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VALE INCO LIMITED

EXTERNAL AUDIT OF MINERAL RESERVES

VOLUME 2, SECTION 6

ONÇA PUMA PROJECT

Submitted to:
Vale Inco Limited
2060 Flavelle Blvd, Sheridan Park
Mississauga, Ontario
Canada L5K 1Z9

REPORT

Project Number: 10-1117-0032 Phase 6000

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Executive Summary

Golder Associates S.A. representatives Mr Honorio Lima, Dr Frederico Carmo and Mr Jani Kalla visited the site from 1 to 6 July 2010 to carry out an independent audit of the mineral resources and mineral reserves estimated by VALE for the Onça Puma Project.

During the site visit they inspected mining operations, interviewed personnel and gathered information required to evaluate the appropriateness of the data and methodology used to estimate the resources and reserves. A list of people contacted for this study includes:

- Fernando Marino – Onça Puma Operations General Manager
- David Chiron – Chief Geologist/Manager Geology and Mine Planning
- Arnaldo Moreira Borges – Manager Quality Management
- Roberto Lima – Senior Mine Engineer
- Wander Pinho Reggiani – Engineer
- Edgard Rocha – Engineer
- Valter T. Oliveira – Master Geologist.

This study includes a review of technical reports, memoranda and supporting technical information obtained from Vale. Reports on internal and external technical reviews and audits were also made available to Golder.

The mineral reserve estimates provided to Golder were expected to conform to the requirements of the Securities Exchange Commission's Industry Guide 7 and to Canadian National Instrument (NI) 43-101 using specific terminology from CIM (2004). No exceptions were found to these requirements.

The mineral reserve statement at June 30, 2010 for the Vale was audited by Golder. The mineral reserve audited by Golder was based on the mineral resource models and was prepared using costs, optimisation, mine design and scheduling practices that are appropriate. Golder accepts the procedure adopted to convert the mineral resource into a mineral reserve. The numbers are appropriate for the purpose of public reporting in that they provide an acceptable prediction of the available mineral reserves. The tonnes and grades are reported at an appropriate economic cut-off grade based on documented costs and prices.

The following table with the mineral reserve figures is provided at the appropriate level of precision for public reporting.

Estimated Mineral Reserve for Onça Puma Project as of June 30, 2010

	Million Tonnes	**Ni %**	**Co %**	**Fe %**	**SiO_2 %**	**MgO %**
Proven	55.1	1.79	0.044	13.4	39.30	24.29
Probable	27.6	1.62	0.043	13.7	38.96	24.14
Total	**82.7**	**1.73**	**0.044**	**13.5**	**39.19**	**24.24**

Significant Opinions

Golder believes that the deposits are sufficiently drilled with appropriate drill spacing, depth, orientation and location of drill holes for accurate estimation of mineral resources.

Drilling and logging procedures are industry standard and Golder considers them to be appropriate for Nickel laterite deposits. Golder reviewed the sampling procedures and considers these to be appropriate for geological modelling and mineral resource estimation.

The equipment fleet seems to be properly sized considering the required production targets and mining selectivity. A dispatch system is currently installed and will generate a useful database that can be used for planning and production control. It is important that periodic reports be produced not only with the historic information but pointing to trends in the evolution of the main control variables. This will allow for pro-active decision making to react to grade trends that may be detrimental to meeting production targets.

In both cost and pricing assumptions scenarios used (Vale and three-year moving average) positive project economics support conversion of mineral resources to mineral reserves. Under sensitivity analysis, in all cases tested the NPV remained positive, suggesting robust project economics.

The results of the test mining program confirm the effectiveness of operational mining parameters used to estimate mineral reserves. The reconciliation system designed by MOP (Mineração Onca Puma) will assist in improving the understanding about mining selectivity and equipment performance which will be key factors controlling the effective mining recovery.

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6.0 ONÇA PUMA OPERATIONS

6.1 Location

The Onça Puma Nickel Project is located in the state of Para, northern Brazil. The nearest city is Ourilândia do Norte which is connected by road to Parauapebas (160 km) and to Marabá (390 km). In both localities it is possible to connect with the Carajas Railway (Estrada de Ferro de Carajás – EFC) which is operated by Vale to transport the products from the Carajás Iron Mines and copper concentrate from the Sossego Mine to the Terminal da Ponta da Madeira (TPM) and Itaqui Port at São Luis, Maranhão state.

The main access to transport heavy material (equipment, spare parts, material and ferronickel production) is using the railway from the São Luiz Port to Maraba or Parauapebas and then to the site by paved roads opened to the traffic during all the year. There are regular flights from Maraba to Ourilândia do Norte using small airplanes. Figure 6-1 and Figure 6-2 show the project location.

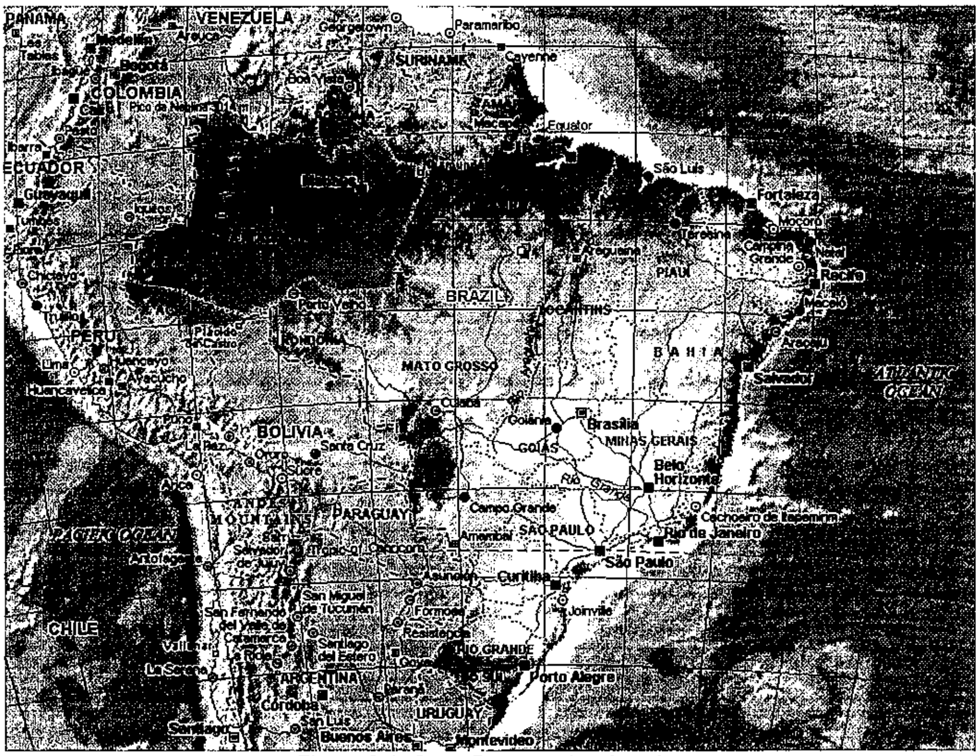

Figure 6-1: Onça Puma project location

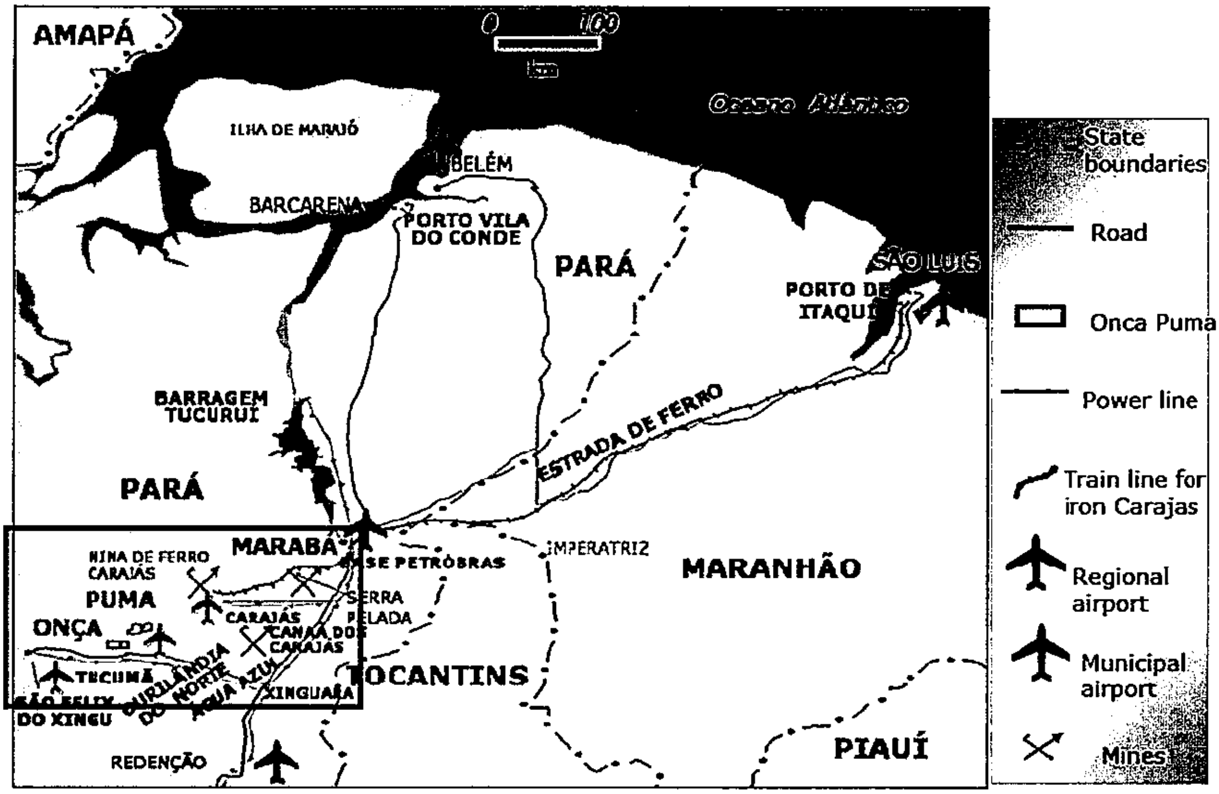

Figure 6-2: Ourilândia do Norte and the Carajás Region

6.2 Ownership

The Onça Puma Nickel Project is 100% owned by Vale S.A. The first owner was Inco Limited whom initiated the geological exploration in 1973. The property was subsequently owned by Canico, and was acquired by Vale S.A. in 2005.

6.3 Land Tenure and Mining Rights

The property consists of two separate laterite nickel deposits covered by five DNPM (Brazilian Mining Regulatory Agency) processes as described in the following Table 6-1. The processes 814.621/1973 and 814.622/1973 lie within the Xikrin indigenous reserve and still are outstanding for a decision by DNPM. All the others had approved its PAE (Economic Evaluation Plan) and have now the status of Mining Concessions.

At present Vale had acquired a big part of the land necessary for to obtain surface rights for mining and infrastructure implantation. Brazilian legislation separates the ownership of the surface from the underground. A mining company can operate a mine even if does not own the surface. In this case it is necessary to pay a royalty to the surface owner. The royalty is calculated as 50% of the CFEM (Compensation for Financial Exploitation of Mineral Resources) which is paid to the government.

Table 6-1: Mining concessions

DNPM No.	License Type	Area (hectares)
811.051/1973	Mining Concession	6,250.00
811.016/1973	Mining Concession	5,250,00
814.621/1973	Mining Application	6,647.20
814.622/1973	Mining Application	10,000.00
850.650/2006	Mining Concession	3,286.80

6.4 Infrastructure

Power Supply

The electric power to the mine site is supplied by a power line (230kV) from the Carajas substation (located in Parauapebas) feeding the main substation at the plant site. The Carajas Substation is fed by a 230 kV power line from the Maraba Substation that is connected with the Tucurui Hydro Power Plant.

The main substation at the plant site is equipped with 3 electrical transformers with 160 MVA each one. The power is distributed internally in 34.5 kV. Figure 6-3 shows the power supply system from the Carajas substation to the mine site. Figure 6-4 shows the main substation at the Mineração Onça Puma (MOP) plant site.

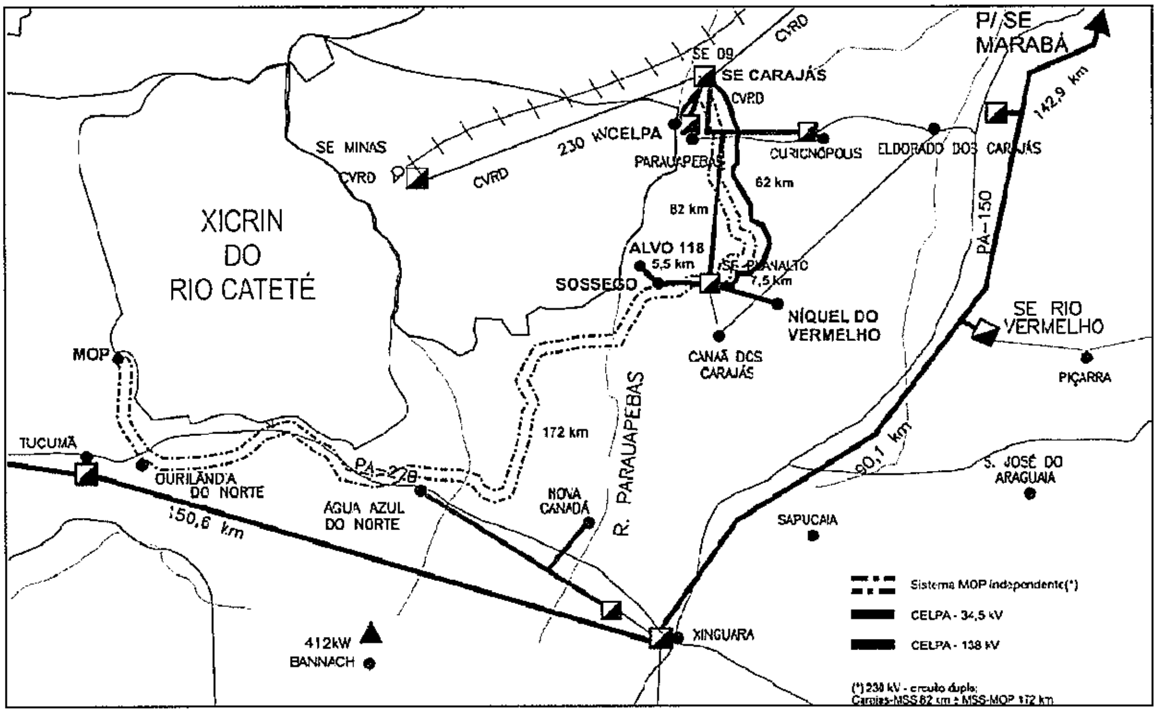

Figure 6-3: Onça Puma Nickel Project power supply (MOP: Mineração Onça Puma)

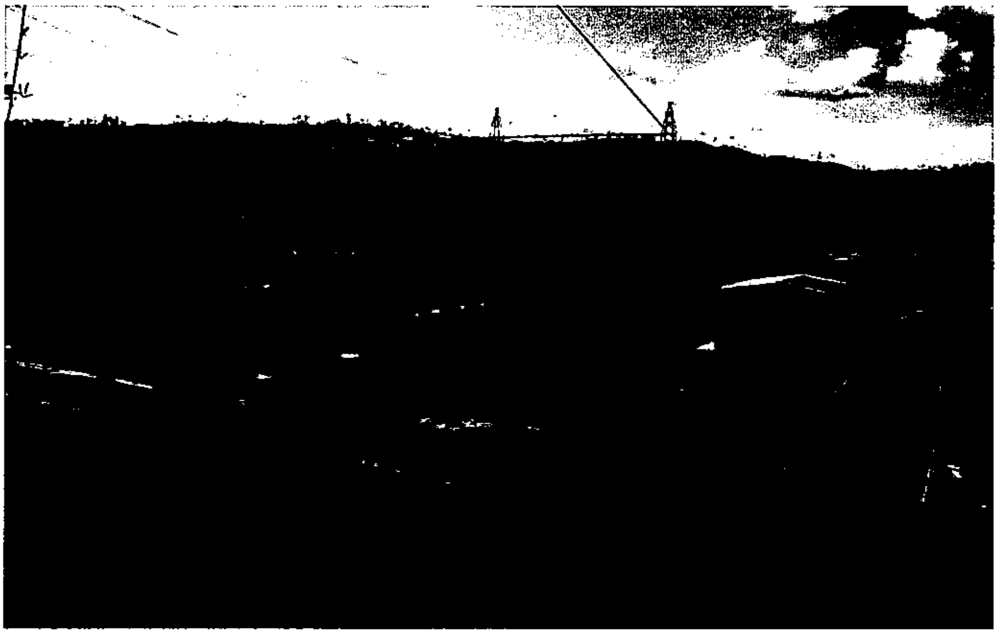

Figure 6-4: Onça Puma Nickel Project - Main substation

Data Transmission

The site is fully connected to the national and international communication (voice and data) systems. The site is connected to the Parauapebas train transhipment station by optical fibre installed on the top of the power line towers and then to the São Luiz Port by optical fibre system installed by the side of the railway. Ourilândia do Norte is connected with fixed and mobile telephony systems. The mine site area is covered by mobile telephony system.

6.5 Production Process and Products

The ore to be treated on the Onça Puma Nickel Project will be supplied by two open pits named Onça and Puma deposits. Both mines will be operated using small size equipment due to the needs of a selective mining operation. The processing plant is located close to the Onça mine. Figure 6-5 shows the general plan covering both pits and the processing plant.

The Onça Puma pyro-metallurgical plant, built with RKEF technology, is located at the extreme East of the Onça ridge. The installed capacity is to produce 52,000 tonnes of Nickel per year contained in a 25% grade ferronickel using two independent production lines (drying, calcining, smelting and refining). The plant will treat the saprolitic ore from Onça and Puma mines which will be transported to the plant by 40 tonnes capacity trucks.

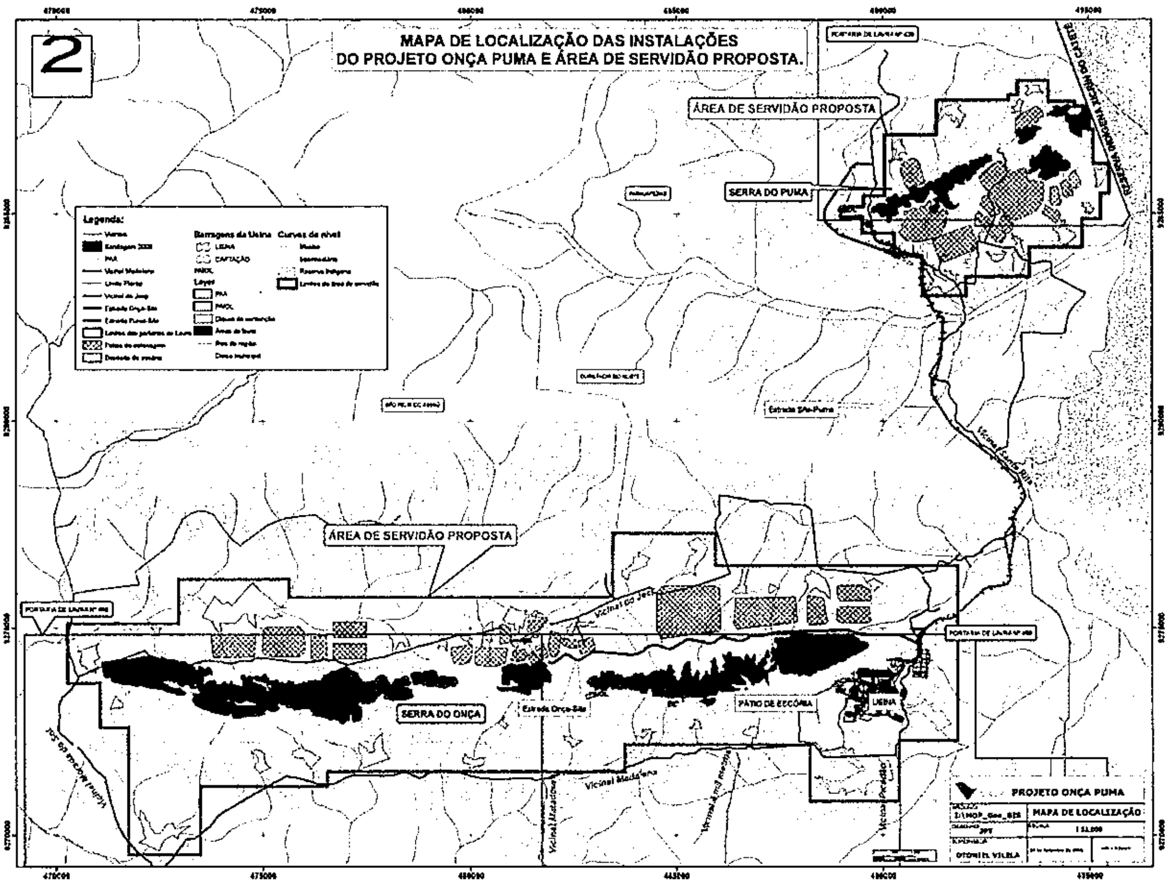

Figure 6-5: Onça Puma Nickel Project - General plan

6.6 Metal Recoveries

Larger scale pilot electric furnace smelting tests were performed at Elkem (Norway). A different ore was smelted during each of three weeks of test work, representing compositions expected in the initial, medium term and long term years of operation. In general, the test work indicated that the Onça Puma ores should behave in a normal fashion in a conventional RKEF commercial operation. The kiln was successfully operated with calcine up to 950°C, above the 900°C selected for the process. The somewhat elevated levels of chromium in the ores did not cause any problems in the electric furnace, which was successfully tapped for metal and slag. The test work provided slag samples for subsequent heat capacity measurements.

The nickel content of the pilot electric furnace discard slag can be used to estimate a portion of the losses of nickel from the proposed plant; the measured slag nickel contents were as low as or lower than those experienced at existing operating process plants. However, losses of nickel occur elsewhere in the processing line between ore receiving and final product (e.g., refining slag losses, dust, mishandling of revert material). Onça Puma forecasts, as the operation achieves stable conditions, planned recoveries as follows: ore preparation – 99.0%, calcining – 97.0%, smelting – 96.0%, and refining - 98.0% for an overall plant production recovery of 90.3%.

6.7 Market

The Onça Puma Project is currently planned to produce a ferro-nickel product that contains approximately 25% nickel with the balance mostly iron. The nickel content and impurities may vary, over time, depending on mineral distribution and association within the deposit, processing techniques and other factors. The end product is to be a ferro-nickel pellet, a Class 2 primary nickel form expected to be used for the production of stainless steel.

6.8 Historic Production

Onça Puma is a nickel operation (mine and plant) built on deposits of nickel laterite saprolite in the Brazilian state of Pará. The nominal production is expected to reach a capacity of 52,000 tonnes per year of nickel contained in ferro-nickel. Commissioning is scheduled to begin in the second half of 2010, with commercial production starting in 2011. There has been no commercial production to date.

6.9 Geology and Mineral Deposits

Regional Geology

The following information is summarised from the feasibility study report by Hatch (2005), a Geological Review Report by AMEC (2005), the Onça Puma Resource Estimation Draft Report (Vale, 2008) and an internal Vale Inco technical presentation (2010):

Elevated nickel concentrations at the Onça Puma deposit are located in elongated ultramafic ridge complexes of the Itacaiúnas Shear Belt within the Amazon Craton of the Brazilian Precambrian Shield, which is underlain by Archean-age gneisses and migmatites. These ultramafic complexes are restricted to prominent structural zones which controlled their emplacement into the surrounding metamorphic basement rocks. The layered complexes consist of variably serpentinized dunite and peridotite, plus related pyroxenite, anorthosite, and gabbro. The units tend to strike east to west and generally dip at 40-45° to the south.

The lateritic nickel deposits are hosted by the mafic-ultramafic rocks of the Proterozoic Catetê intrusive suite which intrude into the Archean Xingu granitic gneisses and Plaque Granite in the Onça Puma area. The Onça and Puma ridges are separated by approximately 16 km and this area also contains meta-sedimentary material, including a considerable zone of banded iron formation (BIF) exposed on Serra Arqueada which is also held by Vale. The simplified regional geology is displayed in Figure 6-6

Local Geology

The Onça ridge complex is a south-dipping, tabular body approximately 23 km long. The western end is approximately 3.6 km in width with local faulting causing the body to narrow to the east. The deposit strikes predominantly in an E-W orientation with a dip of 45° to the south. The favourable rocks for nickel mineralization are ultramafics, more specifically serpentinized peridotites and dunites that extend for nearly 19 km along the ridge and together are up to 1200 m in width (Hatch 2005). Figure 6-7 shows the geology of the Onça deposit.

The Puma Mafic-Ultramafic complex is approximately 23 km in length and 3 km in width. It is hosted by the Itacaiúnas Shear Zone and is oriented, within the shear zone, in a N80°E direction with a 45° southerly dip. Puma deposit geology is displayed in Figure 6-8.

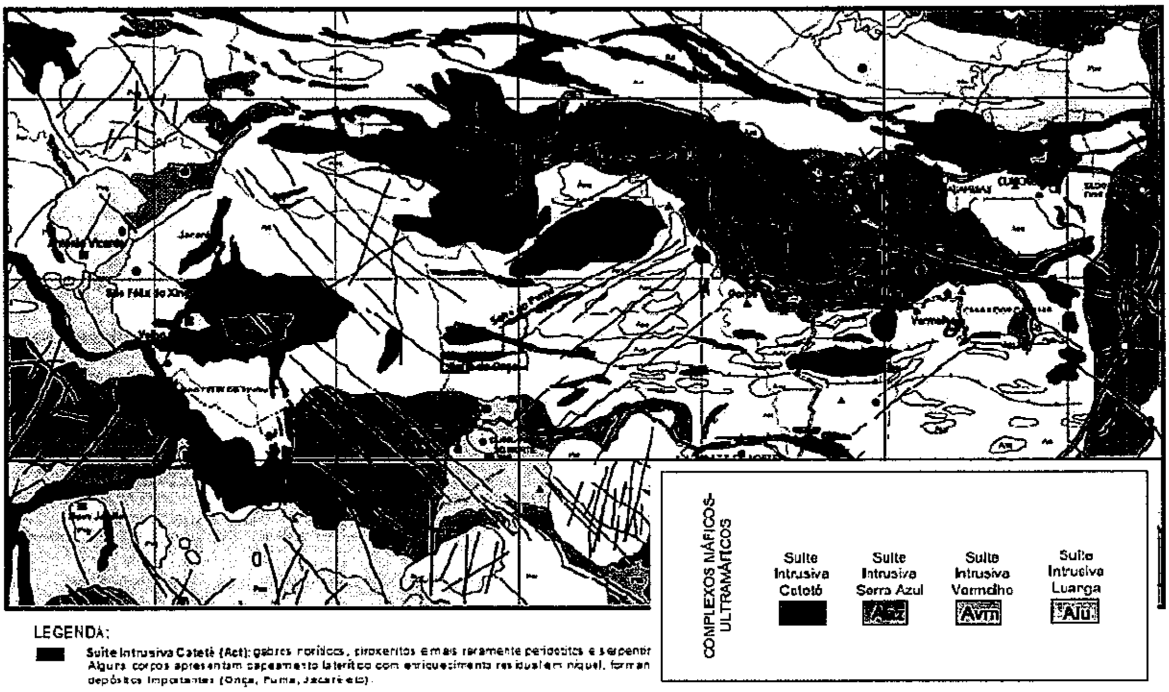

Figure 6-6: Simplified regional geology (sourced from Vale Technical Presentation 2010)

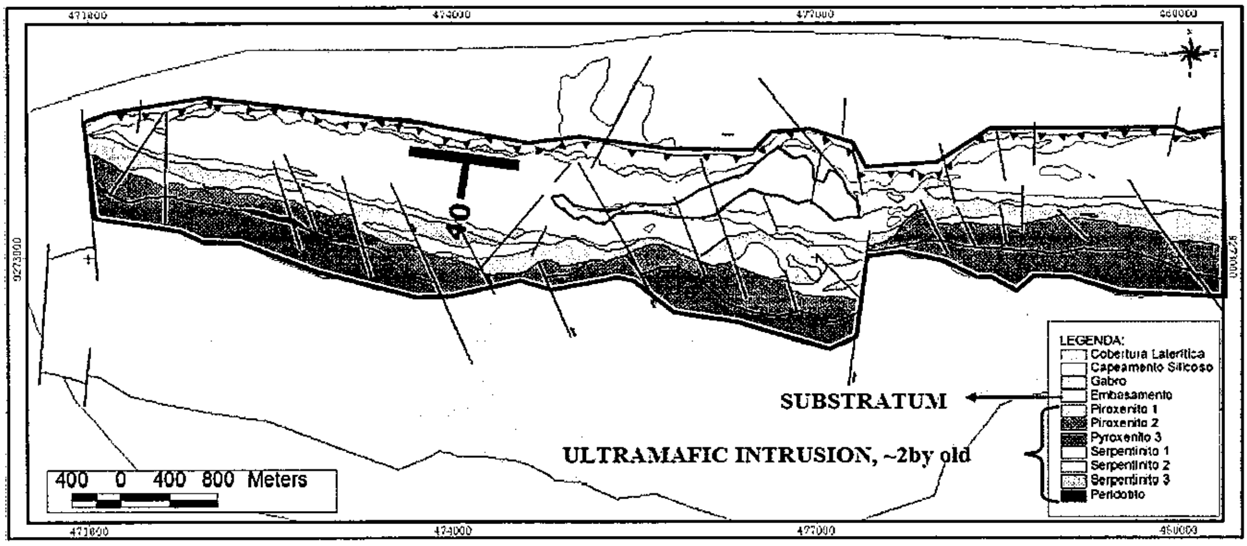

Figure 6-7: Onça Deposit geology (from Vale Technical Presentation 2010)

The Puma complex consists of serpentinized dunite and peridotite, gabbro, and locally, pyroxenite and wehrlite. The host rocks are gneissic, some of which are granodiorite to granite, some are light to dark grey tonalite and some are thin to coarse grained phanerites. A large number of fine-to medium-grained gabbroic dykes intrude the north part of the same fracture zone within which the Puma Complex is located (Hatch 2005).

