



MINE EXPLORATION

A photograph of a sunset over a landscape. The sky is filled with dark, dramatic clouds, with a bright orange and yellow glow from the sun just below the horizon. The foreground shows the dark silhouettes of hills and some trees.

**PRESIDENTE JÂNIO  
QUADROS PROJECT**

**Cone Navegação e Comercio Internacional Ltda**

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## **1 - INTRODUCTION**

### **1.1 - Objective**

The report presented below aims to describe the work done in office and on the field for the economic and geological description of the area relating to the Presidente Jânio Quadros Project of the Cone Mine Exploration. This work has as main goal to draw up an assessment of potential of reserves of iron ore in the area of process, quantifying and qualifying them with precision.

### **1.2 - Mineral Legislation in Brazil**

The laws governing mining activities in Brazil state that the subsoil belongs to the federal government. Thus, activities of prospecting, exploration and exploitation are possible only with permission of the government through its local authority DNPM (National Department of Mineral Production).

Each process mining exploration is evaluated by DNPM based on technical criteria and permits are granted in two stages: Exploration Permit and Mining Concession.

The authorization holder DNPM has full and exclusive rights on the works, as well as on the sale of these rights.

### **1.3 - Mining in Brazil**

The Brazil stands out globally as a leading producer of mineral commodities.

The mining industry in Brazil has very high technical and technological level, ahead of many of the innovations achieved in this area in recent decades.

In all regions of the country there is an extensive network of education for the training of professionals that meet the demands of mining. The high qualification of the workforce, coupled with good infrastructure and low production costs makes mining in Brazil object of great interest from domestic and foreign investors.

Brazil is the second largest producer of iron ore (approximately 20% of world output), the second largest producer of manganese (18%) and third largest producer of bauxite (approximately 13% of the world).

The accelerated pace of growth in Brazil has generated considerable increase in demand for nickel, titanium and vanadium for the production of ferro-alloys in recent years, creating a potential market hungry for these minerals. This generates stability in consumption, making the mining of these resources is unlikely to fluctuations in international trade.

Data from IBRAM (Brazilian Mining Institute) show that in 2008 the Brazilian mineral sector employed 161 000 people in mining activity and the value of domestic production sold was \$ 29 billion.

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Adding to the production of raw ores sold the production sector of mineral processing, mining of Brazil in 2008 generated \$ 42 billion, representing 5.7% of GDP. The positive outlook reflects investments in the sector which are forecast at \$ 47 billion between 2009 and 2013.

### 1.3.1 - Nearest Mining

President Quadros Project is concentrated in two blocks from north to the southern of urban area of President Quadros - BA. The southwest of Cone Mine Exploration Project are mineral research projects of BHP Billiton and spread into several blocks there are projects of the Bahia Mineral Research Company (CBPM), where research takes place in iron ore, nickel, gold, copper and talc.



