



CONE

MINE EXPLORATION

Alumina Project

Aluminum Ore
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Alumina Project

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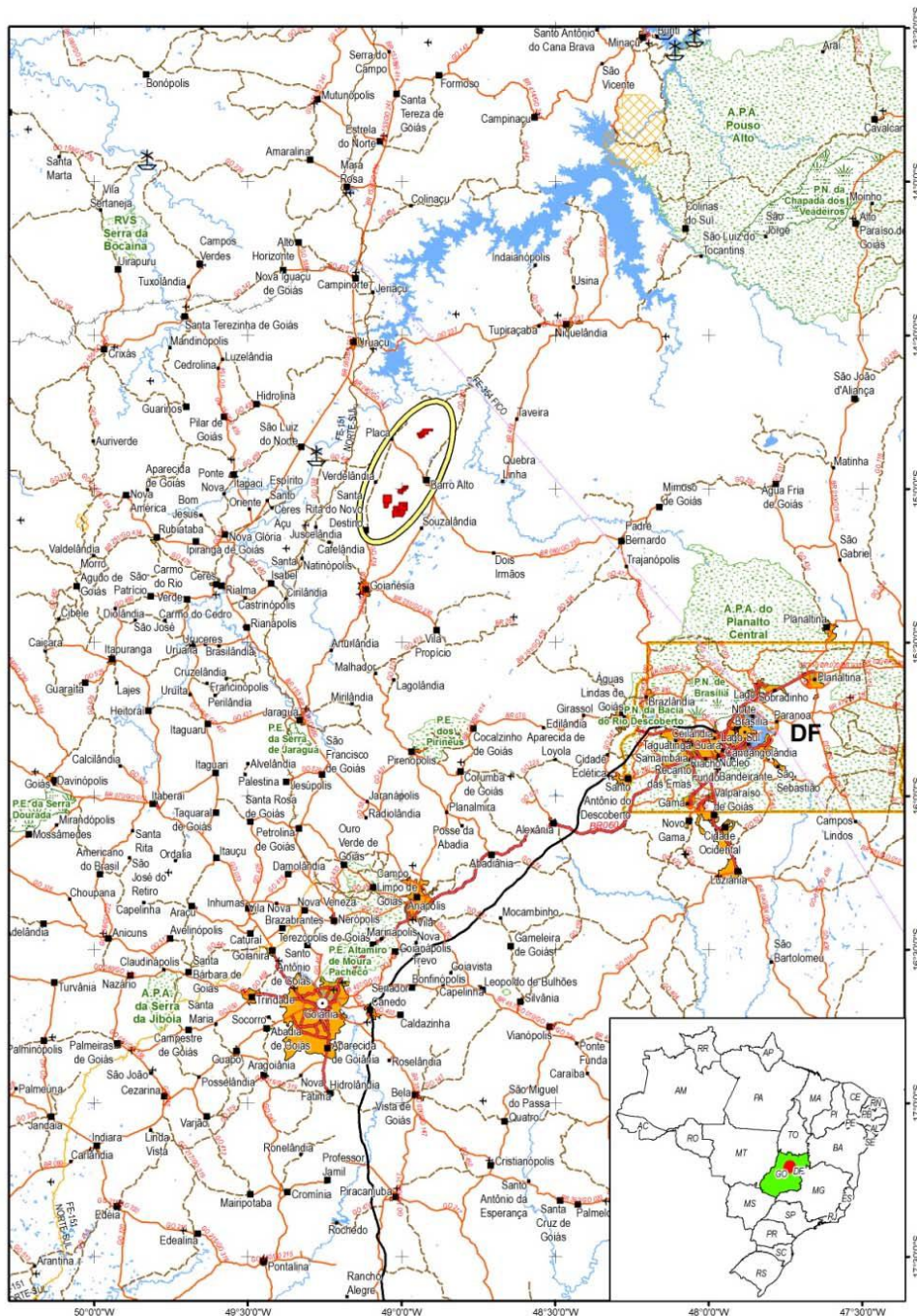
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1 INTRODUCTION

- It is the first bauxite deposit discovered in the Center-West of Brazil.
- It outcrops in great extension, in an accessible region and geologically known.
- It is the result from the weathering of anorthosites from the Mafic-Ultramafic Complex of Barro Alto.
- The research done testified expressive reserves of ore with high quality, able to be applied in different uses.
- The deposit has exceptional physical, chemical and morphological qualities.
- Its use will certainly have positive impacts at the regional and national levels.

2 LOCATION

- Central portion of the state of Goiás: about 200km N of Goiânia and NW of Brasília.
- Municipalities: Barro Alto and Santa Rita do Novo Destino.
- The region has good infrastructure and privileged geo-economic situation.



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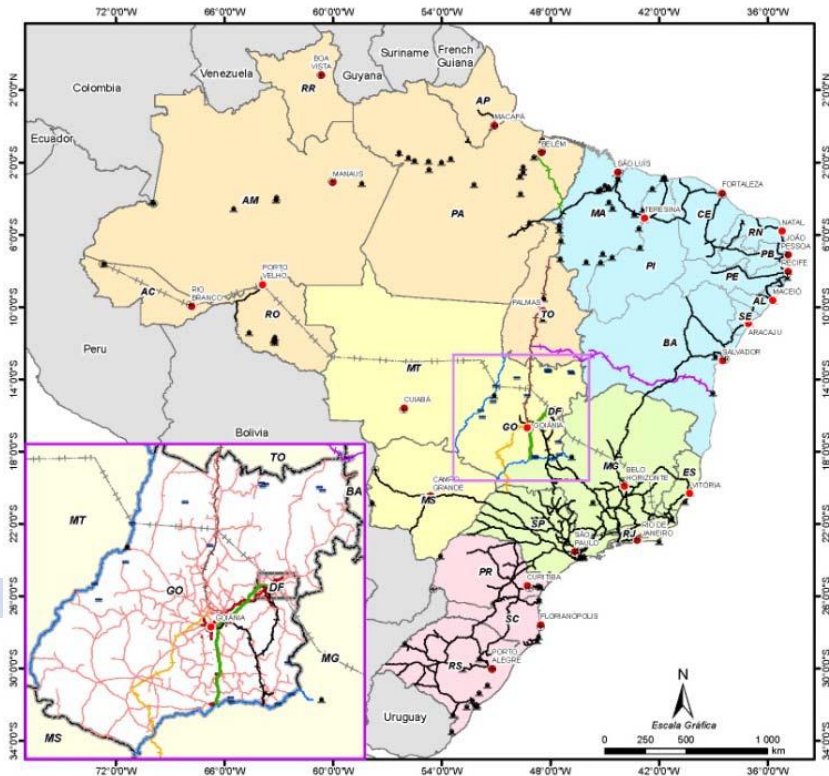
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Fax: +55 31 3286-5111