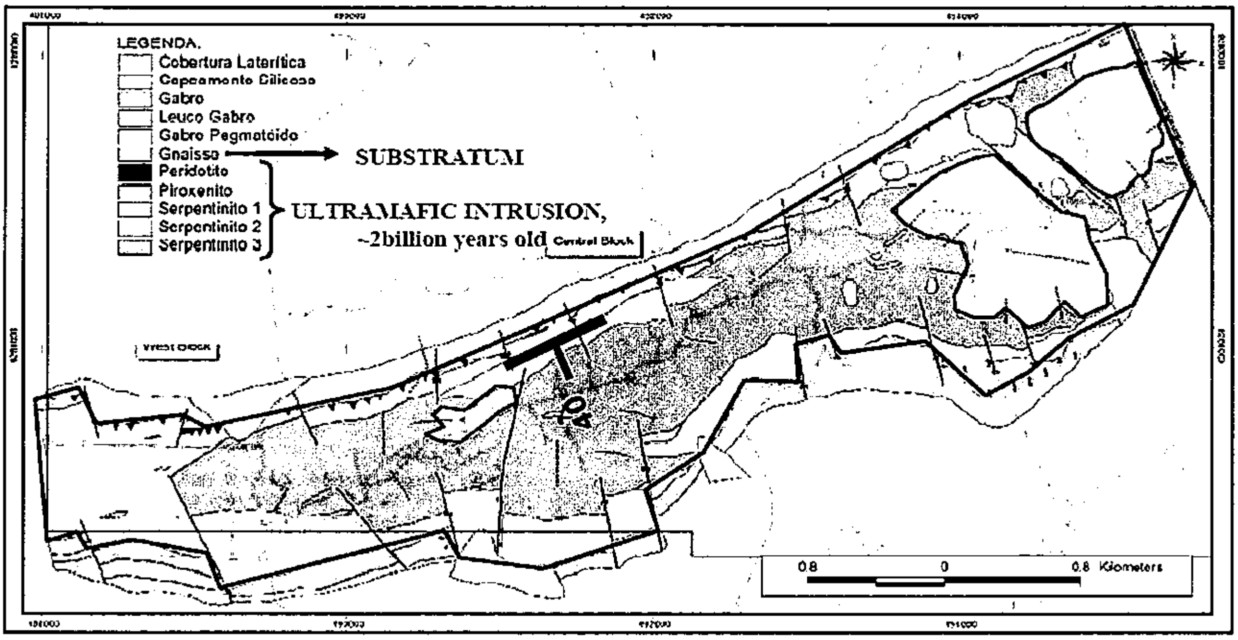

Figure 6-8: Puma deposit geology (from Vale Technical Presentation 2010)

Lithology

The generalised lithology of the Onça and Puma deposits is displayed in Figure 6-9.

The principal lithology units described for the Onça deposit which can be recognised in the field, from the lowermost to the uppermost, are as follows (from Hatch 2005):

- Serpentinite 1 consists of serpentinized orthocumulate peridotite. This unit is not an important host for nickel.
- Serpentinite 2 consists of serpentinized dunite and extends continuously for nearly 19 km along the length of the Onça complex and overlies Serpentinite 1 or rests directly, on the base of the complex in contact with gneissic rocks of the Xingu complex. Serpentinite 1 and serpentinite 2 units are the main protolith source of the Onça nickel deposit. In topographically suitable areas a thick lateritic profile is developed.
- Coarse green Pyroxenite 1: overlies Serpentinite 2 as a thin but continuous layer of pyroxenite. It has no importance as a nickel laterite protolith.
- Serpentinite 3 consisting of serpentinized dunite appears to the south of Pyroxenite 1 and overlies it.
- Pyroxenite 2 overlies Serpentinite 3. Like Pyroxenite 1, it has no economic interest.
- Pyroxenite 3 immediately overlies Pyroxenite 2. This unit has an average width of 230 m, attaining locally, between lines 4200 and 5600, a width of 460 m due to repetition by faulting.
- Other rock types identified and mapped on the property include mafic dykes (likely diabase), and various members of a typical layered intrusive such as peridotite, harzburgite, and gabbro.

At the Puma deposit the protoliths for nickel mineralisation are predominantly serpentinized peridotites and dunites. The nickel accumulations at Puma result from cumulative effects of tectonic processes, hydrothermal alteration and weathering on the serpentinized peridotites and dunites in the deposit area. These units extend continuously over the entire length of the complex. Width varies from 600 m to 1200 m. In comparison to Onça, Puma serpentinites tend to be strongly deformed and altered, and it is not possible to identify convincing unweathered serpentinite compositions in the Puma database.

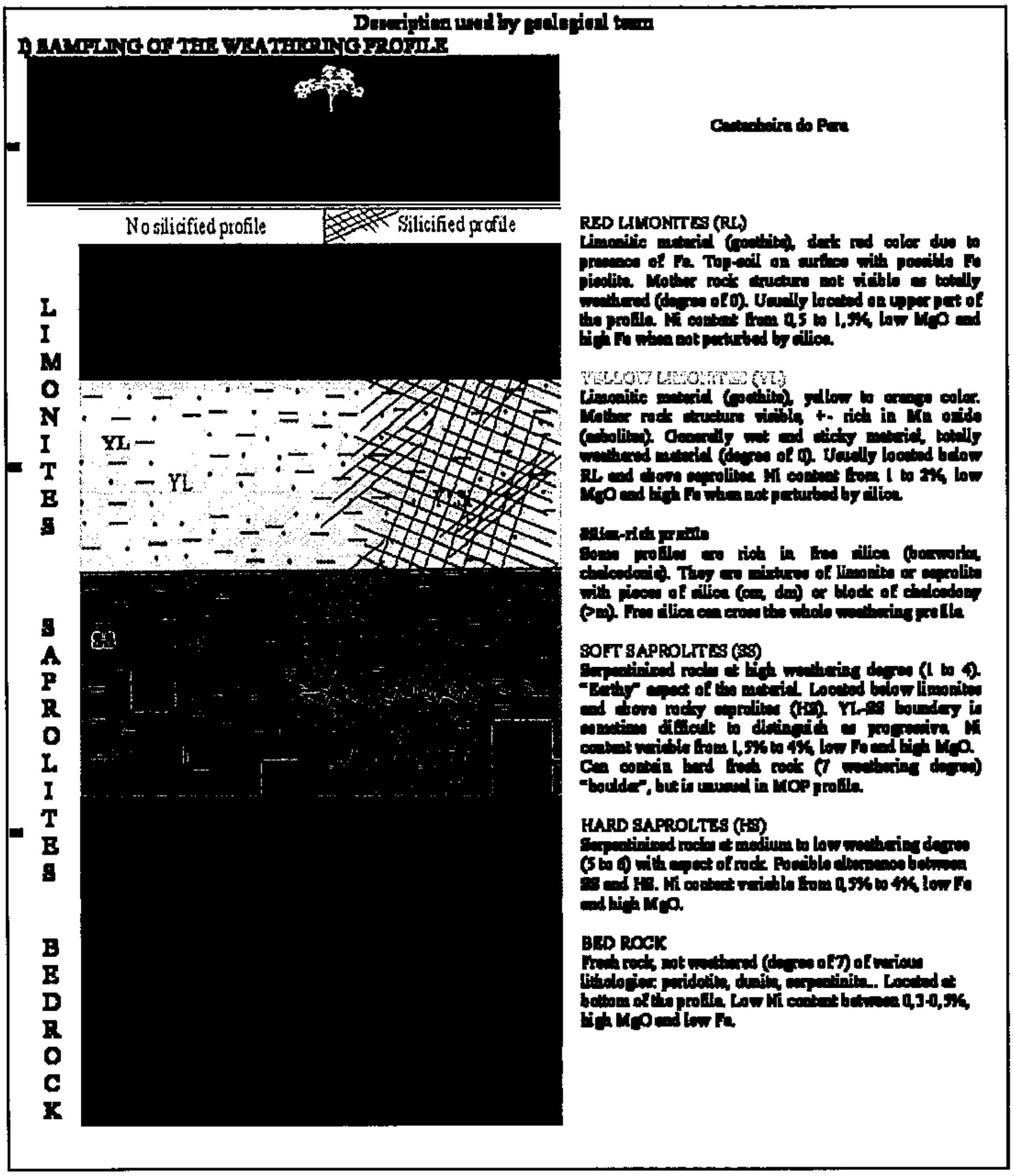

Figure 6-9: Schematic Onça Puma deposit laterite lithology profile

The principal lithology types identified at the Puma deposit are as follows (from Hatch 2005):

- Serpentinite 1 outcrops almost continuously along the south flank of the basal depression zone on the north margin of the ultrabasic body.
- Serpentinite 2 outcrops along the basal portion of the complex and on the north and south sides of Puma ridge. This serpentinite is dark maroon to green and fine to medium grained. With increasing weathering the rock becomes speckled by alteration, ochre and green in color; silica becomes more prominent.
- Serpentinite 3 is the dominant serpentinite outcropping at Puma ridge. It is generally greenish maroon or yellowish maroon in color, and strongly fractured and/or foliated (sheared).
- The gabbro units of the Puma complex commonly outcrop on the south flank of the ridge as large blocks and boulders associated with a pisolitic reddish maroon soil and derived ferricrete.
- Gabbro diabase dykes occur in the low area along the north flank of the ridge, they are most numerous in three areas with a pattern suggesting that they are swarms of narrow, steeply inclined dykes trending grid NW.

Mineralisation

Nickel laterite profiles worldwide generally comprise three or four distinct units formed by the progressive leaching of the underlying Protolith by soil water. From the bottom up they generally have:

- A saprolite zone consisting of a mixture of altered Protolith minerals most notably serpentine with newly formed minerals such as garnierite, quartz, asbolite and limonite;
- An optional transition zone in which smectitic clays such as nontronite or quartz have replaced Protolith minerals;
- A limonite zone;
- A ferricrete cap of goethite ± hematite.

Nickel is released into solution by the decomposition or re-crystallisation of serpentine, nontronite, manganese oxides and goethite and moved downwards where it is re-precipitated as a supergene enrichment zone in the saprolite or transition zones or residually enriched in the lower limonite zone.

Mineralization occurs at both ridges from supergene concentration of nickel, starting from serpentinite rocks with anomalous Ni grade. The main process of nickel concentration was lateritisation during the Tertiary and Quaternary.

The general profile of the Onça and Puma deposits, for geologic mapping and core logging is composed of the following layers (sourced from Internal Vale Technical Report 2008):

Blend of Chalcedony and Limonite (Layer C)

A specific characteristic of the MOP geological profile is the high amount of free silica (chalcedony) in the geological profile. The free silica is located primarily on the upper part of the profile in the limonite lithology.

Areas that have been completely re-crystallised occur as massive chalcedony. Limonite can be observed between silica joints and blocks. A mixture of silica and limonite forms a layer located usually on the top of the ultramafic sequence; which can sometimes be observed in the middle of the limonite horizon forming inter layers. The nickel concentration in this layer varies from 0.2 percent to 0.9 percent, with low Co, MgO and low Fe replaced by SiO_2. It is generally referred to as silica cap and ranges in thickness from 5 to 80 m.

Limonite (Layer L)

Red limonite partially caps the deposits as a layer of topsoil with iron pisolite. This layer contains Ni ranging from 0.50 to 1.50 %, with low MgO and high Fe content. The limonite is typically 2.4 m thick, and ranges from 0 to 49 m thickness at Onça and is typically 2.3 m thick and ranges from 0 to 42 m thickness at Puma.

A second layer of yellow limonite may occur in the upper parts of the column and is generally rich in goethite and manganese with a high content of oxides (high cobalt content). Nickel content generally varies between 1 and 2%, with high Co 0.15 to 0.30%, low MgO and high Fe.

Red and yellow limonite has been grouped into one layer called layer L, typically located below layer C; however, it can form inter layers L1, L2, L3 into C layer or saprolites if horizontally continuous.

Soft Saprolite (Layer S)

Soft saprolite typically is 4.8 m thick and ranges from 0 to 57 m thickness within the Onça trend. Soft saprolite is typically 5.7 m thick and ranges from 0 to 51 m thickness in the Puma trend.

Soft saprolite represents a layer of highly weathered serpentinized rocks (classified as 4) that occurs under the limonite zone. It is characteristically "earthy" and generally occurs between the limonite and the unweathered and hard saprolite. The contact with the overlying layer is generally gradational and difficult to outline. The Ni content is variable from 1.5 to 4%, with low Fe and high MgO. The soft saprolite layer may contain remnant blocks of unweathered saprolite.

Hard Saprolite (Layer H)

Serpentinized rock with a lower degree of weathering (classified as 5 to 6) occurs under the layer of soft saprolite. The contact with the overlying soft saprolite is irregular and it deepens according structural characteristics of the basement rocks. This layer consists of "hard saprolite" with variable Ni content from 0.5 to 4%, low Fe and high MgO. Hard saprolite is typically 4 m thick and ranges from 0 to 71 m thickness in the Onça trend. The thickness of the hard saprolite has not been determined for Puma.

Bed Rock (Layer B)

The basement rock ("bed rock") consists of fresh and unweathered rock (weathering degree 7) of various lithologies, such as peridotite (dunite, harzburgite, lherzolite, and wehrlite), serpentinite, pyroxenite etc. and is located at the base of the stratigraphic column. These rocks may have been the original source of nickel mineralization and are characterized by Ni grades between 0.30 and 0.50%, with high MgO and low Fe content.

Gabbro and Gabbroic Rocks

Gabbro and gabbroic rocks are present in the ultramafic complex represented by layers enriched in AL2O3. Gabbroic rocks can range up to 6% A12O3 within the limonite horizon and up to 15 % within the saprolite horizon. Nickel grade varies from 0.5 to 3%.

Structure

A structural study of the Onça Puma project was undertaken by the school of geology of the Federal University of Rio Grande do Sul, Instituto de Geociências at the request of MOP. The structural study is well documented in *1.1 Geologia Regional_Estrutural MOP.pdf* document provided to Golder in the project data package.

The objective of the study was to define the main structural features of the regional rocks and the influence of the structures on the geometry of the Onça and Puma deposits. The study focused on analyses of small-scale lineaments (less than 10 km of length) in Puma and Onça ridges and no medium sized or major lineaments were identified within the project area.

This study concluded that the deformation process at the Onça and Puma deposits is essentially brittle, with formation of fractures, joints, faults and veins, indicating deformation conditioning of the host lithologies.

Onça Puma ridges are characterized by a large variety of faults with the dominant geometry associated to a sinistral, strike-slip fault system located to the north of the project area. At the Puma ridge this fault system has a N62°E orientation while in Onça ridge it displays a predominantly E-W direction (Internal Vale Technical Report 2008).

6.10 Exploration and Development Drilling

Onça Puma Drilling

The initial drilling at Onça Puma done by Canico started in 2002 and was completed in 2005 (Vale Technical Presentation, 2010). A summary of the available drill data is shown in Table 6-2. The drill hole collar locations for Onça and Puma deposits are shown in Figure 6-10 and Figure 6-11 respectively. The Onça Puma mineral resource models are based on assays from 7,296 diamond drill holes. All the drill holes used for the mineral resource model are diamond drill (DD) holes. Holes are drilled using HQ diameter drilling system. The drill spacing varies from 100 m by 100 m grid down to 25 m by 25 m grid predominantly; however some areas have locally, close-spaced drilling grids down to 12.5 m by 12.5 m and approximately 6 m by 6 m. All drilling at Onça Puma is vertically oriented.

No diamond drilling was being conducted at Onça Puma during the Golder site visit. As a result the procedure on drilling and drill sampling was reviewed from discussions with the Chief Geologist, David Chiron, technical documents, procedures manuals, a geological review report completed by AMEC (2005) and the Hatch Feasibility Report (2005). Discussions with the Chief Geologist confirmed the procedures detailed within MOP PRO 2002-2005_V2.pdf are essentially unchanged.

Table 6-2: Summary of Onça and Puma drilling

	No. of Holes	Depth (m)			
		Minimum	Maximum	Average	Sum
Total	7,296	1.55	111.3	23.5	171,193.4

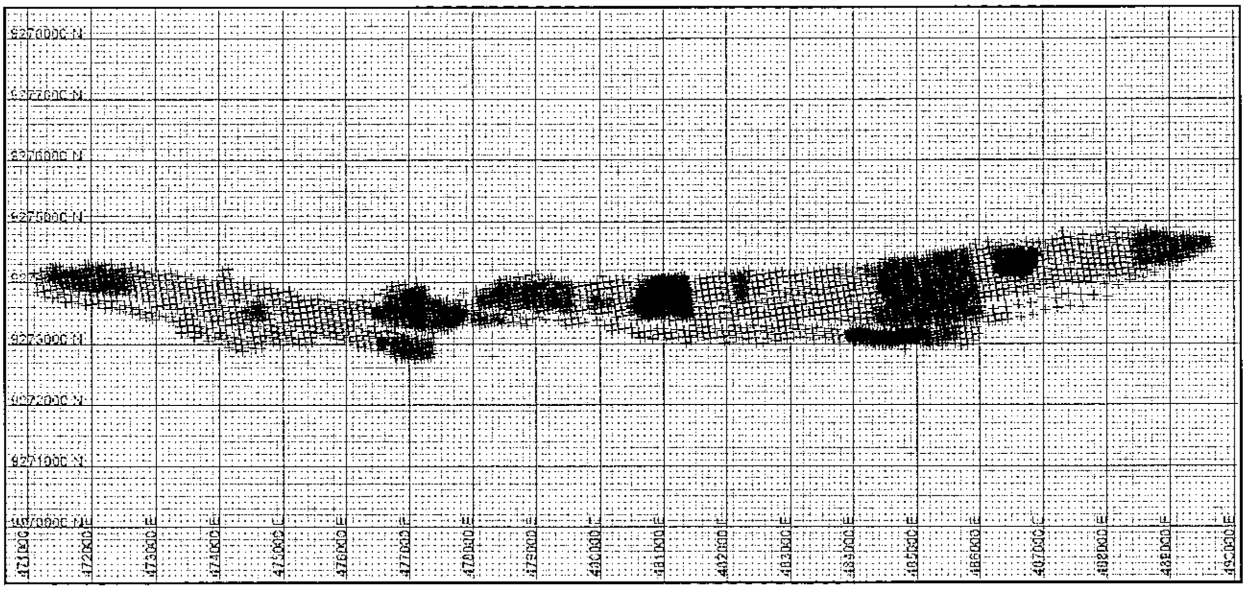

Figure 6-10: Onça deposit drilling (co-ordinates are in UTM and not truncated)

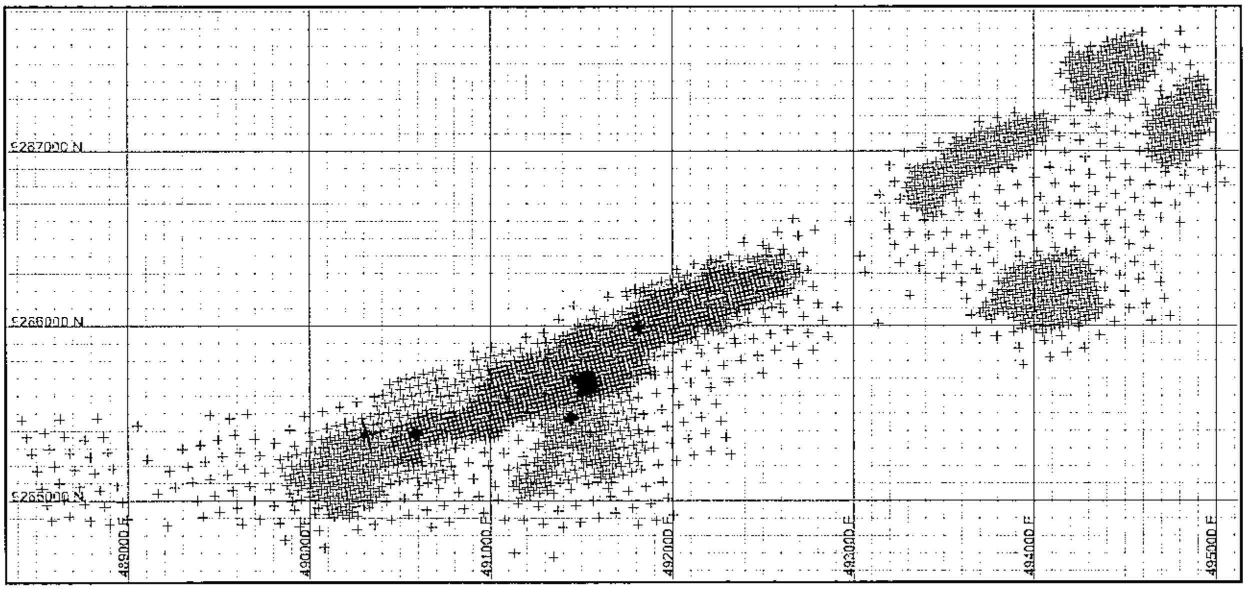

Figure 6-11: Puma deposit drilling (co-ordinates are in UTM and not truncated)

Golder believes that the Onca Puma deposits are sufficiently drilled with appropriate drill spacing, depth, orientation and location of drill holes for accurate estimation of mineral resources leading to the definition of mineral reserves.

MOP drills RC pre-production holes which are routinely used for estimation of short term production models and mine planning purposes. The RC drill hole data is not currently incorporated into the long term mineral resource models and as a result was not evaluated by Golder as it is outside the scope of this audit.

Hole Collars and Survey Grid

The coordinates used for the drill data are related to the SAD69 UTM, Zone 22M grid system. The drill hole data used for modelling and estimation purposes however use truncated UTM co-ordinates where XCOLLAR = UTM_E - 400,000 and YCOLLAR = UTM_N - 9,200,000 and the RL of the collar remains unaltered.

The drill hole collar survey procedure is well documented in the document PRO-0041-GAPMQ Cadastro de Furos_R1.doc. The drill hole collars are surveyed using total station survey equipment by trained Canico survey personnel. The surveyed UTM collar coordinates are downloaded to computer, processed, and loaded into the Datamine DHLogger project database at site by office personnel on a regular basis (AMEC 2005).

Golder considers the collar survey equipment and procedure to be of an appropriate industry standard.

Core Photography

Photographing drill core is an excellent way of preserving a record of the core prior to any sampling activities which may remove half or all the core. The photos taken of the drill core were reviewed and most were found to be of an acceptable quality.

The core photography procedure for the Onça Puma deposit is detailed within the document MOP PRO 2002-2005_V2.pdf. Figure 6-12 shows an example of the core photography at Onça Puma taken from the core photography procedure. The quality of the example in Figure 6-12 is not as high as that of the actual photographs as it is a screen captured reproduction.

Golder believes that the digital core photographs are of an acceptable industry standard.

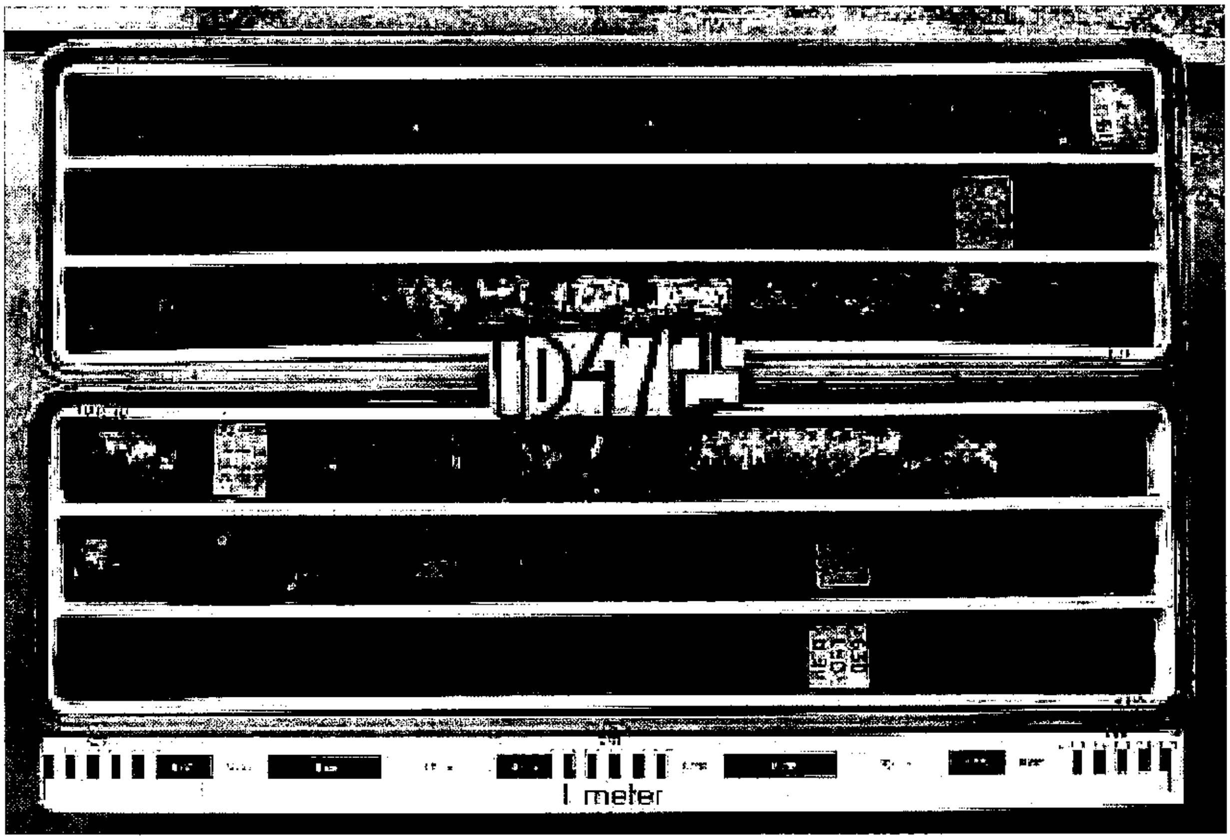

Figure 6-12: Example of digital core photography at Onça Puma (sourced from the MOP Procedures 2002-2005)

Drill Hole Logs

The drill hole logging procedure is well documented in PRO PROCEDIMENTOS OPERCIONAIS 2002 – 2005. The document details the codes to be used by all geologists for the logging of core at Quechua. There are tables, written descriptions and colour photographs that are all very useful for maintaining consistency of logging between geologists for lithology, weathering, mineralisation and structure available as laminated field guides and reference documents for all geologists. All geologists are extensively trained by the Chief Geologist or other appropriately senior geologist to ensure consistency in logging. The Onça Puma project also has a very high rate of retention for staff with very little turnover reported in 5 years which results in greater geological consistency and increased levels of data reliability.

A reference document with written and tabulated descriptions of rock types as well as photographs is a very useful tool to assist in maintaining consistency of logging between individual geologists.

Samples from the drill programs are collected, recorded, and supervised by an experienced team of geologists and technicians. The core is marked for sampling at a nominal one metre interval to the limits of each material code or significant geological break (breccia zone, silica cap, etc.); at contacts, samples of less than a metre are collected. The core is manually logged on to paper logging sheets recording start depth (from), end depth (to), recovered length, sample number, screen fraction, wet weight, dry weight, moisture content, material code, rock type code, grain size, degree of serpentinisation, degree of weathering, hardness, colour, texture, structure, mineral codes, and comments.

The manually-logged and coded geological data is entered into a Datamine 'DH Logger' database, checked, and added to the project database for subsequent electronic receipt of assay results; checking of the computerized logs is carried out at regular intervals.

