's **Oceana Lithium** is investing approximately US\$ 3.7 million in a lithium extraction project in the municipality of Solonópole, in the northeastern state of Ceará. The company holds 10 mineral exploration permits, totaling 124 km<sup>2</sup> (48 square miles), in an area considered highly promising for lithium. Oceana's Brazilian subsidiary, Ceará Lítio, has identified a corridor, approximately 20 km long, holding mineralized pegmatite.

**Spark Energy Minerals Inc.**, a Canadian company, has acquired Tristar Energy Corp.'s exploration permits in the Lithium Valley in Minas Gerais. The permits cover 23 areas totaling 396 km<sup>2</sup> (153 square miles). The location is less than ten miles from Sigma Lithium's Grota do Cirilo project, Lithium Ionic's Itinga project, and Atlas Lithium's Neves project.

**Solis Minerals**, an Australian company, has acquired two spodumene projects (Jaguar, in Bahia, and Borborema, in Rio

Grande do Norte) and has already announced favourable results from a surface survey at Borborema, which identified three new outcropping pegmatite bodies containing lithium. At the Jaguar project, Solis has found rock fragments with up to 4.95 percent Li<sub>2</sub>O along a spodumene-rich pegmatite body measuring 1 kilometre long by 50 metres wide.

## Rare earths

In 2024 Brazil joined the ranks of rare earth element producers, when **Serra Verde Mineração** began commercial production at its venture located at Pela Ema, in the state of Goiás, initially planned to produce 5,000 tons a year. The company mines a large ionic clay deposit having a long useful lifetime and holding a large volume of high-value heavy and light rare earths, mainly Neodymium (Nd), Praseodymium (Pr), Terbium (Tb), and Dysprosium (Dy), all essential for the energy transition. The company has made plans to expand output at its first-stage operation by optimizing the

plant and is now assessing the potential for a second-stage expansion that could double its output by 2030. The company was included in the list of projects approved by the Minerals Security Partnership (MSP), which supports ventures judged to be of critical importance for the global energy transition. Additionally, the Energy and Minerals Group and Vision Blue Resources have led a \$150 million investment at Serra Verde. The MSP, a cooperative undertaking by fourteen partner countries together with the European Union, under the current chairmanship of South Korea, aims to enhance the development of diversified and sustainable supply chains in critical energy minerals.

In addition to Serra Verde, there are several other rare earths-focused ventures in Brazil at different stages of development. The projects closest to completion are those of Aclara Resources, Meteoric, and Viridis, the first in the state of Goiás and the other two in Minas Gerais.

**Aclara Resources**, a company in the Hochschild group with a Toronto stock

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exchange listing, plans to invest US\$ 599 million in the implementation of its Carina project, located in the municipality of Nova Roma, in Goiás. The project is currently at the mineral exploration phase and is planned to become operational in 2028. Aclara is expected to supply approximately 13 percent of the global market for heavy rare earths, mainly neodymium and praseodymium, a market which now has China as its main supplier.

**Meteoric Resources**, listed on the Australian stock exchange, has a project to produce rare earth elements at its Caldeira deposit, located in Poços de Caldas, Minas Gerais. Caldeira holds inferred resources amounting to 409 million tons of ionic clay with grades of 2.626 ppm of rare earth element oxides (REOs). The company says it may invest up to R\$ 1.5 billion (approximately US\$ 250 million) to bring the project on stream by 2027. The idea is to start off with a capacity of 10,000 tons of REOs, which would mean supplying as



*Site of Meteoric Resources' Caldeira project*

much as 5 percent of worldwide demand for Neodymium and Praseodymium. At a later stage the project could easily be scaled up, the company says, possibly reaching 20,000 tons of REOs by 2030. That would be equivalent to approximately 7,000 tons of Neodymium and Praseodymium.



*Viridis's Colossus Project*

**Viridis Mining Minerals**, also listed in Australia, is preparing an engineering study for its Colossus ion adsorption clay project, adjacent to Meteoric Resources' Caldeira deposit at Poços de Caldas. Viridis's current focus is on the alkaline complex within the Colossus project. The first two stages of drilling have yielded grades of up to 23.556 ppm of rare earth oxides. In 2024, the company acquired new areas that will allow it to expand the Colossus project.

**Brazilian Rare Earths**, an Australian company acting through the intermediary of Borborema Mineração, is planning a venture to produce rare earth oxide mineral concentrates at Ubaíra and Jiquiriçá, two adjoining municipalities in the state of Bahia, later adding a plant for the separation of rare earth oxides. The two stages of the project are budgeted at a total R\$ 3.5 billion (approximately US\$ 550 million). The first unit, to produce mineral concentrate

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of REOs, will require an investment of R\$ 500 million (just over US\$ 80 million) and is expected to start operating in 2028. The second stage, for the separation of REOs, will call for a much larger investment, forecast at R\$ 3 billion (US\$ 500 million). Startup is planned for 2034 with an initial output capacity of 15,000 tons per year, to be increased in stages, possibly to as much as 55,000 tons.

Another Australian company, **Australian Mines**, has identified a second prospective exploration target for niobium and rare earths at its Jequié project in the state of Bahia. The site potentially holds primary rare earth elements (REEs) in hard rock; alternatively, it could be a source of secondary REE oxides. The Jequié rare earths project comprises 72 areas of mining rights covering an aggregate 1,310 km<sup>2</sup> (505 square miles).

**Tiros Minerais Estratégicos**, a subsidiary of the Canadian company **Resouro Strategic Metals**, has a project in Minas Gerais budgeted at up to R\$ 500 million (just over US\$ 80 million) for the extraction of rare earths and titanium in the municipality of Tiros. The venture is due to start operating in 2026. The company says its surveys have shown that the area holds approximately 1 billion tons of ore with significant levels of titanium oxide (12 percent) and magnetic rare earths (4,000 ppm). The main elements present in significant quantities are Neodymium, Praseodymium, Dysprosium, and Terbium.

**Appia Rare Earths & Uranium Corp.** is researching the Target IV ionic adsorption clay (IAC) deposit, part of its PCH project

in the state of Goiás, where it has confirmed REE mineralization enabling the recovery of magnetic rare earth oxides (MREOs) and heavy rare earth oxides (HREOs). This may possibly rank as a world-class deposit, the company says.

**Axel REE** has four projects in Brazil, two of them in Minas Gerais (Caladão and Caldas) and the others at Itiquira in Mato Grosso and Corrente in Piauí. The two in Minas Gerais are the company's main investments; the Caldas project is located in Poços de Caldas, the same place where Meteoric Resources has its Caldeira project and Viridis has its Colossus project. In both areas Axel has estimates of resources with high levels of rare earths, including neodymium and praseodymium, the most sought-after magnetic elements for the manufacture of permanent magnets.

**Enova Mining** is conducting exploration work for rare earths in the states of Minas Gerais (the Coda project) and São Paulo (the Jiquiá project). In Minas Gerais, initial exploration work obtained "exceptional" results close to the surface, Enova reports, with an REE content of up to 5,158 ppm in one deposit and 5,042 ppm in another.

**Brazilian Critical Minerals** (BCM) has released the first Mineral Resource Estimate for its Ema and Ema East rare earth projects in the municipality of Apuí, in southeastern Amazonas. The deposit holds 1.02 billion tons of REEs with an REE content of 793 ppm. The Ema Project comprises 189 square kilometres (73 square miles) of felsic volcanic soil over which 194 boreholes were drilled, totaling 2,749 meters (over 9,000 feet).

**Ironbark Zinc (IBG)**, having acquired the Perseverança package of lithium, niobium, and rare earth projects in northeastern Minas Gerais, is now drawing up an mineral exploration program to detail the full potential of the area. Perseverança consists of seven projects comprising 27 mining rights covering a total area of approximately 520 square kilometres (200 square miles) in and around the municipalities of Salinas and Araçuaí, in the region now known as the Lithium Valley.

**OAR Resources Ltd.**, listed on the ASX, is planning to develop joint projects with Indústrias Nucleares do Brasil (INB) for mining both uranium and rare earths. The company sees the plan as giving it enhanced access to promising geological areas in Brazil.

**PVW Resources** is another Australian junior company that has now entered the race to mine rare earths in Brazil. It has signed a binding agreement to acquire Scanty Mineração Ltda., which owns assets considered “highly promising” in three states, São Paulo, Goiás, and Mato Grosso. Scanty holds 39 mining rights in 11 projects totaling 952 square kilometers. The main project is Capão Bonito, in the state of São Paulo.

**Si6 Metals**, now surveying lithium resources in the Lithium Valley area in Minas Gerais, is also committed to searching for rare earths under the terms of its joint venture with Foxfire Metals. Foxfire holds mining rights for rare earths in Goiás and Ceará, in addition to a gold project in Amazonas.

**Equinox Resources** is conducting mineral exploration work at its Mata da Corda project in Minas Gerais. “Significant potential for multi-commodity mineralization”

is Equinox’s summary of the findings so far. The latest results confirm substantial high-grade REE mineralization, along with “exceptional concentrations” of titanium dioxide (TiO<sub>2</sub>).

**St. George Mining** has acquired areas in Araxá, Minas Gerais, previously held by Itafós, and is developing a project for operating in the same carbonatite complex where CBMM is now producing an estimated 80 per cent of the worldwide niobium supply. The company says test drilling has confirmed that Araxá holds extensive surface-level high-grade niobium and rare earth mineralizations.

## Graphite



*Graphite ore*

Brazil has been a major graphite producer for several decades and has the potential to achieve a substantial increase in output with the implementation of new projects, mainly in the state of Bahia.

**South Star Battery Metals Corp.**, listed on the Toronto stock exchange, began commissioning the first stage of its graphite mine at Santa Cruz, Bahia, in October 2024 and is now moving towards commercial production. This will be the first new graphite mine anywhere in the Americas since



*South Star's plant in Bahia*

1996. In the first stage, the mine and processing plant will have an output capacity of 5,000 tons a year, increasing to 25,000 tons at the second stage. The investment budget for both stages together is US\$ 35 million.

