Seara Project

Iron Ore Mine

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Seara Project

SUMMARY

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INTRODUCTION

The follow present report has the objective to describe the accomplished works in offices and fields for the geologic and economic description of the area referred as the “Seara Project” of Cone Mine Exploration. This work has as main goal to elaborate an evaluation of the iron ore reserves in the area of the process, quantifying and qualifying them with accuracy. This Project is the biggest CONE Mine Exploration has surveyed in many aspects such as area, resources, and logistics. The area of the project is a junction of nine different tenements, gathered in order to enable a huge project which this is. This report will be organized in four parts: General information about the region; the nine different tenements and the area of the project; The research in the tenement number 832197/1999, which is a small area of the project (only 198 ha), but once it is located in the heart of the project, it was where CONE Mine Exploration has intensified its research; and finally, the logistic plan. The haul way for exporting the iron ore would be through EFVM (rail ray) which belongs to VALE and connects the iron quadrangle (center of the Minas Gerais state) to the ports of the state of Espirito Santo. In this project the iron ore will be headed to the Ubu port in Anchieta, state of Espírito Santo.

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GENERAL INFORMATION

1 – MINING IN BRAZIL

Brazil stands out worldwide as one of the main producers of the minerals goods.

The mining industry in Brazil has a highest technology level and technique, being forward of a several obtained innovations in this area in the last decades.

In all regions of the country exists an extensive web of education for the formation of professional that feeds the mining's demand. The high workforce qualification, together with a satisfactory infra-structure and low productive cost becomes the mining in Brazil object of a great interest by the part of the foreign and national investors.

Brazil is the second bigger producer of the iron ore (approximately 20% of worldwide production) and the third bigger producer of bauxite (approximately 13% of the worldwide production). Data of the IBRAM (Brazilian Institute of Mining) presented that in 2008 the Brazilian mineral sector employed 161 thousand people in the mine work activity and the value of the commercialized national production was US$ 29 billion.

Adding the commercialized rude ore production to the production of the sector of mineral transformation, the mining of Brazil generated in 2008 US$ 42 billion, what represents 5.7% of the GIP. The positive scene reflects in the investments of the sector that are foreseen in US$ 47 billion between 2009 and 2013.

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2 – THE IRON QUADRANGLE

The worldwide iron ore reserves (measure + indicated) are in the order of 310 billion of tons. Brazil has 6,7% of this reserves (21,0 billion tons) and it is in a 5th place between the countries which have the biggest volumes of the ore. However the high grade of iron in its ore (60,0 to 67,0% in hematite and 50,0 to 60,0% in the itabirites) takes Brazil to occupy the place of prominence in the worldwide scene, in terms of iron contained in the ore. 70% of the Brazilian reserves can be found in the state of Minas Gerais (198 million tons), being the big part of these are in the iron quadrangle, traditional region in the extraction of this mineral goods. The region of the Iron quadrangle, has important itabirite and hematite iron ore deposits of high grade (Fe > 60%).

Figure 1: Iron Ore from the Iron quadrangle and pellets for the steel industry

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3 – STRATIGRAPHY

<table>
<tr><td></td><td colspan="3">RECENT SEDIMENTARY COVERAGE</td></tr>
<tr><td rowspan="12">PROTEROZOIC</td><td>ESPINHAÇO SUPERGROUP</td><td>Conselheiro Mata Group</td><td>Cambotas Formation</td></tr>
<tr><td colspan="3">Itacolomi Group</td></tr>
<tr><td rowspan="10">MINAS SUPERGROUP</td><td rowspan="5">Piracicaba Group</td><td>Sabará Formation</td></tr>
<tr><td>Barreiro Formation</td></tr>
<tr><td>Taboões Formation</td></tr>
<tr><td>Fecho do Funil Formation</td></tr>
<tr><td>Cercadinho Formation</td></tr>
<tr><td rowspan="2">Itabira Group</td><td>Gandarela Formation</td></tr>
<tr><td>Cauê Formation</td></tr>
<tr><td rowspan="2">Caraça Group</td><td>Batatal Formation</td></tr>
<tr><td>Moeda Formation</td></tr>
<tr><td colspan="2">Tamanduá Group</td></tr>
<tr><td rowspan="5">ARCHAEAN</td><td rowspan="4">RIO DAS VELHAS SUPERGROUP</td><td rowspan="2">Maquiné Group</td><td>Casa Forte Formation</td></tr>
<tr><td>Palmital Formation</td></tr>
<tr><td>Nova Lima Group</td><td>Schist meta-sedimentary and metavolcanic</td></tr>
<tr><td>Quebra-Osso Group</td><td>Metavolcanic mafic-ultramafic Association</td></tr>
<tr><td colspan="3">GRANITE-GNEISSIC-ARCHAEAN TERRAIN</td></tr>
</table>

Figure 2: Simplified Stratigraphic Column of the Ferriferous-Quadrilateral - CPRM

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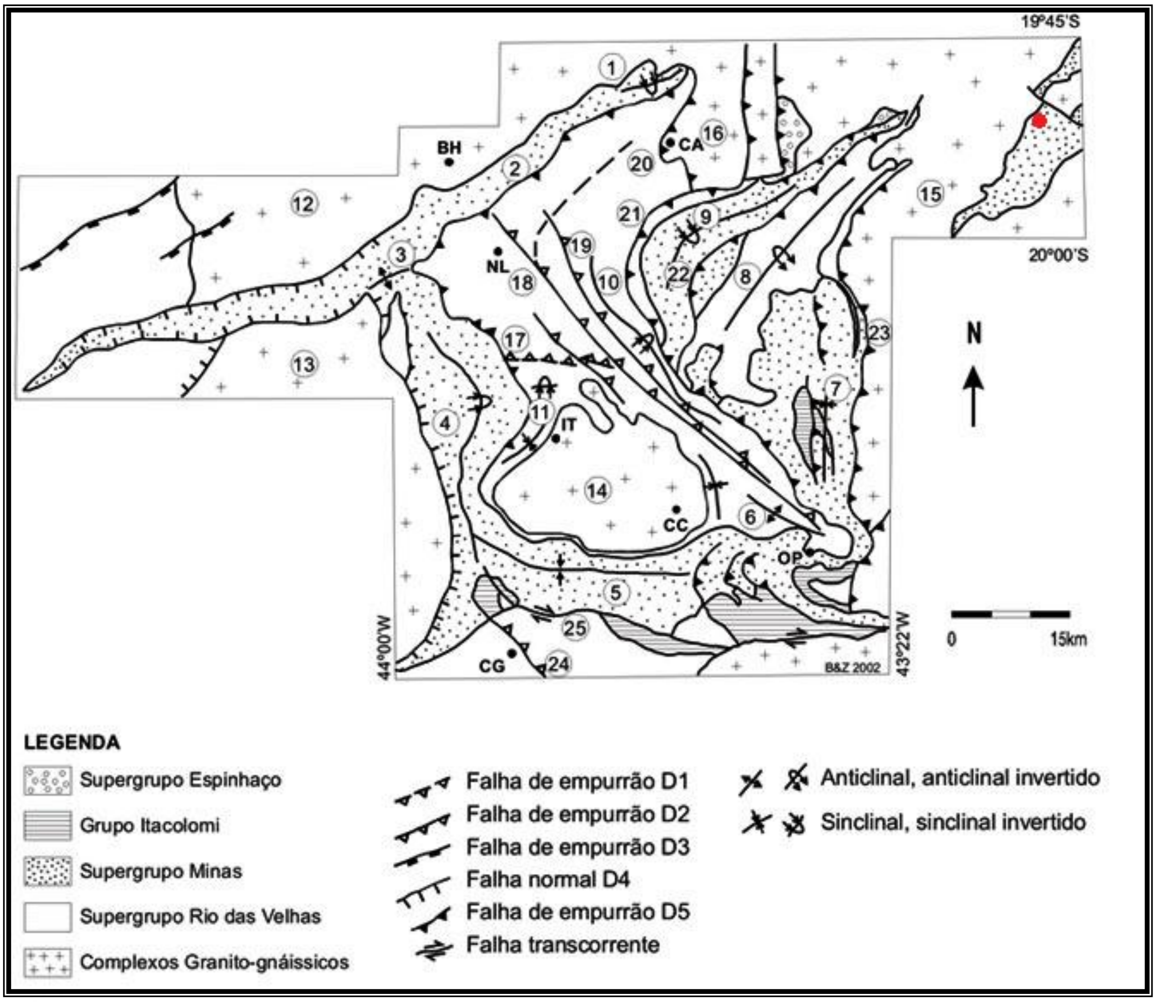

Figure 3: Structural Map of the Iron Quadrangle – CPRM – The red dot is where the project area is located.