The following principal data is logged by the Onça Puma geologists:

- Original material codes (9):
  - SOL: soil
  - LIM: Limonite Zone
  - PIS: Pisolite
  - CAP: Silica Cap
  - CAN: Canga (ferricrete)
  - TRN: Transition Zone
  - SAP: Saprolite
  - BLD: Boulder Zone
  - BRK: Bedrock
- Rock types (e.g., dunite, peridotite, gabbro, pyroxenite, serpentinite, etc.)
- Degree of weathering and serpentinisation, hardness, colour
- Boulders in saprolite zone >15 cm sampled separately
- Silica and breccia zones, other structures
- Visually high and low nickel zones (garnierite)
- Manganese or wad zones
- Relict structures and other visual changes over the core run.

After the receipt of assay results the following domains are identified within the two deposits for geological interpretation and modelling:

- BLD (Boulders)
- BRK (Bedrock)
- GAB (Gabbro)
- GRN (Granite)
- LIM (Limonite)
- SCT (Silcrete)
- SAP (Saprolite)

- SLM (Siliceous Limonite)
- SSP (Siliceous Saprolite).

Onça domain codes also include fields for Peridotite and Pyroxenite.

Golder reviewed the core from four drill holes, two from Onça and two from Puma (OD3381, OD5949, PD2928 and PD14292), in the core shed in Ourilândia and compared them to the drill hole logs. Golder was provided with paper copy printouts of the geological logs of the ten requested drill holes.

There were no major discrepancies identified between the core and the logs.

Drilling and logging procedures are industry standard and Golder considers them to be appropriate for Nickel laterite deposits.

6.11 Deposit Sampling Methods and Data Management

The Onça Puma sampling methodology and sample preparation procedures are detailed in the internal document *PRO PROCEDIMENTOS OPERCIONAIS 2002 – 2005.*

Sample Preparation and Analysis

On completion of the logging, the whole-core samples were immediately bagged and sealed in plastic bags to prevent moisture loss at the logging site. All core was photographed prior to logging. Every tenth hole was split with one half sent for assaying while the other was retained in the core box for reference and later auditing. All the samples were then transferred from the field logging sites to Canico's sample preparation facilities at Ourilândia (operated by Lakefield Geosol now SGS Geosol). Figure 6-13 shows the flowsheet detailing the sample preparation and analysis procedure for Onça Puma.

The preparation procedure involved the following summarised steps:

- Two stages of coarse and fine crushing to 2 mm (10 mesh) followed by riffle splitting to produce a 300 g sub-sample for shipment to the Lakefield Geosol laboratory in Belo Horizonte, where it is pulverized to 95% passing -150 mesh for XRF analysis.
- All equipment was cleaned by compressed air following processing of each sample, and periodically using crushed quartz.
- Composite rejects were bagged and stored in sealed drums at the sample preparation facility.

Four laboratories were used between 2002 and 2005 for chemical analytical work (assaying).

The majority of samples were analysed at the Lakefield Geosol (LGS) laboratory in Belo Horizonte in Brazil. Nickel, cobalt, iron, copper, and the major oxides (SiO2, MgO, Cr2O3, CaO, Al2O3, TiO2, P2O5, and MnO) were analysed by XRF using a lithium tetra-borate fusion of 0.2 grams of sample at 1,000°C for 30 to 40 minutes (LGS code ITRX-4.9-009 Borate Fusion Sample Preparation/XRF). Loss on ignition was analyzed separately by roasting one gram of sample at 1,000°C for one hour. The lower detection limit for all analyses is 0.01%, except for MgO, which has a lower detection limit of 0.10%. It was common practice of the laboratory to report some elements, including cobalt, to the thousandths place.

ALS Chemex (ALS) in Brisbane, Australia, Lakefield Research (LRC) in Lakefield, Canada, and SGS Mineral Services (XRAL) in Don Mills, Canada, acted as secondary laboratories assisting with core assays when the primary, LGS, laboratory had an excessive backlog. The analytical method employed by ALS is ICP-OES using a lithium borate fusion in platinum crucibles. ALS reports lower detection limits than LGS for several elements (Co – 0.005% vs. 0.010% and MgO – 0.01% vs. 0.10%). Analyses completed at XRAL utilise a lithium tetra-borate fusion XRF analytical method reporting all elements to a lower detection limit of 0.01%. LRC laboratory also used a fusion XRF analytical method (50% lithium tetra-borate, 50% lithium meta-borate) however reports different lower detection limits than LGS for Co (0.05%) and MgO (0.02%).

The lower detection limit for nickel is 0.01% for all four laboratories.

QAQC results highlighted that cobalt analysis by LGS showed a consistent low bias. Following work completed by Hatch for the Feasibility Study (2005) a correction formula was determined as:

- Co corrected = LGS Co * 1.1295 + 0.0023

A study was also conducted by Hatch (2004), at the request of MOP, to evaluate if a bias was introduced from the assaying of ½ core for 10% of the collected core for the project and it was determined that no bias was introduced by this practice.

Golder did not review the sample preparation or chemical analysis facilities as they have been dismantled. SGS Geosol in Belo Horizonte has commissioned a new laboratory and preparation facility since drilling ceased at Onça Puma in 2005. AMEC (2005) reported that the primary laboratory and preparation facility used for Onça Puma samples was of appropriate industry standard to produce chemical analyses for mineral resource estimation.

Golder reviewed the sampling procedures and considers these to be appropriate for geological modelling and mineral resource estimation.

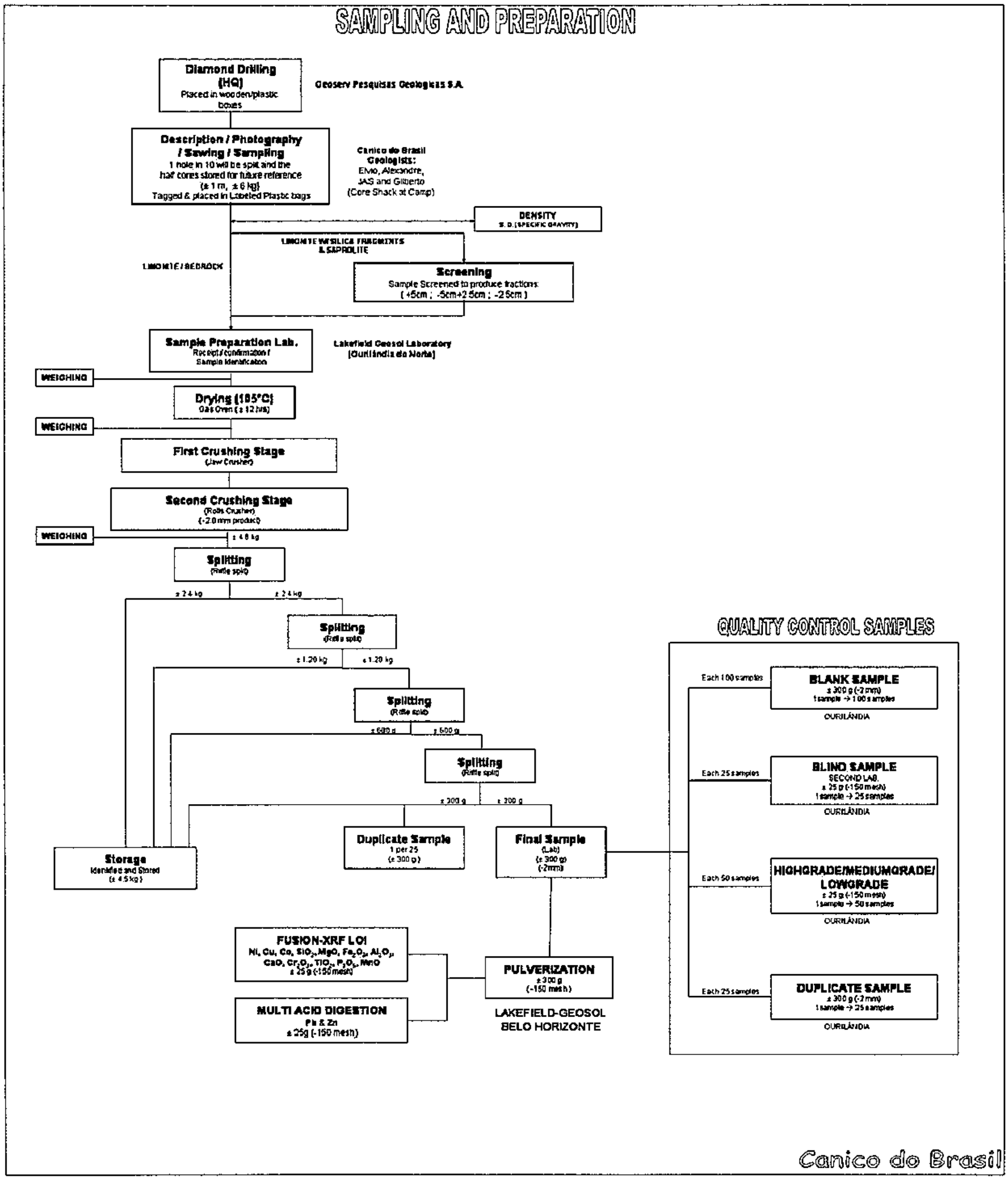

Figure 6-13: Flowsheet detailing the sample preparation and analysis procedure for Onça Puma

Sample Storage

During the site visit Golder visited the sample storage areas. All retained ½ drill core, coarse rejects and duplicates are stored inside a purpose built warehouse (Figure 6-14). Composite rejects of each sample are bagged and stored in sealed drums at the sample preparation facility.

Figure 6-14: Onça Puma core storage facility

Golder reviewed the core and samples warehouse and considers these are of an industry appropriate standard.

Quality Assurance Quality Control (QAQC)

Quality Assurance (QA) is the system and set of procedures used to ensure that the sampling and assaying results are of a high quality. Quality Control (QC) is the data used to prove that the results of sample preparation and chemical analysis are adequate. These include the insertion of standards, twin and coarse duplicates, pulp duplicates, and fine and coarse blank samples into every batch of samples sent to the laboratories.

The QAQC procedures are documented in the internal procedures PRO PROCEDIMENTOS OPERCIONAIS 2002 – 2005. This document details sample types and frequency of insertion.

The sample insertion procedures are acceptable, appropriately documented and meet industry standards.

Table 6-3 details the insertion rates for Onça Puma QAQC samples. MOP has used a suite of 6 standard samples sourced from the project area and certified by external laboratories.

Table 6-3: Onça Puma QAQC sample insertion rates

QAQC Sample Type	Insertion Frequency	Number in Database
Standard JASP-2	1 in 25 samples	1,021 samples Ni
Standard JASP-22		316 samples Ni
Standard JASP-3		1,028 samples Ni
Standard JASP-33		309 samples Ni
Standard JASP-4		428 samples Ni
Standard JASP-5		426 samples Ni
Coarse Blanks	1 in 50 samples	1,029 samples Ni, Co and MgO
Coarse and Pulp Duplicates	1 in 25 samples	7,263 samples
External Lab Check	1 in 25 samples	2,023 samples

Figure 6-15 summarises the Standard samples, and the recommended values and acceptable limits, used by MOP for the Onça Puma QAQC.

The QAQC procedures, insertion frequency of QAQC samples and the selected Standards/CRM are considered appropriate and meet industry standards.

MOP geologists monitor standards, coarse blanks, and duplicates on the basis of 5%, 10%, and 15% variations from the mean for each sample lot shipped to Lakefield Geosol. Any suspect assays varying by more than 10% are re-assayed. This limit was subsequently tightened to three standard deviations (approximately 5% on a relative average basis) for re-run decisions.

As a part of the audit process Golder reviewed all the QAQC analyses for the Onça Puma drilling campaigns. Figure 6-16, Figure 6-17, Figure 6-18, Figure 6-19, Figure 6-20 and Figure 6-21 show examples of the Golder QAQC analyses.

SRM	Statistic	Ni %	Co %	Fe %	Fe_2O_3 %	SiO_2 %	MgO %
JASP-2	Mean	2.117	0.327	38.95	55.69	22.41	3.84
	Variance	0.00040	0.00033	0.26	0.537	0.14	0.00
	Std. Dev.	0.0200	0.018	0.51	0.73	0.37	0.06
	Mean -5%	2.011	0.31	37.00	52.91	21.29	3.65
	Mean +5%	2.223	0.34	40.90	58.48	23.53	4.04
JASP-22	Mean	2.091	0.121	26.45	37.82	32.52	12.19
	Variance	0.00111	0.00001	0.09	0.184	0.27	0.03
	Std Dev.	0.0332	0. 004	0.30	0.43	0.52	0.18
	Mean - 5%	1.986	0.12	25.13	35.93	30.89	11.58
	Mean + 5%	2.195	0.13	27.77	39.71	34.14	12.79
JASP-3	Mean	2.644	0.077	28.84	41.23	26.87	13.74
	Variance	0.00106	0.00004	0.25	0.508	0.27	0.08
	Std. Dev.	0.0325	0.006	0.50	0.71	0.52	0.27
	Mean -5%	2.512	0.07	27.40	39.17	25.52	13.05
	Mean +5%	2.777	0.08	30.28	43.30	28.21	14.43
JASP-33	Mean	2.351	0.191	26.52	37.92	25.73	8.81
	Variance	0.00166	0.00002	0.15	0.312	0.13	0.03
	Std Dev.	0.0407	0.005	0.39	0.56	0.37	0.16
	Mean - 5%	2.233	0.18	25.19	36.02	24.44	8.37
	Mean + 5%	2.468	0.20	27.84	39.81	27.02	9.25
JASP-4	Mean	1.678	0.068	39.80	56.91	21.19	3.79
	Variance	0.00098	0.00003	0.08	0.167	0.13	0.01
	Std Dev.	0.0314	0.006	0.29	0.41	0.36	0.08
	Mean - 5%	1.594	0.06	37.81	54.06	20.13	3.61
	Mean + 5%	1.762	0.07	41.79	59.76	22.25	3.98
JASP-5	Mean	2.792	0.031	19.02	27.19	30.57	19.31
	Variance	0.00180	0.00001	0.26	0.535	0.11	0.19
	Std Dev.	0.0424	0.003	0.51	0.73	0.34	0.43
	Mean - 5%	2.652	0.03	18.07	25.83	29.04	18.34
	Mean + 5%	2.931	0.03	19.97	28.55	32.10	20.27

Figure 6-15: Onça Puma standard recommended values and acceptable limits

Standards

Standard sample composed of materials of "known" grade is used to validate the accuracy of other assay results when included in a batch of samples submitted to the laboratory for analysis. The standard samples are also known as Certified Reference Materials (CRMs) or Standard Reference Materials (SRMs).

The Golder analysis of the Onça Puma Standards considers the upper and lower acceptable limits as defined by MOP and summarised in Figure 6-15. The result of Golder's analysis of the standard sample data is summarised in Table 6-4 and detailed in the following paragraphs.

Table 6-4: Standard sample analysis results for LGS laboratory

Element	Standard	HRD%	HARD%	No. Samples	Comment
Ni	JASP 2	-0.61	1.84	857	Excellent precision and accuracy
	JASP 22	0.80	1.28	115	Excellent precision and accuracy
	JASP 3	-1.02	2.16	871	Excellent precision and accuracy
	JASP 33	0.55	1.43	120	Excellent precision and accuracy
	JASP 4	0.03	1.15	352	Excellent precision and accuracy
	JASP 5	0.26	1.69	347	Excellent precision and accuracy
Co	JASP 2	-6.48	7.51	857	Acceptable precision, slight bias
	JASP 22	-2.54	7.74	115	Excellent precision, slight bias
	JASP 3	-3.17	7.32	871	Acceptable precision, slight bias
	JASP 33	-4.44	4.56	120	Acceptable precision, slight bias
	JASP 4	7.48	9.04	352	Acceptable precision, slight bias
	JASP 5	13.25	13.47	347	Marginal precision, positive bias
Fe_2O_3	JASP 2	-0.79	1.06	739	Excellent precision and accuracy
	JASP 22	0.55	1.62	114	Excellent precision and accuracy
	JASP 3	-0.01	1.30	749	Excellent precision and accuracy
	JASP 33	-0.45	0.97	120	Excellent precision and accuracy
	JASP 4	-1.05	1.60	352	Excellent precision and accuracy
	JASP 5	2.06	2.49	347	Excellent precision and accuracy
SiO_2	JASP 2	-0.36	1.27	857	Excellent precision and accuracy
	JASP 22	-0.92	1.69	115	Excellent precision and accuracy
	JASP 3	-0.99	1.52	871	Excellent precision and accuracy
	JASP 33	0.18	0.85	120	Excellent precision and accuracy
	JASP 4	-0.37	1.47	352	Excellent precision and accuracy
	JASP 5	-1.19	1.36	347	Excellent precision and accuracy
MgO	JASP 2	1.19	2.64	857	Excellent precision and accuracy
	JASP 22	-4.19	4.27	115	Excellent precision and accuracy
	JASP 3	-1.44	2.30	871	Excellent precision and accuracy
	JASP 33	-0.87	1.63	120	Excellent precision and accuracy
	JASP 4	2.20	2.77	352	Excellent precision and accuracy
	JASP 5	0.02	3.40	347	Excellent precision and accuracy

The analyses of the standard samples, with the exception of cobalt, generally shows excellent accuracy (-4.19 to 2.2% HRD) and precision (0.85 to 4.27% HARD). The majority of the samples fall within the accepted tolerance limits defined by Vale. Ideally, 90% of the sample should have a half absolute relative difference or HARD (Shaw, 1997) value below 10%. At Onça Puma all standards, except cobalt results, have over 90% of the samples reporting a HARD of below 10%.

Cobalt reports a consistent negative bias from the primary laboratories. This negative cobalt bias was recognised by MOP during the drilling and a corrective regression equation was developed for calculation of cobalt grades. The equation for cobalt grade correction is Co_corrected = Co*1.1295 + 0.0023. Cobalt is not considered a main constituent for the Onça Puma project and as a result the use of a correction for cobalt assays is not considered to be of major concern for the mineral resource estimation at Onça Puma.

Golder notes that a number of the failed standard analyses are likely due to sample misallocation (i.e. JASP-2 recorded as JASP-22 in the database). MOP review all QAQC results and any batches which reported a failure were sent for re-analysis.

The MOP Standards are certified by accredited external laboratories and of acceptable industry quality.

Figure 6-16 shows an example of the Golder Onça Puma Standard analysis.

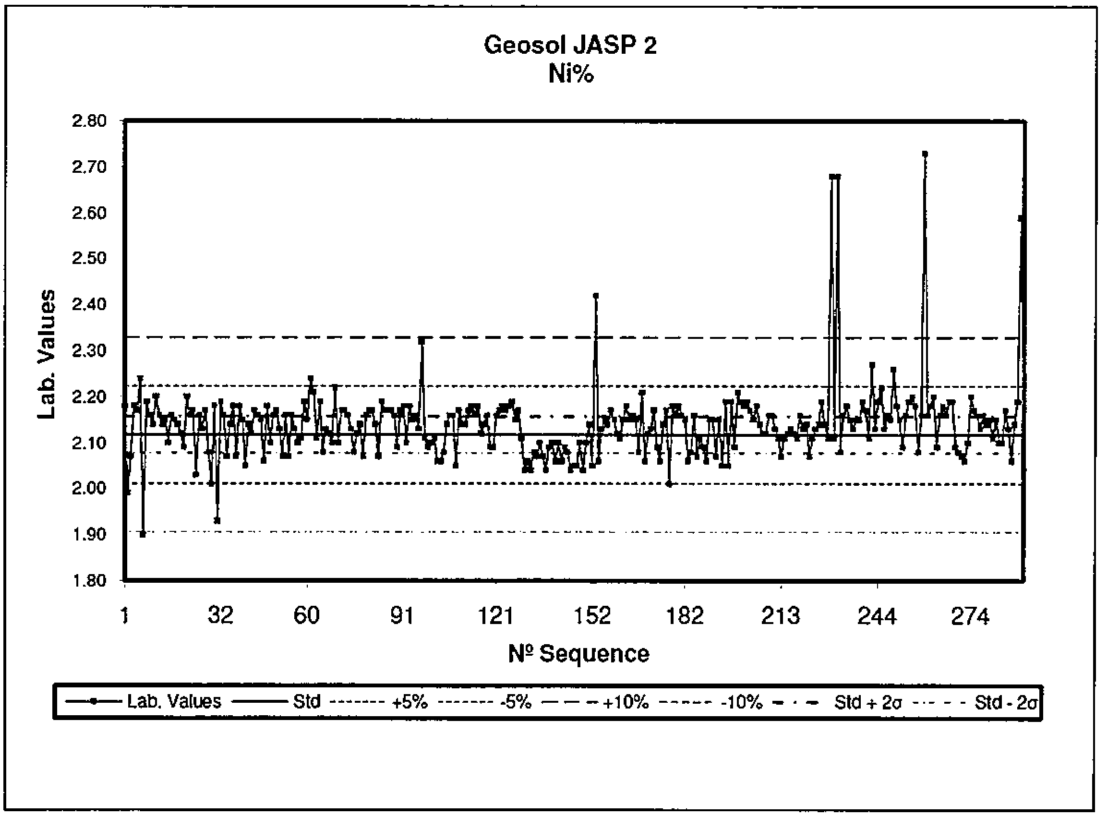

Figure 6-16: Onça Puma standard analysis for JASP-2 Ni

Golder accepts that the results from the QAQC Standards analysis for the Onça Puma drilling are accurate and of an adequate quality for the data to be used for geological modelling and mineral resource estimation.

Blanks

Blank or barren samples are materials with an expected grade of zero. These are submitted to ensure that there is no contamination between samples during the sample preparation or assaying. If the blank samples following high-grade samples have elevated grades, then there have been problems. The Limit of Detection (LOD) is defined as the lower limit of assaying where the precision approaches ±100%.

MOP provided Golder with the values for the coarse blank analyses. The MOP acceptable limits for Ni, Co, Fe_2O_3, SiO_2 and MgO within the blanks is detailed in Table 6-5. MOP inserted blanks at the -10 mesh (coarse crusher) stage and they are used to monitor contamination from the preparation process. Figure 6-17 shows an example of the Ni blank analysis for the Lakefield Geosol laboratory.

Table 6-5: Onça Puma acceptable tolerance limits for blank samples

Laboratory	Element	Lower Limit (%)	Upper Limit (%)
Lakefield Geosol	Ni	0	0.03
	Co	0	0.03
	MgO	0	0.3
Lakefield Research	Ni	0	0.03
	Co	0	0.03
	MgO	0	0.3
XRAL Toronto	Ni	0	0.03
	Co	0	0.03
	MgO	0	0.3

From the Golder analysis some samples exceeded the MOP acceptable limits. The majority of non-acceptable samples are separated in each case by several batches of samples so there is no consistent issue evident with either sample preparation or laboratory cleanliness. MOP informed Golder that results were monitored on a regular basis during the drilling campaign and any unacceptable results were investigated at the time of reporting and any necessary corrections were applied to the Onça Puma database.

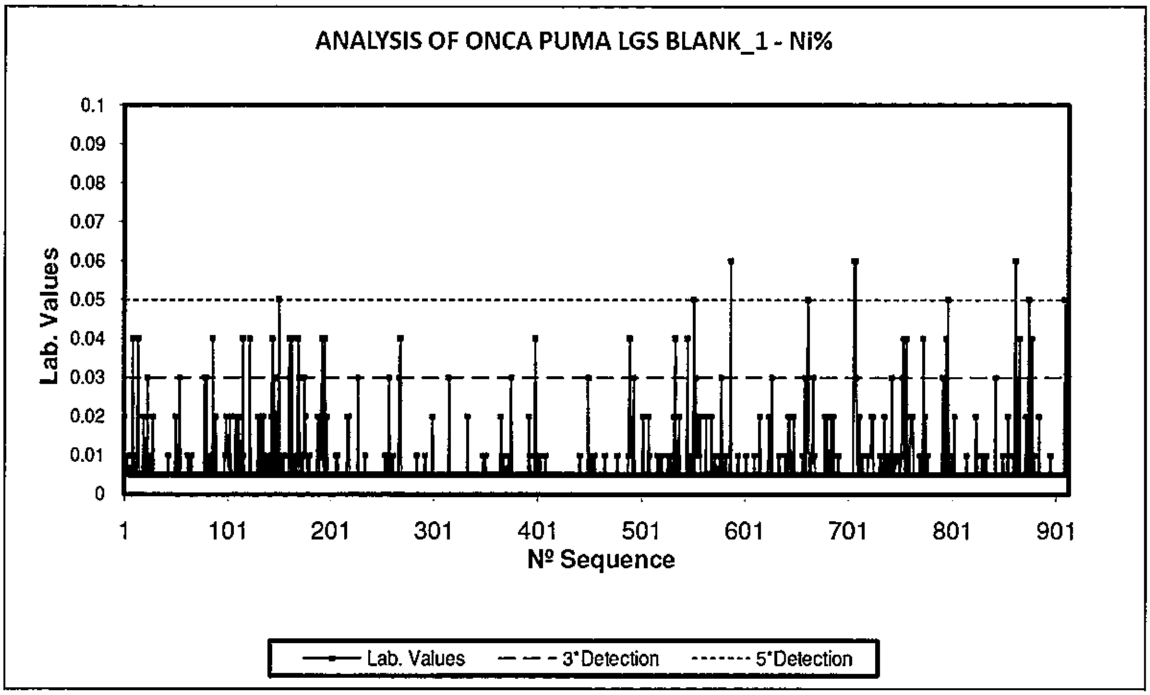

Figure 6-17: Onça Puma Lakefield Geosol Ni blanks QAQC analysis

Any peaks evident within the blanks indicate possible equipment or sample contamination or a potential sample mismatch.

Duplicates

For QAQC MOP collect two different duplicate samples to control and assess assay precision for nickel, cobalt, iron, magnesium and silica. These are:

- Lab duplicates are the equivalent of coarse duplicates which correspond to a split of a sample reject taken immediately after the first crushing and splitting step, and are assayed by the same laboratory as the original sample.
- Pulp duplicates correspond to a second split, or resubmission of the prepared samples that are routinely analysed by the primary laboratory, and is resubmitted to the same laboratory and the same batch under a different sample number.

In general the duplicates show excellent precision with no obvious bias, excepting cobalt, as summarised, for the primary analytical laboratory in Table 6-6.

Table 6-6: Onça Puma primary laboratory duplicate analysis summary

Element	HRD%	HARD%	No. Samples	Comment
			Onça	
Ni	0.11	2.03	3,476	Excellent precision and accuracy
Co	-0.21	5.65	3,476	Acceptable precision, slight bias
Fe_2O_3	-0.18	0.95	372	Excellent precision and accuracy
SiO_2	0.06	1.18	3,476	Excellent precision and accuracy
MgO	0.49	2.17	1,651	Excellent precision and accuracy
			Puma	
Ni	-0.02	1.95	1,985	Excellent precision and accuracy
Co	-0.62	8.10	1,985	Acceptable precision, slight bias
Fe_2O_3	0.03	0.69	320	Excellent precision and accuracy
SiO_2	0.12	0.94	1,985	Excellent precision and accuracy
MgO	0.26	1.46	1,985	Excellent precision and accuracy

Figure 6-18 shows an example of the Onça Puma duplicate QAQC analysis.

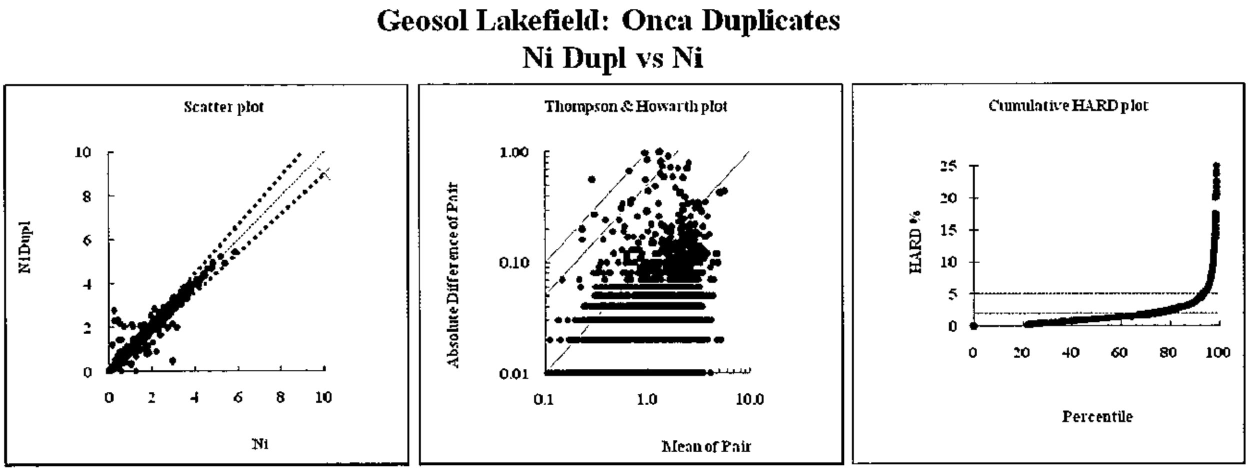

Figure 6-18: Coarse duplicate QAQC analysis for Ni (Lakefield Geosol)

Golder notes that in general the LGS assay precision is acceptable for the selected elements except for cobalt. Greater than 90% of the duplicate pairs yield a Half Absolute Relative Difference of less than 10%. This standard is used by Golder as a measure of acceptable precision in coarse duplicate pairs analyzed by the same laboratory in the same analytical batch.

