



**PALAEONTOLOGICAL DESKTOP ASSESSMENT FOR  
THE PROPOSED FARM 431 MINING RIGHT  
APPLICATION (MRA), NEAR POSTMASBURG, ZF  
MGCAWU DISTRICT MUNICIPALITY, IN THE  
NORTHERN CAPE PROVINCE.**

**Compiled for:**

**LW Consultants**

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**Prepared by**

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February 2022

## **Declaration of Independence**

I, Elize Butler, declare that –

General declaration:

- I act as the independent palaeontological specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favorable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work.
- I have expertise in conducting palaeontological impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity.
- I will comply with the Act, Regulations, and all other applicable legislation.
- I will take into account, to the extent possible, the matters listed in section 38 of the NHRA when preparing the application and any report relating to the application.
- I have no, and will not engage in, conflicting interests in the undertaking of the activity.
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan, or document to be prepared by myself for submission to the competent authority.
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application.
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favorable to the applicant or not
- All the particulars furnished by me in this form are true and correct.
- I will perform all other obligations as expected a palaeontological specialist in terms of the Act and the constitutions of my affiliated professional bodies; and
- I realize that a false declaration is an offense in terms of regulation 71 of the Regulations and is punishable in terms of section 24F of the NEMA.

**Disclosure of Vested Interest**

I do not have and will not have any vested interest (either business, financial, personal, or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations.

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**SIGNATURE:**

A handwritten signature in black ink, appearing to read 'Elize Butler', written in a cursive style.

This PIA report has been compiled considering the National Environmental Management Act 1998 (NEMA) and Environmental Impact Regulations 2014 as amended, requirements for specialist reports, Appendix 6, as indicated in the table below.

*Table 1 - NEMA Table*

<b>Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017</b>	<b>Relevant section in report</b>	<b>Comment where not applicable.</b>
1.(1) (a) (i) Details of the specialist who prepared the report	Page ii and Section 2 of Report – Contact details and company and Appendix A	-
(ii) The expertise of that person to compile a specialist report including a curriculum vitae	Section 2 – refer to <b>Appendix A</b>	-
(b) A declaration that the person is independent in a form as may be specified by the competent authority	Page ii of the report	-
(c) An indication of the scope of, and the purpose for which, the report was prepared	Section 4 – Objective	-
(cA) An indication of the quality and age of base data used for the specialist report	Section 5 – Geological and Palaeontological history	-
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 9	-
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment		Desktop Assessment
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 7 Approach and Methodology	-
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure,	Section 1 and 10	

<b>Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017</b>	<b>Relevant section in report</b>	<b>Comment where not applicable.</b>
inclusive of a site plan identifying site alternative;		
(g) An identification of any areas to be avoided, including buffers	Section 5	No buffers or areas of sensitivity identified
(h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 5 – Geological and Palaeontological history	
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 7.1 – Assumptions and Limitation	-
(j) A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 1 and 10	
(k) Any mitigation measures for inclusion in the EMPr	Section 11	
(l) Any conditions for inclusion in the environmental authorisation	Section 11	
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 1 and 10	
(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and	Section 1 and 10	
(n)(iA) A reasoned opinion regarding the acceptability of the proposed activity or activities; and		
(n)(ii) If the opinion is that the proposed activity, activities, or portions thereof should be authorised, any avoidance, management and mitigation measures that should	Section 1 and 10	-

<b>Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017</b>	<b>Relevant section in report</b>	<b>Comment where not applicable.</b>
be included in the EMPr, and where applicable, the closure plan		
(o) A description of any consultation process that was undertaken during the course of carrying out the study	N/A	
(p) A summary and copies if any comments that were received during any consultation process	N/A	
(q) Any other information requested by the competent authority.	N/A	Not applicable.
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Section 3 compliance with SAHRA guidelines	

## EXECUTIVE SUMMARY

Banzai Environmental was appointed by LW Consultants to conduct the Palaeontological Desktop Assessment (PDA) assessing the proposed Farm 431 Mining Right Application (MRA), near Postmasburg, ZF Mgcau District Municipality, in the Northern Cape Province. In accordance with the National Environmental Management Act 107 of 1998 (NEMA) and to comply with the National Heritage Resources Act (No 25 of 1999, section 38) (NHRA), this PDA is necessary to confirm if fossil material could potentially be present in the planned development area, to evaluate the potential impact of the proposed development on the Palaeontological Heritage and to mitigate possible damage to fossil resources.

The proposed Farm 431 MRA (manganese and iron ore) near Postmasburg in the Northern Cape is mantled by Tertiary to Quaternary superficial deposits as well as the Makganyene Formation of the Postmasburg Group (Transvaal Supergroup). The most south-eastern corner of the proposed development is underlain by Quaternary rubble. According to the PalaeoMap on the South African Heritage Resources Information System (SAHRIS) database, the Palaeontological Sensitivity of the Tertiary to Quaternary superficial deposits and that of the Makganyene Formation (Postmasburg Group, Transvaal Supergroup) is Moderate, while that of the Quaternary rubble is Low (Almond and Pether 2008, SAHRIS website). A Low Palaeontological Significance has been allocated to the proposed Mining application. It is therefore considered that the proposed development is believed to be appropriate and will not lead to detrimental impacts on the palaeontological reserves of the area.

If Palaeontological Heritage is uncovered during surface clearing and excavations the **Chance find Protocol** attached should be implemented immediately. Fossil discoveries ought to be protected and the ECO/site manager must report to South African Heritage Resources Agency (SAHRA) (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: [www.sahra.org.za](http://www.sahra.org.za)) so that mitigation (recording and collection) can be carried out.

Before any fossil material can be collected from the development site the specialist involved would need to apply for a collection permit from SAHRA. Fossil material must be housed in an official collection (museum or university), while all reports and fieldwork should meet the minimum standards for palaeontological impact studies proposed by SAHRA (2012).

These recommendations should be incorporated into the Environmental Management Plan for the proposed development.

## TABLE OF CONTENT

<b>1</b>	<b>INTRODUCTION .....</b>	<b>1</b>
<b>2</b>	<b>QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR .....</b>	<b>1</b>
<b>3</b>	<b>LEGISLATION.....</b>	<b>1</b>
3.1	National Heritage Resources Act (25 of 1999)	1
<b>4</b>	<b>OBJECTIVE.....</b>	<b>5</b>
<b>5</b>	<b>GEOLOGICAL AND PALAEOLOGICAL HISTORY .....</b>	<b>6</b>
<b>6</b>	<b>GEOGRAPHICAL LOCATION OF THE SITE .....</b>	<b>16</b>
<b>7</b>	<b>METHODS .....</b>	<b>16</b>
7.1	Assumptions and Limitations	16
<b>8</b>	<b>ADDITIONAL INFORMATION CONSULTED.....</b>	<b>17</b>
<b>9</b>	<b>IMPACT ASSESSMENT METHODOLOGY.....</b>	<b>17</b>
9.1	Impact Rating System	17
9.1.1	Summary of Impacts	20
<b>10</b>	<b>FINDINGS AND RECOMMENDATIONS .....</b>	<b>21</b>
<b>11</b>	<b>CHANCE FINDS PROTOCOL .....</b>	<b>21</b>
11.1	Legislation	21
11.2	Background	22
11.3	Introduction	22
11.4	Chance Find Procedure	22
<b>12</b>	<b>REFERENCES .....</b>	<b>24</b>

### List of Figures

<b>Figure 1:</b>	<i>Google Earth Image (2022) indicating the locality of the proposed Prospecting Right Application near Postmasburg in the Northern Cape.....</i>	<b>3</b>
<b>Figure 2:</b>	<i>Locality of the proposed Prospecting Right Application.....</i>	<b>4</b>
<b>Figure 3:</b>	<i>Extract of the 1:250 000 Postmasburg 2822 (1977) Geological map (Council of Geoscience, Pretoria) indicating the proposed development.....</i>	<b>9</b>
<b>Figure 4:</b>	<i>Updated Regional Geology of the Maremane Dome in the Northern Cape (from Smith &amp; Beukes 2016). The approximate location of the proposed development is indicated by the yellow rectangle.....</i>	<b>11</b>
<b>Figure 5:</b>	<i>Stratigraphy of the iron formations in the Sishen-Postmasburg area (Schalkwyk 2005).....</i>	<b>12</b>



**Figure 6:**General stratigraphy of the Late Cretaceous to Recent Kalahari Group (Taken from Partridge et al. 2006). ..... 13

**Figure 7:**Surface Geology indicated by Shape files (Council of Geoscience, Pretoria) of the proposed Farm 431 Prospecting project. .... 14

**Figure 8:** Extract of the 1 in 250 000 SAHRIS PalaeoMap map (Council of Geosciences) indicating the proposed development in blue. .... 15

**List of Tables**

Table 1 - NEMA Table ..... iv

Table 2: SAHRIS Palaeosensitivity ratings table. The relevant sensitivity is highlighted. .... 15

Table 3: The rating system ..... 17

**Appendix A: CV**

## 1 INTRODUCTION

MR Tshenolo Iron Ore Investments plans to apply for a manganese and iron ore Prospecting Right Application for Farm 431 south-west of Postmasburg, Mgcawu District Municipality, in the Northern Cape Province (**Figure1-2**). The proposed development is 1558 ha in extent.

## 2 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

This present study has been conducted by Mrs Elize Butler. She has conducted approximately 300 PIAs for developments in the Free State, KwaZulu-Natal, Eastern, Central, and Northern Cape, Northwest, Gauteng, Limpopo, and Mpumalanga Provinces. She has an MSc (*cum laude*) in Zoology (specializing in Palaeontology) from the University of the Free State, South Africa and has been working in Palaeontology for more than twenty-five years. She has experience in locating, collecting, and curating fossils. She has been a member of the Palaeontological Society of South Africa (PSSA) since 2006 and has been conducting PIAs since 2014.

