

**PALAEONTOLOGICAL DESKTOP ASSESSMENT FOR THE  
PROPOSED MINING ACTIVITY ON THE FARMS  
HEUNINGKRAANZ 364 R/E AND LANGVERWACHT 432  
PORTION 1, TSANTSABANE LOCAL MUNICIPALITY,  
SIYANDA DISTRICT MUNICIPALITY, NORTHERN CAPE  
PROVINCE.**

**For:**

**HIA CONSULTANTS  
EXM Advisory Services**

**DATE: 1 August 2017**

**By**

**Gideon Groenewald  
Cell: 078 713 6377**

## **EXECUTIVE SUMMARY**

Gideon Groenewald was appointed by EXM Advisory Services to undertake a Desktop Survey, assessing the potential Palaeontological Impact of the proposed “Mining Activity” on the farms Heuningkranz 364 R/E and Langverwacht 432 Portion 1, Tsantsabane Local Municipality, Siyanda District Municipality, 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 proposed “Mining Activity” on the farms Heuningkranz 364 R/E And Langverwacht 432 Portion 1, Tsantsabane Local Municipality, Siyanda District Municipality, Northern Cape Province is underlain by Vaalian aged rocks of the Postmasburg Group and Quaternary aged sediments of the much younger Kalahari Group and Recent limestone and windblown sand. Highly significant fossil finds are therefore expected in this study area. In the Vaalian aged rocks the Moderate chance of finding significant stromatolite structures is retained and in the more recent sediments the High possibility of finding younger aged fossils is also retained. The recommended actions contained in the Chance Find Protocol (CFP) must be adhered to.

### **Recommendations:**

- The Environmental Assessment Practitioner (EAP) as well as the Environmental Control Officer (ECO) for this project must be made aware of the fact that the underlying Koegas Formation as well as the Makganyane Formation is known to contain important remains of stromatolites. These biogenic structures are important indicators of palaeo-environments and a representative sample must be collected during the mining operations.
- The EAP and ECO for the project must also take note of the rich Palaeontological Heritage preserved in the Quaternary aged sediments on site and any excavation into these units must be inspected by a suitably qualified Palaeontologist. If fossils are observed, the CFP document must be implemented as part of the Environmental Management Programme (EMPr) of the project.
- These recommendations must be included in the EMPr of the project and South African Heritage Resources Agency (SAHRA) must be satisfied that the developer will implement the CFP (included in this report), if applicable.

## **CHANCE FIND PROTOCOL FOR PALAEOLOGICAL HERITAGE**

### **HEUNINGKRAZ MINING APPLICATION PROJECT – 2017**

It is essential that the appointed palaeontologist, in consultation with the Developer, the Heritage Impact Assessment (HIA) specialists, Project Managers and the Contractors of the excavation works develop a short-term strategy for the recovery of significant fossils during the excavation operation.

Fossils are expected during the first site excavations in these rock formations. The potential for finding significant vertebrate, plant and trace-fossils, in any excavation into sediments of the Quaternary aged Formations, is always High and the cooperation of the entire team of mining company and the contractors, is of critical importance. The interest and cooperation of the management team will be highly appreciated and it is essential that the excavation be monitored

during the entire period of excavation and that this “Chance Find Protocol” be updated on a monthly basis during the life-time of the excavation period for the project. It is essential that the Palaeontologist be notified of the final sign-off of the project date, for final posting of the “Chance Find Protocol” on the SAHRIS Website for record purposes. Significant Quaternary aged fossils can be present in the Gordonia Formation and limestone-rich geological formations.

It is recommended that:

- The EAP and ECO must be informed of the fact that a Moderate to High Palaeontological Sensitivity was allocated to the entire development and due to the highly weathered nature of the material, significant fossils is expected after the start of excavations for foundations that exceed 1.5m.
- The allocated team members responsible for environmental monitoring can be introduced to Palaeontological material that is likely to be found on site. A once-off information session with the Palaeontological specialist must be arranged, to present a simple and understandable (preferably audio-visual) presentation in an “interpreted voice” to the majority of the contractual workers on site (isiXhosa and Afrikaans) during the initial site visit that must form part of the EMPr for the project.
- This CFP must be included into the EMPr of the project and a reasonable budget must be allocated to ensure compliance with the legal responsibility of the developer in terms of the proper conservation of and storage of Palaeontological Heritage.
- The SAHRA must be informed of the content of this CFP and EMPr arrangements by the EAP or the developer, for final approval of the ROD documentation during the EIA process.

