COZA IRON ORE PROJECT

Proposed Mining Activities

Sections of Portion 1 of the farm Doornpan 445, north of Postmasburg, Northern Cape Province

Heritage Impact Assessment

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Declaration of Independence

The report has been compiled by PGS Heritage an appointed Heritage Specialist for Synergistics Environmental Services. The views stipulated in this report are purely objective and no other interests are displayed during the decision making processes.

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Report Title	Proposed mining activities on Portion 1 of the farm Doornpan 445, north of Postmasburg, Northern Cape Province		
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EXECUTIVE SUMMARY

PGS Heritage was appointed by Synergistics Environmental Services to undertake a Heritage Impact Assessment (HIA) that forms part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the proposed mining activities located on sections of Portion 1 of the farm Doornpan 445, north of Postmasburg, Northern Cape Province.

Desktop Study

This Heritage Impact Assessment was preceded by a Heritage Scoping Report which included a detailed desktop study. This desktop study indicated that both the study area and surrounding area have a rich historical and archaeological history. The scoping report provided a number of findings and observations which can be grouped within archival and historical maps, history, archaeology and palaeontology. These will be individually discussed here again, after which the findings from the heritage field survey will be provided.

- **Archival and Historical Maps**

  The following observations can be made as a result of the study of archival and historical maps of the study area:

  - In 1911 the farm Doornpan as well as the study area was entirely undeveloped and was likely characterised by farming activities.
  - By 1928 a farmhouse had been built on Doornpan. However, based on the information available on the maps, this farmhouse represented the only man-made feature within the farm at the time. Although the exact age of this farmhouse is not known, it would have been built between 1911 and 1928. As such, the farmhouse can be anything between 86 years and 103 years old if it still exists today. It is important to note that this farmhouse is depicted outside of the present study area.
  - By 1970 considerable development has taken place in proximity to the study area. This includes mining as well as infrastructural development such as the

construction of the railway line between Postmasburg and Lohatla that was built in 1936.

- One additional building appears on the farm Doornpan on the 1970 map. This building appears to be associated with the farmhouse which had been built sometime before. This additional building would have been constructed between 1928 and 1970, and as such would be between 86 years and 44 years old if it still exists today.

- **History**

The archival and historical research has revealed a long and significant history in terms of the surroundings of the study area. However, even though this historical study was quite intensive and detailed, very little historical information with regard to the study area itself could be located.

However, the historic study highlighted some of the historical and archaeological sites which may potentially have been located within the study area. These include Stone Age sites, Iron Age sites associated with the histories of the Thlaro and Thlaping, sites associated with the Kora and Griqua periods (graves, buildings and middens), sites associated with the early and later settlement of white farmers in the area (graves, farmsteads and middens) as well as mining-related sites (shafts, trenches, discard dumps, abandoned mine machinery and mine buildings).

- **Archaeology**

Previous studies conducted in the surroundings of the study area have identified a number of archaeological sites. These include Stone Age (ESA, MSA and LSA) sites including find spots, surface scatters and rock art sites; pre-colonial specularite mining sites; historic structures and buildings; historic mining sites as well as graves.

Due to the arid nature of the surroundings of the study area, it seems likely for many of the archaeological site types (with the possible exception of pre-colonial and historical mine sites) to be concentrated in proximity to water sources such as riverine edges and pans.

- **Palaeontology**

  The study areas are underlain by chemical and clastic sedimentary sequences of the Campbell and Postmasburg Groups of the Transvaal Supergroup. These sedimentary sequences are associated with BIFs in the Postmasburg region where mining is envisaged. The dolomite sequences can contain good examples of stromatolite structures that are of medium palaeontological significance.

  It is recommended that the developer and the development ECO be made aware of the possible presence of stromatolites. If these structures are present, a qualified palaeontologist must be informed and a representative sample of at least 1m3 must be collected for future reference. Photographic recording of the structures must form part of the Environmental Management Plan of the mining development.

Fieldwork Findings

Fieldwork was undertaken of the proposed footprint areas during May 2013 and February 2014. This comprised intensive walkthroughs through the proposed footprint areas to identify archaeological and heritage sites. As a result of the fieldwork, three sites were identified. The two sites identified during a previous Archaeological Impact Assessment on a smaller section of the study area are also included in this report. The five sites identified within the study area (three sites identified during the present study and two during a study undertaken in 2010) will be discussed individually below:

- **Site 1**

  The site comprises a findspot of a Middle Stone Age flake. No other lithics were identified here. The site has Low Significance.

- **Site 2**

  The site comprises a deep excavation which may have been a well or mining feature. It is circular, roughly 2m across and some 10m deep. A second similarly sized excavation was made through a section of the first. At this point it is not known

whether the site can be interpreted as a well or mining excavation. The available Google Earth imagery appears to indicate that the site is located on a non-perennial stream which suggests that the site may be a well. It has Moderate Significance.

- **Site 3**

  The site comprises an old road that was built along the northern slope of Bleskop hill. It has a stone packed terrace on the downhill side that was built to make the road surface level. It is a well constructed feature which in all likelihood provided access to the summit of the hill. As a result the road was in all likelihood used for exploration or mining activities. In terms of establishing a date for the road, an unfired round of ammunition was observed on the site. Its headstamp contains the following information: "U 44 VII". As a result the round can be identified as a Mark VII .303 round that was manufactured in 1944 by the South African Mint. The date appearing on this round provides a chronological marker for the road and although it does not provide any absolute dates, the suggestion is that the road can in all likelihood be dated to the 1940s or 1950s. The site has a Moderate Significance.

- **Site 4**

  A Middle Stone Age flake was identified by L. Webley and D. Halkett. The flake showed retouch and was manufactured using fine grained raw material. The authors assessed the site to be of Low Significance (ACO, 2010).

- **Site 5**

  An Early Stone Age core manufactured of quartzite was identified by L. Webley and D. Halkett. The authors assessed the site to be of Low Significance (ACO, 2010).

The impact of the proposed mining development on Sites 1 to 3 was calculated. Site 4 and 5 had originally been assessed to be of Low Significance with no mitigation measures required and as a result were not included in the impact risk calculations.

The impact risk calculations on the other three sites showed that the impact risk of the development on Sites 1 and 2 fall within Impact Class 2 which represents a Low Impact. The impact risk for Site 3 falls within Impact Class 3 which represents a Moderate Impact. The following mitigation measures are required:

- The road is older than 60 years and cannot be disturbed or impacted upon without a permit from the relevant heritage authority.
- The site must be documented with plan drawings as well as photographic recording. This documentation must accompany the permit application.
- Once the permit is received, the proposed road in this area can be constructed.

The impact risk calculation for Site 1 was based on the assumption that the proposed activities in this area would be undertaken strictly within the development footprint areas. However, should any impacts be expected on this site the following will be required:

- The site is likely older than 60 years and is potentially also older than 100 years as well. As a result it cannot be disturbed or impacted upon without a permit from the relevant heritage authority.
- The site must be documented with plan drawings as well as photographic recording. This documentation must accompany the permit application.
- Only once the necessary permits have been received can any impacts be allowed.

In general terms, only the footprint areas of the proposed mining activities as depicted on the mine development layout plan and the track logs map from within this report were assessed during this heritage impact assessment. Should the development footprints of the proposed development change in any way, these additional areas will have to be assessed in the field and included as part of a revised heritage impact assessment study.

On the condition that these recommendations are adhered to, the proposed mining development may be allowed to continue.

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1 INTRODUCTION

PGS Heritage was appointed by Synergistics Environmental Services to undertake a Heritage Impact Assessment (HIA) that forms part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the proposed mining activities located on sections of Portion 1 of the farm Doornpan 445, north of Postmasburg, Northern Cape Province.

1.1 Scope of the Study

The HIA aims to inform the EIA in the development of a comprehensive EMP to assist the developer in managing the discovered heritage resources in a responsible manner, in order to protect, preserve, and develop them within the framework provided by the National Heritage Resources Act of 1999 (Act 25 of 1999) (NHRA).

1.2 Specialist Qualifications

This Heritage Impact Assessment Report was compiled by PGS Heritage (PGS).

The staff at PGS has a combined experience of nearly 45 years in the heritage consulting industry. PGS and its staff have extensive experience in managing HIA processes. PGS will only undertake heritage assessment work where they have the relevant expertise and experience to undertake that work competently.

Polke Birkholtz, the Project Manager, is registered with the Association of Southern African Professional Archaeologists (ASAPA) as a Professional Archaeologist and is accredited with the CRM Section of ASAPA. He has 16 years experience in the heritage assessment and management field and holds a B.A. (cum laude) from the University of Pretoria specialising in Archaeology, Anthropology and History as well as a B.A. (Hons.) in Archaeology (cum laude) from the same university.

Dr Gideon Groenewald, the appointed Palaeontologist for this project, holds a PhD in Geology from the Nelson Mandela Metropolitan University (1996) and the National Diploma in Nature Conservation from the University of South Africa (1990). He specialises in research on South African Permian and Triassic sedimentology and macrofossils with an interest in biostratigraphy, and palaeoecological aspects. He has extensive experience in the locating

of fossil material in the Karoo Supergroup and has more than 20 years of experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the southern, western, eastern and north-eastern parts of the country. His publication record includes multiple articles in internationally recognized journals. Dr Groenewald is accredited by the Palaeontological Society of Southern Africa (society member for 25 years).

1.3 Assumptions and Limitations

Not detracting in any way from the comprehensiveness of the fieldwork undertaken, it is necessary to realise that the heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources present within the area. Various factors account for this, including the subterranean nature of some archaeological sites and the current dense vegetation cover. As such, should any heritage features and/or objects not included in the present inventory be located or observed, a heritage specialist must immediately be contacted. Such observed or located heritage features and/or objects may not be disturbed or removed in any way until such time that the heritage specialist has been able to make an assessment as to the significance of the site (or material) in question. This applies to graves and cemeteries as well. In the event that any graves or burial places are located during the development, the procedures and requirements pertaining to graves and burials will apply as set out below.

1.4 Legislative Context

The identification, evaluation and assessment of any cultural heritage site, artefact or find in the South African context is required and governed by the following legislation:

i. National Environmental Management Act (NEMA), Act 107 of 1998
ii. National Heritage Resources Act (NHRA), Act 25 of 1999
iii. Mineral and Petroleum Resources Development Act (MPRDA), Act 28 of 2002
iv. Development Facilitation Act (DFA), Act 67 of 1995

The following sections in each Act refer directly to the identification, evaluation and assessment of cultural heritage resources (CRM).

i. National Environmental Management Act (NEMA) Act 107 of 1998
    a. Basic Environmental Assessment (BEA) – Section (23)(2)(d)

b. Environmental Scoping Report (ESR) – Section (29)(1)(d)
c. Environmental Impact Assessment (EIA) – Section (32)(2)(d)
d. Environmental Management Plan (EMP) – Section (34)(b)

ii. National Heritage Resources Act (NHRA) Act 25 of 1999
a. Protection of Heritage Resources – Sections 34 to 36; and
b. Heritage Resources Management – Section 38

iii. Mineral and Petroleum Resources Development Act (MPRDA) Act 28 of 2002
a. Section 39(3)

iv. Development Facilitation Act (DFA) Act 67 of 1995
a. The GNR.1 of 7 January 2000: Regulations and rules in terms of the Development Facilitation Act, 1995. Section 31.

The NHRA stipulates that cultural heritage resources may not be disturbed without authorization from the relevant heritage authority. Section 34(1) of the NHRA states that, "no person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority…" The NHRA is utilized as the basis for the identification, evaluation and management of heritage resources and in the case of CRM those resources specifically impacted on by development as stipulated in Section 38 of NHRA, and those developments administered through NEMA, MPRDA and the DFA legislation. In the latter cases the feedback from the relevant heritage resources authority is required by the State and Provincial Departments managing these Acts before any authorizations are granted for development. The last few years have seen a significant change towards the inclusion of heritage assessments as a major component of Environmental Impacts Processes required by NEMA and MPRDA. This change requires us to evaluate the Section of these Acts relevant to heritage (Fourie, 2008).

The NEMA 23(2)(b) states that an integrated environmental management plan should, "…identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage".

A study of subsections (23)(2)(d), (29)(1)(d), (32)(2)(d) and (34)(b) and their requirements reveals the compulsory inclusion of the identification of cultural resources, the evaluation of the impacts of the proposed activity on these resources, the identification of alternatives and the management procedures for such cultural resources for each of the documents noted in the Environmental Regulations. A further important aspect to be taken account of

in the Regulations under NEMA is the Specialist Report requirements laid down in Section 33 of the regulations (Fourie, 2008).

Terminology and Abbreviations

Archaeological resources

This includes:

i. material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years including artefacts, human and hominid remains and artificial features and structures;
ii. rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation;
iii. wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the republic as defined in the Maritimes Zones Act, and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation;
iv. features, structures and artefacts associated with military history which are older than 75 years and the site on which they are found.

Cultural significance

This means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance

Development

This means any physical intervention, excavation, or action, other than those caused by natural forces, which may in the opinion of the heritage authority in any way result in a change to the nature, appearance or physical nature of a place or influence its stability and future well-being, including:

i. construction, alteration, demolition, removal or change in use of a place or a structure at a place;
ii. carrying out any works on or over or under a place;

iii. subdivision or consolidation of land comprising a place, including the structures or airspace of a place;
iv. constructing or putting up for display signs or boards;
v. any change to the natural or existing condition or topography of land; and
vi. any removal or destruction of trees, or removal of vegetation or topsoil

Early Stone Age

The archaeology of the Stone Age between 700 000 and 2 500 000 years ago.

Fossil

Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

Heritage

That which is inherited and forms part of the National Estate (historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).

Heritage resources

This means any place or object of cultural significance

Holocene

The most recent geological time period which commenced 10 000 years ago.

Late Stone Age

The archaeology of the last 20 000 years associated with fully modern people.

Late Iron Age (Early Farming Communities)

The archaeology of the last 1000 years up to the 1800's, associated with iron-working and farming activities such as herding and agriculture.

Middle Stone Age

The archaeology of the Stone Age between 20 000-300 000 years ago, associated with early modern humans.

Palaeontology

Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

The table below provides a description of the abbreviations which are used in this report:

Abbreviations	*Description*
AIA	Archaeological Impact Assessment
ASAPA	Association of South African Professional Archaeologists
BIF	Banded Iron Formations
CRM	Cultural Resource Management
DEA	Department of Environmental Affairs
EIA	Environmental Impact Assessment
ESA	Early Stone Age
GPS	Global Positioning System
HIA	Heritage Impact Assessment
LIA	Late Iron Age
LSA	Later Stone Age
MSA	Middle Stone Age
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
PGS	PGS Heritage and Grave Relocation Consultants
PHRA	Provincial Heritage Resources Authority
PSSA	Palaeontological Society of South Africa
ROD	Record of Decision
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System

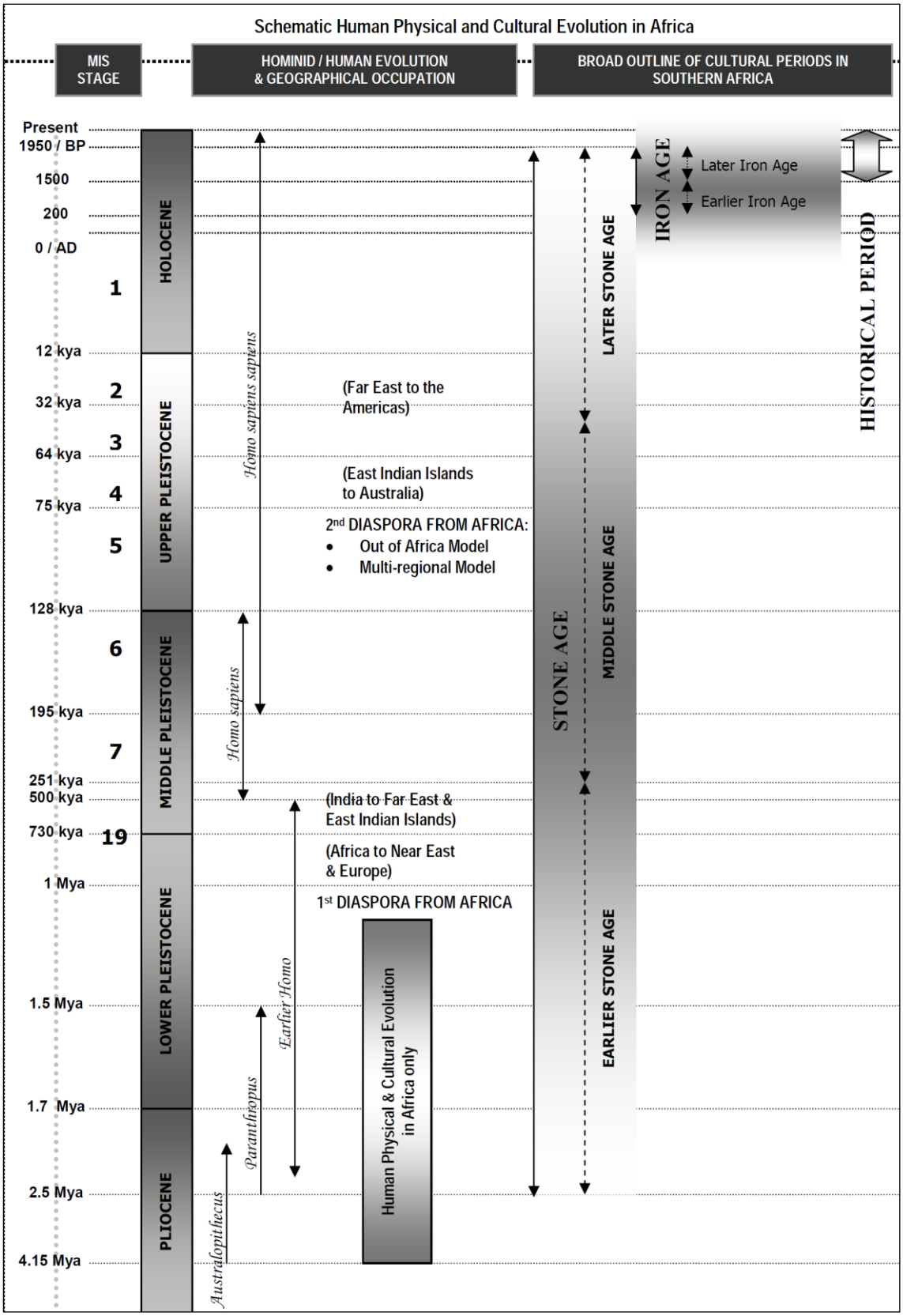

Figure 1 – Human and Cultural Time line in Africa (Morris, 2008)

2 TECHNICAL DETAILS OF THE PROJECT

2.1 Site Location and Description

Coordinates	Approximate Centre of Proposed Development: S 28°12'17.1" E 23°04'13.60"
Property	The proposed activity is located within Portion 1 of the farm Doornpan 445.
Location	The site is located 12.5km north of Postmasburg in the Northern Cape Province.
Extent	The proposed mining development comprises mining blocks and access roads. The combined extent of the mining blocks is roughly 51 hectares whereas the combined extent of the access roads is 3.84 hectares (comprising a combined length of 7.67km and a standard estimated width of 5m).
Land Description	The land is currently utilised for grazing and consists of grass and bush cover. As suggested by the name of the farm, extensive sections of the study area is characterised by dense thickets of black thorn (*Acacia mellifera*).

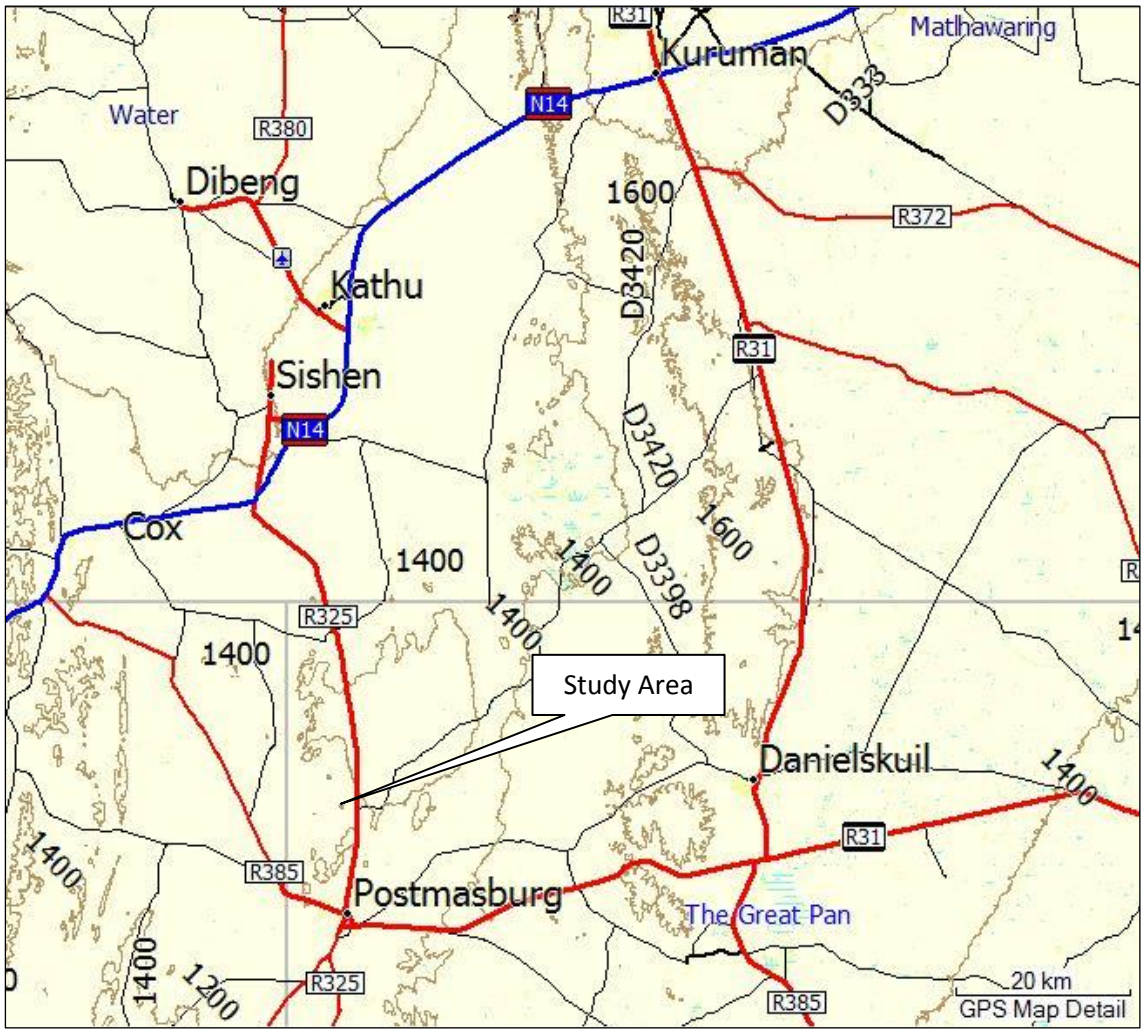

Figure 2 – Location of the Study Area within its Regional Context.

2.2 Technical Project Description

This section was provided by Synergistics.