## 3 LEGISLATION

### 3.1 National Heritage Resources Act (25 of 1999)

Cultural Heritage in South Africa, includes all heritage resources, is protected by the National Heritage Resources Act (Act 25 of 1999) (NHRA). Heritage resources as defined in Section 3 of the Act include **“all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens”**.

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

- National Environmental Management Act (NEMA) Act 107 of 1998
- National Heritage Resources Act (NHRA) Act 25 of 1999
- Notice 648 of the Government Gazette 45421- general requirements for undertaking an initial site sensitivity verification where no specific assessment protocol has been identified.

The next section in each Act is directly applicable to the identification, assessment, and evaluation of cultural heritage resources.

GNR 982 (Government Gazette 38282, 14 December 2014) promulgated under the National Environmental Management Act (NEMA) Act 107 of 1998

- Basic Assessment Report (BAR) – Regulations 19 and 23
- Environmental Impacts Assessment (EIA) – Regulation 23

- Environmental Scoping Report (ESR) – Regulation 21
- Environmental Management Programme (EMPr) – Regulations 19 and 23

National Heritage Resources Act (NHRA) Act 25 of 1999

- Protection of Heritage Resources – Sections 34 to 36
- Heritage Resources Management – Section 38

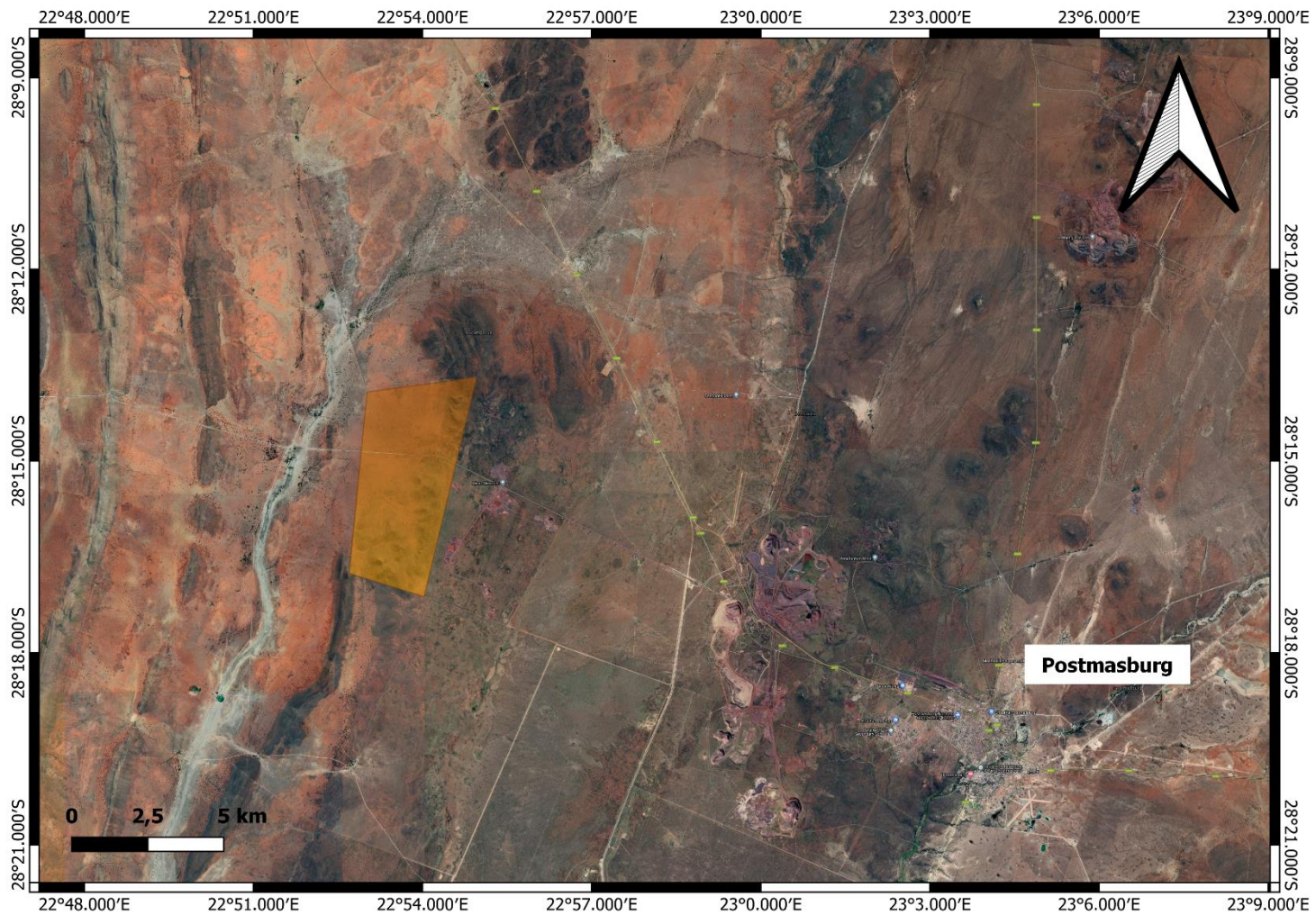
The NEMA (No 107 of 1998) states that an integrated EMP should (23:2 (b)) “...*identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage*”.

In agreement with legislative requirements, EIA rating standards as well as SAHRA policies the following comprehensive and legally compatible PIA report have been compiled.

Palaeontological heritage is exceptional and non-renewable and is protected by the NHRA. Palaeontological resources and may not be unearthed, broken moved, or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

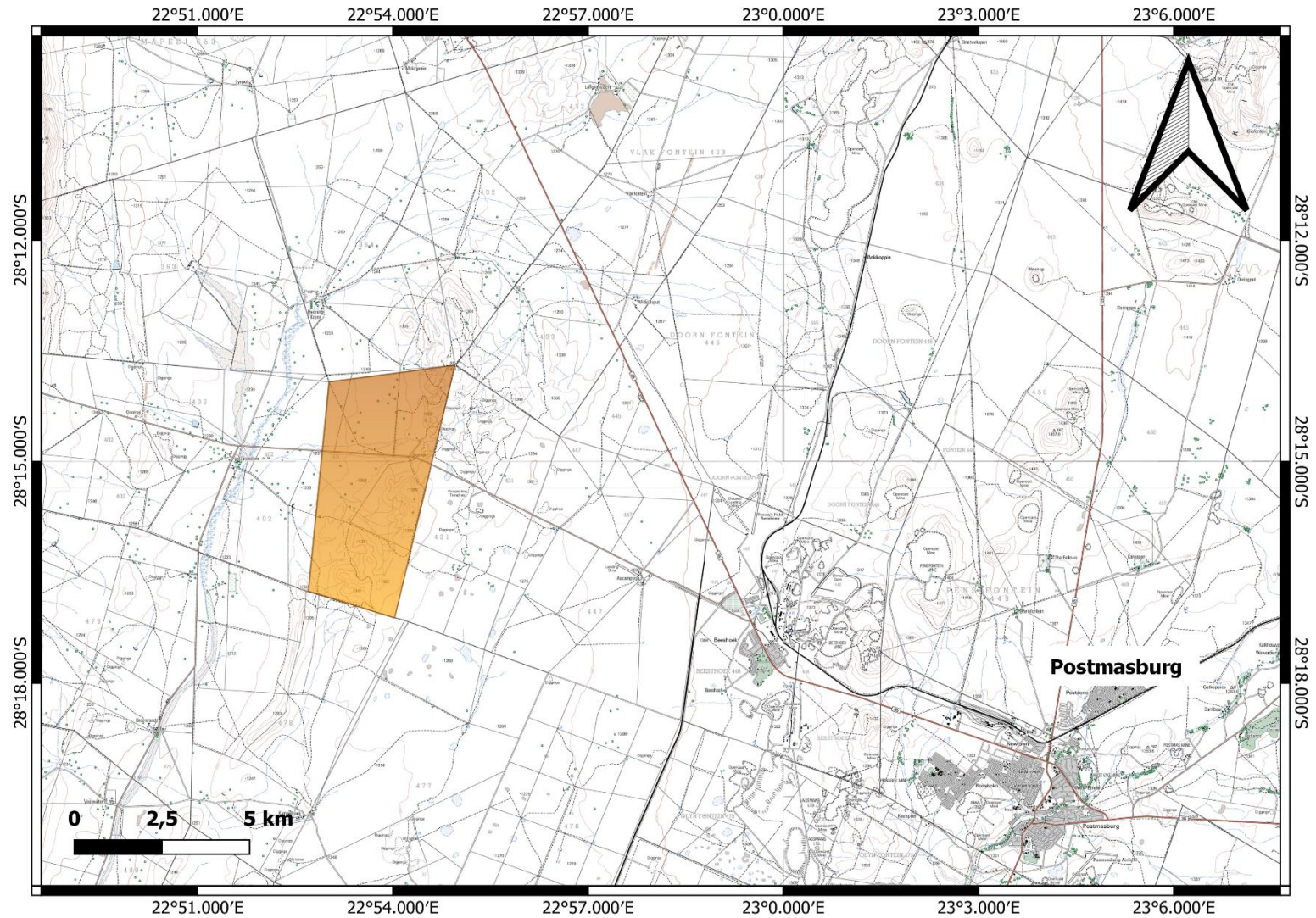
This Palaeontological Impact assessment forms part of the Heritage Impact Assessment (HIA) and adhere to the conditions of the Act. According to **Section 38 (1)**, an HIA is required to assess any potential impacts to palaeontological heritage within the development footprint where:

- the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length.
- the construction of a bridge or similar structure exceeding 50 m in length.
- any development or other activity which will change the character of a site—
- Exceeding 5 000 m<sup>2</sup> in extent; or
- involving three or more existing erven or subdivisions thereof; or
- involving three or more erven or divisions thereof which have been consolidated within the past five years; or
- the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority
- the re-zoning of a site exceeding 10 000 m<sup>2</sup> in extent.
- or any other category of development provided for in regulations by SAHRA or a Provincial heritage resources authority.