Image - Nearest Mines

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**1.4 - Location**

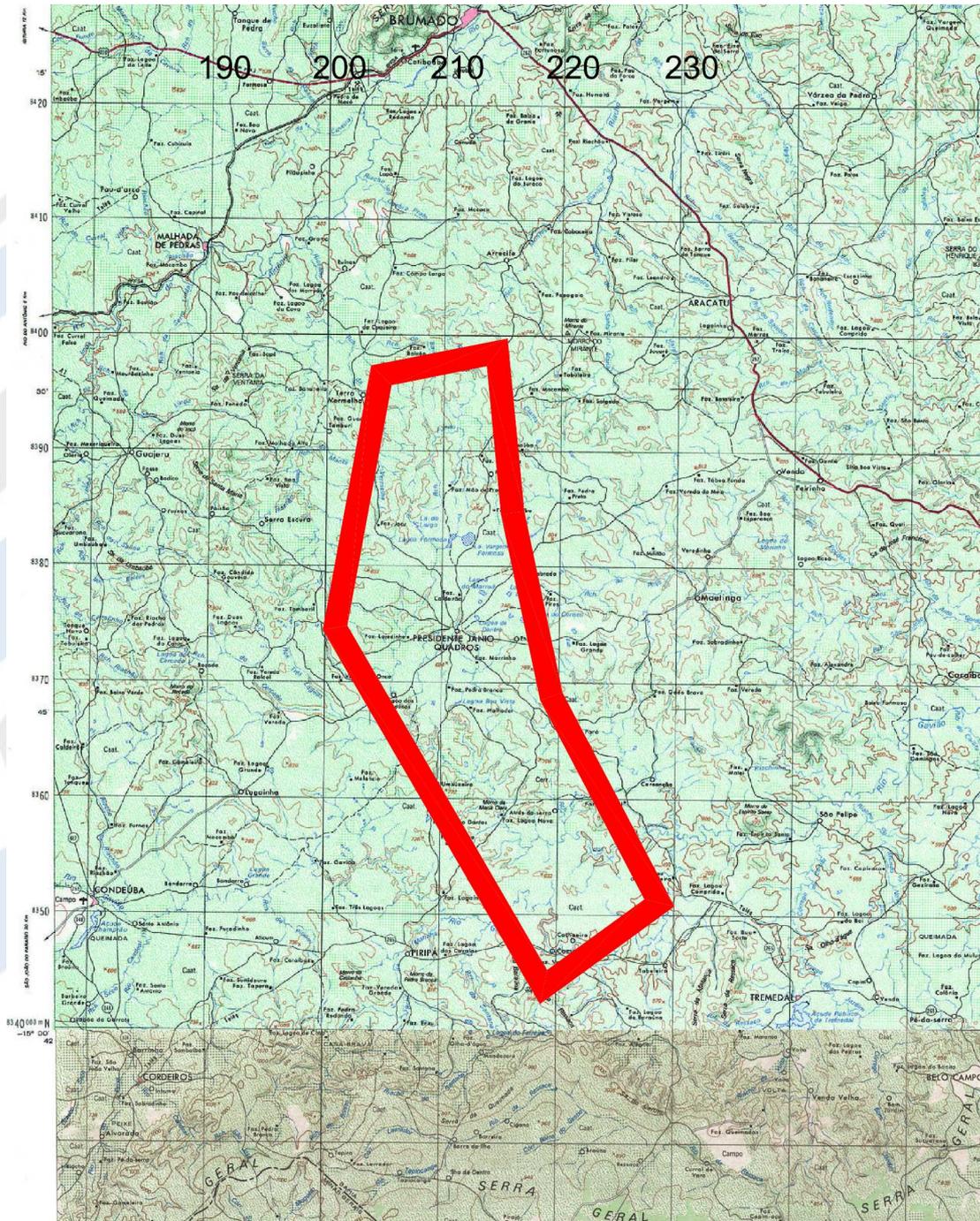


Image - Location (Base - IBGE)

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Image - Location

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## **1.5 - Preliminary Information of Geology And Mineral Occurrences of Areas**

### **1.5.1 - Description of Outcrops**

The banded iron formations (itabirite) occur associated with thin intercalations not individualized cherts, ferruginous cherts, quartzites and white fine-grained quartzite highly recrystallized average of bodies scattered throughout the area, associated with ferruginous quartzite.

Usually have dark gray, dark brown colors, taking a look reddish brown when altered.

The most common aspect is of dark bands in the millimeter-centimeter thickness, rich in iron minerals, which are interspersed with lighter bands, no rust, consisting predominantly of quartz and / or chert. It is dense rocks, magnetic, very consistent, fine-grained, with granoblastic texture with the grunerite kinds. These rocks are strongly folded with crystals stretched under the plan of the axis of the fold.

In thin section is observed rock is highly fractured, with a mosaic made up of very fine polygonal ( $\ll 0.1$  mm) quartz dust impregnated with iron oxide (hematite) cut by quartz veinlets clear, hyaline masses associated with opaque (iron oxide), remobilized, which blend and dominate the visual field of thin section.

The ferruginous quartzite with intercalations of iron formation occur in a large portion of the area, ranging from the southern to the northeastern

portion. They are usually fine to medium grained, finely stratified, with layers rich in secondary oxides of iron, with high porosity caused by dissolution.

In certain sections are observed abundant concentrations of fine antique crystal rhombohedral carbonate (magnesite?), Now completely dissolved and filled with quartz, keeping only the original contour, associated with abundant limonite. Correspond to levels in the sample with high porosity ferruginous. Opaques (magnetite / hematite) occurs even included in the quartz of the rock as a whole. Are still observed pockets of contour diffuse quartz coarser, recrystallized, cutting the laminate. In the western, southern and southeastern area form extensive range of colluvium.

Associated with these rocks occur intercalated bands of iron formation (itabirite), which need to be individualized on a work detail later.