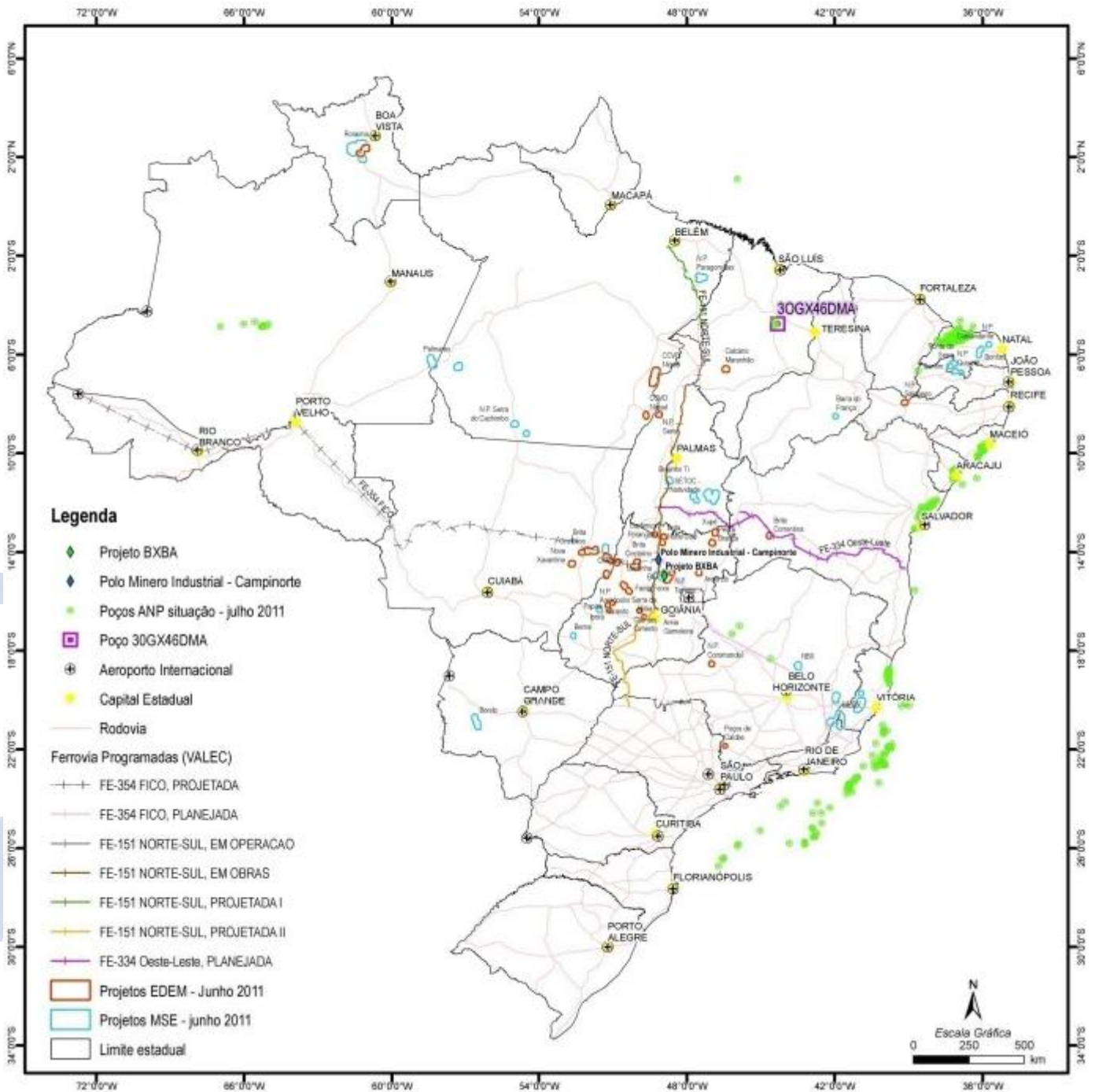
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- Access through paved roads until Souzalândia.
- Railway FE-151 (North-South): under construction, 40km from Santa Rita.
- Railway FE-354 (East-West): planned.



N-S Railway, in Petrolina

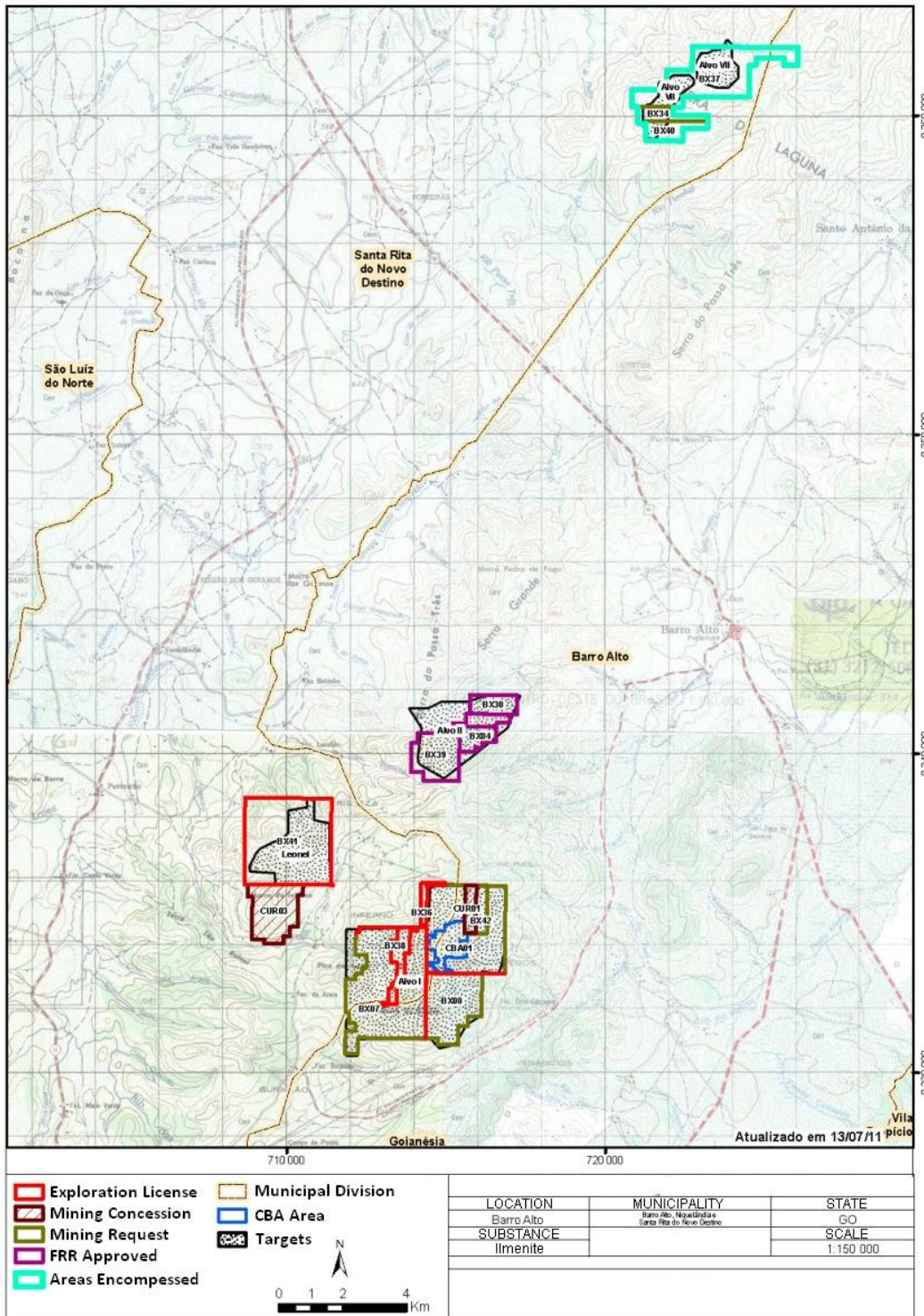




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3 LEGAL SITUATION

All the areas of the project are under Exploration License or have already applied for the Mining Concession and waiting for the Environmental License as well.