Subtitles: Fold: 1 - Syncline Piedade, 2 - Homocline Serra do Curral, 3 - Anticline Serra do Curral, 4 - Moeda Sincline, 5 - Dom Bosco Sincline, 6 - Mariana Anticline, 7 - Syncline Santa Rita, 8 - Anticline Conceição, 9 - Syncline Gandarela, 10 - Syncline Vargem do Lima, 11 – Andaimes Syncline. Granite-gneiss Complex: 12 - Belo Horizonte, 13 - Bonfim, 14 - Bação, 15 - Santa Bárbara, 16 - Caeté. Falhas: 17-Bem-Te-Vi, 18 -São Vicente, 19 - Raposos, 20 - Caeté, 21 - Cambotas, 22 - Fundão, 23 - Água Quente, 24 - Congonhas, 25 - Engenho. Cidades: BH - Belo Horizonte, CC - Cachoeira do Campo, IT - Itabirito, NL - Nova Lima, CA - Caeté, CG - Congonhas, OP - Ouro Preto.

The important matter in regard to iron ore of the Stratigraphy Column of the Iron Quangrangle is the location of the Caue Formation in the Minas Supergroup, formed in the Proterozoic Eon. This formation is where the iron formation is located and is where the highest iron ore grades are. The detailed description of the geology of the Iron Quadrangle and its layers is found in the next section.

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4 – GEOLOGY OF THE IRON QUADRANGLE

The crystalline basement of the Iron Quadrangle is compound by the gneissic metamorphic complex denominated of Bonfim Complex and Moeda Complex (west side of the Moeda Mountain), Congonhas Complex (to southwest of Iron Quadrangle); Santa Rita Complex (to southwest of the Ouro Branco Mountain Range); Caeté Complex (to east of the Caeté town); Belo Horizonte Complex (to the north of the Curral Mountain); Santa Bárbara Complex (to the east of the Caraça Mountain Range) and Bação Complex (which it is in the center of the Iron Quadrangle).

Geocronological Analyses in rocks' samples by some of these complexes, revealed ages of 2,9-3,2 Ga. And also, two generations of plutons for the Neoarchaean: 2,78-2,77 Ga. (calcium alkaline plutons) and 2,73-2,62 Ga. (granites anorogenic).

Rio das Velhas Supergroup

The ages between 2,776 Ga. and 2,857 Ga. allows say that the Rio das Velhas Supergroup along with the plutonic rocks represents a typical terrain granite-greenstone of the Archaean.

The metavolcanic and metasedimentary rocks form the Rio das Velhas Supergroup, subdividing in two groups (Nova Lima (base) and Maquiné (top)). The Maquiné Group divide in two formations:

- Palmital Formation (base); compound by quartz sericite, quartz phyllite and phyllite.

- Casa Forte Formation; compound by quartz sericite, chloritic, schists and phyllite.

The Nova Lima Group represents a sequence of a "greenstone belt" type subdividing in three units, from the bottom to the top:

- Metavolcanic Unit; compound by serpentine, steatite, Talc-schists, amphibolites metamorphosed, metabasalt and metatuffs, besides of komatiites with spinifex structure.

- Chemistry Metasedimentary Unity, represented by carbonetic schists, metacherts, banded iron formation and phyllites:

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- Clastic Metasedimentary Unity, represented by quartz-schists, quartz phyllites, impure quartzite and meta-conglomerates.

Minas Supergroup

The Minas Supergroup is subdividing from the base to the top in the Tamanduá, Caraça, Itabira and Piracicaba Group.

The Tamanduá Group is represented by a set of by a set of quartzite, phyllite, quartz and clay shists, itabirites phyllite and dolomite, conglomerates and coarse quartzite.

The Group Caraça is compound by the Caraça quartzite (Moeda Formation) and Batatal schists (Batatal Formation)

- Moeda Formation represented by conglomerates and coarse quartzite of fluvial origin and fine quartzite and phyllites by transitional-marine origin.

- Batatal Formation; constituted by phyllites sericites, graphitic and locally this formation can presents chloritic and carbonate sediments, being that in the superior part can be seen fine layers of chert and hematite.

The Itabira Group divides in two formations, from the base to the top:

- Cauê Formation; predominatly represented by a iron formation of lake superior kind and subordinate by dolomiticos and amphibolitics itabiritos with small phyllites lenses and marl and some manganiferous horizons.

- Gandarela Formation; compound by layers of carbonate rocks represented by dolomite and subordinate by itabiritos, dolomitic phyllites and phyllites.

The Piracicaba Group divides in five formations, from the base to the top:

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- Cercadinho Formation; represented by ferruginous quartzite, ferruginous phyllite, phyllite, quartzite and small interpolated of dolomite;

- Fecho do Funil Formation: represented by dolomitic phyllite, phyllite and impure dolomite;

- Taboões Formation: represented by fine and massive quartzite;

- Barreiro Formation: represented by phyllite and graphitic phyllite;

-Sabará Formation: represented by phyllite, chlorite-schist, greywacke and locally tuffs and cherts.

Itacolomi Group

The Itacolomi Group is represented by quartzite, conglomeratic quartzite and lenses of conglomerate with pebbles of itabirito, phyllite, quartzite and vein quartzite, deposited in coastal and deltaic environment.

6 – ITABIRITES OF THE IRON QUADRANGLE

The Itabirites are compound by iron rich bands (mainly hematite and magnetite) interpolated with quartz and/or dolomite rich bands (BIF- banded iron formations). The high grade iron ore are mainly compound by hematite, being used directly in blast furnace, as granulated ore.

The process area is in the municipality of Ouro Preto, the old capital of Minas Gerais during the heyday of gold mining in Brazil (XVII and XVIII). In recent decades the region has seen innovations in the use of ultra-fine ore, which allowed the region to be itabirites concentrated to levels exceeding 67% Fe.

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THE AREA AND THE 9 TENEMENTS

1-LOCATION

The project is mainly located in the municipality of Rio Piracicaba, in the state of Minas Gerais. Some small parts of the area are located in the municipality of João Monlevade.

Figure 4: Location of the municipality of Rio Piracicaba

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The city of João Monlevade is also near the area of the project. João Monlevade is a 75000 inhabitants city. The economy of the city is basically constituted by the three big mines that aren´t in its municipality but contribute for the economy once it is the biggest city in the region: the agua limpa mine of VALE, the BaoVale Mine and the ArcelorMittal mine (All iron ore mines). This last company has yet a steel plant in João Monlevade.

2-INFORMATION ABOUT RIO PIRACICABA

Area**:** 373 Km^2

Altitude**:**

Maximum:	1340 m
Local:	Serra do Seara
Minimum:	643 m
Local:	Andre creek

Central Point in Town: 690 m

Temperature:

Average Annual:	20,1 °C
Maximum average annual:	26,5 °C
Minimum average annual:	15,9 °C

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Annual average rainfall: 1372 mm

Relief:

Topography:	%
Plan:	10
Corrugated:	20
Mountain:	70

Main Rivers:

Piracicaba River

Caxambu Creek

Population:

Resident Population in 1970, 1980, 1991, 2000, 2005

ANOS	URBANA	RURAL	TOTAL
1970	7.776	5.456	13.232
1980	9.085	3.527	12.612
1991	10.277	3.399	13.676
2000	10.790	3.221	14.011
2005(1)			14.427

Source: Brazilian Institute of Geography and Statistics - (IBGE)

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3. ACCESS

The access is made by the federal road BR-381 which connects the city of Belo Horizonte (third biggest city in Brazil and capital of the State of Minas Gerais) to the coast city of Vitória (capital of the State of Espírito Santo). By car, you take this road for two hours. 5 Km after the city of Joao Monlevade, through the same road, the entrance is on the right side. The area of prospect is 1 Km after this entrance. The city of João Monlevade is 132 Km away from Belo Horizonte to the east and 410 Km away from Vitória to the west.