The proposed COZA Iron Project will involve the mining of iron ore from an open pit to be located on Farm Doornpan. The proposed development will be a green-fields project with an estimated area of disturbance of 159 ha. A preliminary layout plan has been developed for the Doornpan mining area.

Mining from the pit will be undertaken by means of truck and shovel. It is estimated that the pit will reach an average depth of 80 - 100m below surface. Mining will involve the following activities:

- Site clearance which will involve the removal of vegetation (indigenous and alien) within the mine footprint area of approximately 159 ha;
- Removal of available soils and stockpiling at designated areas for rehabilitation purposes;
- Drilling and blasting of overburden material;
- Loading and haulage of overburden to the waste rock dump site within the mine infrastructure areas; and
- Material containing iron ore will be mined out by means of truck and shovel and taken to the crushing and screening plant.
- From the crushing and screening plant, material will be transported via haul trucks off-site.

Following a preliminary resource estimation process, it is estimated that 1 .7 million tons of ore is available to be mined at Doornpan. The current estimated production rates is an average of 430 000 tons of ore per annum over a life of mine of 4 years.

It is expected that crushing, screening, and blending will take place on site. These processing activities will be adjacent to the pit. Crushed ore will then be blended prior to transport off-site. No tailings facilities will be required at the mine.

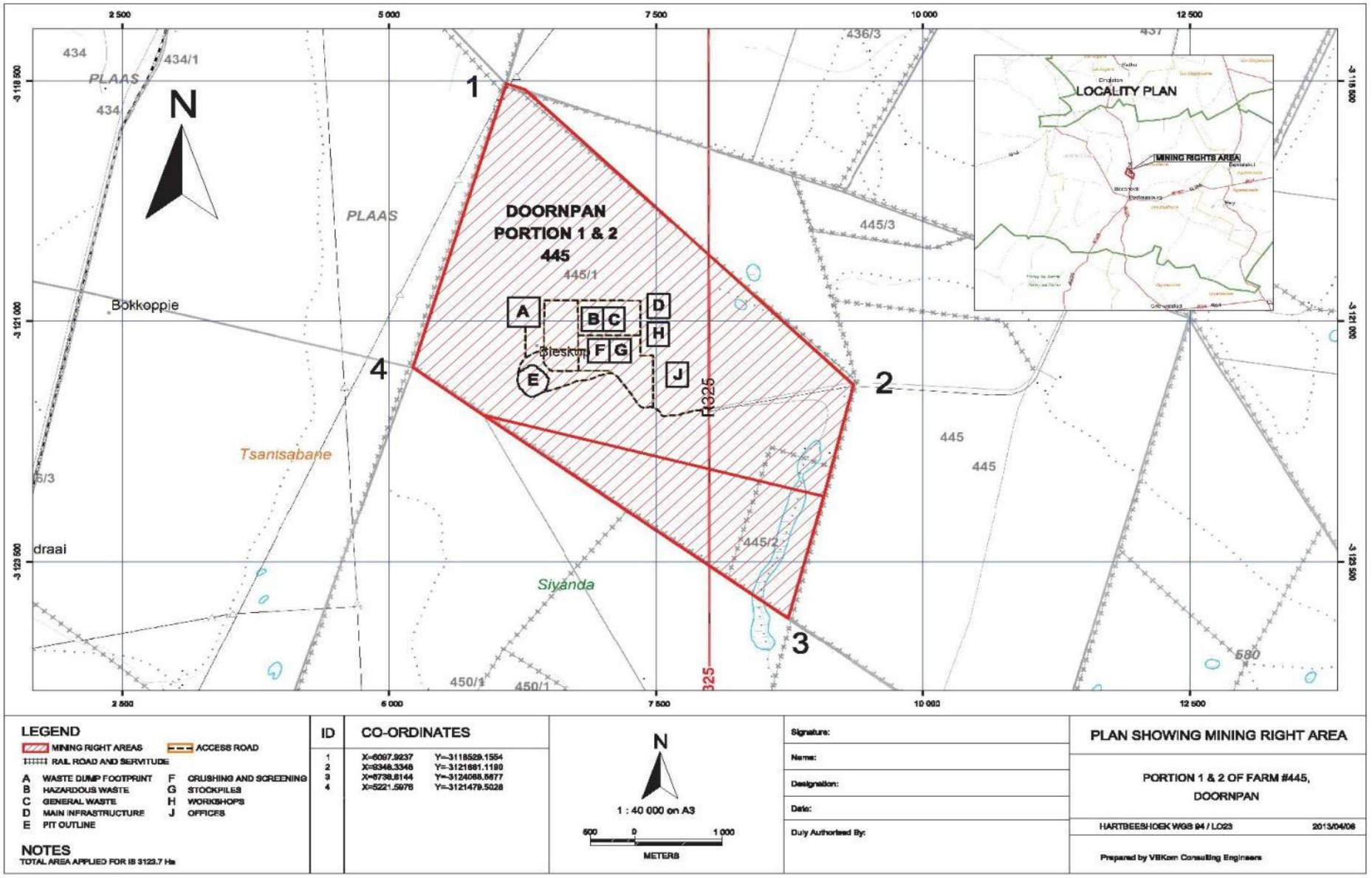

Figure 3 – Development layout plan for the proposed mining activities at Doornpan. Only the footprints of the mining development as indicated on this map was assessed in this heritage impact assessment. Plan supplied by Synergisitcs.

3 ASSESSMENT METHODOLOGY

3.1 Methodology for Assessing Heritage Site Significance

This report was compiled by PGS Heritage for proposed mining activities. The applicable maps, tables and figures are included as stipulated in the NHRA (no 25 of 1999) and the National Environmental Management Act (NEMA) (no 107 of 1998). The HIA process consisted of three steps:

Step I – Desktop Study: The background information to the field survey leans greatly on the archival and historical cartographic material assessed as part of the study as well as a study of the available literature. The desktop study also included a detailed historical overview of the study area and surrounding landscape as well as a palaeontological desktop study.

Step II – Field Survey: Physical field surveys comprising intensive walkthroughs of the proposed footprint areas were conducted on Monday, 13 May 2013 and Tuesday, 14 May 2013. Due to the fact that changes had been made to the proposed mining development layout that was surveyed in 2013, additional fieldwork was undertaken between Friday, 14 February 2014 and Sunday, 16 February 2014. The original fieldwork was undertaken by a team comprising a professional archaeologist (Polke Birkholtz) and field assistant (Derrick James). The more recent fieldwork was undertaken by a team comprising a professional archaeologist (Polke Birkholtz) and three field assistants (Derrick James, Thomas Mulaudzi and Edward Khorommbi).

Step III – Report: The final step involved the recording and documentation of relevant heritage resources, as well as the assessment of resources regarding the heritage impact assessment criteria and report writing, as well as mapping and recommendations.

The significance of heritage sites was based on five main criteria:

- site integrity (i.e. primary vs. secondary context),
- amount of deposit, range of features (e.g., stonewalling, stone tools and enclosures),
- Density of scatter (dispersed scatter)
    - Low - <10/50m2
    - Medium - 10-50/50m2
    - High - >50/50m2

- uniqueness and
- potential to answer present research questions.

Management actions and recommended mitigation, which will result in a reduction in the impact on the sites, will be expressed as follows:

A - No further action necessary;
B - Mapping of the site and controlled sampling required;
C - No-go or relocate development position
D - Preserve site, or extensive data collection and mapping of the site; and
E - Preserve site

Site Significance

Site significance classification standards prescribed by the South African Heritage Resources Agency (2006) and approved by the Association for Southern African Professional Archaeologists (ASAPA) for the Southern African Development Community (SADC) region, were used for the purpose of this report (see **Table 1**).

Table 1: Site significance classification standards as prescribed by SAHRA

FIELD RATING	GRADE	SIGNIFICANCE	RECOMMENDED MITIGATION
National Significance (NS)	Grade 1	-	Conservation; National Site nomination
Provincial Significance (PS)	Grade 2	-	Conservation; Provincial Site nomination
Local Significance (LS)	Grade 3A	High	Conservation; Mitigation not advised
Local Significance (LS)	Grade 3B	High	Mitigation (Part of site should be retained)
Generally Protected A (GP.A)	Grade 4A	High/Medium	Mitigation before destruction
Generally Protected B (GP.B)	Grade 4B	Medium	Recording before destruction
Generally Protected C (GP.C)	Grade 4D	Low	Destruction

3.2 Methodology for Impact Assessment

In order to ensure uniformity, a standard impact assessment methodology has been utilised so that a wide range of impacts can be compared. The impact assessment methodology makes provision for the assessment of impacts against the following criteria:

- Significance;
- Spatial scale;
- Temporal scale;
- Probability; and
- Degree of certainty.

A combined quantitative and qualitative methodology was used to describe impacts for each of the aforementioned assessment criteria. A summary of each of the qualitative descriptors, along with the equivalent quantitative rating scale for each of the aforementioned criteria, is given in **Table 2**.

Table 2: Quantitative rating and equivalent descriptors for the impact assessment criteria

RATING	SIGNIFICANCE	EXTENT SCALE	TEMPORAL SCALE
1	VERY LOW	*Isolated corridor / proposed corridor*	Incidental
2	LOW	*Study area*	Short-term
3	MODERATE	*Local*	Medium-term
4	HIGH	*Regional / Provincial*	Long-term
5	VERY HIGH	*Global / National*	Permanent

A more detailed description of each of the assessment criteria is given in the following sections.

Significance Assessment

The significance rating (importance) of the associated impacts embraces the notion of extent and magnitude, but does not always clearly define these, since their importance in the rating scale is very relative. For example, 10 structures younger than 60 years might be affected by a proposed development, and if destroyed the impact can be considered as VERY LOW in that the structures are all of Low Heritage Significance. If two of the structures are older

than 60 years and of historic significance, and as a result of High Heritage Significance, the impact will be considered to be HIGH to VERY HIGH.

A more detailed description of the impact significance rating scale is given in **Table** 3 below.

Table 3: Description of the significance rating scale

RATING		DESCRIPTION
5	VERY HIGH	Of the highest order possible within the bounds of impacts which could occur. In the case of adverse impacts: there is no possible mitigation and/or remedial activity which could offset the impact. In the case of beneficial impacts, there is no real alternative to achieving this benefit.
4	HIGH	Impact is of substantial order within the bounds of impacts which could occur. In the case of adverse impacts: mitigation and/or remedial activity is feasible but difficult, expensive, time-consuming or some combination of these. In the case of beneficial impacts, other means of achieving this benefit are feasible but they are more difficult, expensive, time-consuming or some combination of these.
3	MODERATE	Impact is real but not substantial in relation to other impacts, which might take effect within the bounds of those which could occur. In the case of adverse impacts: mitigation and/or remedial activity are both feasible and fairly easily possible. In the case of beneficial impacts: other means of achieving this benefit are about equal in time, cost, effort, etc.
2	LOW	Impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts: mitigation and/or remedial activity is either easily achieved or little will be required, or both. In the case of beneficial impacts, alternative means for achieving this benefit are likely to be easier, cheaper, more effective, less time consuming, or some combination of these.
1	VERY LOW	Impact is negligible within the bounds of impacts which could occur. In the case of adverse impacts, almost no mitigation and/or remedial activity is needed, and any minor steps which might be needed are easy, cheap, and simple. In the case of beneficial impacts, alternative means are almost all likely to be better, in one or a number of ways, than this means of achieving the benefit. Three additional categories must also be used where relevant. They are in addition to the category represented on the scale, and if used, will replace the scale.
0	NO IMPACT	There is no impact at all - not even a very low impact on a party or system.

Spatial Scale

The spatial scale refers to the extent of the impact i.e. will the impact be felt at the local, regional, or global scale. The spatial assessment scale is described in more detail in **Table 4**.

Table 4: Description of the spatial significance rating scale

RATING		DESCRIPTION
5	Global/National	The maximum extent of any impact.
4	Regional/Provincial	The spatial scale is moderate within the bounds of possible impacts, and will be felt at a regional scale (District Municipality to Provincial Level). The impact will affect an area up to 50 km from the proposed site / corridor.
3	Local	The impact will affect an area up to 5 km from the proposed site.
2	Study Area	The impact will affect an area not exceeding the boundary of the study area.
1	Isolated Sites / proposed site	The impact will affect an area no bigger than the site.

Temporal/Duration Scale

In order to accurately describe the impact, it is necessary to understand the duration and persistence of an impact in the environment.

The temporal or duration scale is rated according to criteria set out in **Table 5**.

Table 5: Description of the temporal rating scale

RATING		DESCRIPTION
1	Incidental	The impact will be limited to isolated incidences that are expected to occur very sporadically.
2	Short-term	The environmental impact identified will operate for the duration of the construction phase or a period of less than 5 years, whichever is the greater.
3	Medium-term	The environmental impact identified will operate for the duration of life of the project.
4	Long-term	The environmental impact identified will operate beyond the life of operation of the project.
5	Permanent	The environmental impact will be permanent.

Degree of Probability

The probability or likelihood of an impact occurring will be outlined in **Table 6** below.

Table 6: Description of the degree of probability of an impact occurring

RATING	DESCRIPTION
1	Practically impossible
2	Unlikely
3	Could happen
4	Very likely
5	It's going to happen / has occurred

Degree of Certainty

As with all studies, it is not possible to be 100% certain of all facts, and for this reason a standard "degree of certainty" scale is used, as discussed in **Table 7**. The level of detail for specialist studies is determined according to the degree of certainty required for decision-making.

Table 7: Description of the degree of certainty rating scale

RATING	DESCRIPTION
Definite	More than 90% sure of a particular fact.
Probable	Between 70 and 90% sure of a particular fact, or of the likelihood of that impact occurring.
Possible	Between 40 and 70% sure of a particular fact, or of the likelihood of an impact occurring.
Unsure	Less than 40% sure of a particular fact or the likelihood of an impact occurring.
Can't know	The consultant believes an assessment is not possible even with additional research.

Quantitative Description of Impacts

To allow for impacts to be described in a quantitative manner, in addition to the qualitative description given above, a rating scale of between 1 and 5 was used for each of the assessment criteria. Thus the total value of the impact is described as the function of significance, spatial and temporal scale, as described below:

Impact Risk = (SIGNIFICANCE ***+****Spatial****+*** Temporal) X Probability

3 5

An example of how this rating scale is applied is shown below:

Table 8: Example of Rating Scale

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	Low	Local	Medium Term	Could Happen	**Low**
Impact on heritage structures	2	3	3	3	**1.6**

Note: The significance, spatial and temporal scales are added to give a total of 8, which is divided by 3 to give a criterion rating of 2.67. The probability (3) is divided by 5 to give a probability rating of 0.6. The criteria rating of 2.67 is then multiplied by the probability rating (0,6) to give the final rating of 1,6.

The impact risk is classified according to five classes as described in the table below.

Table 9: Impact Risk Classes

RATING	IMPACT CLASS	DESCRIPTION
0.1 – 1.0	1	Very Low
1.1 – 2.0	2	Low
2.1 – 3.0	3	Moderate
3.1 – 4.0	4	High
4.1 – 5.0	5	Very High

Therefore, with reference to the example used for heritage structures above, an impact rating of 1.6 will fall in the Impact Class 2, which will be considered to be a low impact.

4 CURRENT STATUS QUO

4.1 Description of Study Area

The proposed activity comprises mining activities on sections of Portions 1 of the Farm Doornpan 445, north of Postmasburg, Northern Cape Province.

Apart from a conical hill known as Bleskop near its south-western corner, the study area can be described as topographically flat. Extensive sections of the study area are densely overgrown with black thorn (*Acacia mellifera*). The land is currently utilised for grazing and consists of grass and bush cover.

The wider surroundings of the study area is characterised by both mining activities as well as limited farming activities.

Figure 4 - General view of Bleskop Hill.

Figure 5 – General view over sections of the study area.

Figure 6 – Characteristic view across the study area.

Figure 7 – Another characteristic view of the study area.

5 ARCHIVAL AND HISTORICAL MAPS OF THE STUDY AREA

5.1 Griquatown Sheet of the Cape of Good Hope Reconnaissance Series, 1914

The figure below depicts a section of the Griquatown Sheet of the Cape of Good Hope Reconnaissance Series (National Archives, Maps, 3/652). The sheet was surveyed in 1911 by Captain R.B. Hopkins (Manchester Regiment) and Lieutenant J.L. Lockhart (Hampshire Regiment) under the direction of the Staff Captain in charge of Reconnaissance Surveys, Cape of Good Hope. The sheet was drawn and printed by the War Office in 1914. The approximate position of Portion 1 of the farm Doornpan 445 is depicted in red. The following observations can be made:

- No heritage sites are depicted within (or in close proximity to) the study area.
- Although a number of farms (with farmsteads) are depicted within the general vicinity, none of these are located within the study area.

5.2 Geology Map of the Postmasburg Manganese Deposits, 1927 - 1928

The figure below depicts a section of the map titled "*The Geology of the Postmasburg Manganese Deposits and Surrounding Country*" that was surveyed by L.T. Nel (with assistance provided by A.K. Parrott) during 1927 and 1928. This work was undertaken by the Geological Survey of the Union of South Africa's Department of Mines and Industries under the directorship of A.W. Rogers (National Archives, Maps, 3/709). The boundaries of the study area are marked in red and the following observations can be made from the map:

- One building is depicted on the farm Doornpan as well (see white circle). This building also appears to be a farmhouse.
- As these buildings are not depicted on the 1911 map, it is evident that they were built between 1911 and 1928. If they still exist today, the buildings would be between 102 years and 85 years old.
- It is evident from the surrounding landscape that no railway lines have yet been constructed in this area.
- No evidence for mining activities is depicted within the study area on the map.
- Although the depicted section of the map does not show it, the farm within which the present study area is depicted, is not shown as Doornpan but Doornput.

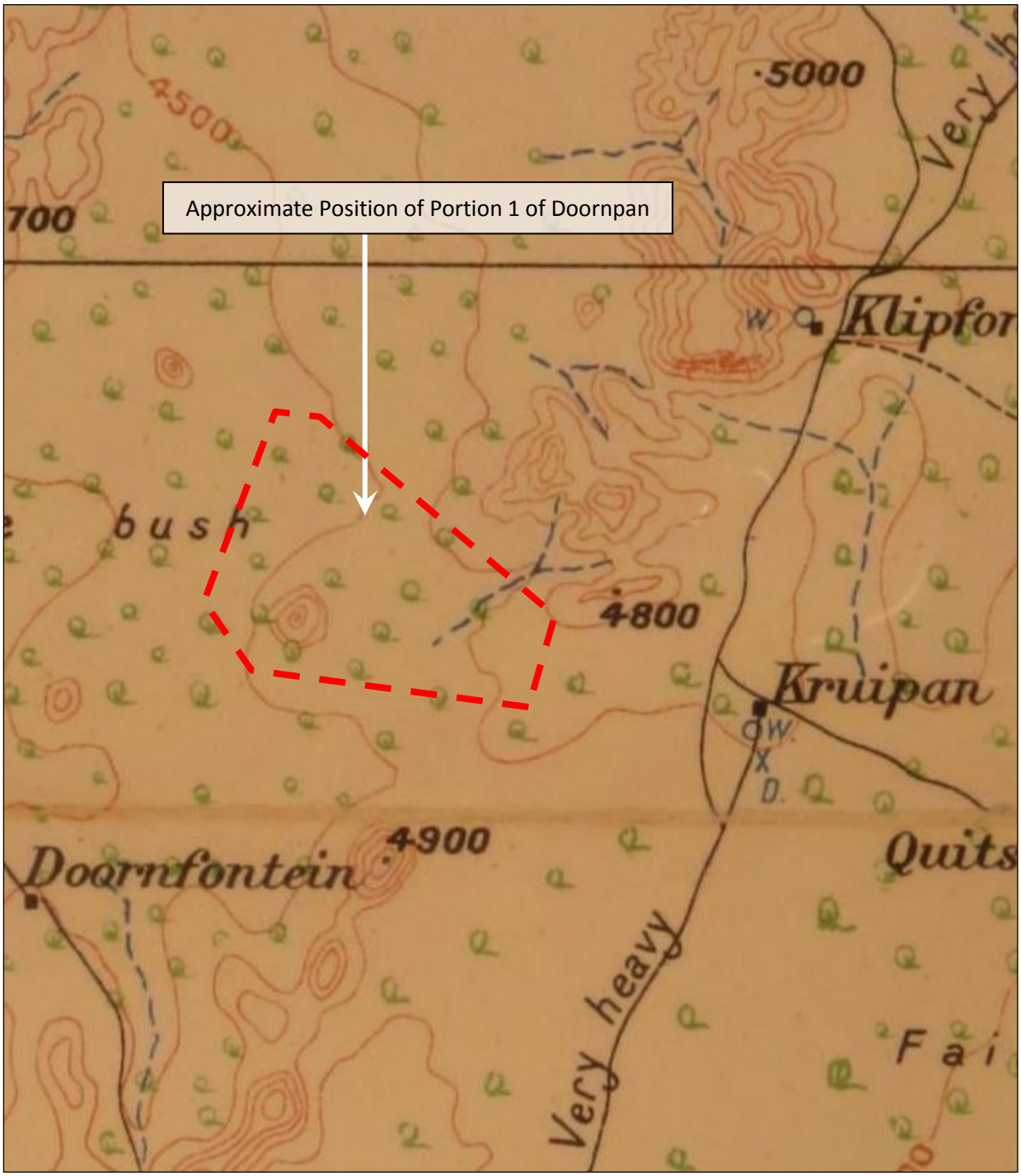

Figure 8 – Section of the Griquatown Sheet of the Cape of Good Hope Reconnaissance Series, dated to 1911 (National Archives, Maps, 3/652).