The cobalt duplicate pairs at Onça Puma display a poor precision as a large percentage of the cobalt data is near the lower detection limit of the analytical method. When duplicate pairs are plotted in which both assay results are greater than 0.05% cobalt (five times the lower detection limit), the pairs yield acceptable precision (Figure 6-19).

Lakefield Geosol: Onca Duplicates
Co Dupl vs Co

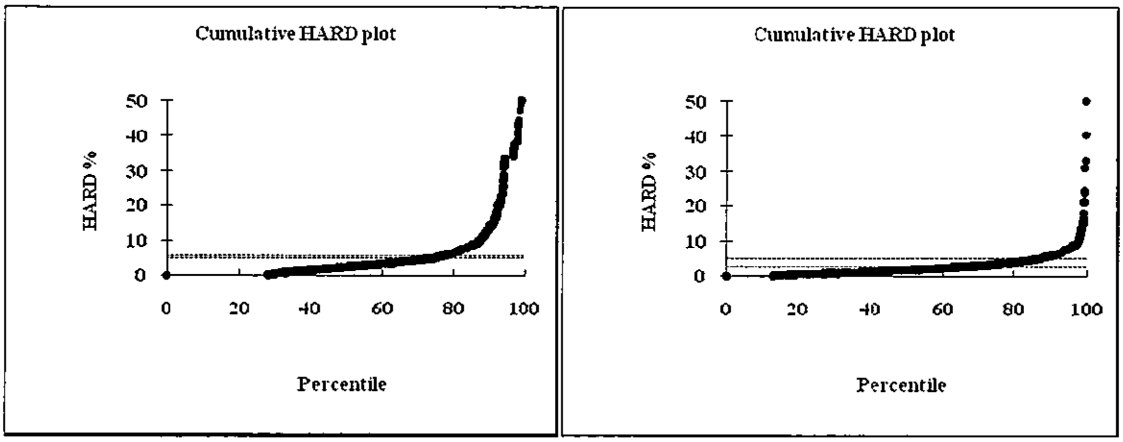

Figure 6-19: Lakefield Geosol Co coarse duplicate analysis
(Left = all data, right = data trimmed for Co ≥ 0.05 or five times lower analytical detection limit)

Check Samples

From all batches sent for analysis 4% of the pulp samples were sent for check assaying by an external certified laboratory. Samples initially analysed by LGS are sent for check assay to ALS Chemex, samples initially analysed by ALS Chemex are sent for check assay to Lakefield Research (LRC) in Canada. The selection of check samples is completed at random creating a new batch which maintains the original sample numbering.

Figure 6-20 shows an example of the Golder check sample analysis for nickel between LGS and ALS laboratories.

Golder observed no measurable bias evident within the LGS nickel assays comparative to the ALS Chemex nickel assays and no bias noted for the ALS Chemex assays relative to the LRC nickel assays. The check assay results for cobalt however show a negative bias when comparing LGS to ALS and also LRC to ALS. This difference is likely to result from the ALS laboratory having a lower analytical detection limit for cobalt than either the LGS or LRC laboratories.

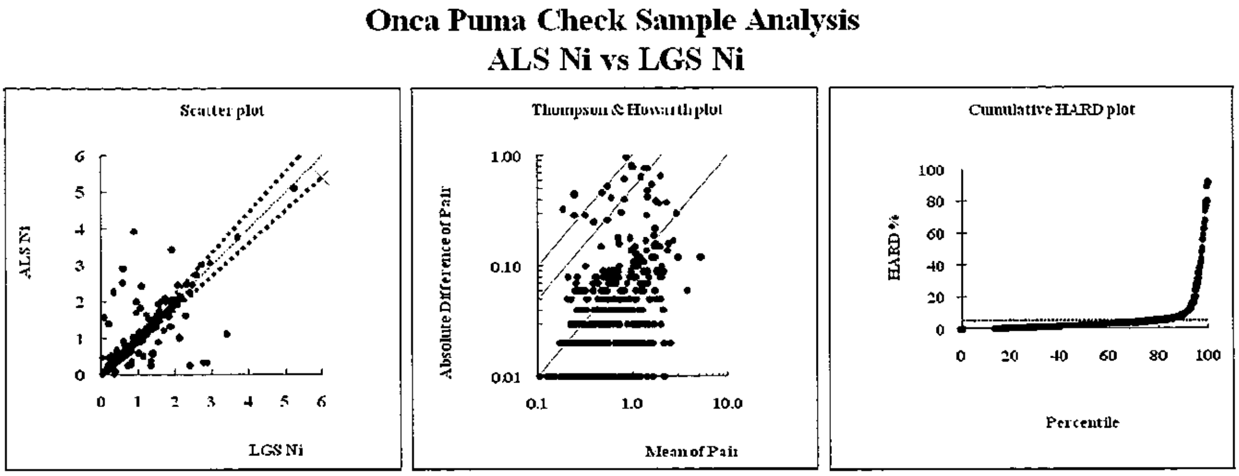

Figure 6-20: Onça Puma check sample QAQC analysis for Ni (LGS vs. ALS)

Stoichiometric Closure

A standard check on the accuracy of the overall analysis of assays is to add the assays of the oxides to produce a total that should equal about 100% as the oxide assays should account for all the components present in the rock. This check is referred to as a check of stoichiometric closure. Allowing for analytical error and some oxides possibly not being assayed, a total of between 97% and 102% is considered to be acceptable within the industry. When the assays reported are for the elements and not the oxides, the assays will need to be multiplied by a conversion factor to attain an oxide equivalent value. As a check of potential anomalous assay values, the stoichiometric totals were calculated from the raw assay data for the Onça Puma project.

MOP has adopted values of 95% and 105% as the limits of acceptable results. If results reported were outside these limits the results were reviewed by a sight geologist to determine possible explanations. If no plausible explanation could be found assays were reanalysed.

Figure 6-21 displays the stoichiometric totals for Onça and Puma saprolite domains.

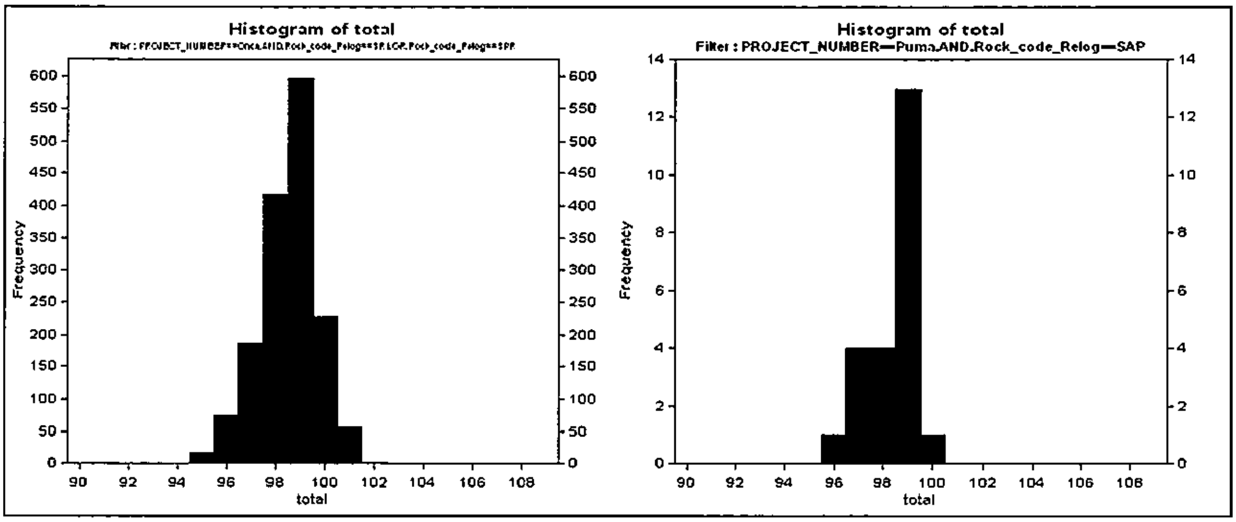

Figure 6-21: Stoichiometric totals for Onça and Puma saprolite domains

Golder believes that the results from the QAQC Standards analysis for the Onça Puma drilling is accurate and provides an adequate review of the quality of the data.

Database

Golder was provided with the complete Onça Puma drill hole database (1.6 DB Onça Puma.csv) in electronic format through the electronic data room. The database is a Microsoft Excel CSV format file and contains information for Collar, Assay, Geology, hole orientation and Density. In order to evaluate the data quality of the drill hole database Golder created individual csv files for collar, survey, assay, geology and density. A survey csv file was also created by using the collar azimuth and dip and applying this to the end of hole depth also.

Details about the Onça Puma database are documented in PRO PROCEDIMENTOS OPERCIONAIS 2002 – 2005. MOP currently employs Database Administrators who manage the database. Modifications can be made to the database only by authorised Senior CMQ geological staff or the Database Administrators when authorised to do so. The database is backed-up to an external hard drive regularly.

Golder considers the database and associated procedures to be of an acceptable industry standard.

Database Validation

The integrity of the database was confirmed and further analysis of the dataset was completed using Golder proprietary software prior to loading into the modelling software. The analysis included the following checks:

- Cross table checks (holes in collar but not in assay, etc);
- Collar depth against final assay and logged geology depths;
- Overlapping intervals or gaps in the assay and geology tables;
- Duplicate hole names and duplicate coordinates;
- Coordinate values of zero;
- Integer coordinate values (can be indicative of a lack of detailed survey data); and
- Extreme variations (≥10°) in drill hole azimuth or dip between consecutive down hole survey records.

The Onça Puma database does not have any major errors or issues with consistency between tables that should be addressed.

Golder found the Onça Puma drill hole data to be free of any errors and considers the data to be of an acceptable standard and suitable for geological modelling and mineral resource estimation.

Database Audit Trail

To ensure that information on the logging sheets was correctly transferred into the database; Golder randomly selected 10 drill holes, five from Onça and five from Puma, and checked the consistency of the electronic data with the information contained in the hard copy reports. The database tables reviewed during the process were: collar, assay and lithology. Normally Golder would review a minimum of 5% of hard copies to electronic copies but due to the large amount of drilling and short time available for the site visit this was not possible. AMEC (2005) reviewed 5% of holes from Onça and Puma and reported finding no systematic errors. Golder reviewed data from drill holes OD3721, OD4175, OD4245, OD4539, OD4995, PD1235, PD1397, PD2266, PD2354 and PD2401 and found no errors within the database.

All hardcopy data for drill holes is stored in folders in a lockable storage room in the main planning area at the Onça Puma operation. Mine personnel were able to locate all drill hole folders requested for the selected drill holes. Review of the log sheet with the database shows a good consistency. The storage of the drill hole folders is systematic and well organised, a similar approach should be maintained in the future.

Golder compared hard copy information with the database information and found the database to be an acceptable match of the hardcopy data.

Topography

The Onça Puma project has topographic surveys available in two different forms. The initial topographic survey was conducted by Onça Puma personnel using Total Station surveying equipment. This procedure is accurately documented in PRO-0039-GAPMQ Levantamento Topográfico com Estação Total_R1.doc. This topography was essentially composed of drill hole collar surveys and as a result did not accurately depict features such as gullies or areas with little drilling. More detailed LIDAR topographic survey has now been flown for the Onça and Puma deposits. Figure 6-22 shows a comparison of the Total Station topographic survey against the LIDAR topographic survey.

Figure 6-22: Comparison of the total station topographic survey (brown) against the LIDAR topographic survey (green)

Golder considers the LIDAR topographic surveys to be of an acceptable standard to be used for geological modelling and mineral resource estimation. The LIDAR survey is obviously far more detailed and will provide for a more accurate estimate of volumes.

Density

MOP calculates the density for varying lithology units for drill core by using either the immersion (weight in air-weight in water) method, or the calculated volume method. The MOP density measurement procedure is well documented in PRO PROCEDIMENTOS OPERCIONAIS 2002 – 2005.

For the immersion method the density measurements are taken from 20 cm to 30 cm lengths of whole HQ sized, intact and coherent core. At the drill site a technician selects the sample for measurement and wraps it in plastic and returns it to the correct location in the core tray. During logging the sample is weighed in air and then weighed submerged in water which provides the wet weight. The weight in water is measured using a scale and water bath system similar to that in Figure 6-23. The wrapped core is then transferred to the sample preparation laboratory, where it is dried and the dry bulk density is calculated. The core is then returned to the assay sample bag for sample preparation.

The calculated volume method determines the density by calculating the volume of the core from the core length and the diameter and the wet and dry weight of the sample.

MOP have utilised the calculated volume method derived densities for the mineral resource estimation.

Golder considers the density measuring process and facilities to be adequate for determining densities to be used for mineral resource estimation.

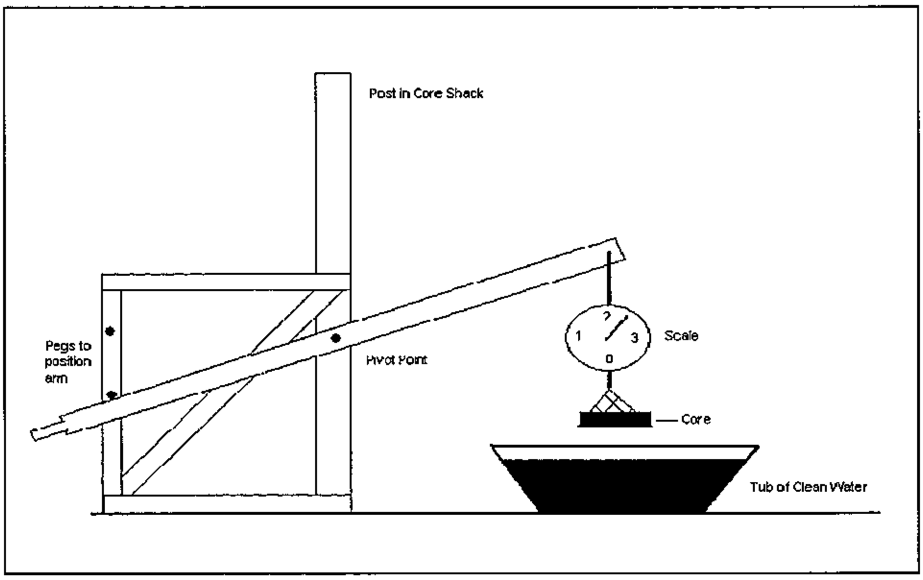

Figure 6-23: Diagrammatic representation of the density measuring equipment for Onça Puma

Table 6-7 summarises the average bulk densities used for mineral resource estimation at Onça Puma. The density values are assigned by ordinary kriging into the final resource models.

Table 6-7: Average bulk densities used for resource estimation

Lithology	Dry Bulk Density	
	Onça	Puma
Bedrock	1.74	1.83
Limonite	1.18	1.20
Pyroxenite	1.69	1.55
Silcrete	1.28	1.28
Saprolite	1.22	1.10
Siliceous Limonite	1.24	1.21
Siliceous Saprolite	1.21	1.15

The highly weathered nature of the deposit style could affect the density calculations/results for the techniques currently used as there is considerable permeability and therefore pore space within samples of differing lithologies.

Geological Modelling

The geological modelling uses a series of Datamine macros, developed in-house, which generate a set of points at the contacts of the various layer intervals in each drill hole. These points are meshed into a Digital Terrain Model (DTM) to generate the geological model. If done correctly, no overlapping of the DTMs should occur. The DTMs used in this resource were checked for overlaps and none were found.

Golder concentrated on reviewing the resulting surfaces and coded block models and composite files more than the actual mechanics of the triangulation creation. Golder visually reviewed the models using Vulcan, and Datamine software, checking section by section, to evaluate how well the models honour the drill hole data and to check geological coherence. The geological models were also evaluated against each other to check for inconsistencies. In addition, the geological codes assigned to the block model were compared to the wireframes solids.

Golder checked the DTMs to ensure that the triangle vertices were snapped to the appropriate drill hole sample end points. At Onça the D1D2 mineral resource area was reviewed and at Puma the Jatoba area was similarly reviewed. Figure 6-24 and Figure 6-25 show the drilling coverage for D1D2 and Jatoba respectively. Both areas display all triangulation vertices snapped to the correct drill hole intervals and triangulations do not display any crossovers.

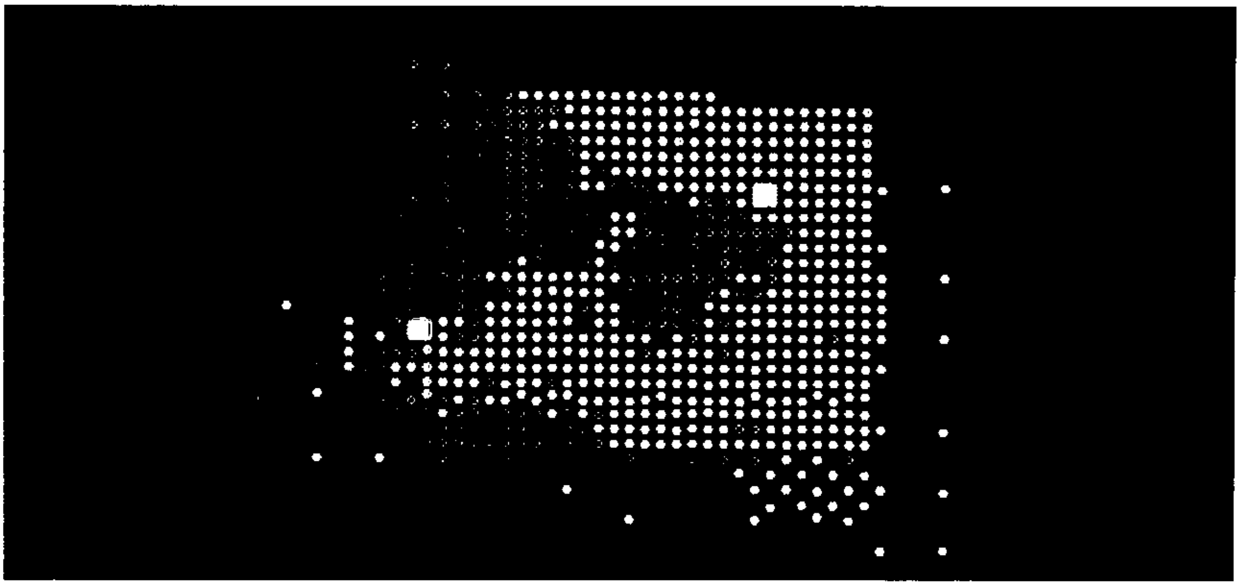

Figure 6-24: Drilling coverage for Onça D1D2 resource area (showing also the extent of the resource model)

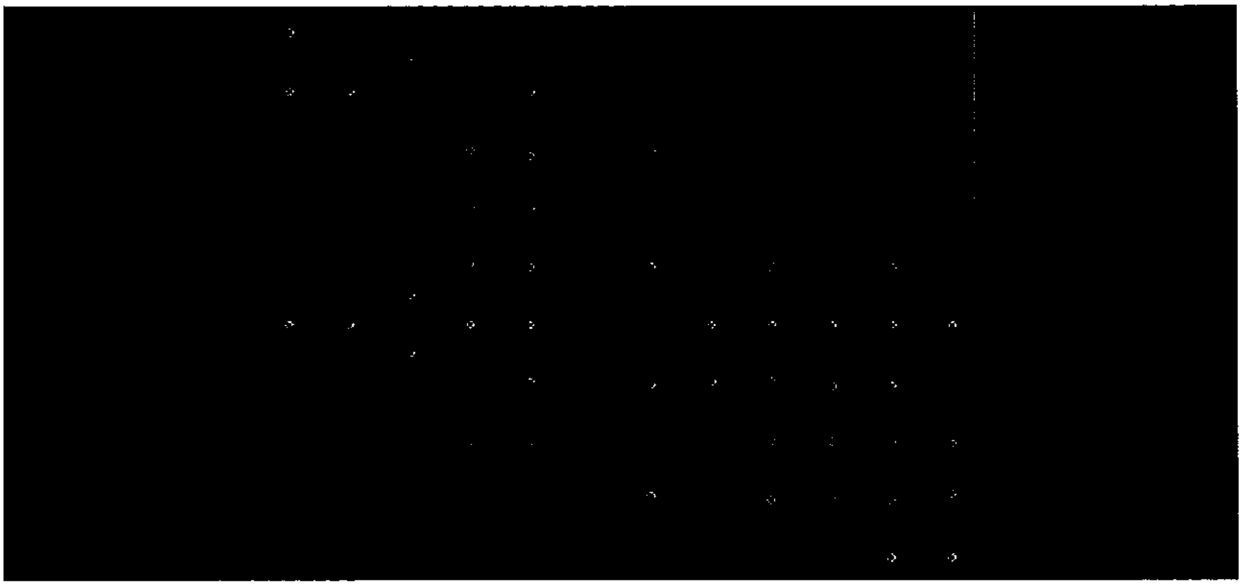

Figure 6-25: Drilling coverage for Puma Jatoba resource area (showing also the extent of the resource model)

Figure 6-26 and Figure 6-27 show typical cross-sectional comparisons of the block models and sample coding compared to the wireframed domain surfaces for Onça D1D2 and Puma Jatoba respectively.

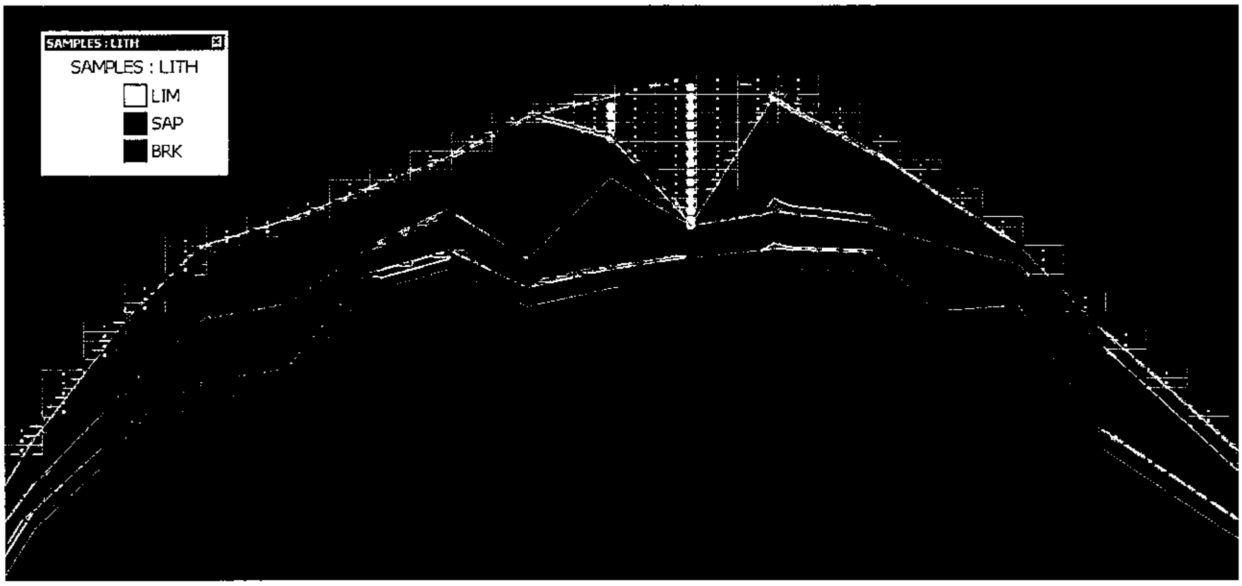

Figure 6-26: Visual comparison of block model and sample coding and surface wireframes (DTMs) for Onça D1D2

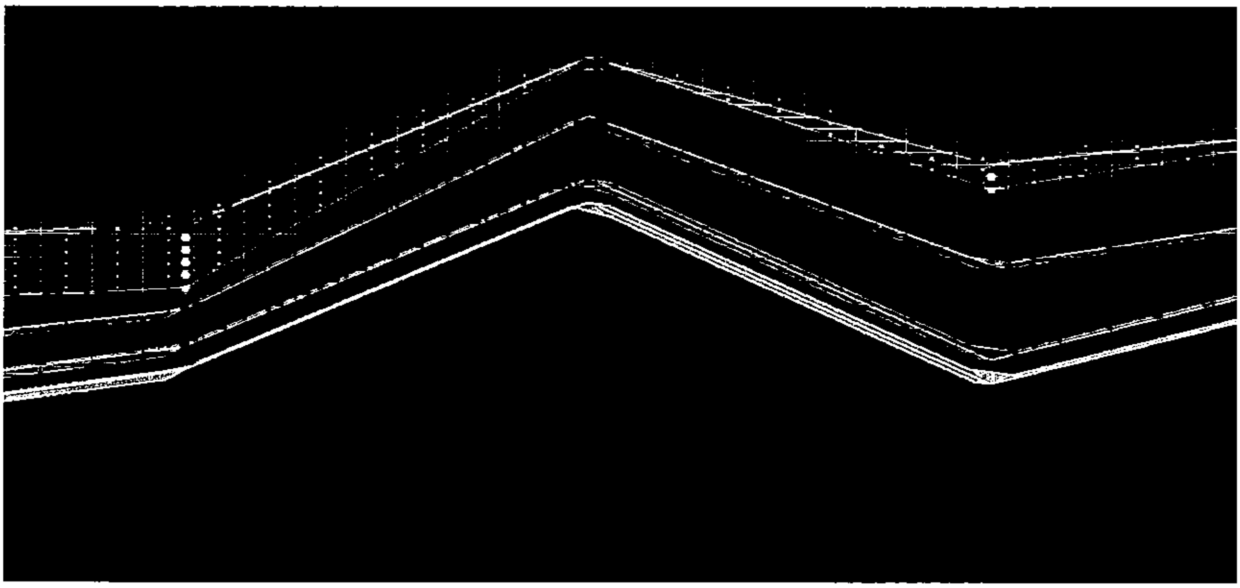

Figure 6-27: Visual comparison of block model and sample coding and surface wireframes (DTMs) for Puma Jatoba

Visual review of the Onça Puma models showed no significant anomalies and the information was considered consistent with the conceptual model for nickel laterite deposits.

Golder considers the lithological model to generally be accurate and of a sufficient quality to be used for mineral resource estimation purposes.

6.12 Mineral Resource Estimation

The December 31, 2009 Onça Puma MRMR declaration is based on 18 individual block models created for Onça and Puma properties (see Figures 6-28 and Figures 6-29). The models were constructed in 2007 by the Vale Mineral Reserves Mineral Resources group in Canada using block modelling techniques that were originally implemented for the PT Inco and VINC (Goro) deposits and later adapted to the specific characteristics of the Onça Puma deposits. The same models were used to support the 2008 Onça Puma MRMR declaration and are unchanged from that point.