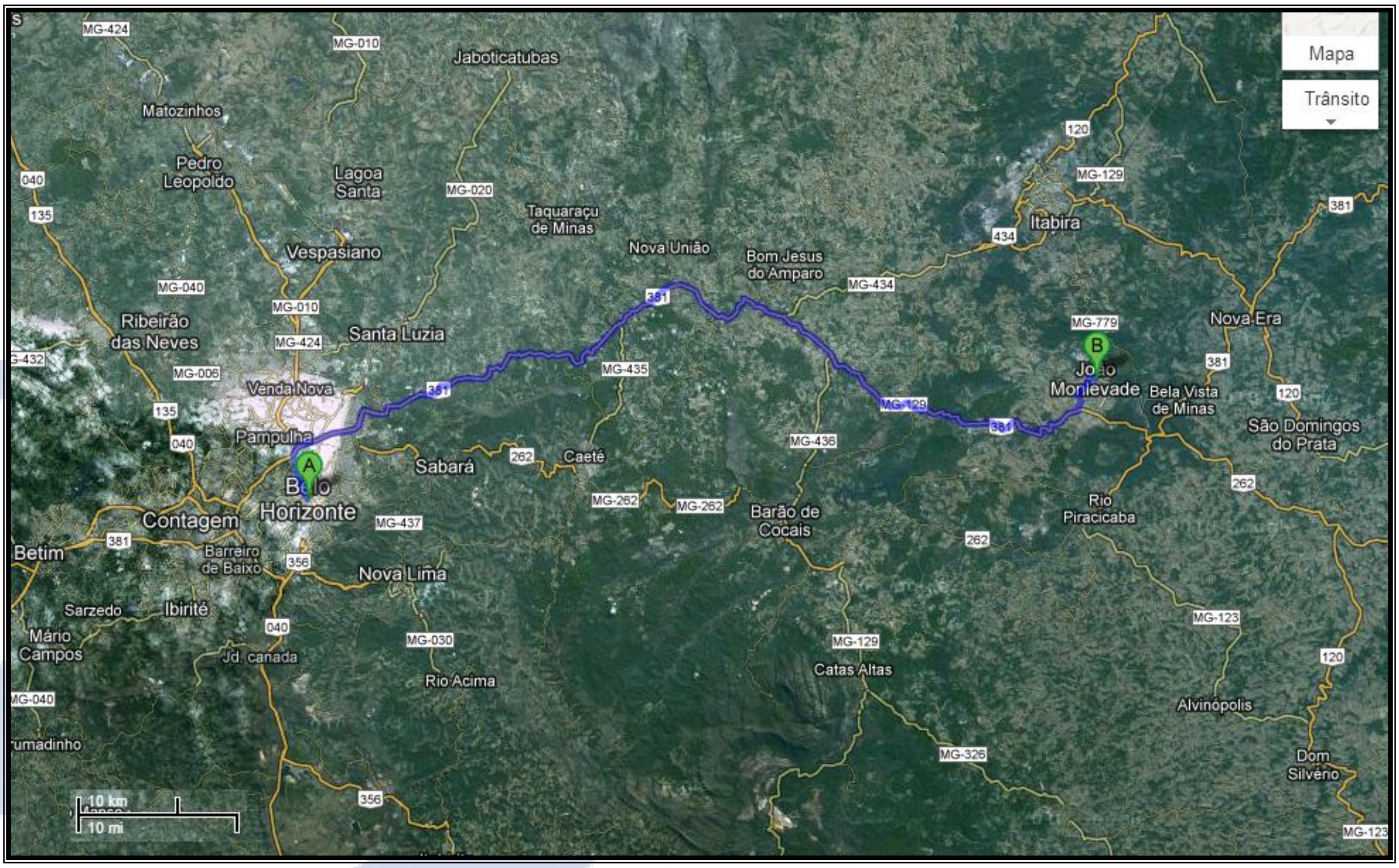

Figure 5: The BR-381 and the 132 Km way Belo Horizonte/João Monlevade

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4. DESCRIPTION OF THE TENEMENTS

There are nine tenements which constitute the area of the project. They can be located in the map below. The area is in the south direction of the city of João Monlevade.

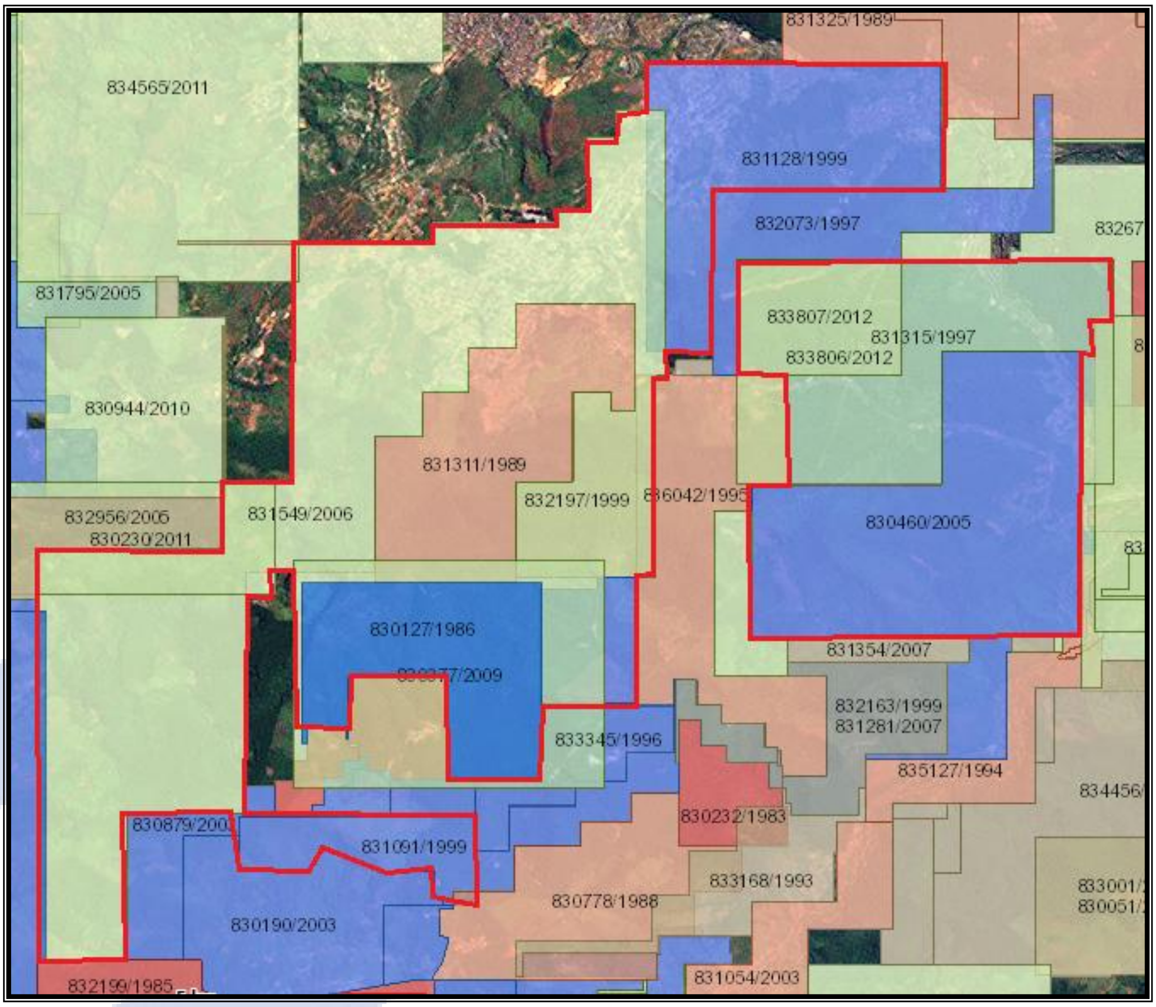

Figure 6: The area inside the two polygons in red boundaries are the areas of this project. It extends throughout 5562 ha in total.

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To understand the situation of each tenement, it is important to understand the mining laws in Brazil. The laws that conduct the mining activities in Brazil established that the subsoil belongs to the federal government. That way, activities of prospection, exploration and exploitation just are possible with the government authorization through of its department DNPM (National Department of Mineral Production). Each process of mineral exploration is evaluated by the DNPM based in technique criteria and the authorizations are granted in two stages: Exploration License and The Mine Work Concession. The authorization holder of DNPM has full and exclusive rights about the work execution, as well about the commercialization of the area.

Each tenement holder has done its own resources research. And the relation of each one of them is:

1- DNPM number: 832197/1999

   Resources: 105,000,000 tons of iron ore

   Area: 198 ha

   Average Grade of Iron Ore: 61% Fe

   Phase: Mine Work Request

2- DNPM number: 831311/1989

   Resources: 120,000,000 tons of iron ore

   Area: 509 ha

   Average Grade of Iron Ore: 61% Fe

   Phase: Mine Work Request

3- DNPM number: 830127/1986

   Resources: 200,000,000 tons of iron ore

   Area: 412 ha

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Average Grade of Iron Ore: 61% Fe