**Figure 1:** Google Earth Image (2022) indicating the locality of the proposed Prospecting Right Application near Postmasburg in the Northern Cape.





**Figure 2:** Locality of the proposed Prospecting Right Application.

## 4 OBJECTIVE

The aim of a PIA is to decrease the effect of the development on potential fossils at the development site.

According to the “SAHRA Archaeology, Palaeontology and Meteorites (APM) Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports” the purpose of the PIA is: **1)** to identify the palaeontological importance of the rock formations in the footprint; **2)** to evaluate the palaeontological magnitude of the formations; **3)** to clarify the **impact** on fossil heritage, and **4)** to suggest how the developer might protect and lessen possible damage to fossil heritage.

The palaeontological status of each rock section is calculated as well as the possible impact of the development on fossil heritage by a) the palaeontological importance of the rocks, b) the type of development and c) the quantity of bedrock removed.

When the development footprint has a moderate to high palaeontological sensitivity a field-based assessment is necessary. The desktop and the field survey of the exposed rock determine the impact significance of the planned development and recommendations for further studies or mitigation are made. Destructive impacts on palaeontological heritage usually only occur during the construction phase while the excavations will change the current topography and destruct or permanently seal-in fossils at or below the ground surface. Fossil Heritage will then no longer be accessible for scientific research.

Mitigation usually precede construction or may occur during construction when potentially fossiliferous bedrock is exposed. Mitigation comprises the collection and recording of fossils. Preceding excavation of any fossils a permit from SAHRA must be obtained and the material will have to be housed in a permitted institution. When mitigation is applied correctly, a positive impact as possible because our knowledge of local palaeontological heritage may be increased

The terms of reference of a PIA are as follows:

### **General Requirements:**

- Adherence to the content requirements for specialist reports in accordance with Appendix 6 of the EIA Regulations 2014, as amended.
- Adherence to all applicable best practice recommendations, appropriate legislation and authority requirements.
- Submit a comprehensive overview of all appropriate legislation, guidelines.
- Description of the proposed project and provide information regarding the developer and consultant who commissioned the study.

- Description and location of the proposed development and provide geological and topographical maps.
- Provide Palaeontological and geological history of the affected area.
- Identification sensitive areas to be avoided (providing shapefiles/kml's) in the proposed development.
- Evaluation of the significance of the planned development during the Pre-construction, Construction, Operation, Decommissioning Phases and Cumulative impacts. Potential impacts should be rated in terms of the direct, indirect and cumulative:
  - a. **Direct impacts** are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity.
  - b. **Indirect impacts** of an activity are indirect or induced changes that may occur as a result of the activity.
  - c. **Cumulative impacts** result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities.
- Fair assessment of alternatives (infrastructure alternatives have been provided):
- Recommend mitigation measures to minimise the impact of the proposed development; and
- Implications of specialist findings for the proposed development (such as permits, licenses etc).

## 5 GEOLOGICAL AND PALAEONTOLOGICAL HISTORY

The proposed mining development, located north-west of Postmasburg in the Northern Cape, is depicted on the 1: 250 000 Postmasburg 2428 (1977) Geological Map (Council for Geosciences, Pretoria) (**Figure 3**). According to this map the proposed development is mostly underlain by Tertiary to Quaternary superficial deposits (Yellow dots, Qs, windblown sands) as well as the Makganyene Formation (light green with dots, Vm) of the Postmasburg Group (Transvaal Supergroup). The most south-eastern corner of the proposed development is underlain by Quaternary rubble (yellow with scattered triangles). According to the PalaeoMap on the South African Heritage Resources Information System (SAHRIS) database, the Palaeontological Sensitivity of the Tertiary to Quaternary superficial deposits is Moderate, that of the Quaternary rubble is Low and that of the Makganyene Formation (Postmasburg Group, Transvaal Supergroup) is Moderate (Almond and Pether 2008, SAHRIS website).

**Recently**, revisions to the stratigraphic subdivision and alignments of the Precambrium rocks present in the Postmasburg and Kathu area has been completed. Eriksson *et al.* (2006) conducted stratigraphic studies on the Transvaal Supergroup while Moen (2006) conducted the study for the Olifantshoek Supergroup. Simplified regional geological maps based on Cairncross and Beukes

(2013) and Smith and Beukes (2016) were published. The geological map (**Figure 4**) indicates that the proposed development is located west of the Maremane Dome (a major N-S trending anticline within the Early Proterozoic bedrocks of the Ghaap Group, Transvaal Supergroup. The Maremane Dome comprises of carbonate rocks of the Ghaap Group, Transvaal Supergroup overlain by the Kalahari Group .

In the past the shallow marine carbonates of the Campbell Rand Subgroup (Ghaap Group) were included in the Ghaapplateo Formation. It is about 2.6 to 2.5 Ga (billion years old) and was deposited on the shallow submerged shelf of the Kaapvaal Craton. This carbonate platform is very thick (about 1.6 -2.5 km) and comprise of cherts with minor tuffs and siliciclastic rocks as well as dolostones and dolomitic limestones.

Sea level changes were caused by changing depositional cycles in shallow water facies. Stromatolitic limestones and dolostones, oolites, minor tuffs as well as laminated calcilutites, cherts, with subordinate siliclastics (shales, siltstones) are present in this area (Beukes 1980, Beukes 1986, Sumner 2002, Eriksson *et al.* 2006, Sumner & Beukes 2006).

West of the Maremane Dome, a major unconformity exists at the base of the Palaeoproterozoic Elim Group (basal Keis Supergroup) (**Figure 5**), This unconformity (about 2.2-2.0 Ga) cuts the folded Ghaap Group succession and is associated with the development of manganese and iron ores in Griqualand West. High grade manganese and iron ores are present in the extensively modified Precambrium sediments of the Ghaap and Elim Group (Manganore or Gamagara Formations). These ores are associated with the basal Gamagara Formation of the Elim Group as well as the palaeokarst-related Manganore Formation. This formation overlies the carbonates of the Campbell Rand Subgroup of the Maremane Dome (Van Niekerk 2006, Da Silva 2011, Cairncross & Beukes 2013, Smith & Beukes 2016). In the past the Elim Group was included in the Olifantshoek Group.

In the greater Kathu region, the Postmasburg Group is represented by the unfossiliferous volcanic Ongeluk Formation as well as the Makganyene Formation. The basaltic to andesitic lavas/magma of the Ongeluk Formation (dated to 2.2 Ga) crops out near the proposed development. The Makganyene Formation near Postmasburg, comprise of diamictites that is about 500m thick. Various authors are of the opinion that these diamictites indicate a 250-million-year glacial episode (Palaeoproterozoic age) (Evans *et al.* 1997; Polteau *et al.* 2006). This event was most probably triggered by oxygenic cyanobacterial photosynthesis (Kopp *et al.* 2005; Coetzee *et al.* 2006). The Makganyene Formation includes sandstones, shales, large coarsely bedded diamictites, BIF and manganese-rich carbonates with stromatolitic reefs. However, Almond (2017) did not uncover fossil reefs from the shallow platform facies of the Makganyene Formation in the Griqualand Basin (Ghaap Plateau Sub-basin).



In this area Precambrian rocks are mantled by the late Cretaceous to Late Cenozoic aeolian sands, clays, calcretes, and gravels of the Kalahari Group [approximately Ca 65 – 2.5 million years old (Ma)]. Studies north west of the proposed development site has shown that the Kalahari Group sediments that overlies the Precambrian rocks are about 80 m thick (Haddon, 2005). The earliest Kalahari beds are assigned to the Wessels Formation (basal gravels) and Budin Formation (calcareous clays) and is probably Late Cretaceous in age (Partridge *et al.* 2006). The top 15 m of the Kalahari sediments consist of clays, calcretised siltstones, and pebbly horizons with the occurrence of solution hollows along joint surfaces (10 m from the surface) (**Figure 6**). Calcretised silcretes with *in situ* brecciation are present close to the surface . Thick pedogenic calcretes (Plio-Pleistocene Mokalanen Formation) are mapped along the Ga-Mogara drainage line and underlies the Kalahari sands in this region. These deposits indicate the seasonally arid climates over the last five million years (Truter *et al.* 1938; Boardman and Visser 1958). Surface limestones may be up to 20 m thick and are locally conglomeratic with clasts of reworked calcrete and foreign pebbles.