Analysis done in the laboratories of SGS GEOSOL in fragments of rock surface, randomly taken in the locality, found 334 ppm vanadium and 58% iron.

**1.5.2 - Field Photo Memorial**



**Photo - Tenure of iron formation - Top of the North Hill**



**Photo - Tenure of iron formation - Top of the South Hill**

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**Photo - Tenure of iron formation - Slope of the North Hill**



**Photo - Tenure of iron formation - Slope of the South Hill**

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## 1.6 - The City of Presidente Jânio Quadros

### 1.6.1 - Characterization

**Área:** 827,379 Km<sup>2</sup>

**Altitude:** 682 m



### 1.6.2 - Population

**Total:** 14.212 (estimativa IBGE 2009)

### 1.6.3 - Transport

#### Highway

#### Approximate distances to major centers (Km):

Salvador: 623

Belo Horizonte: 854

Vitória: 928

Brasília: 960

Rio de Janeiro: 1217

#### Limiting municipalities:

MAETINGA

PIRIPÁ

TREMEDAL

CARAÍBAS

GUAJERU

CONDEÚBA



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## **2 - LOGISTICS AND ACCESSIBILITY**

### **2.1 - Access to the Area**

Leaving Salvador, take the BR - 324, exit northeast of the city, meaning Feira de Santana. Followed by about 107km and the city of Feira de Santana enter the left in BR - 116 southbound. Follow for another 397km to the city of Vitoria da Conquista. From there follow the highway for another 83km BA-262 (via BR-407) westbound until the roundabout access to President Quadros. Sign in clover the left and follow for another 32km on the main road to the city of President Quadros.

The project area is divided into two blocks, one north and one south of the urban area.

The center of the northern block is located approximately 15km (straight line) from the urban area and center of the southern block is located about 18km (straight line) from the urban area. The municipalities covered by the project are Maetinga, Caribbean, Tremedal and Presidente Jânio Quadros.

### **2.2 - Main Access Roads**

The main access routes to the area of the process are the BR -116, BR - 407 BR - 122 BA - 262, besides the back roads near the processing area.

### 2.3 - Airports

The main airport near the area of the airport process is Pedro Otacílio Figueiredo in the city of Vitoria da Conquista, about 118km away from the area, which operates domestic flights to some major cities in Brazil.



Image - Area of departure/arrival of Airport Pedro Otacílio Figueiredo.

Alternatively there is the International Airport Magalhães, located in Salvador, capital of Bahia state, about 623 km distant from the area.



Image - Partial view of the International Airport Deputado Luís Eduardo Magalhães

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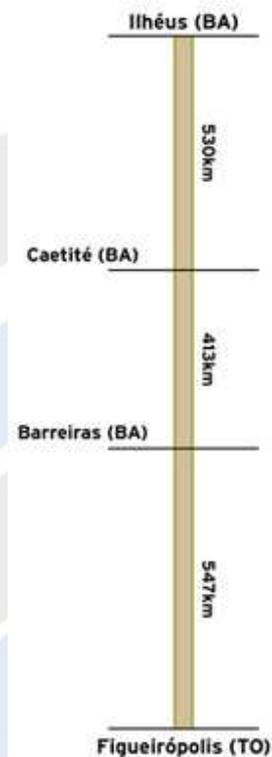
## 2.4 - Railways

### 2.4.1 - Railway East-West Integration

The Railway East-West Integration will boost the flow of production of Bahia state and serve as liaison with other poles in this region of the country, through connection to the North-South. Included among the priorities of Growth Acceleration Program (CAP), the Railway East-West Integration 1.490km long and will involve an estimated investment of £ 6 billion by 2012.

The railway will link the cities of Ilheus, Caetité and Barreiras - state of Bahia – to the Figueirópolis in Tocantins state, forming a transport corridor that will optimize the operation of the Port of Ponta da Granary and even open new alternative logistics for ports in north served by the North-South and Carajás railroad.

Among the advantages provided by the construction of Railway East-West Integration for the state of Bahia are reducing shipping costs of supplies and miscellaneous items, increased competitiveness of agribusiness products and the possibility of deploying new agroindustrial poles and mineral exploration, using the connection to the national railway network.