## TABLE OF CONTENT

CHANCE FIND PROTOCOL FOR PALAEOLOGICAL HERITAGE.....	ii
1. INTRODUCTION.....	1
1.1. Background.....	1
1.2. Aims and Methodology.....	1
1.3. Scope and Limitations of the Desktop Study.....	3
2. DESCRIPTION OF THE PROPOSED DEVELOPMENT.....	4
3. GEOLOGY.....	5
3.1. Griqualand West Supergroup - Postmasburg Group.....	5
3.1.1. Gamagara Formation (Vg).....	5
3.1.2. Makganyane Formation (Vm).....	5
3.1.3. Ongeluk Formation.....	5
3.2. Kalahari Group.....	5
3.2.1. Quaternary Limestone (Ql).....	5
3.2.2. Quaternary windblown sand (Qs).....	6
4. PALAEOLOGY OF THE AREA.....	6
4.2. Griqualand West Supergroup - Postmasburg Group.....	6
4.2.1. Gamagara Formation (Vg).....	6
4.2.2. Makganyane Formation (Vm).....	6
4.2.3. Ongeluk Formation (Vo).....	6
4.3. Kalahari Group.....	6
4.3.1. Quaternary Limestone (Ql).....	6
4.3.2. Quaternary windblown sand (Qs).....	6
5. PALAEOLOGICAL SENSITIVITY.....	7
6. CONCLUSION AND RECOMMENDATIONS.....	8
7. CHANCE FIND PROTOCOL FOR PALAEOLOGICAL HERITAGE.....	9
7.1. Mitigation for Excavation Impact on Palaeontological Heritage Resources.....	9
Mitigation Measures Normally Encountered.....	9
Functional responsibilities of the Developer and Implementing Agencies.....	9
Documentary record of palaeontological occurrences.....	10
Functional responsibilities of the appointed Palaeontologist.....	10
Exposure of palaeontological material.....	11
8. CONCLUSION.....	11
9. REFERENCES.....	13
10. QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR.....	13
11. DECLARATION OF INDEPENDENCE.....	13

## LIST OF FIGURES

Figure 2-1 Locality of the Proposed Heuningkranz Area in black polygon.....	4
Figure 2-2 Layout of mining activities.....	4
Figure 3-1 Geology of the area underlying the Heuningkranz Project. Gamagara Formation (Vg), Makganyane Formation (Vm), Ongeluk Formation (Vo), Quaternary aged surface limestone (Ql) and windblown sand (Qs).....	5
Figure 5-1 Palaeontological sensitivity of the area underlying the proposed mining development. For explanation of colours, see Table 1-1.....	8

## LIST OF TABLES

Table 1.1 Palaeontological sensitivity classification and colour coding.....	2
--	---

# 1. INTRODUCTION

## 1.1. Background

Gideon Groenewald was appointed by Exm Advisory Services to undertake a Desktop Survey, assessing the potential Palaeontological Impact of the proposed “Mining Activity” on the farms Heuningkranz 364 R/E and Langverwacht 432 Portion 1, Tsantsabane Local Municipality, Siyanda District Municipality, 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 identify 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 (2822 POSTMASBURG). 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 classification and colour coding**

<b>PALAEONTOLOGICAL SIGNIFICANCE/VULNERABILITY OF ROCK UNITS</b>	
The following colour scheme is proposed for the indication of palaeontological sensitivity classes. This classification of sensitivity is adapted from that of Almond et al (2008) and Groenewald et al, (2014).	
<b>RED</b>	Very High Palaeontological sensitivity/vulnerability. Development will most likely have a very significant impact on the Palaeontological Heritage of the region. Very high possibility that significant fossil assemblages will be present in all outcrops of the unit. Appointment of professional palaeontologist, desktop survey, phase I Palaeontological Impact Assessment (PIA) (field survey and recording of fossils) and phase II PIA (rescue of fossils during construction ) as well as application for collection and destruction permit compulsory.
<b>ORANGE</b>	High Palaeontological sensitivity/vulnerability. High possibility that significant fossil assemblages will be present in most of the outcrop areas of the unit. Fossils most likely to occur in associated sediments or underlying units, for example in the areas underlain by Transvaal Supergroup dolomite where Cenozoic cave deposits are likely to occur. Appointment of professional palaeontologist, desktop survey and phase I Palaeontological Impact Assessment (field survey and collection of fossils) compulsory. Early application for collection permit recommended. Highly likely that a Phase II PIA will be applicable during the construction phase of projects.
<b>GREEN</b>	Moderate Palaeontological sensitivity/vulnerability. High possibility that fossils will be present in the outcrop areas of the unit or in associated sediments that underlie the unit. For example areas underlain by the Gordonia Formation or undifferentiated soils and alluvium. Fossils described in the literature are visible with the naked eye and development can have a significant impact on the Palaeontological Heritage of the area. Recording of fossils will contribute significantly to the present knowledge of the development of life in the geological record of the region. Appointment of a professional palaeontologist, desktop survey and phase I PIA (ground proofing of desktop survey) recommended.
<b>BLUE</b>	Low Palaeontological sensitivity/vulnerability. Low possibility that fossils that are described in the literature will be visible to the naked eye or be recognized as fossils by untrained persons. Fossils of for example small domal Stromatolites as well as micro-bacteria are associated with these rock units. Fossils of micro-bacteria are extremely important for our understanding of the development of Life, but are only visible under large magnification. Recording of the fossils will contribute significantly to the present knowledge and understanding of the development of Life in the region. Where geological units are allocated a blue colour of significance, and the geological unit is surrounded by highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of development on significant palaeontological finds that might occur in the unit that is allocated a blue colour. An example of this scenario will be where the scale of mapping on the 1:250 000 scale maps excludes small outcrops of highly significant sedimentary rock units occurring in dolerite sill outcrops. Collection of a representative sample of potential fossiliferous material recommended. At least one site visit recommended to ensure that no fossils are present.