**Appian Capital** Brazil is investing approximately US\$ 60 million in its subsidiary Graphcoa's projected graphite facility in the state of Bahia. The plant will process ore from the Boa Sorte mine, located in the municipality of Itagimirim, with an annual capacity of 5,500 tons. By the end of the first quarter of 2025 Appian expects to have submitted its graphite concentrate to selected customers, to assess the market potential and thus to guide a future decision on a possible expansion project, which might boost capacity to as much as 25,500 tons a year. The corresponding investment budget is estimated at US\$ 250 million.

## Nickel sulfide

Although Brazil produces nickel only on a modest scale, mainly for use in electric vehicle batteries, a handful of projects have been reported that might help to bring about a change.

**Atlantic Nickel**, also controlled by Appian Capital Brazil, is currently the only commercial-scale producer of nickel sulfide in Brazil, with facilities located in Itagibá in the state of Bahia. Its current installed capacity is 112,000 tons of concentrate per year, equivalent to approximately 15,000 tons of metal. The company is studying the possible development of an underground mine at the site, which would add 27 years to the useful lifetime of the venture.

**Brazilian Nickel** has a project in the state of Piauí where it plans to produce nickel and cobalt from laterite ore, through a leaching process. For the time being, the unit is operating on a pilot scale to test the process and the product with a view to large-scale production. Brazilian Nickel is negotiating financing for the project. A feasibility study, completed in 2022, allows for a mine with a 33-year useful lifetime. The ore will be processed on site to recover nickel and cobalt in the form of a mixed hydroxide precipitate (MHP) with an average annual output of 25,000 tons. The company expects to conclude the financing arrangements by the end of 2025, enabling the venture to operate on an industrial scale from 2028 onward.



*Brazilian Nickel's samples store*

**Centaurus Metals**, listed on the Australian Stock Exchange, expects to make a decision, before the end of 2025, on whether to go ahead with its Jaguar project, said to be one of the world's largest undeveloped nickel sulphide projects. Located in the Carajás region in the state of Pará, the Jaguar nickel sulphide deposit holds resources of 109.2 million tons having a 0.87 percent nickel content, equivalent to 948,900 tons of metal. A feasibility study concluded in 2024, considering only open-pit nickel sulphide ore to be mined over an initial 18-year useful lifetime, includes a conventional nickel flotation plant with a planned capacity of 3.5 million tons of ore per year. The C1 operating cost would be US\$ 2.30 per pound with an AISC, based on the nickel content, of US\$ 3.57 per pound. The pre-production capex (including growth and contingency) is stated as US\$ 371 million and pre-production (pre-mine stripping) as US\$ 68 million.

## Niobium

Niobium, of which Brazil produces a dominant world share, has been added to the list of minerals for the energy transition, for two main reasons: it is important for making lighter and tougher steels of the kind needed, for example, in wind turbines; and niobium oxide has been introduced in the manufacture of batteries for electric vehicles.

**CBMM** has opened the world's first volume manufacturing facility dedicated to the production of Echion Technologies' proprietary XNO ultra-fast charging ac-



*New CBMM plant at Araxá*

tive anode material technology. Located in Araxá, Minas Gerais, the new facility is the world's largest niobium-based anode producer, with an annual output capacity of 2,000 tons of XNO, equivalent to 1 GWh of lithium-ion cells. CBMM has set itself a target of achieving 30 percent of its revenue from non-steel products by 2030. To achieve this aim, the company is investing, each year, R\$ 250 million (over US\$ 40 million) in its technology program. CBMM's strategic growth plan envisages an output capacity of 20,000 tons a year of battery-grade niobium oxide, to be reached by 2030.

As well as rare earths (*see above*), **St. George Mining** also intends to produce niobium in Araxá, Minas Gerais, in areas close to CBMM's venture. It raised US\$ 20 million in a bond placement in Australia to finance the start of the project. The company has signed a trade agreement with Chinese steelmaker Fangda, under an offtake and project finance model, granting Fangda the exclusive right to purchase 20 percent of the niobium products for a period of five years. □



## **Brazil:** Great Opportunities Require Great Partnerships

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*Lithium Ionic's Bandeira Project*

# GOVERNMENT STRUCTURES FINANCIAL SUPPORT MECHANISM FOR PROJECTS

*Francisco Alves*

**T**he federal government is seeking to create financial support mechanisms for mining projects in the field of strategic minerals for the energy transition. In February 2024, mining projects of this kind were included in a decree setting rules for the issuance of incentivized debentures raising funds for the benefit of certain infrastructure sectors (including logistics and transportation, urban mobility, energy, tele-

communications and broadcasting, basic sanitation, irrigation, free public education, free public health, public safety, and others).

In the case of strategic minerals, the financing can be used to cover the cost of the development phase of the mine as well as the mining operation itself.

The type of debenture provided for in the decree allows an issuing company to deduct the interest paid when calculating net profit



*Sigma Lithium plant in the Lithium Valley*

and the CSLL (Social Contribution on Net Profit). For investors in incentivized debentures, the incentive is a flat 15 percent rate in the case of corporate income tax or zero in the case of personal income tax.

The decree followed earlier government initiatives aimed at increasing investments in the mining industry, such as the creation of an investment fund announced by BNDES (the National Economic and Social Development Bank) to support mining projects. The target is to raise R\$ 1 billion, to include R\$ 250 million contributed by the bank. The Equity Investment Fund (FIP) to finance mining projects, a BNDES initiative, may receive initial contributions of over R\$ 3 billion (approximately US\$ 500 million). In addition to the contributions to be made by BNDES and Vale, in the amount of up to R\$ 500 million, other financial institutions have expressed an intention to contribute up to R\$ 3 billion.

Ore Investments, one of the companies forming the consortium appointed to manage the new fund, jointly with JGP BB Asset, reports that the FIP will have a ten-year lifetime, comprising a four-year investment period to be followed by a six-year divestment period. Fund managers will seek a return in the 20 to 25 per cent range per year, multiplying the initial capital investment by a factor of three to five and yielding an average annual return of 8 percent in real terms, on top of the consumer price index.

These parameters are said to be in line with what is observed in the international market for funds in natural resources, including mining. The company adds that, since this involves financing assets at an earlier stage, the return needs to be higher, in line with the greater risk.

The fund intends to make ten to fifteen investments in pre-implementation or pre-Capex assets and around five investments

in Capex and in operation. A portfolio will be assembled with mineral research as the main focus, but also with exposure to assets under development and in operation.

Another initiative aimed at supporting strategic mineral projects for the energy transition was also launched by BNDES together with another federal agency, Finep (Finance for Studies and Projects). An announcement was published, inviting applications for financing ventures engaged in processing strategic minerals for the development of the chain of sustainable strategic materials in Brazil. With a R\$ 5 billion budget, credit lines, equity stakes in companies, and non-reimbursable resources, the two institutions intend to invest in production capacity and in research, development, and innovation (RD&I), aiming at the processing of minerals for the energy transition and decarbonization.

BNDES and Finep intend to develop supply chains for lithium, rare earths, nickel, graphite, and silicon, among other products, and to mobilize investments for the manufacture of components: battery cells, photovoltaic cells, and permanent magnets. The support includes industrial-scale plants and pilot or demonstration plants, research and studies needed for the feasibility of new industrial capacity, depending on the stage of the projects and the technologies involved. This new source of financing has the potential to leverage investments, over a period of years, in a volume equivalent to five to ten times the budget made available, the two institutions say. If the result matches this expectation, it will mean investments

in the range from R\$ 25 billion to R\$ 50 billion.

Current strategic mineral production projects in Brazil are “world-class”, the government says. In combination with Brazil’s clean and low-cost energy, this puts the country in a privileged position to build production capacity for sustainable, low-carbon materials. Brazil holds the world’s largest niobium reserves and is also the top producing country. It holds the second largest reserves of natural graphite, the third largest reserves of nickel, and the third largest reserves of rare earths, among others, in addition to being the fifth largest lithium producer and the third largest silicon producer. The country is now on its way to becoming one of the largest suppliers of critical materials for the production chains included in the energy transition and decarbonization agenda.

The BNDES expects the announcement to have the effect of mobilizing players in different links in the production chains dependent on these minerals. “Mining companies and those in possession of technologies and experience in processed materials and manufactured components, in Brazil and abroad, will be able to form partnerships and can count on the best financing options for industries in Brazil,” said BNDES president Aloísio Mercadante, adding that “it signifies a major step forward towards achieving the Brazilian government’s objectives of expanding the industry’s productive capacity in the context of sustainable and technological development of the new industrial policy and the ecological transformation plan.” □

# BAHIA: A POWERHOUSE IN GLOBAL RACE FOR RARE EARTH ELEMENTS

In recent years, the growing global demand for critical and strategic minerals, such as rare earth elements, has placed Brazil in a privileged position to become a relevant supplier of these essential inputs. In this scenario, Bahia—one of Brazil's leading mining states and a reference in the production of nickel, copper, vanadium, phosphate, silica, graphite, and manganese, minerals that are crucial to the technological and sustainable industries—stands out as a strategic territory for the exploration of indispensable elements to the energy transition.

Essential for manufacturing equipment such as electric vehicle batteries, wind turbines, and solar panels, rare earth elements play a key role in the energy transition and the advancement of sustainable technology. Although China leads global production, the increasing demand for these minerals has triggered a race to discover new sources of extraction. This movement aims to global diversify supply and reduce dependence on the Chinese market.

In this context, Brazil emerges as one of the countries with the greatest potential for rare earth production, and Bahia, with recent discoveries of promising deposits, becomes a key player in the global strategy for supplying these strategic minerals.