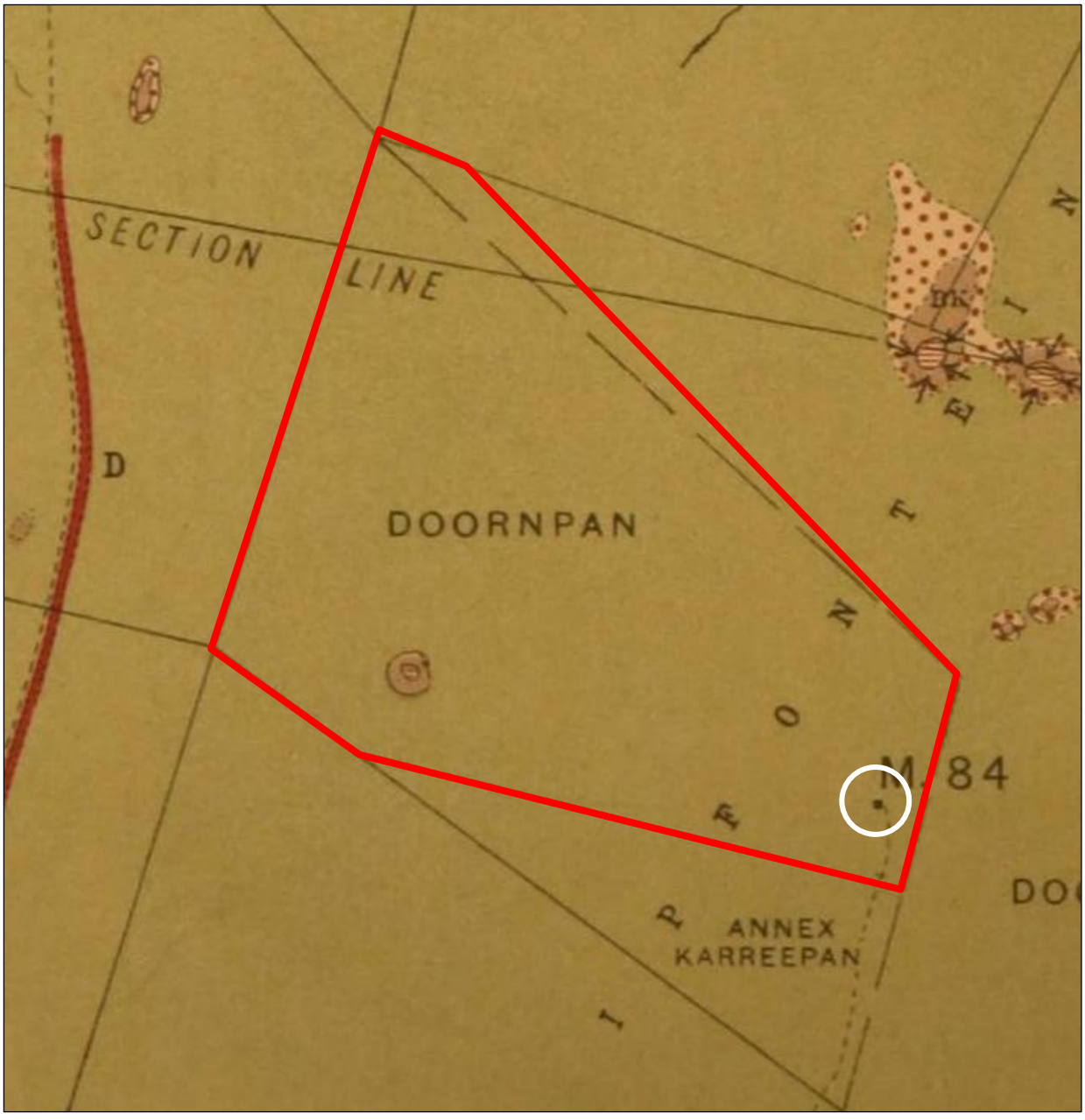

Figure 9 – Section of the Geology Map of the Manganese Deposits of Postmasburg that was surveyed during 1927 and 1928 (National Archives, Maps, 3/709).

5.3 First Edition of the 2823AA Topographical Sheet, 1970

The figure below depicts a section of the First Edition of the 2823AA Topographical Sheet. The sheet was based on aerial photography undertaken in 1967. It was surveyed in 1970 and drawn by the Trigonometrical Survey Office in 1971. The following observations can be made in terms of Portion 1 of the farm Doornpan:

- A farmstead comprising two buildings is depicted (see green circle). It is highly likely for the farmstead depicted on the 1928 map to be one of these buildings. Although this farmstead is located on Portion 1 of the farm, it is situated well away from the present mining footprint area.
- If these buildings still exist it would appear that one of these would be at least 85 years old while the second building would be at least 43 years old.

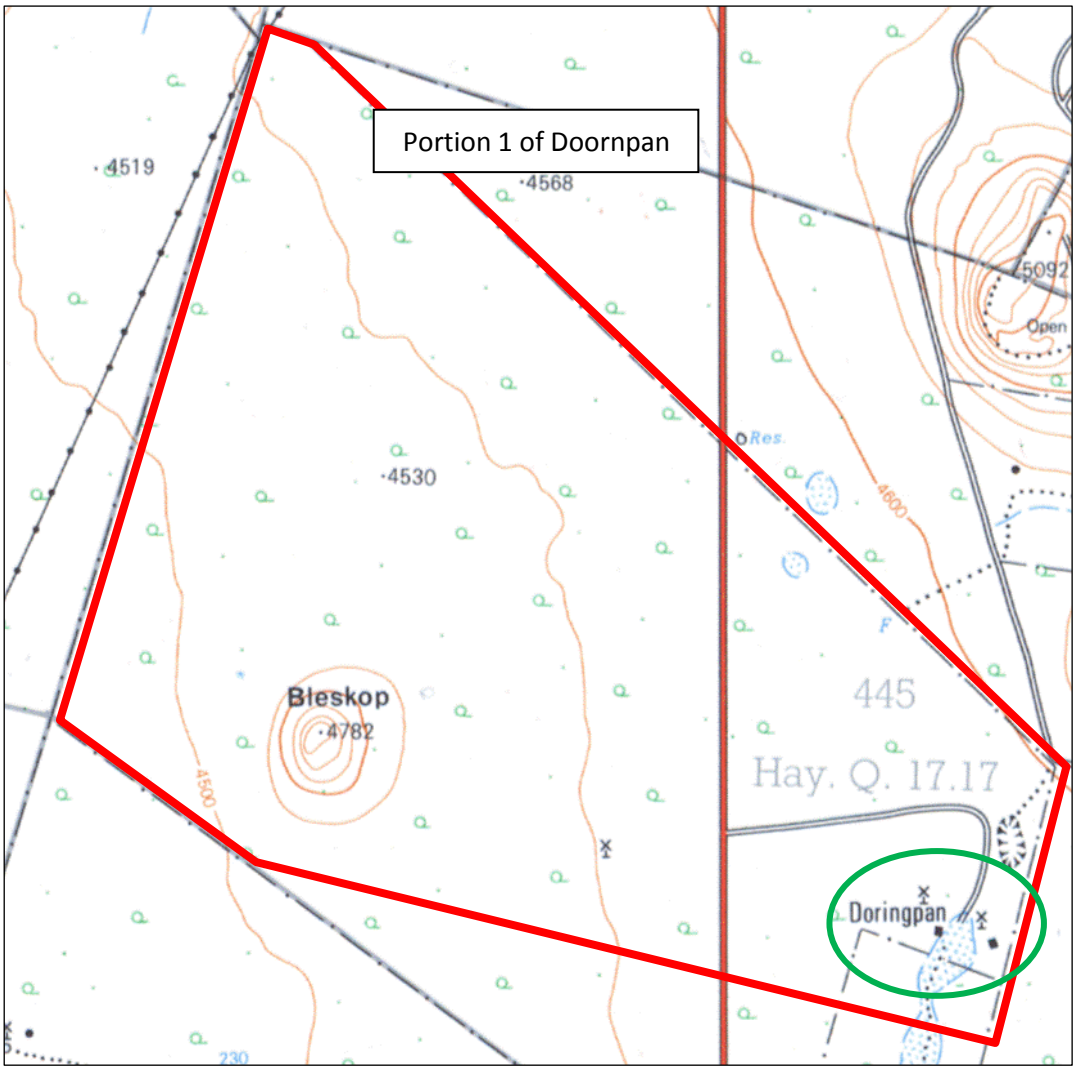

Figure 10 – First Edition of the 2823AA Topographical Sheet that was surveyed in 1970.

5.4 Summary of Findings in terms of the Archival and Historical Maps

The following observations can be made as a result of the study of archival and historical maps of the study area:

- In 1911 the study area was entirely undeveloped and was likely characterised by farming activities.
- By 1928 a farmhouse had been built on Doornpan. However, based on the information available on the map, this farmhouse represented the only man-made features within the farm at the time. Although the exact age of this farmhouse is not known, it would have been built between 1911 and 1928. As such, this farmhouse can be anything between 85 years and 102 years old.
- By 1970 considerable development has taken place within the general vicinity of the study area. This includes mining as well as infrastructural development such as the construction of the railway line between Postmasburg and Lohatla which had been completed in 1936.
- One additional building appears on the farm Doornpan on the 1970 map. This building appears to be associated with the farmhouse which had been built sometime before. This additional building would have been constructed between 1928 and 1970, and as such would be between 85 years and 43 years old if it still exists today.
- It is important to note that although the farmstead depicted on these maps is located on Portion 1 of the farm Doornpan 445, it is situated well away from the present study.

6 ARCHAEOLOGICAL OVERVIEW AND FINDINGS

6.1 Overview of the Archaeological Fabric of the Study Area and Surroundings

A number of archaeological surveys and research projects have been undertaken in the vicinity of Postmasburg and the study area. The reason for this focus in archaeological work in the surrounding area particularly, is most likely due to the large scale manganese and iron ore mining activities taking place and the resulting requirement for archaeologists to assess the proposed mining areas as well as the well-known presence of pre-colonial mining sites, rock art sites as well as Stone Age sites from the surroundings of Postmasburg and the study area.

With this as background, two main types of archaeological reports and publications were used to compile this overview. The first of these are reports that were accessed from the SAHRA electronic database known as SAHRIS, and which for the most part came about due to the requirement for archaeological and heritage impact assessments to be undertaken for mining (and other development) activities. The second source of information on the archaeology of the area is the use of published literature. It is important to note that the information listed here do not necessarily represent all the previous archaeological work undertaken in the vicinity of the study area.

6.1.1 Archaeological Sites as Revealed Through a Study of Published Literature

The following sites were identified by studying archaeological journals and books. The sites are grouped according to their respective farm names. At the end of each description the approximate distance between the site and the present study area is provided.

- **Blinkklipkop**

  This site is arguably the most significant archaeological and historical site in the vicinity of Postmasburg. It is a pre-colonial specularite mine located in a hill known as Blinkklipkop (or Gatkoppies) roughly 5km north-east of the town of Postmasburg. Specularite is a "...*crystalline form of hematite that is steel grey/iron-black in colour with a silvery sparkle*..." (Thackeray et.al., 1983:17) and which was much prised as a cosmetic by the different pre-colonial cultures of the area.

The presence of the site had been known since the early historical times, and European explorers and travellers such as Lichtenstein and Burchell visited the site in 1805 and 1812 respectively. At the time the specularite mine was interpreted by these and other visitors as associated with Kora and Tswana groups. However, the archaeological research undertaken by A.I. Thackeray, J.F. Thackeray and P.B. Beaumont between 8 and 25 April 1980 provided much older origins for the site (Thackeray et.al., 1983).

The archaeological excavations revealed a large number of lithics (stone artefacts) which included mining tools as well as scrapers; ostrich eggshell fragments and beads; pottery; glass beads as well as faunal remains (Thackeray et.al., 1983).

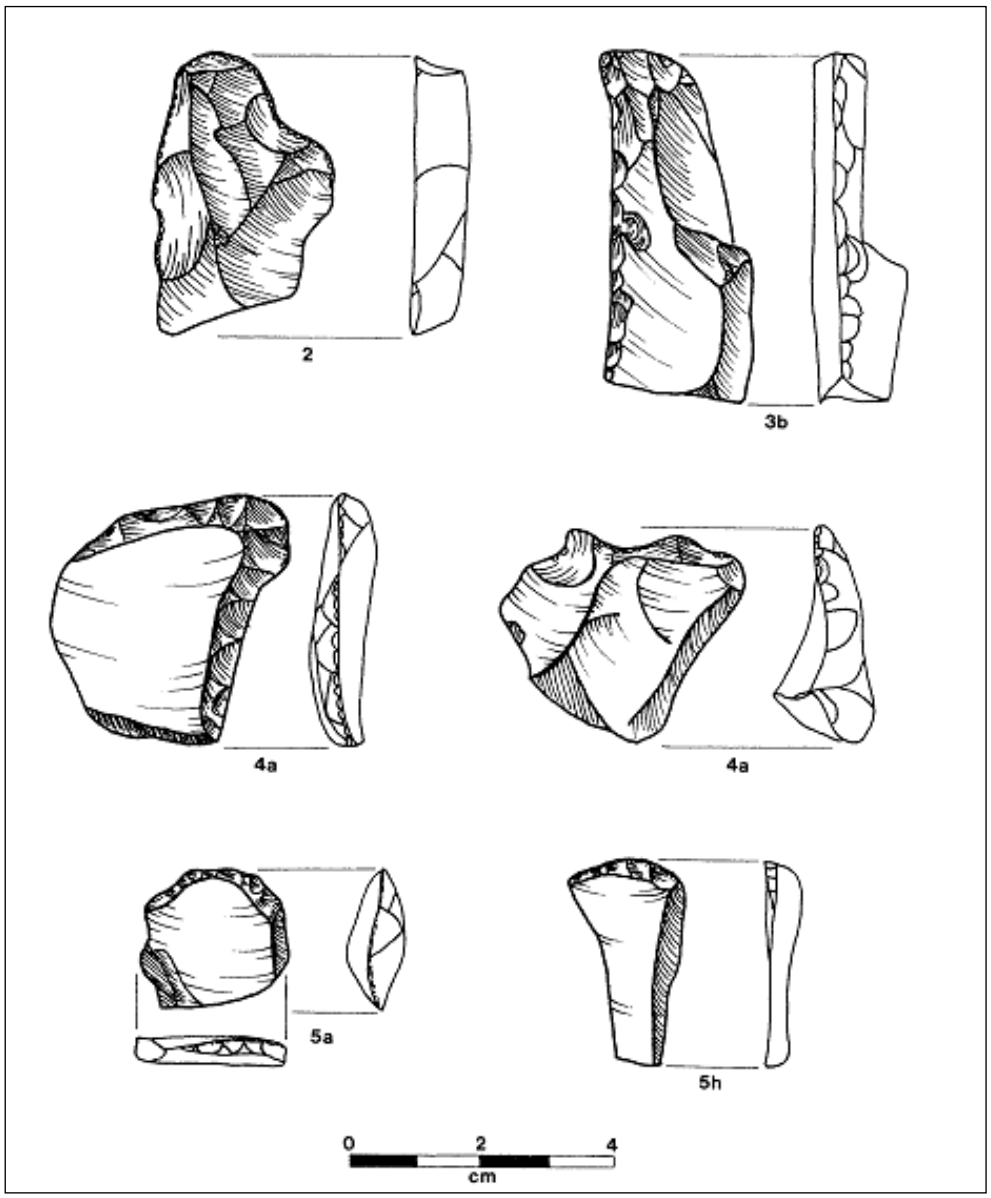

Figure 11 – Examples of scrapers excavated from Blinkklipkop (Thackeray et.al., 1983:20).

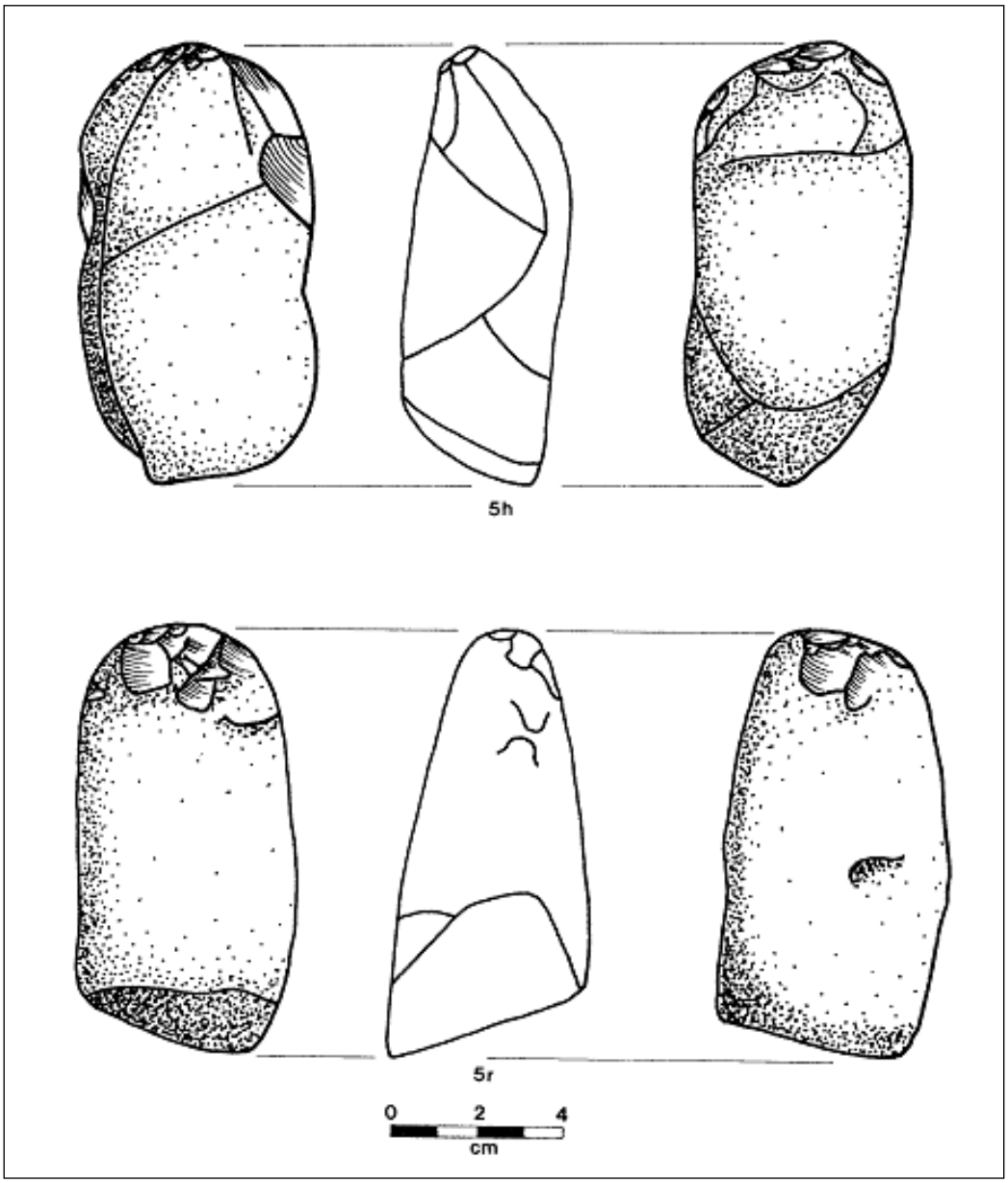

Figure 12 – Examples of mining-related lithics from Blinkklipkop (Thackeray et.al., 1983:20).

The archaeological research have revealed that mining activities at the site likely commenced before roughly 800 AD, and that before the 17th century these mining activities were undertaken by Khoi herders and possibly San hunter gathers with Late Iron Age Tswana pastoralists also in all likelihood involved thereafter (Thackeray et.al., 1983).

Blinkklipkop is located 10.3km south-east of the present study area.

- **Doornfontein**

During 1973 archaeological research was undertaken by P.B. Beaumont and A.K. Boshier on a pre-colonial specularite mine located in a slight rise in an area known as Jonas Vlakte on the farm Doornfontein 446. The farm is located 6.8km north-west of Postmasburg (Beaumont & Boshier, 1974).

The archaeologists identified four chambers at the site, and excavated two trenches located within Chamber 3. The archaeological collection excavated from the site included a large number of lithics of which typical mining tools such as hammer stones were particularly evident; ostrich eggshell fragments and beads; decorated and undecorated pottery, metal artefacts which included an iron spear head and a copper strip bead; bone artefacts such as an arrow point and possible pendant as well faunal remains. Interestingly, human remains were also excavated from the site (Beaumont & Boshier, 1974).

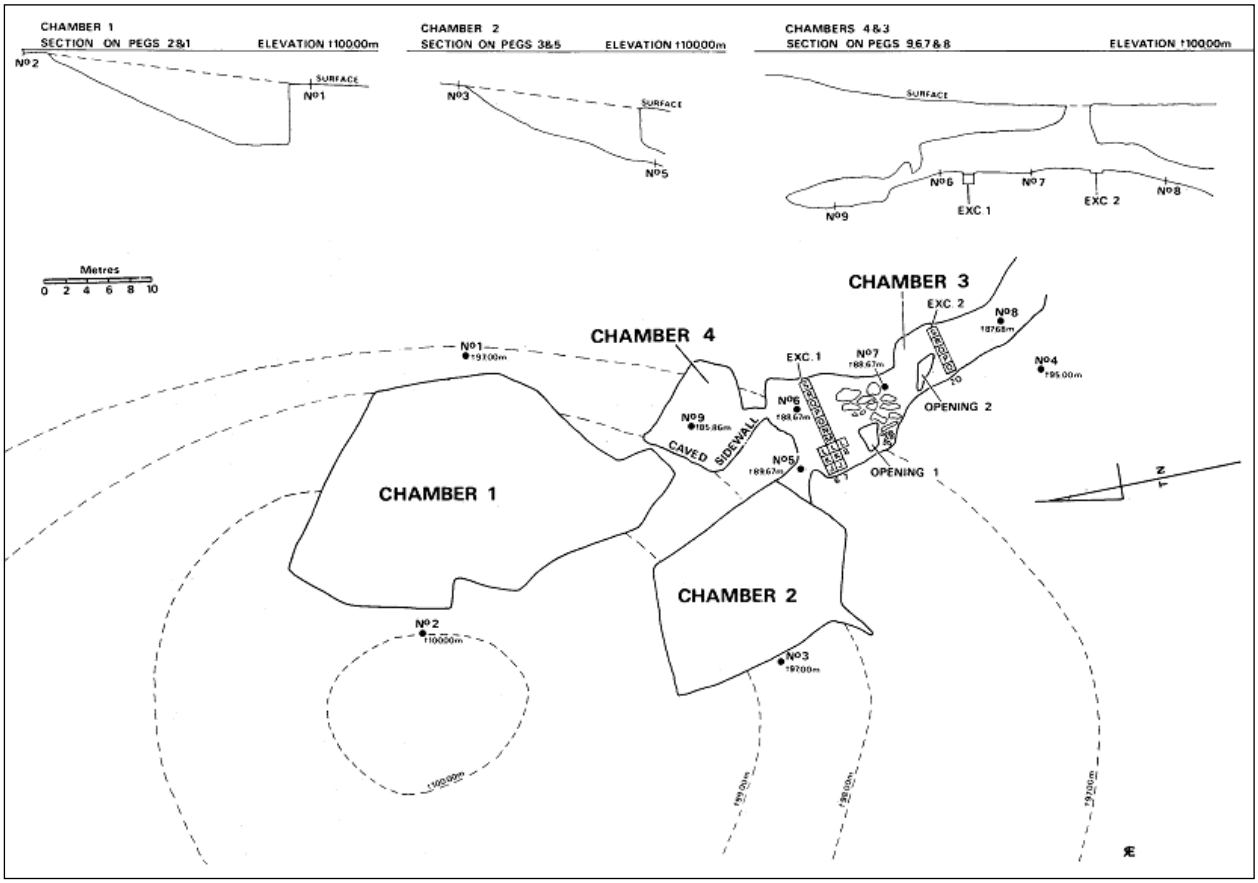

Figure 13 – Site layout plan of the specularite mine at Doornfontein (Beaumont & Bashier., 1983:42).