Moreover, the railway will promote vibrant local economies, leveraging the new developments in the region, with increased tax collection, in addition to generating approximately 30 000 direct jobs. The railroad should do more to foster agricultural development in the region west of the state, whose forecast is a production of 6.7 million tons in 2015. The main products to be transported are soybeans, soybean meal and corn, and fertilizer, fuel and iron ore.



Link: <http://www.valec.gov.br/oeste-leste.htm>

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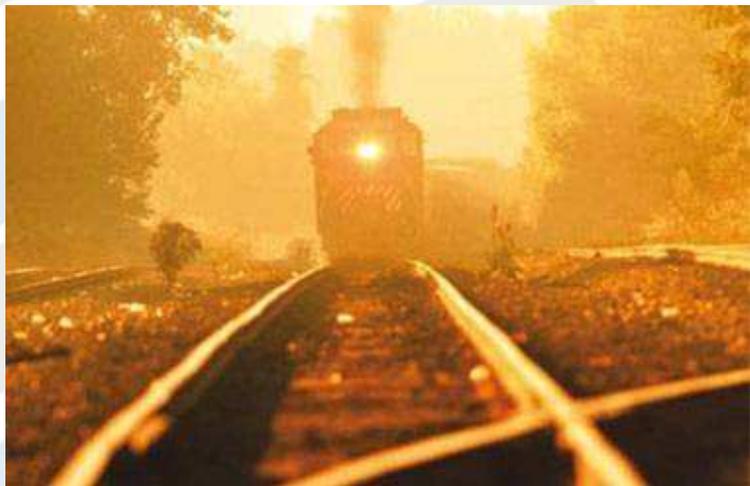
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## 2.4.2 - Ferrovia Centro-Atlântica - (FCA)

Exists in the local loop access to the Ferrovia Centro-Atlântica (FCA - [www.fcasa.com.br](http://www.fcasa.com.br)) from the city of Brumado, which would link the area to the Port of Aratu.

The route of about 565km to the city of Candeias enables the flow of production with minimum investment on infrastructure logistics.

The Ferrovia Centro-Atlântica (FCA) began operations in September first 1996, after the process of privatization of the Rede Ferroviária Federal S.A. (RFFSA).



Devoted exclusively to the operation of rail freight, the FCA started to develop its logistics focused primarily in bulk such as soybeans, oil and alcohol fuel.

In September 2003, authorized by the National Land Transport (ANTT), Vale took a controlling stake in FCA, with 99.9%.

Since taking over the operation of the mesh East Central, the FCA has put in place a solid investment plan in recovery of the permanent way (railroad), purchase / rehabilitation of locomotives and wagons, technological

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improvements and safety, environment and qualification professional. From 1997 until 2005, the company has invested more than \$ 2 billion.

Link: [www.antf.org.br](http://www.antf.org.br)

## **2.5 - Ports**

### **2.5.1 - Port of Ilhéus - BA**

With a volume of cargo movement by rotating around one million tonnes per year the Port of Ilheus, now a grain port drains, open to new challenges. The policy of modernization and expansion, adopted by CODEBA determines changes in infrastructure and in attracting business.

The idea is to anticipate the process of economic growth projected for the state, establishing the conditions necessary for the efficient flow of import and export of products and goods are generated in all regions of the state, especially the pulp in the south; grains , fruits and minerals in the north, west and southeast of the state.

The earliest efforts, already building a mooring dolphin at the north end of the pier. In the short term, expansion of backyard with over 100,000 square meters, stretches over 80m quay and increased depth of 10 to 12m. From the backyard of the new port will be leveraged to expand quay at over 600m, reaching 1200m, optimizing their potential for internal expansion, no need to go overboard.

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Within these perspectives, ultimately, new investment community benefits signal port of Ilheus and bring more development conditions for the southern, southwestern and west of Bahia state, putting the port of Ilheus as a participant in economic growth and development of the State Bahia and Brazil.



Image - Port of Ilheus

Link: [http://www.codeba.com.br/porto\\_ilheus.php](http://www.codeba.com.br/porto_ilheus.php)

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### **2.5.2 - Port of de Aratu - BA**

Responsible for 60% of all freight moved in modal sea in Bahia State, the Port of Aratu holds an undeniable importance in the economic process of the state, since that supports the flow of production and the entry of products for the Petrochemical Camaçari the Aratu Industrial Center (CIA) and the Ford Complex Camaçari.

