BRAZIL mineral

MINING - METALLURGY

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# MINING IN BRAZIL
# BEYOND EXPECTATIONS

## A MAJOR WORLD PLAYER IN THE DIMENSION STONES INDUSTRY

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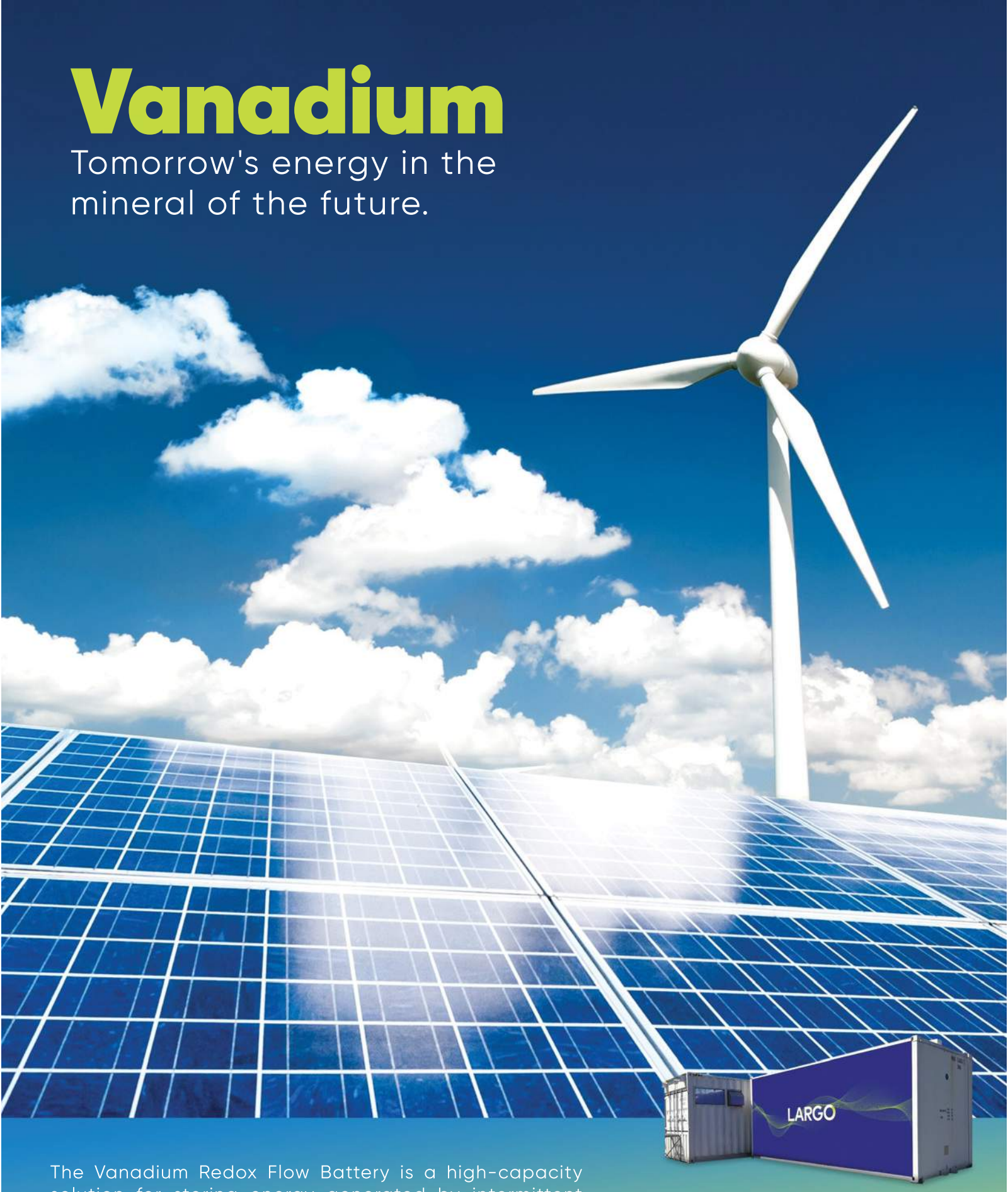


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# HAS BRAZILIAN MINING NOW ENTERED A VIRTUOUS CIRCLE?

Even while it struggles with all the difficulties caused by the Covid pandemic, the Brazilian mining industry is experiencing a favourable moment. In 2021, driven mainly by high metals prices – which in some cases set new records – and by the advance of the dollar against the Brazilian real, mining output grew more than 60 percent, in local currency terms, compared with the previous year. This growth is duly reflected in companies' balance sheets, where profits are well above the average for recent years.

The driving force behind the favourable performance was, once again, iron ore, which remains – and will remain for many years to come – the country's foremost mining product. As has been widely reported, world iron ore prices have risen to record levels. Gold, which is our second largest mining product, also maintained a price level that ensures producers are well remunerated, even those whose production costs are high. Copper, in which Brazil is beginning to emerge as an important producer, also surprised the market with a price surge.

It was not only export products that performed well in 2021. Minerals produced exclusively for the home market, such as aggregates for the construction industry, limestone for farm use, and inputs for cement manufacture also reported growth. In the case of limestone, the provisional estimate is that in 2021 output grew, in value terms, at a rate of around 15 percent. Output of aggregates grew about 9 percent, while cement sales in Brazil were up 6.6 percent in the year.

In addition to the growth in output, investments in mining projects are also increasing. Data compiled by Ibram, the Brazilian Mining Association, show that companies' planned investments for the 2021-2025 period add up to US$ 41.3 billion, comprising some US$ 6 billion in social and environmental actions and US$ 35.3 billion in production capacity and infrastructure. Out of this total, 47 percent is already in execution and 53 percent programmed. The products attracting the largest volumes of capital expenditure are iron ore with US$ 12.89 billion, followed by bauxite with US$ 6.48 billion and fertilisers with US$ 6.39 billion, while significant amounts are also earmarked for copper (US$ 1.68 billion) and gold (US$ 1.44 billion). Infrastructure projects, such as railways and port facilities, are to receive US$ 1.30 billion, leaving a balance of US$ 5.11 billion for all other mining products.

The government's intention is to create the conditions for investments to increase further. To this end it is carrying out bidding procedures to hand over to the private sector areas made available for mineral exploration. These are areas for which permits had already been issued at some earlier date, but where for one reason or another the companies left their commitments unfulfilled. In addition, also made available under similar bidding procedures are certain areas controlled by the Geological Survey of Brazil (SGB–CPRM), while the existing Mining Code is being revised to give the rules greater stability.

Thus the outlook for the immediate future is that Brazilian mining will continue to grow, favoured by good conditions on the world market for mineral commodities, where price levels afford a good rate of return on investments, given that the greater part, in value terms, of Brazil's mining output goes to export markets. Consequently, short of the world market being convulsed by a sudden shock, everything suggests that Brazil's mining industry has entered a virtuous circle and is likely to remain there. □

***Francisco Alves, Editor***

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# MASTHEAD


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**Editorial Director**
Francisco E. Alves
franalves@signuseditora.com.br

**Commercial Director**
Sergio de Oliveira
sergio@signuseditora.com.br

**Designer**
Alexandre Paes Dias

**Translation**
Brian Gould

Filiada à
anatec
www.anatec.org.br

**Advertising, Editorial & Accounting Offices:**
R. Amaro Cavalheiro, 347 - cj 1020 – Pinheiros
Zip Code 05425-011 – São Paulo – SP – Brazil
Phone: +55 11 3814.6899
e-mail: brasilmineral@signuseditora.com.br
**www.brasilmineral.com.br**

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# CONSULTING COUNCIL

*JMC Yamana Gold mining complex at Jacobina in Bahia*

# GOOD PRICES BOOST 2021 RESULTS FOR BRAZIL'S MINING INDUSTRY

***Francisco Alves***

Brazil's mining output set a new record in 2021 at an estimated R$ 339.1 billion (about US$ 63 billion), up no less than 62.2 percent in the year. The main impulse came from the good prices paid for iron ore, gold, and copper, the three leading products in value terms. Iron ore alone accounted for 73.6 percent of the total, with sales of R$ 249.8 billion. Gold came second with about 8 percent (R$ 27.0 billion), while copper reported a 5.2 percent share with R$ 17.8 billion.

SERABI GOLD

# Serabi Mineração

Building Brazil's next mid-tier gold company
(LSE: SRB | TSX: SBI)

Serabi Mineração is a gold exploration and production company involved in the evaluation and development of gold deposits in Brazil. The company's primary interests are it's 100% owned Palito Mining Complex and the recently acquired Coringa Gold Project both located in the Tapajós region of northern Brazil. Combined gold production from the Palito Mining Complex is currently approximately 40,000 ounces per annum, whilst the Coringa Project, when in production, is forecast to produce an average of 38,000 ounces per annum.


www.serabigold.com

The Long Barn, Cobham
Park Road, Downside -
Surrey KT11 3NE

contact@serabigold.com

Phone:
+44 (0)20 7246-6830

www.blogdaserabi.com.br

Mina Palito
Rod. Transgarimpeira KM 22
S/Nº
Jd. do Ouro, Itaituba/PA
CEP: 68181-140

Fone:
+55 (31) 3615-1216

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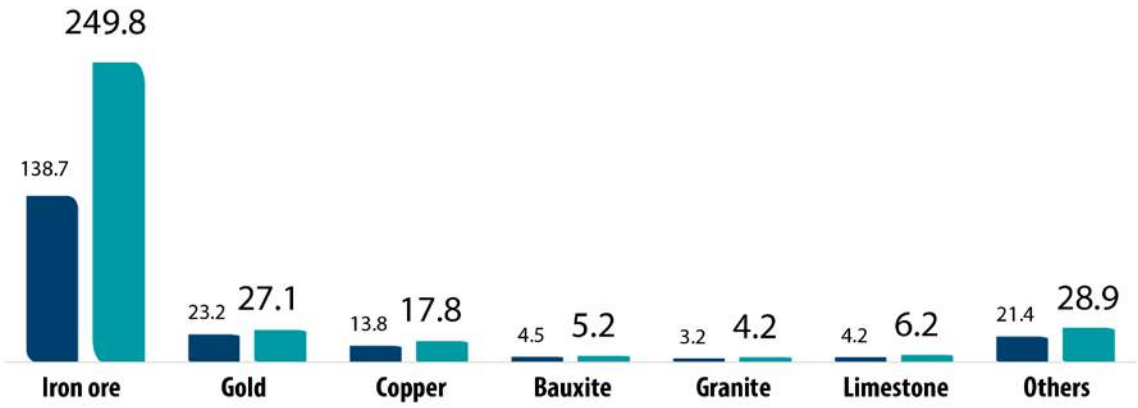
Leaving aside mineral water, which contributed R$ 3.99 billion or just over 1 percent of the year's total, the Brazilian mining industry's main products in 2021, in addition to iron ore, gold, and copper, were dolomitic limestone (R$ 6.15 billion or 1.80 percent of the total), bauxite or aluminium ore (R$ 5.24 billion or 1.54 percent), granite (R$ 4.17 billion or 1.23 percent), phosphate (R$ 2.61 billion or 0.77 percent), sand (R$ 2.45 billion or 0.72 percent), nickel ore (R$ 2.43 billion or 0.71 percent), and basalt (R$ 1.95 billion or 0.57 percent).

With this high value of the year's output, revenues from the Financial Compensation for the Exploitation of Mineral Resources (CFEM) rose to R$ 10.29 billion, up 68.9 percent in the year and setting a new record. The mineral products providing the largest shares of revenue were iron ore with R$ 8.7 billion, about 84.5 percent of the total, followed by gold with R$ 410 million or 4.0 percent; copper with R$ 354 million or 3.4 percent; dolomitic limestone with R$ 132.6 million or 1.3 percent; aluminium ore with R$ 156.5 million or 1.5 percent; phosphate with R$ 54 million or 0.52 percent; nickel ore with R$ 48.7 million or 0.47 percent; granite with R$ 44 million or 0.42 percent; tin ore with R$ 36.7 million or 0.35 percent; and sand with R$ 30.2 million or 0.29 percent.

**Revenues by mineral product**
*(in R$ billion)*

IBRAM
MINERAÇÃO DO BRASIL




| | Iron ore | Gold | Copper | Bauxite | Granite | Limestone | Others |
|---|---|---|---|---|---|---|---|
| 2020 X 2021 | +80% | +16% | +29% | +16% | +32% | +47% | |

Source: ANM/Ibram

In terms of geographical distribution, the northern state of Pará was in first place, contributing R$ 4.81 billion to overall CFEM revenue, followed by Minas Gerais with R$ 4.60 billion, Bahia with R$ 175.1 million, Goiás with R$ 166.6 million, and Mato Grosso with R$ 102.3 million.

## Trade surplus

Mining made the largest contribution to the Brazilian trade surplus in 2021, ahead of the agribusiness sector. While the country's overall surplus ended the year at US$ 61.2 billion, the corresponding result for trade in mining products alone was US$ 48.9 billion.

Mining exports set a new record in 2021, up 58.6 percent in the year at US$ 58.0 billion, compared with US$ 36.5 billion in 2020. Overall Brazilian exports grew 34 percent to US$ 280.6 billion, while imports rose faster, at a rate of 38.2 percent, ending the year at US$ 219.4 billion. The improvement in the trade surplus was due, above all, to higher prices for both minerals and soft commodities alike, in addition to a stronger dollar.

Brazil's leading export products were iron ore, soyabeans, and oil. These three categories together accounted for 41 percent of all exports in 2021. Iron ore was at the top of the list, with a figure of US$ 44.6 billion, or 16 percent of the country's overall export total in the period. In comparison with the previous year, iron ore exports increased by US$ 18.8 billion, for a 73 percent growth rate in the period. Soyabeans, the second-ranking category, contributed US$ 38.6 billion, giving a 14 percent share of total exports, while oil exports amounted to US$ 30.5 billion or 11 percent. Apart from iron ore, mineral

*Atlantic Nickel's Santa Rita mine*

exports also included gold (US$ 5.3 billion or 1.9 percent of the year's total exports), copper ores (US$ 3.4 billion or 1.2 percent), and alumina (US$ 2.8 billion or 1.0 percent). In the category of semimanufactures, ferroalloys exports yielded US$ 5.1 billion, for a 1.8 percent share of the total.

Weighing on the negative side of the trade balance in the minerals category are fertilisers, which in 2021 ranked top of the list of Brazilian imports with a cost of US$ 15.1 billion or 6.9 percent of all imports. In comparison with the previous year, fertiliser imports grew 89 percent, adding US$ 7.1 billion to the 2020 figure. This means that part of the export income from soyabeans, our second-ranking export product, goes out through the other door to pay for imported fertilisers. Something similar may be observed in the case of copper and aluminium, both of which feature prominently in the list of export products. In 2021 Brazil imported copper in the amount of US$ 2.6 billion or 1.2 percent of all imports, with aluminium imports costing a further US$ 2.1 billion or 0.97 percent.

## More concessions granted

Exploration activity increased in 2021, as is shown by the number of Exploration Permits (Alvarás de pesquisa) issued. The National Mining Agency (ANM) has released data showing that the number rose to 9,132, up from 5,308 permits issued in 2020, for a 72 percent increase. The states reporting the sharpest growth were Bahia (an additional 665 permits in the year), Minas Gerais (up from 1,491 to 2,077), Goiás including the Federal District (an additional 549) and Mato Grosso, up by 471, from 192 permits in 2020 to 663 in 2021).

There was a significant increase, too, in the case of Mining Permits (Portarias de Lavra). From 527 such permits in 2020, the number grew to 650, meaning an additional 123 permits and a 23 percent growth rate in the year. In this case, the southern state of Paraná is listed in first place with 142 permits, followed by Minas Gerais with 133, São Paulo with 118, Santa Catarina with 78, Goiás and the Federal District with 33, Espírito Santo with 28, and Bahia with 25.

## Iron ore bonanza

In 2021 iron ore lengthened its lead in the Brazilian mining output statistics with record sales, as the direct result of the price improvement on world markets. Data calculated on the basis of CFEM revenues give a figure for the year's iron ore output of R$ 249.8 billion, or almost 74 percent of the total for Brazil's overall mining output. It was also the foremost contributor to CFEM revenue, providing 84.5 percent of the 2021 total for all products. Furthermore, iron ore made the largest contribution to Brazil's trade surplus, having overtaken soyabeans, which for many years have been among the country's top earners in export markets.

*Vale iron ore storage site*

# We produce precious metals, investing and preserving what we value the most

Luz and Ruben, Aura Aranzazu.

The 360° Mining concept represents Aura's vision and values: to produce wealth in an ethical manner, respecting people and the environment. By adopting the EESG, we go beyond environmental, social and governance sustainability to add another "E" for "employees". We believe that the wealth we produce must serve the progress of our employees. That the transformation of the communities, regions and countries in which we operate begins with the transformation of the company and our employees. We prioritize safety, encourage innovation and recognize merit. We invest in social inclusion projects and training. We are committed to the communities that host and surround us, as we understand mining as a connection. And we are building a future that is good for the company and for the world.

aura
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**We are Aura. And we think differently about mining.**

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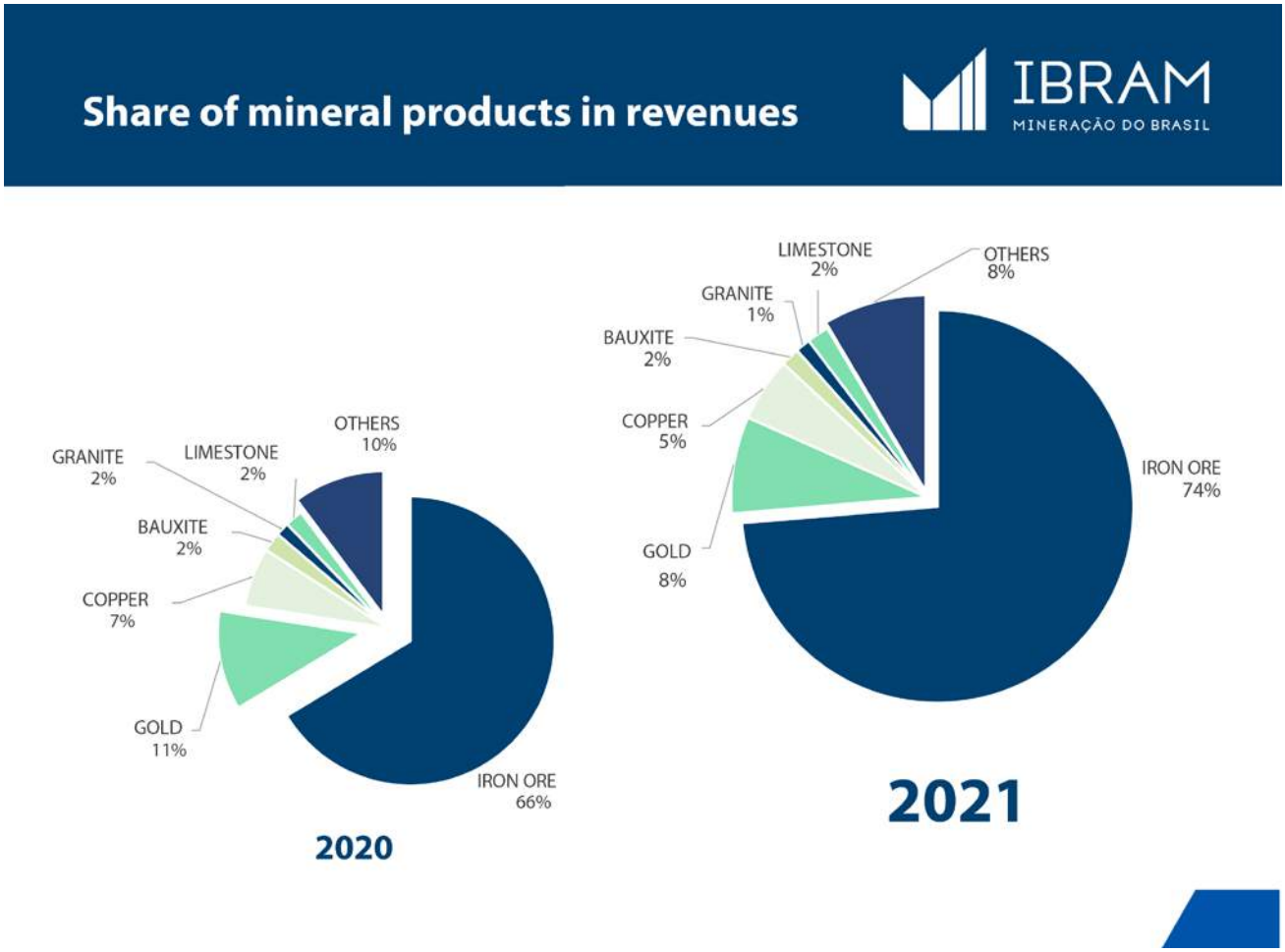



Among producing companies, on the basis of output in value terms declared for CFEM purposes rather than on tonnages, Vale (taking its two mining units together, Minerações Brasileiras Reunidas and Baovale) once again retained its top-ranking position, with a 2021 figure of R$ 186.8 billion. Anglo American Minério de Ferro Brasil placed second with R$ 19.1 billion, followed by CSN Mineração with R$ 18.6 billion, Mineração Usiminas with R$ 5.2 billion, Vallourec with R$ 3.3 billion, Ferrous Resources with R$ 2.16 billion, Ferro+ Mineração with R$ 2.1 billion, Ferromar with R$ 1.6 billion, Extrativa Mineral with R$ 1.49 billion, Mineração Corumbaense Reunida with R$ 1.44 billion, Mineração Conemp with R$ 1.36 billion, ArcelorMittal with R$ 1.08 billion, Minerita with R$ 943 million, Mineração Baratihha with R$ 857 million, Gerdau Açominas with R$ 817 million, Samarco – which completed its first full year after restarting its operations – with R$ 714 million, Minérios Nacional with R$ 566 million, JMN Mineração with R$ 530 million, SAFM Mineração with R$ 524 million, Mineração Comisa with R$ 507 million, and BAMIN, which has now joined the list of Brazilian iron ore producers, with R$ 483 million.

As the result of the good prices prevailing in 2021, which averaged US$ 158 per dry metric ton (dmt), Brazil's iron ore producers enjoyed an exuberant year in terms of

profitability, clearly demonstrated in the balance sheets of major players such as Vale, CSN, and Anglo American.