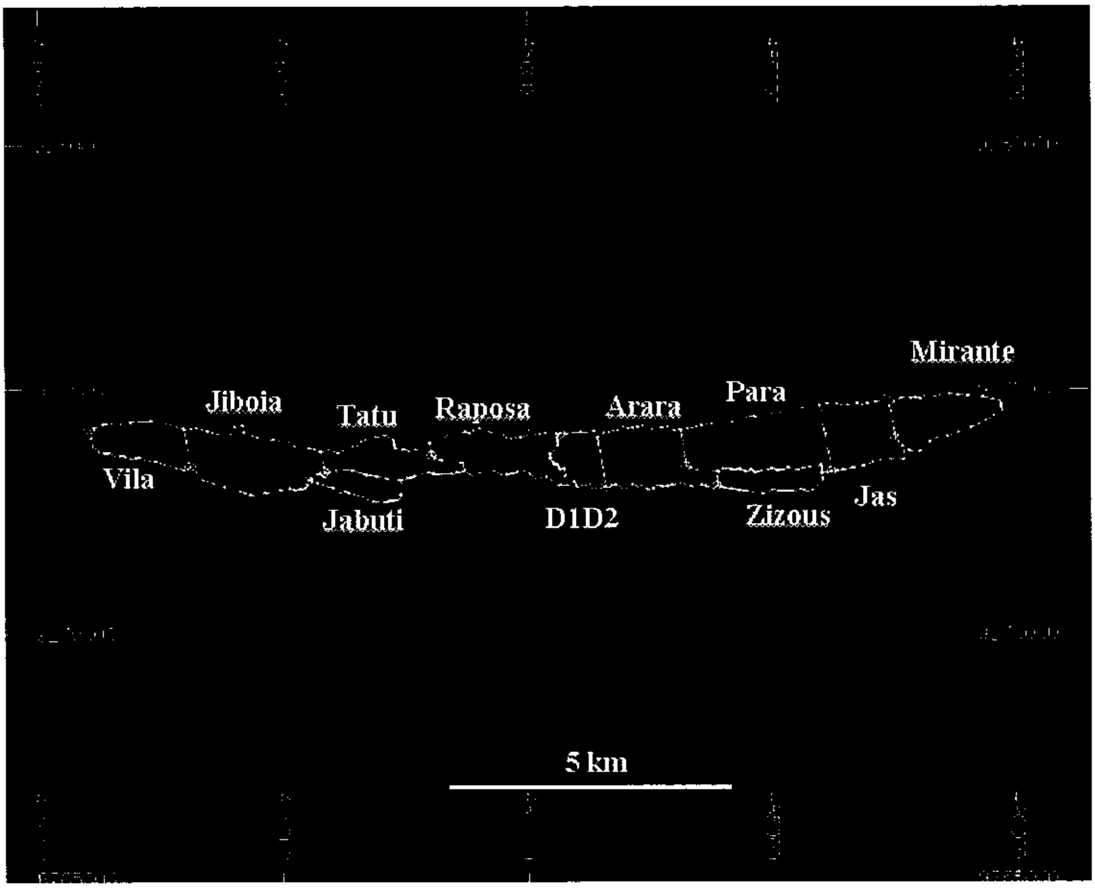

Figure 6-28: Individual block model areas on the Onca property

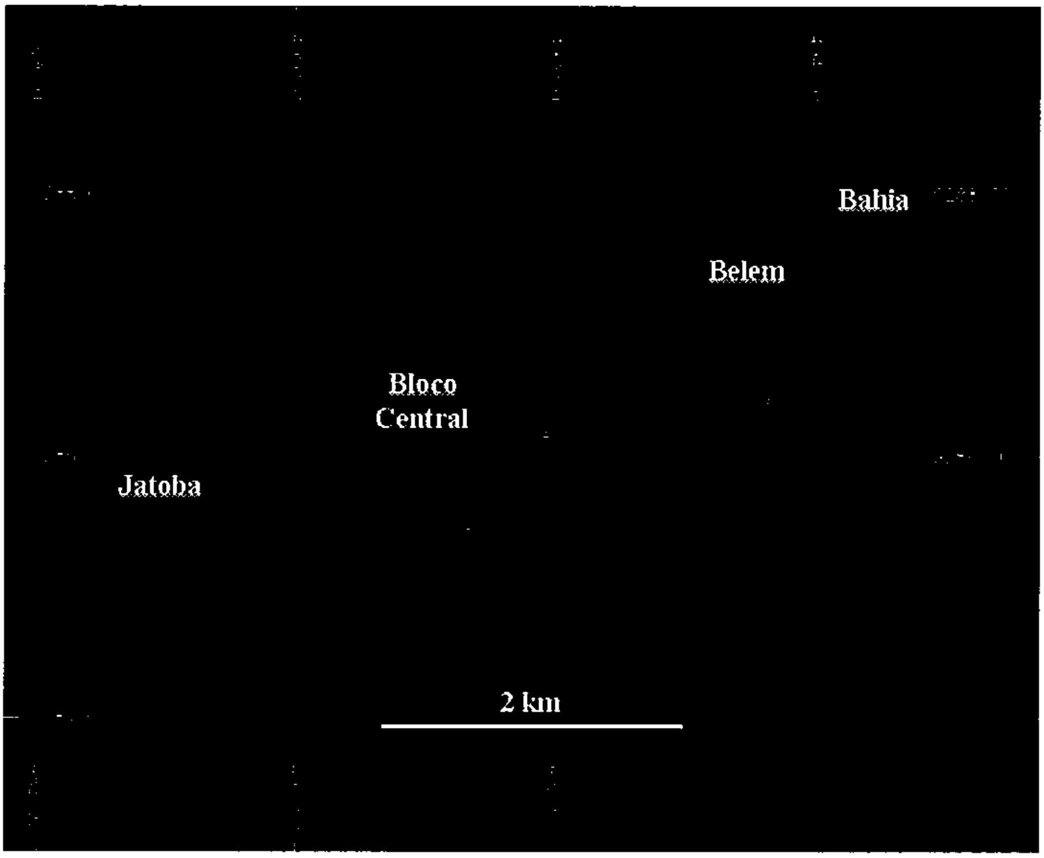

Figure 6-29: Individual block model areas on the Puma property

Onça Puma mineral resource estimation is conducted using a series of Datamine macros and scripts, developed in-house by the Vale Mineral Reserves Mineral Resources Group in Canada. A systematic folder structure and systematic file naming conventions are used to store the macros, files and reports for each block model. Golder validated these macros and the underlying mineral resource estimation process they embody using the Onca Raposa deposit as an example.

Golder considers that the use of macros for the purposes of standardization, reproducibility and auditing to be an appropriate industry practise for mineral resource estimation.

The steps in the mineral resource estimation process are as follows.

Drill Hole Database

The UTM coordinates for all the Onça deposits were transformed by subtraction of 400,000 to the Eastings, 9,000,000 to the Northings and rotated clockwise by 10 degrees. In this transformed coordinate system, the drilling coverage for Raposa extends from 124,422 m to 127,023 m East, from 255,238 m to 256,252 m North and from 247 m to 428 m Elevation.

The core-drilling program conducted over the Raposa deposit consists of 389 HQ (6.11 cm diameter core) diamond drill holes with a cumulative length of 4,725 m. The drill spacing ranges from 50 m x 50 m to 100 m x 100 m (Figure 5.30). These drill holes were selected by applying a 100 m buffer zone to the perimeter of the Raposa resource model.

All the holes are vertical and most intersected limonite or saprolite mineralization. No specific zones or domains were used in the construction of the mineral resource block model other than the vertical layering of the weathering profile, namely limonite, saprolite, bedrock (hard saprolite). In general, there is considerable homogeneity within each layer in terms of nickel grade and chemistry distributions but significant variations in layer thickness.

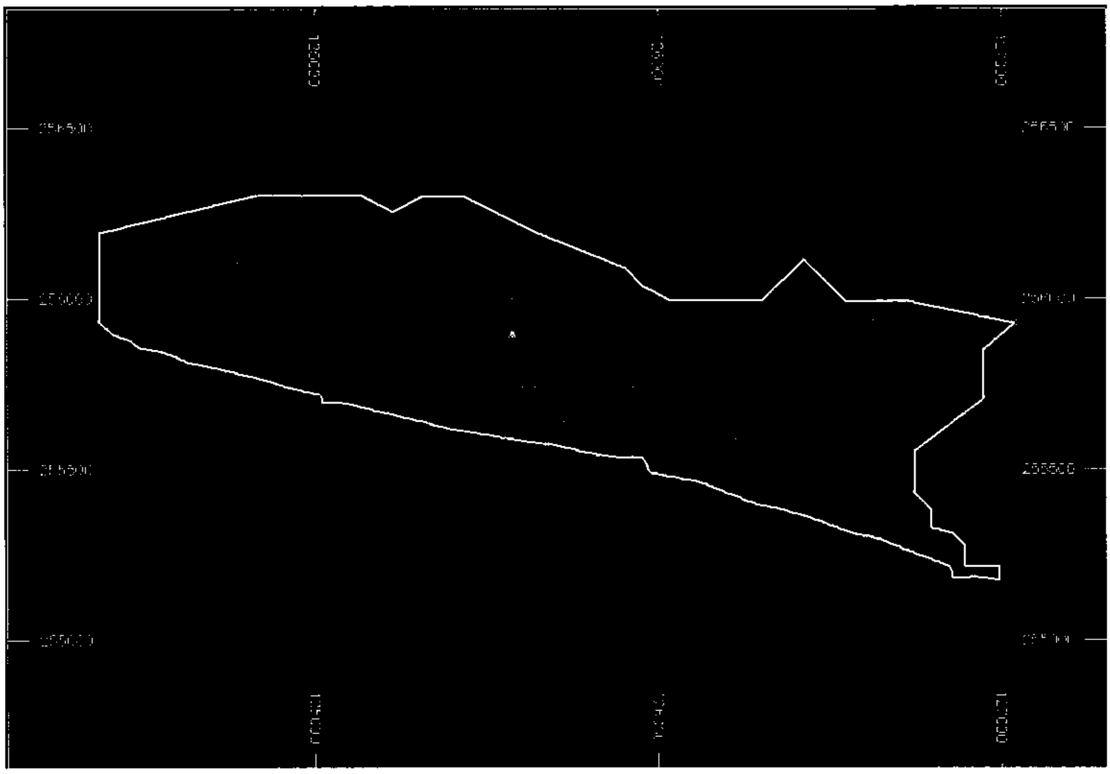

Figure 6-30: Distribution of Drilling at Raposa

Definition of Geological Layers

A simplified geological coding is applied for laterite layer definition. The Litho field provided by MOP is used to create a new Layer field where lithologies have been grouped according to Table 5.8. LIM represents the limonitic material (siliceous and non-siliceous), SAP represents the soft saprolite and BRK represents the hard saprolite and bedrock samples. The geological coding is verified in the drill hole database to ensure consistency and vertical continuity of each layer. The same coding is used for all deposits.

Table 6-8: Geological and Layer Coding

Litho	Layer
B	BRK
C	LIM
C1	LIM
C2	LIM
C3	LIM
GB	BRK
GC	BRK
GH	BRK
GL	LIM
GL1	LIM
GS	SAP
GS1	SAP
H	BRK
H1	SAP
H2	SAP
HC	LIM
HS	SAP
HS1	SAP
L	LIM
L1	LIM
L2	LIM
L3	LIM
S	SAP
S1	SAP
S2	SAP

Systematic visual inspections of the layer coding revealed that a significant amount of very low-grade mineralization has been included in the SAP layer (Figure 6-31). Most of this material is located at the bottom of the SAP layer and this will result in the "diluting" of the SAP layer. No mining dilution is applied to the base of the deposit in order to compensate for this likely bias.

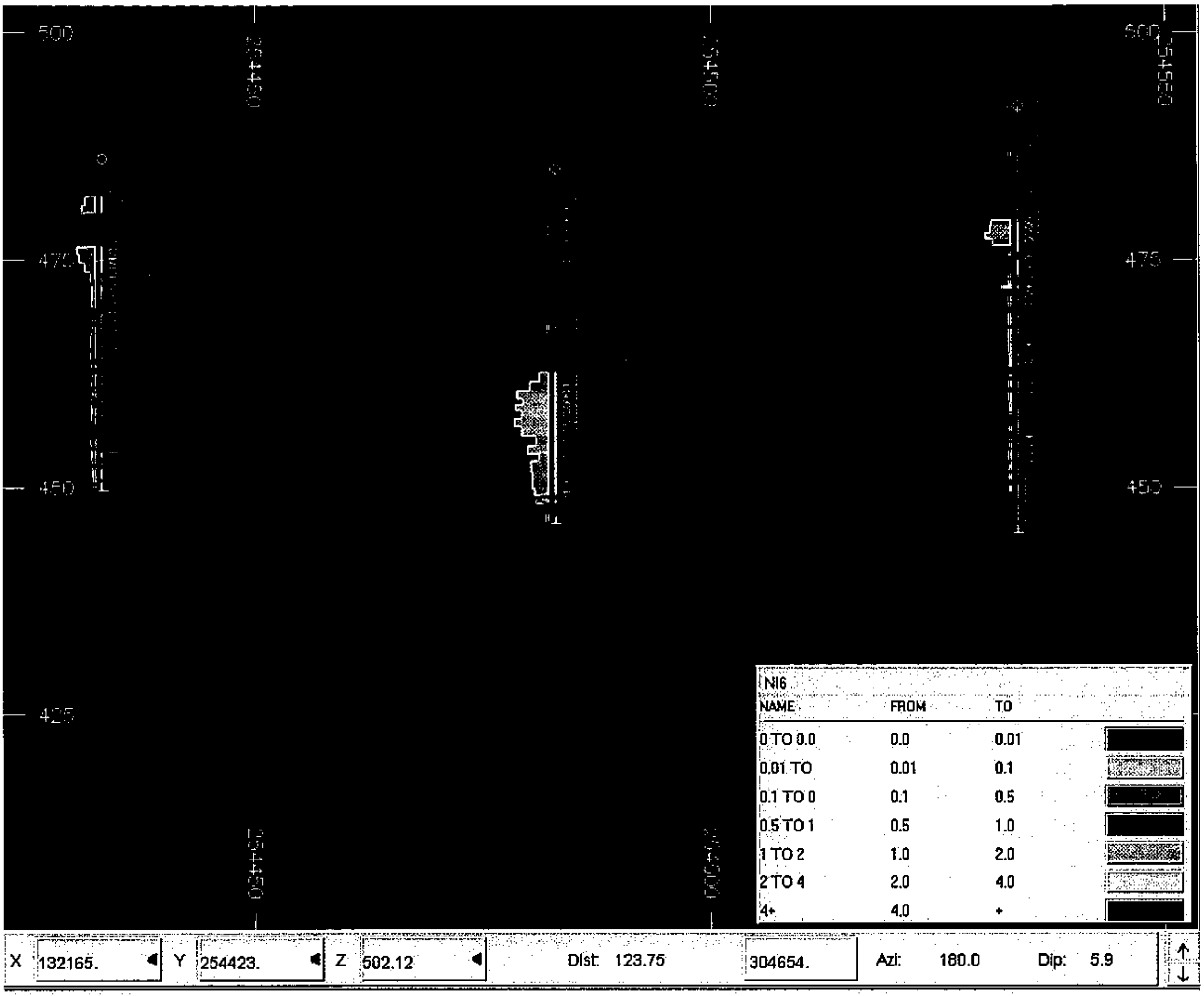

Figure 6-31: Illustration of inclusion of low grade material (%Ni <0.7) at the bottom of the SAP layer

Digital Terrain Models (DTMs) are constructed for the top of the LIM, the bottom of the SAP and the LIM/SAP contact based on the layer definition coded in the Datamine database. If one of the layers is absent at any drill hole location, the bottom elevation of the layer is reset to its top elevation (i.e. zero thickness). Visual verifications are conducted to ensure that there is no overlap within or between layers.

Chemistry Variables and Compositing

The variables modelled, %Ni, %Co, %Fe, %SiO_2, %MgO and %Al_2O_3, are assumed to represent the chemistry of the total material after drying. This material is considered representative of the feed to be sent to the FeNi plant and is used as a basis for FeNi mineral resource and mineral reserve reporting.

Unassayed samples values are recorded and treated as lost core.

Prior to data analysis, the samples located inside each layer are composited into 1 m intervals. Due to the uncertainty and measurement errors on the dry weights in the saprolite layer, these weights are not used as weighting factors in the compositing process (i.e. samples are weighted on length only). Samples at the bottom of the layer which are less than 0.2 m in length are included in the previous composite (therefore, giving a potential length of 1.2 m). Global statistics by layer did not indicate any significant difference between the mean and variance of samples before and after compositing.

Exploratory Data Analysis

Exploratory data analysis is conducted for each layer. Histograms and statistics of each variable are developed. In the LIM layer of the Raposa deposit, all the elements are positively skewed with the exception of Fe displaying a nearly normal histogram. In the SAP layer, SiO_2 shows a nearly normal histogram with a small population of silicified saprolite (SiO_2>55%), while Fe, Co and Al_2O_3 are positively skewed. The Ni histogram appears to be bimodal population, likely reflecting the inclusion of the low Ni/high MgO material at the bottom of the SAP layer.

Scatter-plots between the various elements, show the existence of different co-existing populations related to the inclusion of silicified and Al_2O_3 rich zones in the 3D interpretation of the LIM and SAP layers. The coefficients of linear correlation presented in Table 6-9 are biased by the mixing of populations. For example, the expected negative correlation between Fe and MgO and positive correlation between SiO_2 and MgO in a normal "laterite profile" are masked by the impact of the silicified zones. In fact, the relationships are typical and expected characteristics of Ni laterite deposits affected by silicification and the presence of gabbroic dykes.

Table 6-9: Correlation Matrix between Chemistries from Core Drilling Data at Raposa

	LIM							SAP					
	Ni	Fe	Co	SiO_2	MgO	Al_2O_3		Ni	Fe	Co	SiO_2	MgO	Al_2O_3
Ni	1.00	-	-	-	-	-	**Ni**	1.00	-	-	-	-	-
Fe	0.63	1.00	-	-	-	-	**Fe**	0.36	1.00	-	-	-	-
Co	0.40	0.52	1.00	-	-	-	**Co**	0.43	0.56	1.00	-	-	-
SiO_2	-0.66	-0.87	-0.41	1.00	-	-	**SiO_2**	-0.48	-0.65	-0.28	1.00	-	-
MgO	0.55	0.03	-0.10	-0.25	1.00	-	**MgO**	0.11	-0.44	-0.26	-0.28	1.00	-
Al_2O_3	-0.31	-0.35	-0.31	-0.07	-0.11	1.00	**Al_2O_3**	-0.42	-0.03	-0.13	0.47	-0.80	1.00

The inclusion of the gabbroic Al_2O_3 rich zones in the LIM and SAP layer and of the silicified zones in the SAP layer are justified by their poor lateral extent. It is deemed that some of the silicified zones in the LIM layer can be modelled separately.

Unfolding

The Onça Puma laterite deposits are produced by a weathering process and the action of groundwater, as are other Ni laterite deposits, this result in layers that have the appearance of being folded. Therefore, estimating within the regular Cartesian coordinate system does not necessarily reflect the natural geological chemistry distribution within the laterite profile. The Datamine "unfolding" process is used in order to examine samples in an unfolded coordinate system both for variogram calculation and for grade interpolation.

The unfolded coordinate system better reflects the relative position of each composite sample in the layer to be modelled. The transformed samples are subjected to thorough quality control measures including visual validation of the drill hole geometry after unfolding. In the case of the Raposa deposit, all samples were successfully unfolded in both the SAP and LIM layers.

Golder considers that the use of unfolding to be an appropriate industry standard based on the geological layering observed within the laterite profile.

Grade Variography

Grade variography for the Raposa deposit was based on the dense core drilling density available for modelling in the nearby D1D2 area. The variograms were calculated in the unfolded coordinate system. The pair-wise relative variograms were modelled by a linear combination of nugget and spherical structures. A zonal anisotropy was recognised for some elements in the vertical direction but was not incorporated in the models as it is deemed to have no impact on the mineral resource estimate.

Golder considers that the variography approach adopted and the documentation of that approach is based on industry standards.

Grade Estimation

Separate mineral resource block models are built for each layer. The LIM and SAP layers are later combined into a single resource model. Each block is entirely assigned to one of the layers based on the location of its centroid (i.e. a block is either LIM or SAP, it cannot contain partial components of different layers). The block size used for the Raposa deposit is 12.5 m x 12.5 m x 1 m (X/Y/Z or East/North/Elevation) and represents a reasonable compromise between drilling density (25 m to 100 m) and resource and reserve reporting requirements (i.e. selective mining operation on a 12 m x 12 m x 1 m basis).

Grades %Ni, %Co, %Fe, %SiO_2, %MgO and %Al_2O_3 were estimated using nearest neighbour and ordinary kriging, both in Cartesian and unfolded coordinate space. Different search strategies (nested searches, minimum/maximum number of samples, octant constraints and maximum samples per drill hole) were employed for each layer.

The mineral resource model to be used for mine planning and mineral resource reporting is based on an unfolded ordinary kriging algorithm while the other interpolation methods are utilized for validation purposes.

Ordinary kriging has many advantages over other traditional empirical interpolators (masking effect, de-clustering, minimizing the variance of the error). Ordinary kriging can generate negative kriging weights, which are normal and expected. Values obtained outside the range of the input data as a result of these negative weights are investigated. In the case of the Raposa deposit, no corrective action was required due to negative weights.

Golder considers that the grade estimation approach adopted, the documentation of that approach, and the specific controls used for the different materials and elements estimated is based on industry standards.

Block Model Validation

Three types of validation are conducted on block models. The first is the visual validation of the consistency between the block model and drill-hole information. These are systematically performed from cross-section to cross-section. This confirmed the applicability and advantage of the unfolding approach (Figure 6-32).

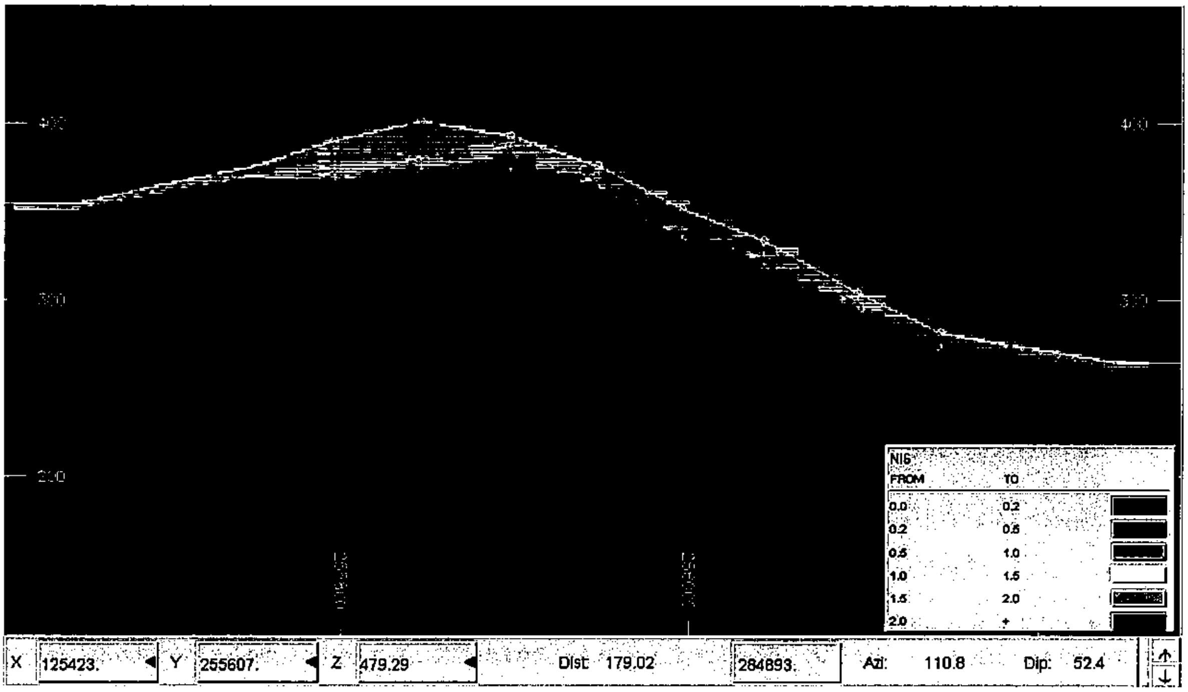

Figure 6-32: Example of visual validation of the Raposa unfolded ordinary kriging model

The second type of validation is a check for global or systematic local bias. The global and layer statistics were compared between the drill hole composites and block models built using nearest neighbour and ordinary kriging, both in Cartesian and unfolded coordinate space. The comparison of sample and the nearest neighbour model statistics showed significant differences (lower grade in SAP) in the models than in the composites demonstrating the de-clustering effect of the nearest neighbour models in both coordinate system. The comparison of the ordinary kriging and nearest neighbour statistics shows small differences. The mean of the kriged estimates is between the mean of the nearest neighbour estimates and the composites mean. This is expected and reflects the contribution of the nugget effect in the de-clustering of the kriged estimates.

A third validation consisted of comparing the variance between the blocks obtained in the kriged model with a theoretical calculation of what this variance should be according to the Krige Formulae (Journel and Hjuibregts, 1978) using the variogram model for the Ni interpolation. This assessment was conducted for a selective mining unit of 12.5 m x 12.5 m x 1 m and was conducted separately for areas of different drilling density and with different statistical characteristics.

For the Raposa deposit, the volume-variance assessment was conducted inside and outside of a core zone of higher drilling density, which also corresponds to higher %Ni values (Figure 6-33).

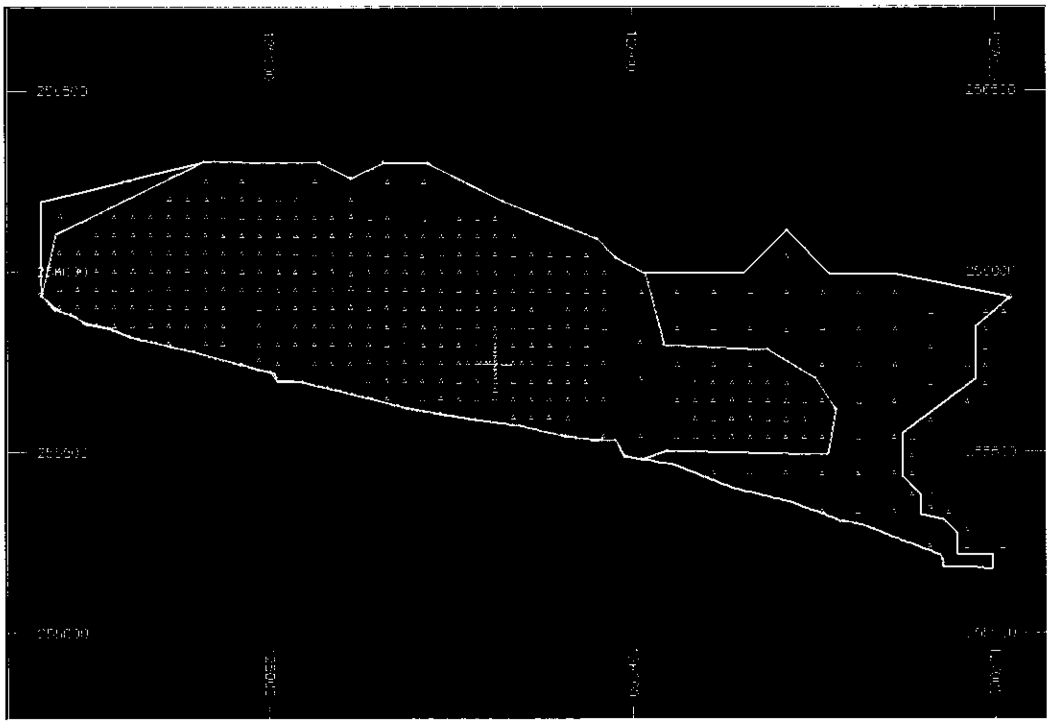

Figure 6-33: Volume-variance assessment conducted on two different domains

At Raposa, a volume-variance correction was considered necessary for the Ni grade in the LIM layer for the zone with higher drilling density only. The correction was implemented through an indirect lognormal correction but does not impact the FeNi mineral resources as reported within the SAP layer only.

Golder considers that the grade block validation approaches adopted and the documentation of those approaches is based on industry standards.

6.13 Mineral Reserve Estimation

The key parameters adopted for the pit optimization using the MineSight software were:

- Metal price: US$5.44 per pound of Nickel
- Sales Cost: US$0.15 per pound of Nickel
- Mine Cost: US$4.09 per tonne of material moved
- Plant Cost: US$61.13 per tonne of ore
- Global Angle Slope: 30°
- Rec. Metallurgical: 0.783+(0.1238 x Ni)-(0.0199 x Ni2), Rec max 92%

Pit Design

The operational pit parameters to the mine design are:

- Berms: 5 m
- Benches: 3 m
- Face Angle: 90°
- Global Angle Slope: 30°

Reconciliation of Optimized Pit Versus Designed Pit

The differences of the operational pit in relation to the designed pit are:

- +7% in mass
- +1% in Ni grade
- +2% in Limonite (t)
- +353% in Saprolite (waste)
- +16% in Hard Rock
- +10% in Waste:Ore ratio

Mining Sequencing

The mining operations will be phased and alternated between the Onça and Puma pits. The waste material will be stockpiled near the mines. The limonitic waste material which can be eventually treated in a high pressure acid leaching process (HPAL) will be stocked separated from the regular waste. The mineralized saprolitic material is considered to be the FeNi plant feed and will be stocked in temporary piles close to the excavated pits. From there the mineralized saprolite will be transported by trucks to the processing plant. The Onça hill is divided in Central, West and East sectors. In 2010, the mining operation will be concentrated in the Central sector of the Onça hill.

The following Figures 6-34 to 6-37 show the final pits and the stockpiles configuration for the Onça Puma. Tables 6-10 to 6-13 has the schedule of ore production and waste removal. Figure 6-38 to 6-40 show the production charts.

