Social Dynamics

Health:

One of the main socio-economic challenges relates to the prevention of the spread of HIV/Aids and TB. Different programmes have been implemented by the John Taolo Gaetsewe District Municipality, as well as the Gamagara Local Municipality to combat the spread of the disease (KDM IDP, 2008).

Crime:

Crime levels in the study area (Sishen, Deben, Olifantshoek, Kathu and Postmasburg Police Stations) are very low compared to the rest of the country (www.saps.org.za).

Community Resources

Natural Resources and Land-Use:

The study area is characterised by abundant mineral resources and mining therefore comprises a prominent land-use in the area. Other land-uses include commercial cattle, sheep and game farming. There is some subsistence farming taking place with livestock such as cattle, sheep and goats.

Infrastructure:

The railway line from Sishen to Saldanha Bay is mainly used to transport iron ore to its export market. Poor road conditions, however, cause poor access and usage of all modes of transport and associated facilities. Various projects will be implemented to address this issue (KDM IDP, 2008).

Housing:

The Gamagara Local Municipality IDP (2007) stated that in terms of housing there is a huge backlog especially amongst the residents of Dibeng and Olifantshoek. In addition, it was noted that the expansion of the mines has exacerbated the situation in Sesheng. The provision of housing and shelter to informal dwellers is thus a priority.

Basic Services:

The majority of the households in the Gamagara Local Municipality have access to electricity for heating, lighting and cooking purposes. Other sources of light include candles. In Ward 1, the majority of the households also have access to electricity for lighting purposes, but not necessarily for heating and cooking purposes (Phetogo Consulting, KDM SDF, 2006).

In terms of sanitation the focus since 1996 was the eradication of the usage of pit latrines and the bucket system. Although some still make use of these, major developments have taken place ensuring that the majority of residents in the study area now have access to the flushing sewer system (Phetogo Consulting, KDM SDF, 2006).

The Gamagara Local Municipality IDP (2007) identified one of the main tasks as the provision of water and sanitation, as well as infrastructure (electricity) to those areas that are in need of these services such as Sesheng, Dibeng and Olifantshoek.

From the above it is clear that the provision of basic services such as electricity, water and sanitation remains important in the study area.

Community, Health and Safety Services:

The following table provides a summary of the main community, health and safety services available in the study area.

Type of Facility	Gamagara Local Municipality
Schools	12 Schools / 8 Primary Schools / 4 Secondary Schools
Clinics	2 Clinics and 2 Mobile Clinics
Hospitals	2 Hospital
Police Stations	5 Police Stations, namely the Kathu, Deben, Olifantshoek, Postmasburg and Sishen Police stations

Tourism and Leisure:

Based on information sourced it is indicated that the Northern Cape received 3.1% of all the tourists that flows into South Africa (Northern Cape Province Growth and Development Strategy: Abridged Discussion Document). The main tourist attractions of the province are the Augrabies Falls National Park, 120 km west of Upington along the Orange River, as well as the Kgalagadi Transfrontier Park on the border with Namibia and Botswana. Other attractions in the study area are the largest single open pit cast iron ore mine in the world in the Kathu area.

Economy

Regional Economy:

Although mining and agriculture are the main industries in the Northern Cape Province, this province has the smallest economy of the nine provinces. The Gross Geographic Product (GGP) represents approximately 1.8% of South Africa's GDP. The trade sector, transport and finance industries also comprise a share in the provincial economy. Further promising industries are tourism, fishing and mariculture, although it is doubtful whether these could act as the drivers of the economy. There are thus significant potential for growth in the following sectors:

- Agriculture and agro-processing;
- Fishing;
- Mining and mineral processing;
- Transportation; and
- Manufacturing.

Local Economy:

As with the province's economy, the economies of the John Taolo Gaetsewe District Municipality and the Gamagara Local Municipality are largely dominated by mining, quarrying and agriculture. Recent expansions at the Kumba Sishen Iron Ore Mine and the establishment of the Khomani Mine contributed to the growth in the local economy. Furthermore, the agricultural sector's share in the local economy is also growing due to the promising grape production for export purposes, as well as the development taking place in the livestock and game farming sectors. Tourism is also fast becoming an important contributor to the local economy as more tourists are attracted to the distinguished desert landscape with relative accessibility.

According to the John Taolo Gaetsewe District Municipality IDP (KDM IDP, 2008), an important issue that needs to be addressed is the fact that the economic potential of the area is not yet fully utilised. This will be undertaken through the following objectives:

- Reviewing the Local Economic Development (LED) strategy in line with the new National LED Framework;
- Improving the institutional capacity for LED;
- Creating and facilitating an enabling environment for LED in the district;
- Stimulating tourism growth; and
- Facilitating the creation of job opportunities in the district.

Effect of HIV/AIDS:

Although the effect of HIV/AIDS is not required to be included into the compilation of this report, it is included as a reference for the management of the facility. The information included is extracted from a technical paper delivered by Dr. Izak Fourie on 28 March 2003 at the 34th annual conference of the Institute of Quarrying Southern Africa.

"At the onset of the 21st century post-apartheid South Africa faces daunting economic and social challenges. Most economists and political leaders, regardless of their political orientation, have come to accept that, for South Africa to succeed and meet its social and economic challenges, including the expectations of the majority of its population, it must participate and compete effectively in the global economy.

If South African is to (re)join the global economy and kick-start the "African Renaissance", it will have to attract significant amounts of foreign direct investment while its private, formal sector companies must cut costs, increase productivity and improve quality standards.

Sadly, just as the opportunities of the global economy are opening up to South Africa, the country is facing an HIV/AIDS epidemic of considerable proportions. Although the country's health care systems will bear (and is already bearing) the initial brunt of the epidemic, there is no doubt that HIV/AIDS will affect virtually every aspect of our society, including our companies and workplace to the extent that it may threaten the very survival of some of our private sector enterprises."

"In its latest Global Update, the Joint United Nations Program on HIV/AIDS (UNAIDS) provide the following estimates of the global HIV/AIDS epidemic as at December 2001:

- *People newly infected with HIV in 2001:5 million*
- *Number of people living with HIV/AIDS:40 million*
- *AIDS deaths in 2001 :3 million*
- *Cumulative AIDS deaths (since 1980) :24 million*

Sub-Saharan Africa continues to dwarf the rest of the world on the HIV/AIDS scorecard with 3.4 million of the total of 5 million new infections in 2001 occurring on our continent. Similarly, of the 40 million people living with HIV/AIDS, 28.1 million or 70.2% are from sub-Saharan Africa.

While no country in sub-Saharan Africa has escaped to virus, some are far more severely affected than others. According to the latest UNAIDS report, the bulk of new infections continue to be concentrated in Eat and especially Southern Africa.

The following table indicates the progression of HIV/AIDS and the economical impacts associated with each progression.

Year	Progression of HIV/AIDS	Economic Impact
0	Infection occurs	-No cost
0-5	Incubation period	-Little or no costs
6-7	HIV/AIDS-related morbidity begins	-Increased sick leave and absenteeism -Reduced productivity -Increased medical costs -Employee requires attention from occupational health, supervisory, human resource and employee assistance personnel
8-10	Employment terminated due to resignation, medical incapacity or death	-Death and/or disability claims -Retirement benefits claims by employee or dependants -Increased medical costs continues post-employment for employees on medical schemes -Company-sponsored loans not repaid -Funeral expenses -Compassionate leave for co-employees to attend funeral -Negative effect on morale and productivity of co-employees -Costs of keeping employee on payroll until medical separation procedures have been completed
8-10	Company recruits and retrains a replacement employee	-Cost of temporary staff or overtime until new employee is operational -Cost of recruitment, training and induction -Salary during training/induction period -Initial lower productivity -Time spent by other employee on in-service training

Economic impacts of HIV/AIDS

It is important for all personnel manager to take note of the possible implications of the disease on his workforce. An employer must also realise that a certain responsibility towards employees must be accepted. .

Sensitive Environmental Features:

Features Requiring Protection:

There are no environmental features identified on the mining area that require protection.

Features Requiring Remediation:

There are no environmental features identified on the mining area that require remediation.

Features Requiring Management:
The following environmental features identified as sensitive, will require specific management measures:

- Air Quality (dust fallout monitoring).
- Noise Pollution (noise levels monitoring).

Features Requiring Avoidance:
There are no environmental features identified on the mining application area that require avoidance.

End Land Use Objectives:

The predominant land use in this area is live stock farming and other agricultural activities.

Chapter 2 – Project Description:

MPRDA Section 39 (3)(b)(i)
MPRDA Section 39 (3)(d)(i)

2.1 Surface infrastructure:

Roads, Railways and Power Lines:

See **Regulation 2(2) Plan and locality Map** for location of access roads. Only the R 325 runs through the mining application area. No railroad or Power line runs though the mining application area.

2.1.1 Industrial and Domestic Waste Disposal Sites:

Domestic waste will be disposed of in suitable covered receptacles on the application area.

All used oils, grease or hydraulic fluids shall be placed in suitable covered receptacles and will be removed from the site on a regular basis for disposal at a registered or licensed disposal site.

Mine residue to be produced by the proposed activities is considered to be minimal and will consist primarily of cleared vegetation. The residue will be disposed of at a registered waste disposal site.

2.1.2 Water Pollution Management Facilities:

No new sewage treatment plant will be established at the site. Existing sewage lines will be used and Chemical or toilets of the "Enviroloo" type will be provided for quarry personnel. One toilet per 10 persons will be available on the site for the duration of the operation.

- **Pollution Control Structures:**

  Pollution of water should not occur and pollution control dams are not required.

