

## **EXECUTIVE SUMMARY – MIRIRI PROJECT**

### **Summary**

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

However, CPRM's activities in mineral exploration activities were practically ended in the 1990s. The edition of Constitutional Amendment No. 6/1995 allowed the opening of the mining sector to foreign capital, there was a substantial increase in private investments in mineral research, eliminating the performance of this function by CPRM. In addition, Law No. 8,970, of December 28, 1994, transformed CPRM into a public company and changed its corporate objects, so that CPRM started to perform mainly the function of Geological Service in Brazil and stopped acting in the execution of mineral research itself.

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

### **Location**

The set of surveyed areas is located in the coastal region of the states of Pernambuco and Paraíba, in a strip parallel to the coast, about 45 km in a north-south direction. In the state of Paraíba, the areas are located south of the city of João Pessoa, encompassing the municipalities of Alhandra and Pedras do Fogo, forming the so-called Northern Block. In Pernambuco, the areas are located near the city of Goiana, forming the South Block. The access is by the BR-101 highway, which cuts part of the areas. From there, the other areas can be reached by numerous back roads that serve farms and villages in the region.

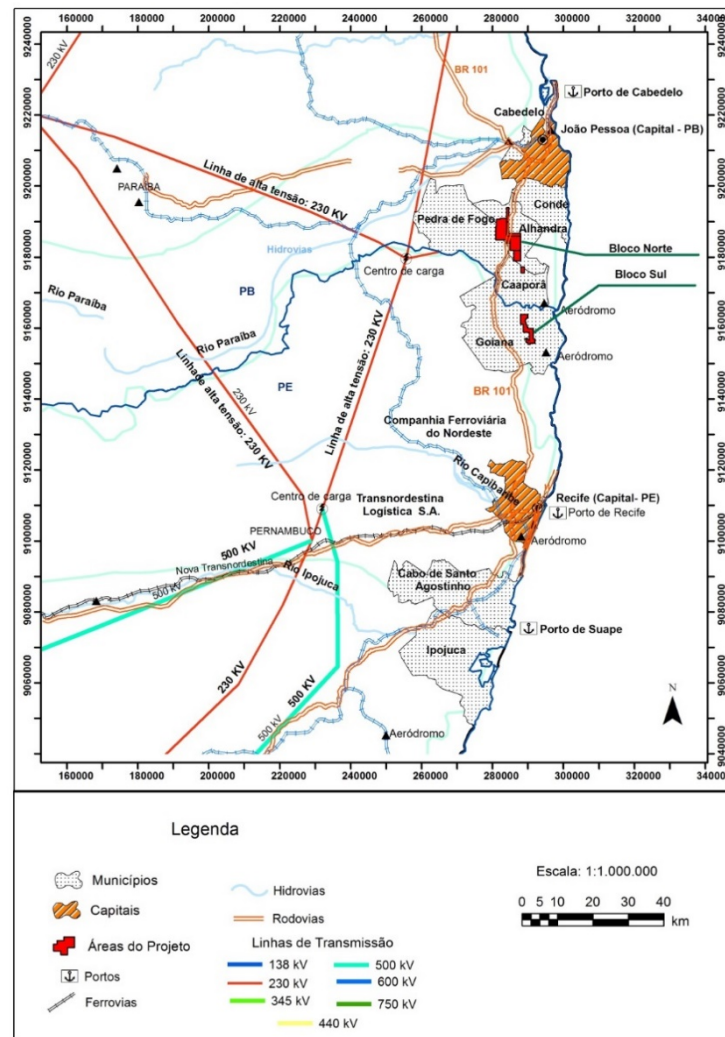


Figure 01 – Map of location of Miriri Project

## Infrastructure

The areas are located between two large and important commercial centers in the northeast of Brazil (Recife and João Pessoa), it places this project in a highly favorable position regarding the basic infrastructure available necessary for installation of a future mining enterprise. The region has qualified labor, electricity, underground water, communication, banking, hospitals and a wide system of road, air and port transportation, represented by the ports of Cabedelo (PB) and Suape (PE).

## Legal and Environment Situation

The Miriri Project consists of seven mining processes, all on behalf of CPRM, totaling 6.112,18 acres. The final research report was presented jointly for the seven areas and forwarded to National Mining Agency (ANM) on 02/06/1986.

The report was analyzed in a fragmented manner and approved by the aforementioned body, being published in the Official Gazette (DOU) of May 20, 1987 (840.302/1979, 840.305/1979 and 840.306/1979), July 2, 1987 (840.307/1979) and July 7, 1987 (840.303/1979, 840.304/1979 and 840.446/1980). CPRM has authorization from ANM to

continuous the mineral exploration studies until today ensured by respective exploration Licenses.