Favourable profit margins enabled companies to shift their investments away from dams and introduce new technologies for processing tailings, mainly filtration and dry stacking, and also dry concentrates production. Almost all companies followed that course in their investment programmes, notably Vale, which – likely prompted by the Brumadinho tragedy, now three years in the past – has allocated both the largest budget and the largest number of personnel for work of this kind. Vale has placed tailings dams in the forefront of its concerns. Since 2019 it has eliminated seven dams, including two (Fernandinho and Vargem Grande) that were cleared away in 2021. However, Vale still faces an enormous work load between now and 2035, the deadline for removal of all twenty-three remaining dams, which will mean a great deal of work burdened with complications such as the risks to local communities and to the environment. Putting this dam removal strategy into practice called for investments in filtration plants and dry tailings stacks adding up to no less than US$ 1.2 billion in the 2019-2021 period, to be followed in 2022-2025 by further investments budgeted at US$ 1.3 billion.

In parallel, Vale has set itself a growth target aiming at an output capacity of 400 million tons a year, adopting the strategy of maximizing what it calls the "flight to quality". This includes adopting new operating procedures, lessening dependence on tailings dams, and developing dry processing solutions, including dry concentration, in addition to filtration of tailings and retaining sandy tailings to be marketed as a by-product.

On course to achieve its planned 400 million ton capacity in accordance with its new operating strategy, Vale expects to bring several new units on stream by the end of 2022: filtration and tailings plants at Brucutu/Itabira; the Gelado project for the recovery of tailings from the Gelado dam at Carajás; the project known as S11D 100 Mtpa, which will boost capacity at the S11D mine to 100 million tons a year, and the Torto dam. The company is also engaged in strengthening its portfolio by developing solutions that will help to decarbonise the steel industry, particularly in China, which is its main export market. For Vale this involves several activities such as increasing its output of high-grade ores, introducing dry concentration to obtain a higher iron content, and achieving a leadership position in the supply of products for direct reduction (pellets and "green" briquettes), in addition to asset-light solutions in the form of partnerships with other producers. Among these developments, Vale singles out its "green" briquettes, introduced in September 2021, which are seen as an innovative, environment-friendly solution, the fruit of an eighteen-year development programme and now with patents applied for in forty-seven countries. The solution can be applied in the BF-BOF route, helping to achieve a 10 percent or better reduction in $CO_2$ emissions.

CSN Mineração, after going public on the Brazilian stock exchange at the beginning

## Brazilian Trade Balance
*(in US$ billion)*

IBRAM
MINERAÇÃO DO BRASIL

| | 2020 | 2021 | 2020 X 2021 |
|---|---|---|---|
| BRAZILIAN EXPORTS | $209.2 | $280.6 | +34% |
| **MINERAL EXPORTS** | **$36.5** | **$58** | **+58.6%** |
| | | | |
| BRAZILIAN IMPORTS | $158.8 | $219.4 | +38.2% |
| **MINERAL IMPORTS** | **$4.1** | **$9.1** | **+120.8%** |
| | | | |
| BRAZIL SURPLUS | $50.4 | $61.2 | +21.5% |
| **MINERAL SURPLUS*** | **$32.5** | **$48.9** | **+50.7%** |

* Mineral surplus = 80% of Brazilian surplus n 2021. In 2020, that value was 64.4%

Source: Comex Stat/Ibram

of 2021, is now implementing a growth programme involving a number of projects that will enable it to triple its output capacity to around 116 million tons, making it the world's fifth largest iron ore producer by 2031. The first phase of the programme, to be concluded by 2026, calls for capex investments of R$ 12 billion covering several projects: CMAI 3, secondary crushing and coils, to enhance product quality, to be concluded by the end of 2022; recovery of 3 million tons of tailings from the Pires dam by 2023; the P15 and P4+ expansion projects at Itabirito, adding a further 19 million tons to existing capacity; recovery of ultrafine tailings and all tailings from the B4 dam, for a further expansion adding 3.5 million tons a year to existing capacity, both projects to be concluded by 2024; capacity expansion at the Central Plant, adding 5 million tons; extension of the shipping terminal at Itaguaí, adding 15 million tons and bringing capacity up to 60 million tons by 2025; and a further project for the recovery of tailings, adding 2.6 million tons a year, in 2026. The second phase of the programme is still at the planning stage, but projects include Itabirito P28 Mascate, Itabirito P28 Esmeril, and conversion of the central plant and expansion of the shipping terminal to 84 million tons and 130 million tons a year respectively.

Like other players in the iron ore industry, CSN Mineração is also focusing

on improving the quality of its products. This will enable it to obtain better prices on the world market, which is now rewarding those suppliers whose ore has a higher iron content and a correspondingly lower content of contaminants such as silica and alumina. At the same time, the company is also committed to lowering its production costs. The outlook for 2022 is that it will reduce its C1 cost by a full dollar, from US$ 19 to US$ 18 per ton.

Anglo American experienced a slight fall in output, amounting to around 5 percent, at its Minas-Rio operation, the result of unforeseen maintenance work that was required at the plant and of exceptionally heavy rainfall in the last few months of the year. Altogether, in 2021, Anglo American produced 22.95 million tons in Brazil, down from 24.08 million tons in 2020. On the other hand, the company achieved an average US$ 150 per wet metric ton FOB Brazil, considered a very good price. For Minas-Rio in 2022, the company has set a guidance of 24 million to 26 million tons, subject to review depending on the impact of the Covid-19 pandemic.

BAMIN, producing iron ore in Bahia on a scale of 1 million tons per year (the output achieved in 2021), is now focusing its efforts on the construction of the FIOL railway line, needed for transporting ore from the Pedra de Ferro mine at Caetité to the Porto Sul shipping terminal. FIOL is budgeted at R$ 3.3 billion, comprising R$ 1.6 billion in engineering and track laying and R$ 1.7 billion in rolling stock, including locomotives. When it is concluded, the railway will be

*CBMM's niobium mine at Araxá, Minas Gerais*

able to carry 60 million tons a year, though BAMIN itself will occupy only one-third of that capacity, since output at Pedra de Ferro is expected to stabilise at 18 million tons a year. The surplus capacity will be used by other mining companies, by agribusiness, and other industries needing to export their products or to import inputs, capital goods, and machinery. BAMIN's iron ore will be shipped through Porto Sul (South Port) now under construction at Ilhéus in partnership with the Bahia state government. In addition to iron ore, other products to be exported and imported through Porto Sul will include other ores, grain, and fertilisers. A deep-water terminal will be able to accommodate vessels of up to 220,000 tons.

ArcelorMittal has announced a R$ 350 million investment budget for a mine and processing plant at Serra Azul in the state of Minas Gerais, with an output capacity of 4.5 million tons a year of pellet feed, used for steelmaking by the direct reduction process. The plant will be equipped to process compact itabirite ore, which has a relatively low iron content. The ore from the new mine will be shipped primarily to ArcelorMittal's steel mill in Mexico. The venture is scheduled to come on stream in the second half of 2023.

Sulamericana de Metais (SAM), a subsidiary of the Honbridge group of China, is budgeting a US$ 2.1 billion capex for its Bloco 8 venture, listed by the federal government as a strategic project. The company is currently awaiting the environmental licence, to be issued by the Minas Gerais state Secretariat for the Environment, following a decision by Ibama, the federal government's Brazilian Institute for the Environment and Renewable Resources, to hand the licensing procedure over to the state level. As announced earlier, the project calls for construction of a complex at Grão Mogol in Minas Gerais, having an output capacity of 27.5 million tons of iron ore per year, using mineral with a 20 percent iron content, and a processing plant that

will transform the ore into a high quality product. The company had been hoping to obtain the licence before the end of 2021, but says it may still be issued in the early months of 2022.

Samarco, which restarted its operations in December 2020 after a five-year halt dictated by the Fundão dam accident at Mariana, ended 2021 with a total output of 7.7 million tons of iron ore pellets. This level of output represents around 26 percent of installed capacity. Following the success of the first full year back in operation, Samarco is now examining alternatives that will enable it, at some future date, to resume production at 100 percent of its capacity.

Mineração Usiminas, which also ended the year with an increase in output and sales, is close to concluding a R$ 235 million investment in the construction of a filtration system and dry-stacking of tailings, which will enable it to dispense with tailings dams at its mining sites. The company has also invested R$ 24 million in a new high-frequency screening plant, enabling it to improve the quality of its pellet feed and thus to compete more effectively in the market.

## Higher gold price favours new investments

A marked advance in world prices has helped to warm up the gold mining industry in Brazil. In 2021 gold ranked second in the output list, in value terms, behind iron ore, with a figure of R$ 27.05 billion or about 8 percent of total output of minerals in the year. The prospect for the next few years suggests further growth in output, at least by industrial producers, in the light of the major investments now programmed and projects now being implemented. The rising gold price and the depreciation of the real act together to favour the feasibility of projects, affording reasonably attractive rates of return on investments.

One of the main investments is that of GMining Ventures, acting through its Brazauro subsidiary. To be brought on stream before the end of 2022, the Tocantinzinho project, located in the municipality of Itaituba in the state of Pará, calls for a total investment of US$ 605 million, comprising US$ 442 million in implementation, US$ 151 million in sustaining, and US$ 12 million in mine closure costs. The open pit mine will operate for ten years, working a deposit holding 1.87 million ounces of gold. Total output during the lifetime of the venture is forecast at 1.625 million ounces, at a rate of 187,000 ounces a year in the first eight years. Production on a commercial scale is due to begin in the third quarter of 2024.

Belo Sun, controlled by the Forbes & Manhattan group, has another major gold project under development in Brazil. With a capex budgeted at US$ 298 million, its Volta Grande project, located in the municipality of Senador José Porfírio, near Altamira in Pará, is expected to produce 268,000 ounces in each of the first ten years, for a total gold output over its productive lifetime of 3.53 million ounces at an all-in sustaining cost (AISC) of US$ 779 per ounce of gold. The feasibility study is based on reserves of 3.8 million ounces and resources (measured

*Largo's vanadium plant at Maracás, Bahia*

and indicated) of 5.0 million ounces, and a price of US$ 1,200 per ounce. In 2021 this project, too, was added to the federal government's list of strategic projects. In December 2021 Belo Sun signed an agreement with Incra, the National Land Reform Institute, giving it full use of the land under Incra's control for the duration of mining operations at Volta Grande. In exchange, the company agrees to extend benefits to local farmers, landowners, and the municipality itself.

Equinox Gold Corporation, which reported a worldwide 2021 output of 602,000 ounces, is planning to extend its Brazilian operations. For 2022 the company's published guidance is the range from 625,000 to 710,000 ounces, with Brazil to provide part of the increase. Equinox's worldwide capital spending budget for the next few years amounts to US$ 450 million. In Brazil, construction at its Santa Luz project in Bahia is now nearing completion, after Yamana had begun work on it in 2021 and then reclassified it as in "care and maintenance". Equinox is investing US$ 103 million in the venture, which is due to come on stream by the end of March 2022. The company has also concluded a feasibility study for underground mining at its Aurizona site, which would add a further eleven years to the mine's useful lifetime, in addition to boosting annual output volume. The development work needed to gain access to the underground ore deposit may begin as early as the fourth quarter of 2022. The underground mine has the potential to produce 740,500 ounces of gold over a ten-year period.

JMC Yamana Gold, whose operation is located at Jacobina in Bahia, is engaged in an expansion programme that will boost capacity from the present 2.5 million tons of ore per year to 3.65 million tons. At the metallurgical plant, the present capacity of 7,500 tons per day will be raised to 8,500 tons before the end of 2022, and at the same time feasibility studies will begin for the next stage, known as Phase Three, aiming at a further increase to 10,000 tons a day. The feasibility study and schedule for construction are to be concluded by a 2023 deadline. With this expansion, gold output at Jacobina will rise to approximately 200,000 ounces in 2022 and then again to an average 230,000 ounces per year from 2023 onward. Capital investments for the Phase Two expansion are budgeted at approximately US$ 57 million, made up of US$ 35 million for the processing plant, US$ 14 million for the underground mine, and US$ 8 million for infrastructure.

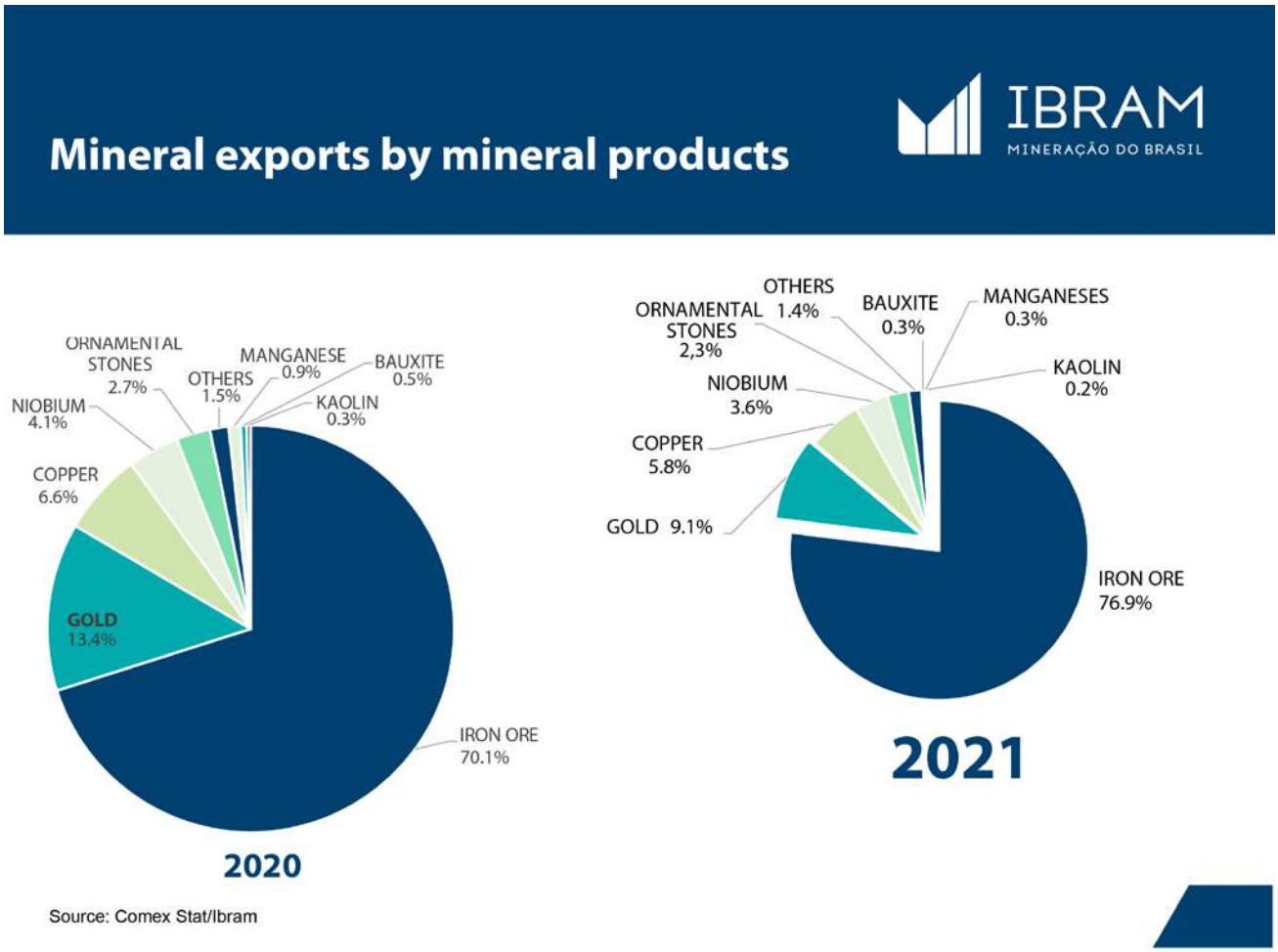
Serabi Gold, which produced 33,848 ounces of gold in 2021, has begun development work towards the implementation of its Coringa project in the state of Pará. The venture aims to exploit a deposit holding over 195,000 ounces of gold. Planned annual output is 38,000 ounces over a nine-

year period. The investment is estimated at US$ 25 million and the feasibility study was based on a projected gold price of US$ 1,450 per ounce. The AISC is US$ 852 per ounce, considered a low cost, and the project has the advantage that a tailings dam will not be required. The machinery and equipment for a processing plant that will have a capacity of 850 tons a day are yet in the site. When Coringa comes on stream in 2023, Serabi will then rank as a medium-sized gold mining company, having an overall production capacity of 100,000 ounces of gold per year.

Aura Minerais, which since 2020 has been a publicly quoted company on the Brazilian stock exchange, has plans to double its output capacity by 2024, with the target stated as the range from 400,000 to 480,000 ounces equivalent. In 2021 Aura produced 269,000 ounces worldwide, including 61,000 ounces in Brazil, at the Ernesto Pau a Pique complex in Mato Grosso. In the same year Aura Minerals ranked first among the thirty best performing companies on the Toronto Stock Exchange (TSX), measured by the return to shareholders over the last three years. In Brazil, Aura's increased output is to come from two projects, Almas and Matupá. At Almas, in the state of Tocantins, implementation is beginning now, with startup planned for 2023. In the first five years of operation the open-pit mine is expected to produce 51,000 ounces a year. The mine's productive lifetime is estimated at seventeen years.

The Matupá project, for which the preliminary economic assessment study estimated a capital cost of approximately US$ 94.6 million, is expected to produce around 60,000 ounces of gold in the first three years, averaging 42,700 ounces a year over the mine's estimated seven-year productive lifetime, at an AISC of US$ 765 per ounce. The project is located in the state of Mato Grosso, in the gold-bearing province known as Juruena-Teles Pires.

*Lundin Mining's Chapada unit*

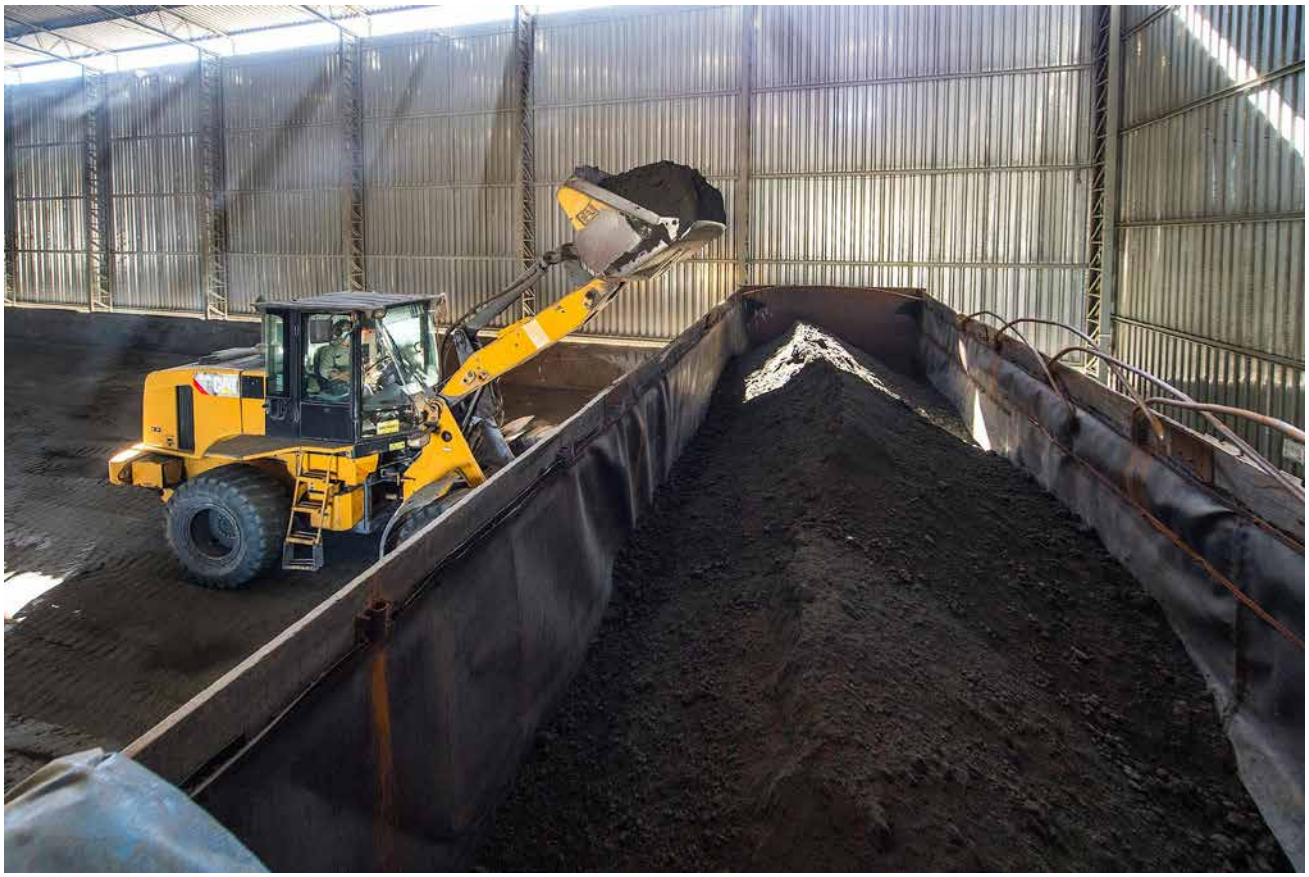



Great Panther, which reported a 2021 output of 105,000 ounces, of which 79,348 ounces came from its Tucano mine in the northern state of Amapá, has programmed a 2022 capital spending budget of US$ 22 million. This includes US$ 9 million for the development of underground mining and US$ 6 million for exploration. The company is currently focusing its attention on recovering its production capacity, beginning in the second half of 2022. Output at Tucano was 37 percent lower in 2021 compared with the previous year, owing mainly to a lower gold content in the ore fed to the crushing plants. Investment in exploration at Tucano has two aims: the conversion and extension of resources close to the mine, and the development of new regional exploration targets. A high-content gold trend extending over a distance of 16 kilometres (10 miles) has already been successfully identified in the same region. For 2022, Great Panther has defined an output guidance in the range from 100,000 to 119,000 ounces of gold equivalent. Plans for the coming year also include speeding up the decision to develop the high-grade underground mine at the Urucum Norte deposit. Engineering and licensing studies are now in progress. Construction work is due to begin in late 2022, with a view to bringing the Urucum Norte underground mine into operation in 2023.

Amarillo Gold, now controlled by Hochschild Mining, is beginning construction work at its Posse project, located at Mara

Rosa, for which it has already obtained an Installation Licence (Licença de Instalação). The Posse gold project includes an open-pit mine, a carbon-in-leach (CIL) plant, and dry-stacking of tailings. An economic feasibility study concluded in June 2020 showed that Posse will produce gold at an AISC cost of US$ 656 per ounce, based on a gold price of US$ 1,730 per ounce and an exchange rate of R$ 5.30 to the dollar. The mine's initial productive lifetime is stated as ten years, with output to begin at 104,000 ounces of gold per year and a present value after tax of US$ 360 million.