As a major booster of mineral development in the state, the Companhia Baiana de Pesquisa Mineral (CBPM) invests in research and promotes strategic partnerships to sustainably utilize new mineral deposits. CBPM's commitment goes beyond exploration: the company aims to foster the industrialization of

## HENRIQUE CARBALLAL\*



Photo: Alvaro Vilella

strategic minerals, ensuring that Bahia not only supplies raw materials but also increased value to its mineral production.

Regarding rare earth elements, CBPM has led strategic initiatives to identify new areas rich in these minerals and enable their sustainable exploration. The company has been identifying promising deposits in Bahia, with a special focus on the Strategic Minerals Project in the Southwest region of the state. This area, which hosts key players in rare earth elements research in Bahia, has shown promising numbers aligned with other established companies, encouraging CBPM to intensify efforts and investments in the project.

Another important example is the Northern Bahia Metallogenic Province, mapped by CBPM and recognized for its enormous potential in exploring critical minerals,

including rare earth elements. In addition to these strategic elements, the area also contains iron-titanium-vanadium, nickel-copper-cobalt, graphite, and phosphate, further increasing its economic relevance and attracting the interest of investors and industry investors.

To facilitate the exploration and processing of rare earth elements, CBPM has been investing in strategic partnerships with private companies, universities, and research centers. These initiatives go beyond mineral extraction, aiming to add value to production and encourage the establishment of industries that utilize these inputs within the state itself, thus strengthening and verticalizing the local supply chain.

Furthermore, CBPM maintains a strong commitment to sustainability and responsible mining, adopting practices that ensure activities are accomplished in harmony with the environment, minimizing impacts, and promoting economic and social development in mining regions.

The global race for rare earth elements and other critical and strategic minerals places Brazil, and especially Bahia, in a prominent position on the international stage. With rich and diverse geology, robust investments, and a strong commitment to sustainability, the state is well-prepared to meet the growing demand for these essential resources. This presents a significant opportunity for Brazilian mining, particularly in Bahia, to position itself as a global leader in the energy transition.

**\*HENRIQUE CARBALLAL, PRESIDENT OF CBPM**



# OVERDEPENDENCE ON IRON ORE AND THE CHALLENGE OF DIVERSIFICATION

**H**ow is Brazil to diversify its range of mining products? This is one of the industry's greatest challenges, in the view of Marcos André Gonçalves, the chairman of Adimb. The Brazilian mining industry, he says, remains overdependent on iron ore, produced mainly for the export market, although this dependence has now become somewhat less extreme following the expansion of gold and copper.

One of the bottlenecks he sees is the lack of financing mechanisms for mining, something that countries such as like Canada and Australia, two other important mineral producers, have successfully achieved. In this connection he praises recent initiatives adopted in Brazil, such as the launch of an investment fund set up jointly by BNDES and Vale to finance early-stage mining projects; the financing offered by BNDES in cooperation with Finep to support technology development projects for the use of strategic minerals for the energy transition and food security; and the government decree that includes mining companies among the qualified issuers of incentivized

debentures affording tax relief for investors.

Another factor that Gonçalves lists as positive is the resumption this year by the Brazil Geological Survey of aerial geophysical surveying, mainly because the fact that the Brazilian public was consulted in advance, allowing private-sector companies to give their opinion on the areas to be prioritized in aerial surveys. "After all," he notes, "the work will cover a million linear kilometers. It will mean a significant advance for the industry."

At the same time, he calls attention to what he sees as a negative factor, namely the gap that persists in the regulation of mineral exploration activity. There is a very large stock of pending applications for areas where interested companies ought to have already started their exploration work. "Assigning these areas would help to achieve greater diversification of the Brazilian mineral mix. We noticed strong interest from companies in commodities linked to the energy transition, which is positive," he says. However, there is a shortage of areas available for mineral exploration.

Gonçalves also sees difficulties in obtain-

ing financial resources to support company projects, particularly in the more traditional commodities. Junior mining companies or medium-sized companies producing iron ore, copper, nickel, lead, zinc, gold, and tin, among others, are currently experiencing great difficulty in accessing financial resources, while at the same time “it is raining money,” in Gonçalves’ words, for those that operate in minerals aimed at the energy transition, such as lithium, cobalt, rare earths, and graphite.

He regrets that, amid this shift that promises to lead to a diversification of its product range, Brazil is not taking advantage of uranium, of which it holds important reserves, though still insufficiently known. Uranium is still treated as a strategic mineral in Brazil, he notes, and the law does not allow private investors to engage in production. He hopes the law may change, opening up this activity to the private sector.

An issue that Gonçalves considers essential to give more dynamics to the race that is on in today’s Brazil, above all in the field of the energy transition minerals, is the full computerization of ANM procedures together with making up the personnel shortfall at the Agency. The undersupply of areas available for exploration is leading to a surge of speculative deals, with many companies opting to acquire areas from other holders, in order to speed up their mineral exploration work. This is pushing up prices, in comparison with the cost of acquiring the rights at an ANM auction.

## **The importance of the retail investor**

In the financing connection, another major challenge for mining in Brazil, Gon-

çalves says, is winning over retail investors. This is not a problem in countries like Australia and Canada but in Brazil the path will not be easy, he warns. It will require education, in order to show the financial market that mining has its attractions. To meet this need, Adimb has teamed up with Ibmecc, an educational institution that is a reference for those working in the financial area, to offer a new MBA degree course. One of the guidelines is to show what mining can do for the financial sector. Mining can be very successful, making it an excellent investment option, for institutional investors and for the retail investor alike. “If, for example, we analyze free cash generation in iron ore operations,” he says, “we see that it is extraordinary. Few commodities offer this level of profitability.” And this needs to be shown clearly, he adds. “It must also be demonstrated that the world is going to need more and more minerals, in particular the base metals. In other words, the world is still going to depend on mining.” □



*Marcos André Gonçalves*



*Atlas Lithium's exploration drilling*

# BRAZIL HAS THE POTENTIAL TO BECOME A MAJOR GLOBAL PLAYER

**Roberto Xavier, ADIMB's Executive Director, traces the Australian-Canadian connection in the race to expand into Brazil**

*Francisco Alves*

**W**hat did trigger the sudden rush in Brazil to acquire minerals considered as critical for the energy transition, such as lithium and rare earths? “First of all,” says Roberto Perez Xavier, Executive Director at ADIMB (Agency for the Development and Innovation of the Brazilian Mining Sector), “most of the companies now targeting these two commodities, in Brazil, are junior mining companies from Australia and Canada, two countries

that have extensive experience in mineral exploration, in the discovery of deposits, and in the development of mining. They are mature countries in the mineral sector industry.

“And it is in the nature of junior mining companies,” he adds, “to do exactly that: to hunt around for opportunities, regardless of geographic location. These companies understand the risk. They know how to manage the high risk inherent to mineral

exploration, because they are also aware that there is the potential for substantial returns. This is particularly noticeable at moments like the present, when the mining industry is booming all over the world, mainly due to the demand for critical minerals that are important for the development of low-carbon technologies and clean energy generation. There is an estimate that the market for these critical minerals should be worth around US\$ 1 trillion by 2030. That means the financial support is available for this business.”

Xavier, a geologist with extensive expertise in economic geology and mineral deposits, notes that both Australia and Canada possess consolidated, well-structured, mature mechanisms for raising funds on the stock exchange. “They have a culture of developing projects in the mining industry,” he says. “In fact, within the investment funds in Canada and Australia, we find technically qualified personnel acquainted with mineral exploration and mining, enabling them to conduct a better evaluation of these projects.”

Thirdly, he mentions that there may be a concern about reducing dependence on the geopolitical control of some countries for commodities such as lithium and rare earths. “In particular,” he notes, “this is the case of China, which supplies 99 percent of the worldwide demand for rare earths. China is also the world’s third largest lithium producer.”

The choice of Brazil as a destination for these companies can be attributed to several other considerations as well, Xavier says. He highlights the creation of the ANM (Na-

tional Mining Agency). While conceding that there remain many structuring problems to be overcome, he points out that it has made an improvement. “We now have a little more agility in the processing and approval of mineral exploration applications, and this gives companies a sense of legal security. Another upside is the auction system for awarding new contracts in available areas, in cases where the original company failed to comply with the ANM’s protocol for the permits and consequently lost its rights. The area is then made available for auction, which is a good thing. I am not making a value judgment here, but simply stating that the fact exists and that it can be a positive factor for attracting these companies.”

A further improvement, he notes, is that state governments are seen to be speeding up their procedures for issuing environmental licenses, particularly in those states where mining makes an important contribution to the local economy. This is the case, above all, in states such as Minas Gerais, Bahia, Pará, Goiás, and Mato Grosso. “This improved dynamic in environmental licensing,” he says, “may be another factor that ends up adding value, being an additional incentive for the arrival of junior mining companies.”

Finally, there is Brazil’s geological potential for lithium and rare earths, which to this day remains underexplored. “In the case of lithium, I usually say that several years ago, no one really paid attention to this metal, due to its very limited market. It was in the fourth division of the world commodities championship. Today, it has



*Roberto Xavier*

moved up to the Champions League, occupying a leading position, with huge investments. Brazil's enormous potential has attracted junior companies, offering fertile ground for research projects, especially in greenfield ventures."

As a result, Brazil is now the fifth largest lithium producer worldwide and is in seventh or eighth place in terms of world reserves. In the case of rare earths, Xavier notes that Brazil has the third largest reserves in the world, at 21 million tons, or about 18.2 per cent of the world total. However, Brazilian production is still only on a modest scale, with one single company fully in operation so far.