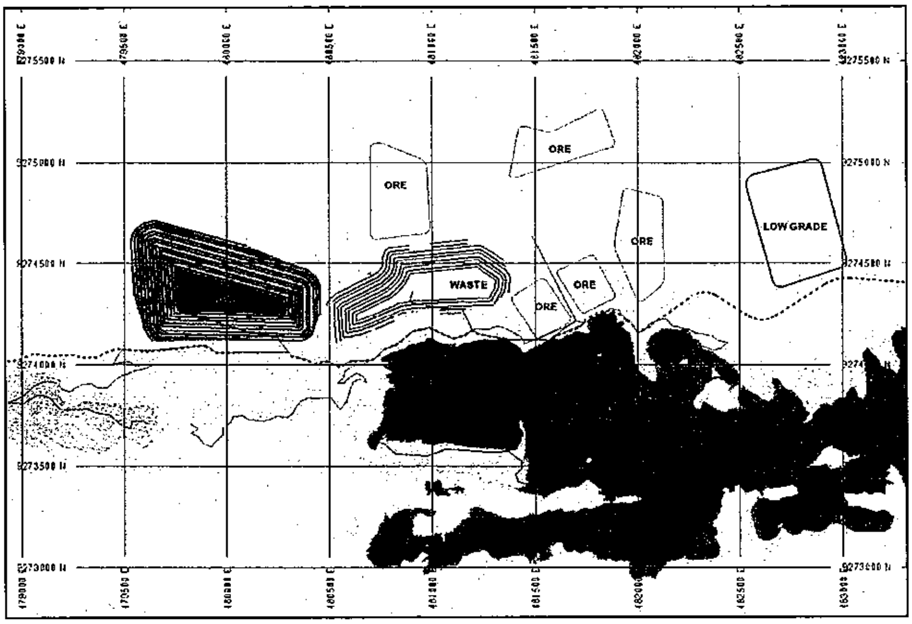

Figure 6-34: Onça Mine Central and stockpiles

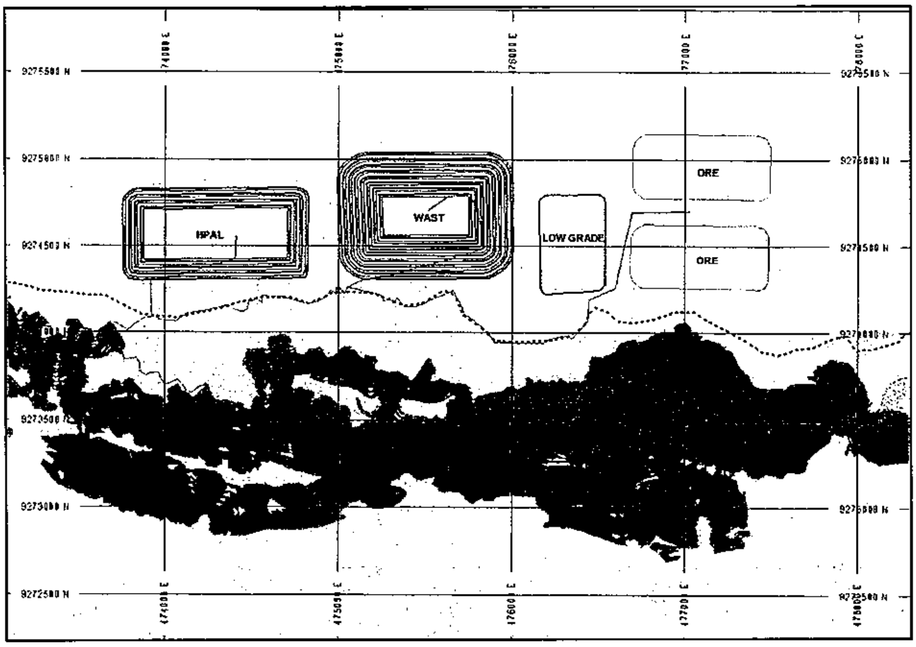

Figure 6-35: Onça Mine West and stockpiles

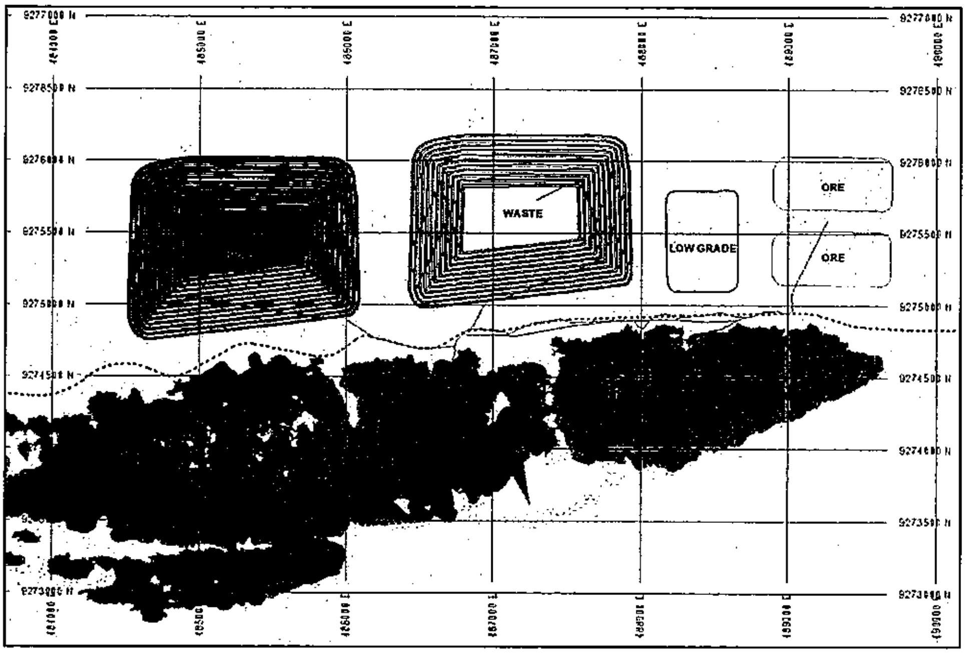

Figure 6-36: Onça Mine East and stockpiles

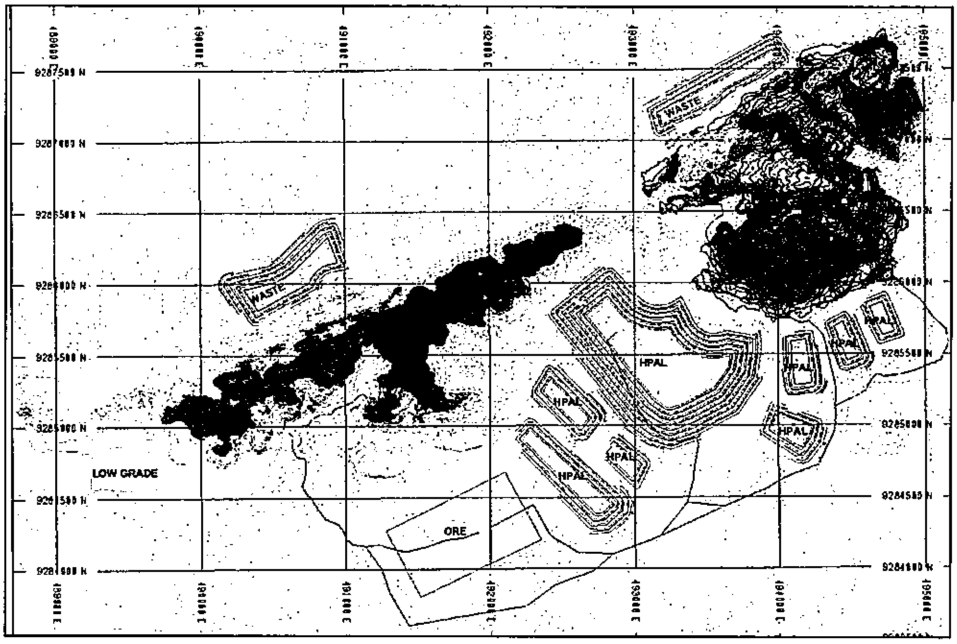

Figure 6-37: Puma Mine and stockpiles

Table 6-10: Mine Production Schedule

Onça and Puma Estimated Production

Year	Total Material Moved (t)			Ore (t)		
	Onça	Puma	Total	Onça	Puma	Total
2010	4,638,793	0	4,638,793	2,418,184	0	2,418,184
2011	6,460,979	1,020,208	7,481,188	3,156,148	498,365	3,654,514
2012	0	8,554,455	8,554,455	0	6,403,866	6,403,866
2013	0	9,551,770	9,551,770	0	5,034,735	5,034,735
2014	1,457,214	7,982,183	9,439,397	560,632	3,070,975	3,631,607
2015	9,327,022	0	9,327,022	1,045,623	0	1,045,623
2016	15,600,000	0	15,600,000	39,609	0	39,609
2017	15,600,000	0	15,600,000	289,007	0	289,007
2018	15,600,000	0	15,600,000	938,070	0	938,070
2019	15,600,000	0	15,600,000	2,483,669	0	2,483,669
2020	15,600,000	0	15,600,000	3,730,680	0	3,730,680
2021	15,600,000	0	15,600,000	3,684,375	0	3,684,375
2022	15,600,000	0	15,600,000	6,228,369	0	6,228,369
2023	15,600,000	0	15,600,000	7,058,976	0	7,058,976
2024	15,600,000	0	15,600,000	5,041,051	0	5,041,051
2025	15,600,000	0	15,600,000	111,759	0	111,759
2026	15,600,000	0	15,600,000	764,423	0	764,423
2027	15,600,000	0	15,600,000	1,415,982	0	1,415,982
2028	15,600,000	0	15,600,000	2,190,045	0	2,190,045
2029	15,600,000	0	15,600,000	2,161,272	0	2,161,272
2030	15,600,000	0	15,600,000	2,382,004	0	2,382,004
2031	15,600,000	0	15,600,000	2,413,123	0	2,413,123
2032	15,600,000	0	15,600,000	3,824,319	0	3,824,319
2033	15,600,000	0	15,600,000	4,589,783	0	4,589,783
2034	14,884,195	715,805	15,600,000	5,874,883	282,533	6,157,416
2035	0	15,600,000	15,600,000	0	2,214,969	2,214,969
2036	0	15,600,000	15,600,000	0	4,803,920	4,803,920
2037	5,929,605	9,670,395	15,600,000	2,397,452	3,909,925	6,307,377
2038	15,600,000	0	15,600,000	1,039,948	0	1,039,948
2039	14,554,243	1,045,757	15,600,000	4,015,676	288,536	4,304,212
2040	0	10,643,372	10,643,372	0	4,835,524	4,835,524
Total	**353,652,051**	**80,383,946**	**434,035,997**	**69,855,062**	**31,343,348**	**101,198,409**

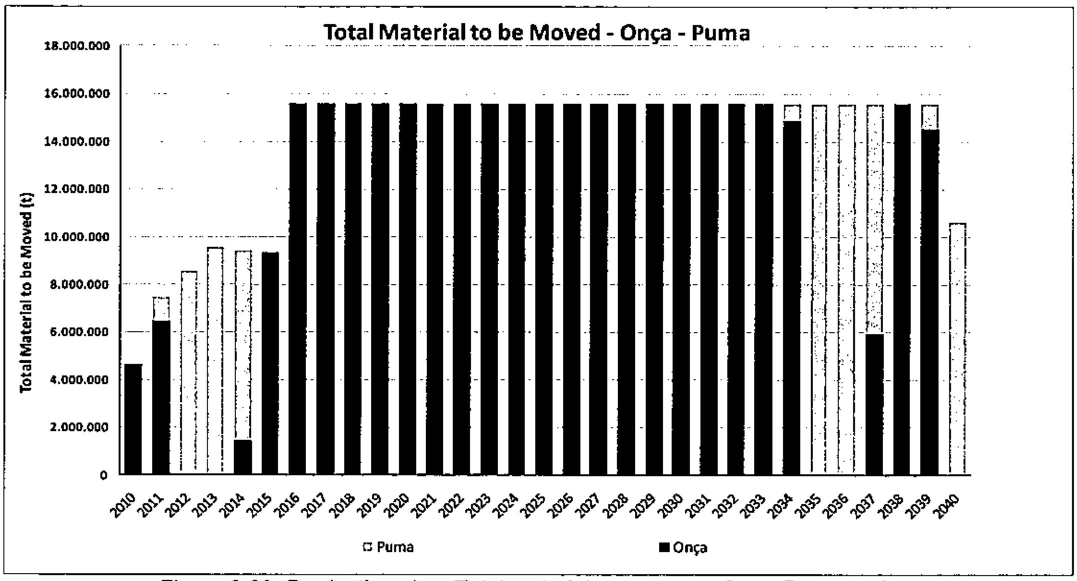

Figure 6-38: Production plan: Total material movement - Onça-Puma project

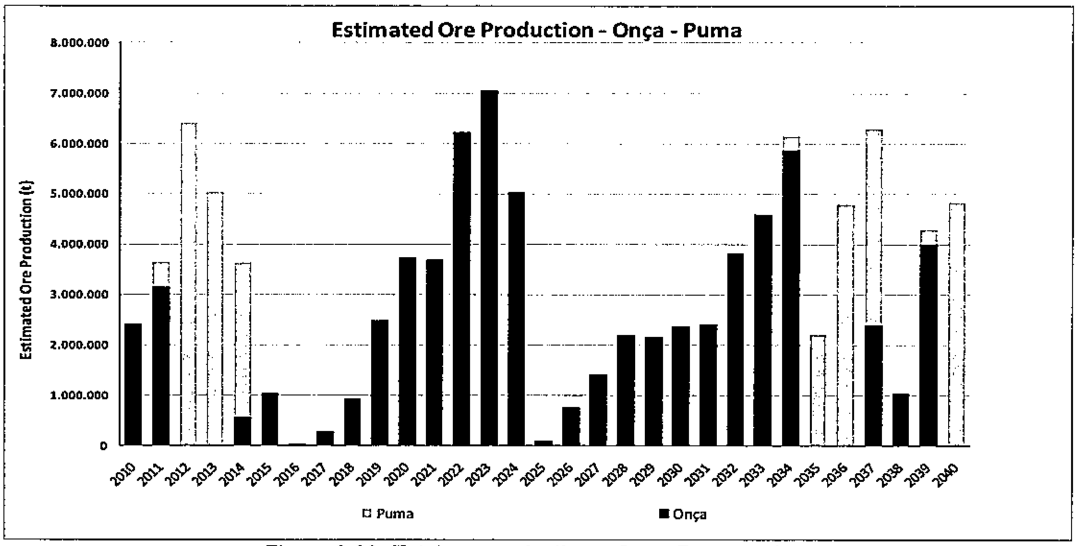

Figure 6-39: Total ore production – Onça-Puma project

Table 6-11: Onça Puma Nickel Project - Stockpiles

Stockpiles

Year	Stockpiles (t)	Ni (%)	Co %)	SiO_2 (%)	MgO (%)	Al_2O_3 (%)	Fe (%)	SiO_2:MgO	Ni:Co	Fe:Ni
2010	1,960,844	2.17	0.07	38.86	24.91	1.41	12.56	2	31.61	5.79
2011	4,502,837	2.02	0.06	39.58	23.98	1.61	13.07	1.65	31.18	6.48
2012	8,647,353	2.09	0.04	38.72	23.58	1.56	14.24	1.64	49.89	6.82
2013	11,128,088	2.03	0.04	39.10	23.44	1.60	14.21	1.67	53.31	7.01
2014	12,198,698	1.95	0.04	38.63	22.94	1.71	14.93	1.68	48.22	7.66
2015	10,690,321	1.87	0.04	38.75	22.52	1.75	15.14	1.72	43.55	8.11
2016	8,175,929	1.80	0.05	38.82	21.93	1.84	15.53	1.77	37.84	8.64
2017	5,910,936	1.76	0.06	38.92	20.24	2.08	16.60	1.92	31.15	9.44
2018	4,288,008	1.75	0.07	39.27	16.78	2.54	18.69	2.34	24.31	10.65
2019	4,217,677	1.74	0.08	40.95	13.65	2.78	19.82	3.00	20.95	11.40
2020	5,394,357	1.71	0.08	40.82	14.13	2.81	19.48	2.89	20.72	11.37
2021	6,524,732	1.68	0.08	41.37	14.76	2.59	18.81	2.80	20.27	11.21
2022	10,192,103	1.63	0.07	40.19	17.90	2.29	17.33	2.25	22.33	10.63
2023	14,697,079	1.60	0.06	38.76	20.40	2.16	16.36	1.90	25.19	10.23
2024	17,184,129	1.56	0.06	37.97	21.31	2.24	16.11	1.78	27.04	10.32
2025	14,741,888	1.57	0.06	38.32	20.88	2.22	16.25	1.84	26.23	10.35
2026	12,945,313	1.56	0.06	39.06	19.71	2.32	16.63	1.98	24.67	10.64
2027	11,807,295	1.56	0.07	39.65	18.05	2.46	17.44	2.20	22.74	11.16
2028	11,443,340	1.56	0.07	40.27	16.67	2.52	18.06	2.42	21.12	11.56
2029	11,050,611	1.57	0.08	40.69	15.33	2.58	18.78	2.66	19.72	11.94
2030	10,871,618	1.58	0.09	41.17	13.92	2.65	19.50	2.96	18.42	12.34
2031	10,730,740	1.58	0.09	41.83	12.26	2.77	20.22	3.41	17.01	12.77
2032	12,511,175	1.56	0.09	42.11	12.96	2.71	19.56	3.25	17.27	12.52
2033	14,546,957	1.59	0.09	41.80	14.26	2.57	18.81	2.93	18.38	11.85
2034	18,143,376	1.59	0.08	40.76	16.25	2.65	17.84	2.51	20.22	11.25
2035	17,804,345	1.58	0.08	41.14	15.63	2.70	18.11	2.63	19.73	11.49
2036	20,054,265	1.55	0.08	40.72	16.10	2.61	18.22	2.53	20.11	11.72
2037	23,807,641	1.51	0.07	40.04	16.94	2.71	18.08	2.36	21.37	11.96
2038	22,286,591	1.52	0.07	40.27	16.19	2.81	18.38	2.49	20.42	12.12
2039	24,036,803	1.51	0.07	40.44	16.21	2.96	18.06	2.49	20.53	11.94
2040	26,318,326	1.48	0.07	39.84	16.43	2.93	18.40	2.42	21.76	12.42
2041	23,764,326	1.49	0.07	40.09	15.46	3.03	18.87	2.59	20.54	12.68
2042	21,203,329	1.50	0.08	40.31	14.26	3.21	19.47	2.83	19.18	12.95
2043	18,649,328	1.53	0.09	40.58	12.21	3.50	20.59	3.32	17.87	13.46
2044	18,485,607	1.53	0.09	40.60	12.05	3.52	20.68	3.37	17.80	13.49

Table 6-12: Onça Puma Nickel Project - Limonite Stocked

Limonite Stocked

Year	Limonite Stocks (t)	Ni (%)	Co (%)	SiO_2 (%)	MgO (%)	Al_2O_3 (%)	Fe (%)
2010	1,811,813	1.02	0.16	43.73	2.84	2.93	26.32
2011	2,398,277	1.05	0.18	45.14	3.27	2.85	25.88
2012	1,375,013	1.69	0.11	28.67	4.66	3.67	34.21
2013	3,732,119	1.11	0.12	47.93	3.04	2.79	25.05
2014	3,927,891	1.07	0.14	40.00	2.42	2.94	30.35
2015	2,943,570	0.83	0.10	48.30	1.66	3.29	23.99
2016	3,631,737	0.74	0.06	54.36	1.23	2.35	22.57
2017	6,832,724	0.75	0.08	60.42	1.32	1.86	19.28
2018	7,149,700	0.81	0.10	59.08	1.46	1.91	19.71
2019	8,105,503	0.86	0.13	56.48	1.59	1.82	21.24
2020	6,974,717	0.97	0.12	48.64	2.40	2.36	24.73
2021	6,989,187	0.97	0.14	41.44	2.91	3.01	28.11
2022	4,817,334	0.99	0.13	39.18	3.06	3.28	29.04
2023	3,006,280	1.10	0.12	31.74	4.12	4.23	31.59
2024	3,706,052	0.98	0.09	24.99	3.30	6.10	34.95
2025	7,582,993	0.84	0.08	46.35	1.65	2.06	27.29
2026	9,409,122	0.90	0.10	46.81	2.13	2.23	26.23
2027	7,525,559	0.87	0.10	49.22	2.10	2.23	24.82
2028	7,700,418	0.90	0.12	49.61	2.17	2.30	24.28
2029	6,996,131	0.90	0.13	49.96	2.23	2.28	23.92
2030	8,775,851	0.86	0.12	51.15	2.20	2.20	23.36
2031	8,289,859	0.94	0.13	50.41	2.42	2.06	23.66
2032	8,112,523	0.90	0.13	52.71	2.27	1.92	22.68
2033	6,695,087	0.89	0.12	52.56	1.98	1.99	23.02
2034	5,226,354	0.94	0.11	42.41	2.52	4.28	26.57
2035	10,641,965	0.87	0.14	40.41	1.67	2.75	31.62
2036	7,320,190	0.98	0.13	44.04	2.28	2.57	28.79
2037	3,326,475	0.91	0.10	38.62	2.29	3.76	31.04
2038	7,625,428	0.88	0.12	44.79	1.51	2.22	28.09
2039	4,199,319	0.88	0.13	46.19	2.18	3.38	25.06
2040	3,254,471	1.27	0.06	20.84	4.35	6.02	38.22
Total	**180,083,661**	**0.92**	**0.12**	**46.91**	**2.22**	**2.63**	**25.92**

Table 6-13: Onça Puma Nickel Project - Total Production Plan

Mineralized Saprolite + Waste + Limonite Production Plan

Year	Mineralized Saprolite(t)	Waste + Limonite			Waste:Mineralized Saprolite (t:t)
		Waste (t)	Limonite (t)	Total (t)	
2010	2,418,184	408,796	1,811,813	2,220,609	0.92
2011	3,654,514	1,428,397	2,398,277	3,826,674	1.05
2012	6,403,866	775,576	1,375,013	2,150,589	0.34
2013	5,034,735	784,915	3,732,119	4,517,035	0.90
2014	3,631,607	1,879,899	3,927,891	5,807,790	1.60
2015	1,045,623	5,337,829	2,943,570	8,281,399	7.92
2016	39,609	11,928,654	3,631,737	15,560,391	392.85
2017	289,007	8,478,269	6,832,724	15,310,993	52.98
2018	938,070	7,512,230	7,149,700	14,661,930	15.63
2019	2,483,669	5,010,828	8,105,503	13,116,331	5.28
2020	3,730,680	4,894,603	6,974,717	11,869,320	3.18
2021	3,684,375	4,926,437	6,989,187	11,915,625	3.23
2022	6,228,369	4,554,298	4,817,334	9,371,631	1.50
2023	7,058,976	5,534,745	3,006,280	8,541,024	1.21
2024	5,041,051	6,852,897	3,706,052	10,558,949	2.09
2025	111,759	7,905,248	7,582,993	15,488,241	138.59
2026	764,423	5,426,456	9,409,122	14,835,577	19.41
2027	1,415,982	6,658,460	7,525,559	14,184,018	10.02
2028	2,190,045	5,709,536	7,700,418	13,409,955	6.12
2029	2,161,272	6,442,597	6,996,131	13,438,728	6.22
2030	2,382,004	4,442,145	8,775,851	13,217,996	5.55
2031	2,413,123	4,897,019	8,289,859	13,186,877	5.46
2032	3,824,319	3,663,157	8,112,523	11,775,681	3.08
2033	4,589,783	4,315,129	6,695,087	11,010,217	2.40
2034	6,157,416	4,216,230	5,226,354	9,442,584	1.53
2035	2,214,969	2,743,065	10,641,965	13,385,031	6.04
2036	4,803,920	3,475,890	7,320,190	10,796,080	2.25
2037	6,307,377	5,966,148	3,326,475	9,292,623	1.47
2038	1,039,948	6,934,624	7,625,428	14,560,052	14.00
2039	4,304,212	7,096,469	4,199,319	11,295,788	2.62
2040	4,835,524	2,553,377	3,254,471	5,807,849	1.20
Total	**101,198,409**	**152,753,927**	**180,083,661**	**332,837,588**	**3.29**

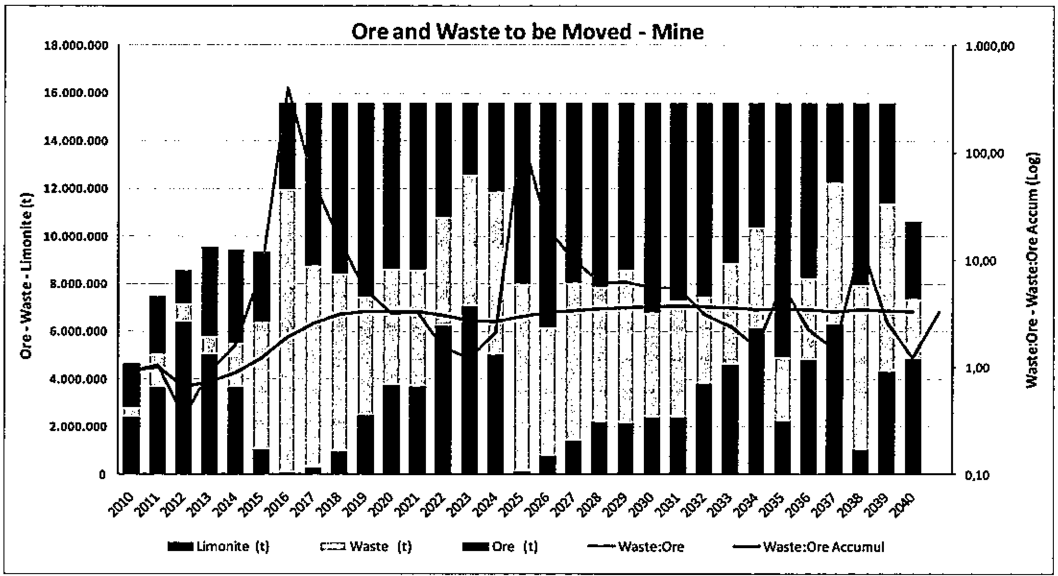

Figure 6-40: Ore production and waste removal – Onça-Puma project

Mine Fleet

The Onça and Puma mine will be owners operated using small equipment due to the needs of selectivity. The main and auxiliary equipment are described below:

- Backhoes excavators (5.2 m^3) CAT 365 CL: Loading on the mine
- Articulated Trucks (40 t) CAT 740: Hauling from mine to intermediated stockpile
- Front Loader (6 m^3) CAT 988H: Loading on the intermediated stockpile: re-handling to plant
- Rigid Trucks Scania (8x4 – 30 t): Hauling from intermediated stockpile to plant
- Drill Machine: Drilling for blasting
- Cat 320 CL with Rock Break: Break big blocks
- Motor grader Cat 12H: Roads maintenance
- Dozer Cat D9: Auxiliary Services
- Dozer Cat D6: Auxiliary Services
- Water Truck: To wet the access roads
- Service Truck: "Gas station"

Articulated trucks have longer operational cycles (they are slower than rigid trucks) and larger operational costs. The use of this type of trucks is indicated for severe working conditions. During the rain season the trucks manage to operate in the mine but all roads and accesses get deteriorated to a point that other vehicles cannot circulate. This makes it really difficult for other teams to have access (surveying, grade control, etc.) to the pits. In this case, it is important to build the accesses in the dry season and provide appropriate maintenance for the give traffic of conventional vehicles.

The following Table 6-14 and Figures 6-41 and 6-42 present the LOM equipment fleet estimated on the MRMR 2009.

Table 6-14: Onça and Puma LOM Mine fleet

Estimated Mine Fleet

Year	DRILL Samp.	DRILL Blasting	CAT 365CL	CAT 988H	CAT 740	SCANIA	CAT 12H	CAT 938G	CAT D6R	CAT D8T	CAT D9T	SERV. TRUCK	WATER TRUCK	CAT 320CL CAC	CAT 320CL Breaker
2008	1	1	4	3	16	15	5	1	2	1	6	5	5	1	1
2009	1	1	6	4	25	22	9	1	2	1	10	6	5	1	1
2010	1	1	6	4	25	21	9	1	2	1	10	6	5	1	1
2011	1	1	6	4	25	19	9	1	2	1	10	6	5	1	1
2012	1	1	6	4	25	19	9	1	2	1	10	6	5	1	1
2013	1	1	6	4	25	9	9	1	2	1	10	6	5	1	1
2014	1	2	10	4	44	8	9	1	2	1	10	6	5	1	1
2015	1	2	10	4	45	8	9	1	2	1	10	6	5	1	1
2016	1	2	10	4	46	8	9	1	2	1	10	6	5	1	1
2017	1	2	10	4	47	8	9	1	2	1	10	6	5	1	1
2018	1	2	10	4	47	14	9	1	2	1	10	6	5	1	1
2019	1	2	11	4	48	6	9	1	2	1	10	6	5	1	1
2020	1	2	10	4	44	6	9	1	2	1	10	6	5	1	1
2021	1	2	10	4	45	6	9	1	2	1	10	6	5	1	1
2022	1	2	10	4	46	6	9	1	2	1	10	6	5	1	1
2023	1	2	10	4	47	6	9	1	2	1	10	6	5	1	1
2024	1	2	10	4	47	6	9	1	2	1	10	6	5	1	1
2025	1	2	11	4	48	6	9	1	2	1	10	6	5	1	1
2026	1	2	10	4	44	6	9	1	2	1	10	6	5	1	1
2027	1	2	10	4	45	6	9	1	2	1	10	6	5	1	1
2028	1	2	10	4	46	6	9	1	2	1	10	6	5	1	1
2029	1	2	10	4	47	6	9	1	2	1	10	6	5	1	1
2030	1	2	10	4	47	6	9	1	2	1	10	6	5	1	1
2031	1	2	11	4	48	6	9	1	2	1	10	6	5	1	1
2032	1	2	10	4	44	18	9	1	2	1	10	6	5	1	1
2033	1	2	10	4	45	18	9	1	2	1	10	6	5	1	1
2034	1	2	10	4	46	18	9	1	2	1	10	6	5	1	1
2035	1	2	10	4	47	19	9	1	2	1	10	6	5	1	1
2036	1	2	10	4	47	13	9	1	2	1	10	6	5	1	1
2037	1	2	11	4	48	17	9	1	2	1	10	6	5	1	1
2038	1	2	7	3	30	18	9	1	2	1	10	6	5	1	1
2039	0	0	0	3	0	18	4	1	1	0	3	3	2	1	1
2040	0	0	0	3	0	18	4	1	1	0	3	3	2	1	1
2041	0	0	0	3	0	19	4	1	1	0	3	3	2	1	1

The equipment fleet seems to be properly sized considering the required production targets and mining selectivity.