Big River Gold is pressing ahead with its preparations for implementing its Borborema project, located in the municipality of Currais Novos in the state of Rio Grande do Norte, where capital investment is budgeted at US$ 94.6 million. The project includes a mine and a plant, with an initial output capacity of 71,500 ounces of gold per year for a duration of 10.2 years, at an AISC of US$ 713 per ounce. In Phase One of the operation, ore output will be 2 million tons per year, obtained from open-pit mining. The Borborema deposit holds total resources of 2.43 million ounces of gold, including a reserve of 1.61 million ounces. For this reason the company is already looking at the possibility of doubling ore production to 4 million tons a year, in either the second or third year of operations. One of the advantages of the project is that a tailings dam will not be needed.



*Copper concentrate at Mineração Caraíba*

## Copper and nickel gain greater prominence

Copper ranked third by value among Brazil's mineral products in 2021, behind iron ore and gold. As in the case of those two products, copper prices too are experiencing a virtuous circle. The prospects for growth in Brazil are good, as can be seen from the projects currently in execution and the exploration work now in progress, principally in Bahia and along both sides of the Pará-Mato Grosso state border. In Bahia, Mineração Caraíba is making important discoveries in the Curaçá Valley, while in the Mato Grosso-Pará area porphyries discovered in the Alta Floresta region are an indication of favourable potential. Specialists believe that this area may become a new mining frontier in Brazil, with an excellent potential for the production of copper and associated minerals.

Vale, Brazil's leading producing company with two ventures, Salobo and Sossego, both in Pará, is betting heavily on expanding its copper production. Forecasts show that Vale's copper output may rise to the 500,000 ton level by 2025. Its Salobo III project, in which it is investing an estimated US$ 570 million to US$ 670 million with a 2022 startup date, will add some 30,000 to 40,000 tons per year to its copper capacity. Vale is also examining the option of starting its Salobo IV project, which would boost output capacity by a further 30,000 tons a year of copper content in concentrates. Another project in Vale's portfolio is Alemão,

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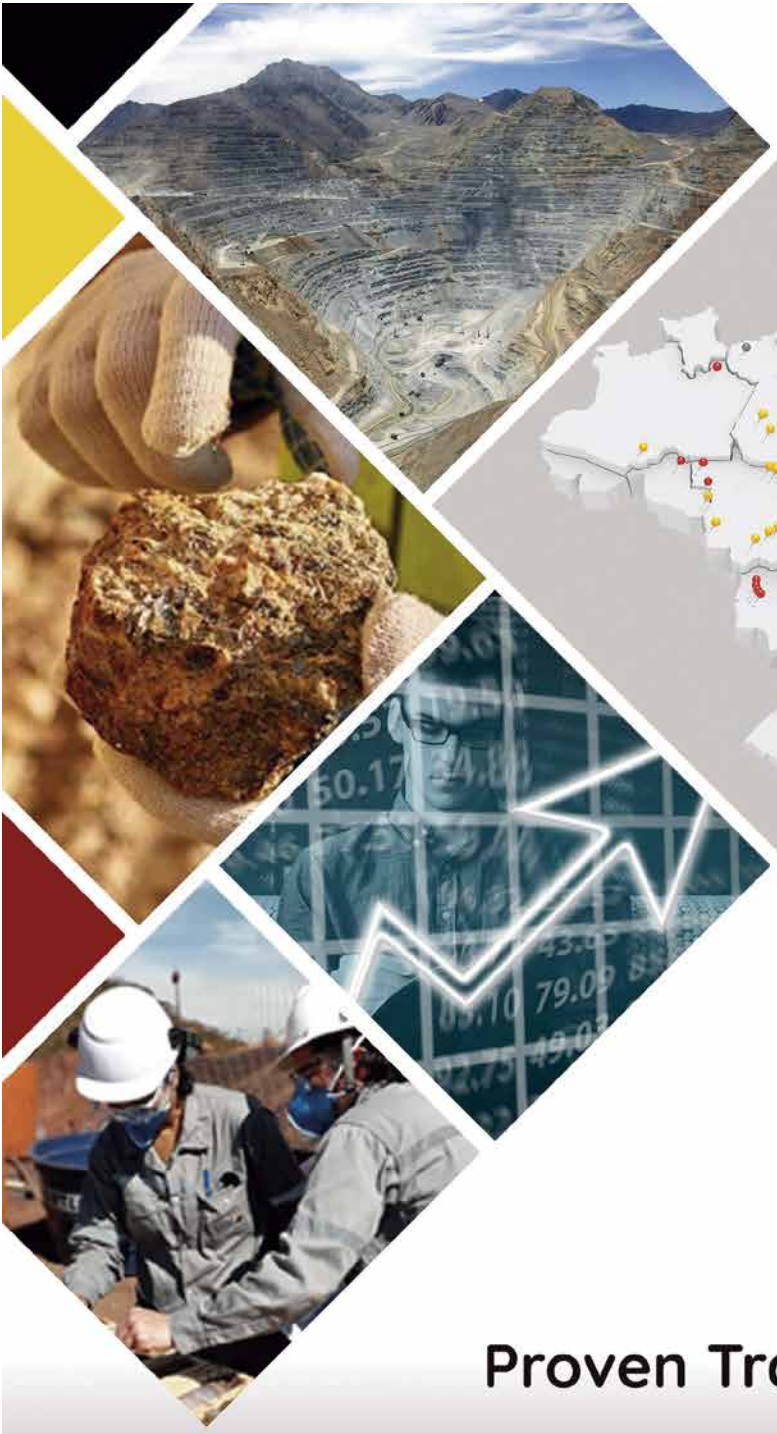

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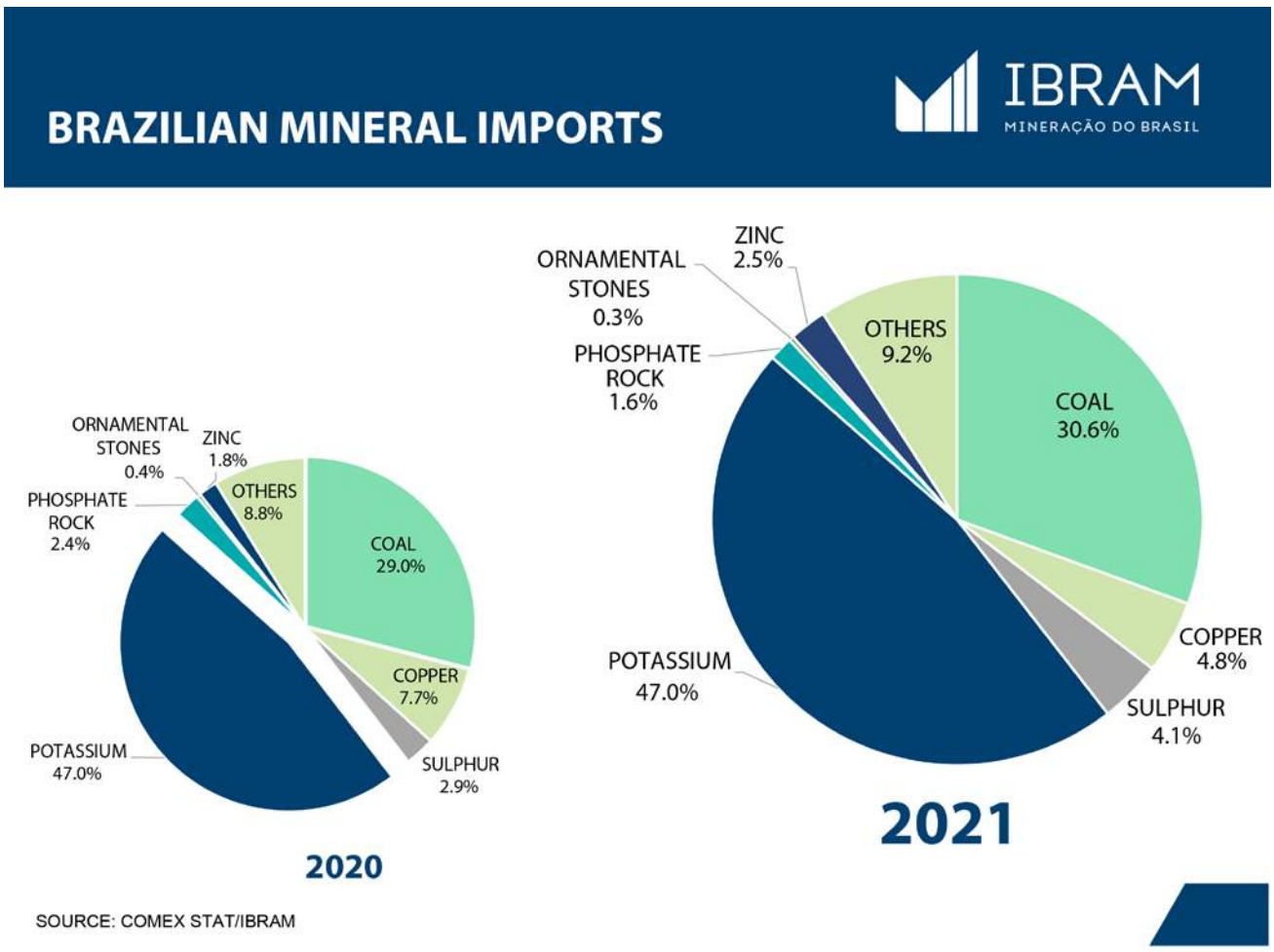
with a feasibility study to be concluded in 2022. This will be an underground mine in the Carajás region, at the site where the Igarapé Bahia gold mine was formerly worked, with a planned capacity of 60,000 tons of copper a year. To finance the venture, Vale is considering the streaming option of advance sales of the gold to be mined at the site, in the light of the high gold content of the copper ore at Alemão. Vale's third copper project in Brazil is Cristalino, located close to the Sossego unit in what Vale calls the South Hub. A feasibility study is now in progress, which includes extending the productive lifetime of the Sossego processing plant. Output capacity at Alemão is envisaged as 80,000 tons of copper per year. In a further addition to the South Hub, Vale is considering the possibility of exploiting satellite deposits such as Bacaba, Visconde, and 118, which would require the construction of a wholly new processing plant in the area. Similarly, in the Salobo area Vale is looking at the feasibility of what it now calls the North Hub, involving five separate deposits that together represent a potential annual copper output in the range from 70,000 to 100,000 tons. The five deposits are named Paulo Afonso Sul, Pojuca, Gameleira, Furnas, and Grota Funda.

Ero Copper, present in Brazil through Mineração Caraíba S.A., is planning to



more than double its output capacity over the next four years, from the present level of 45,500 tons (the 2021 result) to a range from 92,000 to 102,000 tons, to be completed by 2025. This is to be achieved under two new projects: an expansion programme at the Pilar mine in Bahia, and implementation of the Boa Esperança project in Pará. Capital spending is estimated at around US$ 605 million, to be spread over a period of several years, comprising US$ 300 million for construction of the Boa Esperança project; US$ 250 million for works at the Pilar 3.0 project, including construction of a vertical external shaft, wider than the existing one, with the associated infrastructure such as ventilation, cooling, and equipment; US$ 35 million in auxiliary costs, including a contingency fund and the cost of managing the outsourced construction work; and approximately US$ 30 million to fund the expansion of the Caraíba mining complex, which includes boosting the ore crushing capacity to 2 million tons per year and improvements in the long-term storage capacity for tailings, needed to accommodate the increased volume that will arise from the extension of the mine's productive lifetime. The Boa Esperança project is now awaiting board approval for construction work to begin, planned for the second half of 2022. The project comprises an open-pit mine and a processing plant. In the first five years of operations it is expected to produce 35,000 tons of copper content in concentrates, at a cash cost of US$ 1.12 per pound. The productive lifetime is provisionally estimated at twelve years, with the expectation that the period will be lengthened as the results of exploration work now being done become known.

A new copper producer appeared on the Brazilian scene in 2021, when Mineração Vale Verde inaugurated its Serrote project. Located in the northeastern state of Alagoas, Serrote operates on a scale of 20,000 tons per year of copper equivalent, taken from an open-pit mine having a projected productive lifetime of fourteen years. Vale Verde has the capacity to process 4.1 million tons of ore per year. The ownership of the company is disputed. Until October 2021 Vale Verde was controlled by Appian Advisory Capital Brazil, which then sold it, together with another mining company it owned, Atlantic Nickel, to the Sibanye-Stillwater group of South Africa, for an agreed price of US$ 1 billion. In January 2022, however, Sibanye-Stillwater cancelled the acquisition, alleging a geological event at Atlantic Nickel's Santa Rita mine. Appian now says it is going to take the South African company to court to uphold the original deal.

Lundin Mining exceeded its output guidance in 2121, producing 52,019 tons of copper and 76,000 ounces of gold. For 2022 it has programmed an expenditure of US$ 65 million at Chapada, in the state of Goiás, including US$ 10 million for exploration alone, which includes 60,000 metres of drilling. The company is also proceeding with its studies aimed at optimising the mine's productive lifetime. For 2022, Lundin forecasts output in the range from 53,000 to 58,000 tons of copper and from 70,000 to 75,000 ounces of gold.

*Vale's Brucutu mine*

## Nickel and zinc

Although only three companies –Vale, Anglo American, and Atlantic Nickel – are producing it at the moment, nickel is gaining importance in the Brazilian mining industry. Now ranking in ninth place, it is expected to increase its share of overall mining output over the next few years, in the light of companies' present and future plans.

Vale, now the world's leading nickel producer, is thinking of enlarging its Onça-Puma venture in Pará. Bringing a second furnace on stream, the company will add 10,000 to 12,000 tons a year to its existing capacity, and further expansions are already on its radar.

Horizonte Minerals is beginning implementation of its Araguaia ferronickel project aimed at the stainless steel industry and is now programming the execution of its Vermelho project, both of which are located in the state of Pará, within the area of influence of Carajás. Vermelho will produce both nickel and cobalt, with an eye mainly on the market for batteries for electric vehicles. The Araguaia project comprises a mine and mill with a capacity of 52,000 tons a year of ferronickel having a nickel content of 14,500 tons. The investment is budgeted at US$ 443 million and the productive lifetime is 28 years. The feasibility study proposes a second stage, doubling the capacity to 29,000 tons a year of nickel contained in ferronickel. The Vermelho project also calls for a new open-pit mine to produce lateritic ore and a high-pressure leaching plant, in addition to a refining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unit to produce sulphates. Production is to be on the scale of 25,000 tons of nickel and 1,250 tons of cobalt. The initial investment is budgeted at US$ 652 million, for a productive lifetime estimated at 38 years. In November 2021 Horizonte Minerals signed several investment and subscription agreements as part of a US$ 633 million financing package, ensuring the resources that will be needed for executing the Araguaia project.

Atlantic Nickel, formerly controlled by the Appian group which sold it it to Sibanye-Stillwater, has drawn up a Preliminary Economic Assessment (PEA) extending the period of operations at the Santa Rita mine from eight to 34 years. Santa Rita is located at Itagibá in the state of Bahia. The new PEA estimates the potential for underground mining at 26 years, which added to the eight years for the open-pit mine gives the new total of 34 years. The Santa Rita operation is to be divided ino two stages. First, Atlantic Nickel will operate only the open-pit mine until 2028, with a planned capacity of 20,000 to 25,000 tons per year of nickel content in concentrates. In the second stage an underground mine will be opened, to remain in operation for a further 26 years. Under the terms of the PEA, investments in the first five years will amount to US$ 355 million. Soundings taken by Atlantic Nickel confirm that the planned underground mine holds mineral resources (indicated plus inferred) adding up to 134 million tons of ore having a high nickel content stated as 0.54 percent. This second stage will raise capacity to the range of 40,000 to 45,000 tons a year of nickel in concentrates.

*Bamin's Pedra de Ferro mine at Caetité, Bahia*

In zinc, Nexa Resources is concluding the implementation of its Aripuanã project in Mato Grosso, comprising an underground mine holding polymetallic zinc and a processing plant to produce concentrates of zinc, copper, silver, and gold. Zinc production is estimated at 120,000 tons a year over a period of 13 years, taking into account proved and probable reserves only, estimated at 26.2 million tons. The plant is to process 6,300 tons per day, for an expected output of 66,700 tons of zinc in concentrates, 23,000 tons of lead, 1.87 million ounces of silver, and 13,000 ounces of gold. Owing to the pandemic and adjustments to the project, the total investment cost rose from US$ 392 million to US$ 547 million. Production is expected to begin before the end of March 2022.

In the future, a further zinc venture will emerge in Brazil, if Perth Recursos Minerais decides that its Palmeirópolis project is economically feasible. This is the area for which the company put in a successful bid under the Investment Partnerships Programme (PPI) managed by the Geological Survey of Brazil (SGB-CPRM). Covering an area of over 6,000 hectares (over 23 square miles) in the state of Tocantins, Palmeirópolis

holds a polymetallic deposit containing zinc, copper, lead, and gold. Perth estimates that developing the project would require a capital spending budget of approximately R$ 255 million.

## Niobium, lithium, vanadium, rare earths

Brazil is the world's leading producer of niobium; it is also the only vanadium producing country in Latin America; it is advancing in lithium production; and beginning in 2022 it is expected to become a producer of rare earth elements, as the investments undertaken by several companies begin to bear fruit.

The country is expected to strengthen its position as a niobium producer as the outcome of investments by the country's two producing companies, CBMM and Mineração Taboca. In November 2021 CBMM inaugurated its new unit with an extended output capacity, up from 100,000 to 150,000 tons a year of niobium, in which it had invested around R$ 3 billion over an eight-year period. On that occasion the company announced its intention to double in size by 2030. To this end it has begun a new investment programme involving some R$ 7 billion, to be disbursed from 2023 onward. The company has also invested heavily in developing technologies for the wider use of niobium, in particular its Battery Programme, for which it had earmarked an investment of R$ 60 million in 2021. Under this programme CBMM has signed several international partnership agreements, most recently with Nano One Materials Corp. of Canada, which has developed an innovative process for cost reduction and performance enhancement of cathodes used in lithium ion batteries. CBMM and Nano One will jointly produce niobium oxide for use in this process. In Brazil, a partnership between CMM and Senai, the federal government's Industrial Apprenticeship Service, has launched a pilot plant in Curitiba, Paraná, producing lithium ion batteries and supercapacitors.

Mineração Taboca, controlled by the Minsur group of Peru, is developing a strategic plan aimed at broadening its product range, introducing products that have a higher value-added and making the fullest possible use of its Pitinga polymetallic deposit in the municipality of Presidente Figueiredo in the state of Amazonas. Pitinga's main product in volume terms is tin, but it also holds other materials such as niobium and tantalum, both of which are now being marketed. To date, Taboca has invested some US$ 160 million in the plan, split into four stages, the first two of which have now been completed. Phase One stabilised production and Phase Two achieved higher productivity by increasing the rate of recovery in the processing plants, which now operate more efficiently. At present the company is implementing Phase Three, readying a pilot plant to improve niobium and tantalum concentrates, with a view to obtaining better quality products and developing new ferroniobium and ferrotantalum alloys, which will strengthen the company's market position. Phase Four, the recovery of rare earths contained in the slag left by niobium and tantalum metallurgy, may also

possibly include mining a cryolite deposit. Cryolite has applications in the aluminium industry and can also be used to produce hydrofluoric acid.

In vanadium, whose sole producer is Largo Inc./ Vanádio de Maracás, output was slightly lower in 2021 at 10,300 tons, down from 11,800 tons a year earlier. The main cause of the setback was heavy rainfall. The company is now concluding a US$ 10 million investment in setting up a new unit to produce high purity vanadium, V2O3, which has a wide range of applications in the aerospace industry. This initiative is in line with the company's strategy to boost its sales of high purity products, aiming to achieve a level of 70 percent of all sales income. Ramp-up of the new plant was concluded in the fourth quarter of 2021. Largo is now engaged in constructing two new plants, one to produce ilmenite concentrate and the other titanium dioxide (TiO2). Investments are programmed at US$ 29.5 million for the former and US$ 9.5 million for the latter. The capex figure for the ilmenite concentrate plant is US$ 6.8 million higher than the original estimate, because changes were needed following a decision to upgrade the TiO2 content from 40 to 45 percent. The company is now seeking to develop more strongly its clean energy storage business, to supply safe and sustainable vanadium redox flow batteries (VRFB) to meet demand in the rapidly growing renewable energies market.

In rare earths, Mineração Serra Verde has begun work on a project to be concluded and to become operational before the end of 2022. This will be Brazil's first mining venture producing and processing rare earths only. It is located in the municipality of Minaçu on the northern edge of the state of Goiás, which holds one of the world's largest deposits of ionic clays. Begun in 2009 as a spin-off from Mining Ventures, this project aims to process from 11 million to 13 million tons per year of raw ores that will yield 7,000 tons a year of rare earth oxides (REO) contained in the end product, with a content in excess of 92 percent, adopted as the minimum specification for oxides in mixed carbonates. The productive lifetime of the venture in the initial stage is estimated at 24 years, but the size of the resources would allow this period to be extended or for production capacity to be expanded.

In the lithium area, Sigma Lithium, acting through the intermediary of Sigma Mineração, has also begun construction work at its Grota do Cirilo project, which will have a capacity of 220,000 tons of spodumene concentrate. The company possesses reserves of 13.5 million tons of ore with a 1.56 percent lithium oxide content, at its Xuxa mining venture in the municipalities of Araçuaí and Itinga, in the Jequitinhonha River Valley region in the north of Minas Gerais. Capital expenditure required for the project is estimated at US$ 65 million.

AMG Mineração S.A. is investing US$ 150 million in a project to increase its output of lithium concentrate, recovering resources now held behind two tailings dams (in disuse since 2018) in the municipalities of Nazareno and São Tiago, in Minas Gerais, where the company operates a complex at which, in addition to lithium concentrate, it also produces spodumene,

tin, tantalum, and feldspar. AMG is now the world's leading producer of tantalum, providing 23 percent of global output. The planned expansion will raise capacity to 90,000 tons of lithium concentrate per year. AMG has closed an advance sales contract to deliver 200,000 tons of lithium concentrate over a five-year period, averaging 40,000 tons per year. The project will contribute to the dismantling of the two dams and to the economic disposal of the tailings, reducing the risk. After the existing reserves held at these dams are exhausted, the processing plant will be fed instead by the new tailings still to be produced by tantalum mining.

## Fertilisers: the search for reduced dependence

While it is the world's fourth largest consumer of fertilisers, it is only the tenth largest producer, pointing to the need to increase domestic output in the next few years to meet the growing demands of agribusiness. Imports of fertilisers consistently tend to depress the trade surplus that the country earns from its exports of iron ore, gold, copper, and even soyabeans, which in 2021 were its second largest export product. In In a bid to reduce this dependence the government, acting jointly with private enterprise, has drawn up a national feritiliser plan, now awaiting approval and subsequent publication.