### Geological potential

Brazil's geological potential for lithium is significant though underexplored, Xavier says. "Today, 85 percent of the country's total reserves are found in one small area, the Jequitinhonha river val-

ley in the northeast of Minas Gerais. The two main municipalities are Araçuaí and Itinga. We should remember that lithium in this case is extracted from a mineral, spodumene, which is a lithium-rich aluminium silicate occurring within a specific igneous rock, named pegmatite. The latter consists mainly of quartz, feldspar and mica, in addition to several other minerals, including spodumene. That is why we use the term 'hard-rock lithium'.

The Jequitinhonha valley region is in a geological province that is rich in pegmatites, named the Eastern Brazilian Pegmatite Province. It covers an area of approximately 150,000 square kilometres (58,000 square miles) in parts of three states: the northeast of Minas Gerais (basically 90%), the south of Bahia, and the north of Rio de Janeiro.

In this region, Australian and Canadian companies are currently very active in different stages of lithium exploration. At the same time, there are other regions where lithium-bearing pegmatites exploration is also quite intense. This is the case of the Borborema Mineral Province in Northeast Brazil, in particular the Seridó belt, which includes the Rio Grande do Norte and a small part of Paraíba, and the Solonópole region in Ceará. Xavier also mentions the central region of Brazil, in particular the states of Tocantins and Goiás, whose potential remains underexplored.

In the case of the rare earth elements, the potential is equally great, in Xavier's assessment. "Why? Because today the cutting-edge frontier, as I understand it,

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in rare earth elements exploration space, both in Brazil and worldwide, is narrowly focused on a specific type of deposit where REEs are hosted in regoliths. These are weathering mantle, unconsolidated material that forms above previously rare earth element-enriched hard rocks, such as alkaline igneous rocks or alkaline granites. This is where the rare earths are found, especially the heavy rare earths that have greater value on the market due to their technological applications. This is the case of Neodymium, Praseodymium, Dysprosium, and Terbium. In these regolith deposits, these rare earths are not locked within the structure of the minerals. On the contrary, they are found in the ionic adsorption form, loosely bound on the surface of clay minerals (ionic adsorption- clay type deposits). These deposits are shallow, because they form almost close to the surface, and the extraction of rare earths, in this case, is more easily achieved using saline solutions rather than acids. This means, in turn, that it causes much less environmental disturbance, making extraction much easier and the cost much lower.”

In addition, radioactive materials such as uranium and thorium – which are commonly found in association with rare earths – are generally present in deposits of this kind only in very low concentrations.

All these factors are drivers to the significant exploration boom in regolith – hosted rare earth element deposits in Brazil, conducted mainly by Canadian and Australian junior companies. Today,

these companies are focusing exploration for these deposit type in several geological settings in Brazil, in particular the Poços de Caldas alkaline rock complex in the south of Minas Gerais and granites within the Goiás Tin Province in the northern portion of the Goiás State and in the southern tip of the Tocantins State. Emerging potential regions also include the Alto do Parnaíba alkaline complex between Goiás and Minas Gerais; granitoids of the Jequié Block, southern Bahia; volcanic and sedimentary rocks in southern Amazonas, and granitoids from the Ribeira Valley region, southern São Paulo. Collectively, there might be several tens of targets under exploration, but only a very few projects have advanced to feasibility stage.

Nevertheless, very little geological and mineralogical information is publicly available on these deposits, as for example showing the proportion and distribution of rare earths adsorbed onto clay minerals, critical factors in determining the economic viability or guiding metallurgical processing pathways.

“All in all,” Xavier says, “the potential for rare earth elements in this type of regolith-hosted deposit in Brazil is enormous. We’re definitely looking at the possibility of becoming a major global player. But we need to know more about these deposits in Brazil and this can be done via collaborative projects joining academia and the private sector, as ADIMB is currently doing with Meteoric Resources in its Caldeira project.” □



*Vale's S11D complex*

# “THE TIME HAS COME FOR BRAZIL TO TAKE CENTRE STAGE”

**The Brazilian Mining Association (Ibram), a private non-profit organization, looks ahead with confidence**

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“**B**razil, so far removed from geopolitical polarization and conflicts with other nations, while holding enormous mineral potential, can see its time has come to take centre stage in the global mining industry,” promises Raul Jungmann, the president of the Brazilian Mining Association (Ibram), speaking of the current race for strategic minerals for the energy transition.

Jungmann warns, however, that “the outdated view of mining that is still prevalent in Brazil” can be an obstacle to attracting investments. “States and municipalities create new taxes on mining, charging punitive rates,” he says. “The tax reform, which was supposed to ease the burden, includes a selective tax on exports that will hit mining hard. In Congress, proposals are currently being discussed that threaten to increase the



*Raul Jungmann, president of Ibram*

industry's costs. Brazil lacks a public policy that would encourage mineral production. In other words, Brazil is swimming against the tide, instead of fostering this highly strategic industry that, in 2024, thanks to its export performance, provided 47 percent of the overall trade surplus."

Despite these obstacles, Jungmann says the statistics for 2024 demonstrate, once again, the centrality of the mining industry to the Brazilian economy. "The industry accounted for almost half of the 2024 trade surplus. Several new ventures were completed and several new projects were announced. For the five-year period from 2025 to 2029, planned investments add up to US\$ 68.4 billion." There has also been a significant boost in job creation. The number of people in direct employment in the mining industry grew from 185,000 in January 2021 to 221,000 at the end of 2024.

Jungmann also highlights technological advances, citing as an example the advance in the process of dismantling upstream dams, while the emergency level at

all remaining tailings dams was lowered in 2024. "The industry is also advancing in increasingly sustainable practices and in its relationship with society," he says. "A major step forward in this connection was the signing of the Mariana Agreement, ending a long period of uncertainty and legal insecurity, both for the people affected and for companies." The Mariana agreement was signed between Vale, BHP, Samarco, the federal government, the state governments of Minas Gerais and Espírito Santo, federal and state boards of attorneys, and other juridical bodies, awarding compensation in the amount of R\$ 170 billion for the damage caused by the collapse of a Samarco tailings dam in 2015.

Another highly positive fact, Jungmann says, is "the growing perception of the importance of critical minerals for the modern and technological world and mainly for achieving global goals towards the energy transition and decarbonization." This awareness acts in Brazil's favour, he says, since the United States, the European Union, Saudi Arabia, and China, among others, have already proclaimed their intention to seek alternative suppliers of these minerals.

The outlook for 2025 and 2026, he says, is for output and exports alike to remain stable at their current levels, given that the world economic outlook is for lower inflation, with banks and other financial institutions moving in the direction of easier terms and lower interest rates. There has also been the impact of the Chinese government's actions aimed at finding a way to improve their

economic growth rate. Worldwide geopolitical pressures have pushed up the prices of some mineral commodities, notably the gold price, which was the effect of investors seeking safer assets.”

On the other hand, the taxation of mineral exports, which will be subject to the new Selective Tax, is “a negative factor,” in Jungmann’s words. “When Congress was debating the proposed tax reform,” he recalls, “Ibram successfully lobbied for exports to be exempted. But then came the presidential veto, which meant that exports will be taxed, after all. That was one of the most negative factors affecting mining in 2024, and it is not going to change in 2025.”

Jungmann also criticizes “the slowness and bureaucracy that persist in mining and environmental licensing; the lack of incentives for investments in the industry; and the insufficiency of financing mechanisms, which still fall far short of what is needed. And then there’s the National Mining Agency, the ANM. The salary scale dispute has been settled, but the operating structure is still precarious.”

Turning to the question of whether the Trump administration may have an impact on the future of Brazil’s mining industry, Jungmann says that, while it is still too early to attempt an in-depth analysis, Brazilian minerals are mostly exported to Asian countries, which purchase around 80 percent of each year’s output. “China alone imports 69.7 percent of our minerals, according to 2024 data,” he notes. “Consequently, even if the U.S. government slaps a tariff on Brazilian

products, it will not cause a major impact on the industry. Our response would be to further expand our ore exports to Asian countries. As for our imports of mineral products, the United States supplies 19.8 percent of our needs and, in any case, the total volume of our mineral imports is not very great. Brazil’s total imports of minerals in 2024 stood at US\$ 8.48 billion, 23 percent less than in the previous year. In comparison, Brazil exported US\$ 43.4 billion in minerals in 2024, almost 1 percent more than in 2023. The U.S. market presents an opportunity to expand our exports of minerals, particularly the critical and strategic minerals such as lithium, niobium, and graphite, among others.”

He adds that the U.S. government has already signaled that it wants to import minerals for use in defense and the development of new technologies and innovation. “Under the Joe Biden administration,” Jungmann says, “they were mainly interested in minerals for the energy transition. Other countries and economic blocs also have their eye on Brazil’s minerals. The European Union is a case in point. The current president, Ursula von der Leyen Vanderlinde, has stated that the EU countries want to ensure their access to critical minerals from Latin America, including Brazil. Critical and strategic minerals are a passport to the future, and we are very well positioned in this market.” □



In 2024 the **Brasil Mineral** website registered more than **1 million visitors**



# ABPM HOPEFUL THAT REGULATORY BOTTLENECKS WILL NOT BLOCK CAPITAL INFLOW

*Francisco Alves*

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**T**he remarkable success enjoyed by several companies, notably Meteoric (in rare earths), Sigma Lithium (in lithium) and Latin Resources (also in rare earths), has been a contributing factor to the recent intensification of the race for strategic minerals in Brazil, says Luís Maurício Azevedo, the president of ABPM (Brazilian Association of Mineral Exploration and Mining Companies).

Latin Resources in particular quickly completed its full cycle, Azevedo says. It came to Brazil, invested in mineral exploration, and was promptly sold for a good price. This is the normal path taken by junior mining companies, he adds, although it is not the universal rule, because there are some companies that have really intended all along to be mining operators, such as Sigma Lithium and Meteoric, and



In 2024, Brasil Mineral's LinkedIn page received **138,000 reactions** to its nearly **400 posts**, twice as many as the second-ranking mining site worldwide



*Luis Azevedo*

others that operate in gold, such as Serabi and Aura Minerals. This means that not all junior mining companies that come to Brazil are looking for a quick sale.