The motion refers to liquid, gaseous and solid bulk materials, like copper concentrate and fertilizer. To move this cargo, the port infrastructure has four terminals, one for gaseous products (TPG), as the birthplace of 180 meters, other liquid bulk (TGL), which account for two berths with 340 meters and two for dry bulk (TGS), with three berths, a distance of 366 meters.

However, the modernization policy Codeba (Dock Company of the State of Bahia), heralds a new era for the Port of Aratu, by installing more modern equipment to increase further the flexibility of labor and traffic flow of boats and handling and distribution charges. Technological advances provided the port will be placed among the most modern in the country.

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Photo: Aerial view of Port of Aratu

Link: [http://www.codeba.com.br/porto\\_aratu.php](http://www.codeba.com.br/porto_aratu.php)

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### **3 - COSTS**

#### **3.1 - Exploration**

To defining the economic possibilities of the area to explore, will be accomplished the necessary works of prospection that will consist, in the beginning of the following listed steps. However, having the currently existing data, these cannot be considered as definitive.

##### **3.1.1 - Base-Map Elaboration**

The cartographic base to the programming, register and analysis of the exploratory work will be obtained by the restitution of the air photograph, available at 1:40.000 and 1:20.000 in recent images.

The plan will have scale 1:10.000, adjusted with field topographical control and spaced level curves in 5 m

##### **3.1.2 - Opening and Conservation of Roads**

The field exploration implantation should be preceded of recovery works and improvements in the stream bed of the secondary roads that cut the area, opening of new routes, in order to facilitate the access to the distant places.

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### **3.1.3 - Geologic Mapping 1: 10.000**

It is essential the execution of the basic geological mapping, aiming to the identification and cartography of the levels potentially mineralized, as noted above. So, the whole lithological suite in the area should be identified petrographically, with delimitation as accurate as possible from the contacts of the marked units.

The accurate definition of contacts, and petrographic characterization of the emerging lithology, may eventually require the opening of the trenches, in order to expose the rocky substratum to the geologist observation.

The resulting geological map, as mentioned previously, should be presented at scale 1:10.000. To it will be integrated obtained information posteriorly, during the exploration with the execution of trenches, boring and galleries.

### **3.1.4 - Geophysical Prospection**

Intend to accomplished a geophysical prospection in the area, conciliating two geophysical methods, as seismic and resistivity, aiming to detect possible anomalies that become into target for the investigation work in subsurface, posteriorly.

### **3.1.5 - Digging**

It will be executed exploration's digging, aiming at to obtaining information of sub-surface and to propitiate the exposition of the mineralized bodies for the description of the points and posterior sample collection.

Opted by the execution of the trenches (or "pipe") and galleries to the characteristics' determination of the mineralized bodies, once that these ones present partially emerging and in an area of difficult access and mechanical equipment.

The trenches will be directed perpendicularly to the layers' direction. The digging will be made with manual tools, as pickaxes and shovel. To the execution of the service will be contracted the local workforce.

The works will be following by the responsible technician.

### **3.1.6 - Boring**

From the analysis of the obtained data in the geologic mapping, will be leased some orificies of borehole, comprehended in three stages. In the end of each boring stage, an evaluation will be made, aiming to the taking a decision as for the continuity of the exploration.

It is expected, in the three stages a boring with continuous coring. The works will be contracted with specialized companies.

The description of the testimony will include the petrographic aspects, stratigraphic and structural. The intervals will have maximum length of 1,5m, eventually extended to 2,0 m in the portions confessedly sterile.

### **3.1.7 - Chemical Analysis**

The chemical analysis will be executed in a specialized laboratory and will include the grades of Fe, FeO, Mn, SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, CaO, MgO, TiO<sub>2</sub>, S, P and others elements traces.

### **3.1.8 - Technological Assays**

It will be sending samples of ore for the execution of the technological assays in specialized laboratory that include granulometry analyses and the following tests:

- Tumbling Iso
- Crepitation Coismj
- RDI Coismj
- Reduction JIS M 8713
- Midrex Linder Test
- Sulphur Release

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These tests propitiated the verification of the material adequacy to the use in siderurgy, consisting of an evaluation for use in blast-furnace and for use in process of direct reduction.

### **3.1.9 - Final Report**

Completed the exploration, the final report will be in charge of the petitioner's technician team, under the technician responsibility of the works' chief geologist and bunched the whole list of the executed activity, the methodology and the reached results. It should be conclusive as to the reserves existence, its dimensions and the ore characterization, and will have all the elements indispensable to the technician, business and politics decisions which will be followed.