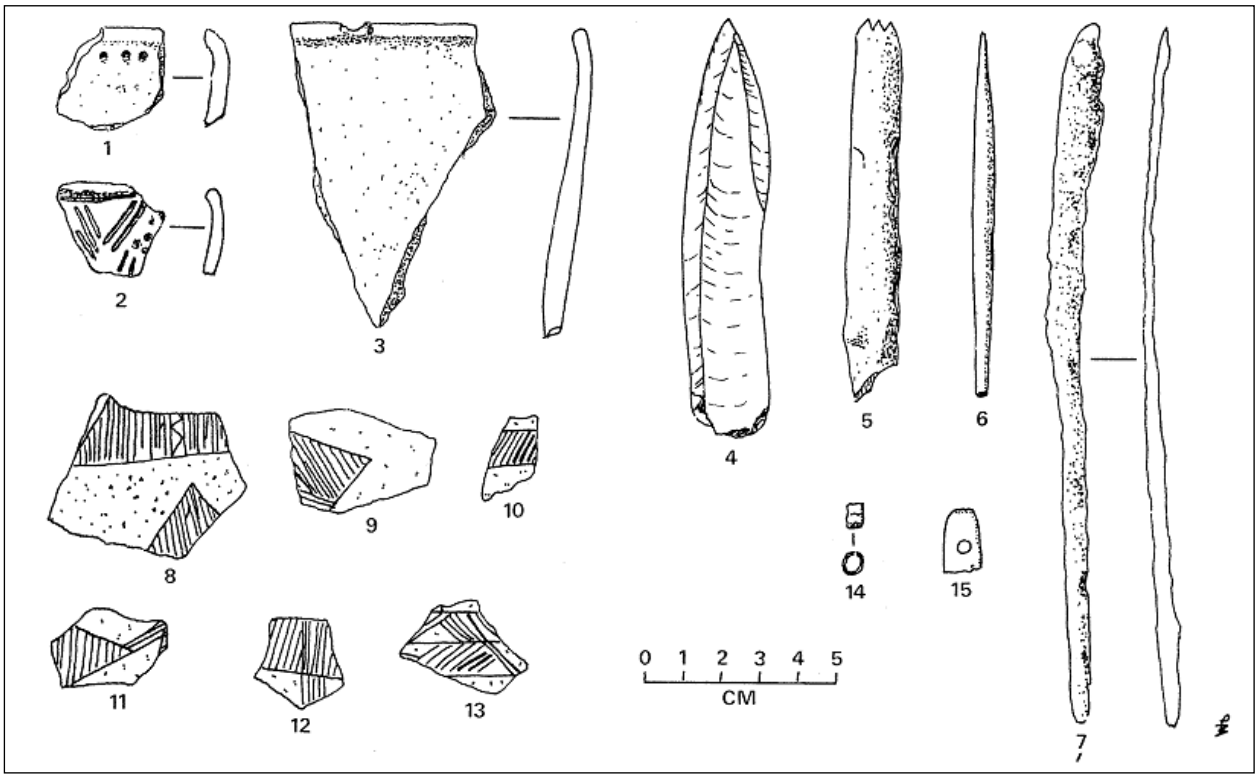

Figure 14 – Non-lithic artefacts from the excavations at Doornfontein (Beaumont & Bashier., 1983:42). Caption numbers 1, 2 and 3 are potsherds; numbers 4, 5 and 6 are bone artefacts (including a bone arrow point); number 7 is a iron spear head; numbers 8, 9, 10, 11, 12, and 13 are decorated ostrich eggshell fragments with numbers 14 and 15 interpreted as a copper strip bead and possible broken bone pendant.

Radiocarbon dates obtained from the excavations indicated that mining activities at this site commenced in approximately 830 AD (Beaumont & Boshier, 1974) which is roughly contemporary with the dates obtained from Blinkklipkop.

The Doornfontein site is located roughly 2km west of Doornpan.

- **Beeshoek**

The farm is located 5.4km north-west of Postmasburg. The rock art at Beeshoek had been known from some time (Wilman, 1933) (Fock, 1969) (Judner & Judner, 1969) and comprises petroglyphs of various animals such as giraffe, ostrich, elephant, kudu as well as some animal foot prints. A number of examples of geometric symbols are also found at the site (Judner & Judner, 1969).

While the exact position of the rock art site at Beeshoek is not presently known, the site is located approximately 10.5km south-west of the present study area.

- **Paling**

  The farm is located 12km north-west of Postmasburg. Beaumont and Boshier (1974) refer to the presence of both a rock art site as well as a pre-colonial specularite mining site on this farm. Although no further information with regard to the mining site is provided, Beaumont and Boshier (1974) state that the rock art site comprises geometric and naturalistic depictions which includes a giraffe. Furthermore, graffiti from the 1920s were also observed here.

  While the exact position of the rock art site at Paling is not presently known, the farm is located directly west of Doornpan.

- **Gloucester**

  The farm is located 22km north of Postmasburg. Beaumont and Boshier (1974) refer to the presence of a pre-colonial specularite mine here.

  While the exact position of the pre-colonial mining site at Gloucester is not presently known, the farm is located 8.2km north of Doornpan.

- **Mount Huxley**

  The farm is located 24.6km north-east of Postmasburg. Beaumont and Boshier (1974) refer to the presence of a pre-colonial specularite mine here.

  While the exact position of the pre-colonial mining site at Mount Huxley is not presently known, the farm is located 11.5km north-east of Doornpan.

6.1.2 Archaeological Sites as Revealed Through a Study of the SAHRIS Database

The reports discussed here were all accessed from the SAHRA electronic database known as SAHRIS. It is important to note that the reports listed here do not necessarily represent all the previous archaeological work undertaken in the vicinity of the study area. An attempt was made to locate reports on the database dealing with properties either within or in close proximity to the study area. The reports with located sites are grouped according to the

respective farms on which these studies were undertaken. At the end of each description the approximate distance between these sites and the present study area is provided.

- **Doornpan**

  The Archaeological Impact Assessment undertaken by Lita Webley and David Halkett in terms of proposed prospecting activities on the farm Doornpan (Webley & Halkett, 2010). A total of two sites were identified, which included one findspot comprising a retouched Middle Stone Age flake as well as another findspot comprising a Quartize Early Stone Age core. These sites are located within the Doornpan section of the present study area.

- **Driehoekspan**

  The Archaeological Impact Assessment undertaken by Lita Webley and David Halkett in terms of proposed prospecting activities on the farm Driehoekspan (Webley & Halkett, 2010). Three sites were identified, which included one findspot comprising a Quartize Early Stone Age core, a historic structure of unknown function as well as a possible Later Stone Age knapping site comprising three flakes and one core. These sites are all located within the Driehoekspan section of the present study area.

- **Paling**

  The Archaeological Impact Assessment undertaken by Anton van Vollenhoven and Anton Pelser in terms of proposed manganese and iron ore mining activities on the farm Paling (Pelser & Van Vollenhoven, 2010). A total of seven sites were identified, which included one findspot comprising a Middle Stone Age lithic (Site 1), another findspot containing a single Middle Stone Age / Later Stone Age lithic (Site 2), a cemetery comprising roughly eight graves (Site 3), a historic ash heap dating to the late 19th and early 20th centuries (Site 4), a historic mining-related structure (Site 5), a Stone Age site comprising a number of Middle Stone Age and Later Stone Age lithics (Site 6) as well as another historic ash heap dating to the late 19th and early 20th centuries (Site 7). These seven archaeological sites are distributed across the farm Paling, and as such they are between 3.6km (Site 1) and 4.7km (Site 4) from the present study area.

- **Kapstewel**

  The Heritage Impact Assessment undertaken by Anton van Vollenhoven and Anton Pelser in terms of proposed mining activities on portions of the farm Kapstewel (Pelser & Van Vollenhoven, 2009). A total of seven sites were identified, which included the remains of an old mining area (Site 1), a site containing low stone walls which could be associated with either the Late Iron Age or Later Stone Age (Site 2), a possible grave in the form of a rectangular stonepacked structure (Site 3), circular stone-lined depressions which may have been associated with historic mining activities (Site 4), a farmstead (Site 5), the mine offices and complex of the old Manganore mining area (Site 6) and a site associated with historic mining activities and which includes features such as an old railway line and conveyor belt (Site 7).

  These archaeological sites are distributed across the farm Kapstewel, and as such they are between 3.8km (Site 7) and 6.9km (Site 1) from the present study area.

4.2 Findings in terms of the Archaeological Overview

The archaeological overview provided above shows that the study area is located in a landscape with a wide array of archaeological resources. As such, it has the potential to contain any of the following sites which are known from the surrounding landscape:

- Early Stone Age findspots and sites
- Middle Stone Age findspots and sites
- Later Stone Age findspots and sites
- Rock Art Sites
- Pre-colonial Specularite Mines
- Historic Mining Sites
- Historic Farmsteads
- Graves and Cemeteries

In fact, the use of the SAHRIS database has revealed the existence of two sites from within the study area. Both these sites comprise Stone Age findspots.

7 HISTORICAL OVERVIEW AND FINDINGS

7.1. Historical Overview

DATE	DESCRIPTION
2.5 million to 250 000 years ago	The Earlier Stone Age is the first and oldest phase identified in South Africa's archaeological history and comprises two technological phases. The earliest of these is known as Oldowan and is associated with crude flakes and hammer stones. It dates to approximately 2 million years ago. The second technological phase is the Acheulian and comprises more refined and better made stone artefacts such as the cleaver and bifacial hand axe. The Acheulian dates back to approximately 1.5 million years ago. A number of Early Stone Age sites are known from the general vicinity, though mostly in the form of Early Stone Age findspots. A very significant Early Stone Age site is located at Kathu Pan, some 47.1km north of the study area. Research here was undertaken by P.B. Beaumont and the site is believed to contain millions of Early Stone Age artefacts (Mitchell, 2002).
250 000 to 40 000 years ago	The Middle Stone Age is the second oldest phase identified in South Africa's archaeological history. This phase is associated with flakes, points and blades manufactured by means of the so-called 'prepared core' technique. MSA find spots and sites were identified in the direct vicinity of the study area.
40 000 years ago to the historic past	The Later Stone Age is the third archaeological phase identified and is associated with an abundance of very small artefacts known as microliths. A number of LSA sites are known from the direct vicinity of the study area. Significant examples include the specularite mines at Blinkklipkop and Doornfontein, as well as the rock engraving sites at Beeshoek and Paling.
800 AD – 820 AD	The archaeological excavations undertaken by Beaumont and Bashier (1974) and Thackeray et.al. (1983) have revealed that the mining of specularite at Doornfontein and Blinkklipkop commenced during this time. During this initial period the mining activities would have been undertaken by San hunter-gatherers and Kora pastoralists. Only after the 17th century were such mining activities likely also undertaken by the Iron Age Tswana groups.
Early 1600s	The Tswana groups known as the Thlaping and Thlaro moved southward into the area presently known as the Northern Cape. A century later they were settled in areas as far south as Majeng (Langeberg), Tsantsabane (Postmasburg) and Tlhaka le Tlou (Danielskuil) (Snyman, 1986). In terms of the Thlaro specifically, Breutz (1963) states that after they broke away from the Hurutshe during the period between 1580 and 1610, the Thlaro travelled along the Molopo River and the Southern Kalahari before arriving at the confluence of the Kudumane, Mosaweng and Molopo. From here they established themselves at Tsowe (west of Morokweng), Gatlhose (34km north-east of the study area), Majeng (Langberg) (roughly 35km to the north-east), Khoiise (Khuis on the Molopo River) and Tlhaka-la-Tlou (present day Danielskuil).

	It is evident that the study area and surrounding landscape would be been located on the southern periphery of the overall settlement area of these two Tswana groups at the time. In fact, the surroundings of the study area were to become the southern edge of Late Iron Age expansion into the Northern Cape, a fact which was later signified by the establishment of the boundary between Griqualand West and British Bechuanaland directly north of the present study area.
c. 1770	During this time the Kora moved into the area. Due to their superior firearms they applied increasing pressure on the Thlaping and Thlaro groups. In the end the Thlaping moved into a north-eastern direction to settle in the general vicinity of Dithakong, north-east of present-day Kuruman. The Thlaro settled in areas to the west and north-west of the Thlaping (Snyman, 1986).
c. 1786 – c. 1795	During this time a German deserter by the name of Jan Bloem established himself at Tsantsabane (Blinkklip) (Legassick, 2010). This place is located 5km north-east of the present-day town of Postmasburg. The settlement of Jan Bloem at the specularite mine may have been a way in which to control the valuable site and any trading activities associated with it.
c. 1795	Legassick (2010) confirms the presence of the Thlaping, Thlaro and Kora in the general vicinity of the study area during this time. This said the study area and surrounding landscape would have represented a southern peripheral area of the overall landscape occupied by especially the Thlaping and Thlaro groups at the time. From a map depicted in Leggassick (2010:338) it is evident that at the time the Kora started moving in north-eastern direction from the areas along the central Orange river to the banks of the Harts River.
Early 1800s	After the threat of the Kora became less intensive, the Thlaping moved to the vicinity of present-day Kuruman. The Thlaro returned to the Langeberg, establishing them on a permanent basis there during the 1820s (Snyman, 1986). The settlement of the Thlaping in the vicinity of Kuruman occurred during the reign of Molehabangwe. This period in the history of the Thlaping was seen as a period of wealth and power, and at the time they even had control of the *sibello* quarry near Blinkklip (Legassick, 2010).
1801	The first known visit to this area by European explorers (i.e. excluding European renegades and fugitives such as Jan Bloem) took place in 1801. The journey was undertaken by P.J. Truter and Dr. W. Somerville. They crossed over the Orange River in the vicinity of Prieska, and passed Blinkklip on their way to present-day Kuruman (Bergh, 1999).
1802 - 1813	During this year William Anderson and Cornelius Kramer, both of the London Missionary Society, established a mission station at a place called Leeuwenkuil. The focus of their work was a group known as the Bastards (Erasmus, 2004). This group could be described as a cultural conglomeration descending not only from relationships between different cultures and races (i.e. European and Khoi), but also comprised remnants of Khoi and San groups as well as freed slaves. The particular group later became known as

	the Griqua. Due to the problems caused by the presence of lions at Leeuwenkuil, the mission station was moved in 1805 to a place higher up called Klaarwater. On 7 August 1813 the name of the settlement which had sprung up at Klaarwater was renamed Griquatown. This came about as a result of a number of proposals made by Reverend John Campbell, the Director of the London Missionary Society who was visiting the mission stations from this area at the time. He suggested that "...*the Bastards change their name to 'Griqua' and that Klaarwater became Griquatown. This was because 'on consulting among themselves they found a majority were descended from a person of the name Griqua'*..." (Legassick, 2010). Griquatown is located 68km south of the present study area.
1805	During this year German explorer Martin Hinrich Carl Lichtenstein travelled through the general vicinity of the study area. After crossing the Orange River in the vicinity of present-day Prieska, Lichtenstein's party visited present-day Danielskuil, and by June 1805 they were at Blinkklip (Postmasburg), a well-known source for obtaining specular haematite. Archaeological investigations at Blinkklipkop (also known as Nauga) established a date of AD 800 for the utilization of this particular rich source (Thackeray, et al 1983). From here they travelled further north and reached the Kuruman River where they met Tswana-speaking people. They followed the river downstream for three days, after which they followed a tributary to reach Lattakoe. From here they turned south and reached the Orange River on 11 July 1805. While on their way to the Kuruman River (and to the south thereof), Lichtenstein and his fellow travellers visited a small settlement consisting of "*…about thirty flat spherical huts.*" Although the people who stayed here were herdsmen who looked after the cattle of richer people living on the Kuruman River, they indicated that San (Bushmen) were also present in the area (Lichtenstein, 1930). Although Lichtenstein was certainly not the first European explorer to travel through this area (the Truter & Somerville expedition had for example passed through this area in 1801), or for that matter the last (Burchell travelled through the area in 1811 followed by John Campbell in 1813) (Bergh, 1999), Lichtenstein did leave behind a written record of this journey providing a valuable glimpse into the early history of the general surroundings of the study area.
1811 - 1813	During this period the famous English explorer and artist William Burchell visited the general vicinity of the study area. Accompanied by missionary Anderson, Burchell crossed over the Orange River at Little Bend from where they travelled to Klaarwater. Using the settlement as a temporary base, Bruchell undertook numerous journeys which included one which passed through Blinkklip (Bergh, 1999).
1813	During 1813 John Campbell of the London Missionary Society also visited the general vicinity of the study area. He arrived at Klaarwater on 9 June 1813, where he rested for a few days before continuing in a northern direction toward present-day Kuruman, passing through Blinkklip on the way (Bergh, 1999).

Figure 15

Reverend John Campbell (Campbell, 1815). He paid a visit to Blinkklip during the second half of 1813.

20 December 1820	On this day Andries Waterboer was elected as leader of Griquatown in the place of Berend Berends (Legassick, 2010). This period saw fission within the Griqua community, and it is not surprising that two long-term leaders moved away from Griquatown to establish autonomous settlements away from their former town. Berend Berends for example moved to Danielskuil (41km east of the study area), whereas Adam Kok II established himself in the vicinity of Campbell (85km south-east of the study area) (Legassick, 2010).
1820s	Barend Barends and his followers moved from their settlement at Danielskuil to Boetsap (roughly 136km north-east of the study area). At the same time Thlaping ruler Mothibi, the brother of Mahura, settled in the vicinity of Boetsap before moving to Griquatown (Legassick, 2010). The first settlement of Blinkklip by the Griqua also took place during this time (Legassick, 2010).
Early 1830s	During this time Andries Waterboer stationed a number of Griqua families at a fountain north of Tsantsabane (Blinkklip) as well as at Danielskuil. Shortly thereafter, a missionary of the London Missionary Society by the name of John Baillie was transferred from the mission station at Kuruman to Tsantsabane. He was to work among the Sotho-Tswana living in and around Tsantsabane at the time. Baillie subsequently left the mission station and resigned from the London Missionary Society in 1836 (Legassick, 2010).

22 April 1842	On this day a treaty was signed between Griqua leader Andries Waterboer and Thlaping leader Mahura at Mahura's settlement near Taungs. The agreement included a definition of the boundary between the two groups. The section of the agreed upon boundary closest to the study area ran from "*...the northerly point of the Langeberg and extending a little south of Nokaneng, and further half-way between Maremane and Klipfontein*..." (Legassick, 2010:291). While the exact location of Nokaneng is not currently known, the farm Klipfontein 437 is situated adjacent and north of the farm Doornpan, whereas the farm Maremane 678 is located 10km to the north-east. This suggests that the present study area was located a short distance south of the boundary line between the Griqua and the Thlaping as defined in the treaty. As such, the study area was defined within this treaty as forming part of the land of the Griqua. However, it must be noted that this boundary line was not cast in stone. This boundary was very similar to an earlier one that was thought to have been agreed to during the 1820s as a boundary between the Griqua and the Thlaping (Legassick, 2010).
1850	During this time a Thlaro leader by the name of Molete and his baThlaro baga Keakopa followers moved away from the Korannaberg and established themselves at Gathlose, roughly 34km north-east of the study area. Breutz (1963) states that the land around Gathlose and Maremane used to belong to the Kora (Koranna) people and that they gave permission to Molete to settle here. After his death between 1885 and 1890, Molete was succeeded by Holele who ruled until his death during the Langberg Rebellion of 1897. Holele was succeeded by Kebiditswe John Holele and filled the post until 1912 when he was succeeded by his younger brother Kgosieng. Kgosieng ruled until he was pensioned on 28 February 1937, and was succeeded by Kebiditswe's son, Kgosietsiele Smous. Kgosietsiele died on 30 June 1956 and was succeeded by his son Frank Motsewakgosi Holele (Breutz, 1963). At roughly the same time (likely between 1850 and 1860) the area known as Maremane (located directly north of Gathlose) was an outpost grazing area of the BaThlaro chief Makgolokwe and his son Toto. The first designated leader of this area was Isaak Thupane Thupane, followed by Toto's son Robanyane who fled to present-day Namibia after the Langberg Rebellion of 1897. He was succeeded by his father's brother Jan Molebane Toto. However, the government only recognised him as chief in 1912 up to which point John Holele of the Gathlose Reserve was appointed by the government to act for the Maremane area as well. Molebane was dismissed in 1925 and was succeeded in 1926 by his brother David Makgolokwe. David Makgolokwe remained at his post until his death in 1942 when he was succeeded by Puso Togelo who remained as leader until his death in 1954. He in turn was succeeded by Felix Kgosithebe Toto (Breutz, 1963).
1850 – 1855	During this period a Thlaro chief by the name of Isaak Thupane Thupane established himself at Logageng (Gatkoppies) near Postmasburg. He subsequently moved with his followers to Groenwater 453. During the time that Thupane was living at Logageng, Kgangeng discovered the fountain at Metsematale. Subsequently, the land was ceded by Waterboer to the Thlaro and Kgangeng and his followers settled at Groenwater as well. Kgangeng was succeeded by Piet Selo in 1897, followed by Sebubi Daniel Selo on 7 February 1908, Leu Motshabeng in 1921 and

	Sebopelo Cornelius Kweetsane in 1927, Steenbok Kgangeng in 1935 and David Mosimanethebe Kweetsane in 1959 (Breutz, 1963). The farm Groenwater 453 is located 15km east of the present study area.
13 December 1852	After the death of Andries Waterboer, his son Nicolaas Waterboer became the leader of Griquatown. He ruled Griquatown until the annexation of the area by the British in 1871 (see below) (Legassick, 2010). It was during the rule of Nicolaas Waterboer that diamonds were discovered in the area which led to a period of claims and counter-claims between the Griqua, the Orange Free State as well as the Zuid-Afrikaansche Republiek and which eventually led to the annexation of the area.

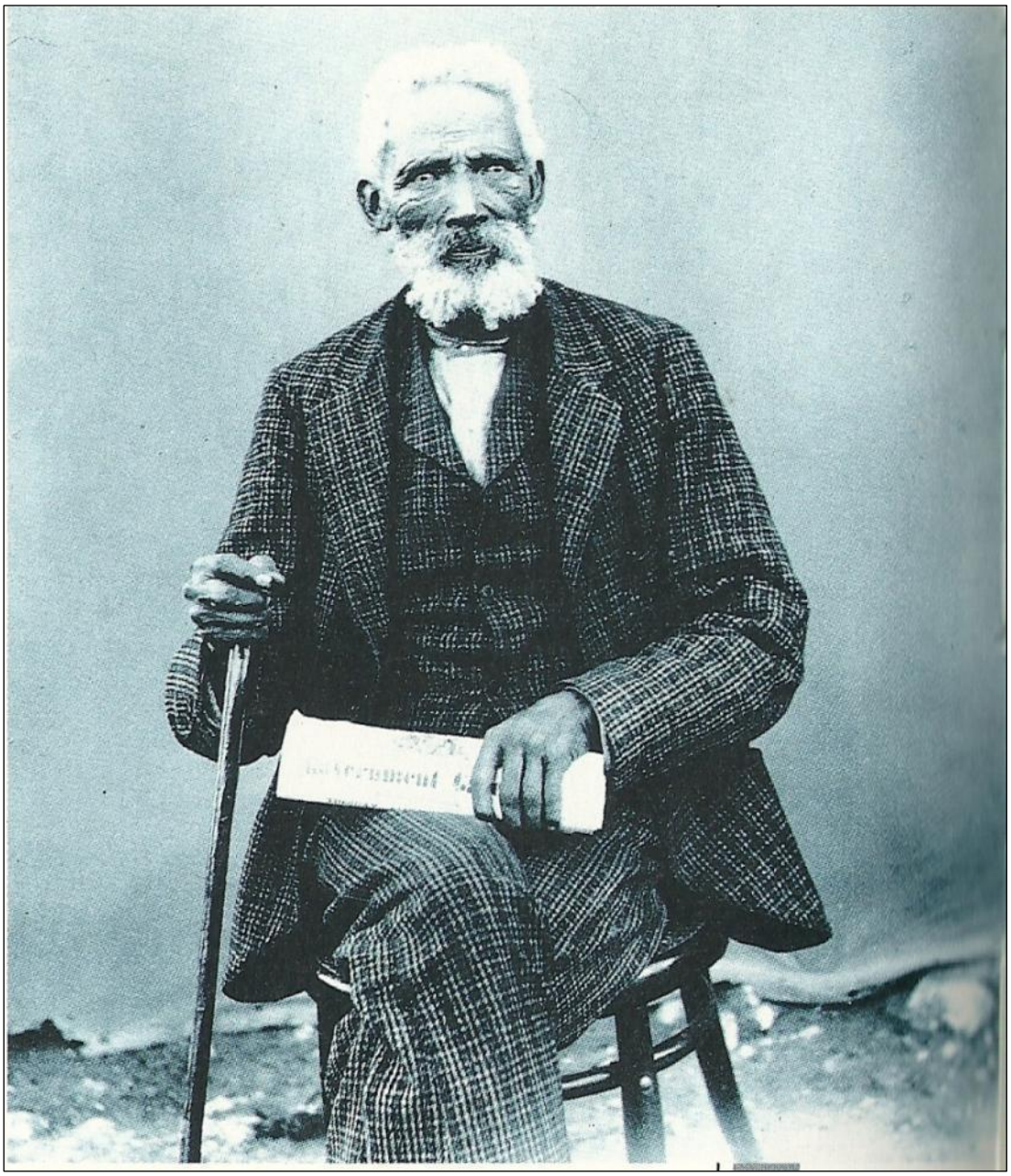

Figure 16

Nicolaas Waterboer, who succeeded as leader of Griquatown in 1852 after the death of his father Andries Waterboer (Reader's Digest, 1994:168).