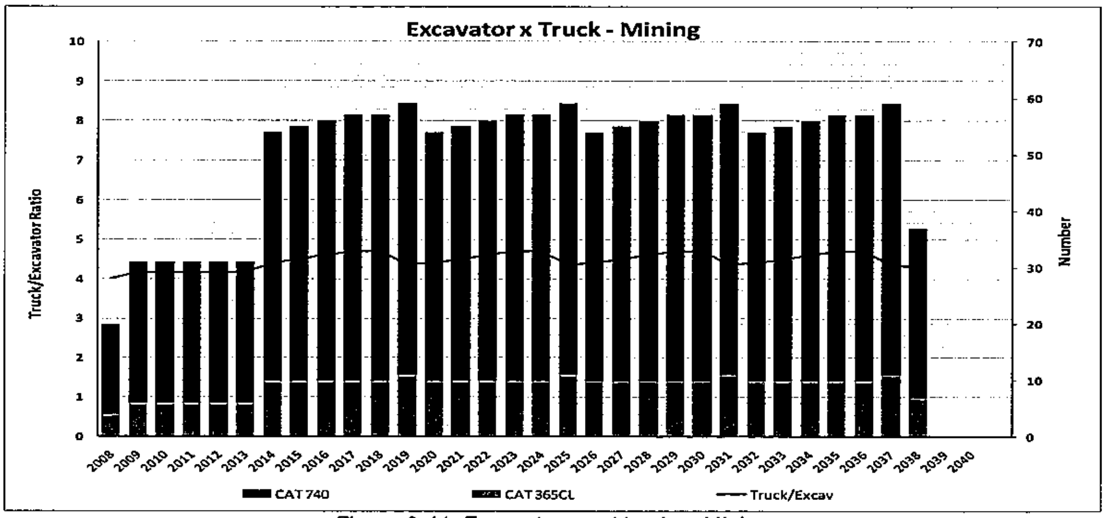

Figure 6-41: Excavators and trucks - Mining

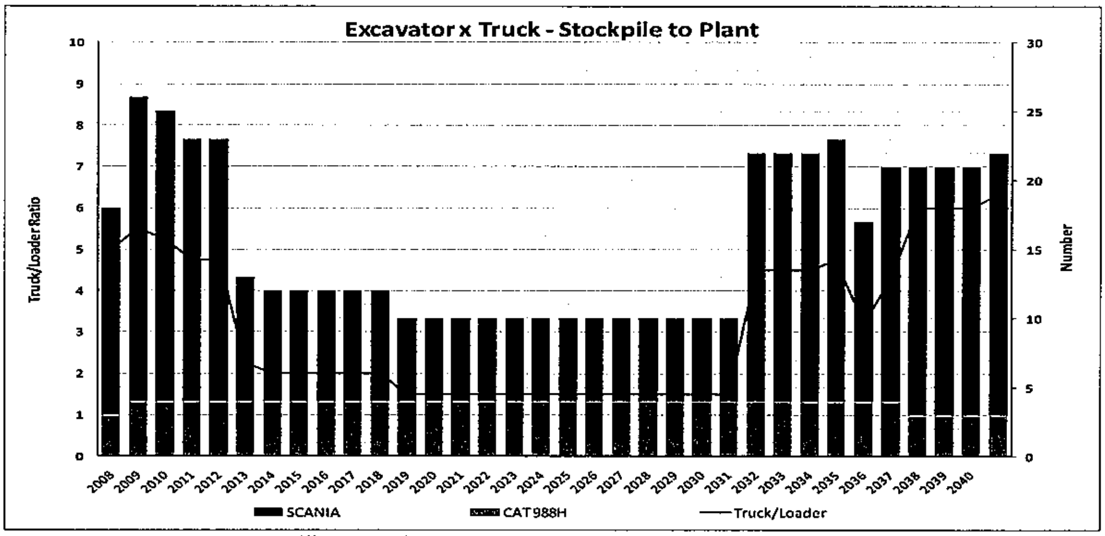

Figure 6-42: Loaders and trucks - Stockpile to plant

The following Figure 6-43 to Figure 6-52 show the mine and the main equipment operating at the Onça Mine.

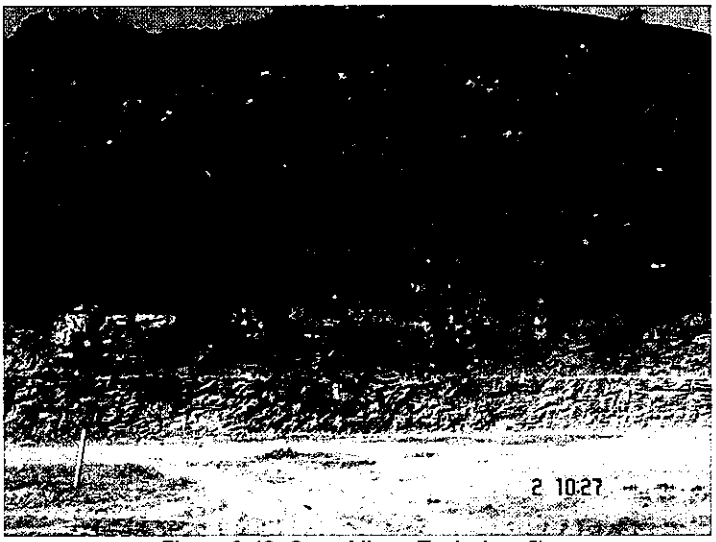

Figure 6-43: Onça Mine - Typical profile

Figure 6-44: Onça Mine – Mining operations

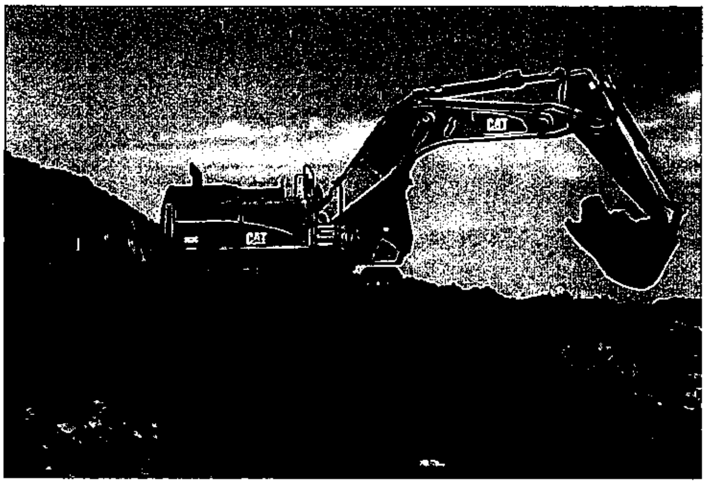

Figure 6-45: Onça Mine - CAT 365C loading ore

Figure 6-46: Onça Mine – CAT 740 articulated truck hauling ore

Figure 6-47: Onça Mine - Atlas Copco drilling machine (blasting)

Figure 6-48: Onça Mine - CAT 320D equipped with breaker

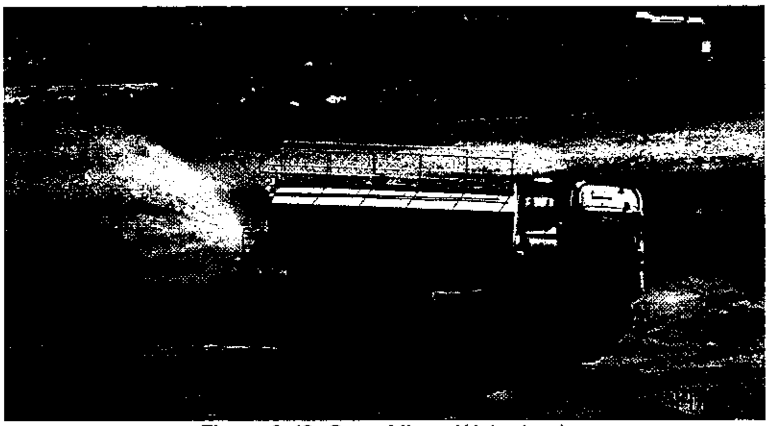

Figure 6-49: Onça Mine - Water truck

Figure 6-50: Onça Mine – Service truck (fuel)

Figure 6-51: Onça Mine - Ore stock piles

Figure 6-52: Onça Mine - Scania trucks (30 t capacity)

Short Term Mining Plan

The mining operations are planned using production maps (diglines) based on the small mining unity (SMU) considering blocks 6.25x6.25x3.00 m to be mined in the same direction of the block model. The maps are produced based on the drilling information, geological interpretation and 3D model and estimation. Figure 6-53 shows an example of the production map.

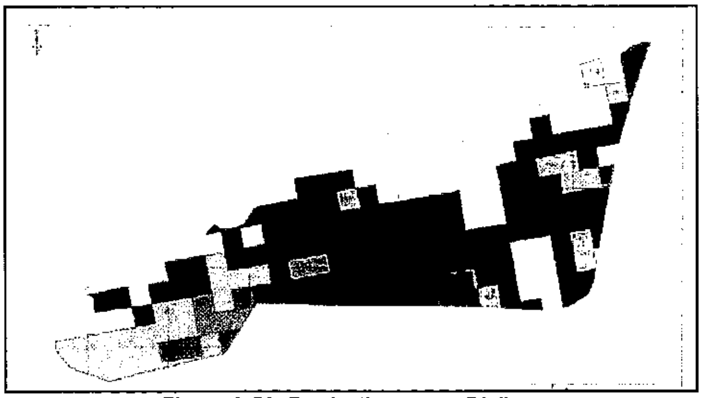

Figure 6-53: Production map - Diglines

Mining Control

The diglines are exported to the SmartMine dispatch system (coordinates, grades and tones). The mining equipment are equipped with high precision GPS devices connected to the dispatch control system. Field geologists provide eventual corrections to guarantee the correct distribution of the material to the designed piles. The following Figure 6-54 shows the mining planning and control system used at the Onça Mine.

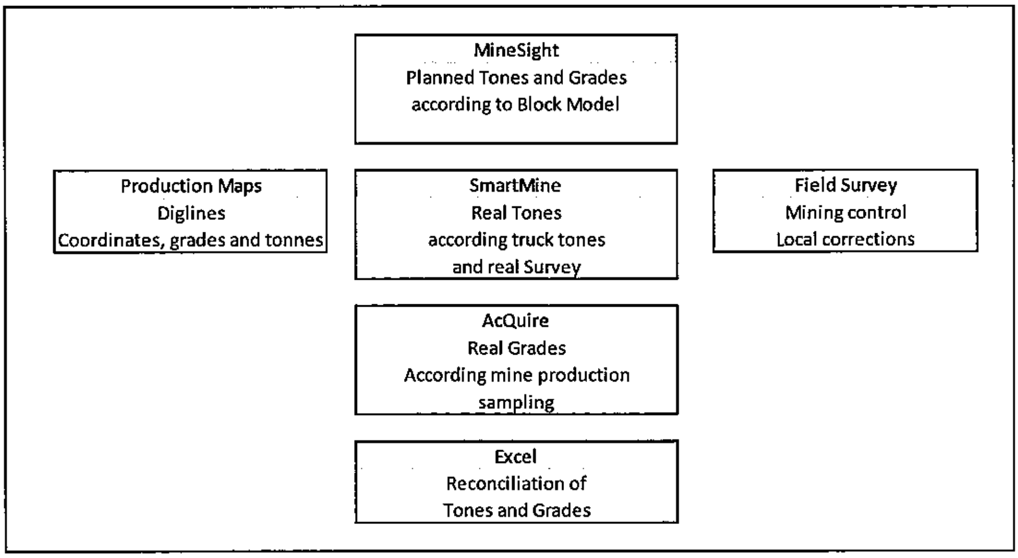

Figure 6-54: Mining planning and control system

A dispatch system is currently installed and will generate a useful database that can be used for planning and production control. It is important that periodic reports be produced not only with the historic information but pointing to trends in the evolution of the main control variables. This will allow for pro-active decision making to react to grade trends that may be detrimental to meeting production targets.

Processing Plant

The Onça Puma pyro-metallurgical plant, built with RKEF technology, is located at the extreme East of the Onça ridge. The installed capacity is to produce 52,000 tonnes of nickel per year contained in a 25% grade ferronickel using two independent production lines (drying, calcining, smelting and refining). The plant will treat the saprolitic mineralized material from Onça and Puma hills which will be transported to the plant by 40 tonnes capacity trucks. Figure 6-55 shows a general view of the processing plant.

Figure 6-55: Onça Puma metallurgical plant

The slag will be transported by trucks from the metallurgical plant to the disposal areas (Figure 6-56).

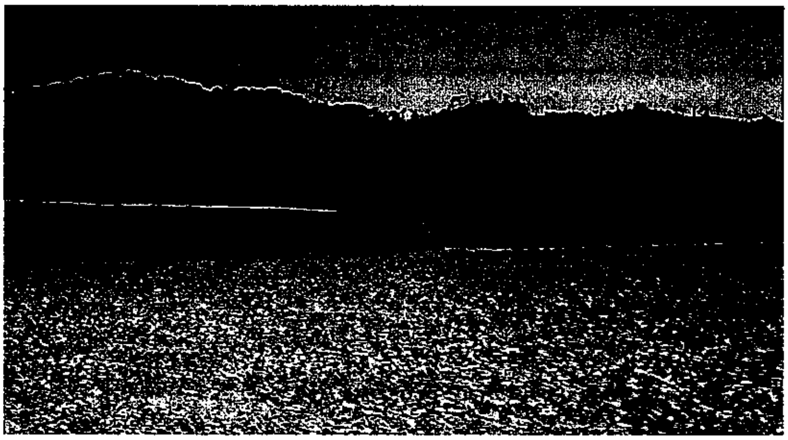

Figure 6-56: Onça Puma metallurgical plant - Slag disposition area

Plant Feed Parameters

The plant feed specs and the key process parameters are presented on Table 6-15 and Table 6-16

Table 6-15: Plant feed parameters

Feed specification ranges for Life-of-Mine Plan			
Parameter	**Pref.**	**Minimum**	**Maximum**
Fe (%)		10.00	20.00
Fe/Ni		5.00	10.00
SiO2/MgO		1.40	1.90
Ni/Co	>30.00	25.00	
Al2O3 (%)	<4.00		
Cr2O3 (%)	<3.00		

Table 6-16: Process plant equipment - Key parameters

Equip.	Dimensions	Nominal Throughput	Features
Dryer	6.0 m diameter 45 m long	255 wt/h @ 25% moisture	Coal fired
Kiln	6.0 m diameter (shell) 135 m long	160 dt/h dry product + 41 dt/h agglomerated dust	Coal fired, tertiary air, coal scoop, lifters, dams
Furnace	Rectangular Furnace 33.5 x 11.4 m	12 t/h FeNi 138 t/h slag	6-electrode, waffle and plate cooling, 3x40 MVA transformers, 6 slag and 2 metal tap holes
Refining		65 t heats in 180 minutes	3 graphite electrodes, 7 storage bins, deslaging rakes, 1 shotting tank
Dust handling	3 lines	85.5 dt/h	Kiln dust cooler, pug mixer, 65 t/h vacuum

Process Flowsheet

The following Figure 6-57 shows the simplified process flowsheet (one process line) of the Onça Puma Metallurgical Plant.

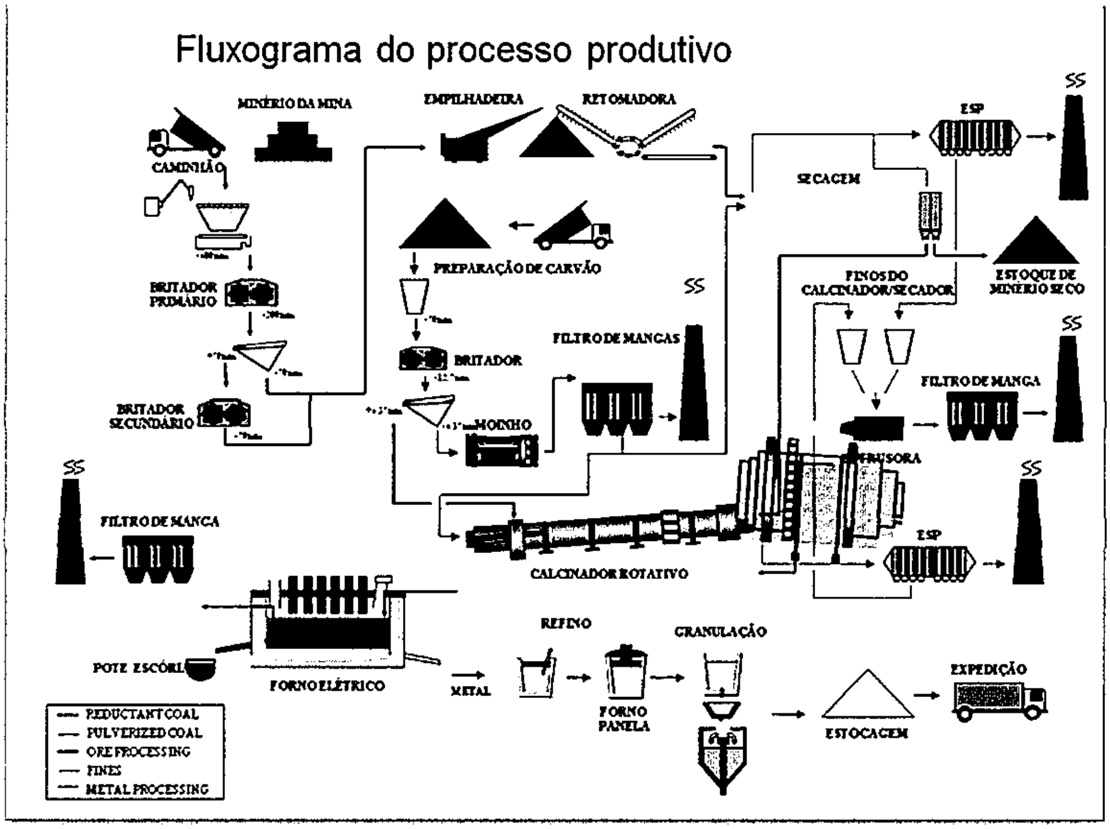

Figure 6-57: Onça Puma metallurgical plant – Simplified process flow sheet

Plant Feed Program

Table 6-17, and Figure 6-58 and Figure 6-59 show the scheduled plant ore feed.

Table 6-17: Onça Puma Plant Feed

Plant Feed											
Year	**Ore (t)**	**Ni (%)**	**Co (%)**	**SiO_2 (%)**	**MgO (%)**	**Al_2O_3 (%)**	**Fe (%)**	**SiO_2:MgO**	**Ni:Co**	**Fe:Ni**	**Ni Cont. (t)**
2010	457.340	2,54	0,09	38,44	23,11	1,45	13,70	1,66	28,68	5,40	11.594
2011	1.112.520	2,21	0,08	38,56	22,75	1,94	14,00	1,70	28,51	6,34	24.553
2012	2.259.350	2,42	0,06	39,21	23,19	1,43	13,96	1,69	43,27	5,77	54.674
2013	2.554.000	2,49	0,04	39,75	23,00	1,57	13,96	1,73	64,25	5,61	63.552
2014	2.560.998	2,40	0,04	38,17	24,44	1,50	13,89	1,56	54,66	5,79	61.446
2015	2.554.000	2,21	0,05	37,63	24,59	1,58	14,01	1,53	48,83	6,35	56.360
2016	2.554.000	2,09	0,03	38,73	24,33	1,47	13,86	1,59	74,05	6,64	53.312
2017	2.554.000	1,85	0,03	39,67	25,40	1,29	12,64	1,56	70,22	6,85	47.137
2018	2.560.998	1,71	0,03	40,74	25,82	1,66	11,29	1,58	57,11	6,59	43.853
2019	2.554.000	1,65	0,04	42,76	24,42	1,61	11,17	1,75	43,85	6,78	42.086
2020	2.554.000	1,79	0,05	39,73	23,64	1,78	13,49	1,68	34,37	7,56	45.592
2021	2.554.000	1,74	0,06	40,24	24,28	1,26	13,16	1,66	29,08	7,57	44.391
2022	2.560.998	1,86	0,06	40,11	22,80	1,45	14,01	1,76	31,15	7,53	47.670
2023	2.554.000	1,82	0,06	38,43	23,72	1,83	14,09	1,62	32,08	7,76	46.383
2024	2.554.000	1,53	0,05	34,69	22,60	3,01	16,51	1,53	32,14	10,80	39.041
2025	2.554.000	1,52	0,05	36,33	23,55	2,30	15,34	1,54	33,00	10,09	38.836
2026	2.560.998	1,60	0,04	37,42	25,36	1,38	13,89	1,48	36,39	8,66	41.067
2027	2.554.000	1,58	0,04	40,74	26,23	1,06	11,54	1,55	41,04	7,30	40.384
2028	2.554.000	1,52	0,05	41,62	24,56	1,13	12,25	1,69	32,95	8,07	38.776
2029	2.554.000	1,48	0,05	41,34	24,17	1,11	12,74	1,71	28,02	8,58	37.898
2030	2.560.998	1,44	0,05	40,95	24,55	1,10	12,67	1,67	29,68	8,81	36.841
2031	2.554.000	1,51	0,04	40,52	25,50	1,19	12,04	1,59	35,49	7,99	38.471
2032	2.043.885	1,73	0,06	42,69	22,01	1,53	13,00	1,94	30,76	7,50	35.411
2033	2.554.000	1,80	0,06	40,47	23,38	1,52	13,15	1,73	32,17	7,32	45.892
2034	2.560.998	1,85	0,05	36,59	24,09	2,30	14,05	1,52	36,45	7,58	47.475
2035	2.554.000	1,57	0,04	39,70	22,27	3,02	13,92	1,78	37,25	8,84	40.215
2036	2.554.000	1,72	0,04	38,96	22,99	2,63	14,25	1,69	40,09	8,27	44.015
2037	2.554.000	1,65	0,04	37,37	24,17	2,10	14,76	1,55	37,79	8,96	42.074
2038	2.560.998	1,48	0,04	38,55	23,74	2,47	14,25	1,62	37,52	9,65	37.801
2039	2.554.000	1,57	0,05	39,43	22,64	2,54	13,94	1,74	33,16	8,87	40.151
2040	2.554.000	1,55	0,04	38,46	24,04	2,27	13,99	1,60	43,19	9,04	39.542
2041	2.554.000	1,42	0,03	37,51	25,48	1,95	14,06	1,47	51,43	9,92	36.192
2042	2.560.998	1,37	0,02	38,26	25,40	1,56	13,92	1,51	58,28	10,19	34.993
2043	2.554.000	1,31	0,03	38,36	29,19	1,08	11,29	1,31	50,95	8,62	33.452
2044	163.721	1,15	0,02	38,24	30,66	0,72	10,22	1,25	48,80	8,89	1.882
Total	82.712.802	**1,73**	**0,04**	**39,19**	**24,24**	**1,74**	**13,47**	**1,62**	**39,36**	**7,78**	**1.433.011**

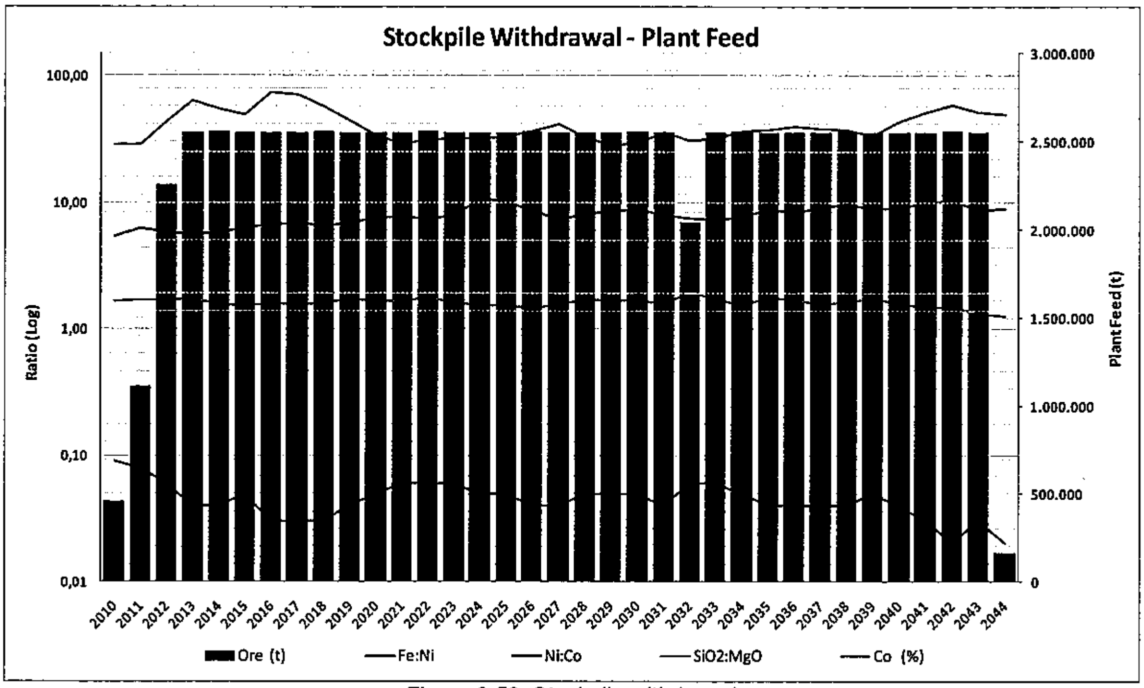

Figure 6-58: Stockpile withdrawal

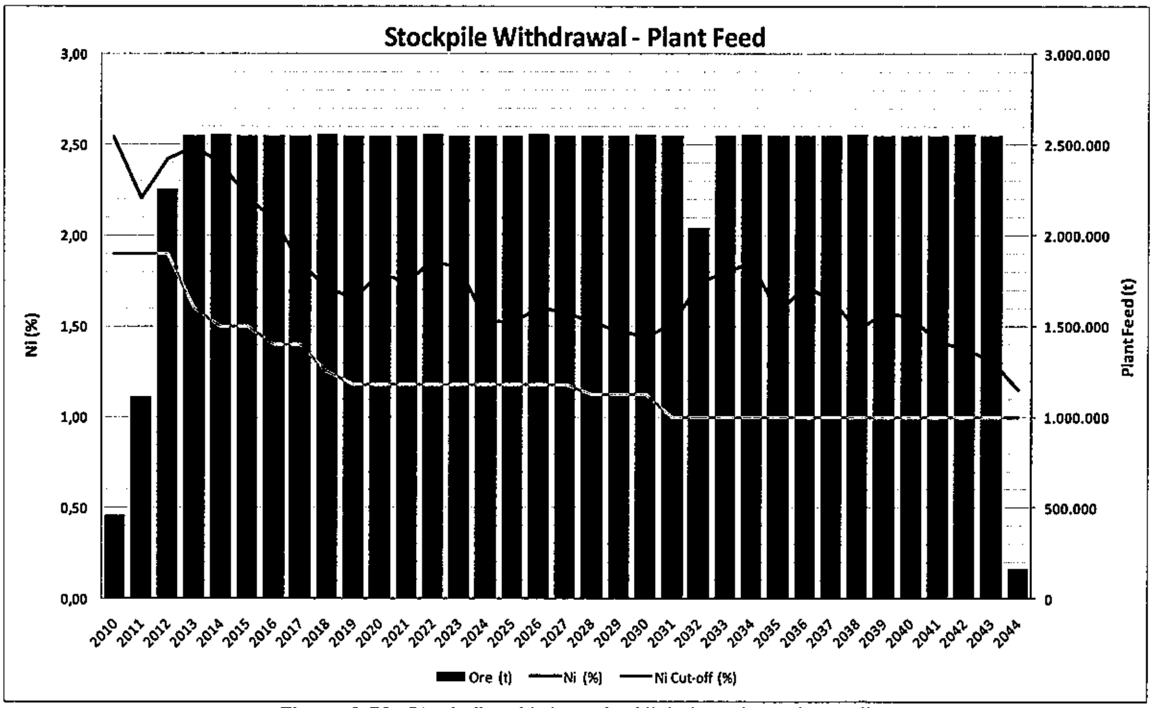

Figure 6-59: Stockpile withdrawal – Nickel grade and cut-off

Metal Recoveries

The following Table 6-18 shows the plant feed program and the expected metallurgical recovery.

