The El Palmar Bauxite Deposit in Venezuela

Noel Mariño
Mining Consultant
Bolívar State, Venezuela
Corresponding author: nmarinop@gmail.com

Abstract

Near El Palmar, eastern Bolívar state, a bauxite deposit was located by CVG-Tecmin in the mid-1980s. The El Palmar Bauxite Deposit was identified by the plateau's geomorphological pattern being similar to that of the well-known Los Pijiguaos Deposit. Chemical analyses allow its classification as a siliceous and/or low grade bauxite, similar that of Los Pijiguaos but of a different quality. The profile is divided into three zones: the upper 2 to 3 metres is 39 % average total alumina and 32 % average silica. The middle zone, 4 to 5 metres thick, is a pisolitic bauxite with 34 % total alumina and high silica around 44 % average. The lower zone down to bedrock has clays with high silica content (> 48 %). Inferred resources are estimated at 475 million tons for an assumed depth of 4 metres, or 270 million tons for an assumed depth of 2 metres. The El Palmar Bauxite Deposit has a favorable geographical location due to its proximity to the CVG-Bauxilum Alumina Refinery in Ciudad Guayana, 90 km to the northwest. However, legal and environmental constraints, as well as bauxite quality, limit the development of the project in the short term.

Keywords: Venezuelan bauxite, geomorphological patterns, average chemical results, inferred resources, bauxite project limitations.

1. Introduction

Following indications reported in unpublished reports from the Ministry of Mines and Hydrocarbons, starting in 1987, CVG-Tecmin (a geological – mining research and development company) began work on the recognition and verification of the existence of granitic rocks with the possible development of laterization profiles containing bauxite, which might be economically exploitable. This exploration took place in the mountain range of Paisapa, about 20 km northeast of El Palmar and about 90 km southeast of Ciudad Guayana, between the municipalities Padre Chien of Bolívar state and Antonio Díaz of Delta Amacuro state, both southeastern Venezuela.

Through aerial reconnaissance missions and field verification work, CVG-Tecmin detected a potentially exploitable reservoir in the El Palmar region (Figure 1). Pereira [1] reported it consisting of a:

"*Lateritic siliceous bauxite from the decomposition and alteration of the rocks of the* [...] *Imataca Complex*."

Imataca Complex rocks are felsic and mafic gneiss, granulites, ferruginous quartzites and granitic rocks, with common amphibolite dikes and sills, and local minor occurrences of calcareous rocks (dolomites) [2].

This deposit exhibits analogies with the bauxite deposit of Los Pijiguaos, such as flat top or plateau relief, a height of between 600 and 700 metres above sea level, high monsoon type rainfall and deep laterization of the bedrock.

2. Field Work

As the first exploratory activity, in 1988, CVG-Tecmin [3] made three trial pits (see Table 1) excavated in the centers of the lobes of better development and drilled 89 boreholes. A 250 x 250 metres grid was used through the symmetry axis of the selected bauxite bodies. Metre by metre samples were taken according to the CVG-Bauxiven standard. These were then sent to the laboratory of the Los Pijiguaos Mine, where there was sufficient expertise in the relevant analytical procedures, a properly calibrated X-ray fluorescence (XRF) instrument for bauxite, and because CVG-Bauxiven had financed the exploration project. CVG-Bauxiven was created in 1979 to manage the operations of the bauxite mine of Los Pijiguaos.

As a result, mineral resources were initially estimated at around 150 million tons, as reported by Mibam [4].