<b>GREY</b>	<p>Very Low Palaeontological sensitivity/vulnerability. Very low possibility that significant fossils will be present in the bedrock of these geological units. The rock units are associated with intrusive igneous activities and no life would have been possible during emplacement of the rocks. It is however essential to note that the geological units mapped out on the geological maps are invariably overlain by Cenozoic aged sediments that might contain significant fossil assemblages and archaeological material. Examples of significant finds occur in areas underlain by granite, just to the west of Hoedspruit in the Limpopo Province, where significant assemblages of fossils and clay-pot fragments are associated with large termite mounds. Where geological units are allocated a grey colour of significance, and the geological unit is surrounded by very high and highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of development on significant palaeontological finds that might occur in the unit that is allocated a grey colour. An example of this scenario will be where the scale of mapping on the 1:250 000 scale maps excludes small outcrops of highly significant sedimentary rock units occurring in dolerite sill outcrops. It is important that the report should also refer to archaeological reports and possible descriptions of palaeontological finds in Cenozoic aged surface deposits. At least one site visit recommended to ensure that no fossils are present in surface deposits.</p>
-------------	---

### 1.3. Scope and Limitations of the Desktop Study

The study included: 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 weathering, or are buried beneath a thick mantle of unfossiliferous "drift" (soil, alluvium etc.).

## 2. DESCRIPTION OF THE PROPOSED DEVELOPMENT

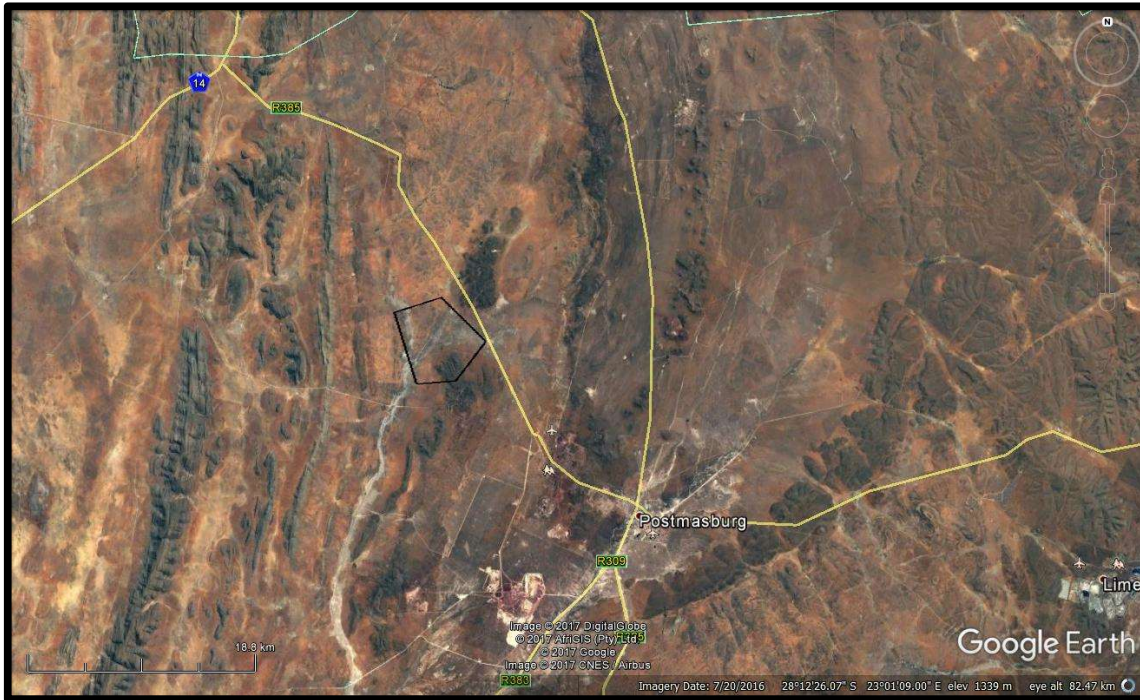


Figure 2-1 Locality of the Proposed Heuningkranz Area in black polygon

The Heuningkranz Project entails the development mining activities on the farms Heuningkranz 364 R/E And Langverwacht 432 Portion 1 and the development entails the entire construction activity associated with mining of bedrock in the designated areas (Figure 2.1)The Components of the Project is distributed as in Figure 2-2.