Phase: Exploration License

4- DNPM number: 830460/2005

Resources: 120,000,000 tons of iron ore

Area: 820 ha

Average Grade of Iron Ore: 61% Fe

Phase: Exploration License

5- DNPM number: 831128/1999

Resources: 100,000,000 tons of iron ore

Area: 557 ha

Average Grade of Iron Ore: -

Phase: Exploration License

6- DNPM number: 831091/1999

Resources: 70,000,000 tons of iron ore

Area: 158 ha

Average Grade of Iron Ore: -

Phase: Exploration License

7- DNPM number: 831549/2006

Resources: 70,000,000 tons of iron ore

Area: 1770 ha

Average Grade of Iron Ore: -

Phase: Exploration Request

8- DNPM number: 831315/1997

Resources: 80,000,000 tons of iron ore

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Area: 703 ha

Average Grade of Iron Ore: -

Phase: Exploration Request

9- DNPM number: 832605/2007

Resources: 70,0000,000 tons of iron ore

Area: 137 ha

Average Grade of Iron Ore: -

Phase: Exploration Request

5-GEOLOGICAL MAP OF THE AREA OF THE PROJECT

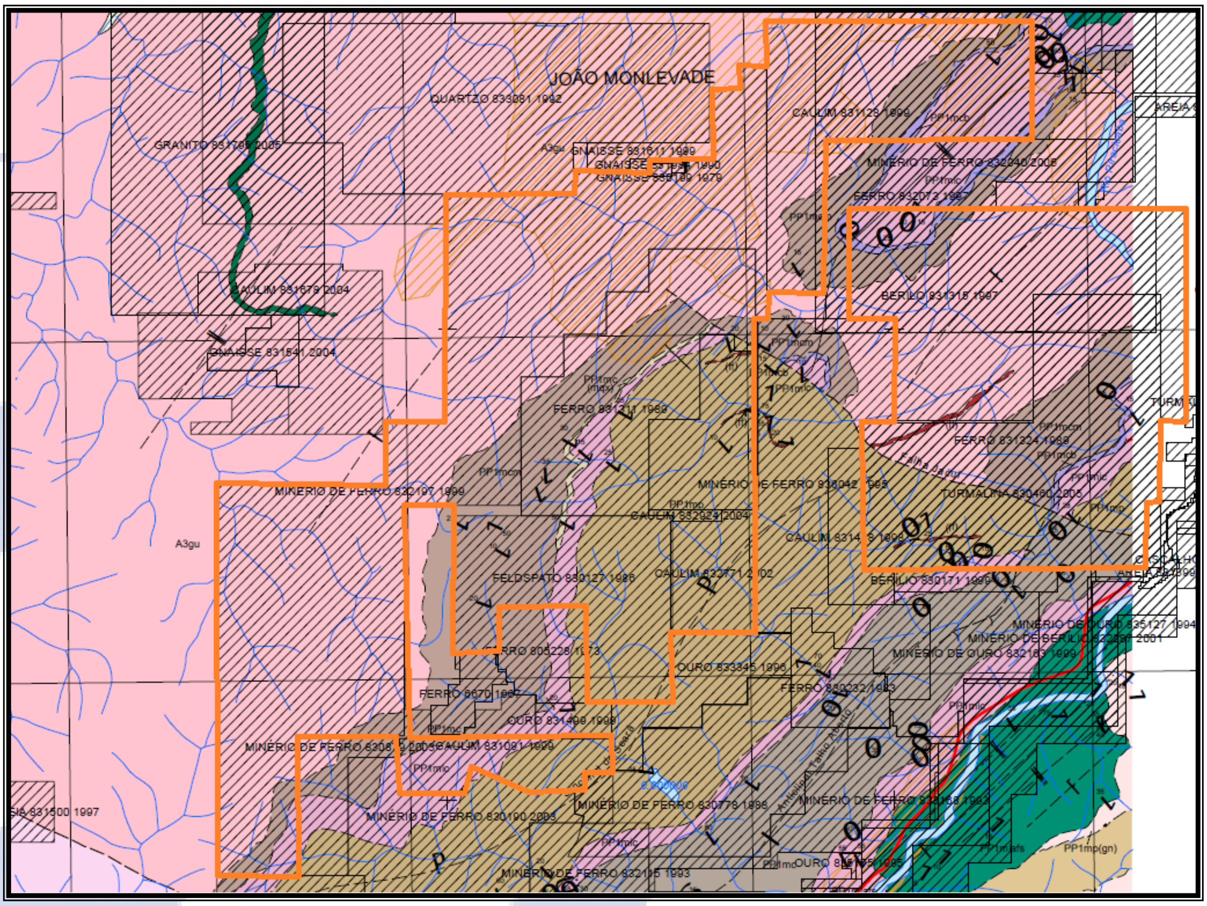

Figure 7: Geology of the area of the project (the two polygonals in the orange are the bounderies)

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The iron ore formation is in the dark pink color formations which have mainly direction NE-SW (The Caue formation as said before). So it is easy to see that in the biggest polygonal there are several outcrops mainly in its eastern area. One can also notice that the southern structure of the geological map is a syncline called "Seara Syncline" name given due to the name of the ridge that is located there (Seara Ridge). Because of the Syncline it is certainly known that under the yellow formation which is quartzite, amphibolite and schist there is also the layer of the iron formation. This hypotheses was confirmed as some drilling holes and bore holes were made by geologists in the area, so that a section in the NW-SE direction was made in the area.

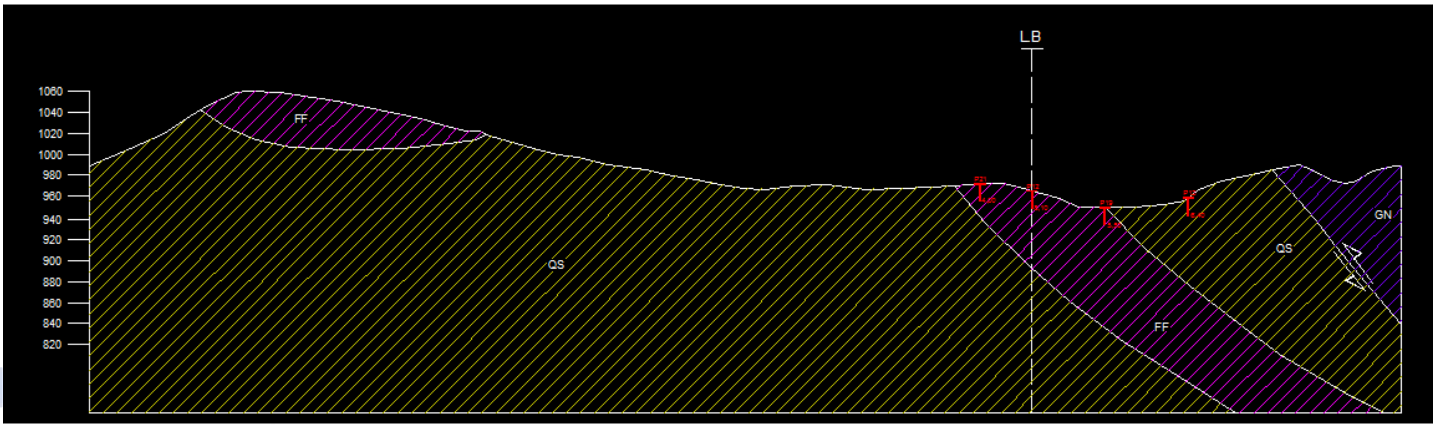

Figure 8: Section drawn by geologist in the project area using field information

In the other polygonal, the smaller one in the right, There is iron formation mainly in its southern part but also in the northwestern part of it. Not a lot of exploration has been done in this area, even though the geology of it implies that it is promising.

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LOGISTIC

1 – INTRODUCTION

With the goal of supplying the demand of iron ore in the region of Rio Piracicaba, EFVM (company of the railway which belongs to VALE) has developed with CONE Mine Exploration a project to the implementation of structures (cargo terminal, permanent way, unloading terminal, undercarriage); in which the iron ore exploited in the mine of the Seara Project would utilize the rail way Minas-Vitoria as haul road.

The terminal would be built right next to the rail way, which goes along the Piracicaba River in this area, as shown in the figure below. It will be build in order to deliver up to 3 million tons of iron ore per year.