- **Polluted Water Treatment Facility:**

  Not Applicable

2.1.3 Potable Water Plant Location, it's design Capacity and the Process to be Used

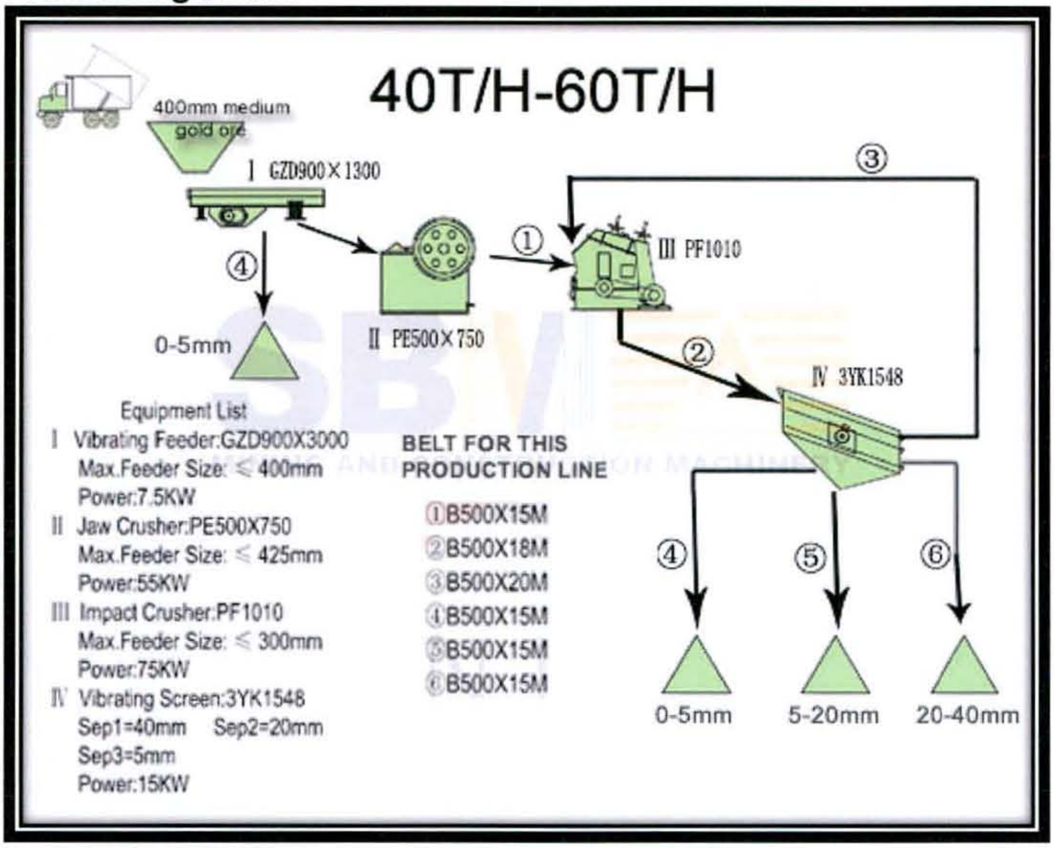
No potable water treatment plant will be necessary on site. Potable water will be obtained from an existing bore hole of which a water use licence application is in progress.

2.1.4 Process Water Supply System, it's design Capacity and the Process to be Used

No Water will be used in the processing all the crushing and screening is done via dry processes. Water will be used for dust suppression only.

2.1.5 Mineral Processing Plant:

Processing Plant:



Example of the crusher plant.

2.1.6 Workshops and Administration Buildings:

No workshop will be needed as all equipment will be hired. The said old farm house will be used for offices and sanitary purposes.

2.1.7 Housing and Recreational Facilities:

There currently is housing on the mining application area.

2.1.8 Transport:

The existing road network will be used. No new road is required on the site or to transport the product from the site.

2.1.9 Water Balance Diagram

Not Applicable

2.1.10 Disturbances of Water Courses

Not Applicable

2.1.11 Storm Water

The quarry excavation will form a “basin” with the sides sloping into the excavation area. Therefore runoff will run into the excavation. If water accumulates into the excavation, it will be used for the brick making plant and dust suppression purposes.

2.2 General Description:

2.2.1 Description of the mining methods:

Iron ore and Manganese mining method:

- As the majority of the Iron ore and Manganese reserve outcrops on the mining area, there is very little topsoil to be removed.
- The Company will appoint a qualified and registered blasting company to execute all blasting and drilling operations. It is estimated that blasting will take place once a month.
- Approximately 40 000 tons (20 000m^3) of material per month will be blasted. The drilling depth will be 9 m, but only 8 m on the lower floor of the pit will be removed as to ensure a solid and level platform. The Company intends to commence with an initial 3 ha (170 m x 170m = 3ha x 70m deep = 5 million tons = to ten years). As the bench mining method will be applied, benches will be 10 m in width, as to cater for the excavator and ADT's to haul the material out of the quarry.
- After material has been blasted an excavator will load the blasted rock on to ADT's that in turn will transport the stone to the crushing plant. Ground moving equipment will be rented. The crushing plant will be closer than 500m from the quarry to minimize the use of heavy earthmoving equipment. A water cart will be on site fulltime to water the roads in order to control and mitigate dust pollution. A fulltime grader will ensure that the roads are properly maintained.
- The beneficiation plant will be situated in a warehouse-type building. The reason for this is that the product is already clean and that it should be kept dry.

The process will be as follows:

- 500mm to 600mm Iron ore or Manganese rock is dumped into a hopper by ADT's transporting material from quarry.
- Consecutively a jaw crusher and then a cone crusher break the material to minus 30mm.
- Material will be sorted by 2 big screens. Should concrete stone between 10 and 19 mm not be required, the material will be crushed by two additional cone crushers until the material is adequately fine according to the clients' requirements.
- The advantages of keeping the material dry are of paramount importance to the Company. The Company therefore doesn't necessitate a washing plant and the use of big dryers. This will result in a reduced environmental impact as opposed to other Iron ore and Manganese mines. This dry process saves large quantities of water (no slimes dams will be needed) and air pollution is minimised as no drying ovens will be utilised in this process. Another benefit to this approach is the retail of the dust particles which would have otherwise ended up in slimes dams.

Stripping and Stockpiling Topsoil (Backfilling)

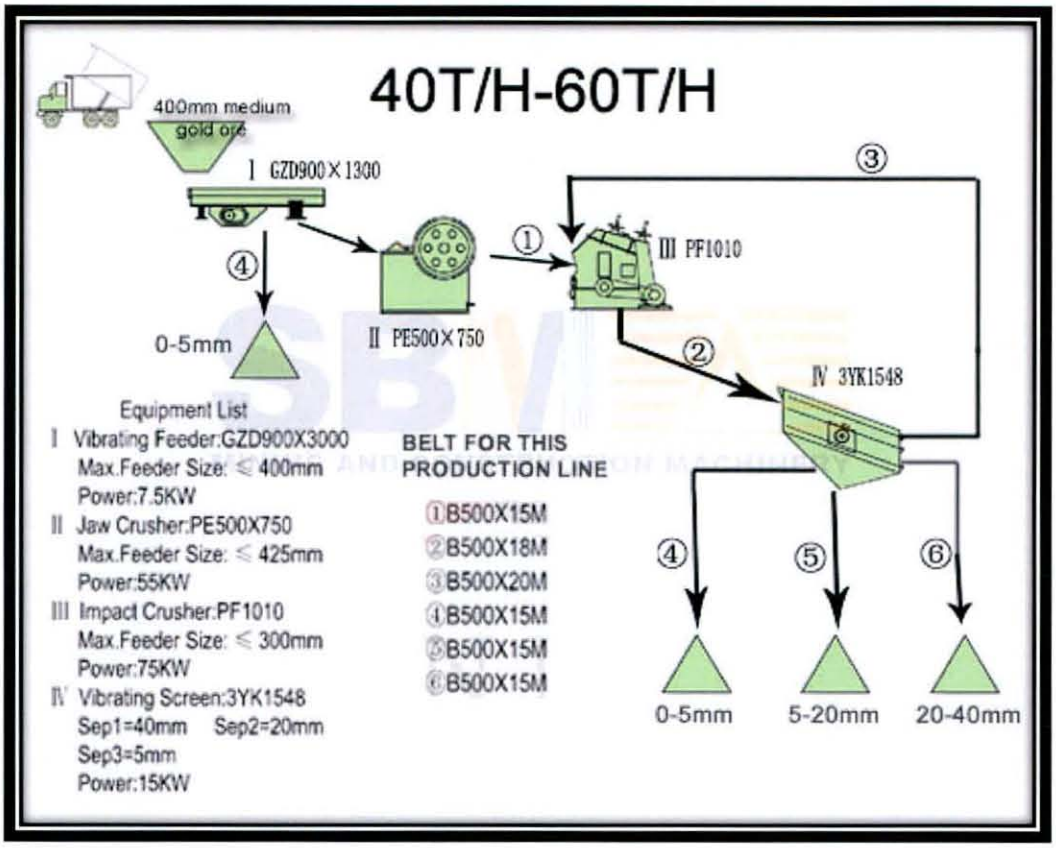
The top 300mm of earth (topsoil) over the first strip will be demarcated, be excavated by an excavator and will either be temporarily stockpiled in the mining area or immediately be utilised for concurrent rehabilitation of a previously mined out area.

Stripping and Stockpiling the Topsoil and Concurrent Rehabilitation

The Topsoil will be transported by an excavator and/or a dumper truck. As mentioned, the topsoil will either be temporarily stockpiled or used immediately in the concurrent rehabilitation of the previously mined out areas.

The process will be as follows:

Process flow chart.



2.2.2 Infrastructure:

Apart from the processing plant referred to above, no infrastructure will be erected on the application area.

2.3 Mining Activities:

Table 2.3: Mining Phases and Activities for Iron ore and Manganese mining.

Phase:	Activity:	Description:
Construction Phase	All topsoil will be stored separately for rehabilitation at the end of life of the mine after the plant has been demolished. A mobile screen (not a permanent structure) will be moved on the mining area wherever it is needed..	
Operational Phase:	Topsoil	When topsoil is removed and stored, it will be done according to the Soil Utilisation Guide below. **Soil Utilisation Guide:** The following design parameters will be taken into account when designing the topsoil stockpiles: -Topsoil will be removed to a depth of 300mm. -The stockpiles must be constructed on the most gradual slope possible. -The slope of the stockpile material must be kept as low and possible to avoid extensive erosion of the natural resource. -If erosion does occur the stockpiles can be stabilised through re-vegetation with pioneering grass species. Species include *Eragrostis curvula* and *Melinis repens.* -Soil fertility need to be assessed and ameliorated where necessary prior to re-vegetation in order to ensure optimal growth.
Operational Phase	Excavating	Iron ore and Manganese mining will be conducted with a front end loader general opencast mining methods. The Iron ore and Manganese will be processed through the said dry mobile screen and then be sold and the clay to the said brick making plant.
Operational Phase:	Hauling	Iron ore and Manganese will be hauled with a front end

		loader from the excavation area to the said screen and plant .
Operational Phase:	Backfilling	The mined out areas of the quarry pit will be backfilled on a continuous basis using the overburden material.
Operational Phase:	Levelling and Sloping	Mined out areas are levelled and sloped to an angel of 1:3 or flatter where possible or benches which will be rehabilitated.
Operational Phase:	Replacing topsoil	After the mined out areas are levelled and sloped, any available stockpiled topsoil will be replaced and levelled over the areas.
Operational Phase:	Vegetating	After topsoil is returned to the levelled and sloped, mined-out areas, a grass seed mixture including *Eragrostis spp* and any other endemic species found surrounding the area will be sown.
Operational Phase:	Dust Suppression	Approximately 5,000 litres of water will be sprayed onto the roads daily for dust suppression purposed, but is only expected to be required during the drier seasons of the year. This water will partly evaporate and partly drain into the soils. Water for dust suppression will be obtained from the borehole on the farm and sprayed by a water truck.
Closure Phase	Final Replacing of Topsoil	After final levelling and sloping, any remaining available topsoil will be replaced over any remaining un-rehabilitated areas.
Closure Phase	Final Backfilling and Sloping	Once mining is ceased, the stockpiled overburden will be backfilled into the mined-out pit. After final backfilling is completed, all material will be left at a slope of at least 1:3 or benches.
Closure Phase	Final Vegetating	A grass seed mixture including *Eragrostis spp* and

		any other endemic species found surrounding the area will be sown on all areas where vegetation growth has not established successfully.
Closure Phase	Dust Suppression	Approximately 5,000 litres of water will be sprayed onto the roads daily for dust suppression purposed, but is only expected to be required during the drier seasons of the year. This water will partly evaporate and partly drain into the soils. Water for dust suppression will be obtained from the boreholes on the farm and sprayed by a water truck.
Post-Closure Phase	Erosion Control	For a period of at least two years after final rehabilitation, the area will be monitored for occurrence of erosion. Any newly eroded areas found will be remediated
Post-Closure Phase	Vegetation monitoring	Vegetation will be monitored for a period of at least two years after final rehabilitation. Any area where the vegetation cover is insufficient will be re-vegetated with a similar seed mixture as above.