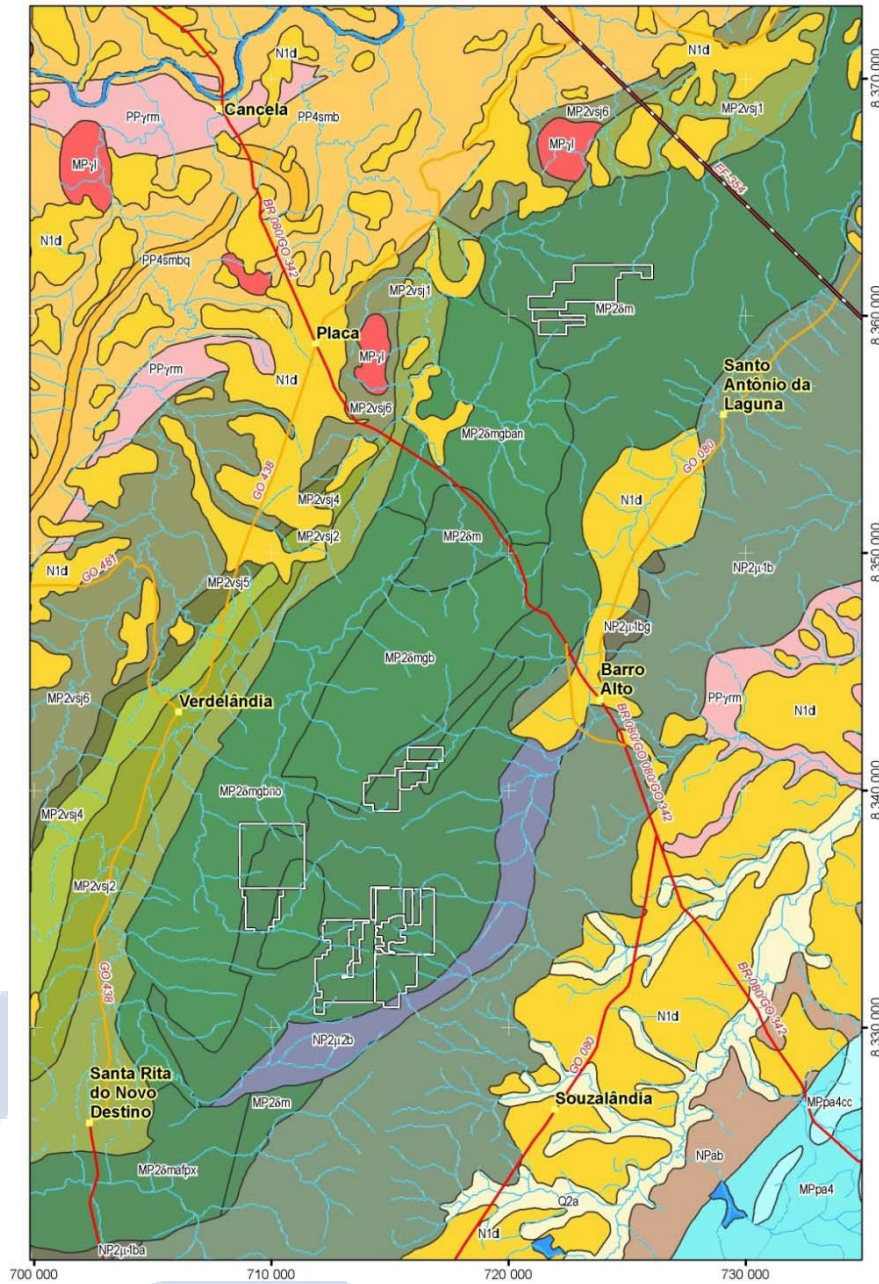
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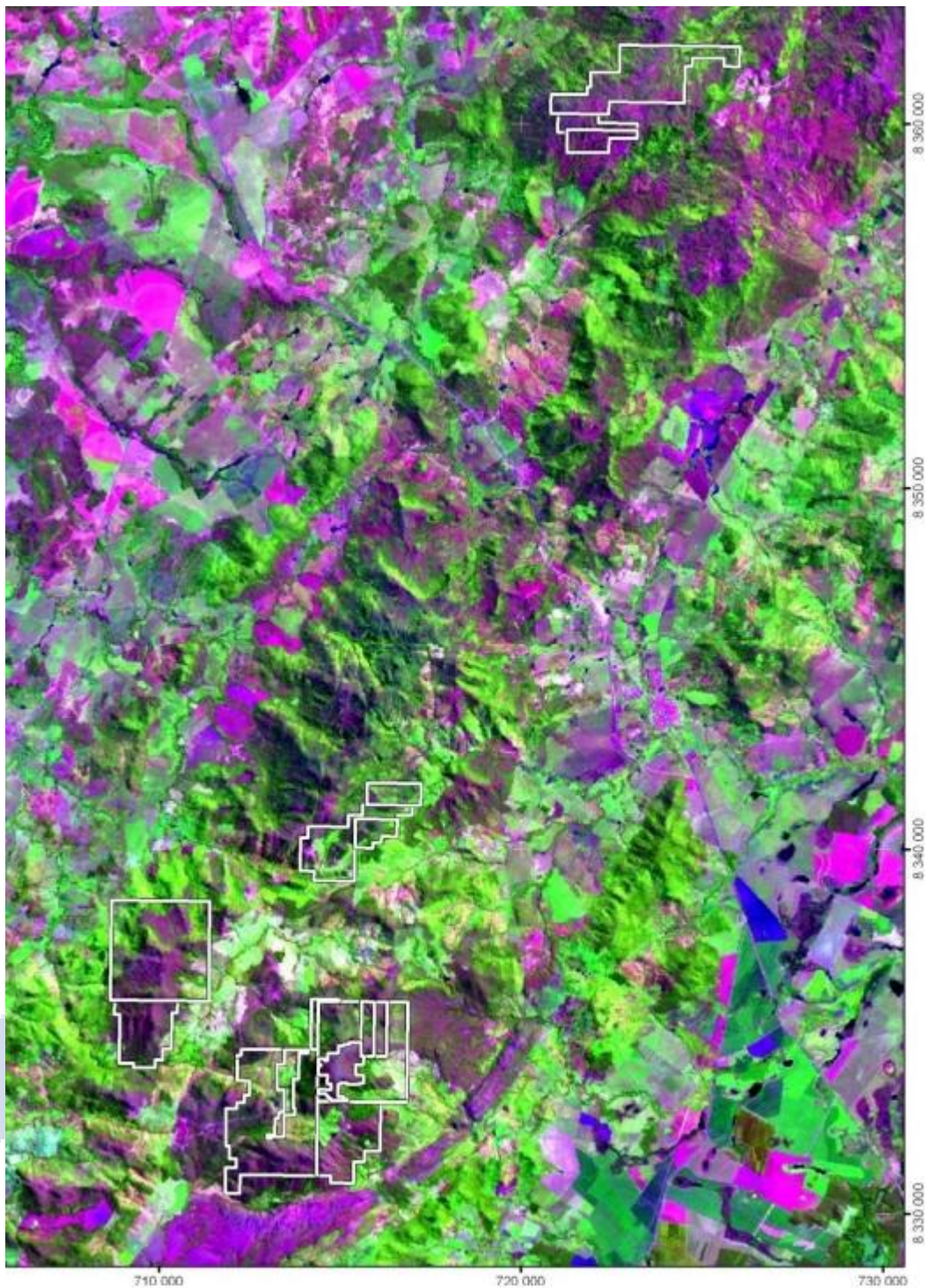
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4 REGIONAL GEOLOGY



- Brasília Range.
- Mafic-Ultramafic Massif of Barro Alto: northern segment.
- Superior serie: anorthosites, gabbros and pyroxenites.