Brazil's chances of reducing its import dependence reside above all in phosphate, although there are also major projects for potash mining. In phosphates, the main project in evidence at the moment is Galvani's Santa Quitéria, with a capex of around R$ 2.5 billion, planned as an integrated operation combining mining, production, and granulation of phosphated fertilisers, a port facility, and distribution centres to supply customers in the Northern and Northeastern regions of Brazil. In addition to fertilisers, Santa Quitéria will also produce dicalcium phosphate and yellowcake (uranium concentrate), the latter to be supplied exclusively to Indústrias Nucleares do Brasil (INB). Within five years this project will quadruple Galvani's output capacity for phosphated fertilisers to 2,2 million tons a year, up from the present level of 540,000 tons, while its sales income will be multiplied by five.

Aguia Fertilizantes has now been issued with a Preliminary Licence, and is awaiting the Installation Licence, for its Três Estradas project located at Lavras do Sul, in the state of Rio Grande do Sul, where it expects to invest around US$ 100 million to bring the operation on stream.

In potash mining, the only project in view is that of Potássio do Brasil at Autazes, in the state of Amazonas. This venture may require investments of up to US$ 2.5 billion. The project specifications include two shafts each measuring 7 to 8 metres (23 to 26 feet) in diameter, an underground mine at a depth of around 800 metres (2,600 feet), a potassium concentrates plant, repairs to a road 12 kilometres (7.5 miles) long, a port facility on the Madeira River, and a power transmission line to connect the site with the existing Tucuruí–Manaus line, at a distance of approximately 130 kilometres (80 miles). □

# THE 200 LARGEST BRAZILIAN MINING COMPANIES

| Ranking | Company | Product | Number of Operations | Output Value (in R$) | % of Output Value |
|---|---|---|---|---|---|
| 1 | Vale S.A | Iron ore | 23 | 164,255,963,993.49 | 48.4318 |
| 2 | Minerações Brasileiras Reunidas S.A | Iron ore | 5 | 20,004,211,531.69 | 5.8984 |
| 3 | Anglo American Minério de Ferro Brasil S.A | Iron ore | 2 | 19,098,758,377.08 | 5.6314 |
| 4 | CSN Mineração S.A. | Iron ore | 2 | 18,578,566,815.77 | 5.4780 |
| 5 | Salobo Metais S.A. | Copper and Gold | 1 | 7,949,261,276.65 | 2.3439 |
| 6 | Kinross Brasil Mineração S.A | Gold | 1 | 5,234,008,889.36 | 1.5433 |
| 7 | Mineração Usiminas S.A | Iron ore | 3 | 5,213,971,404.03 | 1.5374 |
| 8 | AngloGold Ashanti Córrego do Sítio Mineração S.A | Gold | 6 | 3,624,297,560.48 | 1.0686 |
| 9 | Vallourec Tubos do Brasil Ltda. | Iron ore | 1 | 3,301,615,056.50 | 0.9735 |
| 10 | Mineração Maracá Indústria e Comércio S.A | Copper and Gold | 3 | 3,055,019,575.11 | 0.9008 |
| 11 | Mosaic Fertilizantes | Phosphate and Potassium | | 2,827,987,055.51 | 0.8338 |

# BAMIN IS OPENING A NEW EXPORT CORRIDOR IN BRAZIL

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| Ranking | Company | Product | Number of Operations | Output Value (in R$) | % of Output Value |
|---|---|---|---|---|---|
| 12 | Mineração Caraíba S.A | Copper | 6 | 2,552,842,770.30 | 0.7527 |
| 13 | Mineração Paragominas S.A | Bauxite | 1 | 2,293,645,586.45 | 0.6763 |
| 14 | Ferrous Resources do Brasil S.A | Iron ore | 1 | 2,166,719,690.05 | 0.6389 |
| 15 | Ferro + Mineração S.A. | Iron ore | 1 | 2,113,268,635.36 | 0.6231 |
| 16 | Jacobina Mineração e Comércio Ltda | Gold | 1 | 1,742,233,262.79 | 0.5137 |
| 17 | Mineração Rio do Norte S.A | Bauxita | 1 | 1,634,182,593.34 | 0.4818 |
| 18 | Ferromar Indústria e Comércio S.A | Iron ore | 1 | 1,596,484,031.57 | 0.4707 |
| 19 | Baovale Mineração S.A | Iron ore | 2 | 1,527,233,874.07 | 0.4503 |
| 20 | Extrativa Mineral S/A | Iron ore | 1 | 1,491,583,114.69 | 0.4398 |
| 21 | Mineração Corumbaense Reunida S.A | Iron ore | 2 | 1,443,703,840.88 | 0.4257 |
| 22 | Atlantic Nickel | Nickel | 6 | 1,374,096,655.57 | 0.4052 |
| 23 | Mineração Conemp Ltda. | Iron ore | 2 | 1,363,008,954.26 | 0.4019 |
| 24 | Mineração Aurizona S.A | Gold | 1 | 1,301,558,949.48 | 0.3838 |
| 25 | ArcelorMittal Brasil S.A | Iron ore | 2 | 1,086,314,141.29 | 0.3203 |
| 26 | Alcoa World Alumina Brasil Ltda. | Bauxite | 4 | 1,061,479,114.12 | 0.3130 |
| 27 | Minerita Minérios Itaúna Ltda. | Iron ore | 2 | 943,820,785.59 | 0.2783 |
| 28 | Votorantim Cimentos S.A | Limestone | 61 | 891,975,718.64 | 0.2630 |
| 29 | Mineração Serra Grande S.A | Gold | 4 | 886,717,230.17 | 0.2615 |
| 30 | Anglo American Niquel Brasil Ltda. | Nickel | 2 | 861,665,614.39 | 0.2541 |
| 31 | Mineração Baratinha S.A. | Iron ore | 1 | 857,018,583.84 | 0.2527 |
| 32 | Gerdau Açominas S.A | Iron ore | 2 | 817,085,921.46 | 0.2409 |
| 33 | Cia de Mineração Serra da Farofa | Iron ore | 3 | 816,618,458.45 | 0.2408 |
| 34 | Mineração Serras do Oeste Eireli | Gold | 2 | 814,642,150.57 | 0.2402 |
| 35 | Mina Tucano Ltda. | Gold | 1 | 756,248,296.66 | 0.2230 |
| 36 | Nexa Recursos Minerais S.A | Zinc | 6 | 746,539,099.45 | 0.2201 |
| 37 | Mineração Apoena S.A | Gold | 2 | 746,105,335.79 | 0.2200 |
| 38 | Samarco Mineração S.A | Iron ore | 1 | 714,649,295.77 | 0.2107 |
| 39 | Niobrás Mineração Ltda | Niobium | 2 | 652,934,400.64 | 0.1925 |
| 40 | Mineração Riacho dos Machados Ltda. | Gold | 1 | 585,484,184.34 | 0.1726 |
| 41 | Fazenda Brasileiro Desenvolvimento Mineral Ltda | Gold | 4 | 583,708,217.56 | 0.1721 |
| 42 | Minérios Nacional S.A | Iron ore | 1 | 566,727,283.35 | 0.1671 |
| 43 | JMN Mineração S.A | Iron ore | 1 | 530,430,621.96 | 0.1564 |
| 44 | Mineração Taboca S.A | Tin, Niobium and Tantalum | 1 | 529,206,289.84 | 0.1560 |
| 45 | SAFM Mineração Ltda | Iron ore | 1 | 524,548,778.16 | 0.1547 |
| 46 | Mineração Comisa Ltda | Iron ore | 1 | 507,041,178.80 | 0.1495 |
| 47 | Bahia Mineração S.A | Iron ore | 1 | 483,180,827.61 | 0.1425 |
| 48 | White Solder Metalurgia e Mineração Ltda | Tin | 18 | 481,068,469.25 | 0.1418 |
| 49 | Mineral do Brasil Ltda | Iron ore | 10 | 470,571,378.70 | 0.1388 |

| Ranking | Company | Product | Number of Operations | Output Value (in R$) | % of Output Value |
|---|---|---|---|---|---|
| 50 | Morgan Mineração Indústria e Comércio Ltda | Fertilesers | 1 | 457,294,152.66 | 0.1348 |
| 51 | Imerys Rio Capim Caulim S.A | Kaolin (China clay) | 4 | 445,952,381.95 | 0.1315 |
| 52 | MBL Materiais Básicos Ltda | Iron ore | 3 | 436,388,446.12 | 0.1287 |
| 53 | Sama S.A Minerações Associadas | Asbestos | 1 | 428,963,901.83 | 0.1265 |
| 54 | Companhia Brasileira de Metalurgia e Mineração | Niobium | 1 | 409,415,054.29 | 0.1207 |
| 55 | NX Gold S.A | Gold | 3 | 400,566,336.83 | 0.1181 |
| 56 | Mineração Vale do Jacurici S.A | Chromite | 1 | 394,956,605.15 | 0.1165 |
| 57 | Nacional de Grafite Ltda | Graphite | 4 | 385,493,835.76 | 0.1137 |
| 58 | Serabi Mineração S.A | Gold | 7 | 374,472,883.36 | 0.1104 |
| 59 | AMG Brasil S.A | Espodumenium, Tantalum and Feldspar | 1 | 362,460,145.50 | 0.1069 |
| 60 | AVB Mineração Ltda. | Copper and Gold | 2 | 323,181,193.93 | 0.0953 |
| 61 | LafargeHolcim (Brasil) S.A | Limestone | 31 | 321,897,867.96 | 0.0949 |
| 62 | MMX Corumbá Mineração S.A | Iron ore | 1 | 309,921,845.36 | 0.0914 |
| 63 | Pilar de Goiás Desenvolvimento Mineral Ltda | Gold | 2 | 282,103,026.16 | 0.0832 |
| 64 | Itaminas Comércio de Minérios S.A | Iron ore | 3 | 281,732,476.14 | 0.0831 |
| 65 | Mineração Jundu Ltda. | Quartz Sand | 11 | 278,233,287.42 | 0.0820 |
| 66 | Copelmi Mineração Ltda | Coal | 8 | 265,343,934.65 | 0.0782 |
| 67 | Polimix Concreto Ltda | Limestone | 17 | 260,538,948.88 | 0.0768 |
| 68 | GICS Indústria Comércio e Serviços S.A | Clay and Basalt | 3 | 230,761,333.56 | 0.0680 |
| 69 | Embu S.A Engenharia e Comércio | Granite, Sand and Clay | 4 | 221,965,917.84 | 0.0654 |
| 70 | Carbonífera Metropolitana S.A | Coal | 1 | 221,164,331.11 | 0.0652 |
| 71 | Cadam S.A | Kaolin (China clay) | 1 | 220,806,347.82 | 0.0651 |
| 72 | MSM Mineração Serra da Moeda Ltda. | Iron ore, manganese and clay | 1 | 214,542,914.76 | 0.0633 |
| 73 | Mineração Belocal Ltda | Limestone | 7 | 209,556,444.07 | 0.0618 |
| 74 | Vermont Mineração Exportação e Importação Ltda. | Granite | 5 | 195,645,208.46 | 0.0577 |
| 75 | Indústria Carbonífera Rio Deserto Ltda | Coal | 3 | 191,895,662.75 | 0.0566 |
| 76 | MML - Metais Mineração Ltda | Iron ore | 3 | 183,329,094.18 | 0.0541 |
| 77 | Tronox Pigmentos do Brasil S.A | Titanium | 2 | 179,402,721.38 | 0.0529 |
| 78 | Votorantim Cimentos N/NE S.A | Limestone | 12 | 177,767,049.05 | 0.0524 |
| 79 | Vetria Mineração S.A | Iron ore | 2 | 175,306,345.12 | 0.0517 |
| 80 | Vanádio de Maracás S.A | Vanadium | 1 | 175,185,634.57 | 0.0517 |
| 81 | Mineração Santa Elina Indústria e Comércio S.A | Zinc | 1 | 172,198,473.40 | 0.0508 |

| Ranking | Company | Product | Number of Operations | Output Value (in R$) | % of Output Value |
|---|---|---|---|---|---|
| 82 | CMOC Brasil Mineração, Indústria e Participações Ltda. | Phosphate | 5 | 171,607,391.51 | 0.0506 |
| 83 | Zona da Mata Mineração S.A | Iron ore | 2 | 158,624,427.60 | 0.0468 |
| 84 | InterCement Brasil S.A | Limestone | 18 | 157,770,919.09 | 0.0465 |
| 85 | Companhia Nacional de Mineração Candiota | Coal | 1 | 151,470,000.06 | 0.0447 |
| 86 | Mineração Floresta do Araguaia S.A | Iron ore | 1 | 146,144,605.02 | 0.0431 |
| 87 | Caltins Calcário Tocantins Ltda | Limestone | 4 | 142,334,011.61 | 0.0420 |
| 88 | Paupedra Pedreiras Pavimentações e Construções Ltda | Gravel and Sand | 1 | 139,514,697.71 | 0.0411 |
| 89 | Euromaquinas Mineração Ltda | Gold | 1 | 139,275,213.46 | 0.0411 |
| 90 | AVG Empreendimentos Minerários S.A | Iron ore | 4 | 131,722,729.33 | 0.0388 |
| 91 | Magnesita Mineração S.A | Magnesite | 6 | 130,236,186.88 | 0.0384 |
| 92 | Brazil Iron Mineração Ltda | Iron ore | 2 | 128,568,305.91 | 0.0379 |
| 93 | Ciplan Cimento Planalto S.A | Limestone | 5 | 126,705,922.89 | 0.0374 |
| 94 | Lipari Mineração Ltda | Diamond | 1 | 122,659,499.13 | 0.0362 |
| 95 | Cia de Ferro Ligas da Bahia Ferbasa | Chromite | 9 | 118,613,836.72 | 0.0350 |
| 96 | Companhia Riograndense de Mineração | Coal | 2 | 115,408,777.33 | 0.0340 |
| 97 | Super Ligas Indústria e Comércio de Metais Ltda | Tin | 12 | 114,415,929.50 | 0.0337 |
| 98 | Xilolite S.A | Talc | 1 | 114,047,691.50 | 0.0336 |
| 99 | Companhia Brasileira de Alumínio | Bauxite | 14 | 113,734,338.36 | 0.0335 |
| 100 | Companhia Siderúrgica Nacional | Dolomite | 1 | 113,412,351.96 | 0.0334 |
| 101 | Mineração Bodoquena S.A | Limestone | 1 | 112,490,682.90 | 0.0332 |
| 102 | Guidoni Ornamental Rocks Ltda | Granite | 16 | 111,323,853.87 | 0.0328 |
| 103 | Vórtice Consultoria Mineral Ltda | Iron ore | 1 | 109,752,067.37 | 0.0324 |
| 104 | Mineração Tabipora Ltda | Gold | 1 | 109,518,384.38 | 0.0323 |
| 105 | Mineração de Calcário Montividiu Ltda. | Limestone | 6 | 109,172,523.91 | 0.0322 |
| 106 | Vetorial Mineração S.A | Iron ore | 3 | 104,838,677.09 | 0.0309 |
| 107 | Carbonífera Belluno Ltda. | Coal | 5 | 98,038,812.76 | 0.0289 |
| 108 | Corcovado Granitos Ltda | Granite | 15 | 97,514,274.62 | 0.0288 |

| Ranking | Company | Product | Number of Operations | Output Value (in R$) | % of Output Value |
|---|---|---|---|---|---|
| 109 | MTransminas Minerações Ltda | Iron ore | 2 | 94,506,354.78 | 0.0279 |
| 110 | Tombador Iron Mineração Ltda | Iron ore | 1 | 93,122,030.86 | 0.0275 |
| 111 | Geocal Mineração Ltda | Limestone, clay and philite | 1 | 92,120,836.38 | 0.0272 |
| 112 | IMI Fabi Talco S.A | Talc | 2 | 90,110,335.98 | 0.0266 |
| 113 | Tejucana Mineração Ltda | Iron ore | 2 | 89,296,111.52 | 0.0263 |
| 114 | Britacal Indústria e Comércio de Brita e Calcário Brasilia | Limestone | 17 | 87,733,143.77 | 0.0259 |
| 115 | Indústria de Calcários Caçapava Ltda. | Limestone | 4 | 86,494,582.72 | 0.0255 |
| 116 | Brasil Minérios S.A | Vermiculite | 2 | 85,221,563.18 | 0.0251 |
| 117 | Calcário Vale do Araguaia Ltda. | Limestone | 2 | 85,150,780.52 | 0.0251 |
| 118 | Cia de Cimento Itambé | Limestone | 2 | 82,337,732.90 | 0.0243 |
| 119 | Ecoplan Mineração Ltda | Limestone | 4 | 79,384,838.17 | 0.0234 |
| 120 | Indústria e Comércio de Calcário Cuiabá Ltda | Limestone | 4 | 79,262,345.38 | 0.0234 |
| 121 | Emal Empresa de Mineração Aripuanã Ltda | Limestone | 2 | 79,246,356.86 | 0.0234 |
| 122 | Empresa de Cimentos Liz S.A | Limestone | 1 | 79,204,937.32 | 0.0234 |
| 123 | Red Graniti Mineração Ltda | Granite | 11 | 79,007,464.25 | 0.0233 |
| 124 | Pará Pigmentos S.A | Kaolin (China clay) | 1 | 78,037,539.62 | 0.0230 |
| 125 | Pirecal Pirenópolis Calcário Ltda | Limestone | 4 | 77,513,797.43 | 0.0229 |
| 126 | Calcário Mato Grosso Indústria e Comércio Ltda | Limestone | 3 | 77,375,569.34 | 0.0228 |
| 127 | Rocha Bahia Mineração Ltda | Granite | 5 | 77,003,885.82 | 0.0227 |
| 128 | Construtora Martins Lanna Ltda. | Sand and gravel | 2 | 76,090,613.79 | 0.0224 |
| 129 | Copacel Indústria e Comércio de Calcário e Cereais Ltda | Limestone | 2 | 74,487,705.46 | 0.0220 |
| 130 | Goiascal Mineração e Calcário Ltda | Limestone | 1 | 74,126,244.20 | 0.0219 |
| 131 | Pedreira Irmãos Machado Ltda | Sand and gravel | 3 | 73,151,508.49 | 0.0216 |
| 132 | Dow Brasil Indústria e Comércio de Produtos Quimicos Ltda | Rock S.Alt | 1 | 72,996,010.22 | 0.0215 |
| 133 | Vale Dourado Mineração Ltda. | Copper and Gold | 1 | 72,318,023.13 | 0.0213 |
| 134 | Minerinvest Mineração Ltda. | Iron ore | 1 | 70,649,367.83 | 0.0208 |
| 135 | Estanho de Rondônia S.A | Tin | 2 | 70,338,664.62 | 0.0207 |
| 136 | Mineração Itaipú Indústria e Comércio Ltda. | Limestone | 1 | 69,695,979.43 | 0.0206 |
| 137 | Calcário Tangará Indústria e Comércio Ltda | Limestone | 2 | 69,090,488.04 | 0.0204 |
| 138 | Itinga Mineração Ltda | Granite and Marble | 11 | 68,599,593.71 | 0.0202 |
| 139 | Ical Indústria de Calcinação Ltda. | Limestone | 3 | 67,173,474.62 | 0.0198 |
| 140 | Horii Agroindustrial de Minérios Ltda | Limestone | 1 | 67,109,889.48 | 0.0198 |
| 141 | Mineração Morro Verde Ltda | Phosphate | 1 | 67,043,138.19 | 0.0198 |

| Ranking | Company | Product | Number of Operations | Output Value (in R$) | % of Output Value |
|---|---|---|---|---|---|
| 142 | Fosnor Fosfatados do Norte Nordeste S.A | Phosphate | 2 | 65,521,152.27 | 0.0193 |
| 143 | GSM Indústria Comércio Importação e Exportação Ltda. | Granite | 8 | 64,598,418.53 | 0.0190 |
| 144 | Granicap Granitos Capixaba Ltda | Granite | 2 | 64,466,515.35 | 0.0190 |
| 145 | Serra Leste Mineração Ltda | Iron ore | 1 | 63,680,987.08 | 0.0188 |
| 146 | Salinas Gold Mineração Ltda | Gold | 5 | 63,636,880.04 | 0.0188 |
| 147 | Itaquareia Ind. Extr. Minérios Ltda | Sand | 7 | 63,250,390.64 | 0.0186 |
| 148 | Jandaia Calcário Agrícola Ltda | Limestone | 5 | 63,047,241.74 | 0.0186 |
| 149 | Mineradora Pedrix Ltda | Sand and gravel | 1 | 62,675,370.04 | 0.0185 |
| 150 | Nanuba Administradora de Bens e Participações Ltda Epp | Granite and Marble | 1 | 62,410,659.04 | 0.0184 |
| 151 | Calcário Ouro Branco Ltda | Limestone | 3 | 62,003,051.54 | 0.0183 |
| 152 | Mibasa Mineradora Barro Alto Ltda | Nickel | 1 | 61,907,406.13 | 0.0183 |
| 153 | Mineração Santiago Ltda. | Sand and gravel | 1 | 59,976,988.87 | 0.0177 |
| 154 | Copebras Indústria Ltda | Phosphate | 2 | 59,451,801.71 | 0.0175 |
| 155 | Mineração Oro Yte Ltda | Limestone | 1 | 58,350,529.08 | 0.0172 |
| 156 | Minerax Mineração Xambioá Ltda. | Limestone | 3 | 57,782,531.85 | 0.0170 |
| 157 | GSS Mineração Ltda. | Iron ore | 1 | 57,640,232.36 | 0.0170 |
| 158 | Britagem Vogelsanger Ltda | Sand and gravel | 11 | 56,826,316.49 | 0.0168 |
| 159 | MIB Mineração Ibirité Ltda | Iron ore | 1 | 56,516,008.57 | 0.0167 |
| 160 | Toledo Mineração Ltda | Granite | 3 | 55,840,927.08 | 0.0165 |
| 161 | Mineração Serra Dourada Ltda | Limestone | 8 | 55,471,428.64 | 0.0164 |
| 162 | Brasitalia - Agregados para ConstruçãoLtda | Sand and gravel | 1 | 53,762,201.46 | 0.0159 |
| 163 | Solo Fértil Indústria e Comércio Ltda | Limestone | 2 | 52,267,832.43 | 0.0154 |
| 164 | Companhia de Desenvolvimento Econômico de Minas Gerais - Codemig | Pyrochlore (Niobium ore) | 5 | 51,769,897.54 | 0.0153 |
| 165 | Terra Goyana Mineradora Ltda | Bauxite | 2 | 51,521,840.03 | 0.0152 |
| 166 | Margem Companhia de Mineração | Limestone | 2 | 50,754,370.73 | 0.0150 |
| 167 | Gecal Indústria e Comércio de Produtos Minerais Ltda | Limestone | 1 | 50,186,735.20 | 0.0148 |
| 168 | Companhia de Cimento Campeão Alvorada - CCA | Limestone | 5 | 49,511,348.64 | 0.0146 |
| 169 | Geoterra Serviços e Mineração Ltda | Sand and gravel | 3 | 49,278,178.39 | 0.0145 |
| 170 | Unimin do Brasil Ltda | Limestone | 5 | 48,933,060.96 | 0.0144 |
| 171 | Reical Indústria e Comércio de Calcário Ltda | Limestone | 2 | 48,743,783.87 | 0.0144 |
| 172 | Thor Nordeste Granitos Ltda | Granite | 3 | 48,638,299.30 | 0.0143 |
| 173 | Cooperativa de Produtores de Estanho do Brasil | Tin | 4 | 48,072,383.07 | 0.0142 |
| 174 | Camil Cáceres Mineração Ltda | Limestone | 2 | 47,918,105.46 | 0.0141 |
| 175 | Mineração Horical Ltda | Limestone | 3 | 47,747,358.78 | 0.0141 |
| 176 | Mineração Nossa Senhora do Carmo Ltda | Limestone | 2 | 47,726,742.00 | 0.0141 |