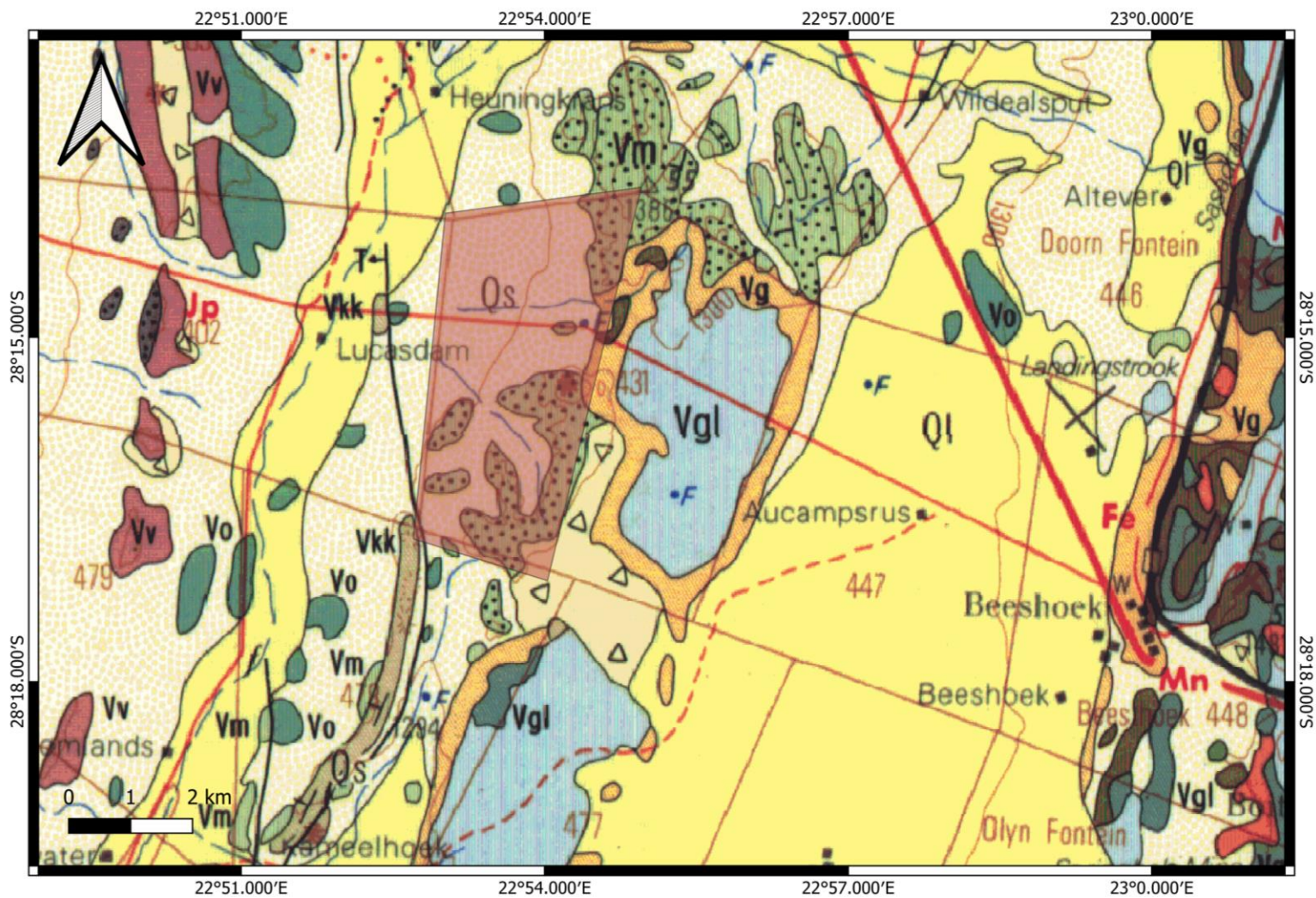
Pleistocene Kalahari sands (Gordonia Formation) has been described to mantle thick calcretes and downwasted surface gravels (Almond 2013). He described a range of calcrete types namely gravelly, brecciated, silicified, honeycomb and karstified facies, the latter with an associated sand- or gravel-infilled solution hollows

Older terrace gravels are described from the banks of the Ga-Mogara drainage line. Unconsolidated, reddish-brown aeolian sands of the Quaternary Gordonia Formation are present. These sands are Late Pliocene / Early Pleistocene to Recent in age due to the Middle to Later Stone Age stone tools (Dingle *et al.*, 1983, p. 291) found in them. Recent studies have dated the Pliocene - Pleistocene boundary from 1.8Ma back to 2.588 Ma and placed the Gordonia Formation almost completely within the Pleistocene Epoch.

Small patches of Late Tertiary to Quaternary calcretes or pedogenic limestones (QI) are present in the development. The calcretes may be correlated with the Pleistocene or Late Pliocene Mokalanen Formation of the Kalahari Group, or even younger (Partridge *et al.* 2006, Moen 2007). These horizons include layered to structureless and nodular calcretes covering basement rocks that are generally less than 3 m thick and partly covered by wind-blown sands.

Quaternary fossil assemblages are generally rare and low in diversity and occur over a wide-ranging geographic area. These fossil assemblages resemble modern animals and may comprise of mammalian teeth, bones and horn corns, reptile skeletons and fragments of ostrich eggs. Microfossils, non-marine mollusc shells are also known from Quaternary deposits. Plant material such as foliage, wood, pollens, and peats are recovered as well as trace fossils like vertebrate tracks, burrows, termitaria (termite heaps/ mounds) and rhizoliths (root casts).

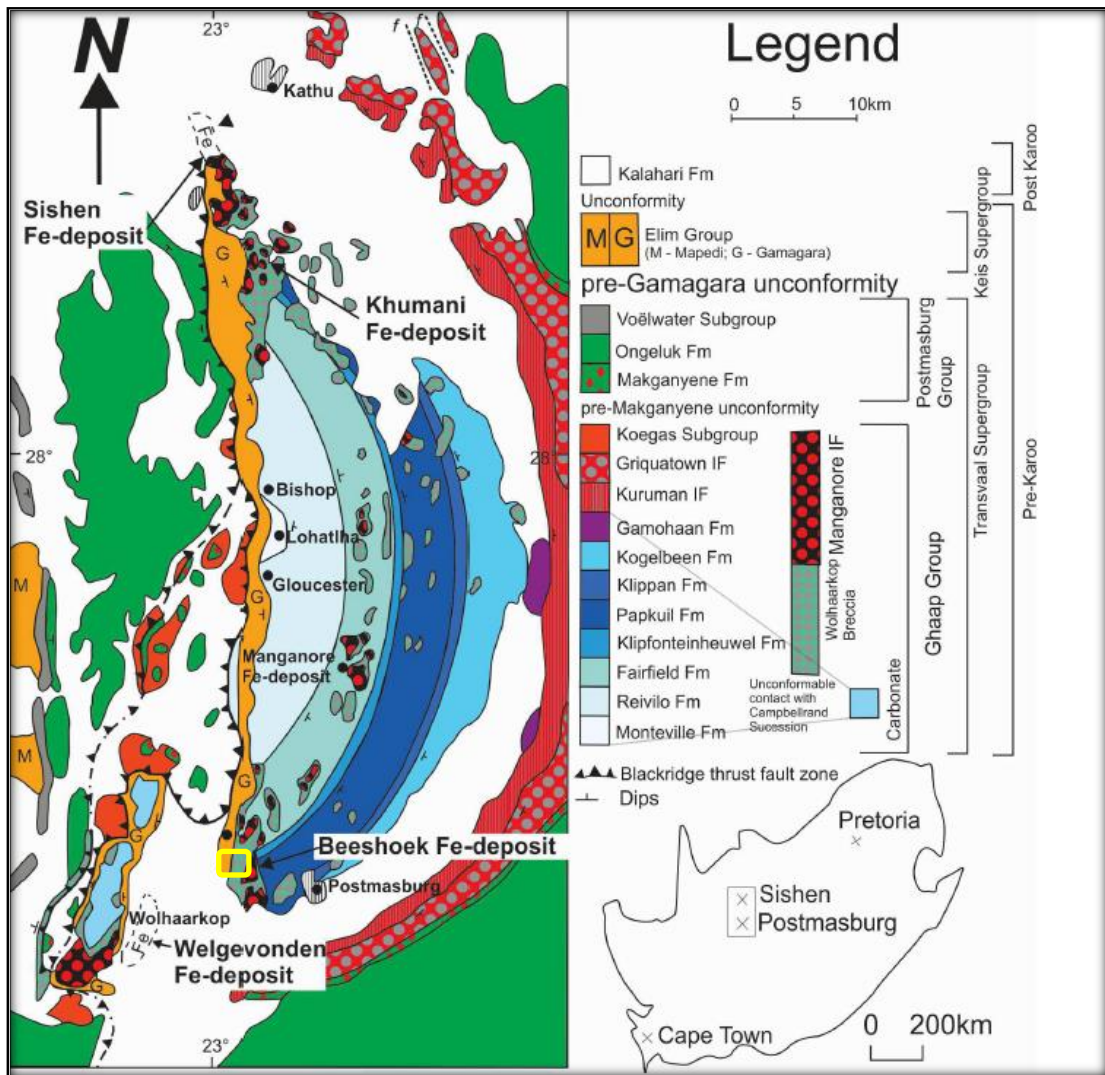
The proposed development is however mantled by windblown sands and the chance of finding fossils in these sands is low.



**Figure 3:** Extract of the 1:250 000 Postmasburg 2822 (1977) Geological map (Council of Geoscience, Pretoria) indicating the proposed development.



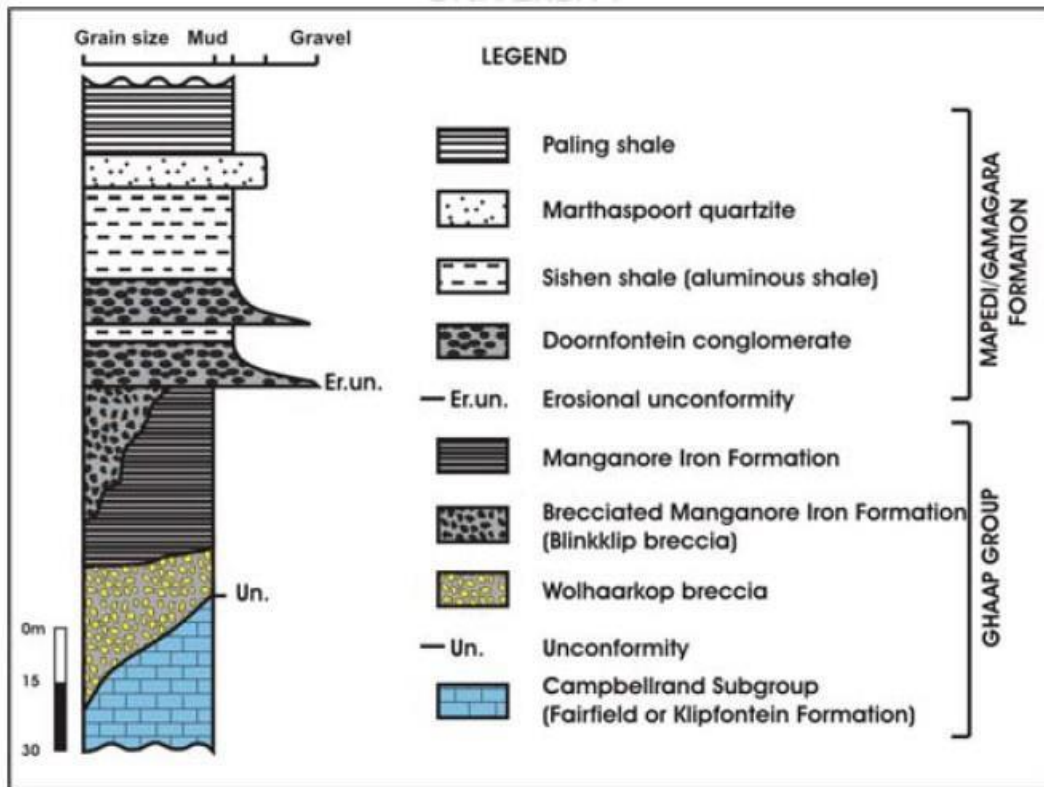




**Figure 4:** Updated Regional Geology of the Maremane Dome in the Northern Cape (from Smith & Beukes 2016). The approximate location of the proposed development is indicated by the yellow rectangle.