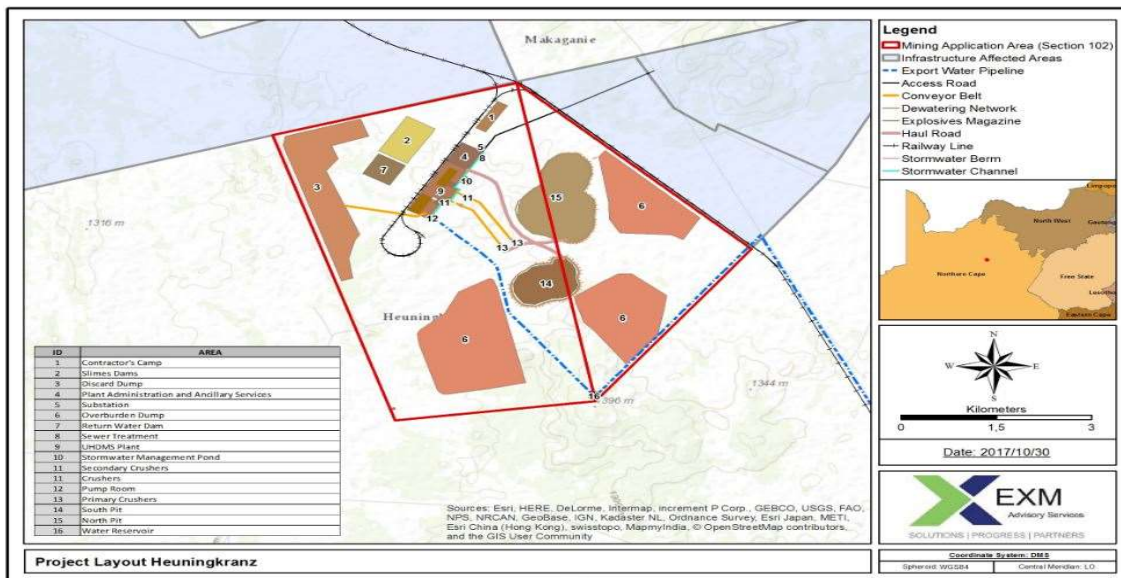


Figure 2-2 Layout of mining activities



### 3. GEOLOGY

The study area is underlain by Vaalian aged sedimentary and volcanic rocks of the Griqualand West Supergroup and Quaternary aged calcrete and alluvium (Figure 3-1).

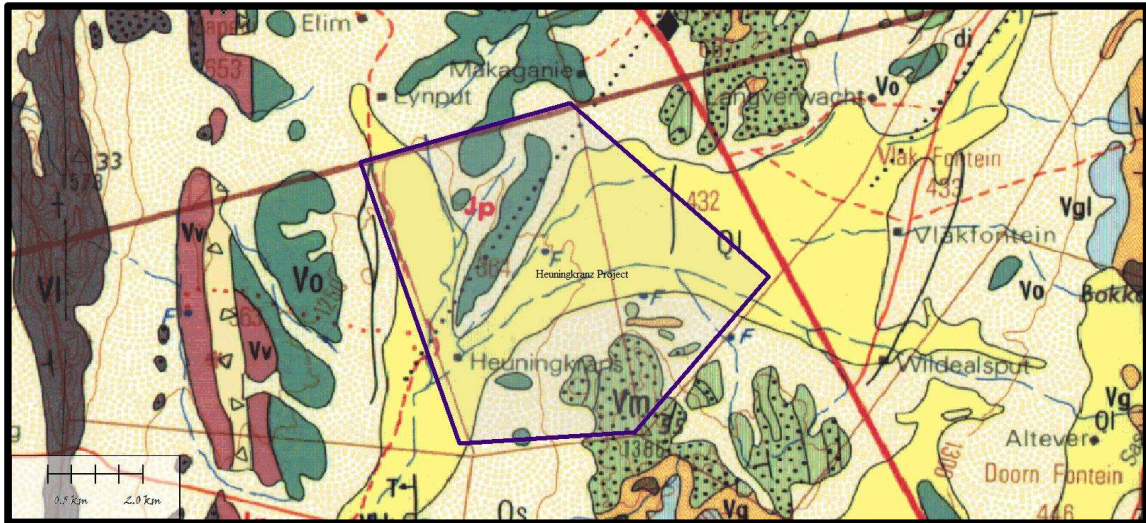


Figure 3-1 Geology of the area underlying the Heuningkrans Project. Gamagara Formation (Vg), Makganyane Formation (Vm), Ongeluk Formation (Vo), Quaternary aged surface limestone (Ql) and windblown sand (Qs)

#### 3.1. Griqualand West Supergroup - Postmasburg Group

##### 3.1.1. Gamagara Formation (Vg)

The Vaalian aged Gamagara Formation of the Postmasburg Group, consists primarily of shale, flagstone, quartzite and conglomerate that overlies the manganese rich Kwakwas Member of the Koegas Formation, Griquatown Group, that is probably the target group of rocks for this proposed mining operation. It is likely that the developer will expose some of this rock during development of the mine

##### 3.1.2. Makganyane Formation (Vm)

The Vaalian aged Makganyane Formation is a predominantly diamictite, banded jasper, siltstone mudstone, dolomite and chert-rich grauwacke, indicating deposition in shallow basins where the growth of algal mats to form Stromatolite structures was highly likely (MacRae, 1999).