Chapter 3 – Anticipated Impacts Assessment:

MPRDA Regulation 49 (1)(c)

3.1 Engagement Process with I&AP's:

All I&AP's will be notified formally in writing either by fax, email or registered mail of the mining right application and provided the opportunity to comment on it. Parties will specifically be requested to identify the following:

- Any possible socio economic impacts which your concern would wish to identify in regard to my client's proposed mining and related activities.
- Any possible sites of national heritage that your concern can identify which could be impacted by my client's proposed activities and need to be protected.
- Any other environmental impact(s) or risk(s) which you may identify and wish to mention.

The following steps will be taken to ensure that all I&AP's are given the opportunity to raise their concerns if any:

- Two site notices have been placed at two entrances to the application area. The notices have been placed in such a way to ensure that they are clear and visible.
- Due to the fact that *inter alia* the Local Municipality will be personally and formally consulted, most of the possible I&AP's will be aware of the project proposal.
- Placing of an advertisement in the local newspaper.
- All parties will be invited to an on-site meeting in the above formal letters and in the said advertisement. An attendance register will be filled out and signed by all the persons attending the site meeting

3.2 Potential Environment Impacts Identified by I&AP's:

As the public participation process is still in progress, no impacts are as yet identified by any I&AP's. Any impacts identified through the public participation process will be incorporated and addressed in the EMP.

3.3 Potential Environmental Impacts Identified by State Departments:

No such impacts are as yet identified by State Departments. In terms of the provisions of the MPRDA the DMR is compelled to consult with same. Any impacts identified by the State Departments will be incorporated and addressed in the EMP.

3.4 Potential Environmental Impacts of the Mining Activities:

The following table indicates the possible impacts that may occur from the mining activities

Possible Construction Phase Impacts

	Construction Phase for Iron ore and Manganese mining:	
Activity:	**Environmental Aspect:**	**Impact**
Topsoil Removal:	**Geology:**	No impact
	Topography:	The removal of topsoil will create a lowered topography.
	Soil:	The topsoil is removed to a stockpile.
	Flora:	Vegetation is removed completely
	Fauna:	Fauna will leave the area for a long period of time.
	Surface Hydrology:	The lowered topography will alter the surface water runoff patterns.
	Groundwater:	No impact.
	Air Quality:	An increase in dust levels due to vehicle movement and excavation.
	Noise:	Vehicles and machinery will cause an increase in the noise levels.
	Visual Aspects:	The plant will have a visual aspect but only within the farm boundaries.
Excavating:	**Geology:**	The geological structure will not be affected because building will only be on the surface.
	Topography:	The topography will not be affected because building will only be on the surface.
	Soil:	The soil will not be affected because building will only be on the surface.
	Flora:	No impact.
	Fauna:	No impact.
	Surface Hydrology:	No impact.
	Groundwater:	No impact.
	Air Quality:	Excavating will cause an increase in dust levels.
	Noise:	Excavating will cause an increase in dust levels.
	Visual Aspects:	The plant will have a visual aspect but only from the said road.
Hauling:	**Geology:**	No impact. No hauling will take place.
	Topography:	No impact. No hauling will take place.

	Soil:	No impact. No hauling will take place.
	Flora:	No impact. No hauling will take place.
	Fauna:	No impact. No hauling will take place.
	Surface Hydrology:	No impact. No hauling will take place.
	Groundwater:	No impact. No hauling will take place.
	Air Quality:	No impact. No hauling will take place.
	Noise:	No impact. No hauling will take place.
	Visual Aspects:	No impact. No hauling will take place.
Dust Suppression:	**Geology:**	No impact.
	Topography:	No impact.
	Soil:	No impact.
	Flora:	No impact.
	Fauna:	No impact.
	Surface Hydrology:	No impact.
	Groundwater:	Water spayed on the roads or disturbed areas may seep into the groundwater system.
	Air Quality:	Water sprayed on the roads or disturbed areas will reduce dust pollution of moving vehicles.
	Noise:	The movement of vehicles will increase the noise levels.
	Visual Aspects:	Visual impact from the said road.

Possible Operational Phase Impacts

	Operational Phase for Iron ore and Manganese mining:	
Activity:	**Environmental Aspect:**	**Impact**
Topsoil Removal:	**Geology:**	No impact
	Topography:	The removal of topsoil will create a lowered topography.
	Soil:	The topsoil is removed to a stockpile.
	Flora:	Vegetation is removed completely
	Fauna:	Fauna will leave the area temporarily.
	Surface Hydrology:	The lowered topography will alter the surface water runoff patterns.
	Groundwater:	No impact.
	Air Quality:	An increase in dust levels due to vehicle movement and excavation.
	Noise:	Vehicles and machinery will cause an increase in the noise levels.
	Visual Aspects:	Visual impact from the said road.
Excavating:	**Geology:**	The geological structure is removed through excavating.
	Topography:	Excavating will create a lowered topography and leave a final void.
	Soil:	The underlying soil structure (overburden) is removed and stockpiled.
	Flora:	No impact.
	Fauna:	No impact.
	Surface Hydrology:	The lowered topography and final void will alter the surface water runoff patterns.
	Groundwater:	No impact.
	Air Quality:	Excavating will cause an increase in dust levels.
	Noise:	Excavating will cause an increase in dust levels.
	Visual Aspects:	Visual impact from the said road.
Hauling:	**Geology:**	No impact.
	Topography:	No impact.
	Soil:	No impact.
	Flora:	No impact.
	Fauna:	No impact.
	Surface Hydrology:	No impact.
	Groundwater:	No impact.

	Air Quality:	Hauling will cause an increase in dust levels.
	Noise:	Hauling will cause an increase in dust levels.
	Visual Aspects:	Visual impact from the said road.
Backfilling:	**Geology:**	The backfilling of overburden restores the geological material, but with an altered geological structure.
	Topography:	The void left by excavating is partially backfilled using overburden, thus minimising the initial negative impact. The topography however remains altered when compared with the natural topography.
	Soil:	No impact.
	Flora:	No impact.
	Fauna:	No impact.
	Surface Hydrology:	Backfilling will alter the topography and cause a change in surface water runoff patterns.
	Groundwater:	No impact.
	Air Quality:	Movement of vehicles and machinery, together with dumping of overburden into the pit will increase dust levels.
	Noise:	Movement of vehicles and machinery will increase noise levels.
	Visual Aspects:	Visual impact from the said road.
Replacing Topsoil:	**Geology:**	No impact.
	Topography:	The replacing of topsoil over the partially backfilled pit or excavation areas will have the final alteration on the topography.
	Soil:	The replacing of topsoil creates a new, altered soil structure.
	Flora:	No impact.
	Fauna:	No impact.
	Surface Hydrology:	The replacing of topsoil over the partially backfilled pit or excavation areas will have the final alteration on the topography and changed runoff patterns.
	Groundwater:	No impact.
	Air Quality:	Movement of vehicles and machinery will increase the dust levels.
	Noise:	Movement of vehicles and machinery will increase the noise

		levels.
	Visual Aspects:	Visual impact from the said road.
Vegetating:	**Geology:**	No impact.
	Topography:	No impact.
	Soil:	Vegetating the disturbed areas will prevent soil erosion.
	Flora:	Vegetating the disturbed areas with endemic species will create a new altered habitat for fauna.
	Fauna:	Vegetating the disturbed areas with endemic species will create a new altered habitat for fauna.
	Surface Hydrology:	No impact.
	Groundwater:	No impact.
	Air Quality:	No impact.
	Noise:	No impact.
	Visual Aspects:	Visual impact from the said road.
Dust Suppression:	**Geology:**	No impact.
	Topography:	No impact.
	Soil:	No impact.
	Flora:	No impact.
	Fauna:	No impact.
	Surface Hydrology:	No impact.
	Groundwater:	Water spayed on the roads or disturbed areas may seep into the groundwater system.
	Air Quality:	Water sprayed on the roads or disturbed areas will reduce dust pollution of moving vehicles.
	Noise:	The movement of vehicles will increase the noise levels.
	Visual Aspects:	Visual impact from the said road.

Possible Closure Phase Impacts

	Closure Phase for Iron ore and Manganese mining:	
Activity:	**Environmental Aspect:**	**Impact**
Final Backfilling and Sloping:	**Geology:**	The backfilling of overburden restores the geological material, but with an altered geological structure.
	Topography:	The void left by excavating is partially backfilled using overburden, thus minimising the initial negative impact. The topography however remains altered when compared with the natural topography.
	Soil:	Sloping will result in a new, altered soil structures.
	Flora:	No impact.
	Fauna:	No impact.
	Surface Hydrology:	Backfilling will alter the topography and cause a change in surface water runoff patterns.
	Groundwater:	No impact.
	Air Quality:	Movement of vehicles and machinery will increase dust levels.
	Noise:	Movement of vehicles and machinery will increase noise levels.
	Visual Aspects:	Visual impact from the said road.
Final Replacing of Topsoil:	**Geology:**	No impact.
	Topography:	The replacing of topsoil over the partially backfilled pit or excavation areas will have the final alteration on the topography.
	Soil:	The replacing of topsoil creates a new, altered soil structure.
	Flora:	No impact.
	Fauna:	No impact.
	Surface Hydrology:	No impact.
	Groundwater:	No impact.
	Air Quality:	Movement of vehicles and machinery will increase the dust levels.
	Noise:	Movement of vehicles and machinery will increase the noise levels.
	Visual Aspects:	Visual impact from the said road.