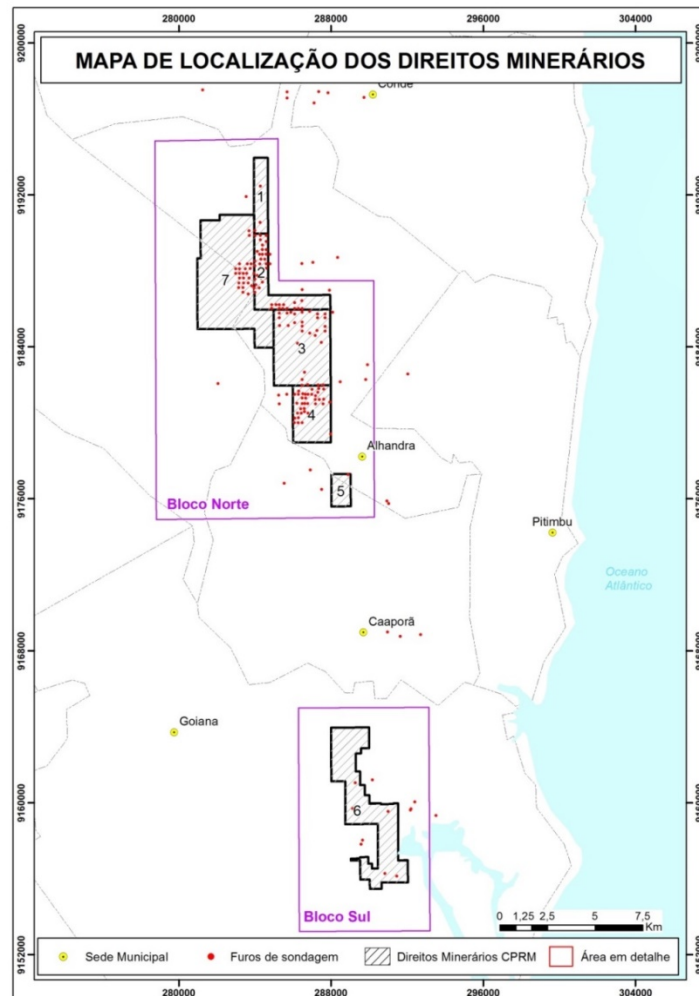


Figure 02 – Miriri Project Mining Rights location

## Geology

From a geological point of view, the Miriri phosphate deposit is inserted in the Olinda and Alhandra sub-basins and is predominantly covered by Cenozoic sediments from the Barreiras Group and post-Barreiras deposits. The main geological unit correspond to the Gramame and Itamaracá formations and, secondarily, to the Maria Farinha Formation, which only occurs in the beach areas and in the most offshore portions of the basin. The Beberibe Formation, in turn, was described only in testimonies.

Three ore types occur in the deposit:

- Type 1 (High grade ore): Phosphorites with  $P_2O_5$  grades from 18% to 33% and low aluminum oxides;
- Type 2 (Low grade ore): Phosphatic siliciclastic rocks, with  $P_2O_5$  grades between 1% and 15%;

- Type 3 (Low grade ore): Calcareous phosphatic rocks, with  $P_2O_5$  grades from 4% to 17%, representing secondary ores.

The phosphate sedimentary deposits in the Paraíba Basin represent records of a major resurgence event that occurred in the basin during the Maastrichtian period. These records suggest that the phosphate was deposited on a shallow marine platform, in an environment with a geographic morphology of a bay with sea entry from the east and north, carrying phosphate-rich sediments. Such deposits can be correlated to deposits in Colombia and Venezuela, north and northwest Africa and the Middle East.

### **Geological Exploration**

Throughout the region, 10,763.97 meters of rotary drilling were conducted, distributed in 247 holes, of which 176 holes are located within the CPRM areas and were used in the modeling and resource estimation of this report, totaling 6,890.54 meters.

Radiometric measurements made during the Miriri Project (CPRM, 1982) in the core samples indicated a clear correlation between increased phosphate content and increased natural radioactivity in the uranium channel. Using this positive correlation as a prospective parameter, during the reassessment of the project, carried out in 2013, the aerogammaspectrometric data in the uranium channel of the Borborema Plateau East Edge Aerogeophysical Project (LASA & PROSPECTORS, 2008) was used to locate new anomalous targets for phosphate research in the Alhandra Sub-basin. Gravimetric data were used to establish the Alhandra Sub-basin framework and allowed to make inferences about the deposition model of the phosphate rocks.