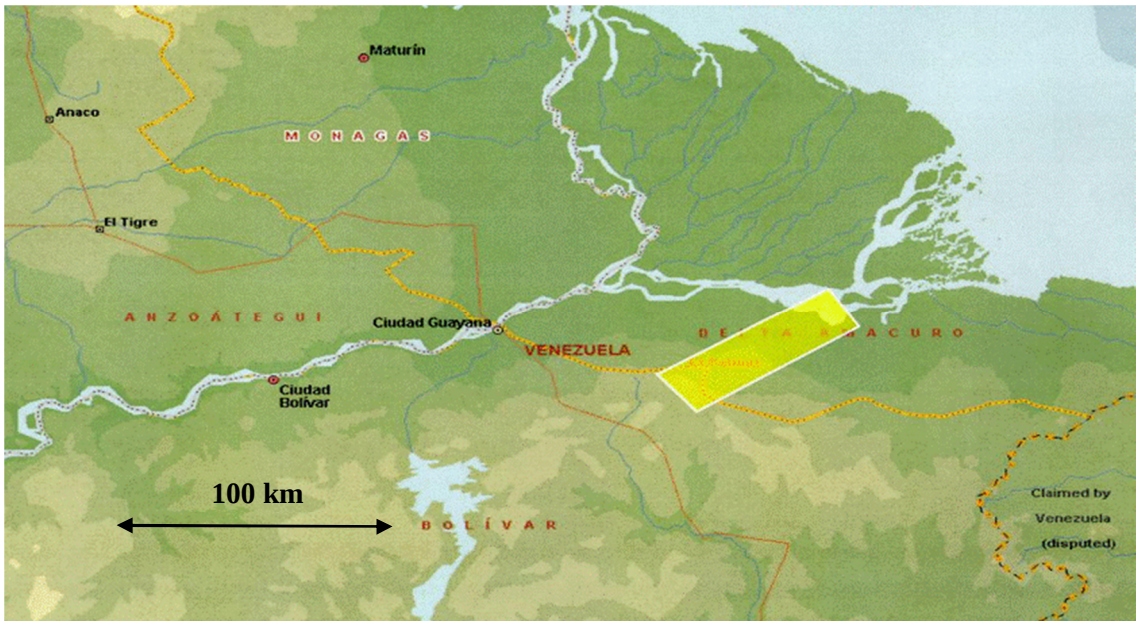

Figure 1. Relative location (yellow box) of the El Palmar Bauxite Deposit [4].

Table 1. Average chemical results of the samples taken at the three trial pits [4].

Trial Pits	Depth (m)	SiO_2 (%)	Al_2O_3 (%)	Fe_2O_3 (%)	TiO_2 (%)	PPR
1	8	23.6	34.77	14.48	1.35	17.45
2	8	17.4	49.90	7.2	1.14	24.83
3	7.5	35.27	36.84	6.58	1.04	19.60

In May 1988, the author carried out a field inspection at the site, to take some samples of bauxite for analysis and comparison. From the results of these analyses and the CVG-Tecmin reports [5], it was possible to make a first description of the lateritic profile from top to bottom:

- A lateritic cover of 2 to 3 metres thick, with 39 % average total alumina and 32 % average silica was observed.
- The middle zone 4 to 5 metres thick is a pisolitic bauxite with interlayers of hard thin layers. This zone has 34 % total alumina and 44 % average silica.
- The lower zone down to bedrock has clays with high silica content (> 48 %).

In Figure 2, it is shown how the three main chemical parameters vary versus the depth in the El Palmar Bauxite Deposit. Iron (Fe_2O_3), total alumina (Al_2O_3 T) and total silica (SiO_2 T), are based on the average analysis of the 89 boreholes at the El Palmar Bauxite Deposit as reported by CVG-Tecmin [3].

Later on, in 1992, CVG-Tecmin [5] indicates:

"*The results obtained suggest that these are areas with siliceous and / or low grade bauxite* [...] *very similar in appearance to bauxite present in Los Pijiguaos Deposit, but of a different quality*."

At the beginning of this century, Beltrán [6] published the following news:

"*Anglo-Australian mining conglomerate BHP Billiton and Corporación Venezolana de Guayana* (CVG, a company created to develop the natural resources of Guayana*) are working on a joint-venture for the El Palmar Bauxite Project* […] *The owner of the mining titles of the El Palmar Bauxite Deposits is the local company Delta Mining and work is being done to transfer the property to CVG, after which they will be able to advance the negotiations with BHP Billiton.*"

These negotiations failed and the concessions, known by the name of "Rio Grande I Concession", expired.