##### 3.1.3. Ongeluk Formation

The Vaalian aged Ongeluk Formation consist of amygdaloidal andesitic lava with interbeds of tuff, agglomerate and red jasper. This volcanic sequence is the upper most sequence of Vaalian aged rocks in the study area and is in turn overlain by Quaternary material in which the client will not be interested for this project.

#### 3.2. Kalahari Group

##### 3.2.1 Quaternary Limestone (Ql)

The Quaternary aged Limestone that covers large parts of the study area is presently put under the main Kalahari Group of sediments and represent recent deposits of calcrete that form extensive calcareous deposits in the drier parts of South Africa.

### **3.2.2 Quaternary windblown sand (Qs)**

The Quaternary aged windblown sand deposits of this part of South Africa now also falls under the Kalahari Group of sediments that represent a large expanse of windblown sand and calcretes that formed during the most recent drier conditions that prevails in this region. The windblown sand is a testament to the dust storms that can cause devastation to life and these deposits are some of the least studied in terms of the Palaeontological Heritage of South Africa.

## **4. PALAEOLOGY OF THE AREA**

### **4.2 Griqualand West Supergroup - Postmasburg Group**

#### **4.2.1 Gamagara Formation (Vg)**

The Vaalian aged Gamagara Formation overlies the stromatolite rich Koegas Formation and it is possible that thin dolomite bands can contain significant stromatolites. The dominantly shale, quartzite and conglomerate formation is however only moderately significant for Palaeontological Heritage and stromatolites are associated with the lower part of the formation.

#### **4.2.2 Makganyane Formation (Vm)**

The Vaalian Aged dolomite and chert layers in the Makganyane Formation indicate strong evidence for shallow sea conditions in this Early Proterozoic (2.2 billion years old) rock sequence. The Formation can contain Highly significant stromatolites and the rescue of these structures must form part of the Environmental Management Programme (EMPr) of the project. It is important to note that the rescue of stromatolites is a once-off activity that is planned during the phases of mining into these rocks, and the collection must be coordinated with the contractors so that no standing time is needed to sample a representative sample of these fossils.

#### **4.2.3 Ongeluk Formation (Vo)**

The Vaalian aged volcanic sequence of rocks might have some isolated stromatolites that can be associated with dolomitic zones within this dominantly volcanic sequence of rocks. The "Chance Find" of stromatolites is small and no significant fossils are expected in this Formation.

### **4.3 Kalahari Group**

#### **4.3.1 Quaternary Limestone (Ql)**

The Quaternary aged limestone, colluvium, spring tufa (calcareous) and sinter (siliceous), lake deposits, peats, pedocretes or duricrusts (calcrete, ferricrete), soils and gravel can contain significant remains of a very wide range of possible fossil remains. These fossils are often sparse, such as: mammalian bones and teeth, tortoise remains, ostrich eggshells, non-marine mollusc shells, ostracods, diatoms and other microfossil groups, trace fossils (e.g. calcretised termitaria, rhizoliths, burrows, vertebrate tracks), freshwater stromatolites, plant material such as peats, foliage, wood and pollens. These sediments are however not part of the economic target rocks for mining and it is unlikely that the mining activity will involve excavation into these beds for extensive periods of time. Due to the highly likelihood that unique fossils can be present in the sequence, and the fact that these sediments are not well studied, any discovery of fossils will be Very Highly sensitive for Palaeontological Heritage. A Chance Find Protocol (CFP) that will form part of this document, must be included into the EMPr for this project and the developer need to allow for a budget to implement the proposals made in the CFP.

#### **4.3.2 Quaternary windblown sand (Qs)**

The windblown sand is part of what is now also termed the Gordonia Formation and this layer of sediments can contain significant fossils with a very wide range of possible fossil remains. As in the above mentioned young sediments, potential fossils include mammalian bones and teeth, tortoise