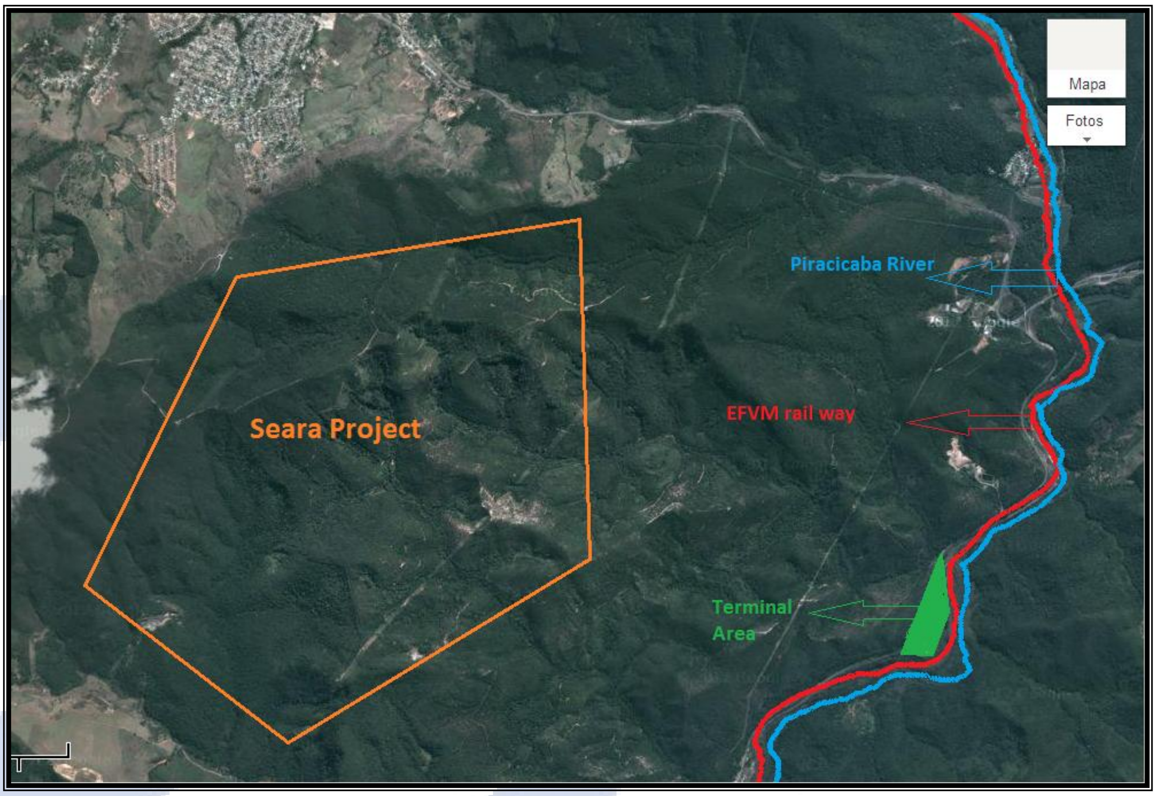

Figure 9: Geographic location of the project, terminal and railway

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The outlines of the terminal has already been planed and drawn. The terminal will be built next to the railway Vitoria-Minas and the roadway. The river Piracicaba is near it too. An area of 200,000 square meters will be utilized in order to make the terminal feasible. Basically, this terminal can be classified as a loading terminal, as its main objective is to load the iron ore in the wagon.

The AutoCAD drawing is shown below (The same area as the green one in the figure above).

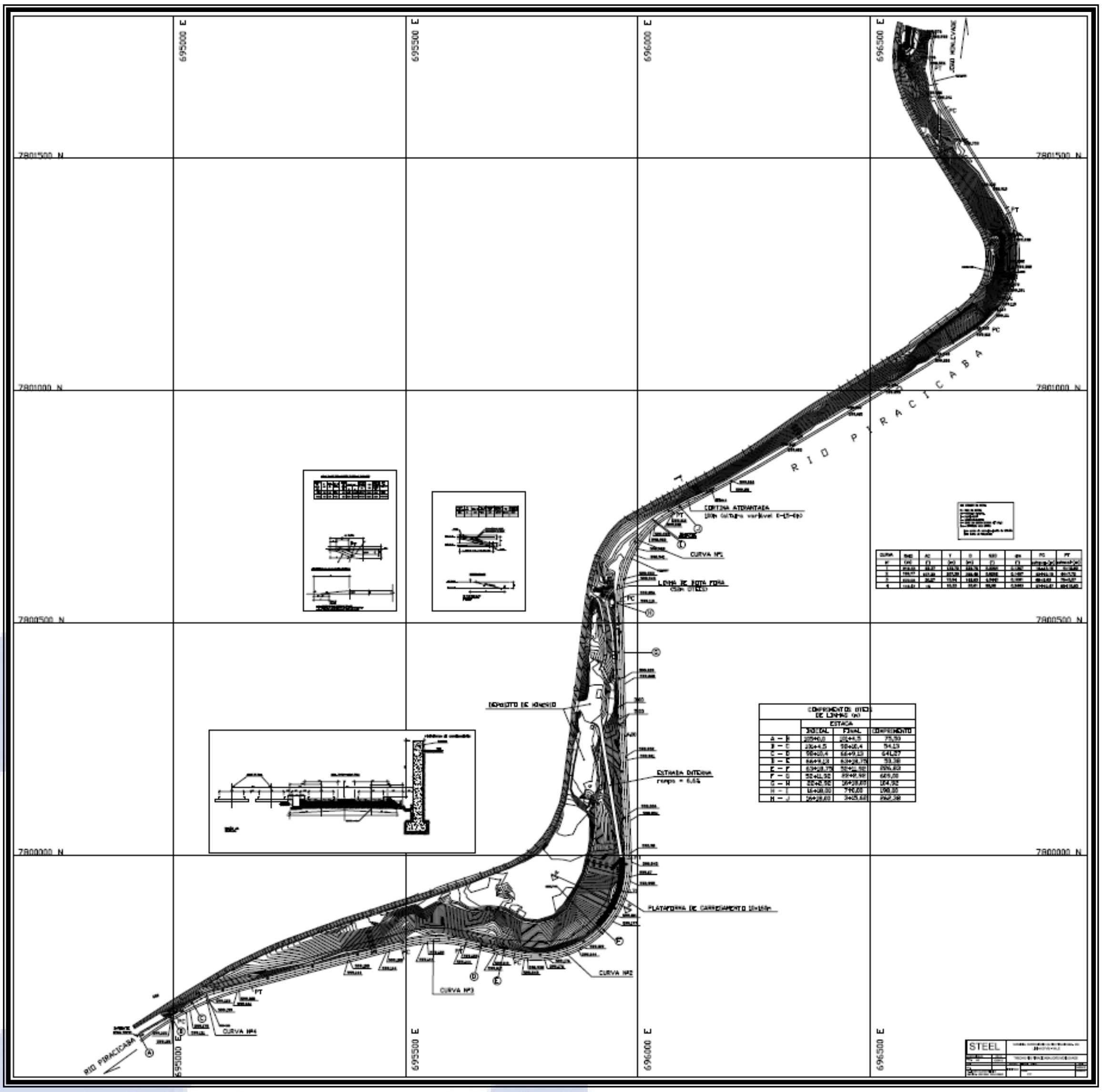

Figure 10: Blueprint of the Terminal

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2- THE VITÓRIA-MINAS RAILWAY (EFVM)

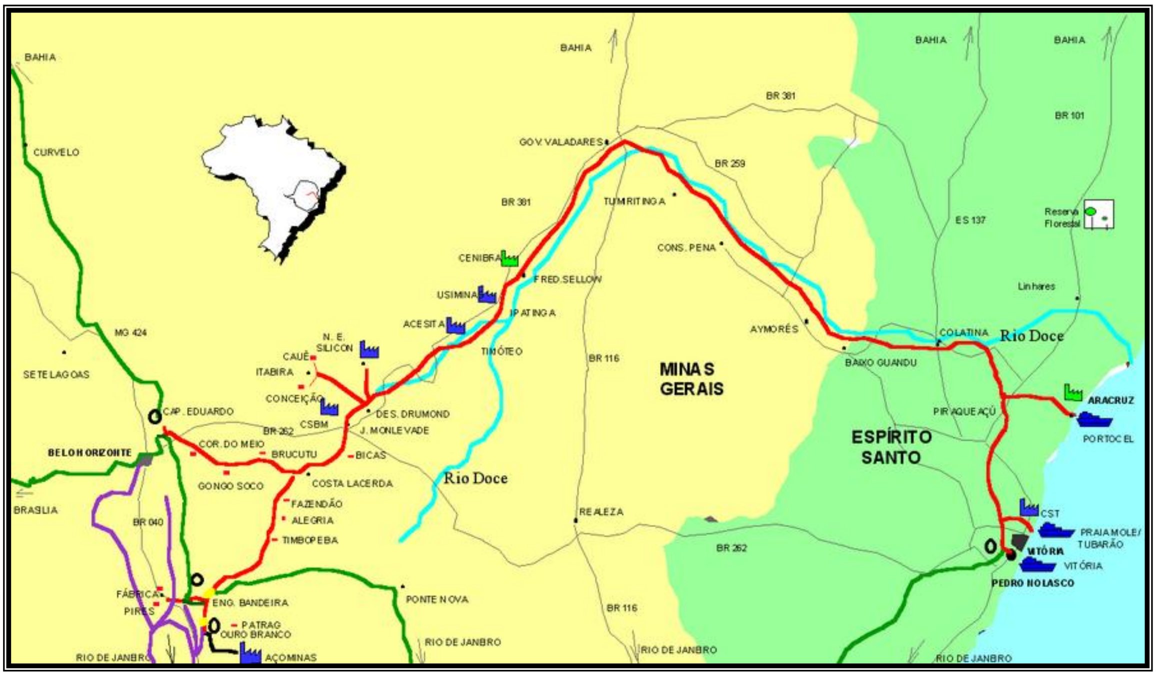

Figure 11: Vitória-Minas Railway (in red).

The railway begins in the Iron ore quadrangle. It is the main haul way of the ore of several mining municipalities.. Among these, the most important are Ouro Branco, Ouro Preto, Belo Horizonte, João Monlevade, Nova Era, Itabira, Ipatinga and Governador Valadares. A lot of steel manufactured in the steel industry in the east of Minas Gerais State is also transported through this railway. In the municipality of João Leiva, Espírito Santo, the rail way divides itself into two different ways, one is headed to Barra do Riacho, where the Port of Barra do Riacho is located. The other one goes through Vitória where the Port of Vitória and Tubarão are situated. The railway goes until the Ubu port, in the municipality of Anchieta.