Australian junior mining companies, he says, were initially attracted by the lithium price, which at one point soared to over US\$ 80,000 per ton, although by the time they actually arrived in Brazil, the price had already sunk back to around US\$ 10,000. That could have meant that these companies would flee the country, he says. But that is not what happened, possibly because companies are betting that lithium is so essential to produce electric vehicle batteries that the price is bound to recover at some point.

A similar trend occurred with rare earths. The success of Serra Verde Mineração, which successfully implemented its project in Goiás, attracted the atten-

tion of Australian and Canadian junior mining companies. “And now the same thing is happening with niobium,” Azevedo observes. “Until now it had been the general consensus that CBMM held such a dominating role in this market that it practically controlled worldwide production, leaving all other companies fearful of entering the market at all.”

Two companies, however, were not discouraged, and have now arrived to meet CBMM on its own ground. “And others will come,” Azevedo confidently predicts.

The question is whether Brazil is prepared to welcome these companies and, above all, to offer them a regulatory environment that enables the efficient management of resources and affords a return on investments. “Does Brazil have the capacity to handle the hundred Environmental Impact Reports that will be needed?” he asks, adding that a hundred may be an underestimate, since some of the companies have more than one project. “Any bottlenecks that arise are bound to cause frustration, leading to a slowdown in the capital inflow.”

One such bottleneck, he says, is the ANM (National Mining Agency), which has lost many employees and consequently lacks the capacity to keep the paperwork moving. Another bottleneck is that the Agency has not been able to place all the areas available for mineral exploration on the market, since demand is much greater than the number of areas that are made available, at a ratio of almost ten to one. “The first time I counted the number of dossiers held up at the

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**“UNTIL NOW IT HAD BEEN THE GENERAL CONSENSUS THAT CBMM HELD SUCH A DOMINATING ROLE IN THIS MARKET THAT IT PRACTICALLY CONTROLLED WORLDWIDE PRODUCTION, LEAVING ALL OTHER COMPANIES FEARFUL OF ENTERING THE MARKET AT ALL.”**

ANM, there were 30,000. By now it is up to 100,000.”

On Brazil’s attractiveness for mining investments, Azevedo lists the country’s neutrality as a prime factor, as it is not aligned with any group of competing nations. “We are not 100 percent China and we are not 100 percent the United States, for example. We are politically neutral.” In addition, Brazil has something that he also considers extremely important, which is a stable, cost-competitive and clean energy matrix. “In addition, we have an industrial sector that serves the mining industry, which does not have to depend on imports. We have technical expertise, both for mineral research and for the execution and operation of large-scale projects.

“Another major consideration,” he adds, “is that, here in Brazil, we have no difficulty in accessing water resources, so

necessary for mining.” Also, the Brazilian financial sector is strong and fully mature. “That means the pros definitely outweigh the cons.”

Azevedo recalls that the Brazil Geological Survey has recently contracted a new aerial survey program to expand knowledge of the country’s geology, commenting that “This is the type of investment that the country really needs to make.”

Azevedo is the CEO of Bravo Mining, which is now researching areas bearing platinum group minerals (PGMs) in the Carajás region. There was no aerial geophysics coverage of the area available at the time, meaning that the company had to do the job at its own expense. “But that turned out to be in our favour,” he says, “because we ended up discovering a series of very promising opportunities within the project. Among other things, we even found a previously unsuspected copper mineralization.”

Azevedo also defines as “extremely important” the funds that were created by BNDES and Finep (see article in this issue) to finance mining projects that are still in their early stages and to support initiatives that aim to expand technological knowledge and the production of strategic minerals for the energy transition and also for the industrial development of the country in general. He warns, however, that the volume of financial resources on offer under these programs is still very limited. □



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*Geosol drilling operation*

# GEOPAR GROUP INNOVATES WITH INTEGRATED SOLUTIONS

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**T**he Geopar group is a network of companies providing services in geology and mineral exploration, comprising Geosol, Geobit, Geosedna, Rede, and SGS Geosol. Its new concept, named “integrated solutions in mineral exploration”, covers the entire range of services required by mining companies, from the initial geological survey to the operational stage of the mine.

According to Dalmo Pereira, the vice-president of Geosol and the Geopar group,

the launch of this new concept of integrated solutions, he said, aims to meet an identified market need. “For about six years now, we have seen the challenge, which is to carry out not only the survey service but also all other associated steps, such as construction and management of a sample shed, a laboratory for sample analysis, and so on. Our group began to offer and execute these services on an integrated basis, supplying several projects in the states of Bahia, Mato



*Samples handling*

Grosso do Sul, and Alagoas, covering a variety of mineral commodities: iron ore, nickel, gold, and copper. The most complete service, however, was a large-scale, highly innovative and quite challenging campaign for LHG Mining.”

In Pereira’s view, the starting point of the mineral exploration cycle is a simple prospect, following up with the most primary exploration, leading to an accurate assessment of the area’s true potential. “After that,” he says, “we move on to a more advanced geological exploration, doing everything that is needed for the certification of resources and reserves. That includes a procedure manual, a data bank, and drawing up the technical reports in accordance with various standards — JORC, NI 43-101, and others. These reports will then serve as the basis for feasibility studies, to obtain investments and then to implement the mining project. After that, more exploration is carried out, more samples are analysed, geological mapping is expanded, the geophysical analysis is done, until you reach the point of having a reserve approved. Then development begins, followed by implementation of the venture, until finally the

mine comes into production. Eventually the mine will reach the end of its lifetime,” he continues, “leading to decommissioning or alternatively, in the event of new geological discoveries, the cycle will start over with rehabilitation of the mine.”

“The Geopar group takes part in each one of all these stages of a mining venture,” Pereira says, “and I see no other company or other group in the world that has such a diverse and comprehensive portfolio.” He emphasizes that the Geopar group has as its two main values its respect for life and its focus on creativity and innovation. All the companies in the group are certified under ISO 9001:2015, he says, and Geosol is already on the path toward certification under ISO 14001 (the environment) and 45001 (occupational health and safety).

Tradition is a significant feature of the group, Pereira says. Geosol is now over seventy years old — it was founded in 1953 by Victor Dequech — and it has been working in laboratory analysis since 1967.

An important distinguishing feature, he adds, is that the group has its own training school for professionals in drilling. The school has already trained around 350 people, including women: currently the group has eight female drill operators in activity.

Under the heading of innovation and development, an important example is a drill with a hydraulic arm, a type of robot that performs operations previously executed manually and eliminating risks for the operator. The machine was developed by Geosol itself. The group plans to have 100 percent of its drills operated automatically, particularly the hydraulic ones. Pereira also



*Dalmo Pereira*

highlights the Smart Geobit SHPP drill, manufactured by the Geopar group itself. It has “high embedded technology,” he says; “it is easy to operate, in addition to being robust and reliable. The machine is operated from a remote panel, away from the drill, ensuring that the operator works in safety.”

Pereira mentions the Drilling Simulator, which offers an advanced virtual environment, replicating, with precision, the operation of a real drill and allowing users to operate the drill virtually. This is useful also for educational purposes and for gaining practical experience. There is also the Operational Control Center, enabling the operator to remotely film the exploration area and to monitor the drill online, controlling the operation in real time and giving a diagnosis enabling the operator to make decisions and effect any needed correction. Using telemetry, the operator can

evaluate parameters such as the weight on the drill bit or crown, the mud pump flow rate, the speed of advance, top drive pressure, advance pressure, mud pump pressure, recoil pressure, and the rotation speed of the drilling column.

The star of the show, in Pereira’s words, is an electric drill, conceived and now being developed under a partnership with Finep, a Science and Technology Ministry agency providing financing for project development. This is a rotary diamond-tipped drill affording sustainable operation, with zero carbon emissions and using photovoltaic energy.

Pereira further highlights the diversity of the Geopar group’s portfolio, through its subsidiaries: Geosol specializes in rotary diamond drilling and deep tubular wells; Geobit Tools manufactures machinery and tools for drilling and mineral explorations; Geosedna carries out rotopercussive drilling and grade control in reverse circulation; Rede carries out geological and geotechnical exploration; and SGS Geosol operates a laboratory conducting geochemical, environmental, and metallurgical analysis.

When the Geosol team is approached by a client, the first thing it needs to know is the nature of the mineral asset to be explored, Pereira says. On this depends on the type of drilling required, whether diamond-tipped or by reverse circulation. “In this new type of service we are offering,” he explains, “we help the client to define whether it will be drilling with a focus on the subsoil, whether the mining will be underground or on the surface, whether a portable drill can be used, the extent of the survey area



*Remote drilling, risk-free for operator*

to be covered, how many boreholes will be needed and the optimal distance between them, the gradient of any slopes — in brief, the entire range of inputs that we will need to take into consideration. If the project is an unusually complex one, we have a variety of special tools we can use, such as a diverter barrel, for example.”

Pereira cites the case of a campaign now just beginning at a planned underground copper mine in the state of Pará. A borehole measuring 700 to 800 meters (2300 to 2600 feet) will first be drilled, from which branches will be dug out to reach the mineral body at several points. This procedure brings the advantage that more extensive information will be gained, more quickly and at a lower cost.

Another project using the same method is under way at a planned nickel mine in

Bahia, which called for deep boreholes keeping deviation to a minimum. Pereira recalls, “We drilled boreholes from 1,000 to 1,500 meters deep, where the final deviation was just seven meters.”