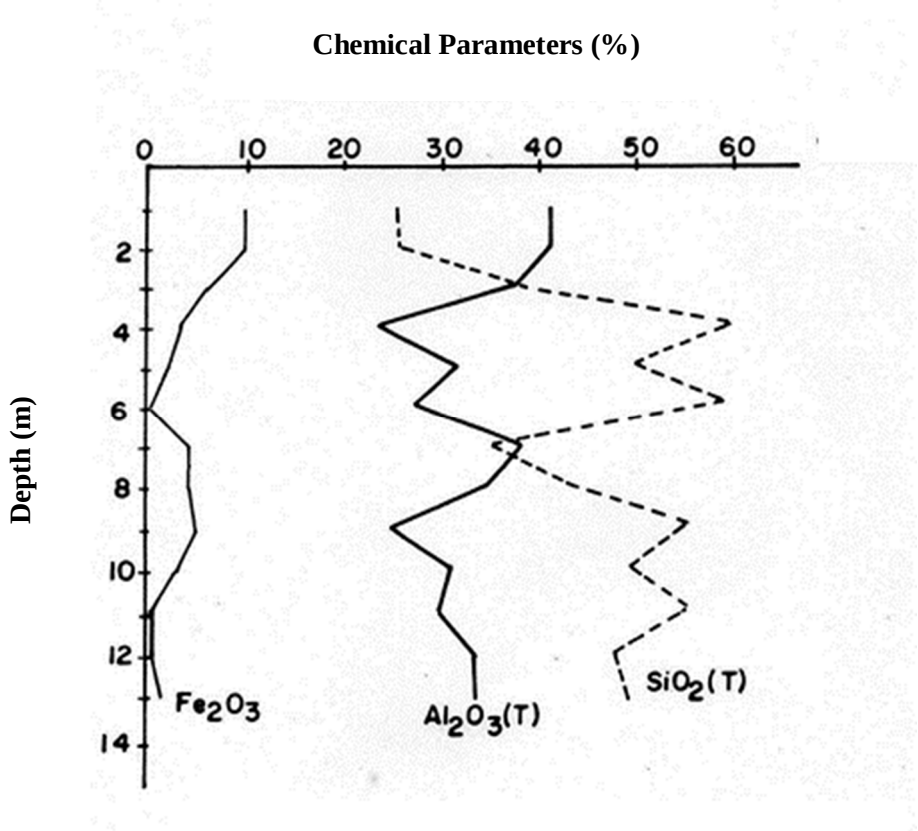

Figure 2. Variation of the chemical parameters versus depth [3].

In environmental terms, it is important to note that the left bank of the Rio Grande river (Figure 3) are lands that are in the jurisdiction of the Imataca Forest Reserve, where mining is prohibited by government decree. This situation could affect more than one third of the

proposed area for possible exploration and subsequent exploitation of the El Palmar Bauxite Deposit [7].

3. Potential Areas with Inferred Bauxite Resources

The potential areas for inferred bauxite resources in the old "Rio Grande I Concession" was evaluated using the paper of Pereira [1] in the El Palmar Bauxite Deposit (Figure 3). Patterns of interpretation were made with SPOT images according to the criteria of the mineralization model observed and studied for the bauxite of the Los Pijiguaos Deposit according to Brojanigo's report [8]. This approach was successfully applied to the La Cerbatana Bauxite Deposit 80 miles northeast of the Los Pijiguaos Bauxite Deposit. These criteria helped to determine and quantify quite closely the potential reserves of bauxite for the areas established as mineralized.