Before 1856	During the period before 1856 the Thlaro leader Masibi occupied the area known as Skeyfontein (also Skeynfontein or Dikeing). After Masibi left the area, Mpokwe (c. 1837 – 1909) succeeded as leader of the Thlaro at Skyfontein, and in turn was succeeded by Andries Mpokwe (1870 – 1919), Jan Mpokwe, Hendrik Mpokwe and John Diemeng Gaseitsiwe (Breutz, 1963). The farm Skeyfontein 536 is located 16.3km south-east of the present study area.
1867	Diamonds were discovered for the first time in South Africa near Hopetown. Alluvial diamonds were also discovered along both banks of the Orange River in the vicinity of the confluence of the Vaal and Harts Rivers (Van Staden, 1983). This resulted in large numbers of fortune seekers streaming into the wider vicinity of the study area from overseas. This factor would have had a profound impact on the social-dynamics of the landscape.
27 October 1871	The area located in general terms between the Orange and Vaal Rivers and south of Kuruman was proclaimed as British Territory and named Griqualand West. This proclamation came as a result of ownership disputes between the Griqua, the Boer Republic of the Orange Free State and the Boer Republic of the Zuid-Afrikaansche Republiek in terms of the newly discovered diamond diggings (www. wikipedia.org). The study area fell within this territory at the time.

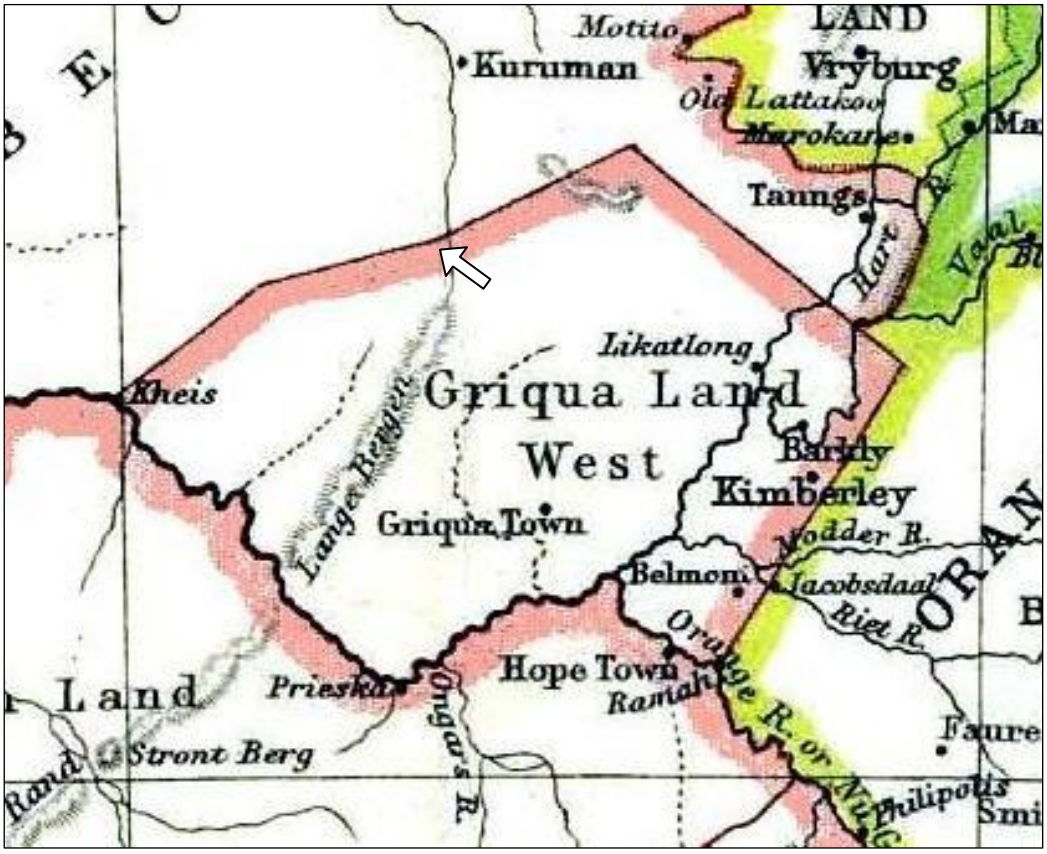

Figure 17

Section of a map titled "Sketch Map of South Africa showing British Possessions". The map is dated to July 1885. (www.wikipedia.com).The boundaries and position of Griqualand West is depicted on this figure. The approximate position of the present study area is shown.

1873 - 1876	After the province of Griqualand West came into existence in 1873, the study area now fell within the Griquatown (later Hay) District of Griqualand West. Subsequently, three government surveyors namely M.P. Auret, F.H.S. Orpen and J. Mintern were sent out to survey the whole district into individual farms (Snyman, 1983).
1876 - 1878	During this period the first farms in the vicinity of Blinkklip were bought by white farmers. These included the farms Pensfontein (bought by C. And G. Harrison), Kappies (bought by John Ryland), Soetfontein (bought by Henry Immuell) as well as the farms Vlakplaats, Abelsvlakte, Blouboskuil, Bloubosputs and Geelputs (all bought by R. Attwell). At the time farms such as Matsap, Klipfontein, Olynfontein, Kalkfontein, Gazip, Ploegfontein, Goedgedacht, Lukasdam, Vaalpan, Rooipoort and Klipbanksfontein had Griqua owners (Snyman, 1983).
1878	A rebellion broke out amongst some of the Tswana communities living in Griqualand West. This rebellion, which was a response to British expansion and colonialism, spread to the Langberg. A force under Colonel Charles Warren left Griqualand West during October 1878 and defeated the “rebels” at the Langberg (Snyman, 1986).
1880 - 1892	During this period a number of events took place which led to the establishment of the town of Postmasburg. One of these events occurred during February 1880 when a troop of the Griqualand West Border Police was stationed at Blinkklip. The reason for this decision was that Blinkklip was situated strategically close to the Bechuanaland border (Snyman, 1983). Another event was the inclusion of Griqualand West in the Cape Colony during 1880, which resulted in higher numbers of permanent white settlement in the area (Snyman, 1983). That the Blinkklip area was seen from government side as favourable for the establishment of a town, can be deduced from the fact that during 1881 a government surveyor by the name of J. Mintern had surveyed the whole Blinkklip valley between Olynfontein and Vinci into agricultural stands. During the same year as many as 38 whites were staying on farms at Blinkklip (Snyman, 1983). During 1882 a number of Reformed Church congregates arrived in the area between Griquatown and Blinkklip. In May 1884 the congregation agreed to establish a church place on the farm Ploegfontein (located 5km south of Postmasburg) for a period of five years. When the period of five years ended, the church council undertook an investigation to find a suitable place for a new church as well as a new town. On 30 November 1889 the congregation finally decided to establish the new town and church at Blinkklip. They submitted an application to the authorities, but it was turned down. On 2 March 1891 their religious leader Dominie Martinus Postma submitted a petition which had been signed by 51 people in favour of the establishment of a town at Blinkklip, to the authorities. This application was approved and during April 1891 a government surveyor by the name of J.A. Thwaites surveyed 82 stands around the police camp. As it took more than a year for

	the stands to be allocated, a second petition was organised during September 1891. The petition asked for the rapid allocation of stands, as well as for the renaming of the settlement from Blinkklip to Postmasburg in honour of Professor Dirk Postma, the founder of the Reformed Church of South Africa. Although the authorities were in favour of the establishment of a town, they did not agree with the proposed name change. In January 1892 Dominie Martinus Postma again asked for the name change and indicated that all the white residents of area were in favour of this. On 14 April 1892 the Assistant-Commissioner of Crown Lands reported as follows: "...*in view of the unanimous request of the inhabitants, instructions have been issued for the necessary arrangements to be made for the change of the name of the township from 'Blink Klip' to 'Postmasburg'* (Snyman, 1983:10). The town's stands were eventually only sold on 12 August 1892 (Snyman, 1983).

Figure 18

Historic portraits of the two members of the Postma family associated with early development of Postmasburg. On the left is Professor Dirk Postma in whose honour the town of Postmasburg was named, with Dominie Martinus Postma on the right. He was the person driving the establishment and naming of the town (Snyman, 1983:9).

30 September 1885	Sir Charles Warren proclaims British Bechuanaland. This area comprised the land between Griqualand West and the Molopo River (Snyman, 1986). As mentioned elsewhere, the boundary between British Bechuanaland and Griqualand West was established directly north of the study area.
1886	As a result of the work of a commission appointed by the British rulers of the Crown Colony of British Bechuanaland, a number of so-called "native reserves" were established in this area. These included the Gatlhose Reserve and the Maremane Reserve (Snyman, 1986).
c. 1890	During roughly this time the Griqua mined iron at Gatkoppies near Postmasburg (Breutz, 1963).
September 1896	During this time a viral disease affecting cattle (and some other species of even-toed ungulates) known as Rinderpest swept through Southern Africa (www.wikipedia.org). Although attempts were made to halt the spread of the disease from the north by erecting a fence between the boundaries of Griqualand West and Bechuanaland, this proved unsuccessful. Incidentally, only three gates were placed in this fence, namely at Gatlhose, Nelsonsfontein and Blikfontein (Snyman, 1988). Of these three places, Gatlhose is the closest and is situated 30km north-east of the study area. Furthermore, it is worth noting that a section of the Rinderpest fence erected between Griqualand West and British Bechuanaland during this time would have been placed along the northern boundary of the farm located directly north of Doornpan, namely Driehoekspan.

Figure 19 An everyday scene in Griqualand West during the Rinderpest Epidemic: large numbers of destroyed cattle (Snyman, 1983:20).

1897	The Rinderpest epidemic did not only have a massive socio-economic impact on the landsccape, it also resulted in the Langberg Rebellion of 1897. During this time conflict broke out between the authorities and a Thlaping leader from Taung, Galeshiwe. The conflict arose after some of Galeshiwe's cattle that were infected by Rinderpest were destroyed by representatives of the government as a way of kerbing the spread of the disease. After killing an officer, Galishewe fled to the Thlaro leader Toto of the Langberg. Subsequently, a full-scale rebellion broke out that was eventually suppressed (Breutz, 1963). Although most of the activities associated with the rebellion took place some distance to the west and north-west of the study area, the impact of the rebellion was felt throughout the surrounding landscape. For example, farms located to the west and south-west of the study area such as Lukasdam (16.5km south-west of the study area), Mount Temple (27.7km west of the study area) and Vlakfontein (located directly west of the study area) came under attack from stock thieves during this time. After the farms Mount Temple and Groenkloof were physically attacked, a police post which had been established on the farm Vlakfontein was reinforced (Snyman, 1983).

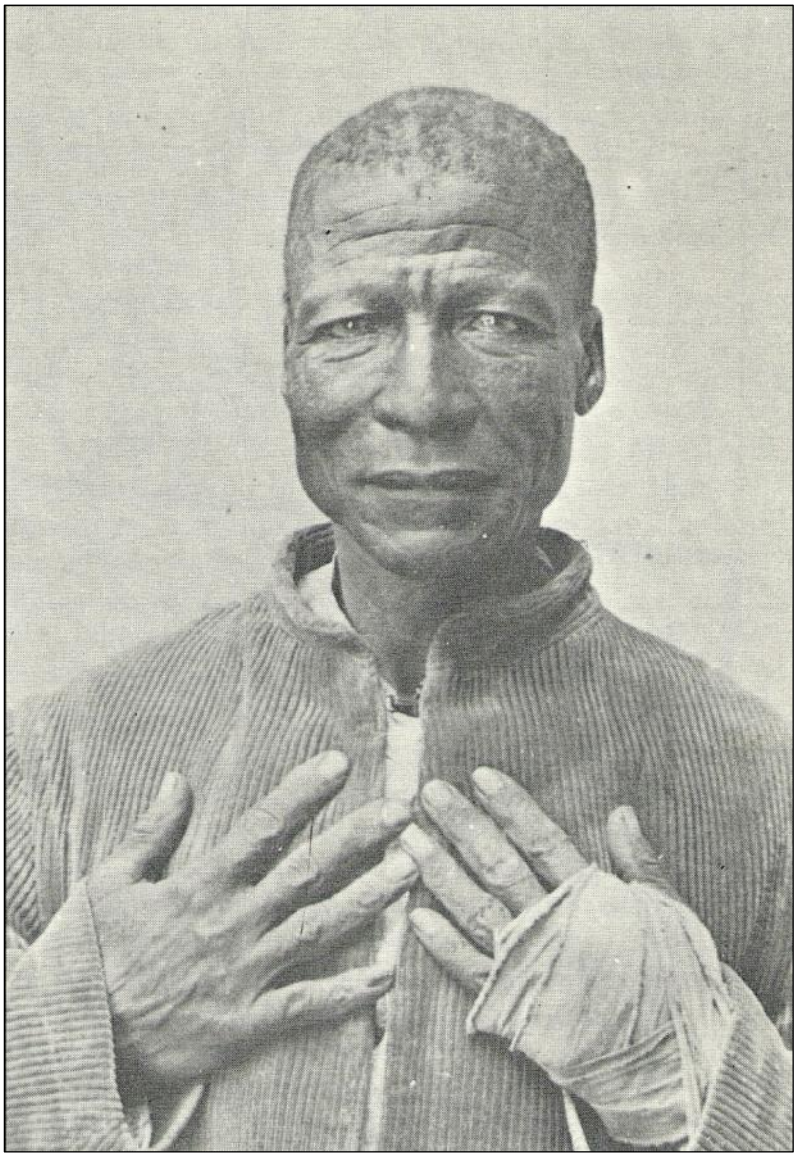

Figure 20

Toto, leader of the Thlaro along the Langberg (Snyman, 1986:17).

1899 - 1902	The South African War (also known as the Anglo Boer War) was fought between Great Britain and the Boer republics of the Zuid-Afrikaansche Republiek and Orange Free State. After the outbreak of hostilities on 11 October 1899, the military commander of Griqualand West and British Bechuanaland Lieutenant-Colonel R.P. Kekewich issued a proclamation whereby all residents of these areas were considered British subjects and as such had to refrain from assisting the Boer forces. However, when a Free State Commando under Kommandant Jan Jordaan and Judge J.B.M. Hertzog occupied Postmasburg on 18 November 1899, a large number of Postmasburg residents took up arms and joined the commando. These rebels formed part of the force under the command of P.J. de Villiers which by March 1900 was in command of the entire Griqualand West. The rebels were under the direct command of Kommandant Jan Vorster and Veldkornet Piet Venter (Snyman, 1983). In April 1900 Sir Charles Warren received the order to retake Griqualand West and British Bechuanaland. Apart from a short delay caused by a skirmish at Fabersput (near Campbell), Warren occupied the towns from within the area (including Postmasburg) within a short period of time. This had a devastating effect on the morale of the rebel forces, who for the most part surrendered. However, fifty rebels under the command of General De Villiers joined the Transvaal forces under the command of General J.H. de la Rey in the western part of the Zuid-Afrikaansche Republiek (Snyman, 1983). In June 1901 General De Villiers attacked the region again to act as a link between General J.H. de la Rey in the Western Transvaal and General J.C. Smuts in the North-Western Cape. On 10 August 1901 the town of Postmasburg was occupied by Boer forces under the command of Kommandant E. Conroy. A number of victories for the Boer forces in this area followed, including the attack on 10 August 1901 of Veldkornet Van Aswegen at Kareepan which resulted in the taking of 110 horses. The farm Kareepan 450 is located directly adjacent and to the south of the study area. Other successes took place at Griquatown and Rooikoppies. These victories resulted in almost the entire white population of Postmasburg taking up arms on the Boer side during August and September 1901. After a battle at Kalkfontein (south of Postmasburg) on 15 September 1901, the town was retaken by the British. However, during January and February 1902 General De Villiers was again in control of Postmasburg and used it as his headquarters during this period (Snyman, 1983). During the last few months of the war, the Boer forces focussed their attention on attacking the British convoys operating between Griquatown and Danielskuil. This resulted in skirmishes and battles at places such as Dirkspan and Doornfontein (not to be confused with the farm Doornfontein located directly south and south-west of the present study area), both located east of the study area (Snyman, 1983). The war ended on 31 May 1902 with the British as victors. The effects of the war were felt for years after the hostilities had actually ended.

Figure 21 A group of Boer rebels from Postmasburg (Snyman, 1983:16).

Figure 22

Captain T.L.H. Shone, who not only discovered a Kimberlite pipe near Postmasburg, but who is also regarded as the first person to mine manganese in the vicinity of the study area (S.A. Manganese, 1977:24)

1913	In this year the so-called “Native Locations” of Skeyfontein and Groenwater were established by Proclamation 131 of 1913 (Breutz, 1963).
1918	During this period the Influenza Pandemic arrived in South Africa. Although the Postmasburg area was seemingly not seriously affected by the disease (Snyman, 1983), the situation on the diamond diggings toward Lichtenburg and Bloemhof were much worse and hundreds of people died there during this period (Van Onselen, 1996).
1918 - 1920	During 1918 a prospector by the name of Casper Venter and his assistant Plaatjie discovered a Kimberlite pipe on the townlands of Postmasburg. The following year T.L.H. Shone discovered a second Kimberlite pipe which became the Postma’s Diamond Mine. Venter sold his discovery rights to Oliver Daniel, and during May 1920 the West End Diamond Mine was established. In the same year Daniel and his partners sold the mine to Sir Abe Bailey for an amount of £80,000.00 (Snyman, 1983). Although the discovery of the Kimberlite pipe brought large numbers of fortune seekers to Postmasburg in the hope that the town would become the new Kimberley, it was only the West End Mine as well as the Postma’s Mine which proceeded with the mining of diamonds (S.A. Manganese, 1977).
1919 - 1930	Mine activities at the West End Diamond Mine continued during this period, until work was ceased due to the financial crisis associated with the Great Depression. During this time the mine retrieved 182, 955 carats of diamonds (Snyman, 1983).
1920 - 1921	The Kimberlite pipe which had been discovered by Shone was mined during this time by Postma’s Diamond Prospect Limited (Snyman, 1983).
1922	In this year T.L.H. Shone (who had discovered the Kimberlite pipe at Postma’s Mine three years earlier) discovered manganese on the farm Doornfontein. Although the presence of manganese in the surrounding landscape had been known before this discovery Shone was the first person to actually mine manganese in this area and was also responsible for focussing the attention of those interested in manganese on the surroundings of Postmasburg (Snyman, 1983). The farm Doornfontein 446 is located directly west of the portion of the study area at Doornpan.
1922 - 1923	After the cessation of activities by the Postma’s Diamond Prospect Limited, mining activities were undertaken during this time by the Diamond Fields of Africa Exploration Company Limited (Snyman, 1983).
1925	With partners Reg Saner and John Dale-Lace, T.L.H. Shone established the first manganese mining company in South Africa, namely Union Manganese Mines and Minerals Limited. The company obtained options on a number of farms in the Postmasburg district (Snyman, 1983).
1924 - 1927	Mining activities were taken over by the Postma’s Diamond Syndicate in 1934 after the cessation of activities by Diamond Field (Snyman, 1983).

22 December 1926 – May 1927	On 22 December 1926 a second manganese mining company was established by Niels Langkilde and A.J. Bester. The company was named South African Manganese Limited (Snyman, 1983). During 1927 the company appointed two experienced prospectors to investigate the properties of the company. These two prospectors were S. Griffiths and W.J. Marais. Their work focussed on the four most important farms owned by the company, namely Kapstewel (located directly adjacent to the study area), Thaakwanene (located directly north-east of the study area), Knoffelfontein (unknown location) and Doornput (seemingly located either directly adjacent or within the study area). Although the results of the prospecting activities were deemed to be very positive, the lack of a railway link between the market and these properties was a serious hurdle (S.A. Manganese, 1977).
1929	A company by the name of the Postma's Diamond Mine undertook mining activities at the Postma's Mine (Snyman, 1983).
4 November 1930	On this day the extension of the railway line from Koopmansfontein to Postmasburg was officially opened by the Minister of Railways, C.W. Malan. This meant that Postmasburg was now one of the few towns in the Northern Cape which boasted a direct rail link. The extension of the railway line to Beeshoek was built by the Manganese Corporation, whereas the further extensions of the line to Lohatla and Manganore (1936), Sishen (1953) and Hotazel (1961) were undertaken by the South African Railways (Snyman, 1983).
1930 - 1932	During 1930 an Englishman by the name of Pringle-Smith was appointed by S.A. Manganese to devise and execute a "...*thorough prospecting programme of S.A. Manganese's properties*..." (S.A. Manganese, 1977:46). This meant that the prospecting work undertaken in 1927 and which had been halted due to the poor financial climate and the lack of a railway link could now be proceeded with. Within a relatively short spate of time Pringle-Smith started opening up the beds on the farms Kapstewel and Doornput. However, the company did not have the market which for example the Manganese Corporation possessed at the time, and as a result the ore was stockpiled at these two farms. Pringle-Smith left the Postmasburg area in 1932 after the financial implications of the Great Depression worsened the situation for S.A. Manganese to such an extent that he was asked to agree to a much lower salary (S.A. Manganese, 1977).
1930 - 1931	The activities at the Postma's Mine were continued during this time by the company Postma's Mine (Snyman, 1983).
1931 -1939	During this time the dumps at the West End Diamond Mine were mined by F. Bernhardi, R.A. Dunsford and T. Begbie. However, this proved unsustainable and this work was ceased in 1939 (Snyman, 1983).
Early 1930s	Due to the financial impacts of the Great Depression, a number of smaller manganese mining companies were closed down. A period of amalgamation followed which resulted in the South African Manganese Limited as well as the Associated Manganese Miners of South Africa Limited becoming the

	leaders in the manganese mining industry (Snyman, 1983).
1935	The Postmasburg Diamond Mine was the last company to undertake mining activities at the Postma's Mine. All activities at the mine were halted when the mine became flooded during this year. The different mining companies operating at the Postma's Mine during the period from 1919 to 1935 retrieved a total of 5,155 carats of diamonds (Snyman, 1983). The Mancorp Mine village was established during this year (Snyman, 1983).
c. 1936	After the willingness of the South African Railways Administration to extend the railway line from Postmasburg to Kapstewel and Lohatla became known, the entire manganese industry north of Postmasburg changed for the better. An example of this was that S.A. Manganese stepped up operations on the farm Kapstewel. The work here was overseen by none other than Captain T.L.H. Shone (S.A. Manganese, 1977). The promise of railway extensions to this area also resulted in other mining activities such as the establishment of a mining company by the name of Gloucester Manganese. This company was established to mine the manganese deposits on the farm Gloucester. Shortly thereafter an amalgamation took place between Gloucester Manganese and the Manganese Corporation which resulted in the formation of the Associated Manganese Mines of South Africa Limited (Ammosal). Ammosal re-erected the old ore handling plant from Beeshoek on the farm Gloucester and the operations here represented a large portion of the total manganese production of 250,000 tons (S.A. Manganese, 1977).