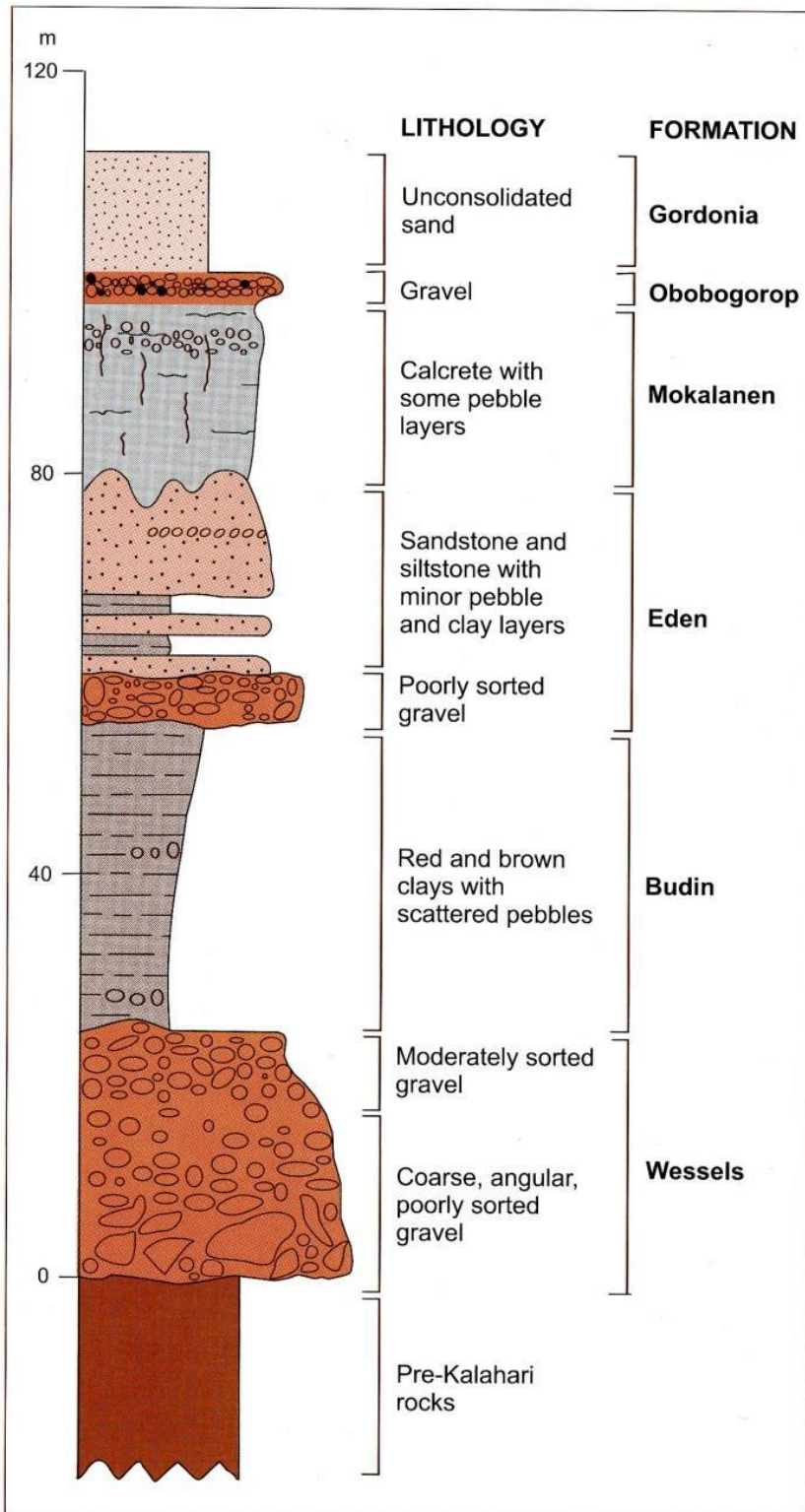
The mining application is located on the western flanks of the Maremane dome. The manganese and iron ores are assigned to the Gamagara Formation. The Makganyene Formation outcrop is indicated in red with green spots (differing from the legend).

The Ongeluk lava outcrop area as well as the Makganyene Formation diamictites forms part of the Postmasburg Group. The basal Elim Group contains the Gamagara Formation. Iron / manganese ores on the western borders of the Maremane Dome.

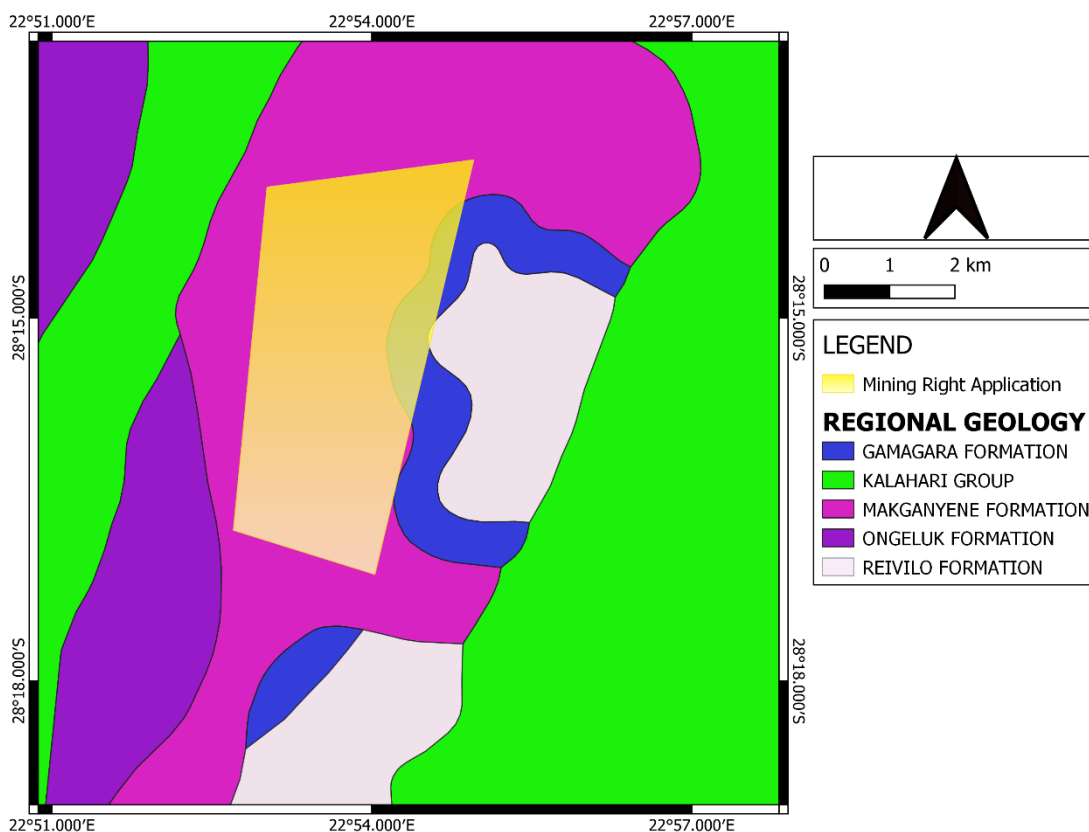


**Figure 5:** Stratigraphy of the iron formations in the Sishen-Postmasburg area (Schalkwyk 2005).

The base of the Elim Group (Kheis Supergroup) is formed by the Gamagara Formation and the ferruginous Doornfontein conglomerates at its base. The Manganore Formation is underlain by the Wolhaarkop Breccia that forms part of a complex, supergene-enriched, lateritic weathering profile below the 2.2-2.0 Ga pre-Gamagara Unconformity associated with the collapse of the Asbestos Hills Subgroup BIF into karstic solution hollows on the Maremane Dome.