Orientated geochemical survey in current and soil sediments was conducted in 2013, within the scope of the Phosphate Brazil Project (CPRM), and focused mainly around the requirements areas, with the objective of establishing geochemical parameters and sampling methodologies, analytical and interpretive, which could be applied in future regional surveys of prospective stream sediments. This survey showed a series of anomalous targets that coincide with the mineralized areas of the Miriri deposit, as well as some new targets located in the southern portion of the basin.

### **Mineral Resources**

Recently, CPRM carried out the reinterpretation and reevaluation of the geological model of Miriri deposit using all data available. The geological modeling was developed using the software Datamine Studio 3 and considered the three types of defined ore with generation of solids for each type individually (Figure 3), reflecting the extent of mineralization throughout the studied areas. The individualization of mineralized types was defined based on lithological and stratigraphic aspects, as well as on the control of  $P_2O_5$ , CaO and  $Al_2O_3$  contents.

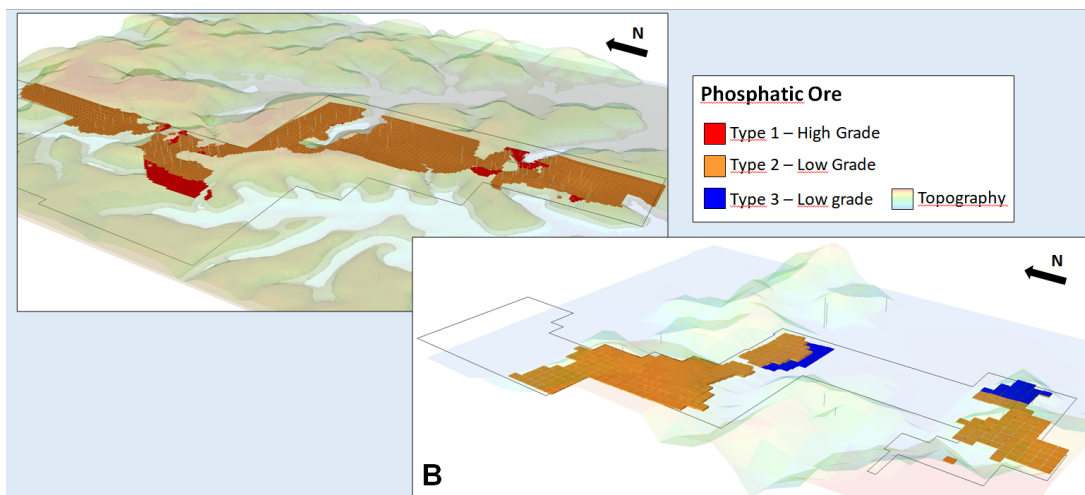


Figure 03 – Geological interpretation of Miriri Project

As a basic premise, a minimum content of 1% P<sub>2</sub>O<sub>5</sub> was considered for the sampled interval to be inserted in the mineralized package, admitting the maximum thickness of up to 1.5 m of sterile as intercalations between the mineralized levels.

The development of this work resulted in the estimation of a deposit of sedimentary phosphate distributed in two larger blocks, delimited by the research requirements of CPRM, totaling inferred resources in the order of **114.8 Mt with an average content of 4.19% of P<sub>2</sub>O<sub>5</sub>**. Considering a cut-off grade of 4% Miriri project presents 38Mt @ 8,14% P<sub>2</sub>O<sub>5</sub>.

### Economic Evaluation

Brazilian agriculture has fed much of the world. Its expansion and growth are associated with the intensive use of fertilizers, especially phosphate. In 2013, about 57% of the phosphates consumed in Brazil came from imports. Undoubtedly, the developments of new phosphate mines in Brazil are a challenge and at the same time an opportunity for new investors.

The Ceres mine consultant, company hired by CPRM, using the data room provided by CPRM, carried out a market study and a conceptual study of the economic viability of the official Mineral Resources presented in the revaluation report.

Considering a waste/ore ratio less than or equal to five as a limit for favoring open pit mining and removing areas with socioenvironmental restrictions, the result obtained reflects the “viable” phosphate resources from both an economic point of view as environmental, we obtained a total Inferred Resource, present in the North Block, corresponding to 28.9 million tons of phosphorous ore at 3.41%, and, in the South Block, at 1.2 Mt at 5.68%.

The consultant concludes that Miriri Project is not mature enough to be implemented due to its current resources, technical and economic conditions. It is understood that the project is still in a stage of transition from the level of Desktop Study to Economic Pre-Feasibility.

In this sense, GE21 concludes that the project is an exploration prospect for development in two phases, the first being complementary research with a minimum initial investment and with an option to withdraw, the second, in case of positive results, for the implantation of a mineral enterprise.