| Ranking | Company | Product | Number of Operations | Output Value (in R$) | % of Output Value |
|---|---|---|---|---|---|
| 177 | Amazonia Mucajai Mineração Ltda | Sand and gravel | 1 | 47,723,803.23 | 0.0141 |
| 178 | Granorte S.A | Granite | 15 | 47,446,357.59 | 0.0140 |
| 179 | Cooperativa de Mineração dos Garimpeiros do Lourenço Ltda | Gold | 5 | 46,823,374.91 | 0.0138 |
| 180 | Mineração Veiga Ltda | Sand | 12 | 46,607,098.04 | 0.0137 |
| 181 | Contil Indústria e Comércio Ltda | Sand and gravel | 1 | 46,216,171.19 | 0.0136 |
| 182 | Mineração Fazenda dos Borges Ltda | Sand and gravel | 2 | 46,014,928.89 | 0.0136 |
| 183 | Jofege Mineração Ltda | Limestone | 3 | 45,098,099.32 | 0.0133 |
| 184 | Calwer Mineração Ltda | Limestone | 9 | 44,537,723.17 | 0.0131 |
| 185 | Fides Gold Mineradora S.A | Gold | 2 | 44,414,009.35 | 0.0131 |
| 186 | Mineração Argentina e Filhos Extração e Comércio Ltda | Iron ore | 4 | 44,284,504.65 | 0.0131 |
| 187 | Calcário Bonito Ltda | Limestone | 6 | 43,945,924.11 | 0.0130 |
| 188 | Belmont Mineração Ltda | Gravel | 2 | 43,790,251.29 | 0.0129 |
| 189 | Ourocal Mineração Ltda | Limestone | 2 | 43,401,448.56 | 0.0128 |
| 190 | Carbomil Quimica S.A | Limestone | 1 | 43,115,294.47 | 0.0127 |
| 191 | Eimcal Empresa Industrial de Mineração Calcárea Ltda. | Limestone | 1 | 42,839,920.35 | 0.0126 |
| 192 | Pedreira Siqueira Ltda | Gravel | 1 | 41,298,038.93 | 0.0122 |
| 193 | Britagem e Pavimentadora Barracão Ltda | Gravel | 2 | 41,020,243.38 | 0.0121 |
| 194 | Pema Beneficiamento de Minérios Ltda Epp | Sand | 1 | 40,970,898.88 | 0.0121 |
| 195 | C. Fernando R. da Paz & Cia Ltda. | Granite | 6 | 40,107,887.55 | 0.0118 |
| 196 | Carbonífera do Cambuí EIRELI | Coal | 5 | 40,053,946.75 | 0.0118 |
| 197 | Ercal - Empresas Reunidas de Calcário Ltda. | Limestone | 7 | 40,041,278.17 | 0.0118 |
| 198 | Gesso Integral Ltda | Gypsum | 3 | 39,851,959.91 | 0.0118 |
| 199 | Dolomita Indústria e Comércio de Calcário Ltda | Limestone | 2 | 39,813,335.49 | 0.0117 |
| 200 | Lamil Lage Minérios Ltda | Agamatolite | 3 | 39,770,942.01 | 0.0117 |
| | | | | | 91.9429 |

7º

SEVENTH NATIONAL
MEETING ON MEDIUM- AND SMALL-SCALE MINING

**BOOK THIS DATE**

**MAY 24-26, 2022**
**GOIÂNIA, GOIÁS**

**INFORMATION:**

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# PROGRAM

## MAY 24 – OPENING PANEL DISCUSSION

### MINING POLICY

**What mining policy would meet the needs of small and medium-size mining companies?**

- Brazilian Association of Mineral and Mining Research Companies (ABPM)
- Geological Survey of Brazil/Mining & Energy Ministry (SGM/MME)
- National Mining Agency (ANM)
- Chamber of Deputies Mining and Energy Committee
- National Confederation of Industry/Mining Council (CNI/Comin)

## May 25 – SESSIONS

### Morning – PANEL DISCUSSION 1: FINANCING/CORPORATE MANAGEMENT

- How can small and medium-size mining companies attract investors?
- How can a junior company obtain a stock exchange listing in Brazil?

### Morning – PANEL DISCUSSION 2: LOGISTICS/MARKET

- Modes of transport: the Brazilian situation
- Logistical challenges in Brazil
- New energy sources for mining
- Local production arrangements: successful case histories

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ABPM
Associação Brasileira de Empresas de Pesquisa Mineral e Mineração

BRASIL mineral

### Afternoon – PANEL DISCUSSION 3:
### MINING, THE ENVIRONMENT, COMMUNITY RELATIONS

- Differentiated licensing
- LOPM
- Self-licensing
- ASG for small and medium-size companies

### Afternoon – PANEL DISCUSSION 4:
### TECHNOLOGY / MARKET PROSPECTS
### Small and medium-size companies

- What are the technological challenges facing small and medium-size mining companies?
- How can small and medium-size companies gain access to technologies?
- Effects of technology on the productive market
- How to increase supply and optimize productive arrangements

## May 26 – SYMPOSIUM ON INDUSTRIAL MINERALS

### Morning – Opening talk:
Profile, trends, and SWOT analysis of main groups of industrial minerals, with details of mineral systems and markets

### Morning – Second talk:
CPRM's programs and projects (for small and medium-size mining companies)

### Morning – Panel Discussion 1:
Opportunities and prospects of supply and demand for high-performance minerals for plastics, paint, and paper

### Morning – Panel Discussion 2:
Opportunities and prospects for minerals with environmental, climatic, and energy applications

## May 26 – SYMPOSIUM ON AGROMINERALS

### Afternoon – Panel Discussion 3:
Soil remineralizers and natural fertilizers
Presentation: Abrefen
The market, associates, and Brazil's production potential

- Launch of Abrefen's online magazine

### Afternoon – Panel Discussion 4:
Technical issues: Brazil's economic dependence and the global crisis – Brazil, a pioneer in sustainable solutions

### First talk:
The world fertilizer market and silicate agrominerals: National and regional solutions

### Second talk:
The possible use of mine tailings for producing remineralizers: Legislation and public policies

### Third talk:
ESG agenda, sustainability, carbon sequestration

### Afternoon – Panel Discussion 5:
**Round Table:** Technical specialists answer questions from the audience about soil remineralizers, natural fertilizers, and public policies

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# GOVERNMENT WELCOMES "UPWARD TRAJECTORY" IN NEW INVESTMENTS IN MINING INDUSTRY

Brazil is on an upward trajectory in investments in the mining industry, says Pedro Paulo Dias Mesquita, Secretary for Geology, Mining, and Mineral Transformation in the Mining and Energy Ministry. The evidence, he says, is the volume of investments projected for the 2021-2025 period, in excess of US$ 41 billion. "Comparing this figure with the data for earlier years, we see that confidence is, in fact, greater than it was before, and this improvement is reflected in a growing inflow of investments in mining," he says, adding that the government has made a great effort to improve policies that affect this industry.

"Since the National Mining Agency (ANM) was set up at the end of 2018," Mesquita recalls, "we have been working on an agenda to simplify procedures, to make everything available online, and to adopt new rules in a number of areas, all of which certainly helped to attract investments. One example is that companies are now authorised to use their mineral resources as collateral for bank loans; another is the resolution governing resources and reserves. These are demands that the industry had been making for a long time. And it has meant a lot of hard work, not only for this Secretariat [for Geology, Mining, and Mineral Transformation] but for the Mining and Energy Ministry as a whole, for the ANM [National Mining Agency] and other federal

*Pedro Paulo Dias, head of Geology and Mining*

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People who believe in our core values:
**Safety, Respect, Integrity and Excellence**
to produce, overcome challenges and
reach better results every day.

lundin mining

government departments. We have made progress we have fostered, on the industry's behalf, the assurance that mining in Brazil is progressing toward attracting and increasing the volume of investments."

The resolution authorizing the use of mineral reserves as collateral means that the holder of a mining concession is free to hand over that document to a financial institution as collateral against a loan, while the new rule about resources and reserves brings Brazil into line with other countries in the specific rules governing the certification of mineral reserves and resources.

**THIS TRANSLATES, OBVIOUSLY, INTO HIGHER OUTPUT, WHICH HAS SUSTAINED THAT GROWTH RATE, THE FRUIT OF A GREAT DEAL OF HARD WORK**

There have been advances, too, Mesquita says, in fulfilling the targets set out in the Mining and Development Programme (PMD) launched by the ministry in 2020. "The PMD is an aggregate of ten plans," he notes, "setting out 110 specific targets. It's a fairly broad plan and serves as guidance for the government's actions in relation to the mining industry, laying out with full transparency what our policy is and the what is our focus for growth with sustainability."

In the interview that follows, Mesquita also discusses other progammes, such as Invest Mining, which seeks to attract investments from the capital market for the mining industry in Brazil; the Strategic Minerals Programme, which establishes priorities for relevant mining projects; the offer to the private sector of mineral deposits under the control of the Geological Survey of Brazil (SGM-CPRM); and the auctions at which companies submit their bids for areas made available for exploration or mining, which have attracted the interest of a large number of investors.

***BRASIL MINERAL – From the government's point of view, what factors account for the growth of Brazil's mining output in 2021?***

**DIAS MESQUITA –** The mining industry is experiencing a truly exuberant moment. In 2021 we attained a mining output in value terms of R$ 339 billion. That is three times the 2018 total. It shows that we truly are on the right path to increase the share of the mining industry's contribution to the Brazilian economy as a whole. Matching this growth, revenues from the Financial Compensation for the Exploitation of Mineral Resources (CFEM) rose to R$ 10.3 billion. This was a leap in comparison with previous years. And the growth is observed not only in value terms but in tonnages too.

Brazil is now on a fruitful investment trajectory, which clearly emerges when we look at the projection for the 2021-2025 period, amounting to some US$ 41 billion. Comparing this projection with the earlier period, we see increased confidence and growth in investments as the outlook for Brazil. This translates, obviously, into higher output, which has sustained that growth rate, the fruit of a great deal of hard work.

For the government's part, we have made a great effort to improve procedures. Since the ANM [the National Mining Agency] was set up at the end of 2018, we have worked in tandem on an agenda that simplifies proce-

dures, including improvements to the relevant legislation, putting the paperwork online, and drawing up new rules on a series of topics that certainly have the effect of attracting investments. Two examples: the use of mineral resources as collateral and the resolution governing resources and reserves. These are matters that the industry had already been calling for, over a long period, and thanks to a lot of work by the Geological Survey, by the Ministry, and by the ANM, we have advanced and have brought about, in fact, security for the industry, giving the assurance that mining in Brazil is on track to attract and increase investments.When we observe that, for the five years from 2017 to 2021, the projected value of mining investments was US$ 18 billion and that for 2021-2025 we are now projecting more than US$ 41 billion, we can in fact observe this recovery of confidence, in particular as displayed by the trajectory that the industry is now following, with all the policies worked out in synergy between the government and institutions in both the public and private sectors. This synergy is fundamental for maintaining the present level of confidence. While other countries are, up to a point, moving in the opposite direction in terms of inward investments -there has been news of risks and uncertainties confronting operations in Peru -Brazil has, as is widely recognised, maintained an environment of outreach, of improvement, of operational agility, and of consistently attracting investments, while never neglecting to promote more sustainable practices. We must remember all the reforms and all the modernisation that has taken place in terms of sustainable resources in Brazil, in recent years. This, too, is an important milestone because the investor, when he is deciding where to place his capital, is going to weigh the various risks, among which the environmental risk is undeniably an important one. And just as we have advanced in the area of regulation and the improvement of inspection procedures, and observation of the ways in which mining interacts with the environment in such a way as to promote more sustainable and more modern mining activity, this naturally has an impact on our perception of risk. And by reducing risks, we make ourselves more attractive. It's a set of factors that do in fact reflect to a great extent the work that has been done in the Ministry.

***BM -The Mining and Development Programme set out a list of specific targets. Are they being met?***

**DIAS MESQUITA** -The PMD is a set of ten plans proposing a total of 110 targets to be met. It is quite a wide-ranging programme and it serves as a guide for government actions in relation to the mining industry, stating, in a transparent manner, what the focus is for achieving growth with sustainability. We have a whole collection of measures that support the various targets set out in the plan.

When we speak of targets in the area of financing for mining, at the end of 2021 we launched Invest Mining, which is a cooperative network for financing mining in Brazil and which brings together players having a very great capability for promoting several targets that are placed for financing mining within the PMD. One example: promoting several targets for financing research exploration activity, which is a great challenge; the use of mining rights as collateral for bank lending,

together with the corresponding regulatory apparatus that the ANM drew up and published in its resolution. There is also the whole development stage involving the Brazilian financial system's learning process, so that banks will gradually acquirfe full cionfidence in accepting the mining licences in practice as an effective guarantee for their lending to mining corporations. This depends, also, on an exchange of experiences with those who have already been doing this for a long time.

The PMD projected a series of measures for attracting investments. It happens naturally, then, that when we assemble a number of financiers together, a pool of projects to promote this encounter about financing mechanisms, we are seeking to attract these investments and stimulate new entrepreneurs and new markets.

Speaking of social and environmental commitments, we are engaged in a series of launches in this direction. One example is the programme of support for small-scale craftsman mining. We are signing a cooperation agreement with the BNDES [the National Economic and Social Development Bank] for sustainable capital in mining, with the focus on publicising and developing new financing mechanisms, both for exploration and mining and for social and environmental investments in the industry. We are launching a campaign for inclusive mining, to raise public awareness of all the benefits that mining brings, the impact it has on communities, both in terms of environmental conservation and in creating jobs and income, transforming the socio-economic reality of the regions where mining occurs. We are starting a new round of SDGs [Sustainable Development Goals] in mining and launching a prize dedicated to mining towns, recognising good management practice and the improvement of services and wellbeing that mining offers to our communities, so as to generate economic opportunities and social welfare.

**SPEAKING OF SOCIAL AND ENVIRONMENTAL COMMITMENTS, WE ARE ENGAGED IN A SERIES OF LAUNCHES IN THIS DIRECTION**

***BM - What have been the results of the Strategic Minerals Programme, launched by the government in 2021?***

**DIAS MESQUITA** - This programme has shown itself to be just what was needed. It began in May 2021, and we already have twelve projects approved and a prospect of investments, under these projects, amounting to R$ 40 billion, and not forgetting that they will create 20,000 jobs. The programme lends support to the licensing and implementation of these investment projects that are relevant for the production of strategic minerals in Brazil. The aim is to provide the investor with the support of a highly qualified team. The policy is jointly coordinated by the Mining and Energy Ministry and the Investment Partnership Programme (PPI), and the entrepreneur can count on the support of this team to work on the environmental licensing of his ventures. I'm sure this is going to speed up the procedure and not only that, it will also tend to bring about improvements in the environmental licensing procedure itself. The projects approved so far are for mining iron ore, gold, potash, phosphate, and copper.

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**OUR EXPECTATION IS FOR AN AGGREGATE R$ 200 MILLION INVESTMENT IN THESE TWO ASSETS, WHICH WILL TOGETHER CREATE 1,200 JOBS**

***BM -How far has the Geological Survey of Brazil advanced with its auction progamme?***

**DIAS MESQUITA** -We have eight projects in the pipeline, in the first stage. Two projects so far have been awarded to successful bidders: the polymetallic deposit at Palmeirópolis, in Tocantins, and the Miriri phosphate deposit in Pernambuco. These are two blocks of assets that had been fenced off from the market for decades, and were brought back to into availability for investing. Our expectation is for an aggregate R$ 200 million investment in these two assets, which will together create 1,200 jobs.

Another policy of considerable importance in the Ministry has to do with offers for the areas made available by the ANM. This is a group of areas that, for one reason or another, reverted to ANM control, either because exploration was discontinued or because the entrepreneurs found themselves unable to carry on mining. On account of an unduly bureaucratic ritual, these areas ended up getting blocked off and failed to return to the private sector to receive new investments. Beginning with the new policy initiated by the federal government, we were enabled to develop a facilitated procedure for placing these areas on the market. Five public offers of this kind have taken place so far, covering 8,205 areas auctioned off for a total R$ 360 million in bonds. As well as returning a large volume of new assets to the market for investment, the ANM has earned a fairly significant cash value on behalf of the federal treasury. New offers are now being readied and we are proceeding firmly ahead, handing over these areas, once again, to the market, so that Brazil will not lose new investments by being tied up in its own bureaucracy.

***BM -Brazil's mining output is still highly concentrated on just two products, iron ore and gold. What can be done to diversify production?***

**DIAS MESQUITA** - We are now starting to put together the thirty-year National Mining Plan for the 2020-2050 period. One of the main focuses of this plan is precisely the production chain of minerals for the energy transition. We can consider as a subset of these minerals for the energy transition those that belong in the chain of lithium, rare earths, silicon (for generating photovoltaic energy), graphene, nickel, and copper, to meet the demand for electric vehicles. The PMN will specifically look out for ways to promote these chains. In addition, when we work on improving our procedures, one result is that we speed up the bureaucratic procedures themselves, and we bring back to the market new areas that had been dammed up by the bureaucracy at various levels. All this will naturally contribute to promoting diversification.

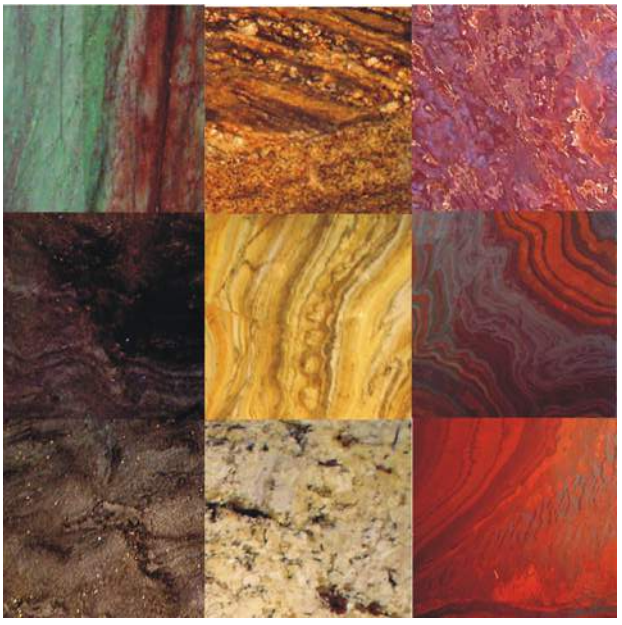
When we look at Brazil's trade balance in 2021, we see that there were certain growth areas, and not in iron ore alone. The first example is nickel. In 2021 our nickel exports surged by 183 percent. There is a price component at work here, but also a very strong

component in the recovery of operations in Brazil. We saw a 105 percent increase in gold exports, 74 percent in copper exports, 64 percent in granite exports. Lithium, which is a highly important mineral in the chain of energy transition, grew 273 percent. This is the fruit of economic recovery, the beginning or the expansion of a number of assets in Brazil.

***BM - What message does the government have for the international investor who wishes to invest in mining in Brazil?***

**DIAS MESQUITA -I** have heard major investors say that Brazil is, in fact, one of their main targets, if not their single principal target – for their investments in coming years. These are not empty words. I often say that Brazil still has an unknown mining potential. When we look, for example, at what Brazil has in terms of underground mining, compared with other traditional mining countries, what we see is a very low number. This means we still have a long way to go, maximising Brazil's mining potential. And this is widely recognised. Brazil has a very great potential for the discovery of new world-class reserves, including reserves of essential minerals for renewable energy. We also have one of the world's cleanest energy patterns, which considering all the debates and pressures, the path the world is following for combating climate change has also been an important differential. The production of minerals for electrification, for instance, will be clean only if the minerals themselves come from a clean production process, and Brazil starts out with an enormous advantage since 85 percent of its electric power comes from clean, renewable sources. We possess the scientific and technological competence, and also the labour power. A large number of research institutes have been operating in Brazil for many years. There are several scientific and technological institutions dedicated not only to mining but also to the manufacturing processes using minerals. And Brazil is traditionally a jurisdiction in which several different regions of the country can count on a constant supply of qualified professionals who understand mining, have operated in mining, and have the competence to act in mining. We have the competence in the form of the supply of qualified personnel and qualified labour, and in the availability of goods and services for mining. Brazil possesses a reasonably diversified industrial structure. Taking the automotive industry as a basis, we have one of the world's largest industries in this area, which is certainly yet another major differential. In terms of the inputs for wind power, Brazil is recognised by leading players as the country having one of the world's best wind potentials. Brazil has expanded its use of wind power on a significant scale. The same is true of solar power. In some of our regions, hours of sunshine in the year are among the world's highest. These, then, are sectors that are advancing rapidly, and that pull the mining chain up with them. Brazil's geological potential also means that the country has an excellent opportunity to develop this chain.

I would stress, too, an improved appetite for risk among investors in the Brazilian capital market. In a recent period we had two Initial Public Offerings on the Brazilian Stock Exchange, those of Aura Minerals and CSN. This clearly shows that the Brazilian investor now has a keener appetite for the stock market. □



# BRAZIL – A MAJOR WORLD PLAYER IN THE DIMENSION STONE INDUSTRY

## GLOBAL SCENARIO

The reported world production of dimension stones evolved from 1.8 Mt/year, in the 1920s to a level of 160 Mt in 2020, when 60 Mt of raw and processed stones were traded in the international market, generating revenues totaling US$21 billion. India is currently the world's largest stone exporter, in terms of volume. China is the world's leading importer of raw stone, as well as the largest exporter of processed stone. The US and South Korea are the main importers of processed stone, while France and the UK are the main importers of slate products.

Globally, Brazil ranks 5th in production and exports. Its mining-industrial park operates with modern techniques in a geological environment that favors ongoing diversification of the stone portfolio offered on the world market.