Returning to the types of drilling, Pereira notes that each method has its particularity. In reverse circulation, for example, the Geopar group offers special services such as Smart Sample, which is a trailer for samples placed next to the drill. It was jointly developed by Geosedna and the SGS Geosol laboratory, with the main purpose of physically preparing the samples in the field, reducing the volume, so that the sample will be representative. Another novelty that the group is offering is Ore Control, a machine having an array of sensors that will provide a reading of the compactness of the rock as drilling proceeds. “This is highly interesting,” Pereira says, “because it is of great help in the concept of ‘mining to mill’, which means having the rock, measuring its hardness, and hence knowing the appropriate way to feed it into the crusher.”

In other words, the testing is carried out at the mining site. Ore control is associated with group control, which is for the short term. And as a result, the samples are considerably more representative than they are when drill-dust drilling is used, Pereira says.

Whenever he is asked which is the better drilling method, diamond-tipped or reverse circulation, Pereira’s answer is that they are both important and each of them has its advantages and disadvantages. “Diamond drilling yields more accurate samples,” he says, “and the geological structures are more

clearly seen. We can observe the orientation of the geological structures and learn more about the structural features of the rock. This method is widely used at near-mine green-field sites.” When diamond drilling is used, he adds, the group can offer additional services such as measuring the borehole trajectory, the core orientation, a plastic container for cores, core cutting, support vehicles and yellow-line equipment.

Special services can also be offered, such as geophysical profiling, which includes the use of a three-arm caliper to measure (borehole diameter, gamma-natural), dual induction (short conductivity, long conductivity, gamma-natural), electric logging (normal resistivity, short and long, SPR, SP, gamma-natural), full-waveform sonic (compressional wave arrival speed), sidewall density (short, medium, and long density, gamma-natural), dual neutron (a qualitative count, short and long, of the hydrogen content of the rock formation), OPTV/ATV (optical imaging), and hi-rat (acoustic imaging).

In reverse circulation drilling, on the other hand, the work is finished more quickly, and it focuses mainly on the content of the material being drilled and on grade control. The sample format is rock fragments, called chips. Differently from diamond drilling, the drilling speed is higher, ranging from 100 to 150 meters in each shift, compared with an average 25 to 30 meters in diamond drilling. On the other hand, with diamond drilling it is possible to reach much greater depths, of up to 3,000 meters, while in reverse circulation drilling the depth can range from 5 to 500 meters in crystalline

rock or 150 meters in iron ore, because in many open pit mines the aquifer is very close to the surface, placing restrictions on the drilling. The sample diameter, in this type of drilling, ranges from 3.5 to 6.0 inches. Trajectory control is much more rudimentary than in diamond drilling, which gives much greater precision.

In this case, too, the Geopar group can supply additional geotechnical services, including instrumentation and testing, which can be done either on site or by collecting samples to be forwarded for lab tests.

Pereira reports that several clients are now using the group’s services ranging from selecting the precise spot for drilling to monitoring the exploration work, providing a sample shed, which can be anything from a tent to a brick-built structure, sample shed management (receiving, checking, organization of samples, photographing the core and the chip container), sending in geologists to produce the geological and geotechnical descriptions, drawing up sampling and density plans, all in accordance with the parameters that will later be audited. “And of course,” he adds, “we feed all this data into the client’s database, whether it’s drilling data or the results of laboratory sample analysis. We’re doing this now for several clients.”

For the analysis of samples requiring a different type of scan, the group sends them to SGS Geosol, where everything is done from the physical preparation of the sample up to the ore processing tests. The laboratory is equipped with everything needed to carry out the chemical analysis of the sample and the complete characterization



*Smelting test at SGS Geosol*

of rocks and sediments, using analytical methods such as fluorescence X-ray, fire assay, ICP-OES, and ICP-MS.

SGS Geosol also works on projects and testing within the client's corporate structure, at either the Capex or the Opex level. "We have done this at several companies," Pereira says, "where we initiated a project from scratch and even provided all the consultancy for equipment purchases. And then, after the project is completed with all the equipment installed, we work to ensure that the laboratory is duly certified."

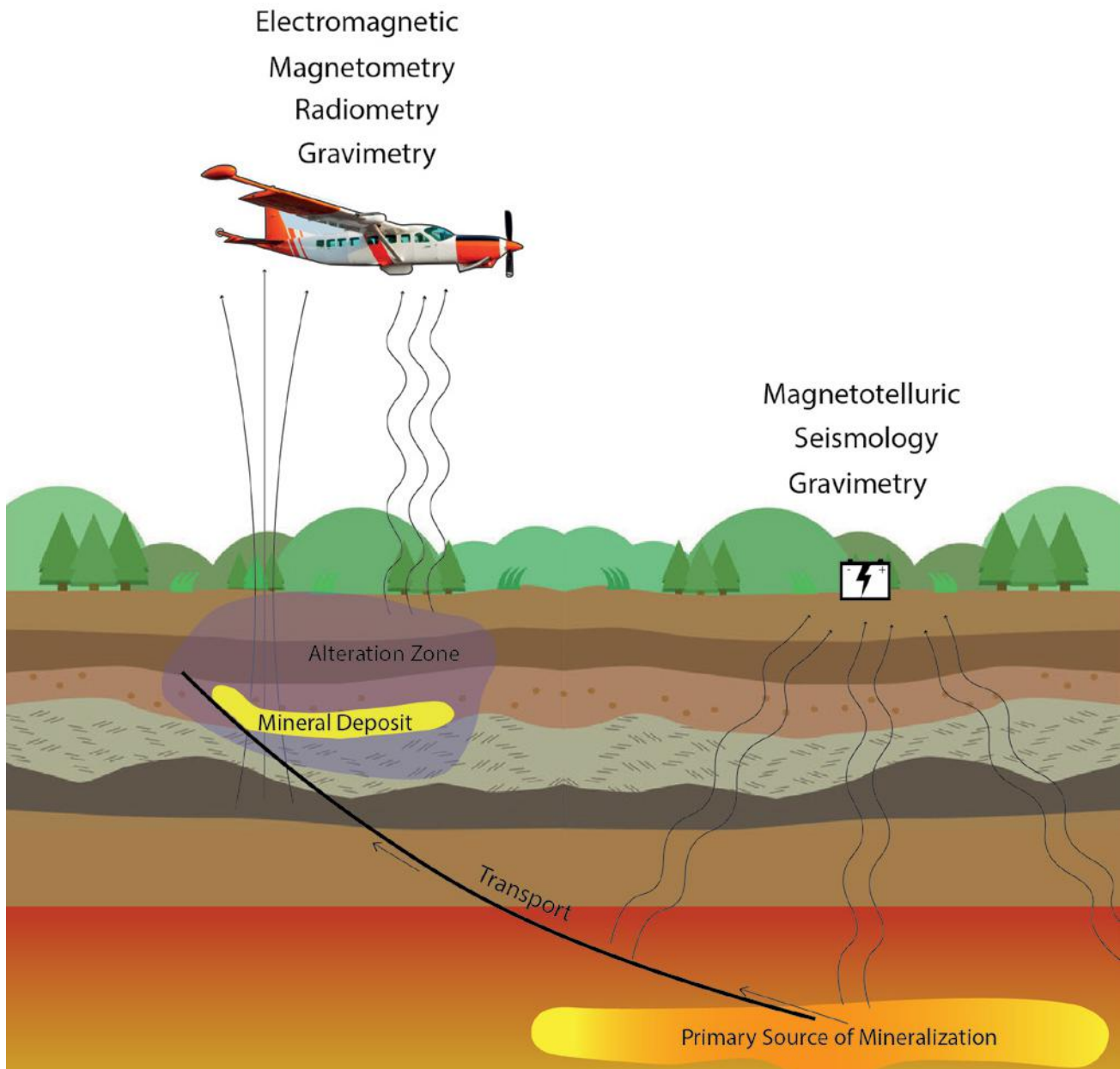
The Opex case applies to a company that already has a laboratory as part of its corporate structure, where SGS Geosol comes in to provide the management and arrange all the documentation. In these cases, the work consists mainly of introducing improvements, expanding quality control, and obtaining productivity gains. Under arrangements of this kind, in addition to its consultancy role, SGS Geosol can also provide qualified technical personnel.

Mineral processing is another important part of SGS Geosol's range of services, Pereira says. The fact that it can be done on a small scale means that operations such as grinding, desliming, flotation, and acid leaching can enable the client to purchase a full-size processing plant. "With that," he says, "you avoid the risk of overspending on a crusher, say, or on another piece of equipment. Sometimes it can guide you to a better choice that is a better fit with your processing needs."

In the area of obtaining certification for resources and reserves, the group works in partnership with several independent Qualified Persons (QPs) who contribute by producing procedure manuals, quality assurance and control (QA/QC), auditing, independent evaluations, due diligence, and calculating resources and reserves, all closely connected with the geological and economic potential of the deposit, in full accordance with standards such as CBRR, Canadian NI 43-101, JORC, and American standard S-K 1300.

Another activity that the group is now developing is core scanning, which gives a readout of parameters associated with digital photography of the rock formation. In this case, Geopar acts in partnership with a foreign company.

In conclusion, Pereira notes that the Geopar group is now proposing to sign a single contract with each client, bringing together the activities to be provided by each company in the group, though with billing still to be handled by each of them separately. □



## GEOLOGICAL SURVEY OF BRAZIL IS FOCUSING ON STRATEGIC MINERALS FOR THE ENERGY TRANSITION

*Lúcia Travassos da Rosa-Costa<sup>1</sup>, Francisco Valdir Silveira<sup>2</sup>*

In line with other renowned geological services around the world, the Geological Survey of Brazil (SGB-CPRM) operates in multidisciplinary Earth science

research that includes geological mapping; geophysical and geochemical surveys; research into mineral resources; hydrogeological and hydrological monitoring, and

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studies on land-use planning and management, such as geological risk mapping and geodiversity surveys. These activities provide underpinning for the formulation of policies and planning at all levels of government, as well as for the mining industry and geoscientific teaching and research.