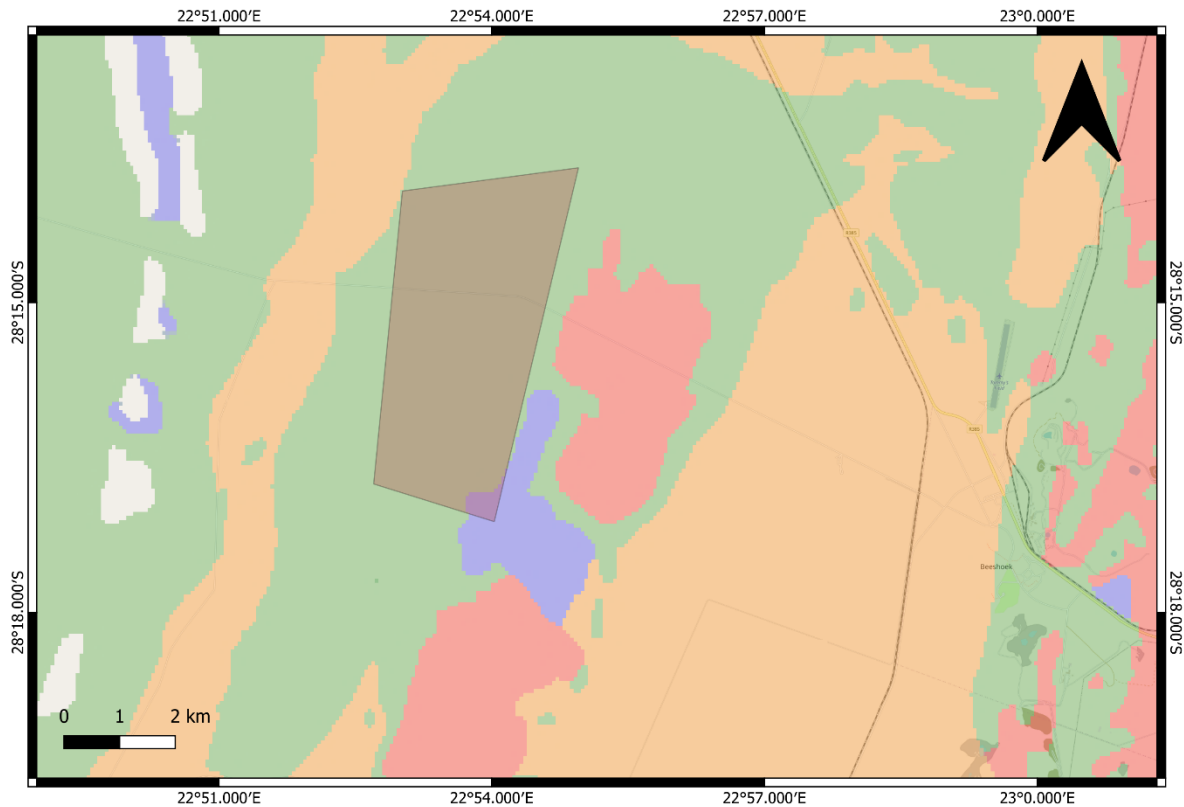


**Figure 6:** General stratigraphy of the Late Cretaceous to Recent Kalahari Group (Taken from Partridge et al. 2006).



**Figure 7:** Surface Geology indicated by Shape files (Council of Geoscience, Pretoria) of the proposed Farm 431 Prospecting project.

The map in Figure 7 was drawn by Shape files supplied by the Council of Geoscience, Pretoria. This map indicates that the proposed mining application is largely underlain by the Makganyene Formation with the north- eastern portion underlain by the Gamagara Formation, Postmasburg Group, Transvaal Supergroup.



**Figure 8:** Extract of the 1 in 250 000 SAHRIS PalaeoMap map (Council of Geosciences) indicating the proposed development in blue.

*Table 2: SAHRIS Palaeosensitivity ratings table. The relevant sensitivity is highlighted.*

Colour	Sensitivity	Required Action
RED	VERY HIGH	field assessment and protocol for finds is required
<b>ORANGE/YELLOW</b>	<b>HIGH</b>	<b>desktop study is required and based on the outcome of the desktop study; a field assessment is likely</b>
GREEN	MODERATE	desktop study is required
BLUE	LOW	no palaeontological studies are required however a protocol for finds is required
GREY	INSIGNIFICANT/ZERO	no palaeontological studies are required
WHITE/CLEAR	UNKNOWN	these areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

According to the SAHRIS Palaeosensitivity map (**Figure 8**) the proposed development is underlain by sediments with a High (Orange) Palaeontological Significance (**Figure 8**).



The colors on the PalaeoMap indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero

## 6 GEOGRAPHICAL LOCATION OF THE SITE

The proposed study area is about 18 km north-west of Postmasburg, ZF Mgcawu District Municipality, in the Northern Cape Province

The approximate middle coordinates of the development is -28.253811° 22.894226°°

GPS Coordinates	Longitude	Latitude
	-28.231832°	22.884650°
	-28.228669°	22.916257°
	-28.279602°	22.878392°
	-28.285078°	-28.285078°

## 7 METHODS

The aim of a desktop study is to evaluate the risk to palaeontological heritage in the proposed development. This includes all trace fossils and fossils. All available information is consulted to compile a desktop study and includes PIA reports in the same area, aerial photos, and Google Earth images, topographical as well as geological maps.

### 7.1 Assumptions and Limitations

When conducting a PIA, several factors can affect the accuracy of the assessment. The focal point of geological maps is the geology of the area, and the sheet explanations were not meant to focus on palaeontological heritage. Many, inaccessible regions of South Africa have not been reviewed by palaeontologists and data is based on aerial photographs. Locality and geological information of museums and universities databases have not been kept up to date or data collected in the past have not always been accurately documented.

Comparable Assemblage Zones in other areas is used to provide information on the existence of fossils in an area that was not yet been documented. When similar Assemblage Zones and geological formations for Desktop studies is used it is assumed that exposed fossil heritage is present within the footprint.

## 8 ADDITIONAL INFORMATION CONSULTED

In compiling this report the following sources were consulted:

- Geological map 1:100 000, Geology of the Republic of South Africa (Visser 1984).
- 1: 250 000 000 Postmasburg 2824 (1977) Geological Map (Council for Geosciences, Pretoria).
- A Google Earth map with polygons of the proposed development was obtained from LW Consultants.
- PIAs in close proximity of the proposed development (See references)

## 9 IMPACT ASSESSMENT METHODOLOGY

### 9.1 Impact Rating System

Impact assessment must take account of the nature, scale, and duration of impacts on the environment whether such impacts are positive or negative. Each impact is also assessed according to the following project phases:

- Construction
- Operation
- Decommissioning

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance should also be included. The rating system is applied to the potential impacts on the receiving environment and includes an objective evaluation of the mitigation of the impact. In assessing the significance of each impact, the following criteria is used:

Table 3: *The rating system*

NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be experienced.		
1	Site	The impact will only affect the site.
2	Local/district	Will affect the local area or district.
3	Province/region	Will affect the entire province or region.
4	International and National	Will affect the entire country.

<b>PROBABILITY</b>		
This describes the chance of occurrence of an impact.		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
<b>DURATION</b>		
This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.
<b>INTENSITY/ MAGNITUDE</b>		
Describes the severity of an impact.		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).

3	High	Impact affects the continued viability of the system/ component, and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component, and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.

**REVERSIBILITY**

This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.

1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	<b>Irreversible</b>	The impact is irreversible, and no mitigation measures exist.

**IRREPLACEABLE LOSS OF RESOURCES**

This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.

1	No loss of resource	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	<b>Complete loss of resources</b>	The impact is result in a complete loss of all resources.

**CUMULATIVE EFFECT**

This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.

1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.
2	<b>Low cumulative impact</b>	The impact would result in insignificant cumulative effects.
3	Medium cumulative impact	The impact would result in minor cumulative effects.

4	High cumulative impact	The impact would result in significant cumulative effects
<b>SIGNIFICANCE</b>		
<p>Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The calculation of the significance of an impact uses the following formula:</p> <p><b>(Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.</b></p> <p>The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.</p>		
Points	Impact significance rating	Description
6 to 28	Negative low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative high impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive high impact	The anticipated impact will have significant positive effects.
74 to 96	Negative very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive very high impact	The anticipated impact will have highly significant positive

### 9.1.1 Summary of Impacts

Only the site will be affected (1). It is that the impact will occur (1). The expected duration of the impact is assessed as potentially permanent to long term (4). The impact on fossil heritage will be irreversible (4) and a complete loss of fossil heritage will take place (4). The cumulative effect of the impact will be low (2). The magnitude of the impact happening will be low (1)

The Impact significance will therefore be a negative low Impact.

## 10 FINDINGS AND RECOMMENDATIONS

The proposed Farm 431 MRA (manganese and iron ore) near Postmasburg in the Northern Cape is mantled by Tertiary to Quaternary superficial deposits as well as the Makganyene Formation of the Postmasburg Group (Transvaal Supergroup). The most south-eastern corner of the proposed development is underlain by Quaternary rubble. According to the PalaeoMap on the South African Heritage Resources Information System (SAHRIS) database, the Palaeontological Sensitivity of the Tertiary to Quaternary superficial deposits and that of the Makganyene Formation (Postmasburg Group, Transvaal Supergroup) is Moderate, while that of the Quaternary rubble is Low (Almond and Pether 2008, SAHRIS website). A Low Palaeontological Significance has been allocated to the proposed Mining application. It is therefore considered that the proposed development is believed to be appropriate and will not lead to detrimental impacts on the palaeontological reserves of the area.

If Palaeontological Heritage is uncovered during surface clearing and excavations the **Chance find Protocol** attached should be implemented immediately. Fossil discoveries ought to be protected and the ECO/site manager must report to South African Heritage Resources Agency (SAHRA) (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: [www.sahra.org.za](http://www.sahra.org.za)) so that mitigation (recording and collection) can be carried out.

Before any fossil material can be collected from the development site the specialist involved would need to apply for a collection permit from SAHRA. Fossil material must be housed in an official collection (museum or university), while all reports and fieldwork should meet the minimum standards for palaeontological impact studies proposed by SAHRA (2012).

These recommendations should be incorporated into the Environmental Management Plan for the proposed development.

## 11 CHANCE FINDS PROTOCOL

A following procedure will only be followed if fossils are uncovered during excavation.

### 11.1 Legislation

Cultural Heritage in South Africa (includes all heritage resources) is protected by the **National Heritage Resources Act (Act 25 of 1999) (NHRA)**. According to Section 3 of the Act, all Heritage resources include “**all objects recovered from the soil or waters of South Africa,**

**including archaeological and palaeontological objects and material, meteorites and rare geological specimens”.**

Palaeontological heritage is unique and non-renewable and is protected by the NHRA and are the property of the State. It is thus the responsibility of the State to manage and conserve fossils on behalf of the citizens of South Africa. Palaeontological resources may not be excavated, broken, moved, or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

## **11.2 Background**

A fossil is the naturally preserved remains (or traces) of plants or animals embedded in rock. These plants and animals lived in the geologic past millions of years ago. Fossils are extremely rare and irreplaceable. By studying fossils, it is possible to determine the environmental conditions that existed in a specific geographical area millions of years ago.