### **3.1.10 - Budget**

It is considered in this study the reference exchange rate as  
US\$1.00 = R\$1,85

For the implementation of the research described above, it is estimated a total cost of **US\$ 4,800,000.00**.

## **3.2 - Mining and Processing**

The cost of mining iron ore for the monthly production estimated at 100,000 tons and its respective processing are presented below:

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### 3.2.1 - Production Data (Monthly Estimates)

					Production	
Mine's Extraction	9	h/day	26	day/month	<b>Rate 427</b>	<b>t / hour</b>
Processing	9	h/day	26	day/month	<b>384</b>	<b>t / hour</b>

**Monthly Production of the Extracted Ore = 100.000 toneladas**

**Monthly Production of the Processed Ore = 90.000 toneladas**

\*P.S.: Considering a recovery of 90% in the process.

Considering the stripping ratio = 2/1

### 3.2.2 - Cost of the Mine work (Monthly Estimates)

Cut and ROM Load (R\$0.50/t) = R\$ 50,000.00

ROM Transport = R\$ 60,000.00

Drilling and Dismounting = R\$ 100,000.00

Road Maintenance = R\$ 20,000.00

Sterile Transport (R\$0.57/t) = R\$ 14,250.00

Cut and Load of Sterile (R\$0.50/t) = R\$ 12,500.00

Overhead = R\$ 15,000.00

**Unit Cost = R\$ 2.71 / ton (US\$ 1.47)**

**MONTHLY TOTAL (USD) = US\$ 146,891.89**

### 3.2.3 - Cost of the Processing (Monthly Estimates)

Materials / Maintenance = R\$ 25,000.00

Crusher Feeding (R\$70,00/h) = R\$ 16,380.00

Electricity = R\$ 15,000.00

Overhead = R \$ 23,000.00

Quality Control = R \$ 5,000.00

**Unit cost = R \$ 0.94 (US\$ 0.51) / tonne of product**

**MONTHLY TOTAL (USD) = US\$ 45,610.81**

### 3.3 - Transportation (Highway)

The cost of road transport is considered in relation to the distance between the area and the City of Brumado-BA at the junction between the lines of the Ferrovia Centro Atlântica and the Ferrovia Oeste-Leste. The base estimate is R\$ 0.1875 per km per tonne of sinter in dump trucks of 30 tons.

**Distance mine-terminal: 83km**

**Unit Cost = R\$ 15,56 (US\$ 8.91) / tonne of product**

**MONTHLY TOTAL (USD) = US\$ 757,094.59**

### 3.4 - Transportation (Railway)

The railway takes as a basis for estimating the use of 340 km from the services of Ferrovia Oeste-Leste between the cities of Ilheus and Brumado.

**Unit Cost = US\$ 12.30 / tonne**

**MONTHLY TOTAL (USD) = US\$ 1,106,700.00**

### **3.5 - Transportation (Port)**

Port costs involve unloading, storing and loading on ships. The estimated average cost for ports in Bahia is R \$ 27.75 per tonne of ore, sinter feed.

**Unit cost = R \$ 27.75 (U.S. \$ 15.00) per tonne**

**MONTHLY TOTAL (USD) = U.S. \$ 1,350,000.00**

### **3.6 - Storage and Loading - Terminal Loads**

The whole process of receiving, weighing, handling, storage, transshipment, loading, and all documentation relating to these transactions will be made based on the costs associated with the Cargo Terminal of Sarzedo-MG. So for a monthly estimate, we have:

**Unit cost = R \$ 10.17 (U.S. \$ 5.50) per tonne**

**MONTHLY TOTAL (USD) = U.S. \$ 495,000.00**

#### 4 - ECONOMIC POTENTIAL OF ENTERPRISE

Verifying the exploration positive result according to the accomplished estimates, the venture will enable the marketing of the ore FOB (Ilheus) at a monthly cost of **US\$ 3,901,288.07** for 90 000 tonnes traded. Assuming an extra cost of \$ 10.00/ton for additional costs, cost FOB result is **US\$ 43.35/tonne**.

This represents a potential gross profit of **US\$ 26.65/tonne** sold, equivalent to **61% profit on the total cost** of the production chain.

Considerations: Currency: US\$ 1.00 = R\$ 1.85 and sales value of ore = US\$ 70.00)