EFVM was originally built to reach the diamond reserves northwest of Vitoria. Discovery of iron-ore at Itabira changed this. Today EFVM is owned by the private mining giant Companhia Vale do Rio Doce (CVRD) and is one of the world's busiest railways. More than 120 million net tonnes of freight, mainly iron-ore, are transported annually over its single main line.

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By the 1970s, 160-wagon iron-ore trains had become standard. Growing traffic has since forced the railway to operate longer trains which gave rise to a lot of technical challenges. The first problem stems from the sheer size of the trains. Trains of more than 160 wagons, headed by two General Electric (GE) Dash 9 locomotives, begin to lose braking efficiency because of the time it takes for air pressure to run through the air pipes. To this must be added increases in the risk of broken couplings due to internal shocks and compression. The solution was the use of distributed traction. This was tested on the standard 160-wagon formation and also on larger trains up to 240 wagons.

Besides the field tests, computerized simulations were made using specific software programs. After much simulation and on-line testing, a new standard train formation was designed: 1 Dash 9 + 160 wagons + 1 Dash 9 + 80 wagons + 1 Dash 9 + 80 wagons, with only one driver in the lead locomotive. All locomotives are controlled from the lead unit using GE-Harris Locotrol remote control equipment. Signals between the locomotives are transmitted by radio. The decision to have 80-wagon rakes is based on a classification yard that receives wagons from different mines along the line in 80-wagon cuts.

3- THE UBU PORT

Figure 12: Ubu port in the southern part of Espírito Santo State

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Administration:

The port is acquired by Samarco Mining, which belongs to Vale

Access:

The access road is can be made by the roads BR-101, followed by the ES-146 and finally the ES-060. It is located 80 Km from on the south of vVitoria. By the sea, the access channel marked out by 7 buoys, with a maximum draft of 13m input and output of 16m plus tide.

Structure:

The facilities of the terminal of Ponta Ubu consists of a concrete pier 313m long and 22m wide, with two berths know as the East Cradle, which allows berthing of boats up to 308m long, 54m wide and draft of 16m beyond the tide height; and the West Cradle, which allows berthing of boats up to 240m long, 32.25 m wide and draft of 13m beyond the tide height. The terminal has a storage facility for iron ore of 1.5 million tonnes, another one for 145 000 tonnes of coal, and a third one of 550.000 square meters of a range of different commodities.

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CONE MINE EXPLORATION

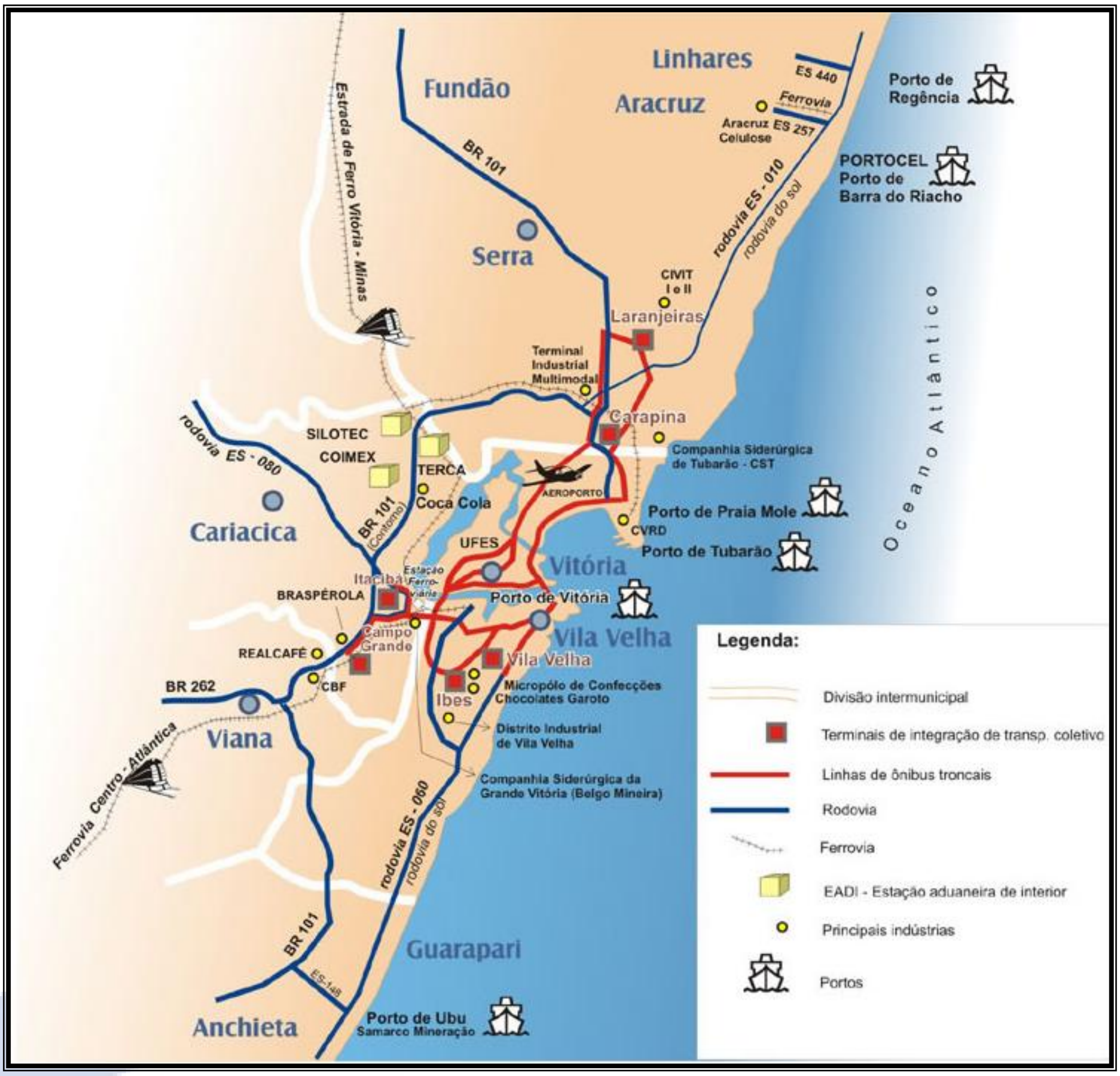

Figure 13: Map of the Espirito Santo´s capital, Vitória and its surroundings

In the map above is shown the location of the port and the main roadways and railways in the area. Location of airports, other ports and cities are also in the map. Vitoria is the capital of Espirito Santo and over 1,500,000 people live in it and its surroundings. The economy of the region is focused basically on the production of cellulose, and on the services provided from ports (the biggest port structure in the country) and infrastructure (the majority of Minas Gerais products are exported through Espirito Santo).

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THE RESEARCH OF THE AREA 832197/1999

1-WORKS CONDUCTED IN THE AREA

In this last section of the report it will be presented the studies and methods conducted in the area, mainly in outcrops, where evidence has been mapped by geologists of the iron formation.

The main performed works were:

-Maps were initially purchased in aerophotographic scale of 1:5,000, with digitization and expansion of 1:2000 maps. The maps were materialized at the vertices of polygonal landmarks as specified by the DNPM. The geological work were carried out in a large survey in the years 1999 and 2000 at 1:20,000 scale, based on those maps, or changing the information which generated doubt.

-21 wells of exploration were made on the NE side, with most of them confirming the presence of iron formation, with a total of 112.60 m.

-The estimation of geological resources is of 105,132,184 tons, amongst 1,671,048 t calculated, 3,341,296 t indicated and 100,119,840 t inferred.

-The cost of exploration was R$ 62,800.00 (sixty-two thousand eight hundred reais).

-Results of the granulometric analysis obtained from the material crushed under 10.00 mm and their chemical quality.

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RANGE Nº	WEIGHT (%)	CHEMICAL (%)								
		Fe	SiO_2	Al_2O_3	P	LI*	Mn	TiO_2	CaO	MgO
+10,00	7,57	57,96	12,48	1,32	0,069	2,93	0,093	0,267	0,005	0,011
-10,00+6,40	8,35	57,81	12,51	1,83	0,068	3,09	0,034	0,289	0,005	0,014
-6,40+1,00	16,25	58,78	11,38	1,33	0,054	2,87	0,036	0,191	0,004	0,010
-1,00+0,10	24,40	62,82	8,67	0,47	0,031	1,06	0,014	0,082	0,004	0,005
-0,10	3,65	62,12	7,56	0,79	0,059	2,42	0,017	0,142	0,004	0,009
AVERAGE	60,22	60,38	10,35	1,02	0,049	2,15	0,033	0,167	0,004	0,009

***LI = Loss on Ignition test**

Results of the products obtained from the cubed ore by transverse vertical sections 105,132,184 t x (P. ROM%) =

RESERVE (t)	WEIGHT (%)	SINTER FEED PRODUCT	CHEMICAL (%)								
			Fe	SiO_2	Al_2O_3	P	PF	Mn	TiO_2	CaO	MgO
105.132.186	60,22	63.310.598	60,38	10,35	1,02	0,049	2,15	0,033	0,167	0,004	0,009

2- INFRASTRUCTURE

There was no need for deployment of infrastructure in the place, as the area is near the city of João Monlevade and there are dirty roads to get there.