## PROFILE OF PRODUCTION ACTIVITIES IN BRAZIL

Brazilian business in the industry, counting domestic and foreign markets, including services and machinery sales, equipment, and inputs, generates a turnover of US$5.5 billion/year. About 10,000 companies, including at least 400 regular exporters, are part of its production chain and account for 120,000 direct jobs.

The Brazilian production in 2021 was estimated by ABIROCHAS – the Brazilian Dimension Stone Industry Association - at 10.2 Mt. This production includes granites, pegmatites, and similar stone, in addition to marble, travertine, slate, quartzite, basalt and gabbro, serpentinite, soapstone, limestone and others. It is assumed that


1- Basalt of Nova Prata; 2 - Slate of Trombudo Central; 3 - Granite of Bragança Paulista; 4 - Granite of Caldas (a) and Candeias (b); 5 - São Tomé Quartzite; 6 - Alpinópolis Quartzite; 7 - Slate of Papagaio; 8 - Quartzite and Soapstone of Ouro Preto; 9 - Granite of Medina; 10 - Paduana Stone; 11 - Marble and Granite of Cachoeiro de Itapemirim; 12 - Granite of Baixo Guandu; 13 - Granite of Nova Venécia; 14 - Granite of Teixeira de Freitas; 15 - Travertine of Ourolândia; 16 - Pirenópolis Quartzite; 17 - Cariri Stone;18 - Morisca Stone.

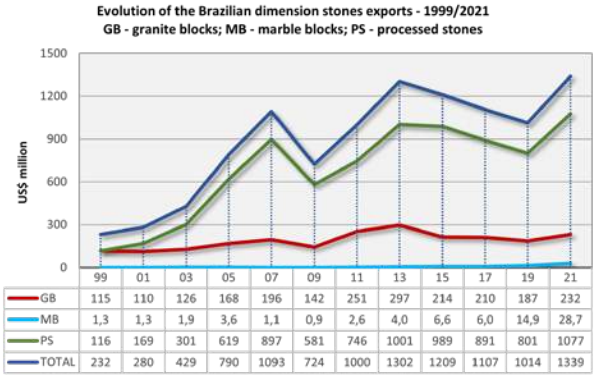
there are at least 1,200 active mining operations, responsible for more than 1,000 commercial varieties of stone sold in the domestic and foreign markets.

Most of the mining and primary processing activities are concentrated in clusters, such as marble and granite from Espírito Santo state, slate and foliated quartzite from Minas Gerais state, foliated gneisses from Rio de Janeiro state, basalts from Rio Grande do Sul state, travertine from Bahia state and limestone from Ceará state, etc.

## BRAZILIAN HISTORY IN THE INTERNATIONAL MARKET

Given its exceptional "geodiversity", Brazil has become known as a provider of a growing variety of stones, especially the so-called "exotic", with high added value. In the last 30 years, Brazil has internationally traded a greater variety of stone than Europe has over the last 500 years!

The insertion of the Brazilian dimension stone industry in the international market, promoted by the partnership




| | 99 | 01 | 03 | 05 | 07 | 09 | 11 | 13 | 15 | 17 | 19 | 21 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GB | 115 | 110 | 126 | 168 | 196 | 142 | 251 | 297 | 214 | 210 | 187 | 232 |
| MB | 1,3 | 1,3 | 1,9 | 3,6 | 1,1 | 0,9 | 2,6 | 4,0 | 6,6 | 6,0 | 14,9 | 28,7 |
| PS | 116 | 169 | 301 | 619 | 897 | 581 | 746 | 1001 | 989 | 891 | 801 | 1077 |
| TOTAL | 232 | 280 | 429 | 790 | 1093 | 724 | 1000 | 1302 | 1209 | 1107 | 1014 | 1339 |


between ABIROCHAS and Apex-Brasil (Brazilian Trade and Investment Promotion Agency), boosted the modernization of the industry and increased its productivity and competitiveness, allowing a notable increase in exports of processed stones.

In 2006, Brazil had already positioned itself as the 5th largest producer and exporter in the world, surpassing several traditional Europeans players. Brazil's growth came on the heels of a significant global rearticulation of the industry, marked by the displacement of mining and processing activities to countries outside the European community, mainly China, India, Turkey, and Brazil itself.

In 2013, Brazilian stone exports totaled US$1.3 billion and 2.73 Mt, surpassing the historical records of 2006 (physical volume) and 2007 (revenue), with the effective incorporation of diamond wire technology for mining and processing of blocks. In addition, dimension stones have become the 5th main mineral-based product exported by Brazil (excluding oil), behind iron ore, copper ore, iron-niobium alloys, and gold.

Brazil remains the world's largest stone supplier to the demanding US market, where Brazilian polished slab mainly serves the single-family residential segment. Due to the history of Brazilian participation, the US is the main prospective target for commercial products targeted by Brazil in the foreign market, including, in this case, semi-finished processed stone (slab) and, mainly finished or dressed ones (tiles, vanity tops, countertops and cut-to-size).

## BRAZILIAN EXPORTS IN 2021

Exports in 2021 reached US$1.34 billion, exceeding those of 2013. Slabs compose the main product of Brazilian exports, with an estimated sale of 22.8 equivalent $Mm^2$. The carbonate (marble), siliceous (quartzite) and ultramafic (soapstone) products have become more important in the international market.

The "global logistical chaos", linked to the increase in ocean freight and the general lack of ships and containers, did not hold back this remarkable export performance in 2021, with a growth of 35.5% compared to 2020. In physical volume, exports grew 11.4%, reflecting the increase in the share of products with higher added value.

Of the total of 121 export destination countries, the US, China, Italy, Mexico, and the United Kingdom accounted for 86.3% of total Brazilian revenue. The participation of quartzite slabs, marble

slabs and soapstone products is already quite significant, which contributed to the increase in the average US dollar price (+21%) of exported products.

## CONCLUDING REMARKS

The behavior of the international dimension stone market in 2020 and 2021 was greatly influenced by the Covid-19 pandemic. In the 1st half of 2020, a decline in Brazilian exports occurred in function of the uncertainties in the development of production activities. The beginning of the recovery, observed from the 2nd half of the same year, was linked to new expectations created by mass vaccination and relaxation of the restrictive measures to movements of the population.

In 2021, the strong increase in Brazilian exports resulted from the significant volume of financial resources and tax incentives dispensed to stimulate the recovery of the world economy. The most vigorous movement came from the US, the largest customer of Brazilian stones in the international market. This was highlighted by the number of resources channeled and captured by real estate sector, reflecting its importance for the formation of GDP in more mature economies.

As was observed in the 2010-2013 period, we reiterate that what occurred in 2021 resulted from a medium and long-term internationalization strategic process, implemented by ABIROCHAS since 1999. Contributing to this more recent performance was the increase in the exchange rate, which ended a long period of overvaluation of the Real.

We consider that this strong phase will persist, albeit not with the same intensity, in 2022. The preservation and improvement of Brazil's position in the international market, and particularly in the US, will depend on a qualitative leap in exports. This leap is guided by the commercialization of finished products and direct service to developers, guaranteed in total by the maturity of the Brazilian dimension stone industry. ■

Authors: geologist Cid Chiodi Filho, ABIROCHAS consultant; economist Reinaldo Dantas Sampaio, Administrative and Financial Vice-President of ABIROCHAS.

### ABOUT BRAZIL

Over the last 20 years, Brazil's performance in the international dimension stone market has followed, or even surpassed, that of the other major new players in the industry, except for China. This effectively differentiated performance was achieved from a process of migration of the production activity to countries outside Europe that, like only a few others, Brazil was able to take advantage of.

During this migration, Brazil became notable for its great variety of raw materials, thus being considered the country with the greatest world geodiversity in dimension stone. It is difficult to determine in what proportion, but the Brazilian growth was based on the permanent support of Apex-Brasil to the successive agreements signed with ABIROCHAS and based on correct strategies of business internationalization.

It is evident that Brazil clearly defines a success story in the international market, establishing itself among the top five world players in the stone industry.

# BRAZIL STANDS OUT IN LATIN AMERICA AS MAGNET FOR MINING INVESTMENTS

## INTERVIEW WITH RODRIGO BARBOSA, CEO OF AURA MINERALS

*Among Latin American countries Brazil stands out in terms of the conditions it offers for a company planning to invest in developing a new mine. This is the opinion of Rodrigo Barbosa, CEO of Aura Minerals, a gold producer with assets in Mexico, Honduras, the United States, and Brazil, which expects to invest two-thirds of its current R$ 1.5 billion investment budget in developing projects in Brazilian territory. The company is now setting up its Almas project in the state of Tocantins, planning to follow up with its Matupá project in Mato Grosso.*

*A mining project is a long-term investment, Barbosa notes, which means that juridical security is a fundamental factor in the investor's decision. Anyone putting capital into a mining venture needs to have the assurance that the rules are not going to change radically within a horizon of ten, fifteen, or twenty years. The company needs to be confident that private property is taken seriously and respected. If a company makes large investments, discovers deposits, starts operating a mine, and then its land is invaded or its assets seized, that can only cause enormous insecurity. Therefore juridical security is of the greatest importance. Another strong point in Brazil's favour, Barbosa says, is that there is a balance between the institutions exercising political power.*


*Rodrigo Barbosa*

*Aura Minerals, which was already listed on the Toronto Stock Exchange, has also successfully concluded an IPO on Brazil's B3 stock exchange and in a sense has cleared a path for other mining companies to obtain a Brazilian stock market listing. For the time being, Aura is the only gold mining company with a B3 listing, but Rodrigo Barbosa says he is a strong believer in the development of the capital market for mining in Brazil, which has several highly interesting aspects. "It begins with the depth of the capital mar-*

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*Drilling samples at Aura's Almas mine in Tocantins*

*ket. What does this mean? It means Brazil has a high Gross Domestic Product (GDP), investors have billions of dollars to invest in the country, and they are looking for opportunities." He is also confident that the Brazilian investor is highly qualified, takes the trouble to understand the fundamentals of the business, has a clear understanding of the key variables, and feels comfortable with the investment he is making. "When the investor understands and sees that the story is consistent, he will make his funds available." For all these reasons, Barbosa sees the Brazilian capital market as having enormous potential for mining companies.*

*In Aura Minerals' case the IPO on the Brazilian market, occurring in mid-2020, enabled it to raise the capital it needed to fund its growth programme, expected to raise capacity to 400,000 ounces of gold per year by 2024. This would be almost double the company's 2021 output. To reach this targeted production level, Aura is relying mainly on its two most advanced Brazilian projects, Almas and Matupá.*

*In this interview Barbosa gives a detailed account of Aura Minerals' growth trajectory, the advantages that Brazil offers for investments in mining, and the potential of capital markets as a source of funding for mining ventures.*

***BRASIL MINERAL – Aura Minerals is active in four jurisdictions, Mexico, Honduras, Brazil, and the United States. How would you rank Brazil among the four in terms of attractiveness?***

**RODRIGO BARBOSA –** If we are planning to invest in the development of a new mine, we see Brazil as outstanding in Latin America. In the case of a long-term, high-risk investment, as in the mining industry, the investor need juridical security, meaning that the rules are not going to change radically in a period of ten, fifteen, or twenty years. He needs to be secure in the knowledge that private property is respected. If a company invests large sums, discovers ore deposits, starts up an operation and then suddenly its land is invaded or its assets are seized, this can only generate enormous insecurity. That is the importance of juridical security.

When we analyse Brazil in comparison with other countries in Latin America, we see that Brazil is ahead. We like Mexico, too, which has excellent stability. From the viewpoint of environmental and bureaucratic licensing, Mexico is even better, though perhaps it does not offer the same institutional balance observed in Brazil. Honduras has shown itself capable of overcoming its differences. It is a new democracy. Elections were held there recently, won by a fairly radical party of the left, but even so with a discourse in favour of the national interest, with no attachment to ideologies. Brazil, however, is further ahead and can be expected to lengthen its lead in coming years, though that us not to say there won't be problems. But if we disregard individuals and examine the institutions, we see there is a balance. This becomes clearer still when we look at what has happened in Peru, with the election in 2021 of a new president who says he is not going to renew mining concessions and is going to change the law. Chile, recognised as a stable jurisdiction, is going through the process of revising its Constitution, having elected a president who wants to review all the laws and the whole legal framework within which mining operates. In this context, Brazil begins to stand out even more sharply. In Latin America, we have two-thirds of our investments focused on Brazil. Out of the total R$ 1.5 billion stated as our investment budget at the time of the IPO, R$ 1 billion will be invested in Brazil.

***BM – The Brazilian government has recently approved the use of mining rights as collateral for bank borrowing, and has brought its rules for declaring resources and reserves into line with international standards. From your viewpoint, what changes might this bring about, in the sense of lending greater impetus to investments in the industry?***

**BARBOSA –** Any change in which the government's aim is to bring greater transparency and clarity to the quality of information, to make companies more accountable for the information they provide, and to carry out audits along the lines of Canada's National Instrument 43-101, brings very great comfort to the investor. The further the advance in this direction, the better. It means more work for us, but it gives the investor peace of mind and this will lead him to entrust more of his money to mining companies. This is always positive. It ends up generating some additional costs, but in the end it is for the best and it is the way ahead. In the absence of this kind of clarity, the industry is not going to develop.

*An Aura samples shed*

As for the possibility of offering mining rights as financing collateral, that is a highly positive change, since in the event of an unforeseen setback of any kind, the company owns an asset that can be given in exchange for an unpaid debt. This acts as a further significant stimulus to borrowing and hence to the development of mining. It is particularly good news for junior mining companies that have not yet started generating their own cash flow. Mining rights are a guarantee for the lender.

***BM – Aura Minerals now has stock exchange listings in both Canada and Brazil. What do you see as the outlook for mining companies on the Brazilian capital market?***

**BARBOSA – I** firmly believe in the development of the capital market for mining in Brazil. Proof of this is that, even in the face of contrary recommendations, given that until now no gold mining company had ever had a stock exchange listing in Brazil, our IPO showed that there was, indeed, a healthy appetite on the part of investors.

Brazil has several very interesting factors for developing the capital market in mining. It starts with the depth of the capital market. What do I mean by depth? Brazil has a high Gross Domestic Product (GDP). Investors have billions of dollars to invest in Brazil, and they're looking for opportunities.

Even though gold mining is a new area for Brazilian investors, the market is highly qualified. Brazilian investors are among the most fundamentalist and qualified to be found anywhere. They examine every detail, they do their sums, they make an effort to understand the fundamentals of the business, they have a clear idea of the important variables, and they feel at ease in going ahead with their investment. When the investor understands and sees that the company has

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*Aura's Ernesto mine in Mato Grosso*

a consistent history, he will make his funds available. That is why I see an enormous market.

***BM – How did 2021 turn out for Aura Minerals, and how is your growth plan progressing?***

**BARBOSA –** It was an important year for Aura, because it was the first year in which we published our balance sheet, together with a progress report on our initiatives since our Brazilian IPO. The IPO was in mid-2020, when we presented to the market our project for doubling in size by 2024 and for developing projects such as Almas and Matupá, so as to reach our targeted production level.

We consolidated the year with a growth rate close to 32 percent, going from 204,000 ounces to a 2021 output of 269,000 ounces, in line with our expectations. We paid our shareholders a return on their investment of about 13.5 percent, which is the biggest dividend ever paid by a gold mining company anywhere in the world. Among the world's gold mining companies, Aura is the one that pays the highest dividends. And it must be among the top dividend payers on the São Paulo stock exchange as well, including every industry listed there. And not only that, but we ended the year with a negative net indebtedness. In other words, we are growing, paying dividends, and keeping a low debt profile, which is a commitment we gave the market from the financial viewpoint. There were many advances, too, in the environmental, social, and governance area (ESG). We made good progress in our relations with our employees and with the communities.

Other achievements in the year were advances in the development of the two projects, Almas and Matupá, that are the key to consolidating our output of 400,000 ounces a year. At Almas, we already began construction of the project at the end of 2021. What is noteworthy is that we introduced several optimisations in capex terms, reducing the size, optimising the cost, and managing to give priority to higher gold content during the earlier years. All this has brought us a very great financial advantage, since the project will repay the entire investment in the space of just two years.

The other project on which we made significant progress was Matupá, in Mato Grosso. It's a project that starts off with 340,000 ounces in resources. We see a possibility of raising that figure to 700,000 or even 1 million ounces, but before reaching that level we opted to invest in construction of the plant and to start generating a cash flow. At the end of 2021 we published our pre-economic assessment (PEA) for the project, showing that with just 30,000 ounces in resources – of which a large part will probably be reclassified as reserves under NI 43-101 – that is already enough to give a return above 35 percent, over a six-year productive lifetime. □

# Água Azul Project

*Gold*


Água Azul is a pre-operational open pit gold mine located in the state of Pará, next to the Carajás Polymetallic Mineral Province.

The extensive geological exploration program carried out, with over 22,000 meters drilled, pointed out to Resources of 1,2 million ounces.

The hydrometallurgical processing plant is under installation and mine operation is expected to start in the 4th quarter 2022.

# Baratinha Mine

*Iron Ore*


The Baratinha Mine, currently in operation, produces iron ore in the region known as Steel Valley in the state of Minas Gerais, an strategic location due to its proximity to major steel mills and railroads.

The operation has an installed capacity of 2 million tons, and uses dry stacking of filtered tailings as its disposal system.

The mine is certified under ISO9001, ISO14001 and ISO45001, and counts over 3,000 days without a lost time accident.

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BEMISA

# THE MINING INDUSTRY IN BRAZIL IS IN GOOD SHAPE

"The mining industry in Brazil is in good shape as long as commodity prices are booming." In these words Luís Maurício Azevedo, president of the Brazilian Association of Mineral and Mining Research Companies (ABPM) sums up the favourable performance achieved by Brazilian mining in 2021, when output increased by more than 60 percent, in local currency terms. The increase was led chiefly by iron ore and gold, the country's leading mine products, which together account for above 80 percent of the total. Iron ore prices in 2021 averaged around US$ 160 per ton, while the gold price was about US$ 1,800 per ounce. The exchange rate also helped, with the dollar close to the R$ 5.50 level almost the whole year. As a result, companies' sales income improved, in local currency terms.

While he celebrates the industry's favourable performance in 2021, Azevedo regrets that he saw "not much being done to attract more investments and develop new ventures." There is undue timidity in this area, he says, while he recognises that the resolutions adopted by the National Mining Agency (ANM) were good signs, though long delayed. "The most important resolutions - one on the system of resources and reserves, another on the reuse of tailings, and a third authorising the use of mining

*Luís Maurício Azevedo*

rights as collateral for bank borrowing - took four years to see the light of day."

Azevedo feels frustrated, he says, in the case of the mining rights to be used as collateral because the new rule basically repeats what was already in the Mining Code. In other words, only a mining licence can serve as collateral, while the industry had been calling for the research licence - giving the holder priority to explore a given area - or the research report could also be used. "In the use of mining rights as col-

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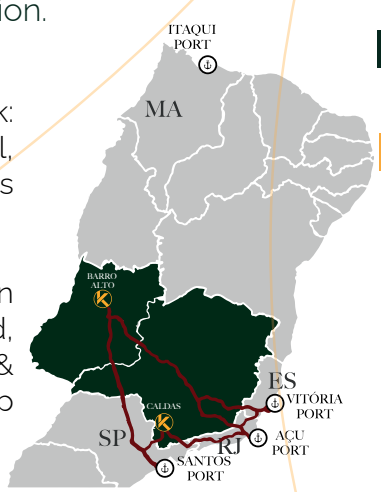


Caldas - Minas Gerais



Rod. BR 459 KM 8 - Laranjeiras de Caldas
Caldas - Minas Gerais - Brazil
ZIP Code 37780-000
Tel +55 35 3713-5751

Estrada Pedra de Fogo KM 15 - Patio 02
Barro Alto - Goiás - Brazil
ZIP Code 76390-000
Tel +55 62 3224-9006

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lateral we saw a very good possibility for leveraging investments," Azevedo says. In the question of the reuse of tailings, he says the new rule will have little effect in reducing tax exposure, while he concedes that it also has a favourable aspect, since it will facilitate sales of materials that had been a source of enormous difficulties for mining companies.

On the new Brazilian system of resources and reserves, Azevedo praises the change, which he considers an advance. "First, because it creates a culture of classification and qualification for mineral resources. There will be greater insistence on the qualitative criterion for the calculation," he says, pointing out that the previous Brazilian classification never enjoyed international recognition. "Now Brazil is integrated with the world context and this creates the culture, it contributes to increase the number of qualified professionals, and it gives greater security to the ANM itself, because the professional who signs a certificate can be held responsible. He can even run the risk of being disqualified if he breaks a rule or does an inadequate job. We will probably see, in due course, as in other countries, a hierarchy emerging within the profession. Those who take their work more seriously, who exercise better judgement, will be more sought after and will command higher fees. All of them will then seek to improve, which is a good thing. Certainly there will be greater transparency and credibility."

Azevedo praises the government for its success in speeding up the issue of mining licences. The 23 percent increase in the number of licences issued in 2021 is the

NOW BRAZIL IS INTEGRATED WITH THE WORLD CONTEXT AND THIS CREATES THE CULTURE, IT CONTRIBUTES TO INCREASE THE NUMBER OF QUALIFIED PROFESSIONALS, AND IT GIVES GREATER SECURITY TO THE ANM ITSELF, BECAUSE THE PROFESSIONAL WHO SIGNS A CERTIFICATE CAN BE HELD RESPONSIBLE

effect, he says, of the greater agility shown by the Mining and Energy Ministry's Secretariat for Geology, Mining, and Mineral Transformation, which analyses applications and issues licences. On the other hand, applications for a Final Research Report, another important document which precedes the mining licence and is issued by the same Secretariat, are dealt with only very slowly, he adds. This process, too, needs to be speeded up. He sees no need for the ANM to inspect the area where exploration is done. The technology is available, he says, for inspections of that kind to be done remotely, economising human resources and financial resources alike.

## Differentiation between large and small companies

Public policies need to discriminate between large, medium, and small businesses

in the mining sector, Azevedo says. "Brazil is totally stratified," he points out, "in terms of the economic capabilities of its inhabitants, and this stratification is repeated in the mining sector, where we have a very small number of large companies and of metals producers using more developed technologies. For a country the size of Brazil, with its diversified mining potential, I think ours is still a very small industry." On the other hand, he says, there are thousands of small companies engaged in mining nonmetallic minerals, family-owned businesses, which receive the same treatment as the big companies. "We need to stop treating them all as equals. We have to recognise the inequalities. We can't expect small and medium-scale producers to comply with the same standards as the majors. You don't ask a builder who puts up low-income housing to do everything that a company that builds fifty-storey skyscrapers does. There are differences that have to be recognised."