Figure 23 Prospecting activities on the farm Kapstewel during 1937 (S.A. Manganese, 1977:59).

1937	The farm to the east of Gloucester, named Lohatla, was now being viewed more favourably by S.A. Manganese. During this year they reached an agreement with the owner, which eventually resulted in the acquisition of the farm (S.A. Manganese, 1977). During the same year the company bought the freehold of the farm Klipfontein (located directly north of Doornpan) and also bought 600 morgen of the farm Kapstewel in order to build a staff village. This village was named Manganore (S.A. Manganese, 1977). The Lohatla mine village was also established during this time (Snyman, 1983).
1948	The production of iron ore came to the foreground during this time with the mining of iron ore by S.A. Manganese at Manganore and by the Associated Manganese Miners of South Africa at Beeshoek (Snyman, 1983).
1953	In this year Iscor commenced iron production at Sishen (Snyman, 1983).
1958 - 1978	Iron ore (and manganese) mining activities were undertaken by Consolidated African Mines on the farms Pensfontein (3.2km south of study area), Kapstewel (directly adjacent study area) and Rooinekke. These activities were halted when the market for iron disappeared in 1978 (Snyman, 1983).
1959 - 1966	Iron ore mining activities were started at the so-called Springbok Mine during 1959. These activities took place around a low hill situated south-west of Postmasburg. The work on the town end of the property was undertaken by the Springbok Industrial and Mineral Ventures Limited and the work undertaken on the other end (toward the farm Koeispeen 475) were undertaken by Griqualand Iron Ore (Pty) Ltd. The mining activities of the companies at Springbok Mine ceased in 1966 (Snyman, 1983). The Springbok Mine is situated 11.8km south-west of the study area.
Early 1960s	The residents of Skeyfontein and Groenwater were forcibly removed from their land as part of the system of Apartheid (BAO, 2390, D188/1235/1).
1963	F.M. Mangan discovered iron ore deposits on the farm Kareepan (Snyman, 1983). This farm is situated adjacent to Doornpan.
1963 - 1977	During this time mining activities were renewed on the original prospecting land of West End Diamond Mine. Mining activities included the sinking of two shafts as well as the working of the old mine dumps. Due to financial losses, all activities here were ceased in 1977 (Snyman, 1983).
c. 1966 - 1978	During this time Springbok Industrial started mining the iron ore deposits which had been discovered on Kareepan in 1963. By 1978 all activities were halted as there was no more market for iron ore (Snyman, 1973).
1976 - 1977	During this time the Gatlhose and Maremane Communities were removed from their land and taken to the Shipton Farms in the then homeland of Bophutatswana. After their removal, the South African Government decided to establish a Battle School here. As the Khosis Community was still staying on the land, they were moved to a section of the original land roughly 14 000 hectares in extent. The Lohatla Battle School was subsequently established (www.lrc.org.za/Docs/Judgments/khosis.doc).

7.2 Findings from Historic Overview

Although the historic overview of the study area and surroundings has revealed a long and significant history for the surroundings of the study area, almost none of the historical events highlighted in this report can be positively linked to the study area itself. This said, in a number of cases, mention is made to properties and localities located adjacent or very close to the study area. For the most part these include aspects relating to the history of manganese and iron mining.

The following events from the historic overview can be linked to the study area itself:

- With the establishment of the Griqualand West in 1871 and the proclamation of British Bechuanaland in 1885, the boundary between these areas was defined as passing a short distance to the north of the study area.
- In 1897 a fence was erected on the boundary line between Griqualand West and British Bechuanaland as an attempt to halt the spread of the dreaded Rinderpest from the north into Griqualand West. This fence would have been erected along the northern boundary of the farm Driehoekspan which is directly north of the farm Doornpan.
- Mention is made of prospecting activities undertaken on the farm Doornput during 1927 as well as between 1930 and 1932. Although farms by this name are located in the wider area as well, the geology map of Postmasburg that was surveyed during 1927 and 1928 identifies the farm within which Portion 1 of Doornpan is located, as the farm Doornput.

Apart from these aspects, the historic study also highlighted some of the historical and archaeological sites which might potentially be located within the study area. These include Stone Age sites, Iron Age sites associated with the histories of the Thlaro and Thlaping (likely in the form of old homesteads with or without stone walling), sites associated with the Kora and Griqua periods (graves, buildings and middens), sites associated with the early and later settlement of white farmers in the area (graves, farmsteads and middens) as well as mining-related sites (shafts, trenches and discard dumps as well as abandoned mine machinery and mine buildings).

8 PALAEONTOLOGICAL OVERVIEW AND FINDINGS

Refer Annexure A for the complete Palaeontological Report. It is important to note that both the report and this section dealing with palaeontology refer to both farms earmarked for mining activities. However, as stated elsewhere, this report only deals with the proposed mining activities on the farm Doornpan.

8.1 Geology of the Study Area

The proposed development site is underlain by low to medium grade metamorphic rocks of the Transvaal Supergroup in the Griqualand West Sequence. Rocks of both the Vaalian-aged Postmasburg (clastic sedimentary and volcanic rocks) and Campbell (chemical sedimentary rocks) Groups have been affected by the stacking of thrust packages as can be seen in the Maremane Dome Region North of Postmasburg.

Banded Iron Formations (BIF) are the result of chemical sedimentary cycles starting with carbonates, followed by sideritic iron-stones and cherts and ending with silicic iron-stones. Iron precipitation was seen as occurring in a bar-basin or lagoon in the most marginal zones of the basin (Eriksson et. al., 1976 in: Johnson et.al., 2009). The interpretation of Banded Iron Formation deposition is further complicated by the Maremane Dome Structure North of Postmasburg, where the Kuruman BIF has a unique setting (Johnson et. al., 2009) leading to the development of rich Sishen-type iron ores.

The farm Driehoeks Pan 435 is underlain by rocks of the Gamagara Formation (Vg) of the Postmasburg Group as well as rocks of the Lime Acres Member of the Ghaapplato Formation (Vgl) of the Campbell Group. The rocks of the Gamagara Formation underlie the Western Corner of the Farm. This formation consists of quartzites, conglomerates, flagstones and shales and constitutes the base of the Postmasburg Group. The formation lies unconformably upon the Ghaapplato and Asbesberge Formations. Lenticular basal conglomerates contain pebbles of jasper and banded iron stone and are completely ferruginised in places. The shales contain lenses of conglomerate and are also locally ferruginised or manganised. Ferruginous flagstone and white, purple and brown quartzites form the top of the formation. Rocks of the Lime Acres Member of the Ghaapplato Formation of the Campbell Group consist of dolomitic limestone with subordinate coarsely crystalline dolomite and chert with lenses of limestone. Stromatolitic puckered limestone consisting of alternating dark and light bands can be found. Lenticular bodies of limestone

occurring in the dolomite are probably the result of irregular dolomitisation of the original limestone (Moen HFG, 1977).

The farm Doornpan 445 1 is mainly underlain by dolomitic limestone with subordinate coarsely crystalline dolomite, and chert with lenses of limestone of the Lime Acres Member of the Ghaapplato Formation of the Campbell Group. Some of the hills on the farm consist of rocks of the upper section of the Lime Acres Member of the Ghaapplato Formation. These rocks consist of chert and chert breccia (silica breccia or manganese marker) containing a thin ferruginous layer of shale that grades southwards into red jasper with chert. This ferruginous layer is fairly constant throughout the area and serves as a marker. Stromatolitic puckered limestone consisting of alternating dark and light bands lies underneath the chert member which forms the top of the Ghaapplato Formation. Lenticular bodies of limestone occurring in the dolomite are probably the result of irregular dolomitisation of the original limestone (Moen HFG, 1977).

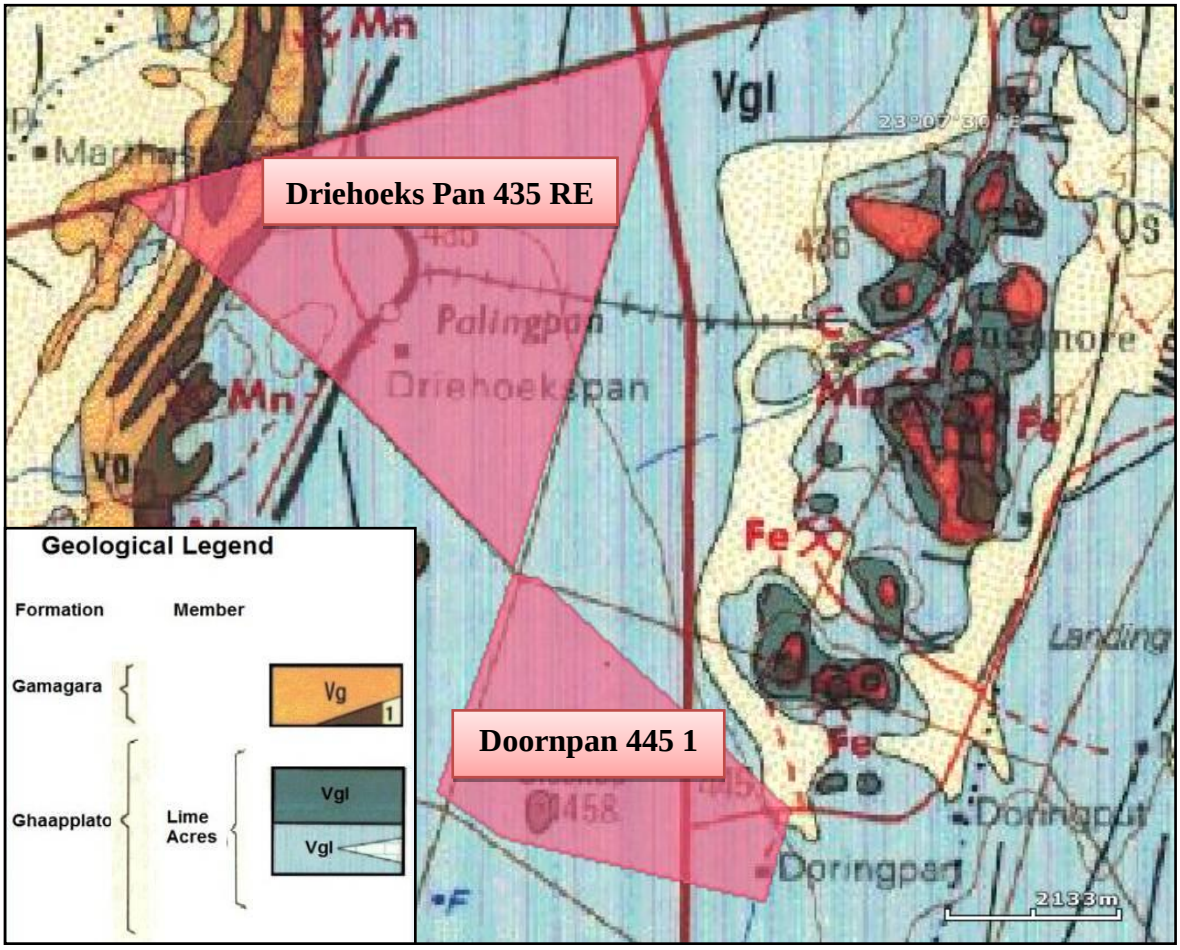

Figure 24 – Map showing the geology of the study area

8.2 Palaeontology of the Study Area

In most of the models presented for the deposition of BIFs, there is a strong correlation with carbonate deposition in shallow marine environments. These environments are in turn known to be associated with well-defined domical stromatolites with fine, internal lamination. Elongated, large stromatolite domes with laminated internal structures reflecting a sub-tidal current-influenced environment have been described from the Ghaapplato Formation, Campbell-Rand Subgroup near Boetsap, east of the study area (Johnson et. al., 2009).

Stromatolite structures are best observed as internal, wavy patterns in limestones or dolomites.

Figure 25 – Typical stromatolite structures usually associated with dolomite deposits such as the dolomite of the Campbell Group. It is highly likely that structures such as in this photograph, might be exposed during exposure of the dolomite and Banded Iron Units. (Photograph from Wikipedia 201 en.wikipedia.org/wiki/Stromatolite.

Stromatolites can also be identified as large domal structures on the bedding plains of chemical sedimentary sequences. Structures like those depicted below are known from the Ghaapplato Formation and might be associated with carbonate rocks such as the dolomites which are in turn associated with BIFs in the study area.

Figure 26 – Dome structures associated with stromatolites in chemical sedimentary sequences (http://jfmoyen.free.fr/IMG/jpg/Stromato-Fig11.jpg)

8.3 Palaeontological Sensitivity of the Study Area

The palaeontological sensitivity is predicted after identifying potentially fossiliferous rock units; ascertaining the fossil heritage from the literature and evaluating the nature and scale of the development itself.

The scale of the quarries proposed for the mining of iron ore will most probably lead to the exposure of chemical sedimentary sequences associated with the deposition of BIFs. Sequences of chemical sedimentary rocks can in turn contain stromatolite structures which will only be exposed during the mining operation. Due to the likelihood of finding these structures during mining operations, the study areas have a moderate palaeontological sensitivity rating with a low sensitivity rating only in the western corner of the farm Driehoeks Pan 435 RE.

8.4 Palaeontological Findings

The study areas are underlain by chemical and clastic sedimentary sequences of the Campbell and Postmasburg Groups of the Transvaal Supergroup. These sedimentary sequences are associated with BIFs in the Postmasburg region where mining is envisaged. The dolomite sequences can contain good examples of stromatolite structures that are of medium palaeontological significance.

It is recommended that the developer and the ECO of the development be made aware of the possible presence of stromatolites. If these structures are present, a qualified

palaeontologist must be informed and a representative sample of at least 1m3 must be collected for future reference. Photographic recording of the structures must form part of the Environmental Management Plan of the mining development.

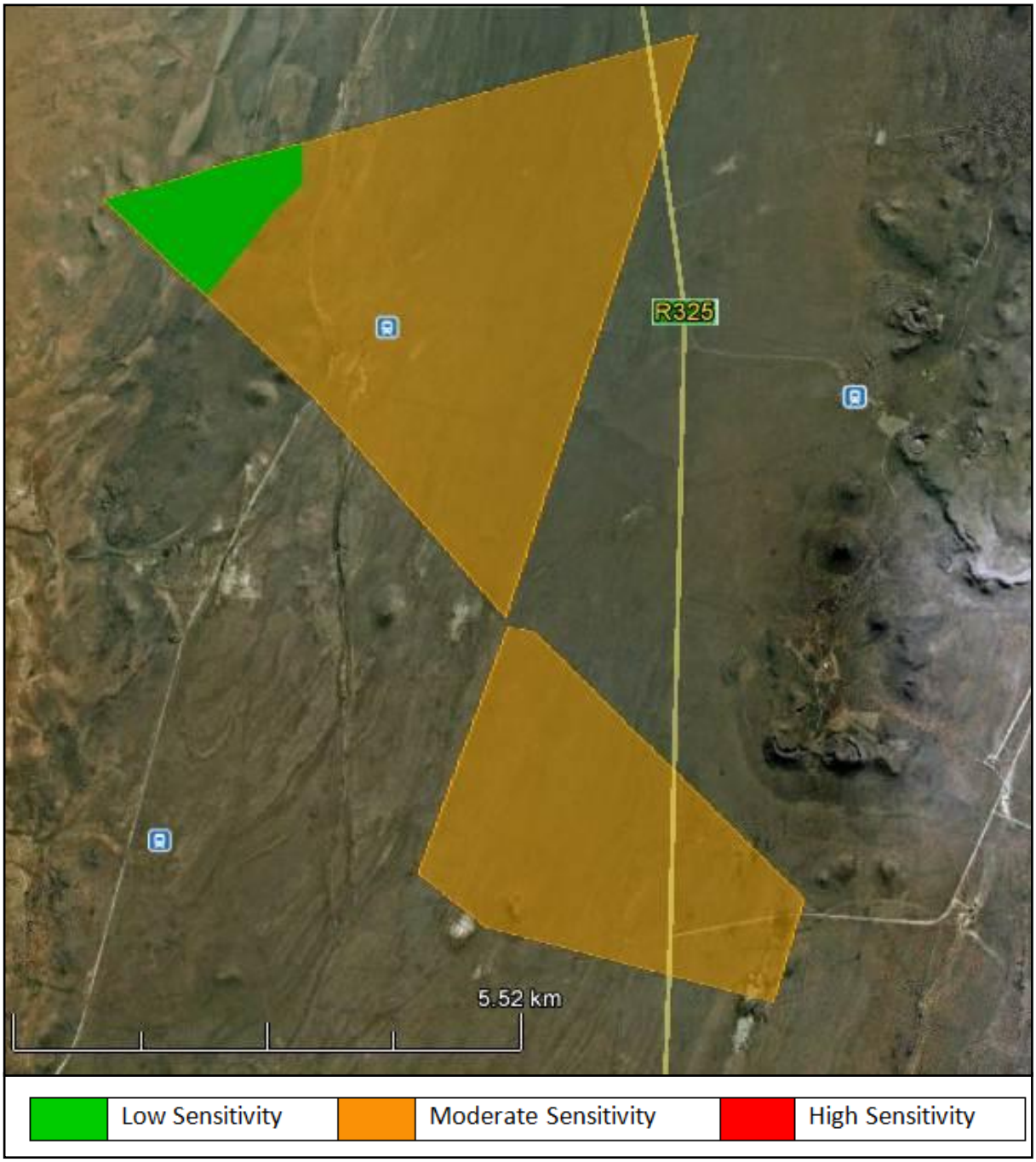

Figure 27 – Map showing the palaeosensitivity of both the farms Driehoekspan (top) and Doornpan (bottom).

9 FIELDWORK FINDINGS

9.1 Introduction

A systematic walkthrough of the study area was undertaken by a fieldwork team comprising an archaeologist and one or more field assistants. The archaeologist was equipped with a hand-held GPS, and his recorded track logs are depicted in white below. During the fieldwork undertaken in 2013 the team comprised two individuals namely Polke Birkholtz (Archaeologist and Project Manager) and Derrick James (Field Assistant). During the more recent fieldwork the team comprised four individuals namely Polke Birkholtz (Archaeologist and Project Manager) as well as Derrick James, Thomas Mulaudzi and Edward Khorommbi (Field Assistants).

Figure 28 – The track logs recorded for the mining blocks as well as the proposed access roads. The proposed mining blocks are marked in red whereas the proposed roads are in yellow. The recorded track logs are in white. The identified sites are marked with white and block icons. The relevant track logs recorded during the survey of the previous mining footprint are also depicted. As can be seen from this image, no fieldwork was undertaken within the mining block on top of Bleskop Hill. This is due to the fact that this area had already been assessed by an Archaeological Impact Assessment report compiled by L. Webley and D. Halkett in 2010.

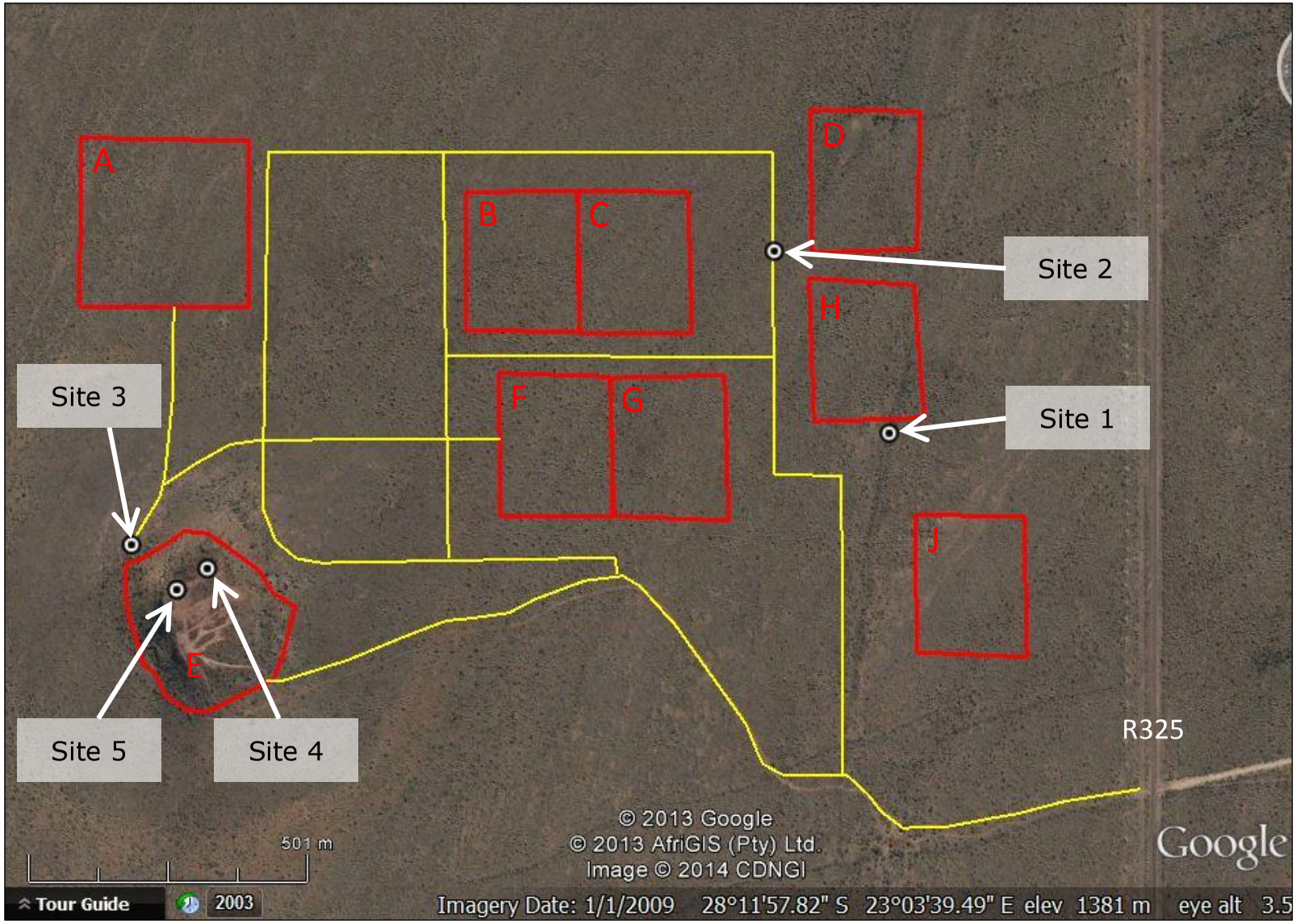

Figure 29 – Overlay map of the distribution of identified sites over the proposed mining footprint areas.