- Tocantins River Basin: Maranhão River and Almas River.
- Remnants of old flattened surfaces: landscape dominated by spikes >1,200m.
- Aluminous poor soils.

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- Sparse vegetation.
- Land use high without significant economic.
- Occupation intensive agriculture in the lowland southeast.
- Urban area: Souzalândia.



Serra da Torre, view from W to E

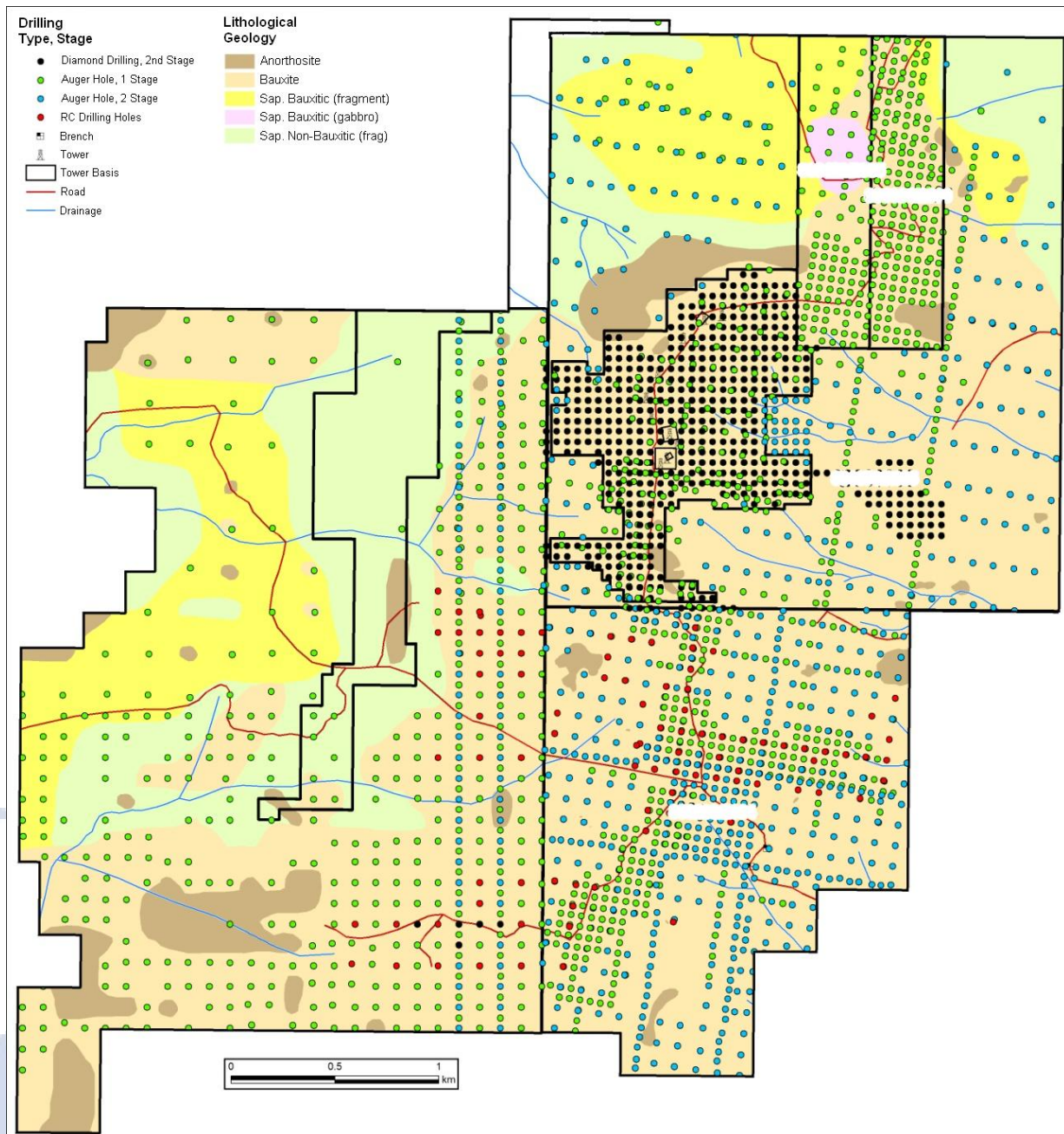
5 RESEARCH WORKS

- 1st Stage - 2004/2005: Auger drilling relatively shallow and chemical analyzes aiming industrial uses.
- 2nd Stage - 2006/2007: the main areas were taken according to a new approach with deeper surveys and chemical analyzes also aiming the metallurgical use.
- 2007/2008: Project was audited by GEOS, in order to verify the research procedures and improvement of its records and controls.
- Since 2008: The auger drilling continues for detailing the portions selected.
- 2010/2011: Reverse Circulation drilling aiming industrial use.



In parallel, progress was made in the geological modeling and geostatistical approach of the features present at the deposit. (Girodo & Veiga, 2008).

The results of the 2nd Stage confirmed initial expectations and increased resources evaluated in depth.



- Substrates dominated by bended anorthosites.
- There are expressive elevations (1,200 to 1,500m): old surface slightly wavy, highlighted in the regional landscape.
- Aluminous saprolites outcrop (bauxite), as fragment of rocks very leached sometimes wrapped in clay matrix.

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The deposit has an extension up to 6,000m and width up to 3,000m, covering the entire detailed region and extending to neighbor areas.

The thickness of the saprolite exceeds 20m in the higher portions of the deposit and, sometimes, is up to 50m.



The transition from fresh rock to saprolite is always abrupt, which shows the strength of the leaching process.



- There is mainly porous bauxite, marked by light and dark bands, inherited from the original banding.

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- The preservation of structures and textures of the parent rock shows rise in situ, and absence of reworking.