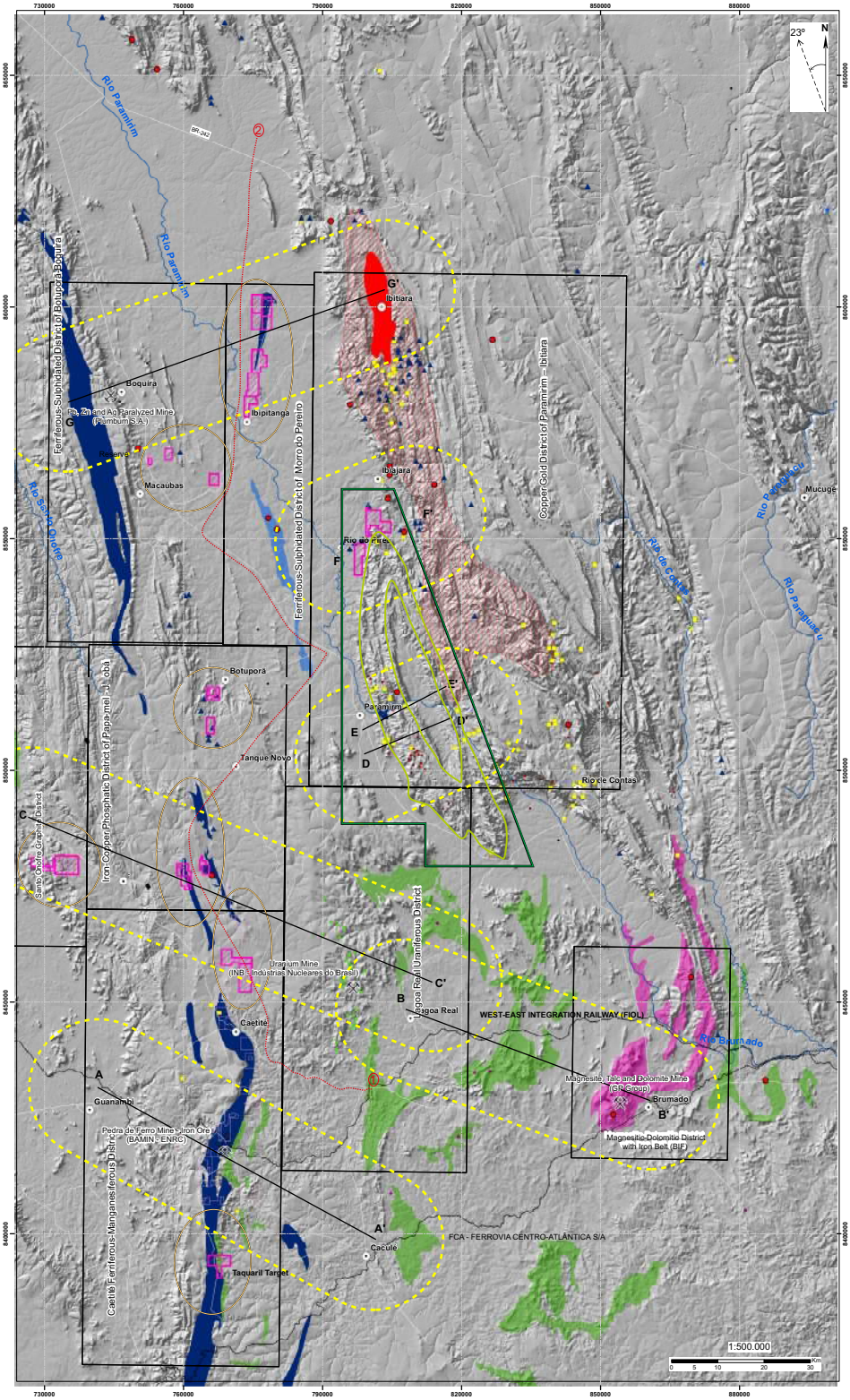
"The bureaucracy and lethargy of government departments," in Azevedo's words, is the reason why Brazil has not, on the whole, been successful in attracting junior companies or investors. A junior company, he says, does not have sufficient capital to wait for a lengthy analysis or licensing application, because all these procedures and analyses mean that the company has to maintain itself in the meantime. "They need to maintain a geologist, a lawyer, an accountant, an office, a whole series of things. And while they're waiting, they're paying. So the shareholder asks, Why should I spend five years in Brazil waiting in a queue that may consume 25 or 30 percent of my capital, while in other countries these things are done much faster and, in consequence, I receive a quicker return on my investment?"

In the case of private equity funds, the investor usually gives the fund manager an eight-year term, Azevedo says. In Brazil, however, that deadline is impossible to meet, he says, and needs to be extended. Not every investor, obviously, is prepared to wait ten or twenty years. "But mining depends on these people, and because of the long term, the investor is sometimes attracted to higher-risk activities that don't entail such a long wait, that mature more quickly. So Brazil is pushed out of this market." And this, in turn, he says, makes it more difficult for Brazil to diversify its range of mining products. □

WE NEED TO STOP TREATING THEM ALL AS EQUALS. WE HAVE TO RECOGNISE THE INEQUALITIES. WE CAN'T EXPECT SMALL AND MEDIUM-SCALE PRODUCERS TO COMPLY WITH THE SAME STANDARDS AS THE MAJORS. YOU DON'T ASK A BUILDER WHO PUTS UP LOW-INCOME HOUSING TO DO EVERYTHING THAT A COMPANY THAT BUILDS FIFTY-STOREY SKYSCRAPERS DOES. THERE ARE DIFFERENCES THAT HAVE TO BE RECOGNISED

# New Brazilian Mineral Frontier

## Mineral Province of the Paramirim Valley - BA




### MINERAL SYSTEMS - GENERAL CONSIDERATIONS

They are dynamic systems, based on the knowledge of the movement of the Earth's crust, during the construction of planet earth, as example, the separation of the Brazilian and African terranes, phenomena that generated in some focus points of the planet Earth, associated with volcanogenic processes and construction of the oceans and continental and epicontinental seas, mineral deposits in places that are physical-chemical-biological favorable. These Mineral Systems, formed in the range of 2.6 to 1.1 billion years, were modified and enriched in other substances at the end of the evolution of the Paramirim Valley. Some of these systems were properly identified in the last 17 months of exploratory Economic Geology work, unprecedented fact in mineral exploration, accompanied, by geological surveys, followed by laboratory tests at SGS Geosol in Belo Horizonte, state of Minas Gerais, in partnership with Department of Economic Geology of the Federal University of Bahia.
Such studies show evidence of a World Class Mineral Reserves in these districts. Types such as Lake Superior / Algoma and IOCG (Iron Oxides Copper Gold Deposits) like Kiruna in Sweden and Olympic Dam in Australia, undoubtedly conferring great potential for this province.
The New Mineral Province, consisting of 8 Mining Districts, named by the technical team of the Vale do Paramirim Company, led by the experienced geologist João Carlos Cavalcanti, responsible for the discoveries of the Mine Pedra de Ferro (ENRC-BAMIN) and iron deposits Rio Pardo de Minas/Salinas (SAM/RONBRIDGE); is similar to the Carajás Mineral Province - Brazil; Ramsley - Australia and Transvaal - Africa, with the difference that in addition to Fe, Mn, Cu and Au ore, the new Vale Paramirim Province, involves high potential for discoveries of new deposits of basic metals, notably (Cu, Pb, Zn and Ag), phosphate, graphite, as well as new deposits of Iron and Manganese ore.

### Iron Sulphidated District of Botuporã-Boquira (100 Km)

BIF mineralizations (Oxide-Hematite Facies, Oxide-Magnetite Facies) associated with Silicate and Carbonate Facies with Pb, Zn and Ag mineralizations - Boquira Mine (paralyzed mine), Superior Lake/SEDEX model. This district is the subject of a detailed geological survey in the scales of 1:10,000 to 1:25,000, especially in the range between the old Boquira Mine and the "in research" Morro do Pereiro mineral deposit, with systematic geophysical prospecting (Magnetometry/Induced Polarization) accompanied by exploratory drilling holes (rock drill), properly and strategically located, aiming the discovery of new mineral deposits of Pb, Zn and Ag (similar to the old Boquira Mine) and Cu and Au (IOCG Model, similar to Olympic Dam - Australia).
The Pb, Zn, Ag Mine of Plumbum S.A., French multinational, paralyzed in 1992, extracted since 1957 about 6 million tons of Pb ore, and as by-products Zn and Ag. We believe that the new mineral prospection methodology to be applied by the Vale do Paramirim Company will lead us to identify new reserves of these sulfide ore deposits, in a distance smaller than 50 kilometers of the exhausted deposit and the Vale do Paramirim's investigated deposit (Morro do Pereira).

### Lagoa Real Uraniferous District (90 Km)

This system consists of metagranitoids with an age of 1.7 billion years, gneisses and albitihites, as well as diabase, and alternating layers of amphibolites and charnoquites. The mineralized rocks are the lenticular albitihites (extensions up to 480 meters, widths up to 30 meters and maximum depth of 850 meters) and the main ore ore is Uraninite.
The reserves are 110 thousand tons distributed in 38 deposits with high-purity at a cost below 40 dollars a pound. If new occurrences or deposits be identified, Vale do Paramirim Company will inform the Ministry of Mines and Energy, more precisely, Industrias Nucleares do Brasil - INB, since these are resources of exclusive exploitation by the federal government.

### Caetité Ferriferous-Manganesiferous District (80 Km)

The ENRC-BAMIN iron ore mine is located in this district, which has already certified approximately 750 million tons of iron ore, with the expectation of reaching 1.2 billion tons. The Vale do Paramirim Company has estimated resources of more than 400 million tons of iron ore on its own areas, in addition to a residual reserve of 150 thousand tons of Manganese ore.
Between 1948 and the end of the 1990s, it was extracted by ICOMI (Antunes de Azevedo Group), Sibra do Nordeste and Vale do Rio Doce Company (across Rio Doce Manganês), expressive amounts of manganese ore associated with graphite-sericitic phyllites stratigraphically below the iron formations (Itabirite/Hematite), which actualy the mining

### Iron-Copper Phosphatic District of Papa-Mel - Jatobá

The resource expectation is over 0.5 billion tons of iron ore, consisting of compact, semi-compact and friable itabirite, interleaved with hematite levels, containing between 35 and 65% Fe, associated with quartzitic and carbonate metasediments with lower sulfide horizon, around 30 meters thick (Papa-mel Mineral Deposit), where levels of sulfides with Cu contents were estimated at 1%, the approximate content of the largest Porphyrytic Copper Mine of Russia - Almalyk (content of 0.8%, reserve of 3 million tons of Cu).

### Ferriferous-Sulphidated District of Morro do Pereiro

This belt is 100 km length of discontinuously mineralized magnetitites placed between sedimentary and hydrothermal volcanic rocks. A body of 27 Km, discontinuous, with thickness ranging from 50 to 80 meters and Fe contents between 45 and 65% was identified.
The quartz-magnetite facies are associated to silicate, amphibolytic, carbonate rocks with metallic sulfides (Cu) disseminations, estimated at 1%. Possibly the basis of the IOCG system. This disseminated sulfide associated to amphibolite facies, is macroscopically correlated to the amphibolite facies containing the Pb, Zn and Ag

### Copper-Gold District of Paramirim – Ibitiara (120 km)

District with presence of Gold and Copper mineralizations over more than 130 km in length. Among the municipalities of Ibitiara and Ibiajara, the deposits are included in the IOCG (Iron Oxide Cooper Gold) model class, where gold mineralization is placed in sericitized hematic breccias developed on subvolcanic facies.

### Magnesitic-Dolomitic District with Iron Belt (BIF) (65 Km)

In this system it is inserted one of the world's largest deposits of Magnesite (Magnesium Carbonate MgCO3) in exploitation, known since 1938. It is also verified the presence of expressive layers of high magnesium dolomite, interspersed with magnesite bodies, as well as levels of banded iron formations (BIFs), oxide-silicate-carbonate facies. However, without expressivity, in terms of volume that justifies its exploitation for iron ore.
The production of basic refractory bricks is made exclusively of Magnesite ore, considering that the existing dolomitic rocks are contaminated by levels of iron formations, increasing the Fe content and making it impossible to use for basic refractories.
It is important to note that in Europe and the USA, basic refractories are predominantly made of high magnesium dolomites, such as the Bolzono deposits in Italy and those in Ohio in the state of Michigam. It is important to note that the Vale do Paramirim Company has areas with significant dolomite reserves of high magnesium content and low iron content.

### Santo Onofre Graphite District (36 Km)

Between the cities of Caetité and Igaporã, more precisely at km 36.5 in the direction of Caetité - Igaporã, it is observed that in the road slope and on the road surface, an expressive outcrop of graphite phyllite (carbonaceous), with carbonaceous levels being textured amorphous and thicker than 50 meters, in a concordant direction (N 010 W) with the regional structuring of the Espinhaço Group. The carbonaceous facies extend for 36 km. Samples were sent to SGS Geosol for chemical analyzes to determine the Carbon content.
If the levels exceed 8%, will be graphite ore of vast application in the automobile, chemical and electronics industry. Undoubtedly, this geological unit will be object of greater details from the geological-mining point of view by the technical team of the Vale do Paramirim Company.


Photo 01 - A- Drill core of Itabirite Ore (hole 02) of Papa-mel mineral deposit (Caetité, Bahia state), with a content higher than 45% Fe. B - Overview of the hole site. C - Outcropping of Banded Iron Formation (BIF) in the Papa-mel Target.

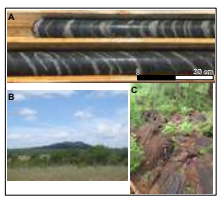



Photo 02 - A - Magnetitite Ore (hole 03) of the Morro do Pereiro mineral deposit, between 50 and 65% of Fe. B - Overview of Morro do Pereiro. C - Outcropping on the same target.

Photo 03 - General view of the Paramirim Valley, where the Paramirim Valley Mineral Province and its eight districts are

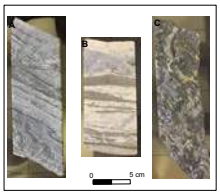



Photo 04 - A - Phosphate interval of Papamel Target. B - Strata Bound mineralization of the Papamel deposit. C – Sulphide Mineralization in Morro do Pereiro Target.

Picture 05 – Carbon phyllite level with the high potential amorphous texture, since the carbon content exceeds 8%, to be economically exploitable ore to produce graphite.

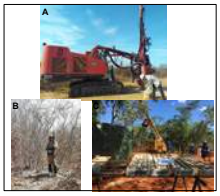



Photo 06 - A – Reverse core drilling (RC Drilling) and Rock Drill, B - Magnatometric geophysical survey carried out on the targets. C - Diamond drilling.

### LEGEND

**Geological Units**
- Serra das Águas Group
- Brumado's Vulcanosedimentary Sequence
- Cauê Formation
- Green Stone Belts
- Rhyacian Granites
- Structure
  Transcrustal conduit zone

**Conventions**
- City
- Road
- Railway
- Drainage

**Districts**
- IOCG
  Iron-Copper-Gold
- Ferriferous

**Mineral Resources**
- Copper
- Uranium
- Lead
- Magnesite
- Tin
- Diamond
- Barium
- Gold
- Iron
- Graphite

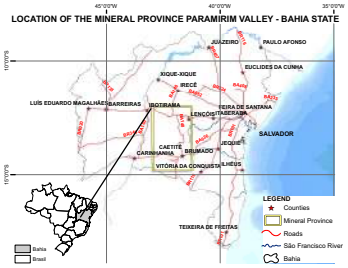
**Mines**
- Active
- Inactive

**Processes**
- CVPSA/WMR/ELM
- Others

**Geoeconomic Sections**
- A——A' Section
- Section influence area

April 2019 version

### LOCATION OF THE MINERAL PROVINCE PARAMIRIM VALLEY - BAHIA STATE




### MEMBERS OF THE VALE DO PARAMIRIM P.S.A./WORLD MINERAL RESOURCES P. S. A.

**Technical Coordinator - Geologist-Engineer João Cavalcanti**
**Financial Coordinator - Economist Emilio Vieira**
**Legal and Administrative Coordinator - Pedro Endres**
**Researcher in collaboration Dr. Reinaldo Brito (Federal University of Bahia)**
**Mineral Exploration - Chief Geologist Mauro Fróes**

Geologist Sub-chief – Graciany da Silva
Senior geologist – Tiago Vasconcellos
Alane Iasmin C. da Silva (Federal University of Bahia)
Trainee geologist – Ramon N. Jorge
(Federal University of Bahia)

Technicians and Technologists:
José Ivanildo - Survey and Surveying
Rogério Mattos - Area Control and IT
José Tadeu Fróes - Accounting

Source:
VALE DO PARAMIRIM P. S.A.
WORLD MINERAL RESOURCES. P. S.A.
CPRM - COMPANHIA DE PESQUISA DE RECURSOS MINERAIS
DNPM - DEPARTAMENTO NACIONAL DE PRODUÇÃO MINERAL

VALE DO PARAMIRIM

## MINERAL PROVINCE OF VALE DO PARAMIRIM
## NEW BRAZILIAN MINERAL FRONTIER – STATE OF BAHIA

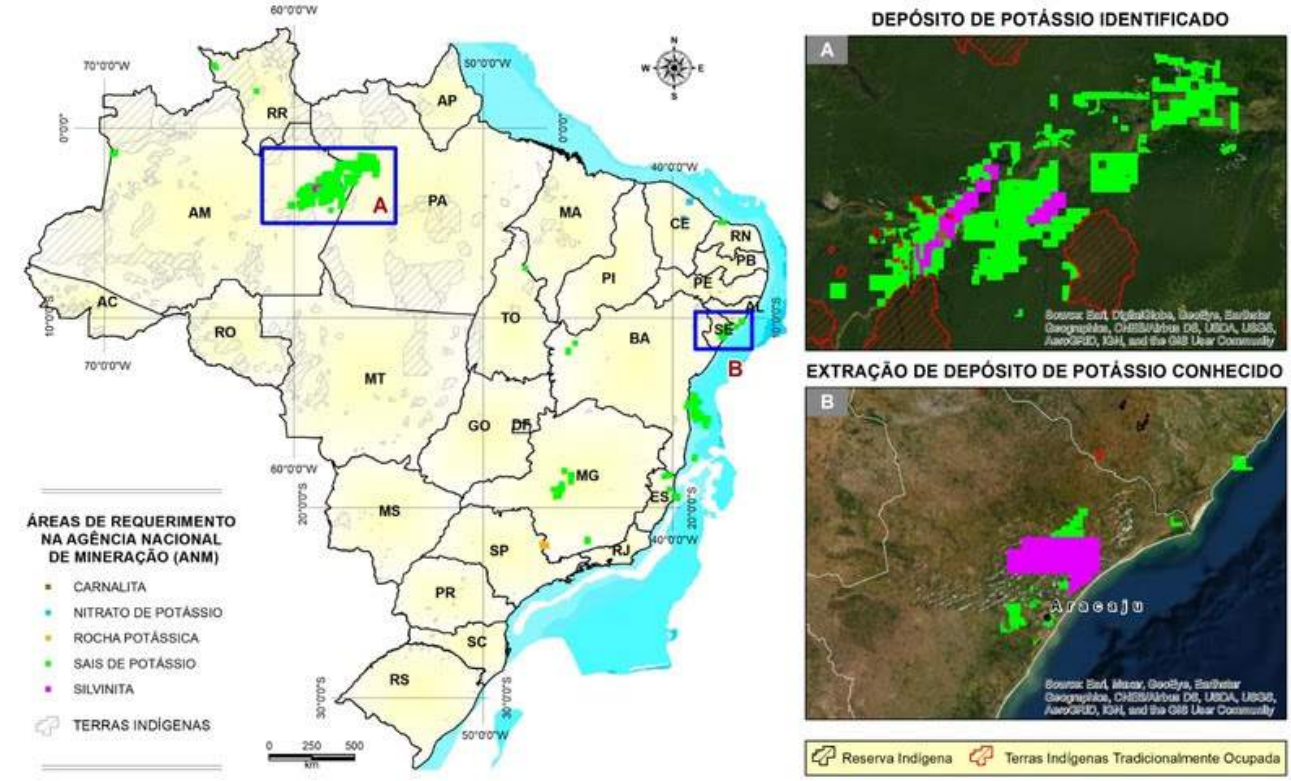
The discovery of a new Brazilian Mineral Province, in the southwest region of the state of Bahia, similar to the Mineral Province of Carajás, state of Pará, differs from one another, due to a greater diversity of mineral resources. In the Mineral Province of Vale do Paramirim, after three years of research and mineral exploration, 8 (eight) mining districts were identified, 3 (three) of which were already known:

**1 -** Magnesitic Dolomitic District of Magnesita S/A, in the Brumado county in the state of Bahia, discovered in 1938;

**2 -** District-ferriferous-Manganese, discovered in 1948, in the Caetité, Urandí and Licínio de Almeida counties in the state of Bahia, when, geologists at the time, did not verify the predominance of ferriferous formations, similar to the iron reserves of the Quadrilátero Ferrífero in the state of Minas Gerais;

**3 -** Uraniferous District of Lagoa Real in the state of Bahia, discovered in the '70s, through mineral prospecting works, in agreement with the INB- Industria Nuclear Brasileira and the Government of the State of Bahia (CBPM).

The other 5 (five) mining districts identified by the Companhia Vale do Paramirim, from 2017, stands out the Ferriferous-Cupiferous District and other associated metals, located 20 km north of the seat of Caetité county on landfarms of Papa-Mel and Jatobá, already acquired by the CVP company. This District is being the object of mineral exploration works, involving detailed geological mapping (1:1.000) and semi-detail (1:10.000), geophysics (magnetometry) and IP with rotating diamond drilling, percursive drilling, excavation openings, laboratory chemical analysis, technological bench tests, and studies of logistics routes for the flow of commercialized products (iron and copper ore concentrates), to the port terminal of Porto Sul, presently under implantation, in the county of Ilhéus in the state of Bahia, through FIOL-01, to the port of Ilhéus and through FCA, to the Camaçari Metallurgical Complex also in the state of Bahia (copper concentrate). Iron ore reserves with a content ranging from 40 to 65% of Fe belong to the category of international class reserves (World Class) ranging over 300,000,000 tons, generating marketable products (after "Pellet Feed" concentration type, with a content up to 65% of Fe, well above the international market requirement (62% of Fe) whose current price per ton would exceed U$D 100.00/Ton. The copper ore reserves, with a content varying from 0.15 to 1% of Cu, are similar, from a geological point of view, to the reserves of the Broken Hill Deposit in Australia, with an estimated volume of 100,000,000 tons. This Deposit, of a polymetallic nature, will be mined in the open, concomitantly, with the only difference, in the the concentration plants. The Deposit also reveals a great potential to the presence of lithium, gold and zinc. The CVP Company is available for further information. ❍




*Potash deposits in Brazil*

# NEWLY PUBLISHED MAPS ADD TO KNOWLEDGE OF BRAZIL'S POTENTIAL

Knowledge of Brazil's geology made important advances in 2021, report two senior officials at the Geological Survey of Brazil (SGB-CPRM), its president, Esteves Colnago, and the director of geology and mineral resources, Márcio Remédio. Numerous maps, reports, technical and scientific articles, and new data bases were finalised in the course of the year and in addition, Colnago notes, "we have been active in strategic areas such as Carajás in Pará, Serra de Jacobina in Bahia, the Juma district in Amazonas, Granjeiro-Cococi in Ceará, and the Rio Grande Shield in Rio Grande do Sul."