In conducting its basic surveys and research into mineral resources, the Geological Survey of Brazil seeks not only to expand geological knowledge, which fosters a wide range of secondary activities, but also to reduce the exploratory risks of mining, to attract investments, and to strengthen the Brazilian mining industry.

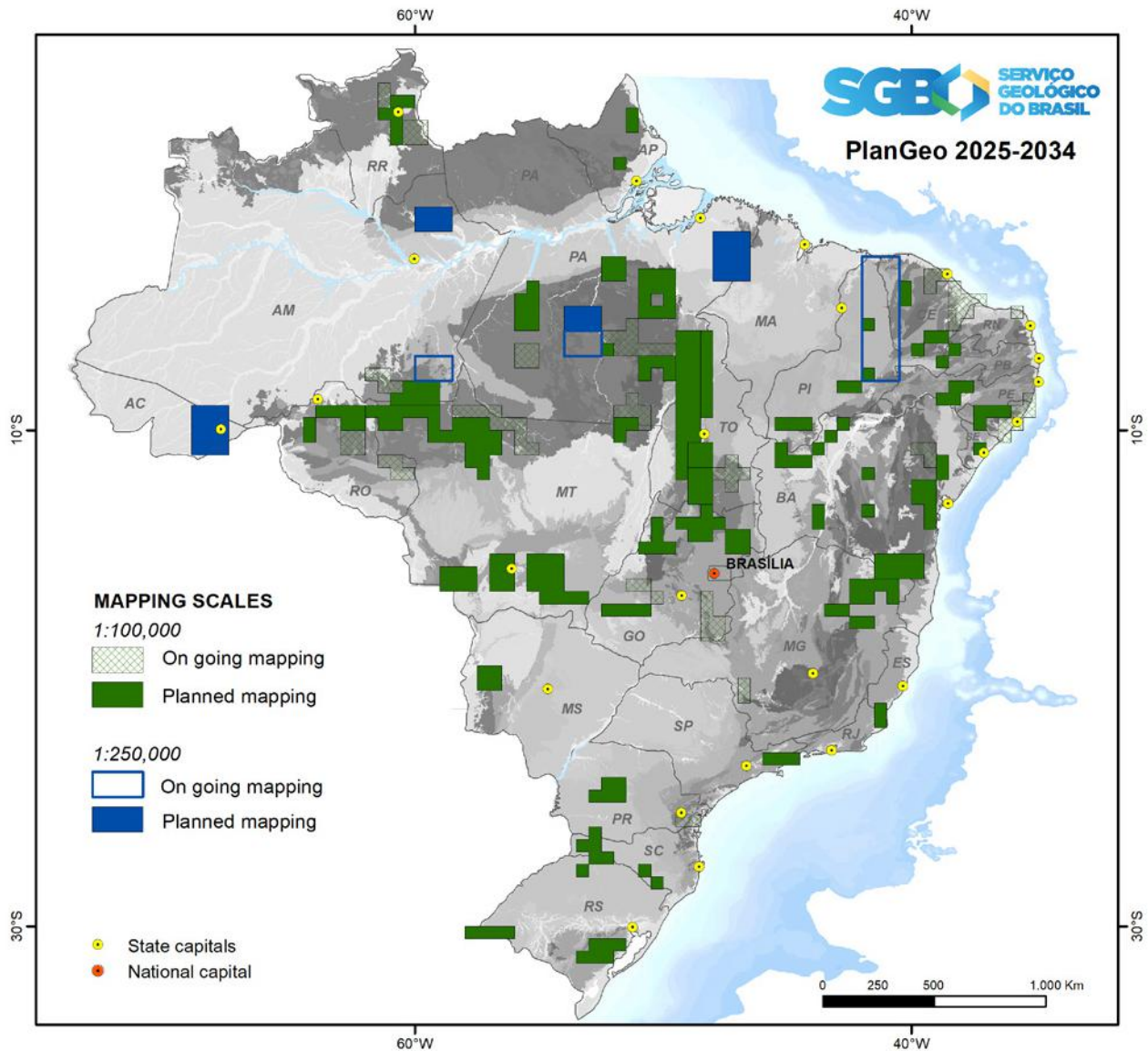
We started 2025 having already, in 2024, consolidated our strategic planning for the coming years, with the aim of optimizing both budgetary resources and our technical expertise. In this context, three fundamental initiatives stand out: the Ten-Year Geological Mapping Plan (PlanGeo 2025-2034), the Deep Earth Exploration Program of Brazil (Deep Brazil), and research targeting the strategic minerals for the energy transition.

PlanGeo 2025-2034\* first arose following the publication, in March 2024, of the Mining and Energy Ministry's ordinance 72/GM/MME, laying down guidelines for geological mapping, including public participation in decision-making. Thus, the ten-year plan was structured on the basis of the SGB-CPRM technical team's definition of the priority areas for systematic geological mapping, assisted also by a public consultation channel to take due account of the expectations of the various segments of Brazilian society, in particular those that benefit from the results of geological cartography projects, such as

mineral research companies, universities, and public institutions.

PlanGeo 2025-2034 selected 73 blocks for geological mapping. Six of which were included based on technically relevant recommendations received during public hearings. These blocks add up to 354 cartographic sheets, with priority given to 1:100,000 scale. This will expand Brazil's existing mapping coverage by approximately 15 percent. The blocks cover established or emerging mineral provinces, mining districts, and new frontiers of geological knowledge, located mainly in the Amazon region. The selection of blocks took into account the mining industry's needs and opportunities at a global level, as well as Brazil's strategic priorities, emphasizing potential areas for strategic minerals essential to the energy transition and inputs for agriculture, a sector in which Brazil is still heavily dependent on imports, despite the great weight of agribusiness in the country's economy.

The Deep Brazil program had as its starting point the need to expand the SGB-CPRM's existing portfolio of geophysical surveys, which previously focused on airborne magnetic and gamma-ray spectrometry methods. The decision was made to incorporate complementary acquisition techniques, enabling it to reach greater depths, visualize the lithospheric architecture and identify areas with high mineral fertility. Thus, Deep Brazil is a program of systematic acquisition of geophysical data, both airborne and terrestrial, for the purpose of investigating the potential of mineral resources from the topmost meters of the Earth's crust down to depths of hundreds of kilometers. The program includes four main projects:



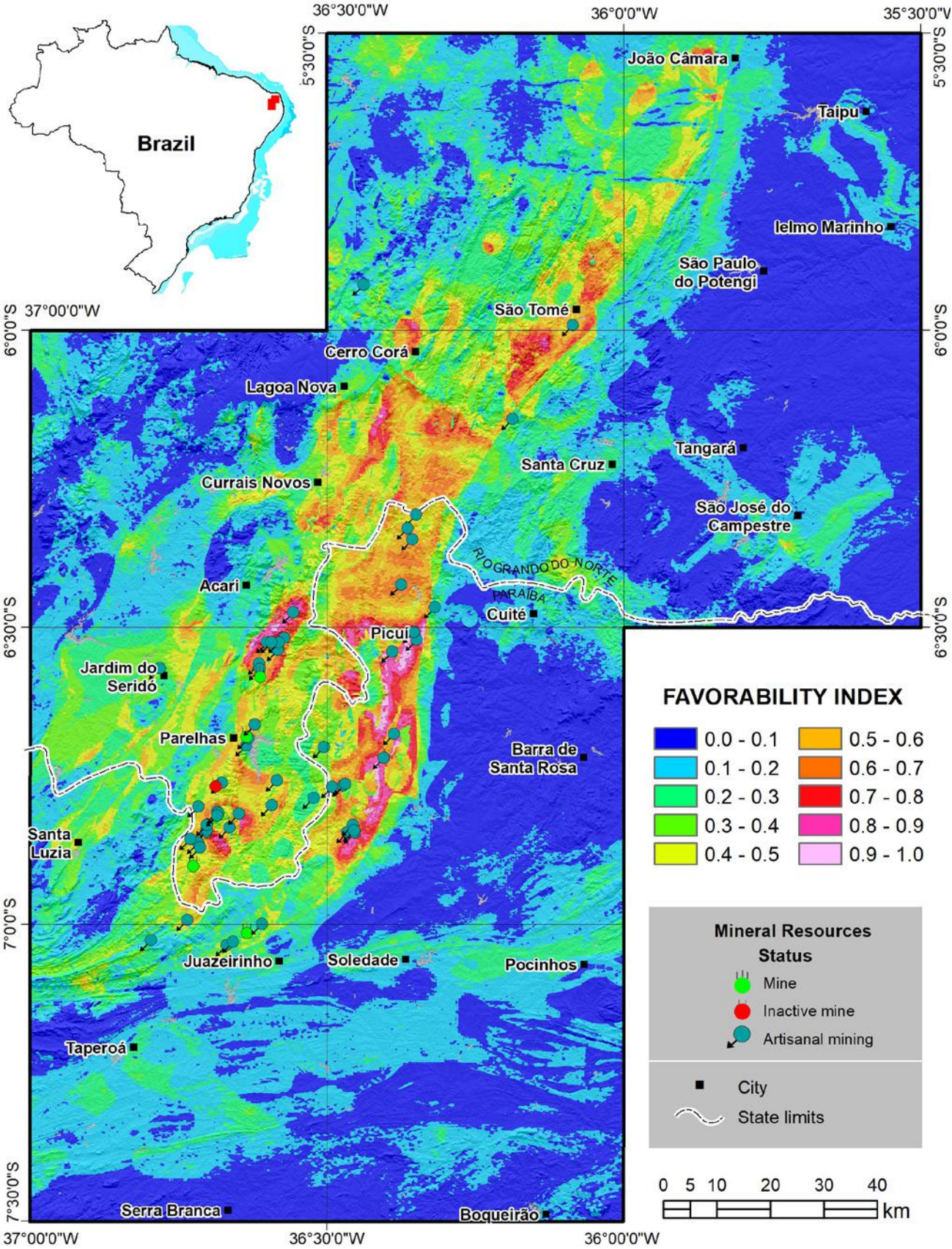
- Aerogeophysics Brazil, which will restart airborne magnetic and gamma-ray spectrometry surveys, also incorporating electromagnetic and gravimetric methods, depending on the geological context and objective of the survey.