Vegetating:	**Geology:**	No impact.
	Topography:	No impact.
	Soil:	Vegetating the disturbed areas will prevent soil erosion.
	Flora:	Vegetating the disturbed areas with endemic species will create a new altered habitat for fauna.
	Fauna:	Vegetating the disturbed areas with endemic species will create a new altered habitat for fauna.
	Surface Hydrology:	No impact.
	Groundwater:	No impact.
	Air Quality:	No impact.
	Noise:	No impact.
	Visual Aspects:	No impact.
Dust Suppression:	**Geology:**	No impact.
	Topography:	No impact.
	Soil:	No impact.
	Flora:	No impact.
	Fauna:	No impact.
	Surface Hydrology:	No impact.
	Groundwater:	Water spayed on the roads or disturbed areas may seep into the groundwater system.
	Air Quality:	Water sprayed on the roads or disturbed areas will reduce dust pollution of moving vehicles.
	Noise:	The movement of vehicles will increase the noise levels.
	Visual Aspects:	Visual impact from the said road.

Possible Post-closure Phase Impacts for Iron ore and Manganese mining:

Erosion Control:	**Geology:**	No impact.
	Topography:	No impact.
	Soil:	Erosion control and monitoring will limit erosion and disturbance of the rehabilitated surfaces.
	Flora:	Erosion control and monitoring will limit erosion and protect the growth medium.
	Fauna:	No impact.
	Surface Hydrology:	Erosion control will maintain the newly formed, changed runoff patterns.
	Groundwater:	No impact.
	Air Quality:	No impact.
	Noise:	No impact.
	Visual Aspects:	Visual impact from the said road.
Dust Suppression:	**Geology:**	No impact.
	Topography:	No impact.
	Soil:	No impact.
	Flora:	Re-vegetating areas where the seeding of first vegetating was not successful will reduce the risk of possible erosion.
	Fauna:	No impact.
	Surface Hydrology:	No impact.
	Groundwater:	No impact.
	Air Quality:	No impact.
	Noise:	No impact.
	Visual Aspects:	Visual impact from the said road.

3.5 Knowledge Gaps

No knowledge gaps anticipated.

Chapter 4 – Socio-economic Impact Assessment:

MPRDA Regulation 49 (1) (c)

4.1 Engagement Process with I&AP's:

See Section 3.1 above for the engagement process in progress.

4.2 Potential Impacts Identified by I&AP:

As the public participation process is still in progress, no impacts are as yet identified by any I&AP's. Any impacts identified through the public participation process will be incorporated and addressed in the AMPR.

4.3 Potential Impacts Identified by State Departments:

No such impacts are as yet identified by State Departments. Any impacts identified by the State Departments will be incorporated and addressed in the EMPR.

4.4 Assessment of Potential Impacts Identified:

Due to the fact that the public participation process is still in progress, no potential impacts were indicated by I&AP's or State Departments as of yet.

4.5 Comparative Land Use Assessment:

No comparative land use and/or development alternatives were considered until such time as all comments from I&AP's have been gathered.

Chapter 5 – Heritage Impact Assessment:
MPRDA Regulation 49(1) (c)

5.1. Engagement Process with I&AP's:

See Section 3.1 above for the engagement process in progress.

5.2. Potential Impacts Identified by I&AP :

As the public participation process is still in progress, no impacts are as yet identified by any I&AP's. Any impacts identified through the public participation process will be incorporated and addressed in the EMPR.

5.3. Potential Impacts Identified by State Departments:

No such impacts are as yet identified by State Departments. Any impacts identified by the State Departments will be incorporated and addressed in the EMPR.

5.4. Assessment of Potential Impacts identified:

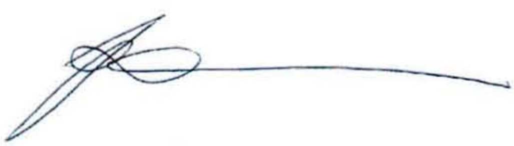
Due to the fact that the public participation process is still in progress no potential impacts were indicated by I&AP's or State Departments as of yet.

5.5. Knowledge Gaps:

No knowledge gaps anticipated.

Signed at Pretoria on this 10th day of February 2012.

Signed of Responsible Person:



Designation: Delegated person: Director

The Thari exploration strategy for Manganese ore in the Northern Cape Province, South Africa.

1. Introduction.

South Africa is internationally renowned for its abundant minerals and precious metals and hosts by far the biggest manganese deposits in the world as shown in Figure 1.

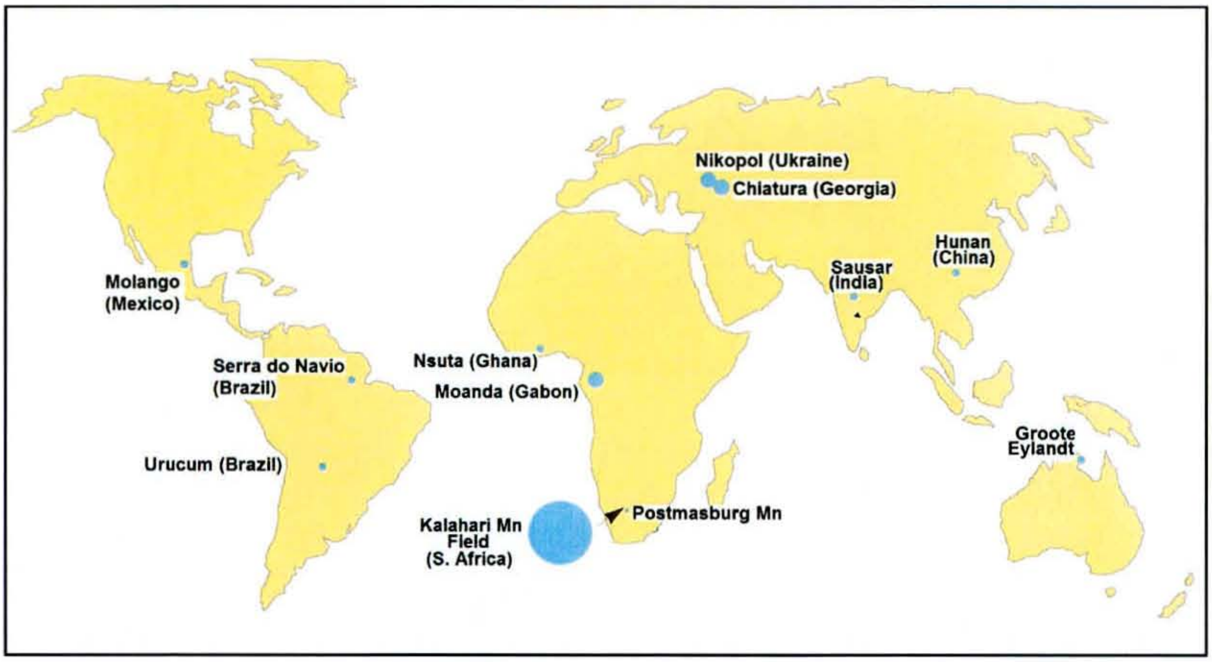


Figure 1.The most important Mn deposits around the world in terms of size. The Kalahari Mn field contains more than 80% of the worlds known manganese ore and is by far the largest.

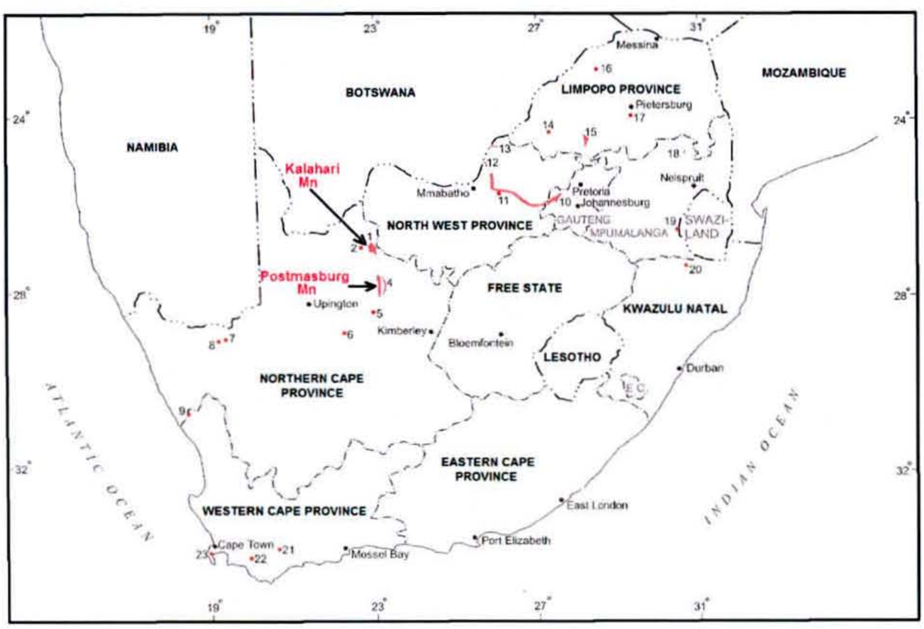


Figure 2. The location of manganese deposits in South Africa. Figure adapted from Astrup&Tsikos 1998.

The well known Northern Cape, Postmasburg manganese (Mn) deposits (Figure 2, above and Figure 3 below) were discovered in 1922 but presently Thari Resources is focusing on an area situated more than 100 km north of Postmasburg where roughly 80 % of the worlds known manganese deposits occur, referred to as the Kalahari Manganese Field (KMF).

