The rediscovery of Rondon do Para, the last giant world-class bauxite deposit in an attractive geography

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Abstract

Rondon do Pará deposit is located in Pará State, north Brazil. Also known as the Amazon Bauxite Province, it holds mineral resources greater than 3 billion tons of bauxite. Lateritization of sedimentary rocks is the genetic process of a thick gibbisitic bauxite layer. Several companies have explored the region for bauxite since the 1970's, defining Trombetas, Juriti and Paragominas deposits, currently under production. At the same time, Votorantim Metais/CBA (VM) defined a small bauxite resource in some mining permits. In 2006 VM returned to the province to re-evaluate its mining permits resources and additional potential. This work program entailed 90 000 m of drilling, analysis of > 40 000 samples and the execution of three pilot pits for bulk sampling. Exploration investment totaled US$ 35 million and all activities were developed according to industry best practices complying with JORC Code. The deposit resources add up to 1.6 billion tons of bauxite grading 42.6 % available alumina, 3.9 % of reactive silica and a stripping ratio of 7, with inexistent organic matter. A feasibility study was completed in 2013 of 9 million tons of washed bauxite per annum mine integrated to an alumina refinery with 3 million tons production capacity.

Keywords: Amazon Bauxite Province; Rondon do Pará deposit; Mineral Exploration; Feasibility Study.

1. Introduction

Votorantim Metais (VM), a subsidiary of Votorantim Group, is one of largest Brazilian metals & mining company producing zinc, copper, nickel, aluminum and with a mineral exploration program with focus in the Americas. The company has 17 production units in several regions of Brazil and the World.

The Alumina Rondon Project (ARP) is VM's largest investment in Brazil and it considers the development of a bauxite mine with an integrated alumina refinery located in Pará State, North Brazil, within the World's second largest bauxite/alumina production province. The ARP will have an annual production capacity of 9 million tons of washed bauxite and 3 million tons of alumina. These projected production capacity had its viability defined after a large investment in Mineral Exploration, executed by VM, that resulted in the rediscovery of the world-class Rondon do Pará deposit, that summed up to other VM bauxite deposits in the province, aggregated resources in the order of 1.6 billion tons of washed high quality bauxite.

This paper presents the main geological characteristics of Rondon do Pará deposit and summarize the exploration work and techniques used to estimate and classify resources. The results presented in this paper were obtained during 2006 - 2015 exploration works at mining rights of VM in *Amazon Bauxite Province* that host the largest bauxite deposits of the world.

2. Location of Rondon do Pará deposit

The Rondon do Pará deposit is located in the Northern Region of Brazil, in the Amazon, southeast portion of Pará State and is surrounded by Rondon do Pará, Dom Eliseu and Goianésia do Sul municipalities (Figure 1). This region is very favorable mining activity with community friendly to mining, developed infrastructure with paved federal highways, electric energy available and skilled human resources. Additionally, the deposit is located very close to an important railway project, the North-South (EF-151) that will connect the cities of Açailândia to Barcarena, about 450 km, where the Vila do Conde Port is located.