## **11.3 Introduction**

This informational document is intended for workmen and foremen on construction sites. It describes the actions to be taken when mining or construction activities accidentally uncovers fossil material.

It is the responsibility of the Environmental Site Officer (ESO) or site manager of the project to train the workmen and foremen in the procedure to follow when a fossil is accidentally uncovered. In the absence of the ESO, a member of the staff must be appointed to be responsible for the proper implementation of the chance find protocol as not to compromise the conservation of fossil material.

## **11.4 Chance Find Procedure**

- If a chance find is made the person responsible for the find must immediately **stop working** and all work that could impact that finding must cease in the immediate vicinity of the find.
- The person who made the find must immediately **report** the find to his/her direct supervisor which in turn must report the find to his/her manager and the ESO or site manager. The ESO or site manager must report the find to the relevant Heritage Agency (South African Heritage Research Agency, SAHRA). (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: [www.sahra.org.za](http://www.sahra.org.za)). The information to

the Heritage Agency must include photographs of the find, from various angles, as well as the GPS coordinates.

- A preliminary report must be submitted to the Heritage Agency within **24 hours** of the find and must include the following: 1) date of the find; 2) a description of the discovery and a 3) description of the fossil and its context (depth and position of the fossil), GPS co-ordinates.
- Photographs (the more the better) of the discovery must be of high quality, in focus, accompanied by a scale. It is also important to have photographs of the vertical section (side) where the fossil was found.

Upon receipt of the preliminary report, the Heritage Agency will inform the ESO (or site manager) whether a rescue excavation or rescue collection by a palaeontologist is necessary.

- The site must be secured to protect it from any further damage. **No attempt** should be made to remove material from their environment. The exposed finds must be stabilized and covered by a plastic sheet or sand bags. The Heritage agency will also be able to advise on the most suitable method of protection of the find.
- In the event that the fossil cannot be stabilized the fossil may be collected with extreme care by the ESO (site manager). Fossils finds must be stored in tissue paper and in an appropriate box while due care must be taken to remove all fossil material from the rescue site.
- Once Heritage Agency has issued the written authorization, the developer may continue with the development on the affected area.



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**ELIZE BUTLER**

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**EDUCATION:** B.Sc. Botany and Zoology, 1988  
 University of the Orange Free State

B.Sc. (Hons) Zoology, 1991  
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Management Course, 1991  
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M. Sc. *Cum laude* (Zoology), 2009  
 University of the Free State

**Dissertation title:** The postcranial skeleton of the Early Triassic non-mammalian Cynodont *Galesaurus planiceps*: implications for biology and lifestyle

Registered as a PhD fellow at the Zoology Department of the UFS  
 2013 to current

**Dissertation title:** A new gorgonopsian from the uppermost *Daptocephalus Assemblage Zone*, in the Karoo Basin of South Africa

**MEMBERSHIP**

Palaeontological Society of South Africa (PSSA) 2006-currently

**EMPLOYMENT HISTORY**

Part-time Laboratory assistant Department of Zoology & Entomology  
 University of the Free State Zoology 1989-1992

Part-time laboratory assistant Department of Virology  
 University of the Free State Zoology 1992

Research Assistant National Museum, Bloemfontein 1993 – 1997

Principal Research Assistant and Collection Manager National Museum, Bloemfontein 1998–currently

**TECHNICAL REPORTS**

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**Butler, E. 2014.** Palaeontological Impact Assessment for the proposed upgrade of existing water supply infrastructure at Noupoort, Northern Cape Province. 2014. Bloemfontein.

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**Butler, E. 2015.** Palaeontological impact assessment of the proposed mixed land developments at Rooikraal 454, Vrede, Free State. Bloemfontein.

- Butler, E. 2015.** Palaeontological exemption report of the proposed truck stop development at Palmiet 585, Vrede, Free State. Bloemfontein.
- Butler, E. 2015.** Palaeontological impact assessment of the proposed Orange Grove 3500 residential development, Buffalo City Metropolitan Municipality East London, Eastern Cape. Bloemfontein.
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- Butler, E. 2015.** Palaeontological Impact Assessment of the proposed Ficksburg raw water pipeline. Bloemfontein.
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- Butler, E. 2015.** Palaeontological Impact Assessment of the proposed Orkney solar energy farm and associated infrastructure on the remaining extent of Portions 7 and 21 of the farm Wolvehuis 114, near Orkney, North West Province. Bloemfontein.
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- Butler, E. 2016.** Palaeontological Impact Assessment of the proposed construction of the 150 MW Noupoot concentrated solar power facility and associated infrastructure on portion 1 and 4 of the farm Carolus Poort 167 and the remainder of Farm 207, near Noupoot, Northern Cape. Prepared for Savannah Environmental. Bloemfontein.
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**Butler, E. 2016.** Recommended Exemption from further Palaeontological studies: Proposed Construction of the Gunstfontein Switching Station, 132kv Overhead Power Line (Single or Double Circuit) and ancillary infrastructure for the Gunstfontein Wind Farm Near Sutherland, Northern Cape Province. Savannah South Africa. Bloemfontein.

**Butler, E. 2016.** Palaeontological Impact Assessment of the proposed Galla Hills Quarry on the remainder of the farm Roode Krantz 203, in the Lukhanji Municipality, division of Queenstown, Eastern Cape Province. Bloemfontein.

**Butler, E. 2016.** Chris Hani District Municipality Cluster 9 water backlog project phases 3a and 3b: Palaeontology inspection at Tsomo WTW. Bloemfontein.

**Butler, E. 2016.** Palaeontological Impact Assessment of the proposed construction of the 150 MW Noupoot concentrated solar power facility and associated infrastructure on portion 1 and 4 of the farm Carolus Poort 167 and the remainder of Farm 207, near Noupoot, Northern Cape. Savannah South Africa. Bloemfontein.

**Butler, E. 2016.** Palaeontological Impact Assessment of the proposed upgrading of the main road MR450 (R335) from Motherwell to Addo within the Nelson Mandela Bay Municipality and Sunday's River valley Local Municipality, Eastern Cape Province. Bloemfontein.

**Butler, E. 2016.** Palaeontological Impact Assessment construction of the proposed Metals Industrial Cluster and associated infrastructure near Kuruman, Northern Cape Province. Savannah South Africa. Bloemfontein.

**Butler, E. 2016.** Palaeontological Impact Assessment for the proposed construction of up to a 132kv power line and associated infrastructure for the proposed Kalkaar Solar Thermal Power Plant near Kimberley, Free State and Northern Cape Provinces. PGS Heritage. Bloemfontein.

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**Butler, E. 2016.** Palaeontological Impact Assessment for the proposed construction of two 5 Mw Solar Photovoltaic Power Plants on Farm Wildebeestkuil 59 and Farm Leeuwbosch 44, Leeudoringstad, North West Province. Bloemfontein.

**Butler, E. 2016.** Palaeontological Impact Assessment for the proposed development of four Leeuwbosch Wind farms and basic assessments for the associated grid connection near Loeriesfontein, Northern Cape Province. Bloemfontein.

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**Butler, E. 2016:** Palaeontological desktop assessment of the establishment of the proposed residential and mixed-use development on the remainder of portion 7 and portion 898 of the farm Knopjeslaagte 385 Ir, located near Centurion within the Tshwane Metropolitan Municipality of Gauteng Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological impact assessment for the proposed development of a new cemetery, near Kathu, Gamagara local municipality and John Taolo Gaetsewe district municipality, Northern Cape. Bloemfontein.

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- Butler, E. 2017.** Palaeontological Desktop Assessment of the proposed development of the new open cast mining operations of the Impunzi mine in the Mpumalanga Province. Bloemfontein.
- Butler, E. 2017.** Palaeontological Desktop Assessment of the construction of the proposed Viljoenskroon Munic 132 KV line, Vierfontein substation and related projects. Bloemfontein.
- Butler, E. 2017.** Palaeontological Desktop Assessment of the proposed rehabilitation of 5 ownerless asbestos mines. Bloemfontein.
- Butler, E. 2017.** Palaeontological Desktop Assessment of the proposed development of the Lephale coal and power project, Lephale, Limpopo Province, Republic of South Africa. Bloemfontein.



**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed construction of a 132KV powerline from the Tweespruit distribution substation (in the Mantsopa local municipality) to the Driedorp rural substation (within the Naledi local municipality), Free State province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment of the proposed development of the new coal-fired power plant and associated infrastructure near Makhado, Limpopo Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed construction of a Photovoltaic Solar Power station near Collett substation, Middelburg, Eastern Cape. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment for the proposed township establishment of 2000 residential sites with supporting amenities on a portion of farm 826 in Botshabelo West, Mangaung Metro, Free State Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment for the proposed prospecting right project without bulk sampling, in the Koa Valley, Northern Cape Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment for the proposed Aroams prospecting right project, without bulk sampling, near Aggeneys, Northern Cape Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed Belvior aggregate quarry II on portion 7 of the farm Maidenhead 169, Enoch Mgijima Municipality, division of Queenstown, Eastern Cape. Bloemfontein.