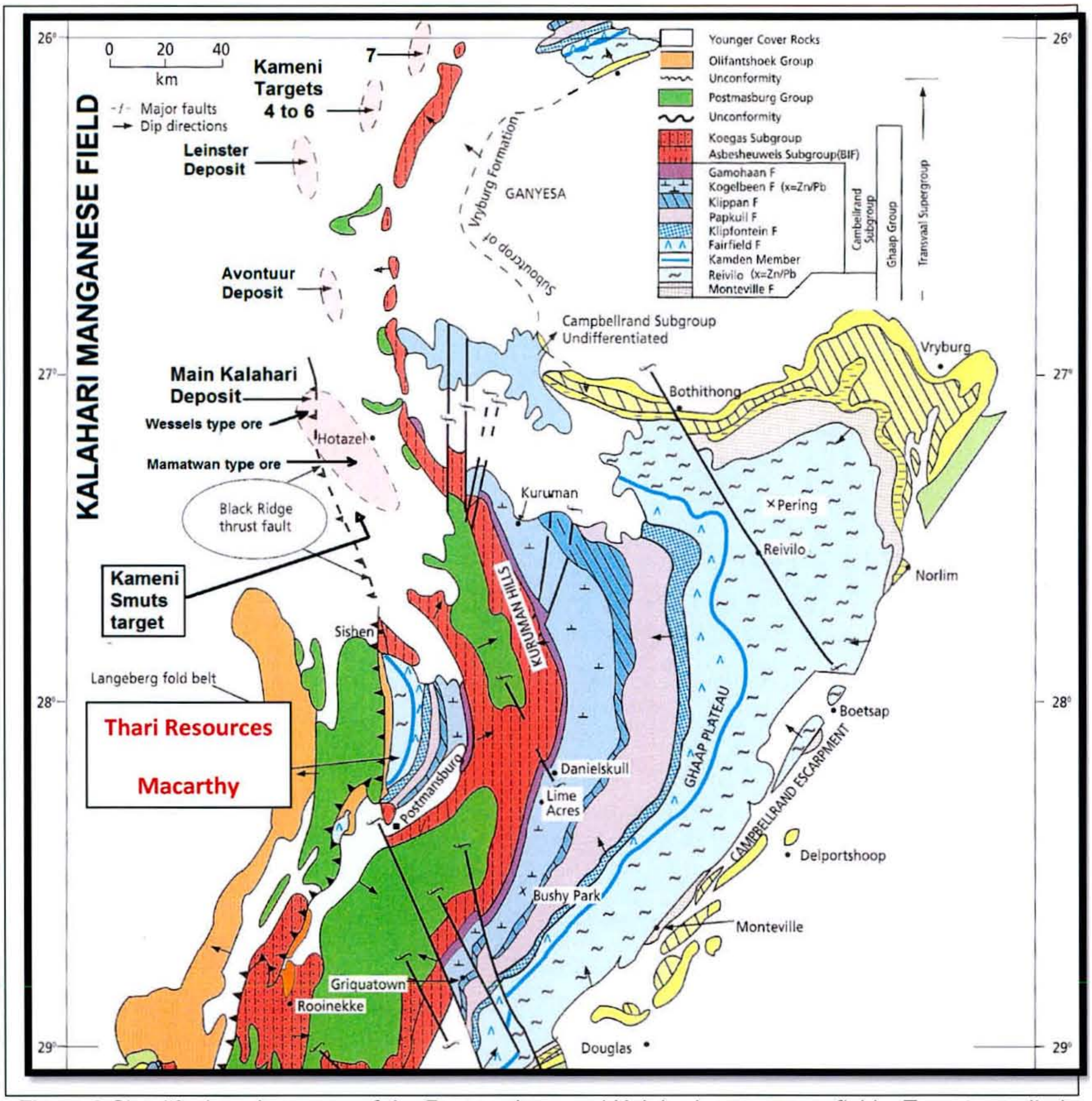


Figure 3.Simplified geology map of the Postmasburg and Kalahari manganese fields. Targets studied byThari Resources presently are also shown. Figure adapted from Cairncross et al.,1997

The manganese ore of the KMF is considered to be of sedimentary origin, (Beukes,1986) hydrothermally enriched, carbonate-rich and interbedded with Lake Superior type banded iron formations (BIF's) of the Kuruman Formation. The KMF is only known from borehole information as the whole basin is covered by Kalahari sand. The KMF is recognized as the remains of five structurally preserved erosional

entities consisting of the Mamatwan-Wessels basin which is the largest and indicated by the brown coloured hatchings in Figure 4, the super high grade Hotazel

and Langdon Annex graben deposits respectively northwest and southeast of the town of Hotazel (Figure 4) and the sub-economic Avontuur and Leinster deposits some 20 km north of the Mamatwan-Wessels basin (Figure 3) where other companies are presently exploring.

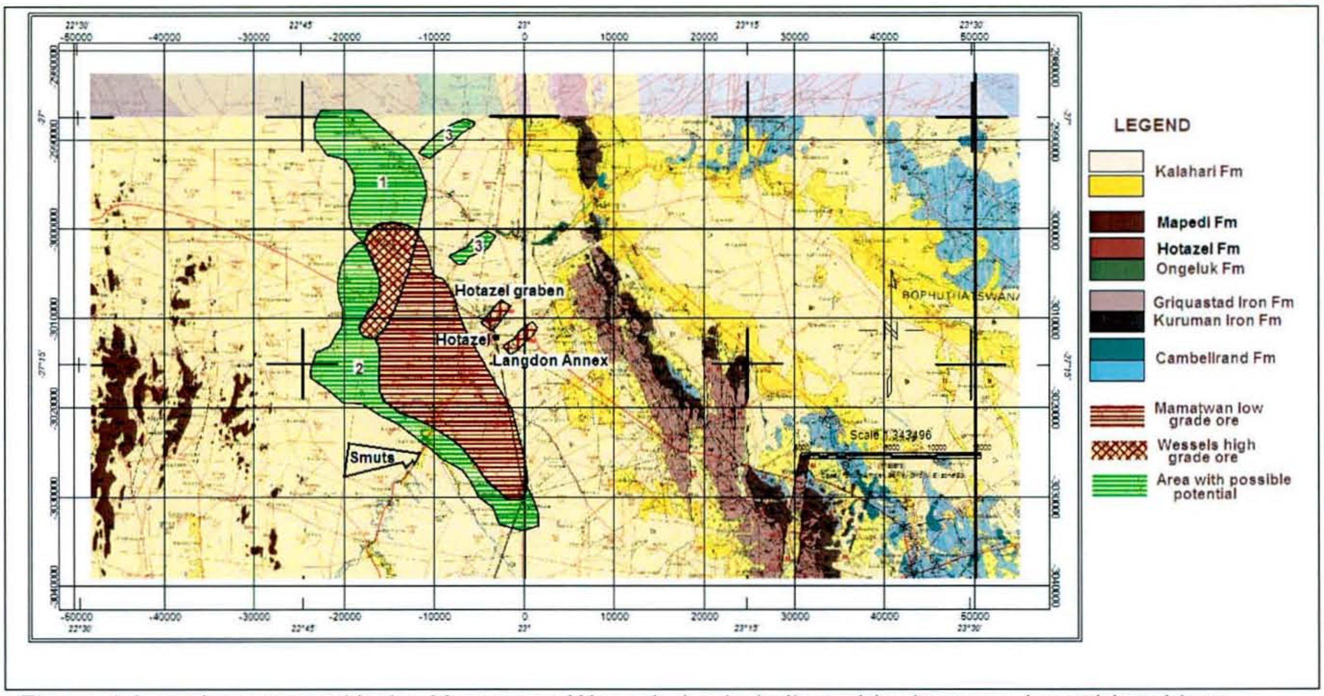


Figure 4.A geology map with the Mamatwan-Wessels basin indicated by brown coloured hatchings. The green coloured hatchings are Kameniexploration targets and targets 1 and 2 show similarities with the Hotazel&Langdon grabens. Smuts is acreage offered to Kameni that fell outside the original selected targets.

The interbedded manganese ore in the HotazelFm occurs as three layers(Astrup, Tsikos,1998), the upper layer and where best developed being about 5m thick, the middle body is only from 1-3m thick and the lower body varies in thickness between 5-45m. In the southern part of the KMF the upper body can reach a thickness of 30m and the middle layer being absent. The Mamatwan-type ore consists of Braunite-Kutnahorite which forms more than 90% of the known manganese resource of the KMF and is considered a lower grade ore with a Mn content of more than 38%. The Wessels type ore which is only found in the northern extremity of the Mamatwan-Wessels basin (Figure 4, brown diamond shaped hatching) has a Mn concentration varying between 44-65 %. Hotazel type super enriched ore has a manganese content in excess of 60%. Large parts of the Mamatwan-Wessels basin are unmineable at present as the cover rocks can be up to 900m thick. The challenge for Kameni is to find a new deposit preferably of Hotazel, or Wessels-type ore in areas that have been investigated in detail by many companies in the past. Adding to the challenge is that opportunists have taken out exploration licenses all over acreages

of land surrounding the known Mn occurrences. Another obstacle is that 99% of the exploration area is sand covered which makes detailed geological information unobtainable.

1. Exploration strategy

The only way geologists can 'see' below the surface of the earth without drilling is by making use of geophysics, and geophysicist are like the radiologists in the medical profession. Before invasive surgery a patient undergoes X-ray, Gamma-ray or CAT scans, or electro-scans and the geophysicist performs the same duty on the earth, thereby minimizing the risk of placing a borehole or shaft in the wrong location. Geophysicists construct their 'image' of the subsurface on the basis of a contrast in the physical properties of rock bodies. Differences in density, electrical resistivity, seismic velocity, magnetic susceptibility, electrical capacitance, and heat conductivity are but some of the properties used to isolate rock bodies and to create an image of the subsurface that subsequently drives a drilling program. However geophysicists need geological input to constrain their subsurface images.

Manganese ore has only one physical property that is of importance and that is its considerable density. But the iron ore in the banded iron formations (BIF's) can be just as dense or denser, so this is of no help in locating Mn ore remotely. However the manganese ore cannot occur without the BIF's being present and apart from being dense the BIF is also magnetic and there lies the key to detecting them. The BIF's are also underlain by an electrically resistive andesitic lava, called the Ongeluk Lava. Furthermore it has been observed in the KMF that the BIF's, where Mn ore is present, have an unusual magnetic pattern with deep magnetic lows, indicating the magnetic minerals not to be orientated in the direction of the earth's present day magnetic field, but to be frozen into a direction that existed when a process of

Africa. However the exploration targets above indicate magnetic deep lows surrounded by magnetic highs, which is totally out of character for southern Africa and is ascribed to a remanent or fossil magnetic direction 'frozen' into these rocks at a time in the earth's history when the earth's magnetic field pointed in a different direction. It is thought that the hydrothermal enrichment event already described formed magnetic minerals with the capability of 'remembering' the earth's magnetic field direction at that time.

In Figure 6 (left) an example of these deep magnetic lows about 70 km north of the Mamatwan-Wessels basin are shown, selected on the above criteria using the Geological Survey's aeromagnetic data with a 1 km flight line spacing. Seven targets were initially chosen of which 5 were allocated to Thari by the South African Department of Mineral Resources.

Figure 6 (right) shows the total field magnetic data observed from a 100m flight line separation survey as recently commissioned by Thari. Target 7 appears to be a very good prospect but all targets are to be followed up with detailed gravity and magneto-telluric measurements, providing additional density and electrical images of the subsurface to guide a drilling program.

Figure 7 depicts enlargements of the recently acquired aeromagnetic data for Targets 3 to 5 on the right hand side and Target 7 on the left hand side. The aeromagnetic data shows a single deep magnetic low surrounded by magnetic highs, with almost no crosscutting features. The image indicates the body to be shallower in the south than in the north. In the figure below Target 7 is a simple geological model just based on the magnetic data as taken along Traverse A-B across the northern part of the body. The model shows a graben–like structure bounded by two eastwards dipping faults and the material in the graben consists of highly magnetic material which can only be represented by BIF's which are also remanently magnetized. No direction of the remanent magnetic field is known yet for Target 7 but in the model the direction was assumed to be that observed in the Wessels-Mamatwan basin as described by Evans et al., 2001. Although the geological model in total is not correct the model allows an approximate depth to the remanently magnetized BIF to be determined and according to the model it varies between ~400m in the west and 500m in the east. However the body will be substantially shallower in the south where depths of approximately 200m are expected.