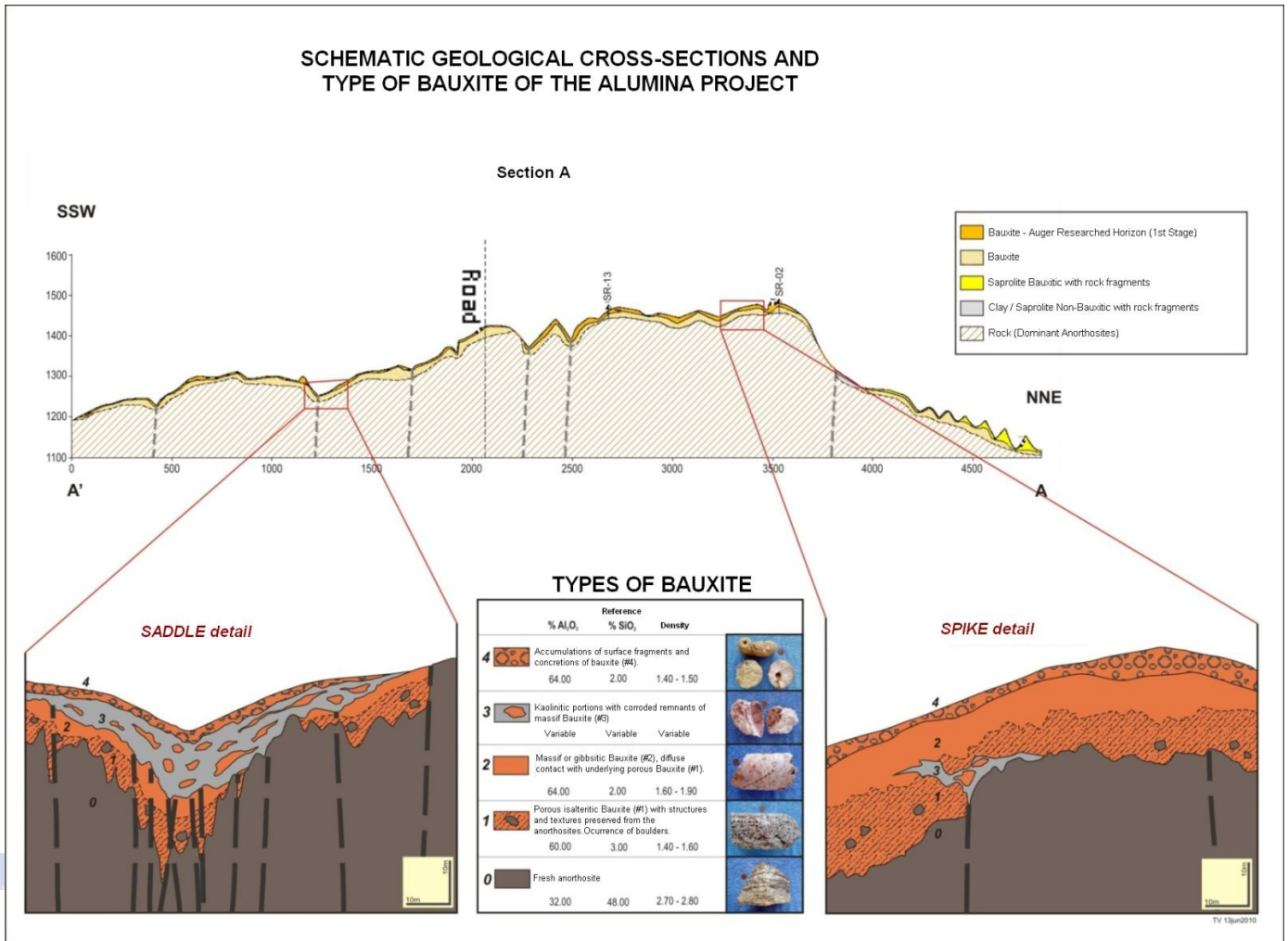


The prolonged weathering under humid climate promoted the leaching of SiO_2 , K_2O , CaO and MnO . At the same time, it provided the supergene enrichment in Al and Fe, represented by goethite and gibbsite.

The levels are significant, the order of 52% Al_2O_3 total (dry basis), similar to the best available deposits in Brazil.

Amid the rich ore, there are clay portions with eroded fragments of bauxite, resulting in significant reserves of aluminous clays.

Anyway, it emphasizes the regularity of saprolite bauxitic, which sets a deposit with expressive dimensions.



The absence of sterile capping made easier the inspection of the deposit and certainly will do the same when exploiting it.



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Motorized Auger Drilling

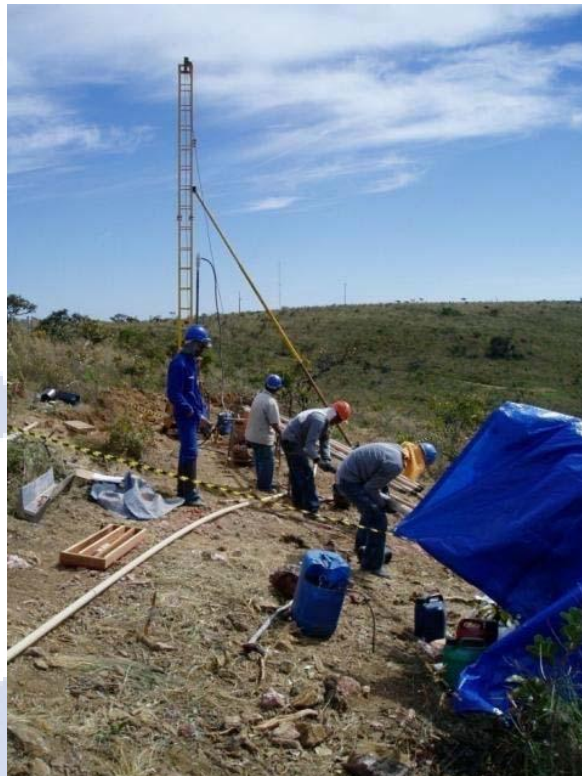


Grids: 200x100, 100x100 and 50x50m.

- Difficulties to drill due to hard ore and rock fragments.
- In any event, the auger provided rapid coverage of large surface with full recovery of the material cut.
- Average depth reached: 1st Stage - 6.01m, 2nd Stage - 9.85 m.
- Generation of reliable samples, in compatible time and cost.

Diamond Drilling

- CBA has done dry drilling for details of the selected portion.
- 13,044.50 m in 513 holes, average of 25.42 m.
- Grids of 50x50m, diameters H and N.
- Satisfactory recovery.
- Results compatible with the auger survey: expectations of resources confirmed and added important information to the geological modeling of the deposit.



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Reverse Circulation Drilling

- Grids of 200x200m and 100x100m, diameters H and N.
- 2,030m in 95 holes, average of 21.32m.
- Average recovery: 93%
- Waiting for analytical results.



Excavations



Mature Outline (Up) – Spike

Immature Outline (Right) – Flank



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1st Stage:

- 7 wells (49,7 m) and 2 benches.
- The excavations allowed the exposure of the profile, the verification of ore percentage and collection of samples for testing.

2nd Stage:

- It was done about 10 wells (94.7 m), being 7 for density tests carried out by CBA.
- The results confirmed the density inferred in the research works (1.60 t/m³).

Chemical Analysis

1st Stage:

- Chemical analysis aiming industrial use.
- Mineração Curimbaba Laboratory (Poços de Caldas – MG).
- Al₂O₃, SiO₂, Fe₂O₃, TiO₂, K₂O, CaO, P₂O₅, MnO, ZrO₂ and P.F.

2st Stage:

- Chemical analysis aiming metallurgical use.
- L. A. Teixeira laboratory (Andradas – MG).
- Total and usable Al₂O₃, total and reactive SiO₂, FeO₃, TiO₂ and P.F..

Target	Stage	Analyzed Boreholes	Samples
1	1	870	3,702
	2	853	8,549
	Sum	1,723	12,251
Others		556	2,142
Total		2,279	14,393

During the auditing of 2007 a program of reference chemical analyzes was executed aiming to evaluate the reliability of the research results.