9.2 Fieldwork Findings

Three sites were identified during the fieldwork. As mentioned elsewhere, the field survey of Block E formed part of an Archaeological Impact Assessment which had been undertaken by L. Webley and D. Halkett in 2010 (ACO, 2010) and as a result was not surveyed again. The two sites that were identified during their survey are included in this report as Sites 4 and 5.

9.2.1 Site 1

Site Coordinates:

S 28° 12' 21.3"
E 23° 04' 36.5"

Site Description:

The site comprises a deep circular excavation which had been dug by hand and which is located 24m south of Mining Block H. The excavation is completely vertical, roughly 2m across and 10m deep. A second similarly sized excavation was made through a section of the first. Two possible interpretations for the site can be suggested, namely that it formed part of historic exploration and mining activities or alternatively that it represents a well. The Google Earth image seems to suggest that the site is located on a non-perennial stream. If this is true, the site can almost certainly be interpreted as a historic well.

The direct surroundings of the site were scrutinised for cultural material. A single Castle Lager beer bottle fragment dating to the mid 20th century was identified. It is not presently clear whether this fragment and the site are directly associated. As a result, the site cannot be accurately dated at present. However, it is likely older than 60 years.

Site Significance:

The site comprises a vertical excavation in the ground with almost no associated cultural material. Although the site can be considered reasonably unique with some historic significance, it does not possess an incredible amount of potential for scientific research nor does it appear to have any particular significance for communities or individuals. The site is deemed to be of Generally Protected B (GP.B) / Medium Significance.

Figure 30 – Fieldwork assistant Thomas Mulaudzi standing near the open excavation.

Figure 31 – Closer view of the excavation.

9.2.2 Site 2

Site Coordinates:

S 28° 12' 10.8"
E 23° 04' 29.0"

Site Description:

The site comprises a Stone Age findspot where a single Middle Stone Age flake was observed. No associated lithics could be identified.

Site Significance:

The site comprises a single Stone Age lithic. As a result it is of Generally Protected C (GP.C) / Low Significance.

Figure 32 – General view of the locality where the lithic was observed.

9.2.3 Site 3

Site Coordinates:

S 28° 12' 27.7"	S 28° 12' 25.4"
E 23° 03' 47.3"	E 23° 03' 50.4"

Site Description:

The site comprises a historic road which had been built all around the slope of Bleskop Hill to gain access to its summit. The two coordinates provided above represents a small section of the road situated in proximity to proposed access roads.

Although the road was built along steep slopes, it has a stone packed terrace all along its downhill edge which allowed the road itself to be level. The road was well built and appears to have been constructed during exploration and mining activities undertaken on Bleskop Hill.

While the road itself cannot be dated, an unfired round of ammunition was identified during the field survey on the side of the road. The headstamp contains the following information: "U 44 VII". As a result the round can be identified as a Mark VII .303 round that was manufactured in 1944 by the South African Mint. Although this round cannot be considered an absolute chronological marker, it does suggest that the road was constructed or used during the 1940s and possibly 1950s. As a result the road is likely older than 60 years.

At its closest point, the proposed access road is located 5m north of the site.

Site Significance:

Although the site cannot be considered unique or possessing of any great scientific significance, it has a certain amount of historical significance which provides insights into historic to recent mining and exploration activities in the Postmasburg area. The road is also older than 60 years.

As a result, the site is deemed to be of Generally Protected B (GP.B) / Medium Significance.

Figure 33 – General view along the stone packed terraced edge of an old road.

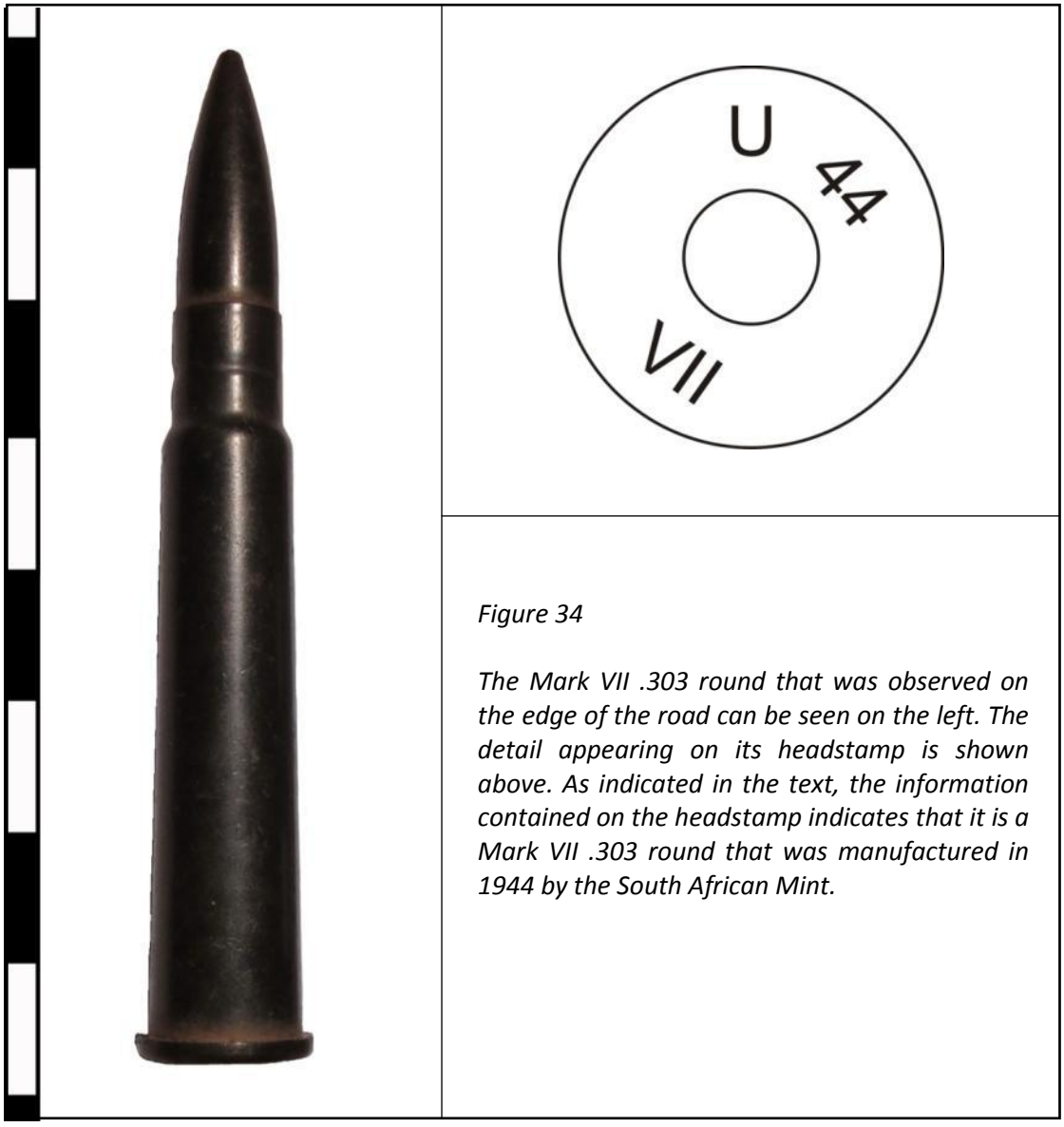

Figure 34

The Mark VII .303 round that was observed on the edge of the road can be seen on the left. The detail appearing on its headstamp is shown above. As indicated in the text, the information contained on the headstamp indicates that it is a Mark VII .303 round that was manufactured in 1944 by the South African Mint.

9.2.4 Site 4

Site Coordinates:

S 28° 12' 29.0"
E 23° 03' 52.6"

Site Description:

A Middle Stone Age flake was identified by L. Webley and D. Halkett during their survey in 2010. They indicated that the flake showed retouch and was manufactured using a fine grained raw material (ACO, 2010).

Site Significance:

The authors of the abovementioned report assessed the site to be of Low Significance (ACO, 2010).

9.2.5 Site 5

Site Coordinates:

S 28° 12' 30.2"
E 23° 03' 50.6"

Site Description:

An Early Stone Age core was identified by L. Webley and D. Halkett during their survey in 2010. They indicated that the core was manufactured on quartzite (ACO, 2010).

Site Significance:

The authors of the abovementioned report assessed the site to be of Low Significance (ACO, 2010).

10 IMPACT OF PROPOSED DEVELOPMENT ON HERITAGE RESOURCES

10.1 Risk Calculation for the Impact of the Proposed Development on Site 1

In this section the impact of the proposed development on Site 1 will be established.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(3 + 2 + 3)}{3} \times \frac{3}{5}$$

IMPACT RISK = 1.6

Table 10: Risk Calculation for Development Impact on Site 1

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	Moderate	Study Area	Medium-Term	Could Happen	**Low**
Impact on Site 1	3	2	3	3	**1.6**

This calculation has revealed that the impact risk of the proposed development on Site 1 falls within Impact Class 2, which represents a Low Impact Risk. As a result no mitigation would be required. However, please note the general recommendations below.

10.2 Risk Calculation for the Impact of the Proposed Development on Site 2

In this section the impact of the proposed development on Site 2 will be established.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(2 + 2 + 3)}{3} \times \frac{4}{5}$$

IMPACT RISK = 1.86

Table 11: Risk Calculation for Development Impact on Site 2

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	Low	Study Area	Medium-Term	Very Likely	**Low**
Impact on Site 2	2	2	3	4	**1.86**

This calculation has revealed that the impact risk of the proposed development on Site 2 falls within Impact Class 2, which represents a Low Impact Risk. As a result no mitigation would be required. However, please note the general recommendations below.

10.3 Risk Calculation for the Impact of the Proposed Development on Site 3

In this section the impact of the proposed development on Site 3 will be established.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(3 + 3 + 3)}{3} \times \frac{4}{5}$$

IMPACT RISK = 2.4

Table 12: Risk Calculation for Development Impact on Site 3

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	Moderate	Local	Medium-Term	Very Likely	**Moderate**
Impact on Site 3	3	3	3	4	**2.4**

This calculation has revealed that the impact risk of the proposed development on Site 3 falls within Impact Class 3, which represents a Moderate Impact Risk. Please see section below for required mitigation measures.

10.4 Risk Calculation for the Impact of the Proposed Development on Sites 4 and 5

These sites were assessed as part of the Archaeological Impact Assessment undertaken by L. Webley and D. Halkett (ACO, 2010). Both sites were found to be of Low Significance at the time and no mitigation measures were required.

11 MITIGATION MEASURES AND GENERAL RECOMMENDATIONS

The three risk calculations above have shown that the impact risk of the proposed development on Site 1 and Site 2 will fall within Impact Class 2 representing a Low Impact Risk. However, the impact risk calculation for Site 3 has show that the impact risk of the proposed development on this site will fall within Impact Class 3 representing a Moderate Impact Risk. As a result the following mitigation measures are required for this site:

- The road is older than 60 years and cannot be disturbed or impacted upon without a permit from the relevant heritage authority.
- The site must be documented with plan drawings as well as photographic recording. This documentation must accompany the permit application.
- Once the permit is received, the proposed road on this side of the slope can be constructed.

The impact risk calculation for Site 1 was based on the assumption that the proposed activities in this area would be undertaken strictly within the development footprint areas. Should any impacts be expected on this site, the following recommendations will have to be undertaken:

- The site is likely older than 60 years and is potentially also older than 100 years as well. As a result it cannot be disturbed or impacted upon without a permit from the relevant heritage authority.
- The site must be documented with plan drawings as well as photographic recording. This documentation must accompany the permit application.
- Only once the necessary permits have been received can any impacts be allowed on the site.

12 CONCLUSIONS

PGS Heritage was appointed by Synergistics Environmental Services to undertake a Heritage Impact Assessment (HIA) that forms part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the proposed mining activities located on sections of Portion 1 of the farm Doornpan 445, north of Postmasburg, Northern Cape Province.

Desktop Study

This Heritage Impact Assessment was preceded by a Heritage Scoping Report which included a detailed desktop study. This desktop study indicated that both the study area and surrounding area have a rich historical and archaeological history. The scoping report provided a number of findings and observations which can be grouped within archival and historical maps, history, archaeology and palaeontology. These will be individually discussed here again, after which the findings from the heritage field survey will be provided.

- **Archival and Historical Maps**

  The following observations can be made as a result of the study of archival and historical maps of the study area:

  - In 1911 the farm Doornpan as well as the study area was entirely undeveloped and was likely characterised by farming activities.
  - By 1928 a farmhouse had been built on Doornpan. However, based on the information available on the maps, this farmhouse represented the only man-made feature within the farm at the time. Although the exact age of this farmhouse is not known, it would have been built between 1911 and 1928. As such, the farmhouse can be anything between 86 years and 103 years old if it still exists today.
  - By 1970 considerable development has taken place in proximity to the study area. This includes mining as well as infrastructural development such as the construction of the railway line between Postmasburg and Lohatla that was built in 1936.

- One additional building appears on the farm Doornpan on the 1970 map. This building appears to be associated with the farmhouse which had been built sometime before. This additional building would have been constructed between 1928 and 1970, and as such would be between 86 years and 44 years old if it still exists today.

- **History**

The archival and historical research has revealed a long and significant history in terms of the surroundings of the study area. However, even though this historical study was quite intensive and detailed, very little historical information with regard to the study area itself could be located. However, the historic study highlighted some of the historical and archaeological sites which may potentially have been located within the study area. These include Stone Age sites, Iron Age sites associated with the histories of the Thlaro and Thlaping, sites associated with the Kora and Griqua periods (graves, buildings and middens), sites associated with the early and later settlement of white farmers in the area (graves, farmsteads and middens) as well as mining-related sites (shafts, trenches, discard dumps, abandoned mine machinery and mine buildings).

- **Archaeology**

Previous studies conducted in the surroundings of the study area have identified a number of archaeological sites. These include Stone Age (ESA, MSA and LSA) sites including find spots, surface scatters and rock art sites; pre-colonial specularite mining sites; historic structures and buildings; historic mining sites as well as graves. Due to the arid nature of the surroundings of the study area, it seems likely for many of the archaeological site types (with the possible exception of pre-colonial and historical mine sites) to be concentrated in proximity to water sources such as riverine edges and pans.

- **Palaeontology**

The study areas are underlain by chemical and clastic sedimentary sequences of the Campbell and Postmasburg Groups of the Transvaal Supergroup. These sedimentary

sequences are associated with BIFs in the Postmasburg region where mining is envisaged. The dolomite sequences can contain good examples of stromatolite structures that are of medium palaeontological significance.

It is recommended that the developer and the development ECO be made aware of the possible presence of stromatolites. If these structures are present, a qualified palaeontologist must be informed and a representative sample of at least 1m3 must be collected for future reference. Photographic recording of the structures must form part of the Environmental Management Plan of the mining development.

Fieldwork Findings

Fieldwork was undertaken of the proposed footprint areas during May 2013 and February 2014. This comprised intensive walkthroughs through the proposed footprint areas to identify archaeological and heritage sites. As a result of the fieldwork, three sites were identified. The two sites identified during a previous Archaeological Impact Assessment on a smaller section of the study area are also included in this report. The five sites identified within the study area (three sites identified during the present study and two during a study undertaken in 2010) will be discussed individually below:

- **Site 1**

  The site comprises a findspot of a Middle Stone Age flake. No other lithics were identified here. The site has Low Significance.

- **Site 2**

  The site comprises a deep excavation which may have been a well or mining feature. It is circular, roughly 2m across and some 10m deep. A second similarly sized excavation was made through a section of the first. At this point it is not known whether the site can be interpreted as a well or mining excavation. The available Google Earth imagery appears to indicate that the site is located on a non-perennial stream which suggests that the site may be a well. It has Moderate Significance.

- **Site 3**

  The site comprises an old road that was built along the northern slope of Bleskop hill. It has a stone packed terrace on the downhill side that was built to make the road surface level. It is a well constructed feature which in all likelihood provided access to the summit of the hill. As a result the road was in all likelihood used for exploration or mining activities. In terms of establishing a date for the road, an unfired round of ammunition was observed on the site. Its headstamp contains the following information: "U 44 VII". As a result the round can be identified as a Mark VII .303 round that was manufactured in 1944 by the South African Mint. The date appearing on this round provides a chronological marker for the road and although it does not provide any absolute dates, the suggestion is that the road can in all likelihood be dated to the 1940s or 1950s. The site has a Moderate Significance.

- **Site 4**

  A Middle Stone Age flake was identified by L. Webley and D. Halkett. The flake showed retouch and was manufactured using fine grained raw material. The authors assessed the site to be of Low Significance (ACO, 2010).

- **Site 5**

  An Early Stone Age core manufactured of quartzite was identified by L. Webley and D. Halkett. The authors assessed the site to be of Low Significance (ACO, 2010).

The impact of the proposed mining development on Sites 1 to 3 was calculated. Site 4 and 5 had originally been assessed to be of Low Significance with no mitigation measures required and as a result were not included in the impact risk calculations.

The impact risk calculations on the other three sites showed that the impact risk of the development on Sites 1 and 2 fall within Impact Class 2 which represents a Low Impact. The impact risk for Site 3 falls within Impact Class 3 which represents a Moderate Impact. The following mitigation measures are required:

- The road is older than 60 years and cannot be disturbed or impacted upon without a permit from the relevant heritage authority.
- The site must be documented with plan drawings as well as photographic recording. This documentation must accompany the permit application.
- Once the permit is received, the proposed road in this area can be constructed.

The impact risk calculation for Site 1 was based on the assumption that the proposed activities in this area would be undertaken strictly within the development footprint areas. However, should any impacts be expected on this site the following will be required:

- The site is likely older than 60 years and is potentially also older than 100 years as well. As a result it cannot be disturbed or impacted upon without a permit from the relevant heritage authority.
- The site must be documented with plan drawings as well as photographic recording. This documentation must accompany the permit application.
- Only once the necessary permits have been received can any impacts be allowed.

In general terms, only the footprint areas of the proposed mining activities as depicted on the mine development layout plan and the track logs map from within this report were assessed during this heritage impact assessment. Should the development footprints of the proposed development change in any way, these additional areas will have to be assessed in the field and included as part of a revised heritage impact assessment study.

On the condition that these recommendations are adhered to, the proposed mining development may be allowed to continue.

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13.5 Historic Topographic Maps

All the historic topographic maps used in this report were obtained from the Directorate: National Geo-spatial Information of the Department of Rural Development and Land Reform in Cape Town.

13.6 Contemporary Cartographic Data

MapSource and Google Earth were used to depict contemporary cartographic data.

Appendix A

PALAEONTOLOGICAL DESKTOP STUDY

PALAEONTOLOGICAL DESKTOP ASSESSMENT FOR TWO PITS AND ASSOCIATED INFRASTRUCTURE ON THE FARMS DRIEHOEKS PAN 435 RE AND DOORNPAN 445 1 NEAR THE TOWN OF POSTMASBURG IN THE TSANTSABANE LOCAL MUNICIPALITY, SIYANDA DISTRICT MUNICIPALITY IN THE NORTHERN CAPE PROVINCE

Developer:
ArcelorMittal South Africa (Pty) Ltd

For:

HIA CONSULTANTS

DATE: 30 April 2013

By

GIDEON GROENEWALD

EXECUTIVE SUMMARY

Gideon Groenewald was appointed by PSG Heritage and Grave Relocation Consultants to undertake a desktop survey, assessing the potential palaeontological impact of the proposed developments of two pits and associated infrastructure on the farms Driehoeks Pan 435 RE and Doornpan 445 1 near the town of Postmasburg in the Tsantsabane Local Municipality, Siyanda District Municipality of the Northern Cape Province.

This report forms part of the Environmental Impact Assessment and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999. In accordance with Section 38 (Heritage Resources Management), a Heritage Impact Assessment (HIA) is required to assess any potential impacts to palaeontological heritage within the development footprint of the development.

The project entails the development of two separate quarries and associated infrastructure on the farms Driehoeks Pan 435 RE and Doornpan 445 1 near the town of Postmasburg in the Tsantsabane Local Municipality, Siyanda District Municipality of the Northern Cape Province. The quarries will be developed as part of an iron ore mining project proposed by ArcelorMittal South Africa (Pty) Ltd

The proposed development site is underlain by low to medium grade metamorphic rocks of the Transvaal Supergroup in the Griqualand West Sequence. Rocks of both the Postmasburg (clastic sedimentary and volcanic rocks) and Campbell (chemical sedimentary rocks) Groups have been affected by the stacking of thrust packages as can be seen in the Maremane Dome Region North of Postmasburg.

In most of the models presented for the deposition of BIFs, there is a strong correlation with carbonate deposition in shallow marine environments. These environments are in turn known to be associated with well-defined domical stromatolites with fine, internal lamination. Elongated, large stromatolite domes with laminated internal structures reflecting a sub-tidal current-influenced environment have been described from the Ghaapplato Formation, Campbell-Rand Subgroup near Boetsap, east of the study area.

The study areas are underlain by chemical and clastic sedimentary sequences of the Campbell and Postmasburg Groups of the Transvaal Supergroup. These sequences are associated with BIFs in the Postmasburg region where mining is envisaged. The dolomite sequences can contain good examples of stromatolite structures that are of medium palaeontological significance.

The scale of the quarries proposed for the mining of iron ore will most probably lead to the exposure of chemical sedimentary sequences associated with the deposition of BIFs. Sequences of chemical sedimentary rocks can in turn contain stromatolite structures which will only be exposed during the mining operation. Due to the likelihood of finding these structures during mining operations, the study areas have a moderate palaeontological sensitivity rating with a low sensitivity rating only in the western corner of the farm Driehoeks Pan 435 RE.

It is recommended that the developer and the ECO of the development be made aware of the possible presence of stromatolites. If these structures are present, a qualified palaeontologist must be informed and a representative sample of at least $1m^3$ must be collected for future reference. Photographic recording of the structures must form part of the Environmental Management Plan of the mining development.

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1. INTRODUCTION

1.1. Background

Gideon Groenewald was appointed by PSG Heritage and Grave Relocation Consultants to undertake a desktop survey, assessing the potential palaeontological impact of the proposed developments of two pits and associated infrastructure on the farms Driehoeks Pan 435 RE and Doornpan 445 1 near the town of Postmasburg in the Tsantsabane Local Municipality, Siyanda District Municipality of the Northern Cape Province.

This report forms part of the Environmental Impact Assessment and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999. In accordance with Section 38 (Heritage Resources Management), a Heritage Impact Assessment (HIA) is required to assess any potential impacts to palaeontological heritage within the development footprint of the development.