3 -TOPOGRAPHIC SURVEY

Maps were initially purchased through aerophotogrammetric (GEORAMA) in 1:5,000 scale and areas in detail were restricted to mineralized zones.

We conducted a demarcation of the permit; determined to be the point of attaching the geographic North by observation of an absolute zenith distance, making up six target to get the average, the variation or approximation, not exceeding 15 "(fifteen seconds), where the zenith distance was corrected for parallax and refraction of the semi diameter, with corrections for the zenith and instrumental level. A concrete milestone was settled to mark the vertices of the polygon.

4 – LOCAL GEOLOGICAL MAPPING

The works were based on geological mapping surveys of the squares of the Piracicaba River and John Monlevade, made by Robert G. Reeves, scale 1:25,000, and regional mapping carried out by M. Antonio Carlos, scale 1:20,000. After the materialization of the polygon, it was made a geological survey in detail, visiting and following all the outcrops of iron formation, differing from the various lithologies, shale, quartzite cave and cover and basement granite-gneiss.

By having the data, one could produce vertical cross-sections of the mineralized zones. Two of these sections are shown below with the detailed geological local map. Throughout each of these sections three bore holes in the iron formation layer (pink one) and ferruginous quartzite

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(yellow one) have been made. With those information as well as the information of outcrops and vegetation the geologist could draw the sections.

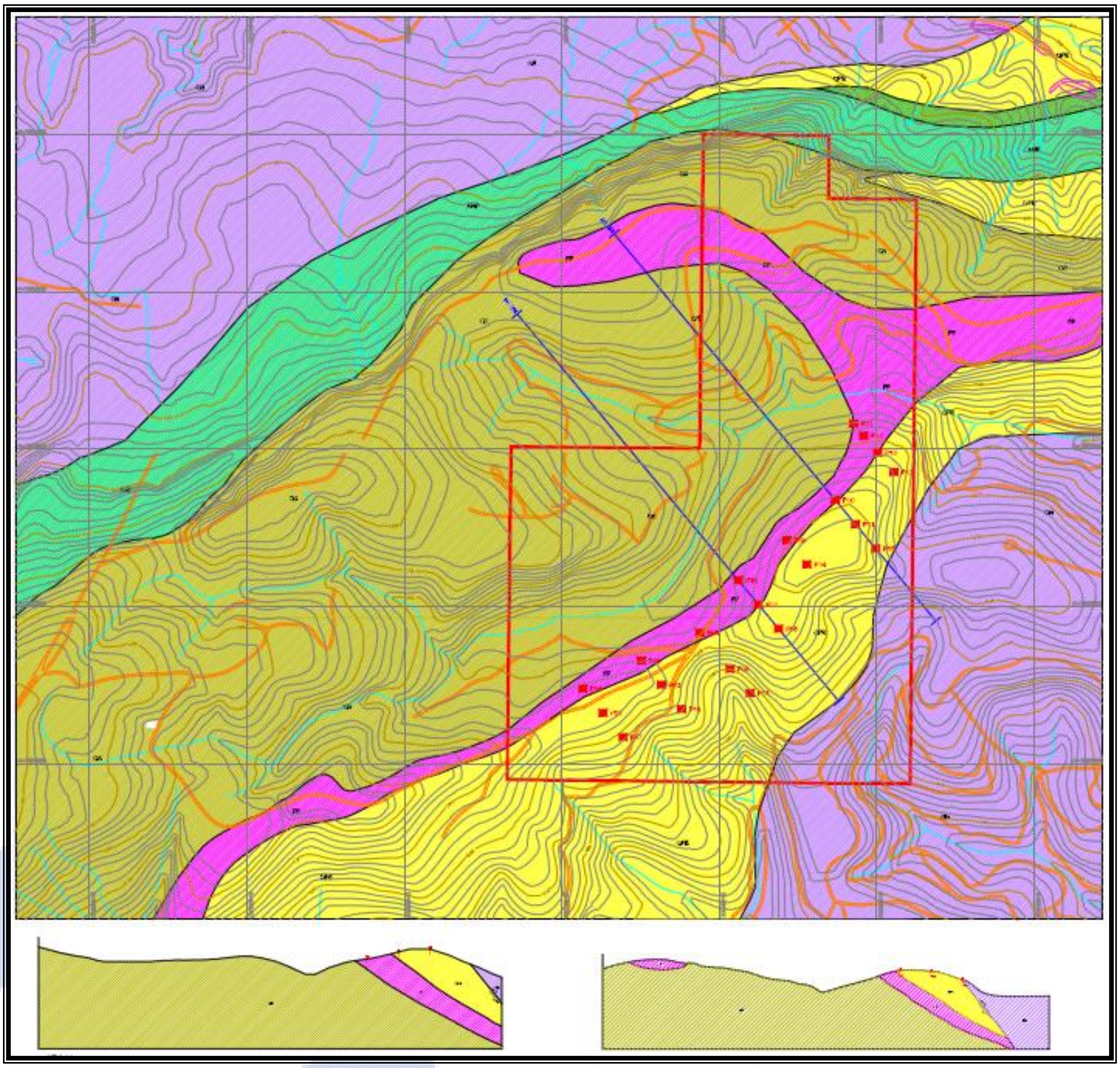

Figure 14: Geological Map and section of the area (The Iron Formation is the pink one). Sericitic quartzite is the dark yellow; ferruginous Quartzite is the light yellow and gneiss is the purple layer. The bore holes are represented as red dots.

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5 - EXPLORATION WELLS

The iron formation area was investigated in the whole tenement extension. The wells were made at irregular mesh covering the entire mineralized area. Most of these wells were positive in iron formation and some wells were located in quartz-mica schist covering. More information about the wells will be given further in this report.

6 – ORE PROCESSING - CHEMICAL ANALYSIS

The iron ore samples have been crushed so that the thin type "sinter feed” could be obtained. The samples have been sieved, separating the grains different sizes in thick and thin series. The following screens have been used: 38 mm 31 mm 25 mm 19 mm 15.9 mm, 12.9 mm, 10 mm, 8 mm, 6.35 mm, 6 mm, 4 mm, 3 mm 2 mm 1 mm, 0.50 mm, 0.25 mm, 0.15 mm, 0.10 mm, 0.074 mm and -0.074 mm.

Samples of the respective intervals were prepared for chemical analysis for the following elements: Fe and SiO_2.

Based on the results of the granulometric and chemical similarity with minerals and products of the surrounding mines (Morro Agudo and Agua Limpa) the ore is a typical coarse itabirite, specularite and magnetic and may be subject to the gravimetric concentration or flotation, in order to obtain products, or concentrates of high purity. The ore has also magnetic properties which would enable the wet high intensity magnetic separation for fines. It appears that the products resulted from the ore and its mixtures have a competitive product on the market. The average content of 41.21% Fe can be easily full released, representing a typical ore of the region's current mining district of Rio Piracicaba.

It is almost certain that the layer of iron formation, in the polygon, is continuous and has in some restricted areas occurrences of pure hematite.

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7 - PHYSICAL AND CHEMICAL PROPERTIES OF THE ORE

The ore is mainly represented by specularite. Secondarily, there are hematite and magnetite.

For this report no metallurgical test has been made. These will be made when feasible and when there is urge for further information.

It is expected that the behavior of the ore and the quality of the products do not present major discrepancies to the ore now processed at the plants of VALE in the Agua Limpa Mine.

The itabirite also composed by coarse quartz and specularite predominates. Superficially, there is a high incidence of flat iron, which shows a high grade of ore.

The itabirite has a light gray color with crisp, coarse quartz and average grade of 41.21% Fe. It is expected that the silica contained in the itabirite from the outcrops is only released when grinding.

In the body of the iron formation there is intercalation of centimetric and metric layers of mica as well as segregation and quartz veins. The itabirite surface is crispy and these are variations with depth which cause retention and fractures through which the occurrence of percolations are enabled.

Another important characteristic is that the minerals leach easily, facilitating the release of silica attached to the grains of hematite and specularite.

The phosphorus content is equal to 0.01%. The body is homogeneous and in small passages is observed lens hematite. They may also be conditioned to faults and formation, probably due to the occurrence of hypogenic metasomatic enrichment processes. There is an iron formation on the surface, partially hydrated, and crusts with “canga”, all the fractures are filled by iron hydroxides. It is observed that recrystallization of quartz.