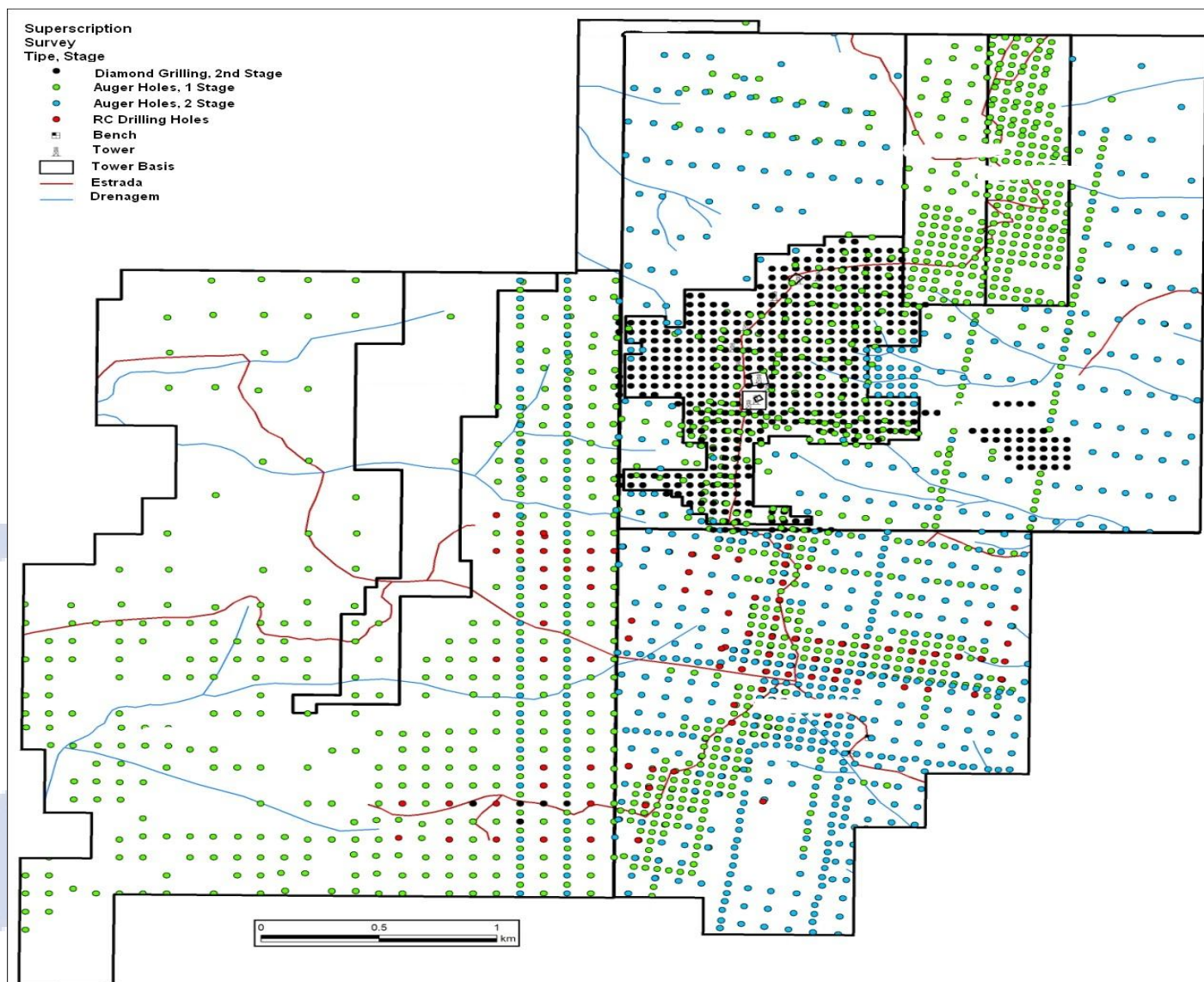
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The preparation procedures and the laboratories Curimba, Teixeira and SGS Geosol were measured. The results showed:

- The sampling held during the auger drilling result in trusted pairs of samples and counter samples.
- The sample preparation is also reliable: twin pulps are equivalent.
- The engaged laboratories are reliable, especially the Teixeira one.

During the research, quality control data is being systematized in a specific program type called QAQC.

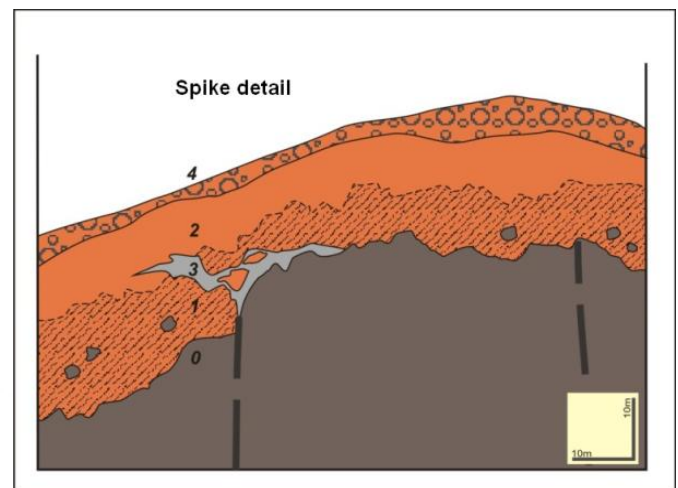
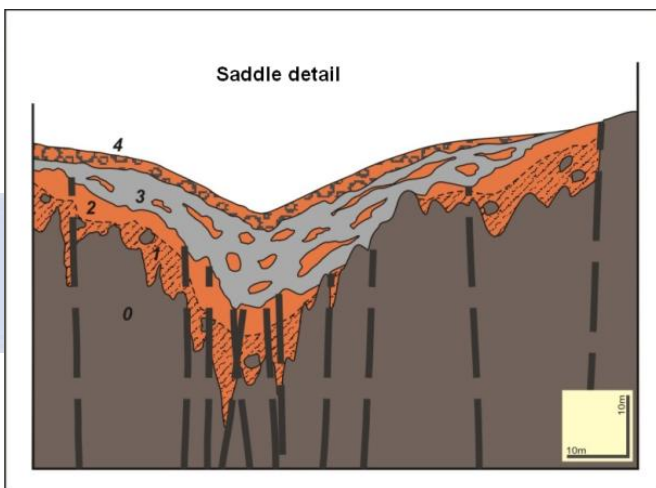
6 Resource Evaluation