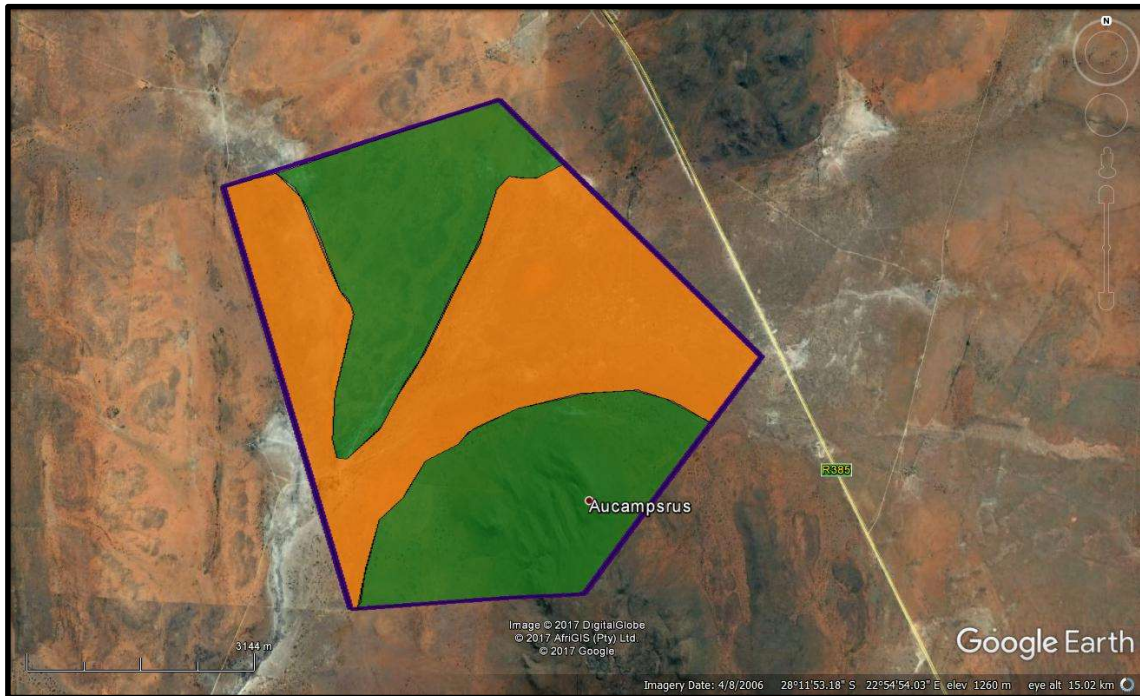
remains, ostrich eggshells, non-marine mollusc shells, ostracods, diatoms and other microfossil groups, trace fossils (e.g. calcretised termitaria, rhizoliths, burrows, vertebrate tracks), freshwater stromatolites, plant material such as peats, foliage, wood and pollens. The CFP explains the methodologies for which the developer must budget as part of the EMPr for this project.

## **5. PALAEOLOGICAL SENSITIVITY**

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 bedrock excavation envisaged. The different sensitivity classes used are explained in Table 1.1 above.

Due to relatively deep sandy soils that cover the potentially rich fossil zones and the fact that the Vaallian aged rocks contain only micro-fossils, little information on the palaeontological heritage of the site is known. Recording of fossils during excavation for mining will contribute significantly to our understanding of the palaeo-environments of the region and the Moderate to High Palaeontological Sensitivity for the sites underlain by potentially fossiliferous rocks are retained.

The CFP included in this study, must be included in the EMPr for the project and the developer must ensure that enough money is allocated for Palaeontological Heritage Mitigation. No site visit or Phase 1 PIA activity is recommended at this early stages of the development, but, as will be highlighted in the CFP, a site visit by a suitably qualified Palaeontologist must be arranged at the onset of any construction work. The Palaeontologist must be appointed to supply the developer as well as the officials of South African Heritage Resources Agency (SAHRA) with enough information to come to logical and economically viable plan to ensure that any new Palaeontological Information gained as a result of this development, be documented and preserved according to the prescriptions of SAHRA and the South African National Heritage Resource Act No 25 of 1999.



**Figure 5-1 Palaeontological sensitivity of the area underlying the proposed mining development. For explanation of colours, see Table 1-1.**

## 6. CONCLUSION AND RECOMMENDATIONS

The proposed “Mining Activity” on the farms Heuningkranz 364 R/E and Langverwacht 432 Portion 1, Tsantsabane Local Municipality, Siyanda District Municipality, Northern Cape Province is underlain by Vaalian aged rocks of the Postmasburg Group and Quaternary aged sediments of the much younger Kalahari Group and Recent limestone and windblown sand. Highly significant fossil finds are therefore expected in this study area. In the Vaalian aged rocks the Moderate chance of finding significant stromatolite structures is retained and in the more recent sediments the High possibility of finding younger aged fossils is also retained. The recommended actions contained in the CFP must be adhered to.

### Recommendations:

- The Environmental Assessment Practitioner (EAP) as well as the Environmental Control Officer (ECO) for this project must be made aware of the fact that the underlying Koegas Formation as well as the Makganyane Formation is known to contain important remains of stromatolites. These biogenic structures are important indicators of palaeo-environments and a representative sample must be collected during the mining operations.
- The EAP and ECO for the project must also take note of the rich Palaeontological Heritage preserved in the Quaternary aged sediments on site and any excavation into these units must be inspected by a suitably qualified Palaeontologist. If fossils are observed, the CFP document must be implemented as part of the EMPr of the project.
- These recommendations must be included in the EMPr of the project and SAHRA must be satisfied that the developer will implement the CFP (included in this report), if applicable.