On the right hand side of Figure 7 the newly acquired magnetic data for Targets 3 to 6 is shown and consists of dissected magnetic lows, the best developed low is that coinciding with Target 3. The magnetic image is less 'smooth' than the one over Target 7 and therefore indicates shallower depths to the magnetic sources. Below the magnetic field image is again a very simplegeological model taken along Traverse C-D across Target 3 in the southern part of the survey area. Since gravity and magnetotelluric data still have to be collected over these targets it is too early to

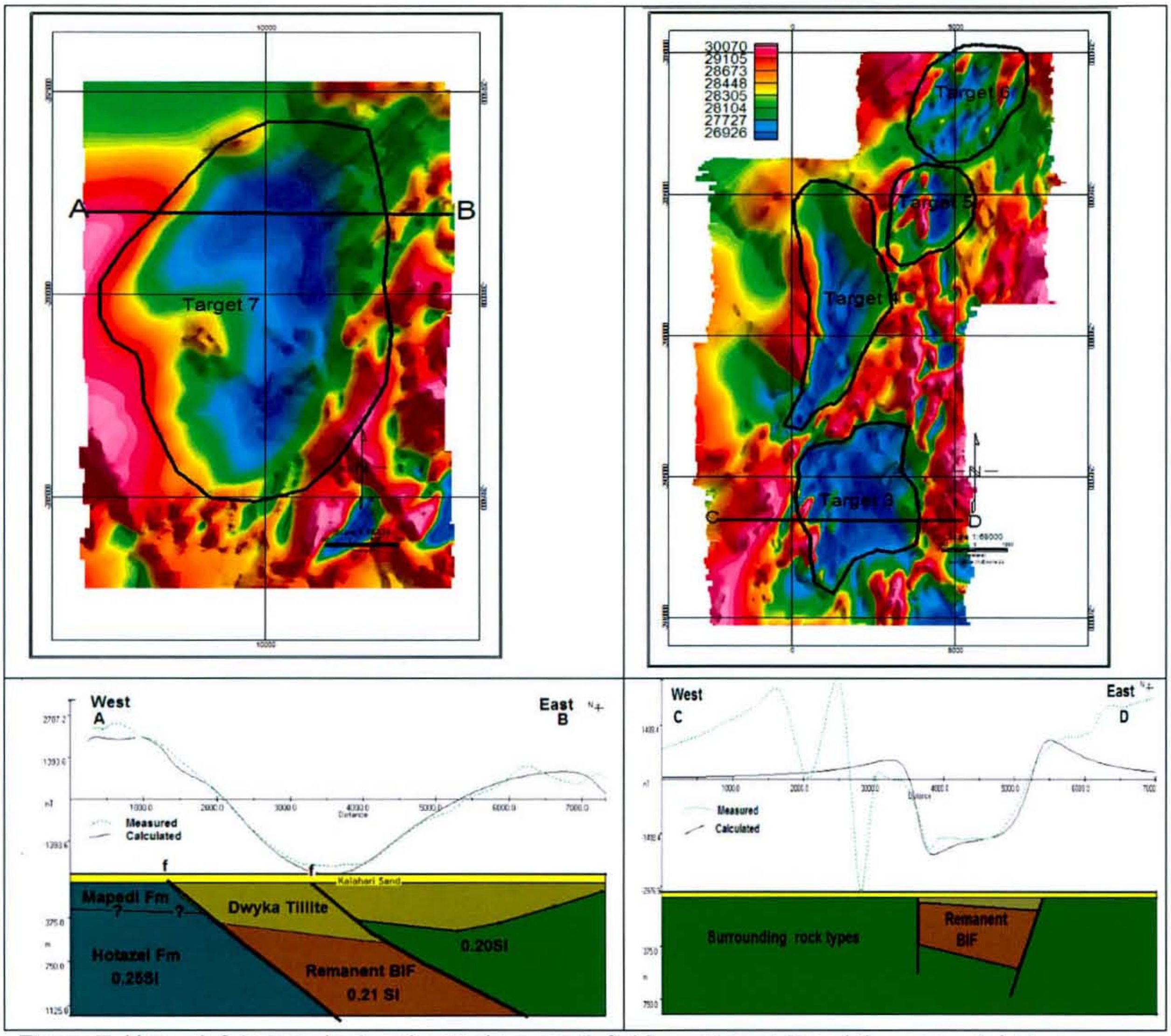


Figure 7. Upper left image depicts the total magnetic field over target 7 and the upper right image over Targets 3 to 6. The lower left image shows a possible very simple subsurface geological model as would be expected along Traverse AB (indicated in the upper left image). The lower right image shows a very simple geological model of the subsurface along Traverse CD enabling a depth determination to the remanent BIF.

consider them as geologically realistic. However the model allows us to make again a preliminary estimate on the depth of the body and varies in depth between 100 in the west and 150 m in the east.

1. **Exploration targets in the southern part of the Kalahari Manganese FieldMacarthy Deposit.**

Figure 8 shows a colour coded aeromagnetic map compiled from 1 km flight line spacing, government data. The magnetic image is dominated by a NNW striking very intense magnetic high-low pattern which are due to Banded Iron Formations of the

KurumanGp which are stratigraphically below our targets. The Wessels-Mamatwan Basin is situated to the west of this dominant feature. The 4 targets selected in the vicinity of the Mamatwan-Wessels basin are coloured in a green hatching. Targets 1 and 2 anticipate an extension of the Wessels-Mamatwan Basin to the north, west and southwest, just based on observing similar magnetic patterns outside the geologically defined basin. Target 3 consists of two possible graben structures very similar to the Langdon and Hotazelgrabens near the town of Hotazel. Unfortunately there is a moratorium on the issuing of exploration licenses at the moment at the Department of Mineral and Resources and therefore the outcomes of the issuing of exploration licenses on any of these targets are still being awaited. They are considered to represent our best targets.

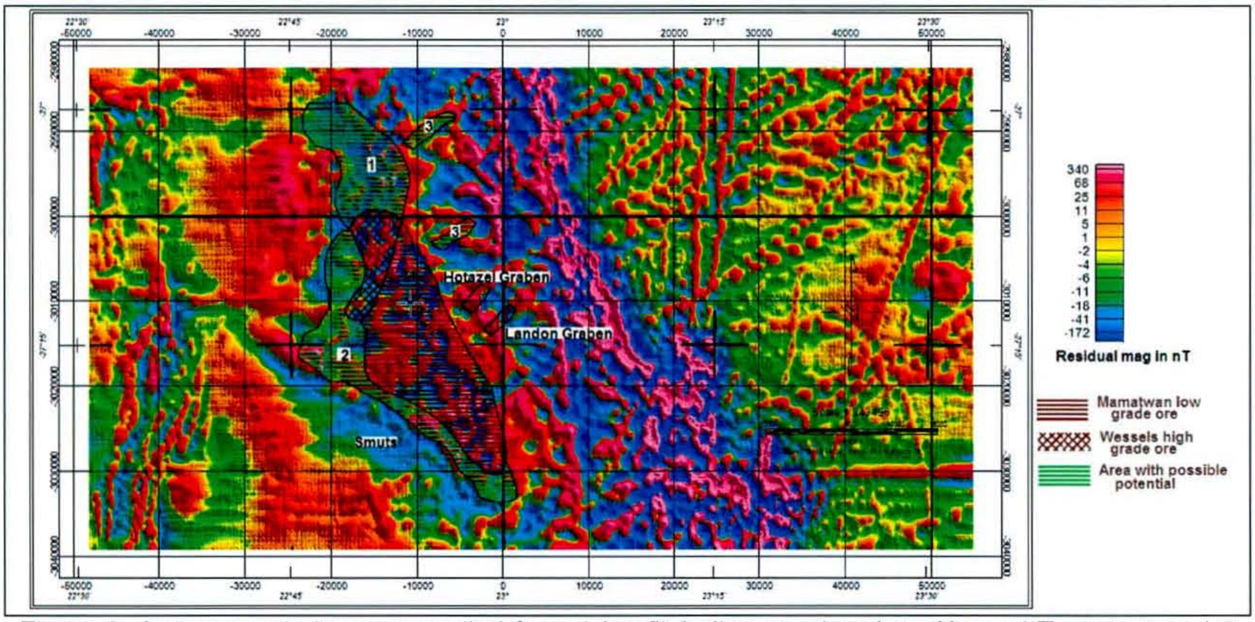
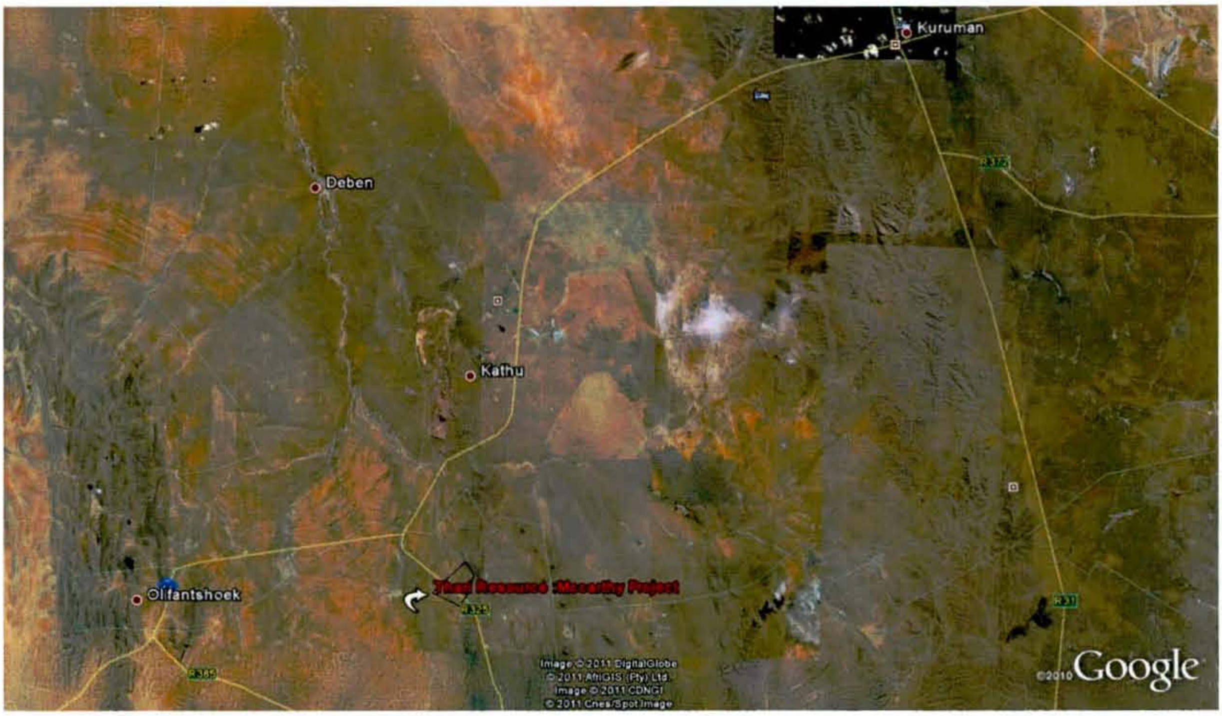
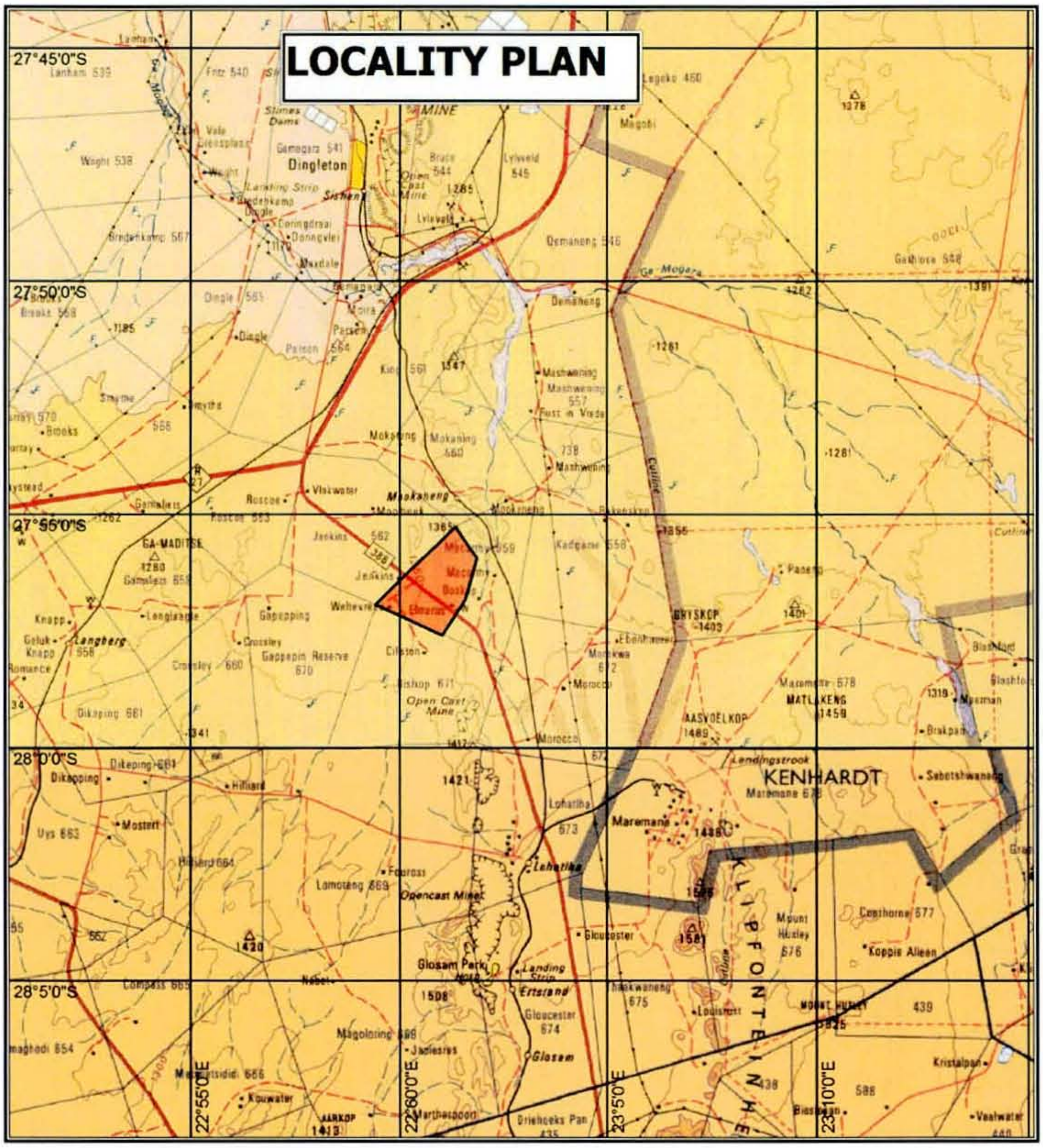