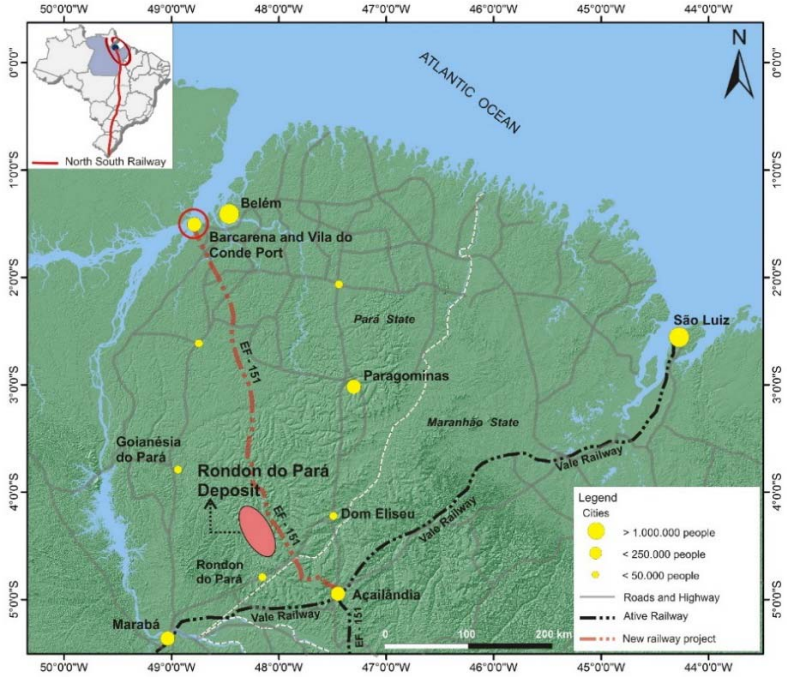

Figure 1. Location of Rondon do Pará deposit and near infrastructure.

3. Geological and geomorphological context

In this paper the term *Amazon Bauxite Province* is used to refer to a region that host all bauxite deposits located in northern Brazil that is formed during Paleogene under similar conditions, as the result of mainly sedimentary rocks exposed to laterization processes.

The bedrocks of these deposits are predominantly sedimentary in origin. The similarities among the bedrocks all over this province and this tectonic stability allowed us to compare and correlate the laterization profiles of all bauxite deposits in this province, such as: Juruti, Trombetas and Paragominas (Figure 2).

The geological underlying units of the *Amazon Bauxite Province* have the paleogeographical reference to the evolution of Amazon Basin and Grajaú Basin related to the opening of Equatorial South Atlantic Ocean during the late Jurassic/early Cretaceous. These geological units are formed by siliciclastic sediments, mainly constituted by clayey sandstone, intercalated with conglomerates of Alter do Chão Formation (Amazon Basin) and Ipixuna /Itapecuru Formations (Grajaú Basin), Figure 2 [1].

The bauxite deposits of *Amazon Bauxite Province* are found as large plateaus, some of then up to 500 km^2, 70 to 450 m above sea level, and with broad thalwegs (Figure 3). The origin of this

7. Conclusions

1. The Rondon do Pará Deposit is the last giant bauxite deposit discovered in the last decade, placing the Amazon region as very important bauxite province in the World and still with a high potential for new discoveries. The total resources inventory including other VM targets sum up to 1.6 billion tons of high quality bauxite.

2. Regional and local geology, as well as the mineralization and its controlling factors, are sufficiently well understood, and their interpretation serve as a basis for the mineral resource estimation.

3. Geologically the Rondon do Pará Deposit profile can be well correlated to those ones from Paragominas, Trombetas and Juruti with lots of similarities in their lateritic profiles, clay cover, origin and age of bedrocks.

4. Among all Amazonian bauxite deposits, the Rondon do Pará Deposit figures with a distinctive lateritic profile hosting a Ferruginous Bauxite horizon that is a very important contribution for ore quality due to its low reactive silica content and good alumina grades. This horizon adds resources to the project and together with the massive bauxite horizon improves economic viability, incrementing ore thickness and lowering the waste/ore ratio.

5. The mineralogy of RPD is mainly constituted by gibbsite, hematite, goethite, with minor content of kaolinite and traces of resistate minerals (zircon, tourmaline, rutile and anatase). Very low grades of TOC (total organic carbon) were obtained.

6. The geological contacts, textures and disposition of lateritic horizons in Rondon do Pará profile allows us to correlate its geologic evolution with the other well-known Amazonian deposits recognizing two later superimposed bauxitization events over the previous laterization stage during Paleogene to Miocene.

7. VM Mineral Exploration team followed strictly defined work protocols for all exploration activities. Topography survey, down-hole survey, geological mapping, drilling, logging and sampling, QA\QC controls and mineral resources estimation were compliant to the industry best practices currently used in exploration programs worldwide.

8. References

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