- Grav Brasil and MT Brasil, focusing on terrestrial geophysical surveys, with the acquisition of gravimetric and magnetotelluric data;

- Sismo Brasil, which provides for the acquisition of seismological data for seismic tomography.

Brazil has been a key player in the world-wide debate on energy transition and climate change, driven by factors such as the government's commitment to discuss solutions to the global climate emergency, the profile of the country's energy mix — one of the least carbon-intensive in the world —, the expectations surrounding COP 30 and Brazil's vast geological potential for strategic mineral deposits, essential for the development of low-carbon technologies.

The climate crisis places the energy transition at the center of global discussions and, in



this context, the Brazilian mining industry plays a crucial role. The Geological Survey of Brazil has developed thematic projects in geological contexts with diverse mineral systems, with potential for lithium, copper, rare earth elements, graphite, nickel, cobalt and uranium.

In these projects, internationally recognized mineral modeling methodologies are used, involving multi-scale integration of geological, geophysical, and geochemical data, as well as the application of advanced processing and spatial data analysis techniques. This allows the prediction of mineral potential in both brownfield and greenfield areas, reducing the risks and costs of mineral exploration, and, at the same time, creating new opportunities for the industry.

The energy transition has been addressed in government policies and financing mechanisms, such as the Ecological Transformation Plan (Finance Ministry), the Climate Fund (Ministry of Environment and Climate Change & National Development Bank), and the Strategic Minerals Equity Investment Fund (Mining and Energy Ministry & National Development Bank). However, it is through the Safe and Sustainable Mining Program, included in the 2024-2027 Multi-Year Plan, that the Geological Survey of Brazil effectively accesses budgetary resources to execute projects, partly financed by the government's Growth Acceleration Program, known as the New PAC.

Although there is a broad consensus on the importance of mining for the technological development required to make the energy transition achievable, this perception does not translate into a significant increase in the

funding allocated to the Geological Survey of Brazil for investments in basic geological research. Such investments are essential for the full implementation of initiatives as PlanGeo 2025-2034 and the Deep Brazil Program, both of which will be fundamental in underpinning the advancement of geological knowledge and the discovery of new mineral deposits.

We face the challenge of providing high quality and timely pre-competitive information and data to meet growing demand. In view of the limited resources available, some initiatives are needed that involve the government-industry-academia triad. Among these, five in particular stand out:

- The involvement of state governments in financing geological research conducted by the Geological Survey of Brazil;
- The establishment of government-industry-academia partnerships to develop programs of mutual interest;
- The regulation of access to and custody of data from research and exploration carried out by mining companies;
- The structuring of national databases, held jointly by the Geological Survey of Brazil and the National Mining Agency, for hosting, management, and custody of mineral research data;
- The strengthening of government-academia cooperation in the development of scientific research having an impact on the discovery of new mineral deposits. □

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*\*The full text can be accessed at <https://rigeo.sgb.gov.br/handle/doc/24990>*

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*Uranium mine in Brazil*

## THE EVOLUTION OF URANIUM MINING IN BRAZIL: REGULATORY CHANGES AND NEW OPPORTUNITIES FOR THE PRIVATE SECTOR

*Frederico Bedran\*, Luiz Carlos Adami\*, Mariana Melo Botelho\**

In recent years, Brazil has undergone a significant transformation in the nuclear mining sector, driven by regulatory flexibility, the redefinition of institutional responsibilities, and the expansion of opportunities for agreements between the government and private companies. These changes have been essential in unlocking investments and revitalizing the market,

enabling the country to better leverage its vast uranium reserves and contribute to the global energy transition.

For decades, the exploration, extraction, and commercialization of nuclear minerals in Brazil were under strict state control, creating barriers to the sector's development. This regulatory rigidity limited private investments, restricted competitiveness, and made

it difficult for Brazil to capitalize on its potential as a global player in uranium mining.

The paradigm shift began in 2022 with the Law No. 14,514/2022. This innovative legislation allowed private companies to participate in uranium exploration, if they do so in partnership with Nuclear Industries of Brazil S.A. (INB), ensuring a more dynamic and attractive regulatory environment for investors.

With this regulatory shift, new opportunities have emerged, particularly in the development of strategic projects that facilitate the extraction of minerals associated with uranium. Before this flexibility, the mere presence of uranium in a mineral deposit could economically hinder a project. Now, mining rights holders can explore these assets in partnership with INB, maximizing the economic value of resources and strengthening the sector.

Additionally, private sector participation is driving an expansion in mineral exploration, essential for identifying and developing new uranium reserves. Brazil, which holds the eighth-largest uranium reserve in the world, according to the Brazilian Energy Nuclear and Binational Holding Company (ENBPar), has the potential to become a strategic global supplier, especially amid the growing demand for nuclear energy as a clean and sustainable source.

## **Institutional Responsibilities and Legal Security**

The restructuring of the nuclear sector was not limited to market liberalization. One of the most significant changes was the redefinition of institutional responsibilities,

ensuring greater legal security and regulatory efficiency.

Historically, uranium mining regulation in Brazil involved multiple agencies, often leading to jurisdictional conflicts, excessive bureaucracy, and investor uncertainty. This scenario began to change with the creation of the National Nuclear Safety Authority (ANSN) under Law No. 14,222/2021. The ANSN assumed critical responsibilities related to nuclear safety, radiation protection, and licensing of exploration, processing, and commercialization activities for nuclear minerals.

At the same time, the Brazilian National Mining Agency (ANM) has taken on a clearer role in regulating, monitoring, and overseeing nuclear mineral exploration and extraction activities, except for nuclear and radiological safety issues, which remain under ANSN's authority. Meanwhile, INB, a state-owned company controlled by ENBPar, retains its monopoly over uranium mining on behalf of the Brazilian government but can now establish partnerships with the private sector to advance projects.

The National Nuclear Energy Commission (CNEN) has maintained its role in promoting exploration activities and development in nuclear energy but now has better-defined responsibilities in relation to other institutions.

This institutional reconfiguration aims to eliminate overlapping competencies, ensuring that regulation is more coordinated and predictable. However, challenges remain, particularly in clearly defining oversight and enforcement responsibilities. The lack of specific guidelines may lead to interpre-

tative conflicts and uncertainties, making it harder to attract investments and implement new projects. Therefore, despite the current debate by the Brazilian government, it is crucial that the new guidelines address these issues.

## **Agreements between the government and private companies and New Business Opportunities**

The new regulatory framework has created numerous opportunities for strategic partnerships between the public and private sectors in uranium mining development in Brazil. This model enables the economic utilization of previously underdeveloped deposits and encourages the modernization of existing operations.

One of the most emblematic examples of this new landscape is the Santa Quitéria Project in the state of Ceará, a partnership between INB and the company Galvani. This initiative aims to explore the Itataia deposit, where uranium and phosphate are associated, allowing production to serve both the agriculture and energy sectors. The Santa Quitéria mine is expected to produce up to 2,300 tons of uranium concentrate annually, representing a significant advancement for the sector.

Another partnership model that could gain traction in the sector is the Special Purpose Entities (SPEs), widely used in large-scale projects such as hydroelectric plants and solar and wind farms. This format, that must have as parties ENBPARG, INB and the private company, could be applied to uranium mining to facilitate long-term

investments, risk-sharing, and sustainable development.

In addition to direct opportunities in uranium exploration and processing, Brazil has potential to position itself as a global supplier of uranium. The country holds strategic advantages, such as significant reserves, strong environmental commitments, and a neutral diplomatic stance, which facilitates international market integration. This positioning could attract foreign investments and further drive sector development.

The evolution of uranium mining regulations in Brazil marks a historic milestone for the sector. The regulatory flexibility, institutional restructuring, and introduction of agreements between the government and private companies have created a more investment-friendly, innovative, and sustainable environment.

The new regulatory model not only boosts uranium exploration but also ensures legal security for investors, providing stability and predictability for business operations. However, for this potential to be fully realized, authorities must continue refining regulatory mechanisms, reducing bureaucratic bottlenecks, and ensuring efficient and balanced oversight.

Ultimately, with proper incentives, well-structured partnerships, and a clear regulatory environment, Brazil can strengthen its energy matrix, attract investments, and establish itself as one of the world's leading uranium producers. □

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## PRIVATE ORGANIZATIONS

### **Agência para o Desenvolvimento e Inovação do Setor Mineral Brasileiro – Adimb (Agency for the Development and Innovation of the Brazilian Mineral Sector)**

*Chairman: Marcos André Gonçalves*  
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### **Associação Brasileira do Alumínio – Abal (Brazilian Aluminium Association)**

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### **Associação Brasileira de Cimento Portland – ABCP (Brazilian Cement Association)**

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**Associação Brasileira do Cobre - ABCobre  
(Brazilian Copper Association)**

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**Associação Brasileira de Cerâmica - ABCeram  
(Ceramics Brazilian Association)**

*President: Luis Leonardo Horne Curimbaba Ferreira*

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Indústrias de Base – Abdib  
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**lian Association)**

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**Associação Brasileira de Metalurgia,  
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**Associação Brasileira das Empresas de  
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tion and Mining Companies)**

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**Associação Brasileira das Indústrias de Máquinas e Equipamentos – Abimaq/ Sindimaq**

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**Associação Brasileira do Carbono Sustentável – ABCS**

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**Associação Nacional das Entidades de Produtores de Agregados para Construção Civil – Anepac**

**(National Association of Civil Construction Aggregates Producers Entities)**

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**Associação Nacional para Difusão de Adubos – ANDA**

**(National Association for Fertilizer Diffusion)**

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