Categories of heritage resources recognised as part of the National Estate in Section 3 of the Heritage Resources Act, and which therefore fall under its protection, include:

- geological sites of scientific or cultural importance;
- objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens;
- objects with the potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage.

1.2. Aims and Methodology

Following the *"SAHRA APM Guidelines: Minimum Standards for the Archaeological & Palaeontological Components of Impact Assessment Reports"* the aims of the palaeontological impact assessment are:

- to identifying exposed and subsurface rock formations that are considered to be palaeontologically significant;
- to assess the level of palaeontological significance of these formations;
- to comment on the impact of the development on these exposed and/or potential fossil resources and
- to make recommendations as to how the developer should conserve or mitigate damage to these resources.

In preparing a palaeontological desktop study the potential fossiliferous rock units (groups, formations etc) represented within the study area are determined from geological maps. The known fossil heritage within each rock unit is inventoried from the published scientific literature and previous palaeontological impact studies in the same region.

The likely impact of the proposed development on local fossil heritage is determined on the basis of the palaeontological sensitivity of the rock units concerned and the nature and scale of the development itself, most notably the extent of fresh bedrock excavation envisaged. The different sensitivity classes used are explained in Table 1.1 below.

Table 1.1 Palaeontological Sensitivity Analysis Outcome Classification

Sensitivity	Description
Low Sensitivity	Areas where a negligible impact on the fossil heritage is likely. This category is reserved largely for areas underlain by igneous rocks. However, development in fossil bearing strata with shallow excavations or with deep soils or weathered bedrock can also form part of this category.
Moderate Sensitivity	Areas where fossil bearing rock units are present but fossil finds are localised or within thin or scattered sub-units. Pending the nature and scale of the proposed development the chances of finding fossils are moderate. A field-based assessment by a professional palaeontologist is usually warranted.
High Sensitivity	Areas where fossil bearing rock units are present with a very high possibility of finding fossils of a specific assemblage zone. Fossils will most probably be present in all outcrops and the chances of finding fossils during a field-based assessment by a professional palaeontologist are very high. Palaeontological mitigation measures need to be incorporated into the Environmental Management Plan

1.3. Scope and Limitations of the Desktop Study

The study will include: i) an analysis of the area's stratigraphy, age and depositional setting of fossil-bearing units; ii) a review of all relevant palaeontological and geological literature, including geological maps, and previous palaeontological impact reports; iii) data on the proposed development provided by the developer (e.g. location of footprint, depth and volume of bedrock excavation envisaged) and iv) where feasible, location and examination of any fossil collections from the study area (e.g. museums).

The key assumption for this scoping study is that the existing geological maps and datasets used to assess site sensitivity are correct and reliable. However, the geological maps used were not intended for fine scale planning work and are largely based on aerial photographs alone, without ground-truthing. There is also an inadequate database for fossil heritage for much of the RSA, due to the small number of professional palaeontologists carrying out fieldwork in RSA. Most development study areas have never been surveyed by a palaeontologist.

These factors may have a major influence on the assessment of the fossil heritage significance of a given development and without supporting field assessments may lead to either:

- an underestimation of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or
- an overestimation of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by tectonism or weathering, or are buried beneath a thick mantle of unfossiliferous "drift" (soil, alluvium etc).

2. DESCRIPTION OF THE PROPOSED DEVELOPMENT

The project entails the development of two separate quarries and associated infrastructure on the farms Driehoeks Pan 435 RE and Doornpan 445 1 near the town of Postmasburg in the Tsantsabane Local Municipality, Siyanda District Municipality of the Northern Cape Province.
The quarries will be developed as part of an iron ore mining project proposed by ArcelorMittal South Africa (Pty) Ltd.

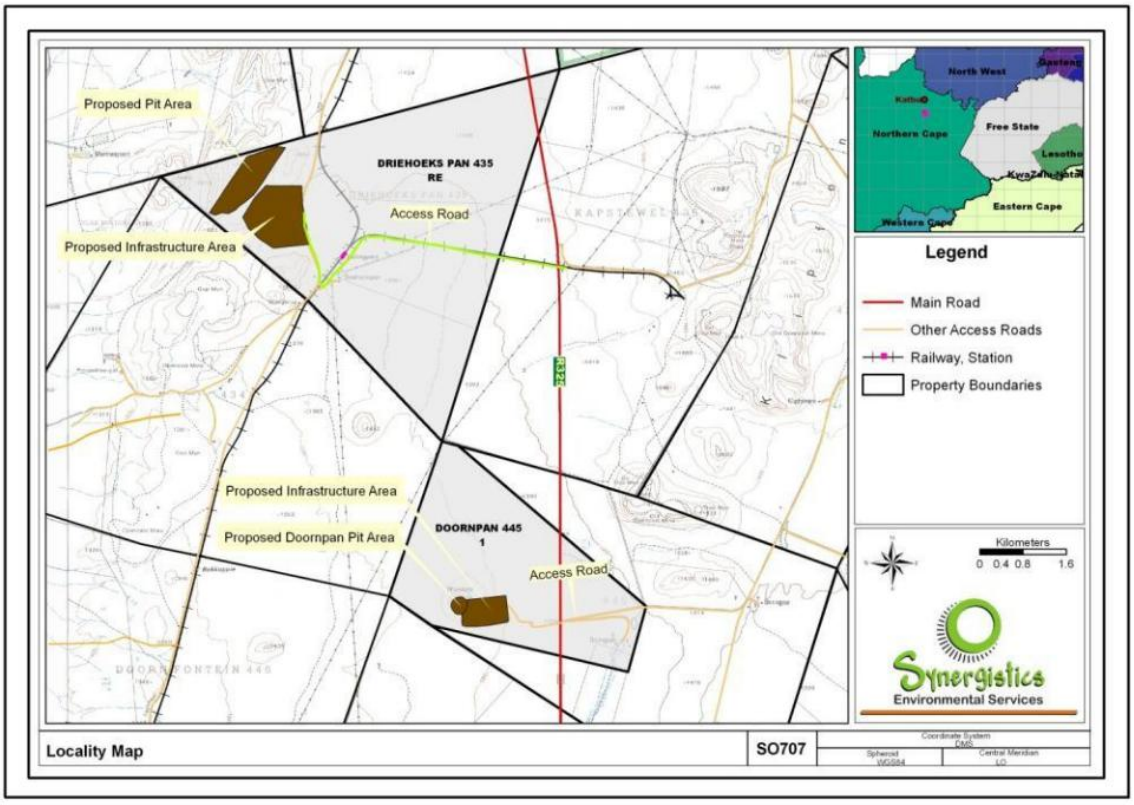

Figure 2.1 Location of study area

3. GEOLOGY

The proposed development site is underlain by low to medium grade metamorphic rocks of the Transvaal Supergroup in the Griqualand West Sequence (Figure 3.1). Rocks of both the Vaalian-aged Postmasburg (clastic sedimentary and volcanic rocks) and Campbell (chemical sedimentary rocks) Groups have been affected by the stacking of thrust packages as can be seen in the Maremane Dome Region North of Postmasburg.

Banded Iron Formations (BIF) are the result of chemical sedimentary cycles starting with carbonates, followed by sideritic iron-stones and cherts and ending with silicic iron-stones. Iron precipitation was seen as occurring in a bar-basin or lagoon in the most marginal zones of the basin (Eriksson et. al., 1976 in: Johnson et.al., 2009). The interpretation of Banded Iron Formation deposition is further complicated by the Maremane Dome Structure North

of Postmasburg, where the Kuruman BIF has a unique setting (Johnson et. al., 2009) leading to the development of rich Sishen-type iron ores.

The farm Driehoeks Pan 435 is underlain by rocks of the Gamagara Formation (Vg) of the Postmasburg Group as well as rocks of the Lime Acres Member of the Ghaapplato Formation (Vgl) of the Campbell Group. The rocks of the Gamagara Formation underlie the Western Corner of the Farm. This formation consists of quartzites, conglomerates, flagstones and shales and constitutes the base of the Postmasburg Group. The formation lies unconformably upon the Ghaapplato and Asbesberge Formations. Lenticular basal conglomerates contain pebbles of jasper and banded iron stone and are completely ferruginised in places. The shales contain lenses of conglomerate and are also locally ferruginised or manganised. Ferruginous flagstone and white, purple and brown quartzites form the top of the formation. Rocks of the Lime Acres Member of the Ghaapplato Formation of the Campbell Group consist of dolomitic limestone with subordinate coarsely crystalline dolomite and chert with lenses of limestone. Stromatolitic puckered limestone consisting of alternating dark and light bands can be found. Lenticular bodies of limestone occurring in the dolomite are probably the result of irregular dolomitisation of the original limestone (Moen HFG, 1977).

The farm Doornpan 445 1 is mainly underlain by dolomitic limestone with subordinate coarsely crystalline dolomite, and chert with lenses of limestone of the Lime Acres Member of the Ghaapplato Formation of the Campbell Group. Some of the hills on the farm consist of rocks of the upper section of the Lime Acres Member of the Ghaapplato Formation. These rocks consist of chert and chert breccia (silica breccia or manganese marker) containing a thin ferruginous layer of shale that grades southwards into red jasper with chert. This ferruginous layer is fairly constant throughout the area and serves as a marker. Stromatolitic puckered limestone consisting of alternating dark and light bands lies underneath the chert member which forms the top of the Ghaapplato Formation. Lenticular bodies of limestone occurring in the dolomite are probably the result of irregular dolomitisation of the original limestone (Moen HFG, 1977).

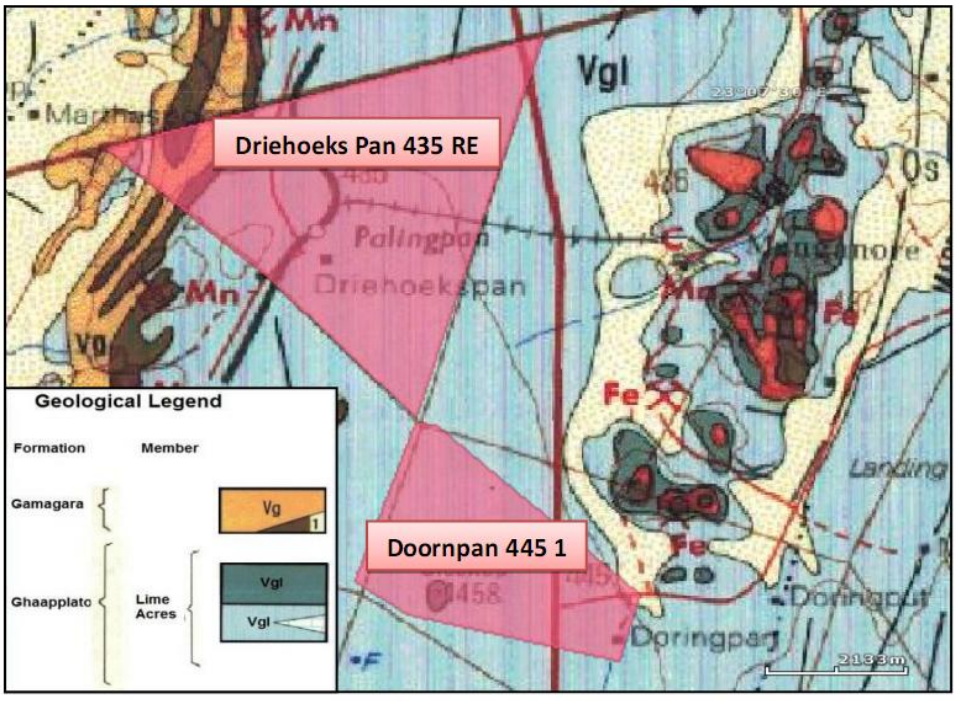

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Figure 3.1 Map showing the geology of the study area

4. PALAEONTOLOGY OF THE AREA

In most of the models presented for the deposition of BIFs, there is a strong correlation with carbonate deposition in shallow marine environments. These environments are in turn known to be associated with well-defined domical stromatolites with fine, internal lamination. Elongated, large stromatolite domes with laminated internal structures reflecting a sub-tidal current-influenced environment have been described from the Ghaapplato Formation, Campbell-Rand Subgroup near Boetsap, east of the study area (Johnson et. al., 2009).

Stromatolite structures are best observed as internal, wavy patterns in limestones or dolomites (Figure 4.1).

Figure 4.1 Typical stromatolite structures usually associated with dolomite deposits such as the dolomite of the Campbell Group. It is highly likely that structures such as in this photograph, might be exposed during exposure of the dolomite and Banded Iron Units. (Photograph from Wikipedia 201) en.wikipedia.org/wiki/Stromatolite.

Stromatolites can also be identified as large domal structures on the bedding plains of chemical sedimentary sequences (Figure 4.2). Structures like those depicted in figure 4.2 are known from the Ghaapplato Formation and might be associated with carbonate rocks such as the dolomites which are in turn associated with BIFs in the study area.

Figure 4.2 Dome structures associated with stromatolites in chemical sedimentary sequences. (http://jfmoyen.free.fr/IMG/jpg/Stromato-Fig11.jpg)

5. PALAEONTOLOGICAL SENSITIVITY

The palaeontological sensitivity is predicted after identifying potentially fossiliferous rock units; ascertaining the fossil heritage from the literature and evaluating the nature and scale of the development itself.

The scale of the quarries proposed for the mining of iron ore will most probably lead to the exposure of chemical sedimentary sequences associated with the deposition of BIFs. Sequences of chemical sedimentary rocks can in turn contain stromatolite structures which will only be exposed during the mining operation. Due to the likelihood of finding these structures during mining operations, the study areas have a moderate palaeontological sensitivity rating with a low sensitivity rating only in the western corner of the farm Driehoeks Pan 435 RE (Figure 5.1).

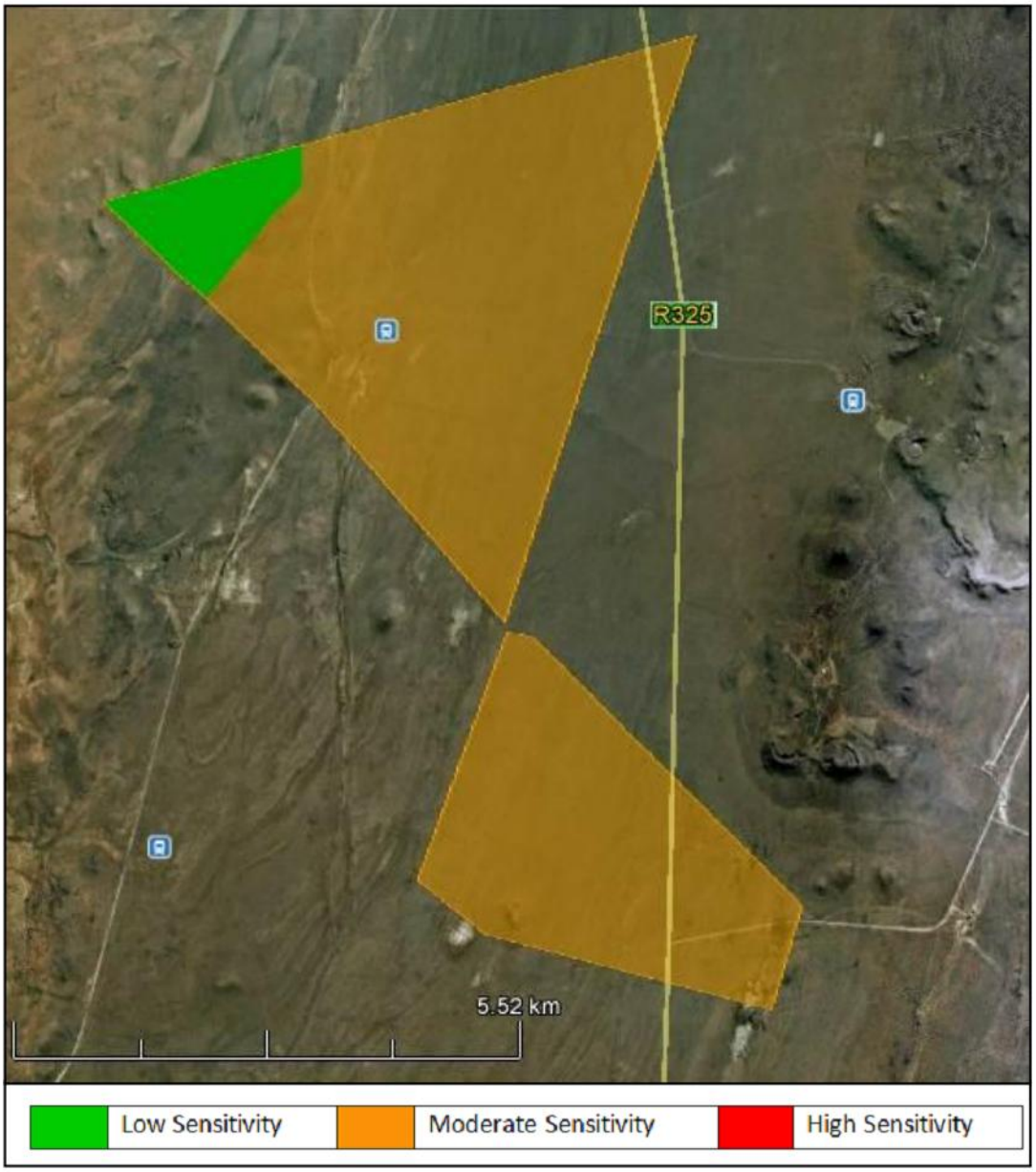

Figure 5.1 Map showing the palaeosensitivity of the study areas

6. CONCLUSION AND RECOMMENDATIONS

The study areas are underlain by chemical and clastic sedimentary sequences of the Campbell and Postmasburg Groups of the Transvaal Supergroup. These sedimentary sequences are associated with BIFs in the Postmasburg region where mining is envisaged. The dolomite sequences can contain good examples of stromatolite structures that are of medium palaeontological significance.

It is recommended that the developer and the ECO of the development be made aware of the possible presence of stromatolites. If these structures are present, a qualified palaeontologist must be informed and a representative sample of at least $1m^3$ must be collected for future reference. Photographic recording of the structures must form part of the Environmental Management Plan of the mining development.

7. REFERENCES

Johnson MR , Anhaeusser CR and Thomas RJ (Eds) (2006). The Geology of South Africa. GSSA, Council for Geoscience, Pretoria.

Moen HFG (1977). 2822 Postmasburg 1: 250 000 Geological map explanatory notes, Geological survey, Council for Geoscience, Pretoria

8. QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

Dr Gideon Groenewald has a PhD in Geology from the University of Port Elizabeth (Nelson Mandela Metropolitan University) (1996) and the National Diploma in Nature Conservation from Technicon RSA (the University of South Africa) (1989). He specialises in research on South African Permian and Triassic sedimentology and macrofossils with an interest in biostratigraphy, and palaeoecological aspects. He has extensive experience in the locating of fossil material in the Karoo Supergroup and has more than 20 years of experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the southern, western, eastern and north-eastern parts of the country. His publication record includes multiple articles in internationally recognized journals. Dr Groenewald is accredited by the Palaeontological Society of Southern Africa (society member for 25 years).

9. DECLARATION OF INDEPENDENCE

I, Gideon Groenewald, declare that I am an independent specialist consultant and have no financial, personal or other interest in the proposed development, nor the developers or any of their subsidiaries, apart from fair remuneration for work performed in the delivery of palaeontological heritage assessment services. There are no circumstances that compromise the objectivity of my performing such work.

Dr Gideon Groenewald
Geologist

Appendix B

LEGISLATIVE REQUIREMENTS – TERMINOLOGY AND ASSESSMENT CRITERIA

1. GENERAL PRINCIPLES

In areas where there has not yet been a systematic survey to identify conservation-worthy places, a permit is required to alter or demolish any structure older than 60 years. This will apply until a survey has been completed and identified heritage resources are formally protected.

Archaeological and palaeontological sites, materials, and meteorites are the source of our understanding of the evolution of the earth, life on earth and the history of people. In terms of the heritage legislation, permits are required to damage, destroy, alter, or disturb such sites. People who already possess such material are required to register it. The management of heritage resources is integrated with environmental resources and this means that before development takes place heritage resources are assessed and, if necessary, rescued or mitigated.

In addition to the formal protection of culturally significant graves, all graves which are older than 60 years and are not in a cemetery (such as ancestral graves in rural areas) are protected. The legislation protects the interests of communities who have an interest in the graves: they must be consulted before any disturbance takes place. The graves of victims of conflict and those associated with the liberation struggle should be identified, cared for, protected and memorials erected in their honour.

Anyone who intends to undertake a development must notify the heritage resource authority and if there is reason to believe that heritage resources will be affected, an impact assessment report must be compiled at the applicant's (i.e. mining company or development company) cost. Thus, the applicant will be able to proceed without uncertainty about whether work will have to be stopped if an archaeological or heritage resource is discovered.

According to the National Heritage Act (Act 25 of 1999 section 32) it is stated that:

An object or collection of objects, or a type of object or a list of objects, whether specific or generic, that is part of the national estate and the export of which SAHRA deems it necessary to control, may be declared a heritage object, including –

- objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects, meteorites and rare geological specimens;

- visual art objects;
- military objects;
- numismatic objects;
- objects of cultural and historical significance;
- objects to which oral traditions are attached and which are associated with living heritage;
- objects of scientific or technological interest;
- books, records, documents, photographic positives and negatives, graphic material, film or video or sound recordings, excluding those that are public records as defined in section 1 (xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996), or in a provincial law pertaining to records or archives; and
- any other prescribed category.

Under the National Heritage Resources Act (Act No. 25 of 1999), provisions are made that deal with, and offer protection to, all historic and prehistoric cultural remains, including graves and human remains.

2. GRAVES AND CEMETERIES

Graves younger than 60 years fall under Section 2(1) of the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925) as well as the Human Tissues Act (Act 65 of 1983) and National Health Act (Act 61 0f 2003) and are the jurisdiction of the National Department of Health and the relevant Provincial Department of Health and must be submitted for final approval to the Office of the relevant Provincial Premier. This function is usually delegated to the Provincial MEC for Local Government and Planning or in some cases the MEC for Housing and Welfare. Authorisation for exhumation and reinterment must also be obtained from the relevant local or regional council where the grave is situated, as well as the relevant local or regional council to where the grave is being relocated. All local and regional provisions, laws and by-laws must also be adhered to. In order to handle and transport human remains, the institution conducting the relocation should be authorised under Section 24 of Act 65 of 1983 (Human Tissues Act).

Graves older than 60 years, but younger than 100 years, fall under Section 36 of Act 25 of 1999 (National Heritage Resources Act) as well as the Human Tissues Act (Act 65 of 1983) and National Health Act (Act 61 0f 2003) and are the jurisdiction of the South African Heritage

Resource Agency (SAHRA). The procedure for Consultation Regarding Burial Grounds and Graves (Section 36(5) of Act 25 of 1999) is applicable to graves older than 60 years that are situated outside a formal cemetery administrated by a local authority. Graves in the category located inside a formal cemetery administrated by a local authority will also require the same authorisation as set out for graves younger than 60 years over and above SAHRA authorisation.

If the grave is not situated inside a formal cemetery but is to be relocated to one, permission from the local authority is required and all regulations, laws and by-laws set by the cemetery authority must be adhered to.