Figure 8. Aeromagnetic image compiled from 1 km flight line spacing data. Kameni Targets 1 and 2 occur north and west of the Wessels-Mamatwan basin. The two targets marked 3 to the northeast apex of Target 1 are expected to be two graben like structures similar to the Hotazel and Langdon grabens.

2. **Macarthy559**



An unforeseen addition that was presented to Thari Resources was the farm Macarthy 559 south of the Mamatwan-Wessels basin. Detailed geophysical work as shown in Figure 9 indicated a magnetic low, that correlated with a gravity high, and an electrical image of the subsurface which indicated approximately the correct resistivity sequence, but located outside the known perimeter of the Mamatwan-Wessels basin. The t borehole drilled (location shown in Figure 9) revealed on target, the Hotazel banded iron formation, at least 65m thick at a depth of 65m below surface and drilling is continuing at this moment in BIF. Borehole core down to 65m below surface is available and the geology observed in the core is almost that anticipated from Figure 5 and revealed below the Kalahari



Legend

Thari Resources Mccarthy

N

Scale 1:225130

0 1.5 3 6 9 12 15 km

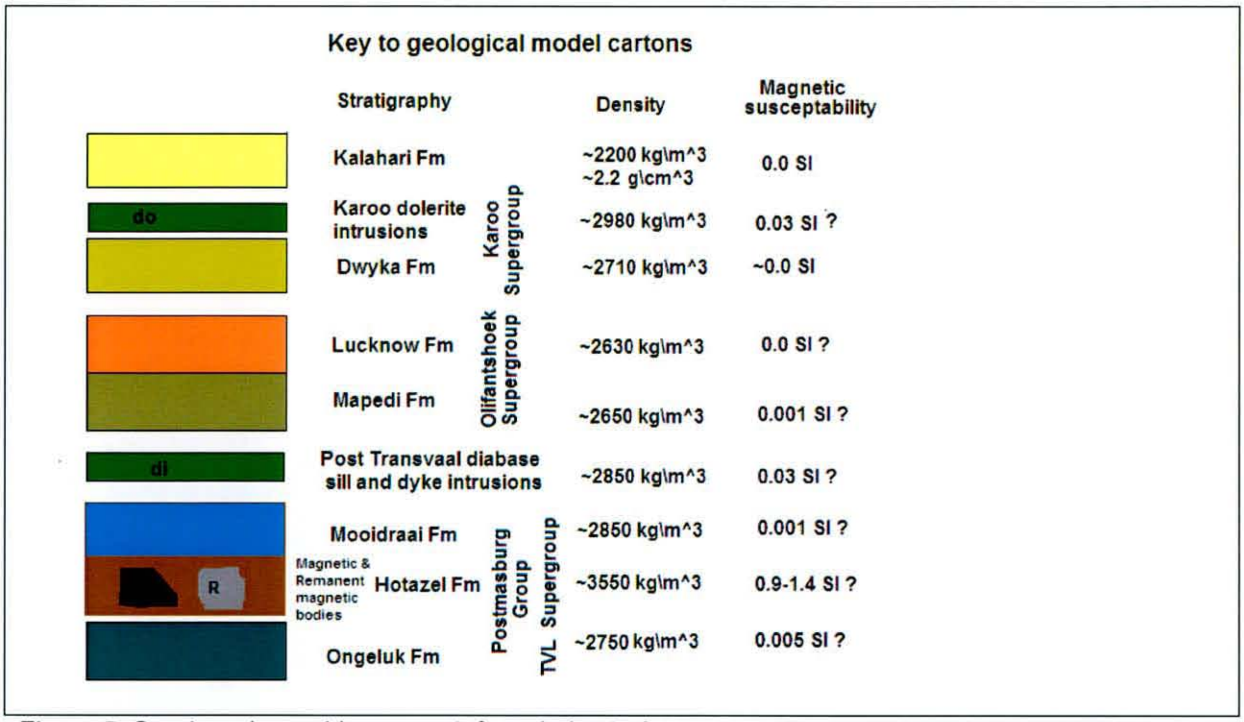


Figure 5. Stratigraphy and known or inferred physical parameters.

possible hydrothermal enrichment of the ore, took place. Some notable geologists who are considered experts on these Mn ore deposits argue against this post hydrothermal enrichment but this is not important. Important for the exploration strategy is that Kameni uses four parameters to locate suitable target areas, namely

i) the correct geological environment,

ii) deep magnetic lows, which correlate with

iii) dense rocks at depth giving a gravity high, and

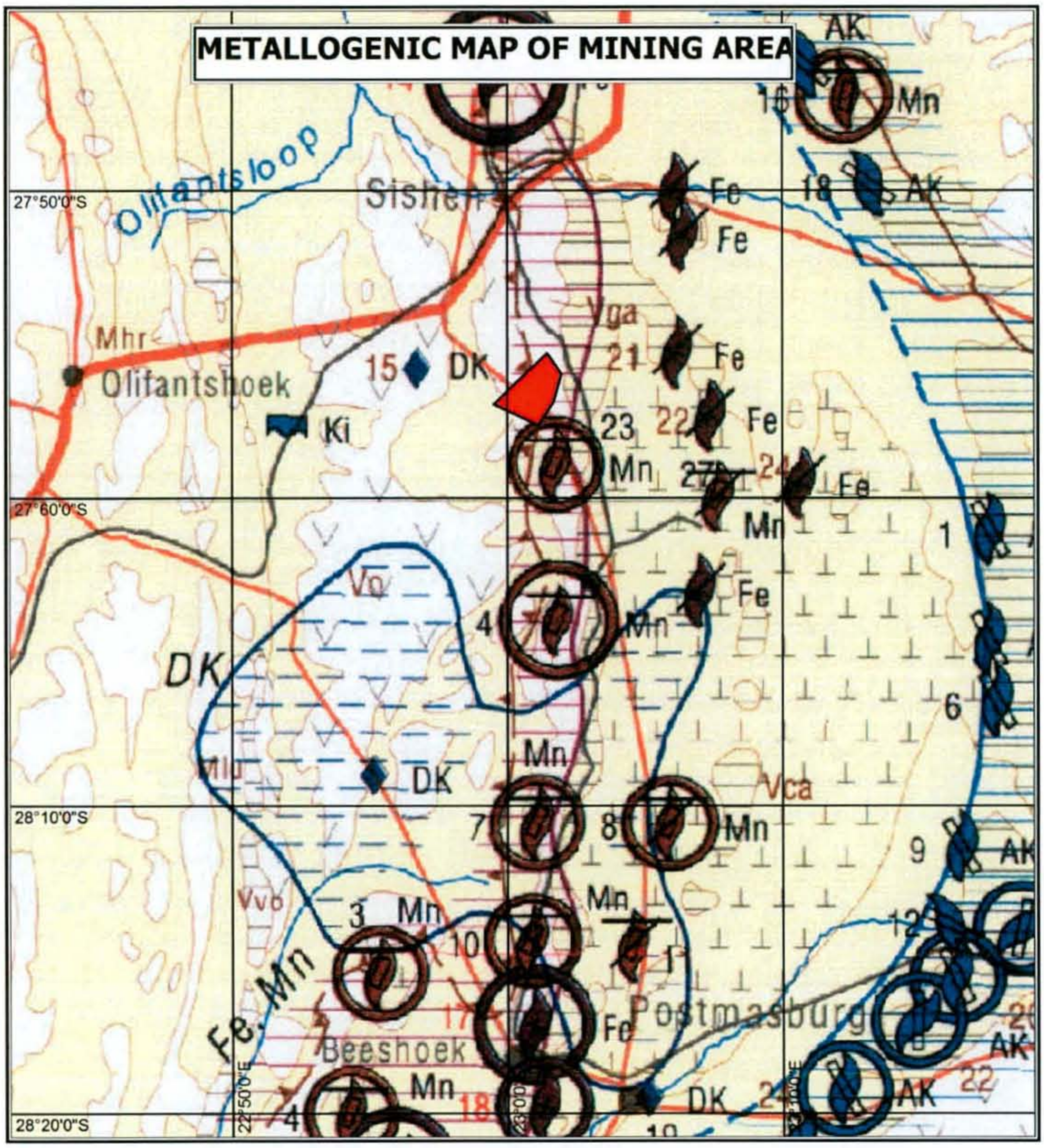
iv) electrically conductive rocks.