Table 6-18: Plant Feed and Metal Recovery

Plant Feed				Metal Recovery	
Year	**Plant feed (t)**	**Nickel (%)**	**Ni Cont. (t)**	**%**	**Ni (t)**
2010	457,340	2.54	11,594	92.00	10,666
2011	1,112,520	2.21	24,553	92.00	22,588
2012	2,259,350	2.42	54,674	92.00	50,300
2013	2,554,000	2.49	63,552	92.00	58,468
2014	2,560,998	2.40	61,446	92.00	56,531
2015	2,554,000	2.21	56,360	92.00	51,851
2016	2,554,000	2.09	53,312	92.00	49,047
2017	2,554,000	1.85	47,137	92.00	43,366
2018	2,560,998	1.71	43,853	92.00	40,344
2019	2,554,000	1.65	42,086	92.00	38,719
2020	2,554,000	1.79	45,592	92.00	41,944
2021	2,554,000	1.74	44,391	92.00	40,839
2022	2,560,998	1.86	47,670	92.00	43,856
2023	2,554,000	1.82	46,383	92.00	42,672
2024	2,554,000	1.53	39,041	92.00	35,918
2025	2,554,000	1.52	38,836	92.00	35,729
2026	2,560,998	1.60	41,067	92.00	37,781
2027	2,554,000	1.58	40,384	92.00	37,154
2028	2,554,000	1.52	38,776	92.00	35,674
2029	2,554,000	1.48	37,898	92.00	34,866
2030	2,560,998	1.44	36,841	92.00	33,893
2031	2,554,000	1.51	38,471	92.00	35,393
2032	2,043,885	1.73	35,411	92.00	32,578
2033	2,554,000	1.80	45,892	92.00	42,221
2034	2,560,998	1.85	47,475	92.00	43,677
2035	2,554,000	1.57	40,215	92.00	36,998
2036	2,554,000	1.72	44,015	92.00	40,494
2037	2,554,000	1.65	42,074	92.00	38,708
2038	2,560,998	1.48	37,801	92.00	34,777
2039	2,554,000	1.57	40,151	92.00	36,939
2040	2,554,000	1.55	39,542	92.00	36,378
2041	2,554,000	1.42	36,192	92.00	33,297
2042	2,560,998	1.37	34,993	92.00	32,193

Plant Feed				Metal Recovery	
Year	Plant feed (t)	Nickel (%)	Ni Cont. (t)	%	Ni (t)
2043	2,554,000	1.31	33,452	92.00	30,776
2044	163,721	1.15	1,882	92.00	1,732
Total	**82,712,802**	**1.73**	**1,433,011**		**1,318,370**

The ferronickel production will be transported by trucks to Parauapebas (rail transhipment terminal) and there to the São Luiz Port by train (Estrada de Ferro de Carajás – EFC).

6.14 Reported Mineral Reserve

The estimated mineral reserves (Table 6-19) constitute that part of the deposit where feasibility studies, including mining plans, schedules and economic analysis have been carried out on estimated measured and indicated mineral resources only and outside the Xikrin aboriginal reserve. These estimates incorporate mining recovery and mining dilution factors.

All and mineral reserves are stated according to the tonnage and grades of the material intended to be treated at the planned ferro nickel process plant. Onça Puma has indicated that screening of this material is not necessary. These estimates represent the product from dryer kilns and delivered to smelting operations. The estimated mineral reserves do not include the nickel losses due to smelting.

Table 6-19: June 30, 2010 Onça Puma FeNi Proven and Probable Reserves

	Million Tonnes	Ni %	Co %	Fe %	SiO_2 %	MgO %
Proven	55.1	1.79	0.044	13.4	39.30	24.29
Probable	27.6	1.62	0.043	13.7	38.96	24.14
Total	**82.7**	**1.73**	**0.044**	**13.5**	**39.19**	**24.24**

The mine production schedule extends for a 35 year period and should be completed by year 2044 and includes the reclamation of stockpiles. The maximum plant throughput and plant feed chemistry requirements for metal output are respected throughout.

6.15 Reconciliation and Reserve Audits

Mineral resources and mineral reserves have previously been audited/reviewed by AMEC in 2005. The mineral resource data, procedures and model being audited by Golder is fundamentally unchanged since the previous AMEC audit. However, Vale has continued RC pre-production, grade control drilling since the last audit. This RC drilling data is not incorporated in the model currently being reviewed and is not used by Golder in this audit process.

AMEC carried out a review of a world class test mining program carried out by MOP. The review included

- Validation of Test Mine reconciliation tons and grades, F1, F2 and F3.
- Validation of Onça Puma long-term reserves.
- Validation of short-term mine planning methodology: production drilling, 6.25 m grid spacing, geological modeling, short-term resource estimate, ore tagging strategy into the block model, dig-line production map, and grade control at the mine front.
- Validation of QAQC of Test Mine data, sample preparation protocol and sampling methodology for production samples.
- Validation of mining methodology, mining bench/pit parameters and equipment fleet.

As part of this review AMEC reconciled tonnages and grades of oretypes predicted by the ore-control model to the as-mined tonnages and grades measured by truck counts, surveyed pits and truck and crusher samples. The purpose of the reconciliation was to assess the accuracy of the ore-control models in preparing production forecasts.

The results of the test mining program confirm the effectiveness of operational mining parameters used to estimate mineral reserves. The reconciliation system designed by MOP will assist in improving the understanding about mining selectivity and equipment performance which will be key factors controlling the effective mining recovery.

6.16 Environmental

The main environmental control during the operation of the Onça Puma Nickel Project will be related to the sediment control inside the site areas to avoid discharges to the natural drainage system. The most sensitive point is the Catete river that flows to the Xicrin indigenous reserve situated close to the Puma mine site. It is planned that a system of dikes will receive the waters from the operational areas to retain the solids and provide effluent discharges in accord with the legislation.

Mineração Onça Puma (MOP) currently has, the environmental licenses to operate the mine and the processing plant as showed in the following Figure 6-60. The operational licenses (LO) for the processing plant and for mining should be renewed in 2011 and 2014, respectively. The licensing process to construct the access road to the Puma site and related to the water catchment and effluent discharges systems still are under analysis by the environmental agency (SEMA/PA).

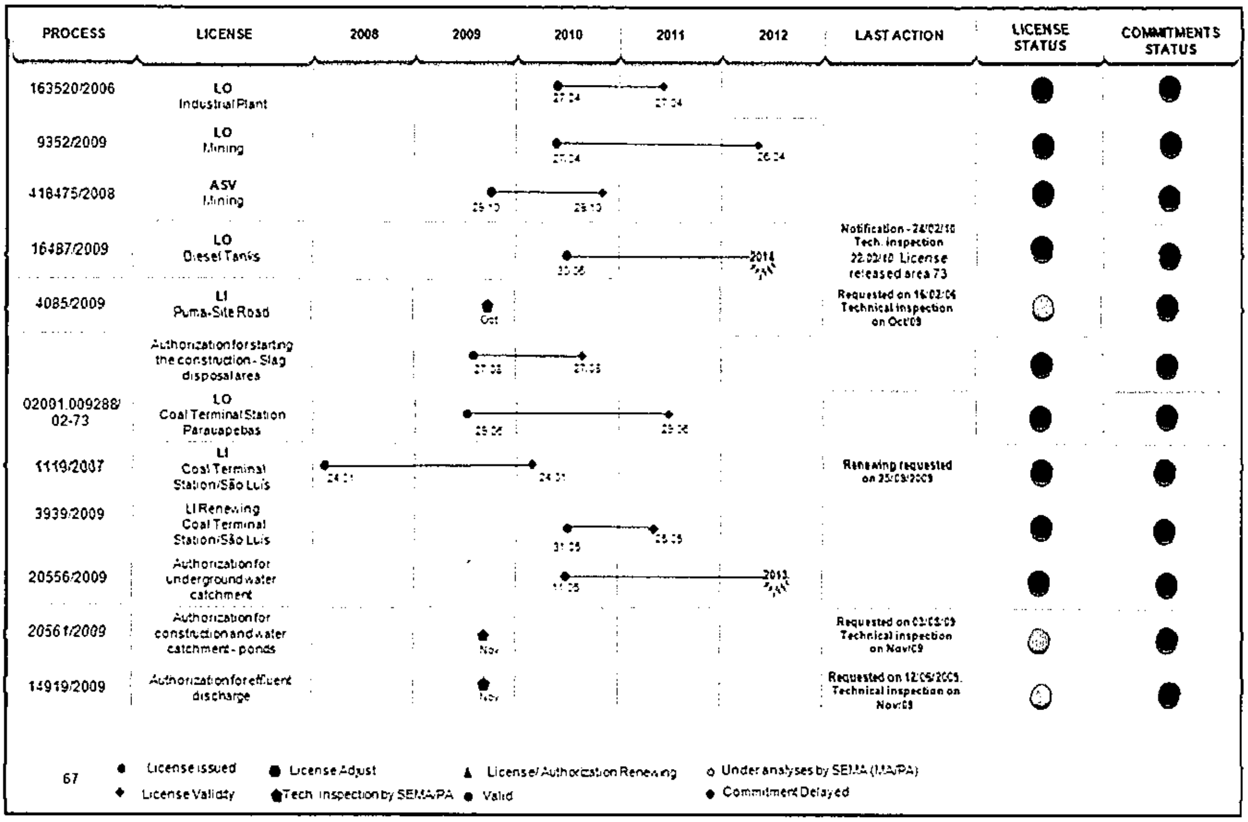

Figure 6-60: Onça Puma Nickel Project - Environmental licensing status

6.17 Community and Government Affairs

Onça Puma is in the process of implementing a sustainability programme in partnership with local municipalities to improve the quality of life. The cost of this programme is approximately US$12 million, which will reportedly be used for the construction of a hospital, schools and education centres, local waste management facilities and housing for low income families.

6.18 Operating Costs

The average LOM unitary Opex adopted on the MRMR 2009 is shown on the following Table 6-20.

Table 6-20: Average Unitary Operating Costs

Average Unitary Opex

	Material (Waste + Ore)	Ore	Nickel	
	(US$/t)	(US$/t)	(US$/t)	(US$/lb)
1. MINING	**6.63**	**28.42**	**2,181.46**	**0,99**
1.1. Mining	5.02	21.52	1,652.22	0.75
1.1.1 Short Term Planning	0.17	0.72	55.05	0.02
1.1.2 Drilling & Blasting	0.07	0.30	22.73	0.01
1.1.3 Loading	0.64	2.74	210.65	0.10
1.1.4 Hauling	1.82	7.81	599.49	0.27
1.1.5 Auxiliary & Support Activities	1.61	6.90	529.94	0.24
1.1.6 Crushing/ Blending	0.71	3.05	234.36	0.11
1.2 Mining Maintenance	1.41	6.04	463.97	0.21
1.3 Mining Management and Support	0.20	0.85	65.27	0.03
2. METALLURGY		**83.49**	**6,408.76**	**2.91**
2.1 Drying		7.19	551.69	0.25
2.2 Calcining		24.69	1,895.25	0.86
2.3 Smelting		37.34	2,866.32	1.30
2.4 Slag Disposal		0.61	46.79	0.02
2.5 Refining		8.40	644.87	0.29
2.6 Shotting		0.12	9.13	0.00
2.7 Utilities		2.20	168.90	0.08
2.8 Milling Maintenance		2.41	185.12	0.08
2.9 Milling Management & Support		0.53	40.71	0.02
3. LOGISTICS			**485.82**	**0.22**
3.1 Road Transport Ourilândia-Parauapebas			148.65	0.07
3.2 Handling & Loadout Parauapebas			30.99	0.01
3.3 Railway Transport Parauapebas-São Luís			77.20	0.04
3.4 Handling and Loadout São Luís			160.94	0.07
3.5 Road Transport Ourilândia->SE Region			61.89	0.03
3.6 Logistics Support			6.14	0.00
4. GENERAL & ADMINISTRATIVE			**714.54**	**0.32**
4.1 General Operations Managing			8.33	0.00
4.2 Production Planning & Control			74.78	0.03
4.3 Geology Long Term Planning			11.63	0.01
4.4 Health, Safety & Environment			66.25	0.03

4.5 Operational Support			49.61	0.02
4.6 Administrative Support			70.26	0.03
4.7 Administrative Services			294.55	0.13
4.8 Other General Costs			139.14	0.06
Total Unitary Opex	**29.74**	**127.55**	**9,790.58**	**4.44**

The total LOM Opex is shown on Table 6-21.

Table 6-21: Onça Puma Nickel Project - Total LOM Opex

LOM Opex (US$ '000)	
1. MINING	**2,875,969**
1.1. Mining	**2,178,232**
1.1.1 Short Term Planning	72,582
1.1.2 Drilling & Blasting	29,961
1.1.3 Loading	277,720
1.1.4 Hauling	790,348
1.1.5 Auxiliary & Support Activities	698,652
1.1.6 Crushing/ Blending	308,968
1.2 Mining Maintenance	611,687
1.3 Mining Management and Support	86,050
2. METALLURGY	**8,449,122**
2.1 Drying	727,331
2.2 Calcining	2,498,641
2.3 Smelting	3,778,864
2.4 Slag Disposal	61,680
2.5 Refining	850,175
2.6 Shotting	12,033
2.7 Utilities	222,678
2.8 Milling Maintenance	244,051
2.9 Milling Management & Support	53,670
3. LOGISTICS	**640,487**
3.1 Road Transport Ourilândia-Parauapebas	195,971
3.2 Handling & Loadout Parauapebas	40,862
3.3 Railway Transport Parauapebas-São Luís	101,782
3.4 Handling and Loadout São Luís	212,174
3.5 Road Transport Ourilândia->SE Region	81,597
3.6 Logistics Support	8,101

4. GENERAL & ADMINISTRATIVE	942,030
4.1 General Operations Managing	10,978
4.2 Production Planning & Control	98,582
4.3 Geology Long Term Planning	15,333
4.4 Health, Safety & Environment	87,339
4.5 Operational Support	65,403
4.6 Administrative Support	92,633
4.7 Administrative Services	388,330
4.8 Other General Costs	183,432
Total OPEX	**12,907,609**

6.19 Capital Costs

Table 6-22 shows the Mine LOM Capex based on the mine fleet mobilization and reposition scheduled by Vale. Golder has considered as mine sustaining Capex the expenditures to be realized from 2011 to the end of the mine life.

Table 6-22: Capital Expenditure - Mining

Year	DRILL SAMP	DRILL	CAT 365CL	CAT 988H	CAT 740	SCANIA	CAT 12H	CAT 938G	CAT D6R	CAT D8T	CAT D9T	SERV. TRUCK	WATER TRUCK	CAT 320CL CAC	CAT 320CL ROMP	Roads	Total
2007	1.522	265	1.793	1.618	7.075	2.483	1.504	235	853	500	3.600	500	500	301	301	8.003	31.052
2008			896	539	3.979	1.159	1.203				2.400	100				6.174	16.452
2009																	0
2010																	0
2011																	0
2012			1.793	1.618	7.075	2.483	1.504	235	853	500	3.600	500	500	301	301		21.263
2013	1.522	530	2.689	539	12.381	1.159	1.203				2.400	100					22.523
2014					442												442
2015					442												442
2016					442												442
2017			1.793	1.618	7.075	3.477	1.504	235	853	500	3.600	500	500	301	301		22.256
2018			3.137	539	12.823	1.159	1.203				2.400	100					21.361
2019	1.522	530			442												2.494
2020					884												884
2021					884												884
2022			1.793	1.618	7.517	3.477	1.504	235	853	500	3.600	500	500	301	301		22.698
2023			3.137	539	12.823	1.159	1.203				2.400	100					21.361
2024			448		884												1.333
2025	1.522	530			884												2.936
2026					1.326												1.326
2027			1.793	1.618	7.959	3.477	1.504	235	853	500	3.600	500	500	301	301		23.140
2028			3.137	539	13.265	1.159	1.203				2.400	100					21.804
2029			448		884												1.333
2030			448		1.326												1.775

Year	DRILL SAMP	DRILL	CAT 365CL	CAT 988H	CAT 740	SCANIA	CAT 12H	CAT 938G	CAT D6R	CAT D8T	CAT D9T	SERV. TRUCK	WATER TRUCK	CAT 320CL CAC	CAT 320CL ROMP	Roads	Total
2031	1.522	530			1.326	1.987											5.365
2032			1.793	1.618	8.401	3.477	1.504	235	853	500	3.600	500	500	301	301		23.582
2033			3.137	539	13.707	1.159	1.203				2.400	100					22.246
2034			448		1.326	166											1.940
2035			448		1.326												1.775
2036			448		1.769	2.649											4.866
2037	1.522	530	1.793	1.618	8.401	3.642	1.504	235	853	500	3.600	500	500	301	301		25.800
2038				539		1.159	1.203				2.400	100					5.402
2039																	
2040																	
2041																	
Total	9.130	2.915	31.372	15.099	137.071	35.430	18.950	1.644	5.968	3.500	42.003	4.200	3.500	2.108	2.108	14.177	329.177

The total Capex adopted on the MRMR 2009 is shown on Table 6-23. Golder was not provided with a detailed breakdown of the Plant and Infrastructure investment capital estimation.

Table 6-23: Total Capex

Initial Mine + Plant + Infra (US$)	2,524,495,914
Sustaining Capex for Mine (US$)	281,673,051
Total Capex (US$)	**2,806,168,965**

The sustaining mining capex was obtained from the mine fleet mobilization and reposition scheduled by Vale for the entire LOM starting in 2011.

6.20 Taxation

In Brazil, there are seven different taxes, duties and Royalties that are levied by the Federal, Provincial or Municipal entities. The legal taxation on the cash flow is the CFEM (Corporate Income Tax) and the CSLL (Social Contribution on Corporate Profits) that is also an income tax. The CFEM is variable for each mineral commodity and for the Nickel is 2% over the gross revenue (less the transportation costs). Furthermore, taxes are applied differently depending on whether the product is intended for the internal or external markets. In the case of Onça Puma the assumption is that 90% of the nickel product will be sold on external markets, with the balance sold on internal markets.

The income tax is calculated based on the gross profits (revenues less operating costs and depreciation) and is fixed in 25%. The CSLL is fixed in 9%. The combined rates for all levies equates to approximately 15% for internal product and between 15 and 20% for external products

6.21 Economic Evaluation of Mineral Reserves

Golder was not provided with a copy of the MOP discounted cash flow (DCF) spreadsheet model; however, Golder was permitted to review and audit the DCF model on secure Vale computers to gain an understanding of the model, to assess its correctness and to test project sensitivities to key input variables.

Key Assumptions

A summary of the key parameters used in the economic analysis for the Onça Puma is presented in Volume 1, Consolidated Report, Key Assumptions.

Cash Flow Evaluation

The cash flow forecast is based upon the updated, depleted mineral reserve estimate for the Onça Puma Deposit. The total MOP cash flow for both the Vale and three-year pricing assumptions remained positive demonstrating project economics supporting the declaration of mineral reserves.

The cash flow forecast is based on the June 30, 2010 update of the 2009 MRMR Economic Model, including mineral reserve depletion year-to-date, which reflects the following assumptions:

- The financial calculations are based on an after tax discount rate
- Taxes are calculated per the discussion in Section 6.20 of this report. Tax holidays, deferrals, and recoveries are included in the economic model.
- All costs and prices are in un-escalated "real" dollar terms.
- The operating costs include both fixed and variable cash mining costs, based on the mine plans, and milling and delivery variable cash costs based on the 2009 actual costs to the end of May, 2009.
- Fixed cash costs for the MOP overheads, the mill and corporate cost distributions are based on the 2009 budget and are included as line items, adjusted over time based on the annual ratio of the processed Ni from mineral reserves only to the total Ni production in the life of mine plan.
- Closure cash costs are included as lump sums at the end of the life of a site, following the completion of the life of mine plan.
- Unit cost assumptions are based on a defined metal throughput for the 2009 Plan (not reviewed by Golder).
- Future unit cost assumptions assume similar metal production.
- Production is based on the Onça Puma Mineral Reserves only; no external feeds or concentrates have been included in this economic analysis.
- Mill recoveries for nickel are based on a mill model, with factors updated to match the 2009 production plan.
- Revenue is calculated from the recoverable metal and the long term forecast of metal prices and exchange rate, based on SEC reporting requirements (three-year moving average prices). Revenue from the sale of a copper concentrate is included, based on the contained metal, accountability factors and the long term forecast for metals prices and exchange rates. The sale of copper anodes is addressed in the model.

Sensitivity Analysis

Golder was permitted to review and audit the DCF model on secure Vale computers to gain an understanding of the model and to assess its correctness and to test project sensitivities to key input variables.

It was observed that the model contained construction costs, reclamation and closure costs, detailed federal and provincial tax sheets, sustaining capital allowances, and the correct schedule from the (updated) 2009 MRMR reports. The base case cost and price assumptions have been updated since the release of the 2009 MRMR, and these changes are reflected within the model.

Base case cash flows were observed for individual years using the three-year moving average price assumption scenario. Using the DCF spreadsheet, significant changes were made to price and cost assumptions to test the robustness of project economics. As the models were not made available to Golder, detailed sensitivity analysis was not possible; however, the cases tested involved making +/-20% changes, in five percentage point increments, to nickel price, capital expenditure, operating costs and foreign exchange. Furthermore, Golder tested the effect of changes in discount rate between 6% and 10%, in increments of half a percentage point.

The results are presented in Figure 6-61.

In all cases, the NPV remained positive, suggesting robust project economics.

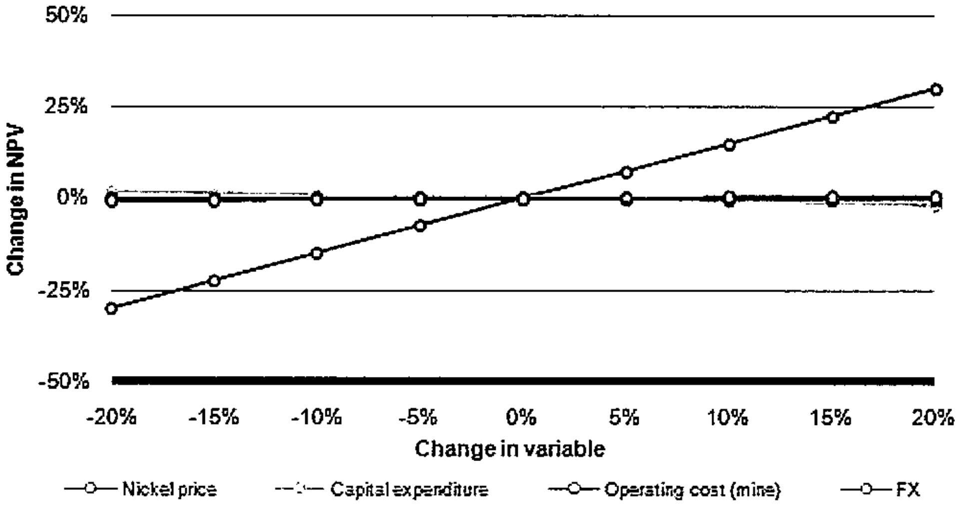

Figure 6-61: MOP sensitivity analysis

The NPV is highly sensitive to nickel price, with other variables having only negligible effect on the NPV. Nickel price in considered a highly significant value driver. The NPV was least sensitive to mine operating costs.

Conclusions and Recommendations

In both cost and pricing assumptions scenarios used (Vale and three-year moving average), positive project economics support conversion of mineral resources to mineral reserves. Under sensitivity analysis, the NPV remained positive in all cases tested, suggesting robust project economics.

6.22 Mine Life

Table 6-24 shows the mining production plan adopted for the LOM according to the MRMR 2009. However the plant will be in operation until 2044 as the lower grade material that could be blended to meet plant feed specification will be reclaimed from 2040 to 2044.

Table 6-24: Total Production for the Life of Mine

Year	Ore (t)	Ni (%)	Co (%)	SiO_2 (%)	MgO (%)	Al_2O_3 (%)	Fe (%)	SiO_2:MgO	Ni:Co	Fe:Ni
2010	2,418,184	2.24	0.07	38.78	24.57	1.42	12.78	1.58	30.93	5.71
2011	3,654,514	2.00	0.07	39.65	23.10	1.81	13.63	1.72	30.00	6.83
2012	6,403,866	2.25	0.03	38.29	23.16	1.48	14.96	1.65	73.37	6.64
2013	5,034,735	2.16	0.03	40.09	22.98	1.66	14.03	1.74	67.76	6.50
2014	3,631,607	2.02	0.05	36.85	22.49	1.91	16.41	1.64	40.36	8.11
2015	1,045,623	1.75	0.08	37.49	22.62	1.81	14.84	1.66	22.64	8.48
2016	39,609	1.49	0.05	50.31	18.12	1.26	11.66	2.78	32.82	7.84
2017	289,007	1.44	0.04	48.42	17.99	1.97	12.00	2.69	33.26	8.31
2018	938,070	1.62	0.06	45.53	19.67	3.03	11.64	2.31	28.78	7.20
2019	2,483,669	1.62	0.05	45.70	19.32	1.99	12.89	2.37	29.44	7.96
2020	3,730,680	1.73	0.06	39.93	21.18	2.14	14.99	1.89	28.28	8.65
2021	3,684,375	1.67	0.07	41.39	22.29	1.35	13.91	1.86	24.91	8.34
2022	6,228,369	1.67	0.06	38.92	23.19	1.64	14.42	1.68	29.22	8.61
2023	7,058,976	1.63	0.05	36.58	25.22	1.86	14.14	1.45	34.54	8.66
2024	5,041,051	1.43	0.04	34.00	24.61	2.85	15.58	1.38	40.08	10.88
2025	111,759	1.76	0.07	46.73	15.18	1.06	16.39	3.08	25.34	9.32
2026	764,423	1.59	0.07	47.94	16.09	1.13	14.80	2.98	23.74	9.32
2027	1,415,982	1.59	0.06	46.97	17.66	1.16	14.19	2.66	25.13	8.94
2028	2,190,045	1.51	0.07	45.20	18.45	1.22	14.65	2.45	21.64	9.69
2029	2,161,272	1.52	0.08	43.68	18.64	1.21	15.43	2.34	19.36	10.15
2030	2,382,004	1.46	0.07	43.13	18.81	1.26	15.50	2.29	19.82	10.61
2031	2,413,123	1.52	0.07	43.43	18.80	1.68	14.80	2.31	20.97	9.75
2032	3,824,319	1.60	0.06	43.20	19.77	1.91	14.20	2.19	24.58	8.90
2033	4,589,783	1.77	0.06	40.21	22.89	1.60	13.63	1.76	30.43	7.68
2034	6,157,416	1.69	0.05	36.58	24.21	2.68	13.98	1.51	35.18	8.26
2035	2,214,969	1.50	0.05	42.57	18.15	3.53	15.43	2.35	30.76	10.31
2036	4,803,920	1.57	0.05	38.23	21.50	2.27	16.53	1.78	31.58	10.56
2037	6,307,377	1.43	0.04	36.79	22.55	2.79	16.29	1.63	36.85	11.42
2038	1,039,948	1.54	0.07	41.42	17.67	4.26	15.14	2.34	22.19	9.80
2039	4,304,212	1.53	0.05	40.72	20.12	3.48	13.96	2.02	27.80	9.14
2040	4,835,524	1.36	0.02	36.13	21.55	2.40	17.76	1.68	58.38	13.06
Total	**101,198,409**	**1.70**	**0.05**	**39.44**	**22.01**	**2.07**	**14.79**	**1.79**	**32.80**	**8.72**

REFERENCES

Spreadsheets

L&M_Onça-Puma_EFM_PFSRev18 (unlocked).xls

L&M_Onça-Puma_OPEX_PFSRev18 (unlocked).xls

Appendix F-2009 Assumptions-2009 Mineral Res Calc-3-yr avg Metal Prices-May 2010 (2).xls

Planning Assumptions 2010-2014 - April 30 2010 v2.0.xls

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GOLDER ASSOCIATES LTD.

Honorio Lima
Senior Mining Engineer

Marcelo Godoy
Principal Ore Reserves Analyst (CP)

HL/JK/GG/GW/MG/lsc

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Africa	+ 27 11 254 4800
Asia	+ 852 2562 3658
Australasia	+ 61 3 8862 3500
Europe	+ 356 21 42 30 20
North America	+ 1 800 275 3281
South America	+ 55 21 3095 9500

solutions@golder.com
www.golder.com

Golder Associates S.A.
Av.11 de Septiembre 2353 - Piso 2
Providencia
Santiago
Chile
T: +56 (2) 594 2000

Golder Associates