## 7. CHANCE FIND PROTOCOL FOR PALAEOLOGICAL HERITAGE

### HEUNINGKRAZ MINING APPLICATION PROJECT - 2017

#### 7.1. Mitigation for Excavation Impact on Palaeontological Heritage Resources

It is essential that the appointed palaeontologist, in consultation with the Developer, the Heritage Impact Assessment specialists, Project Managers and the Contractors of the excavation works develop a short-term strategy for the recovery of significant fossils during the excavation operation. As part of such a strategy, the discussions with the palaeontologist must include:

- Initially, and at least for the *duration of preparation excavation*, visit the site at least once a month, to ensure recording of all potentially significant fossil strata.
- Determine a short-term strategy and budget for the recording of significant fossils. This Strategy is simply an oral agreement on when the site is to be inspected and what the finds are that might be recorded. The site visit must include an introduction session with all the managers of the Project Team, including training of the ECO and site managers by the appointed palaeontologist, to basically train people to know what to look out for in terms of fossil heritage on site.
- In the case of any unusual structures, the Palaeontologist must be notified, and a site visit must be arranged at the earliest possible time with the Palaeontologist. In the case of the ECO or the Site Manager becoming aware of suspicious looking material that might be a “Significant Find”, the construction must be halted in that specific area and the Palaeontologist must be given enough time to reach the site and remove the material before excavation continues.

#### Mitigation Measures Normally Encountered

1. Mitigation of palaeontological material must begin as soon as possible and preferably when “trial excavation” takes place. The appointed specialists must acquaint themselves with the operation and determine feasible mitigation strategies.
2. A plan for systematic sampling, recording, preliminary sorting and storage of palaeontological and sedimentological samples will be developed during the early stages of the project, in collaboration with the Evolutionary Studies Institute (ESI) at WITS University, which is the closest Institute to the site. If appropriate, the Universities of the North West as well as the University of the Free State might be asked for their involvement in this project.
3. Mitigation will involve an attempt to capture all rare fossils and systematic collection of all fossils discovered. This will take place in conjunction with descriptive, diagrammatic and photographic recording of exposures, also involving sediment samples and samples of both representative and unusual sedimentary or biogenic features. The fossils and contextual samples will be processed (sorted, sub-sampled, labelled, boxed) and documentation consolidated, to create an archive collection from the excavated sites for future researchers.

#### Functional responsibilities of the Developer and Implementing Agencies

1. Ensuring, at their cost, that a representative archive of palaeontological samples and other records is assembled to characterise the palaeontological occurrences affected by the excavation operation.
2. Provide field aid, if necessary, in the supply of materials, labour and machinery to excavate, load and transport sampled material from the excavation areas to the sorting areas, removal of overburden if necessary, and the return of discarded material to the disposal areas. In the case of this project it is foreseen that vertebrate and plant fossils will be present. (*If fossils of Vaalian and*

*Quaternary age are exposed, it will be very Highly significant and the Palaeontologist will obviously be in close communication with the ECO to act as required by SAHRA, without causing undue standing time for the contractors).*

3. "Facilitate" systematic recording of the stratigraphic and palaeo-environmental features of exposures in the fossil-bearing excavations, by allowing time to describe and measure geological sections, and by providing aid in the surveying of positions where significant fossils are found. *(In the case of this specific development, the likelihood of such finds is Very High during the first three months of operation. After that finds will probably be duplicated and an application for a "destruction permit from SAHRA will apply)*

4. Provide safe storage for fossil material found routinely during excavation operations by construction personnel. In this context, isolated fossil finds in disturbed material qualify as "normal" fossil finds.

5. Provide covered, dry storage for samples and facilities that is defined as a work area for sorting, labelling and boxing/bagging of samples.

6. Costs of basic curation and storage in the sample archive at the ESI, WITS University (labels, boxes, shelving and, if necessary, specifically-tasked temporary employees).

#### **Documentary record of palaeontological occurrences**

1. The contractor will in collaboration with the Palaeontologist, make the excavation plan available to the appointed specialist, in which the following information are indicated on the plan in the site office at the excavation site. This must be done in conjunction with the appointed specialist and form part of the on-going revision of the EMPR during the excavation stage of the project:

1.1. Initially, all known specific palaeontological information will be indicated on the plan. This will be updated throughout the excavation period.

1.2 Locations of samples and measured sections are to be pegged, and routinely accurately surveyed. Sample locations, measured sections, etc., must be recorded three-dimensionally if any significant fossils are recorded during the time of excavation. This information must be recorded during the first site visit and a clearance from the Palaeontologist (e-mail message will suffice) must be followed up with subsequent e-mail communications.

#### **Functional responsibilities of the appointed Palaeontologist**

1. Apply for a permit to collect fossils during the lifetime of the Project and establishment of a representative collection of fossils and a contextual archive of appropriately documented and sampled palaeoenvironmental and sedimentological geodata in collaboration with the ESI at WITS University.

2. Undertake an initial evaluation of potentially affected areas and of available exposures in excavations. A short training session of the ECO or a representative must be part of the first site visit to this project.

3. On the basis of the above, and evaluation during the early stages of excavation development, in collaboration with the contractor management team, more detailed practical strategies to deal with the fossils encountered routinely during excavation, as well as the strategies for major finds must briefly be agreed on.