The degree of compaction was established by macroscopic observations and tapping. Compact itabirites which have above 30% of iron content are hematite merged itabitites, which explains some good results obtained by gravimetric separation for semi compact itabirite.

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8 – CHEMICAL CONTENT

The following chart presents the chemical content obtained through samples of the wells.

WELL Nº	METERS (m)	CHEMICAL CONTENT (%)	
		Fe	SiO_2
01	2,40	61,32	8,25
	1,75	33,06	47,50
06	0,85	28,65	51,80
07	3,00	66,81	0,72
	2,20	28,85	51,50
12	2,00	45,38	22,60
	2,80	12,16	48,80
AVERAGE	15,00	41,21	29,62

Very poor itabirite has been included in the sample and chemically analyzed, even though they should be discarded in the extraction.

The analysis of the samples of the wells showed 41.21% Fe. A re-sampling of wells was performed, generating seven bigger samples (more mass) which were tested to determine their concentration, whose average result is presented below.

a) Result of the granulometry analysis of the sample crushed to the range of +10.00 mm -31.50 mm, of the exploration wells:

RANGE Nº	WEIGHT (%)	CHEMICAL (%)								
		Fe	SiO_2	Al_2O_3	P	LI	Mn	TiO_2	CaO	MgO
+10,00	7,57	57,96	12,48	1,32	0,069	2,93	0,093	0,267	0,005	0,011

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b) Result of granulometry analysis of crushed material under 10.00 mm:

mesh (mm) / weight (%)																		
9,50	7,90	6,40	5,60	4,80	3,60	2,40	1,00	0,60	0,30	0,21	0,15	0,105	0,074	0,053	0,044	0,037	-0,032	-1+0,1
0,73	3,29	4,31	2,45	5,22	6,18	5,19	9,57	5,99	20,03	13,75	9,09	5,82	2,56	1,50	0,95	0,35	2,99	54,68

c) Result of the granulo-chemical analysis of the sample crushed under 10.00 mm:

RANGE Nº	WEIGHT (%)	CHEMICAL (%)								
		Fe	SiO_2	Al_2O_3	P	LI	Mn	TiO_2	CaO	MgO
-10,0 +6,4	8,35	57,21	12,49	1,83	0,0068	3,09	0,034	0,289	0,005	0,012
-6,4 +1,0	28,65	53,52	18,54	1,33	0,060	3,28	0,037	0,173	0,005	0,011
-1,0	63,04	46,77	30,51	0,61	0,099	1,83	0,012	0,077	0,006	0,012
ROM CALC.	100,00	49,69	25,47	0,93	0,047	2,37	0,021	0,124	0,006	0,011

d) Results of the test of average friability and mass recovery of material crushed under 10.00 mm:

Average of friability (%)	Average of mass recovery (%)
72,35	52,67

e) Result of the sample obtained from the material crushed to 10.00 mm (concentrated):

Range –10,00 +6,40mm

WEIGHT ROM (%)	CHEMICAL (%)								
	Fe	SiO_2	Al_2O_3	P	LI	Mn	TiO_2	CaO	MgO
8,35	57,81	12,51	1,83	0,068	3,09	0,034	0,289	0,005	0,014

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Seara Project

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Range -6,40 +1,00mm (panning concentrate)

WEIGHT ROM (%)	CHEMICAL (%)								
	Fe	SiO_2	Al_2O_3	P	LI	Mn	TiO_2	CaO	MgO
16,25	58,78	11,38	1,33	0,054	2,87	0,036	0,191	0,004	0,010

Range -1,00 +0,10mm (panning concentrate)

WEIGHT ROM (%)	CHEMICAL (%)								
	Fe	SiO_2	Al_2O_3	P	LI	Mn	TiO_2	CaO	MgO
24,40	62,82	8,67	0,47	0,031	1,06	0,014	0,082	0,004	0,005

Range -0,10mm (panning concentrate)

WEIGHT ROM (%)	CHEMICAL (%)								
	Fe	SiO_2	Al_2O_3	P	LI	Mn	TiO_2	CaO	MgO
3,65	62,12	7,56	0,79	0,059	2,42	0,017	0,142	0,004	0,009

Chemical quality of the products:

RANGE Nº	WEIGHT (%)	CHEMICAL (%)								
		Fe	SiO_2	Al_2O_3	P	LI	Mn	TiO_2	CaO	MgO
+10,00	7,57	57,96	12,48	1,32	0,069	2,93	0,093	0,267	0,005	0,011
-10,00+6,40	8,35	57,81	12,51	1,83	0,068	3,09	0,034	0,289	0,005	0,014
-6,40+1,00	16,25	58,78	11,38	1,33	0,054	2,87	0,036	0,191	0,004	0,010
-1,00+0,10	24,40	62,82	8,67	0,47	0,031	1,06	0,014	0,082	0,004	0,005
-0,10	3,65	62,12	7,56	0,79	0,059	2,42	0,017	0,142	0,004	0,009
AVERAGE	60,22	60,38	10,35	1,02	0,049	2,15	0,033	0,167	0,004	0,009

f) Sinter feed chemical analysis of the measured, indicated and inferred resources of 105,132,184 tons. Considering that 60.22% of the ore processed is the sinter feed, there are 63.310.598 tons of it:

Resource (t)	Weight (%)	Sinter Feed Product	Chemical Analysis (%)								
			Fe	SiO2	Al2O3	P	PF	Mn	TiO2	CaO	MgO
105.132.186	60,22	63.310.598	60,38	10,35	1,02	0,049	2,15	0,033	0,167	0,004	0,009

9 - GEOMETRY AND DISTRIBUTION OF ORE

The basic lithologic constitution is composed by a continuous layer of the iron formation, with the direction of the layer from SW to NE. The hematite is intercalated with quartz in the itabirite. It is contained in the penultimate sequence of the iron formation, composed of a successive thrust fault.

This layer has its wedging in folds in the northeastern side and abrupt and lenticular wedging in the southwestern side.

The iron formation shows a deep weathering profile, thus it is seldom found in surface the compact itabirite. Some bodies of compact hematite can be found in depth, prevailing, however, the condition of a semi-crispy.

10 – ORE PARAGENESIS AND ASPECTS ABOUT GENISIS

L. W. Von Eschwege (1822-1833) in his studies of the Minas Gerais Precambrian geology cited the first basis of the iron ore genesis from the Iron Quadrangle.

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In the following studies about the Iron Quadrangle, not very different theories have been postulated, just some other additions.

There are two fundamental theories, among many others, to explain the genesis of banded iron formations. The first was posited by Djalma Guimarães (1961) and establishes the chemical sedimentation of ferric hydroxides associated with submarine basaltic flows in a sedimentary basin.

The theory of the formation of hematite accepted by D. Guimaraes (1961), Guild and Barbosa (1952), and many other geologists associate the process of metasomatic replacement of character with the phenomena of hydrothermal leaching of quartz. The substitution would give rise to the richest ore lenses.

It is considered that the role of regional metamorphism would also be responsible for the segregation of richer regions, as well as the actions given by tectonism tending to dismember bodies and differentiate them.

The second main theory for the formation of itabirites was enunciated by Edson Suszinski and admits the possibility of continental contribution, ie, from metabasites, hydroxides would be deposited in an oxidizing environment and siliceous nature.

The formation of hematite would be related to dehydration of hydroxides, as a consequence of regional metamorphism, which also produce the lamination itabirites.

It is also believed that the hematite may have a sedimentary origin, where, for any deficiency in silica in the environment, would be deposited only iron hydroxides.

There are some levels locally rich in chlorite and other holders of magnetite (in contacts with the footwall shales). However, the primary mineralogy is represented by hematite and quartz.

It was observed the predominance of friable itabirite bodies with low grade of silica and phosphorus. The silicon can be easily totally liberated. According to the analysis performed the ore is compatible with the today´s demand compared to the "cut off" currently adopted in other mines surrounding the deposit, representing a great resource for the utilization of the entire mining district of Rio Piracicaba.

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11 – ESTIMATE OF RESOURCES

In this report we tried to estimate the mineral resources. Exploration bore holes have been made in the area, a total of 21 wells, most of them positive in iron formation. Initially, it was estimated the total resource of iron formation by measuring the area in each one of the sections (S / SW), (E / SE) and (NE). Later, it was multiplied by the distance of influence of 200 m (equidistant between sections), which yields a volume. Multiplied by the density of d = 2.8 t/m^3, one gets the tonnage (t).

The total tonnage calculated with this method was of 105,132,184 tons of iron ore. It is noteworthy that the 21 wells were located in the area yield a total of 112.60 meters of length, in which the iron formation has been in 48.00 m.

Summary of Reserves

TYPE	TONNAGE (t)
MEASURE	1.671.048
INDICATED	3.341.296
INFERRED	100.119.840
TOTAL	**105.132.184**

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