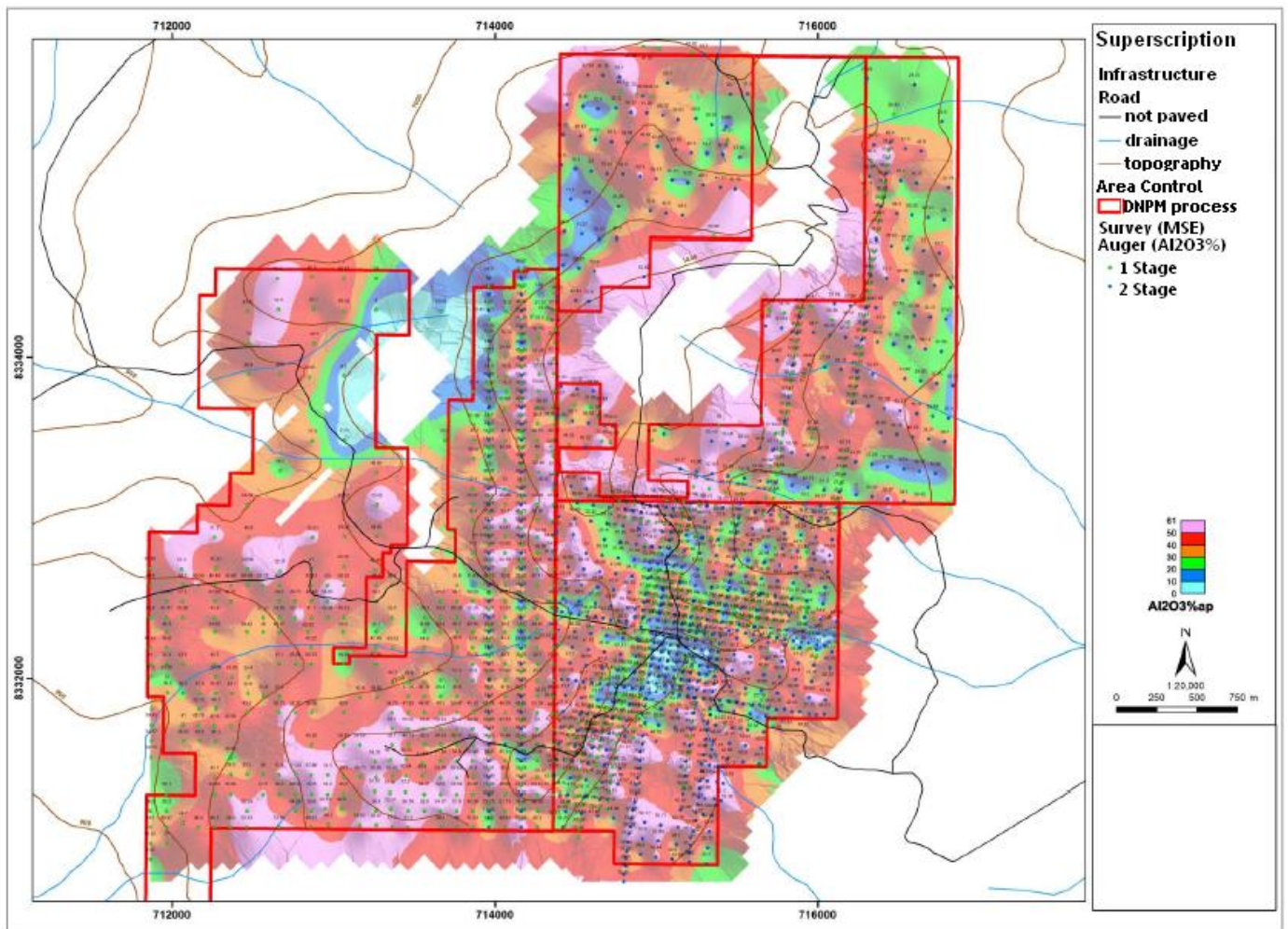


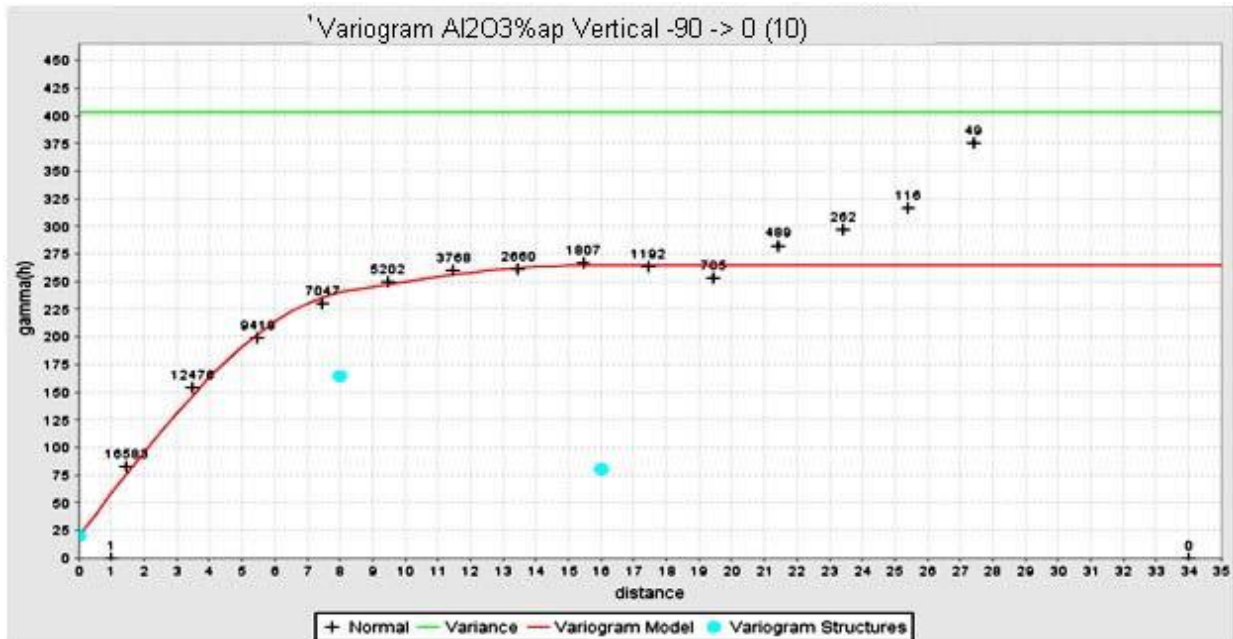
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The deposit comprises three horizons:

- Summit: accumulation of Bauxite fragments concentrated by erosion; high rate (4).
- Intermediate portion: discontinuous clay zone with remaining corroded and massif bauxite; variable proportions and rate.
- Base: rich ore consisting of porous bauxite (1) and massif bauxite (2) derived from anorthosite; sudden transition.
- Although heterogeneous, the clayed area is discontinuous and has little expression in the total volume of ore.
- Geostatistical studies confirmed the regularity of the deposit and authorized the approach in one horizon.
- The distribution of alumina and silica rates indicates a predominance of rich ores in the uppermost parts.







- The variography demonstrated consistent adjustments: Al₂O₃ a SiO₂r, Fe₂O₃ e TiO₂.
- The resources of Target 1 were evaluated by ordinary kriging, with double restriction levels, separating:
 - Rich ore: Al₂O₃ a > 30% e Si O₂ r < 7%.
 - Poor ore: + clay: Al₂O₃ a < 30% and/or SiO₂ r > 7%.

Resources in Barro Alto:

Type	Average thickness (m)	Resources (m)	Content Al ₂ O ₃ a (Mt)	Rate (%)						
				Al ₂ O ₃	SiO ₂	Al ₂ O ₃ a	SiO ₂ r	Fe ₂ O ₃	TiO ₂	
Consolidated resources at Target 1										
Rich ore 2	3.19	56.14	28.72	55.36	4.69	51.18	3.52	5.96	0.35	
Poor ore and clay	4.12	80.48	25.99	46.86	22.35	29.97	16.76	7.28	0.47	
Sum	7.31	136.62	54.71	Average	50.53	15.41	37.10	11.32	6.71	0.43
Geological potential Target 1, 2, 7 Leonel		71.56								
Total		208.18								

Comments: Al₂O₃a > 30% and SiO₂r < 7%.

Al₂O₃a < 30% and/or SiO₂r > 7%.

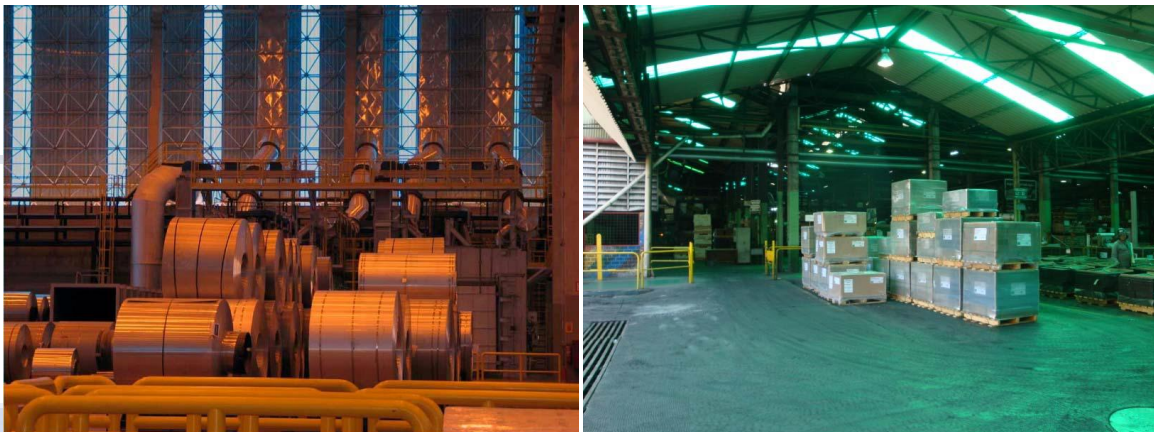
7 Technological Tests

Metallurgical use

- After crushing the rich ore can be used “in natura”.
- The average rate of serviceable Al₂O₃ without contaminant is near 51%.
- In principle, the clay ore may be used after washing, like is practiced in other deposits of bauxite.