The Geological Survey also published in 2021 the initial findings of its project conducted in the area known as the Juruena-Teles Pires province, in the north of Mato Grosso, seen as the country's leading emerging geological province for gold. It has now been raised to the status of a polymetallic province following discoveries of copper in association with gold and also of lead with zinc, and of silver with copper and gold.

"We released the first maps, the fruit of systematic mapping at a scale of 1:100,000, covering around 60,000 square kilometres [around 23,000 square miles] in the north

SGB
GEOLOGICAL SURVEY OF BRAZIL - CPRM

SECRETARIAT OF GEOLOGY, MINING AND MINERAL TRANSFORMATION

MINISTRY OF MINES AND ENERGY

PÁTRIA AMADA BRASIL
GOVERNO FEDERAL

PRESENTES

# GEOLOGY AND MINERAL RESOURCES PRODUCT CATALOG


## GEOSCIENCES IN FAVOR OF DEVELOPMENT

DISCOVER THE VARIOUS PRODUCTS LAUNCHED BY THE GEOLOGY AND MINERAL RESOURCES BOARD OF THE GEOLOGICAL SURVEY OF BRAZIL THROUGHOUT 2021.


*Esteves Colnago*

of Mato Grosso," Colnago says.

Progress was made, too, in projects to assess the potential for strategic minerals, a category that includes agrominerals such as phosphate, potash, and inputs for rock dust, and others needed by the technology industry, particularly graphite, lithium, cobalt, and rare earths.

Reports and favourability maps of mineral deposits were made available in 2021, following survey work conducted in several areas, notably the Potiguar Basin in Rio Grande do Norte (phosphate), the Paraná Basin in Rio Grande do Sul (inputs for rock dust), the Tapajós Province in Pará (gold), and the whole southeast sector of the Amazonia Craton, on both sides of the Pará-Mato Grosso state border. In this case, Marcio Remédio says, "our favourability map is for porphyry and hydrothermal copper systems, opening excellent prospects for areas that have not yet been fully explored."

Exploration fronts aimed at researching rocks and industrial minerals were expanded in the course of the year, while several projects for the assessment of inputs for the building industry were developed in three metropolitan areas – Maceió in Alagoas, João Pessoa in Paraíba, and the Pelotas–Rio Grande area in Rio Grande do Sul. The potential for ornamental rocks, such as the Ornamental Rocks Atlas of Bahia, was developed in partnership with the Bahia Mineral Research Company (CBPM), among others.

Other Geological Survey publications issued in 2021 included geological maps and final reports covering four states, Ceará, Bahia, Rio Grande do Norte, and Paraná, in addition to maps of the Borborema Province, the Rio Grande Shield, the Iron Quadrangle, and the Taubaté Basin. "All these," Remédio says, "will enable companies to make a full assessment of the potential of the respective area. They will be important tools for management, and also for teaching and research activities in Earth sciences at Brazil's universities."

Under a separate programme, the Geological Survey published 48 new maps in the Anomalies series. At a scale of 1:100,000, these maps provide information about the probable presence of important minerals, particularly copper and gold, in areas of three northern states, Amapá, Rondônia, and Pará.

There remains, finally, the marine geology area. Colnago and Remédio note that, in 2021, the Geological Survey was engaged in projects conducted in Brazilian waters on the continental shelf and also beneath the high seas. The findings were set out in Reports on Marine Mineral Reserves that

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*Márcio Remédio*

examine, for instance, the potential for phosphorite deposits and marine granules on the continental shelf, or the preliminary assessment of possible hydrothermal sources in the equatorial Mid-Atlantic Ridge.

Altogether in 2021 the Geological Survey worked on some fifty projects across a wide range of activities.

## International cooperation

In recent years the SGB-CPRM has entered into cooperation agreements with research institutes and government agencies, providing for an exchange of technical visits, training programmes, and meetings. Partner countries include South American neighbours such as Argentina and Guyana, and others on every continent including China, France, Germany, Mozambique, Spain, and the United States. Talks have been held with a view to concluding similar agreements with the national geological surveys in Denmark and Russia and with the government of São Tomé and Príncipe.

Under a separate agreement, the Secretariat for Geology, Mining, and Mineral Transformation is taking part in economic studies concerning critical minerals with the Energy and Minerals Governance Program, linked to the U.S. Defence Department.

## Mineral Deposits transferred to private sector

Within the federal government's Partnership and Investment Programme (PPI), the SGB-CPRM is engaged in a project that has resulted so far in the transfer of two mining areas to the private sector. First, in 2019, Australian-owned Perth Recursos Minerais was the successful bidder for the Palmeirópolis project in the state of Tocantins, a polymetallic asset yielding zinc, copper, and nickel. Then in June 2021 BF Mineração won the rights to the Miriri phosphate deposit straddling the Paraíba-Pernambuco state border. In both cases, say Colnago and Remédio, the companies are conducting their research work with encouraging results so far. In September 2021 Alvo Minerals Ltd., the parent company of Perth Recursos Minerais, concluded a successful IPO on ASX, the Australian stock exchange, raising close to US$ 10 million for starting research work at the Palmeirópolis project and adjacent areas, while BF Minerals has signed an agreement with Harvest Minerals Ltd., also an Australian company, to raise funding for research work at Miriri.

In the course of 2022 the SGB plans to finalise the auctions for six more projects: Bom Jardim, a copper deposit in Goiás; Natividade, a gold project in Tocantins; Santo Inácio, for mining diamonds in Bahia; and three projects all in the state of Pará: one for limestone, another for gypsite, and a third for china clay in the Capim River basin. ☐

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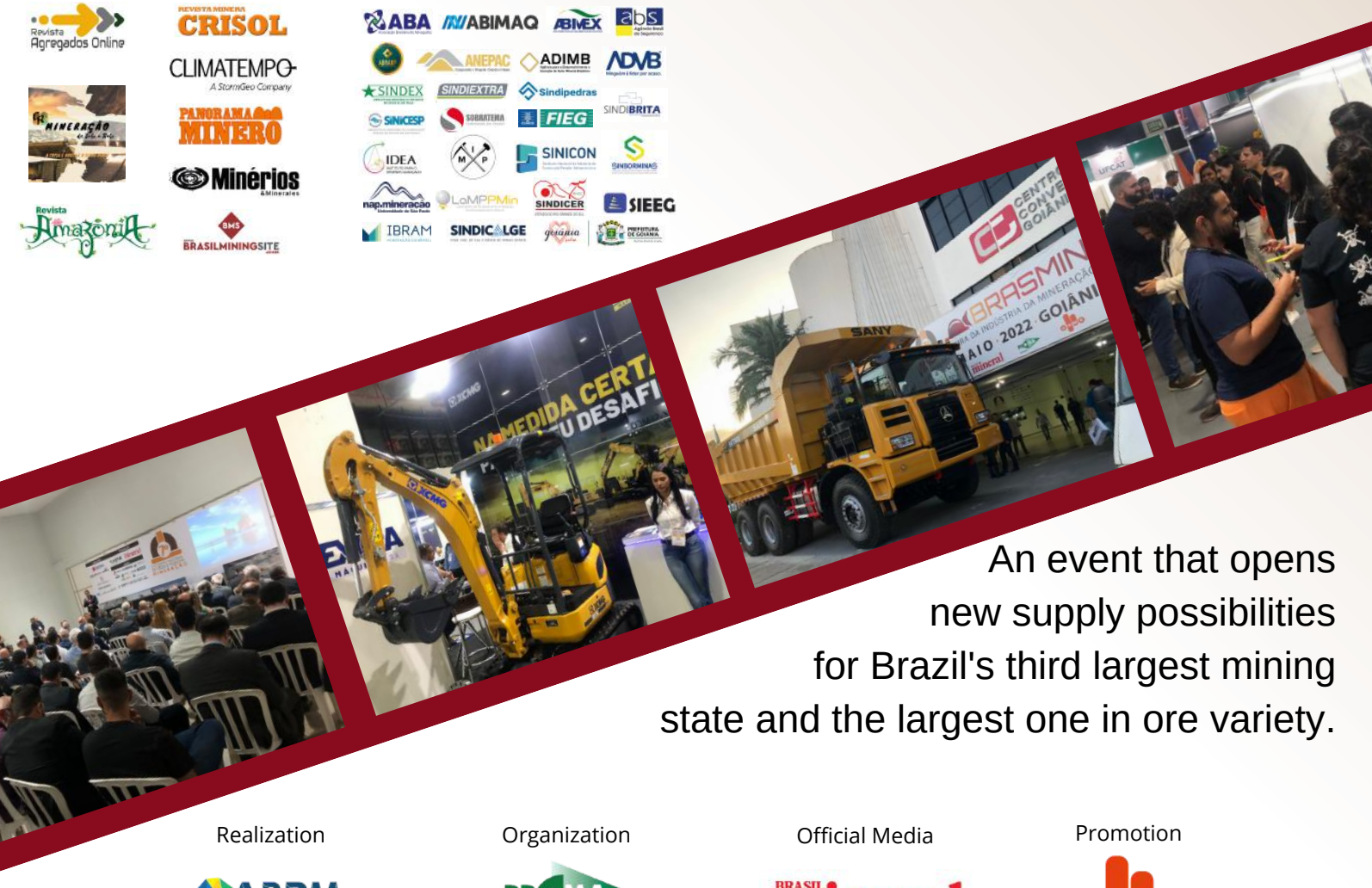

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# BRAZILIAN MINING HAS BECOME MORE SUSTAINABLE, IBRAM SAYS

In addition to the excellent results achieved in 2021 in terms of output and sales, contributing to the country's social and economic development, the Brazilian mining industry "consolidated many policies and activities towards the transformation of its procedures and positioning itself on an even higher level of sustainability," according to Ibram, the Brazilian Mining Association, a private-sector organisation.

Following the severe impact caused by accidents at two tailings dams, first at Mariana and then at Brumadinho, Brazil's mining companies have moved more closely into line with international standards in the environmental, social, and governance (ESG) area. "The Brazilian mining ESG project, now being implemented, is the first major agenda of its kind adopted by any industrial sector in Brazil," Ibram says. "It sets an example for corporate action."

**Social and environmental actions between now and 2030:**

Ibram's ESG agenda and the mobilization of companies supporting our Letter of Commitment have already led to a number of actions and changes in the mining industry.


*For further information: www.ibram.org.br/*

Two further points to be stressed, the association says, are diversity and inclusiveness, and international cooperation. Ibram is now acting jointly with the Mining Association of Canada in implementing the Towards Sustainable Mining (TSM) project in Brazil. "We also note the substantial growth of organisations involved with innovation in the mining industry, in the form of the Mining Hub, an endeavour dedicated to promoting solutions developed by startups."

Under its ESG programme, the Brazilian mining industry has adopted what Ibram calls "a bold set of targets" to be met by 2030. These include a 10 percent reduction in water consumption, measured in litres per ton of ore. This is to be achieved by recirculating used water and introducing new technologies for making reuse more efficient. Measured average consumption in 2018 was 263 litres of water per ton of ore; with a target date of 2030, this is to be brought down to 237 litres. In the same period, energy consumption from renewable sources is to grow at a minimum rate of 10 to 15 percent. In addition, Ibram says, the Brazilian mining industry is fully committed to the declared aim of the International Council on Mining and Metals (ICMM) to achieve decarbonisation by 2050.

## Relations with Brazilian society

In recent years Ibram, acting jointly with its member companies, has been engaged in restoring the prestige of the mining industry as perceived by society as a whole, repairing the damage to its reputation caused by the two dam disasters. In this task Ibram has given priority to the question of operational safety. "Mining companies face the challenge of convincing public opinion that their efforts, begun in the wake of the tragedies of the burst dams, have resulted in effective advances to avoid any repetition of the loss of life or the damage to property and to the environment. From the Brumadinho disaster in 2019 until the present moment the industry has experienced hardships, and every change and adjustment that has been made has demonstrated that we are on the right track."

## Challenges to be faced in 2022

Among the many challenges that the industry expects to meet in 2022, the most serious, in Ibram's view, is the uncertainty prevailing over the economic and political outlook both within Brazil and around the world. The war between Russia and Ukraine will have an impact on demand for commodities and other mineral products, while the run-up to the Brazilian elections to be held in October will affect the enactment of important social and economic reforms.

Challenges will also be faced arising from the new rules on tailings dams, bringing new demands and setting deadlines for the removal of upstream dams. "Apart from the execution of engineering works and highly complex and time-consuming actions for the removal of dams," Ibram says, "companies will need to engage in negotiations in connection with the extension of deadlines. This will require extensive dialogue with communities, official agencies, and society at large. This interface, involving dialogue and transparency, is a challenge to the mining industry that will remain with us many

years into the future."

On the production side, Ibram's expectation is that the mining industry will continue to increase its output tonnages, in the light of the investment programmes that companies have announced in recent months. In dollar terms, the total has risen from US$ 38 billion to US$ 41.3 billion, comprising US$ 6 billion in social and environmental actions and US$ 35.3 billion in production and infrastructure. "An important aspect not to be overlooked," Ibram says, "is that increasing amounts of capital are to be invested in states that in the past were not a priority for mining activities. Bahia is a good example. In the 2021-2025 period, Bahia is now set to receive the second largest investment volume, US$ 7.3 billion or 18 percent of the total, exceeded only by Minas Gerais with US$ 10.1 billion or 25 percent."

**"IN RECENT YEARS IBRAM, ACTING JOINTLY WITH ITS MEMBER COMPANIES, HAS BEEN ENGAGED IN RESTORING THE PRESTIGE OF THE MINING INDUSTRY AS PERCEIVED BY SOCIETY AS A WHOLE, REPAIRING THE DAMAGE TO ITS REPUTATION CAUSED BY THE TWO DAM DISASTERS"**

## Invest Mining network

Along with other private-sector and governmental organisations, Ibram is closely involved with Invest Mining, a new financing network for Brazil's mining industry having as its primary aim "the improvement of the business environment in mining and the promotion of good practices in the field of sustainability, governance, and social concerns." On the private-sector side, other participants in the network are banks, funds, assets managers, stock exchanges, the Brazilian Association of Mineral and Mining Research Companies (ABPM), the National Confederation of Industry (CNI) represented by its Mining Council (Comin), the Brazilian Mining Industry Development and Innovation Agency (Adimb), and the Brazil-Canada Chamber of Commerce (BCCC).

Ibram was one of the prime movers behind the partnerships that originated Invest Mining and put it into operation. In Ibram's own words, "The purpose is to attract the attention of investors in Brazil and abroad. We aim to manage a business, but also to make a contribution to a secure, sustainable business environment focused on the attractiveness of the industry; to promote alternative mechanisms for investment and for raising funds on capital markets; and to bring mining companies closer to desired practices in the field of corporate governance and sustainability." ☐

## FEDERAL GOVERNMENTAL ORGANIZATIONS

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*(Ministry of Mines and Energy)*
Minister: Bento Albuquerque
Esplanada dos Ministérios - Bloco U - 8º andar
70065-900 – Brasília – DF
Phone: +5561 2032-5555
E-mail: ascom@mme.gov.br
www.mme.gov.br

**Secretaria de Geologia, Mineração e Transformação Mineral – SGM**
*(Geology, Mining and Mineral Transformation Secretary)*
Secretary: Pedro Paulo Dias Mesquita
Esplanada dos Ministérios - Bloco U - 4º andar
70065-900 – Brasília – DF
Phone: +5561 2032-5175
E-mail: sgm.gab@mme.gov.br
www.mme.gov.br/sgm

**Cia. Pesquisa e Recursos Minerais – CPRM**
*(Brazilian Geological Survey)*
President: Esteves Pedro Colnago
Setor Bancário Norte – SBN
Quadra 02 - Asa Norte – Bloco H – Edifício Central Brasília 70040-904 – Brasília – DF
Phone: +5561 2108-8400
E-mail: cprmsede@df.cprm.gov.br
www.cprm.gov.br

**Agência Nacional de Mineração – ANM**
*(National Mining Agency)*
General Director: Victor Hugo Froner Bicca
Setor Bancário Norte Quadra 02 Bloco N
Edifício CNC III
CEP: 70040-020 - Brasília - DF
Phone: +5561 3312-6611
E-mail: ascom@anm.gov.br
www.anm.gov.br

**Centro de Tecnologia Mineral - CETEM**
*(Mineral Technology Center)*
Director: Sílvia Cristina Alves França
Av. Pedro Calmon, 900 - Cidade Universitária
21941-908 – Rio de Janeiro – RJ
Phone: +5521 3865-7222
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www.cetem.gov.br

## PRIVATE ORGANIZATIONS

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SCN Quadra 02 - Bloco D - Torre A - salas 501/503/505
Centro Empresarial Liberty Mall
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Phone: +5561 3326-0759
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www.adimb.org.br

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Coordinator: Janaina Donas
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Phone: +5511 5904-6450
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E-mail: abceram@abceram.org.br
www.abceram.org.br

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Executive President: Reinaldo Dantas Sampaio
SRTV – Sul quadra 701 – Ed. Assis Chateaubriand
Conj. L - nº 38 – bloco 2 – sala 601
70340-906 – Brasília - DF
Phone: +5561 3033-1478
E-mail: contatos@abirochas.com.br
www.abirochas.com.br

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Executive President: Venilton Tadini
Praça Monteiro Lobato, 36 – Butantã
05506-030 – São Paulo – SP
Phone: +5511 3094-1950
E-mail: abdib@abdib.org.br
www.abdib.org.br

**Associação Brasileira de Fundição – Abifa**
*(Brazilian Foundry Association)*
President: Afonso Gonzaga
Av. Paulista, 1274 – 20º andar
01310-925 – São Paulo – SP
Phone: +5511 3549-3344
E-mail: abifa@abifa.org.br
www.abifa.org.br

**Associação Brasileira de Metalurgia, Materiais e Mineração – ABM**
*(Metalurgic and Materials Brazilian Association)*
Executive President Executivo: Horacidio Leal Barbosa Filho
Rua Antonio Comparato, 218 - Campo Belo
04605-030 – São Paulo – SP
Phone: +5511 5534-4333
E-mail: abm@abmbrasil.com.br
www.abmbrasil.com.br

**Associação Brasileira das Empresas de Pesquisa Mineral – ABPM**
*(Brazilian Association of Mineral Exploration)*
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Setor Hoteleiro Sul, Quadra 6, Conjunto A, Bloco C, s/nº
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70316-109 – Brasília – DF
Phone: +5561 3547-7645
E-mail: abpm@abpm.net.br
Secretaria_exec@abpm.net.br
www.abpm.net.br

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*(Brazilian Association of Equipment and Machinery Industry)*
President: José Velloso Dias Cardoso

Av. Jabaquara, 2925 – Jabaquara
04045-902 – São Paulo – SP
Phone: +5511 5582-6311
E-mail: abimaq@abimaq.org.br
www.abimaq.org.br

**Associação Brasileira do Carvão Mineral – ABCM**
*(Brazilian Association of Mineral Coal)*
President: Fernando Luiz Zancan
Rua Pascoal Meller, 73 – Bairro Universitário
88805-380 – Criciúma – SC
Phone: +5548 3431-8350
E-mail: zancan@carvaomineral.com.br
www.carvaomineral.com.br

**Associação Nacional das Entidades de Produtores de Agregados para Construção Civil – Anepac**
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Executive President: Fernando Mendes Valverde
Rua Santo Amaro, 71 – 18º andar – Bela Vista
01315-001 – São Paulo – SP
Phone: +5511 3171-0159
E-mail: anepac@anepac.org.br
www.anepac.org.br

**Associação Nacional para Difusão de Adubos – ANDA**
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President: Ricardo Tortorella
Praça Dom José Gaspar, 30 – 9º andar – Centro
01047-010 – São Paulo – SP
Phone: +5511 3218-2807
E-mail: anda@anda.org.br
www.anda.org.br

**Instituto de Metais Não-Ferrosos – ICZ**
*(Non-Ferrous Metals Institute)*
President: Ricardo Suplicy de Araújo Goes
Av. Angélica, 1814 – Conj. 1205 - Higienópolis
01228-200 – São Paulo – SP
Phone: +5511 3214-1311
E-mail: contato@icz.org.br
www.icz.org.br

**Instituto Brasileiro de Mineração – Ibram**
*(Brazilian Mining Institute)*
Executive President: Raul Belens Jungmann Pinto
SHIS QL 12 - Conj. 0 - casa 4 – Lago Sul
71630-205 – Brasília – DF
Phone: +5561 3364-7272
E-mail: ibram@ibram.org.br
www.ibram.org.br

**Instituto Aço Brasil**
*(Brazilian Steel Institute)*
Executive President: Marco Polo de Mello Lopes
Rua do Mercado, 11 – 18º andar – Centro
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Phone: +5521 3445-6300
E-mail: acobrasil@acobrasil.org.br
www.acobrasil.org.br

**Organização Mineronegócio**
*(Mineronegocio Organization)*
President: Adriano Espeschit
Rua Claudio Soares, 72 – Cj 1110 – Pinheiros
05422-030 – São Paulo – SP
Phone: +5511 98176-6677
E-mail: presidencia@mineronegocio.org
www.mineronegocio.org.br

**Sindicato Nacional da Indústria do Cimento – SNIC**
*(National Syndicate of Cement Industry)*
President: Paulo Camillo Penna
Rua da Assembleia, 10 - grupo 4001 - Centro
20011-901 – Rio de Janeiro – RJ
Phone: +5521 2531-1314 / 3553-1266
www.snic.org.br

**Sindicato Nacional da Indústria de Extração de Ferro e Metais Básicos – Sinferbase**
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# DIRECTORY

President: Alexandre Valadares Mello
SHIS QL 12 – Conj. 0 - casa 4 - Lago Sul
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Phone: +5561 3364-7299
E-mail: sinferbase@sinferbase.com.br
www.sinferbase.com.br

**Sociedade Brasileira de Geologia – SBGEO**
*(Brazilian Society of Geology)*

Presidente: Simone Cerqueira Pereira Cruz
Rua do Lago, 562 – Cidade Universitária – Butantã
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