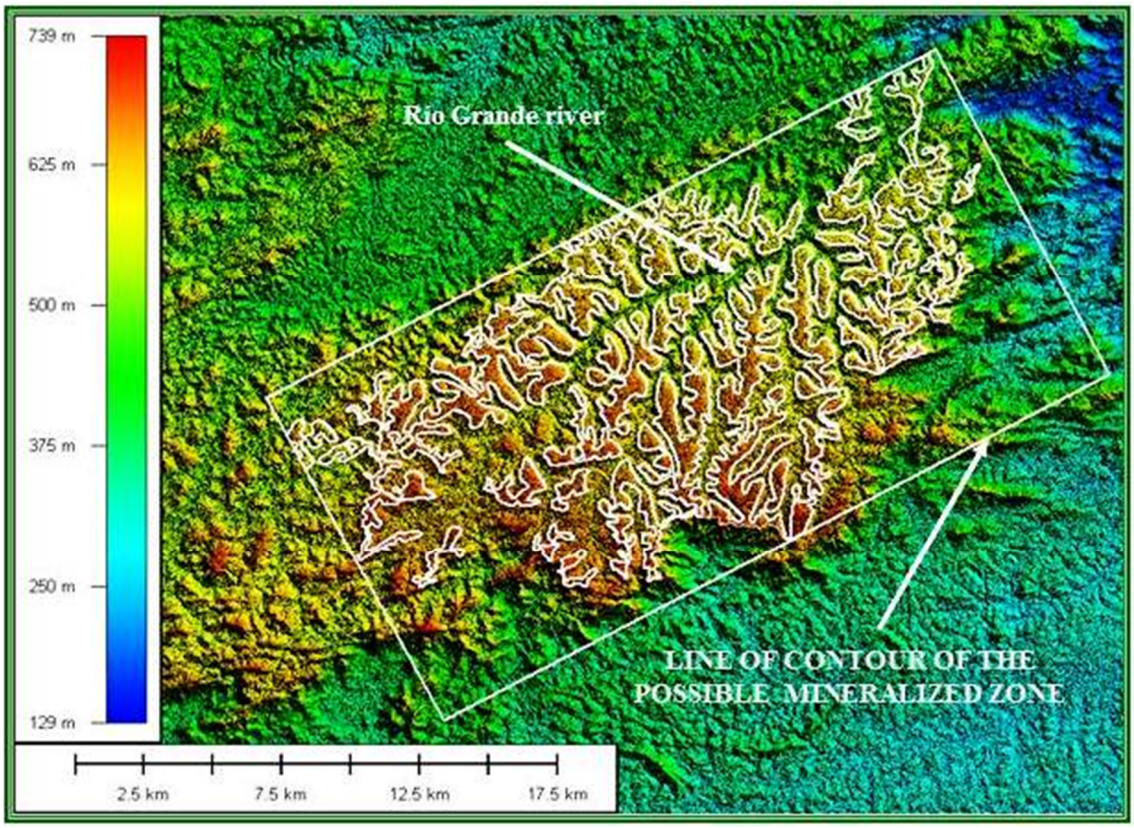

Figure 3. Contour lines of the mineralized zone where existence of bauxite is presumed. Location: SPOT image of the Rio Grande I Concession [1].

4. Study Summary

The main conclusions are the following and are based on the Pereira [1] and Mariño [7] reports:

- The geomorphological characteristics observed in the "Rio Grande I Concession", allows the conclusion that they are similar to the plateau patterns of Los Pijiguaos Bauxite Deposit.
- An area of 8,922 ha of good exploration prospect for bauxite was observed.

- In a vertical profile three well defined zones of mineralization were observed. The middle zone could be considered as ore, although with average values of total alumina and high silica.
- The spectral response of the vegetation, geomorphological domains, texture features and tonality, was evaluated to estimate inferred bauxite resources.
- For ore quantification, two assumed deposit depths were chosen: the first, very conservative, 2 metres and another, more realistic of 4 metres.
- Inferred resources are 475 million tons to a depth of 4 metres and 270 metres tons for 2 metres.
- For both depths, resources are higher than the report of Mibam [4], where inferred resources were established at 150 million tons.
- The El Palmar Bauxite Deposit has a favorable geographical location due to its proximity to CVG-Bauxilum Alumina Refinery in Matanzas, Ciudad Guayana, 90 km to the northwest. However, legal and environmental constraints, as well as bauxite quality, limit the development of the project in the short term. CVG-Bauxilum was the merger between CVG Bauxiven and CVG Interalúmina in 1994.
- It is imperative to carry out the further geological prospection to help reach the best investment decision in this area, which has been included in the recently declared "Zone of National Strategic Mining Development" or also known as Orinoco Mining Arc.

5. Acknowledgements

Thanks to Professors Franco Urbani and Sebastian Grande (Universidad Central de Venezuela) and my colleague José A. Rodriguez (FUNVISIS) for their critical suggestions. Special thanks to Steve Healy for his assistance with English editing.

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