Refractory use

- Large part of the ore can be used “in natura” (average rate of 52% Al₂O₃).



8 Economic Perspective

The magnitude and quality of resources ensure broad prospects to the use of the deposit Barro Alto. Currently are considered the following product options:

- Alumina.
- Refractory bauxite.
- Brown fused alumina (electrofusion).
- Refractory brick powder.



Alumina Refinery

- Conceptual design developed by PROGEN.
- Plant with estimated production of 1.5 MT/year.
- Installation local: Barro Alto – Go.
- Economic parameters:
 - Total investment of U.S. \$ 613 million;
 - Overall operating cost of U.S. \$ 136.77 per tonne;
 - Alumina prices: 13 to 16% of the price of aluminum;
 - Product - minimum level: U.S. \$ 332.43/t;
 - Product - maximum level: U.S. \$ 485.02/t;
 - Product - middle level: U.S. \$ 358.25/t (13% of the LME).



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Refractory Bauxite

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- Objective: produce high quality refractory bauxite to meet internal and external demand.
- Quality requirement: $Al_2O_3 > 88\%$ and $Fe_2O_3 < 2.50\%$.
- Testing technology and market research in progress.



Electrofusion

- Objective: install an electrofusion unit in Barro Alto to produce brown fused alumina and other inputs.
- The economic prospects are favorable, considering:
 - Quality of the ore;
 - The possible synergy with the refining units of alumina;
 - The current market conditions and trends.



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Refractory Chamotte



- Objective: produce refractory chamotte with 60 to 70% Al_2O_3 .
- Quality required: $Al_2O_3 > 60\%$ and $Fe_2O_3 < 2\%$ (calcined basis).
- Market research and technological options being evaluated.

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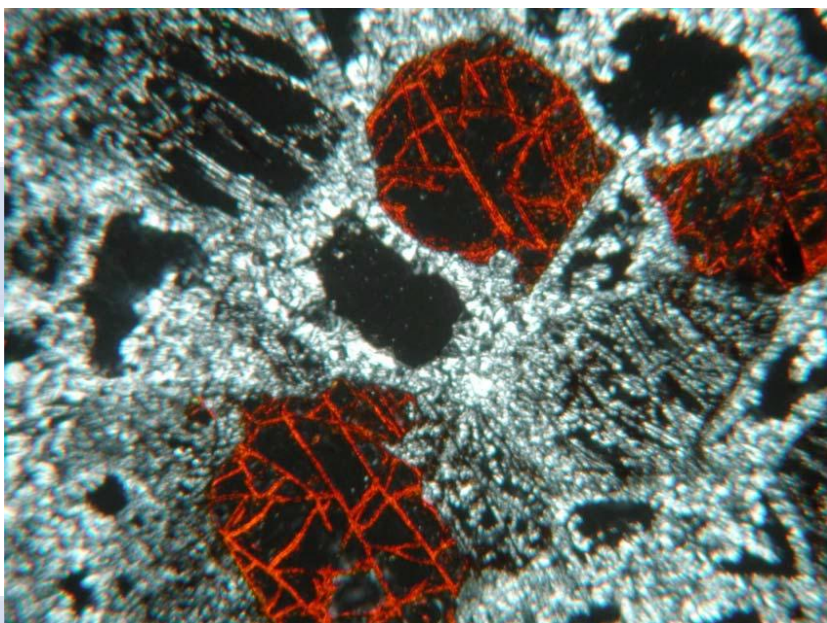
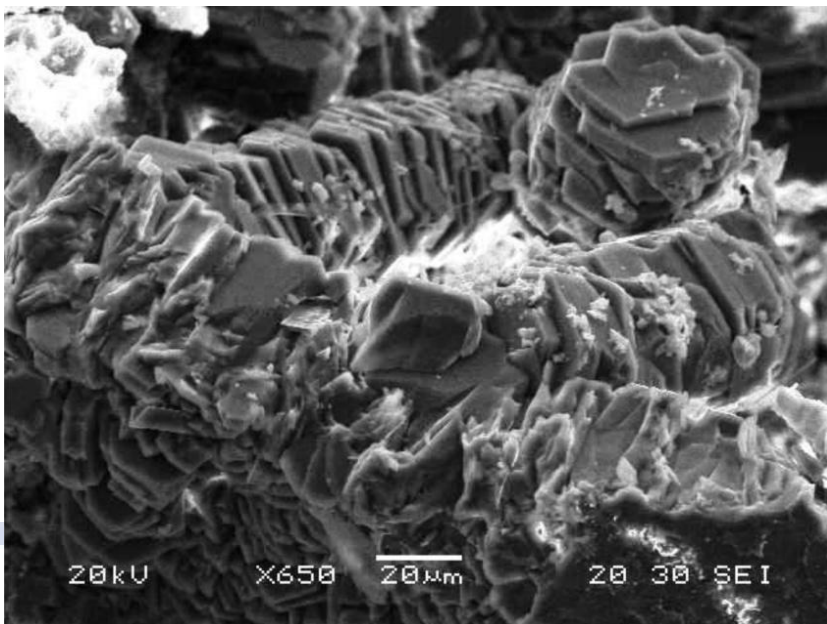
9 Usage Strategies

- Infrastructure and logistics:
 - Electrical energy: can be supply by the substation of Eletrobrás, in Souzalândia – GO.
 - North-South Railway: under construction (40Km from Santa Rita do Novo Destino).
 - East-West Railway: planned.
- Possible integration with other deposits of southeast.
- Partnerships.



10 Partnerships UFOP and UNB

- Partnerships with universities (UNB – UFOP) to aggregate knowledge in field.
- Doctoral Thesis completed – UFOP: “Supergene change and tropical morphogenesis in the mafic-ultramafic layered complex of Barro Alto, GO”, Fábio Soares de Oliveira.
- Master Thesis completed – UNB: “Mineralogy and geochemistry of bauxite derived from anorthosite, Barro Alto, GO”, Wagner Martins dos Santos.



11 Final Considerations

- The bauxite deposit of Barro Alto is important and unique.
- The mineral surfaces regularly in a large area.
- The high rates of alumina indicate broad applicability.
- The evaluated resources are significant.
- The evaluation are resulted of a conservative approach, based on criteria and procedures usual used in bauxite research, gradually adjusted to the geological reality of the deposit.
- This is a research project in an advanced stage.
- The currently running works aim to refine the:
 - Characterization of the ore;
 - Geological modeling;
 - Evaluation of the resources.
- There are technological tests and studies of the environmental future of the mine being made.
- Considering the studies already made, it is known that the mining and treatment process will require simple operations.

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