4. Informal on-site training in responses applicable to "normal" fossil finds must be provided for the ECO and environmental staff by the appointed specialist. This step is needed, due to the very high possibility of discovering significant fossils during the first site visit.

5. Respond to significant finds and undertake appropriate mitigation.

6. Initially, for the first three months of operation, and if the ECO indicates significant "strange looking rocks" that might be similar to the fossils indicated to the staff during the information sessions, visit at least once in two weeks to "touch base" with the monitoring progress. Document

interim “normal” finds and undertake an inspection and documentation of new excavation faces. A strategy for further visits during the life of the excavation must be discussed.

7. Transport of material from the site to the ESI, WITS University.

8. Reporting on the significance of discoveries, as far as can be preliminarily ascertained. This report is in the public domain and copies of the report must be deposited at ESI, and SAHRA. It must fulfil the reporting standards and data requirements of these bodies.

9. Reasonable participation in publicity and public involvement associated with palaeontological discoveries.

### **Exposure of palaeontological material**

1. In the event of construction exposing new palaeontological material, not regarded as normative/routine as outlined in the initial investigation, such as a major fossil find, the following procedure must be adhered to:

1.1 The appointed specialist or alternates (SAHRA; ESI WITS University) must be notified by the responsible officer (e.g. the ECO or contractor manager), of major or unusual discoveries during excavation, found by the Contractor Staff.

1.2 Should a major *in situ* occurrence be exposed, excavation will immediately cease in that area so that the discovery is not disturbed or altered in any way until the appointed specialist or scientists from the ESI at WITS University, or its designated representatives, have had reasonable opportunity to investigate the find. Such work will be at the expense of the Developer.

## **8. CONCLUSION**

The proposed “Mining Activity” on the farms Heuningkranz 364 R/E And Langverwacht 432 Portion 1, Tsantsabane Local Municipality, Siyanda District Municipality, Northern Cape Province is underlain by Vaalian aged rocks of the Postmasburg Group and Quaternary aged sediments of the much younger Kalahari Group and Recent limestone and windblown sand. Highly significant fossil finds are therefore expected in this study area. In the Vaalian aged rocks the Moderate chance of finding significant stromatolite structures is retained and in the more recent sediments the High possibility of finding younger aged fossils is also retained. The recommended actions contained in the CFP must be adhered to.

Fossils are expected during the first site excavations in these rock formations. The potential for finding significant vertebrate, plant and trace-fossils, in any excavation into sediments of the Quaternary aged Formations, is always High and the cooperation of the entire team of mining company and the the contractors, is of critical importance. The interest and cooperation of the management team will be highly appreciated and it is essential that the excavation be monitored during the entire period of excavation and that this “Chance Find Protocol” be updated on a monthly bases during the life-time of the excavation period for the project. It is essential that the Palaeontologist be notified of the final sign-off of the project date, for final posting of the “Chance Find Protocol” on the SAHRIS Website for record purposes. Significant Quaternary aged fossils can be present in the Gordonia Formation and limestone-rich geological formations.

It is recommended that:

- The EAP and ECO must be informed of the fact that a Moderate to High Palaeontological Sensitivity was allocated to the entire development and due to the highly weathered nature of the material, significant fossils is expected after the start of excavations for foundations that exceed 1.5m.
- The allocated team members responsible for environmental monitoring can be introduced to Palaeontological material that is likely to be found on site. A once-off information session

with the Palaeontological specialist must be arranged, to present a simple and understandable (preferably audio-visual presentation in an “interpreted voice”) of the majority of the contractual workers on site (isiXhosa and Afrikaans) during the initial site visit that must form part of the EMPr for the project.

- This “Chance Find Protocol” must be included into the EMPr of the project and a reasonable budget must be allocated to ensure compliance with the legal responsibility of the developer in terms of the proper conservation of and storage of Palaeontological Heritage.
- The `SAHRA must be informed of the content of this CFP and EMPr arrangements by the EAP or the developer, for final approval of the ROD documentation during the EIA process.



## 9. REFERENCES

**Almond J.E. and Pether J. 2008.** *Palaeontological Heritage of the Western Cape*. Internal Report Heritage Western Cape.

**Almond J.E., De Klerk B. and Gess R., 2009.** *Palaeontological Heritage of the Eastern Cape*. Internal Report, SAHRA.

**Groenewald G.H., Groenewald D.P. and Groenewald S.M., 2014.** *Palaeontological Heritage of the Free State, Gauteng, Limpopo, Mpumalanga and North West Provinces*. Internal Palaeotechnical Reports, SAHRA.

**Johnson MR , Anhaeusser CR and Thomas RJ (Eds). 2009.** *The Geology of South Africa*. GSSA, Council for Geoscience, Pretoria.

**MacRae C. 1999.** *Life Etched in Stone*. Geological Society of South Africa, Linden, South Africa.

**McCarthy T and Rubidge BS. 2005.** *Earth and Life*. 333pp. Struik Publishers, Cape Town.

## 10. 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).

## 11. 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**