Figure 5 depicts the current accepted geological stratigraphy together with known or inferred physical parameters for each unit.

2. Exploration targets in the northern part of the Kalahari Manganese Field.

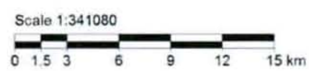
Figure 6 below shows coloured map of total magnetic field strength and the warm colours (red, purple) indicate magnetic highs. The cold colours (shades of blue) indicate magnetic lows. Magnetic highs can be equated with the north seeking pole of a bar magnet and the lows with south seeking poles and the magnetic body is situated between the 2 poles. The magnetic high and lows are normally orientated along the direction of the main component of the earth's magnetic field which dictates a large amplitude high over the northern to northwestern boundary of a magnetic body and a smaller amplitude low on the opposite boundary for southern

sand cover, the DwykaFm, directly overlying a shale unit of the MapediFm and then the Hotazel Banded Iron Fm. The Mooidraai Dolomite formation is not present. The BIF contained a mixture of Jaspelite, Hematite and Mn-carbonate with a Mn content as high as 74%, as measured with a handheld X-ray probe. Based on the information available presently (which still has to be confirmed by laboratory analysis) there is at least a 20m thick unit of Jaspilite \ Mn-carbonate running at an average of 55% Mn and Kameni may be at the point of discovering a new Mn-province outside the known Wessels-Mamatwan basin.

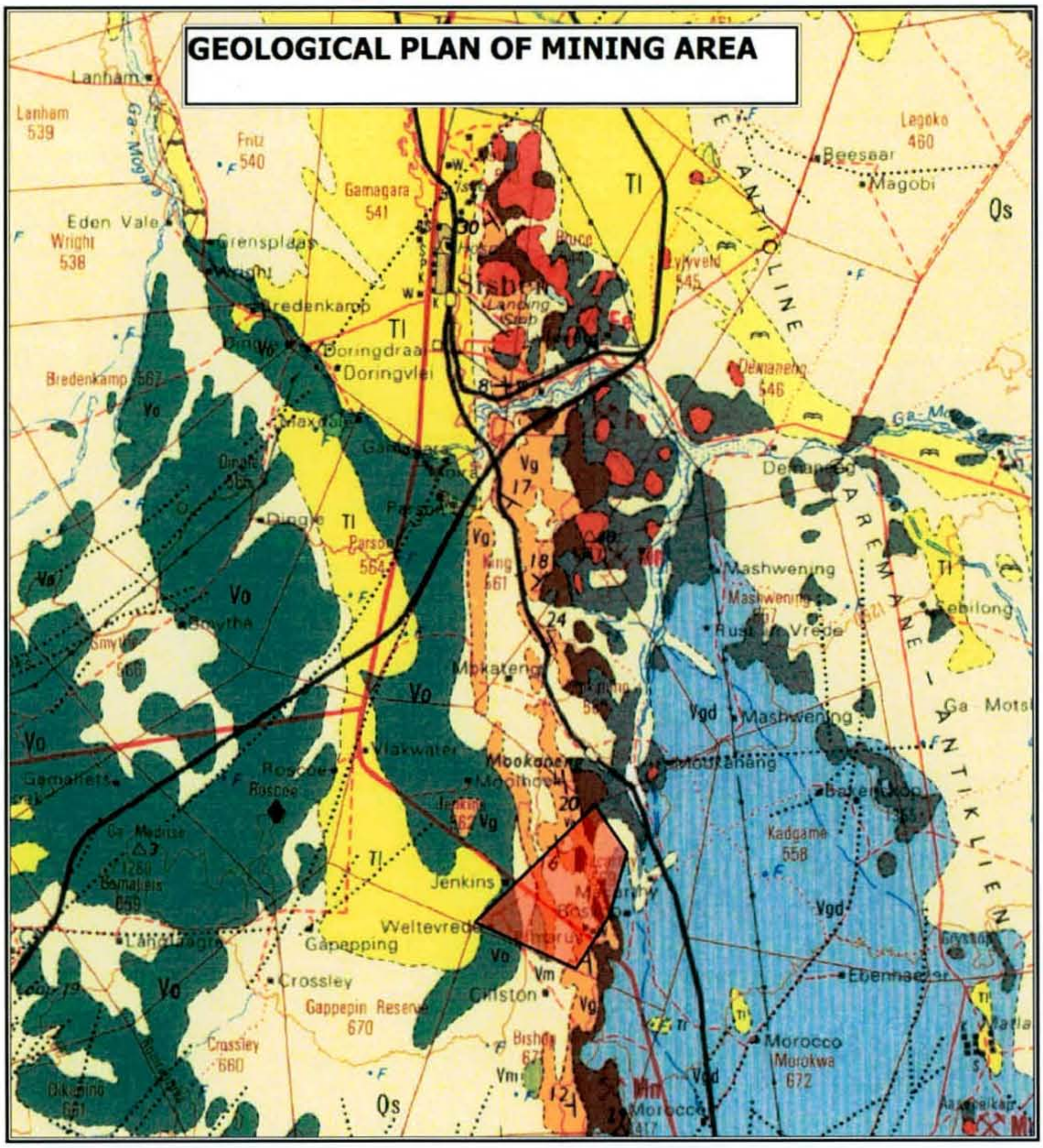


Legend

Thari Resources Mccarthy



GEOLOGICAL PLAN OF MINING AREA



Legend

Thari Resources Mccarthy

Scale 1:149290

0 1 2 4 6 8 10 km

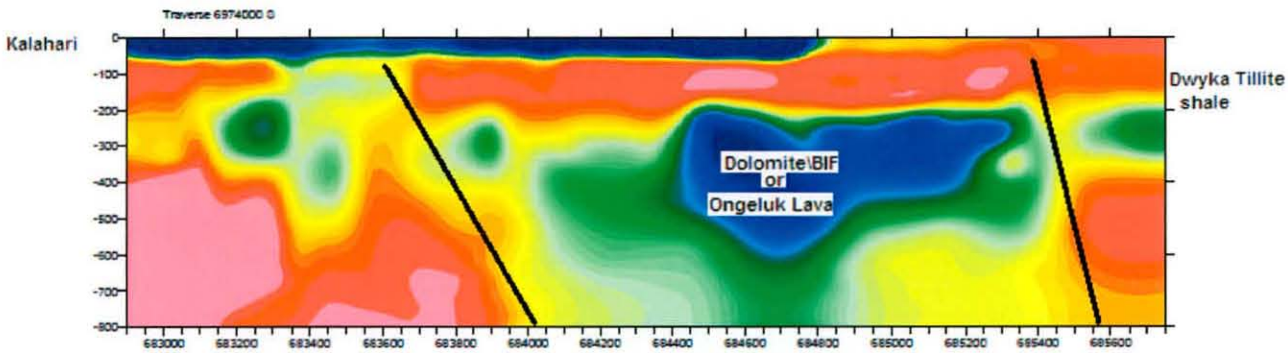


Figure 9. Detailed gravity coverage over Macarthy 559 (upper image). Lower image represents a cross-section through the earth along the magneto-telluric survey line as shown in the upper image.

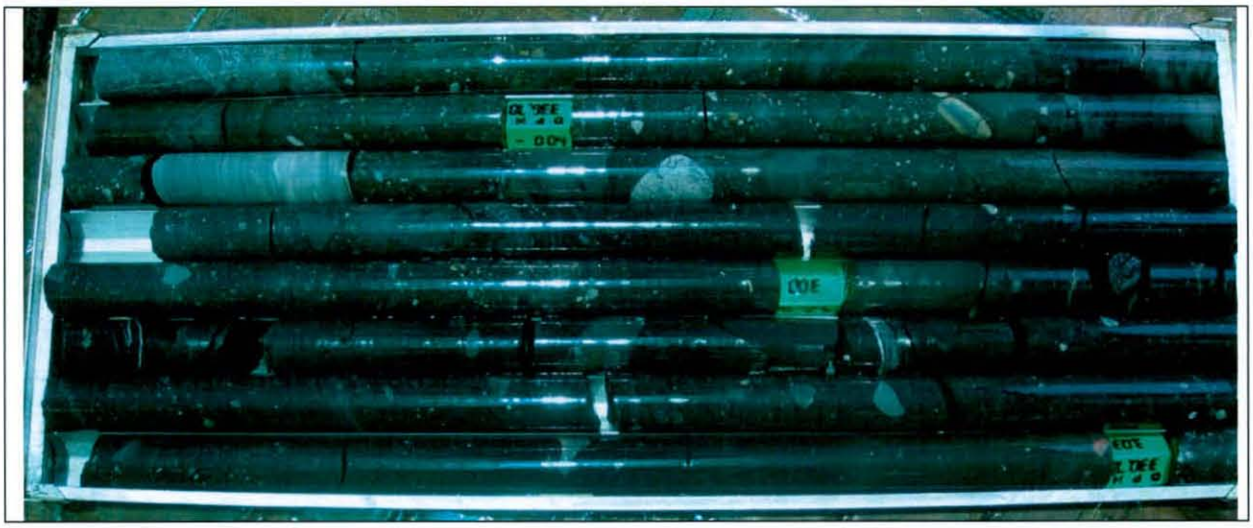


Figure 10.Photographs of the borehole core from 0 m to 65m on the farm Macarthy 559.