**Butler, E. 2017.** PIA site visit and report of the proposed Galla Hills Quarry on the remainder of the farm Roode Krantz 203, in the Lukhanji Municipality, division of Queenstown, Eastern Cape Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed construction of Tina Falls Hydropower and associated power lines near Cumbu, Mthlontlo Local Municipality, Eastern Cape. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment of the proposed construction of the Mangaung Gariep Water Augmentation Project. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed Belvoir aggregate quarry II on portion 7 of the farm Maidenhead 169, Enoch Mgijima Municipality, division of Queenstown, Eastern Cape. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed construction of the Melkspruit-Rouxville 132KV Power line. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment of the proposed development of a railway siding on a Portion of portion 41 of the farm Rustfontein 109 is, Govan Mbeki local municipality, Gert Sibande district municipality, Mpumalanga Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed consolidation of the proposed Ilima Colliery in the Albert Luthuli local municipality, Gert Sibande District Municipality, Mpumalanga Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment of the proposed extension of the Kareerand Tailings Storage Facility, associated borrow pits as well as a storm water drainage channel in the Vaal River near Stilfontein, North West Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment of the proposed construction of a filling station and associated facilities on the Erf 6279, district municipality of John Taolo Gaetsewe District, Ga-Segonyana Local Municipality Northern Cape. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment of the proposed of the Lephale Coal and Power Project, Lephale, Limpopo Province, Republic of South Africa. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment of the proposed Overvaal Trust PV Facility, Buffelspoort, North West Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed development of the H<sub>2</sub> Energy Power Station and associated infrastructure on Portions 21; 22 And 23 of the farm

Hartebeestspruit in the Thembisile Hani Local Municipality, Nkangala District near Kwamhlanga, Mpumalanga Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed upgrade of the Sandriver Canal and Klippan Pump station in Welkom, Free State Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed upgrade of the 132kv and 11kv power line into a dual circuit above ground power line feeding into the Urania substation in Welkom, Free State Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment of the proposed Swaziland-Mozambique border patrol road and Mozambique barrier structure. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed diamonds alluvial & diamonds general prospecting right application near Christiana on the remaining extent of portion 1 of the farm Kaffraria 314, registration division HO, North West Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment for the proposed development of Wastewater Treatment Works on Hartebeesfontein, near Panbult, Mpumalanga. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment for the proposed development of Wastewater Treatment Works on Rustplaas near Piet Retief, Mpumalanga. Bloemfontein.

**Butler, E. 2018.** Palaeontological Impact Assessment for the Proposed Landfill Site in Luckhoff, Letsemeng Local Municipality, Xhariep District, Free State. Bloemfontein.

**Butler, E. 2018.** Palaeontological Impact Assessment of the proposed development of the new Mutsho coal-fired power plant and associated infrastructure near Makhado, Limpopo Province. Bloemfontein.

**Butler, E. 2018.** Palaeontological Impact Assessment of the authorisation and amendment processes for Manangu mine near Delmas, Victor Khanye local municipality, Mpumalanga. Bloemfontein.

**Butler, E. 2018.** Palaeontological Desktop Assessment for the proposed Mashishing township establishment in Mashishing (Lydenburg), Mpumalanga Province. Bloemfontein.

**Butler, E. 2018.** Palaeontological Desktop Assessment for the Proposed Mlonzi Estate Development near Lusikisiki, Ngquza Hill Local Municipality, Eastern Cape. Bloemfontein.

**Butler, E. 2018.** Palaeontological Phase 1 Assessment of the proposed Swaziland-Mozambique border patrol road and Mozambique barrier structure. Bloemfontein.

**Butler, E. 2018.** Palaeontological Desktop Assessment for the proposed electricity expansion project and Sekgame Switching Station at the Sishen Mine, Northern Cape Province. Bloemfontein.

**Butler, E. 2018.** Palaeontological field assessment of the proposed construction of the Zonnebloem Switching Station (132/22kV) and two loop-in loop-out power lines (132kV) in the Mpumalanga Province. Bloemfontein.

**Butler, E. 2018.** Palaeontological Field Assessment for the proposed re-alignment and decommissioning of the Firham-Platrand 88kv Powerline, near Standerton, Lekwa Local Municipality, Mpumalanga province. Bloemfontein.

**Butler, E. 2018.** Palaeontological Desktop Assessment of the proposed Villa Rosa development In the Buffalo City Metropolitan Municipality, East London. Bloemfontein.

**Butler, E. 2018.** Palaeontological field Assessment of the proposed Villa Rosa development In the Buffalo City Metropolitan Municipality, East London. Bloemfontein.

**Butler, E. 2018.** Palaeontological desktop assessment of the proposed Mookodi – Mahikeng 400kV line, North West Province. Bloemfontein.

**Butler, E. 2018.** Palaeontological Desktop Assessment for the proposed Thornhill Housing Project, Ndlambe Municipality, Port Alfred, Eastern Cape Province. Bloemfontein.

**Butler, E. 2018.** Palaeontological desktop assessment of the proposed housing development on portion 237 of farm Hartebeestpoort 328. Bloemfontein.

**Butler, E. 2018.** Palaeontological desktop assessment of the proposed New Age Chicken layer facility located on holding 75 Endicott near Springs in Gauteng. Bloemfontein.

**Butler, E. 2018** Palaeontological Desktop Assessment for the development of the proposed Leslie 1 Mining Project near Leandra, Mpumalanga Province. Bloemfontein.

**Butler, E. 2018.** Palaeontological field assessment of the proposed development of the Wildealskloof mixed use development near Bloemfontein, Free State Province. Bloemfontein.

**Butler, E. 2018.** Palaeontological Field Assessment of the proposed Megamor Extension, East London. Bloemfontein

**Butler, E. 2018.** Palaeontological Impact Assessment of the proposed diamonds Alluvial & Diamonds General Prospecting Right Application near Christiana on the Remaining Extent of Portion 1 of the Farm Kaffraria 314, Registration Division HO, North West Province. Bloemfontein.

**Butler, E. 2018.** Palaeontological Impact Assessment of the proposed construction of a new 11kV (1.3km) Power Line to supply electricity to a cell tower on farm 215 near Delportshoop in the Northern Cape. Bloemfontein.

**Butler, E. 2018.** Palaeontological Field Assessment of the proposed construction of a new 22 kV single wood pole structure power line to the proposed MTN tower, near Britstown, Northern Cape Province. Bloemfontein.

**Butler, E. 2018.** Palaeontological Exemption Letter for the proposed reclamation and reprocessing of the City Deep Dumps in Johannesburg, Gauteng Province. Bloemfontein.

**Butler, E. 2018.** Palaeontological Exemption letter for the proposed reclamation and reprocessing of the City Deep Dumps and Rooikraal Tailings Facility in Johannesburg, Gauteng Province. Bloemfontein.

**Butler, E. 2018.** Proposed Kalabasfontein Mine Extension project, near Bethal, Govan Mbeki District Municipality, Mpumalanga. Bloemfontein.

**Butler, E. 2018.** Palaeontological Desktop Assessment for the development of the proposed Leslie 1 Mining Project near Leandra, Mpumalanga Province. Bloemfontein.

**Butler, E. 2018.** Palaeontological Desktop Assessment of the proposed Mookodi – Mahikeng 400kV Line, North West Province. Bloemfontein.

**Butler, E. 2018.** Environmental Impact Assessment (EIA) for the Proposed 325mw Rondekop Wind Energy Facility between Matjiesfontein and Sutherland in the Northern Cape Province.

**Butler, E. 2018.** Palaeontological Impact Assessment of the proposed construction of the Tooverberg Wind Energy Facility, and associated grid connection near Touws River in the Western Cape Province. Bloemfontein.

**Butler, E. 2018.** Palaeontological impact assessment of the proposed Kalabasfontein Mining Right Application, near Bethal, Mpumalanga.

**Butler, E., 2019.** Palaeontological Desktop Assessment of the proposed Westrand Strengthening Project Phase II.

**Butler, E., 2019.** Palaeontological Field Assessment for the proposed Sirius 3 Photovoltaic Solar Energy Facility near Upington, Northern Cape Province

**Butler, E., 2019.** Palaeontological Field Assessment for the proposed Sirius 4 Photovoltaic Solar Energy Facility near Upington, Northern Cape Province

**Butler, E., 2019.** Palaeontological Field Assessment for Heuningspruit PV 1 Solar Energy Facility near Koppies, Ngwathe Local Municipality, Free State Province.

**Butler, E., 2019.** Palaeontological Field Assessment for the Moeding Solar Grid Connection, North West Province.

**Butler, E., 2019.** Recommended Exemption from further Palaeontological studies for the Proposed Agricultural Development on Farms 1763, 2372 And 2363, Kakamas South Settlement, Kai! Garib Municipality, Mgcau District Municipality, Northern Cape Province.

**Butler, E., 2019.** Recommended Exemption from further Palaeontological studies: of Proposed Agricultural Development, Plot 1178, Kakamas South Settlement, Kai! Garib Municipality

**Butler, E., 2019.** Palaeontological Desktop Assessment for the Proposed Waste Rock Dump Project at Tshipi Borwa Mine, near Hotazel, Northern Cape Province:

**Butler, E., 2019.** Palaeontological Exemption Letter for the proposed DMS Upgrade Project at the Sishen Mine, Gamagara Local Municipality, Northern Cape Province

**Butler, E., 2019.** Palaeontological Desktop Assessment of the proposed Integrated Environmental Authorisation process for the proposed Der Brochen Amendment project, near Groblershoop, Limpopo

Butler, E., 2019. Palaeontological Desktop Assessment of the proposed updated Environmental Management Programme (EMPr) for the Assmang (Pty) Ltd Black Rock Mining Operations, Hotazel, Northern Cape

**Butler, E., 2019.** Palaeontological Desktop Assessment of the proposed Kriel Power Station Lime Plant Upgrade, Mpumalanga Province

**Butler, E., 2019.** Palaeontological Impact Assessment for the proposed Kangala Extension Project Near Delmas, Mpumalanga Province.

**Butler, E., 2019.** Palaeontological Desktop Assessment for the proposed construction of an iron/steel smelter at the Botshabelo Industrial area within the Mangaung Metropolitan Municipality, Free State Province.

**Butler, E., 2019.** Recommended Exemption from further Palaeontological studies for the proposed agricultural development on farms 1763, 2372 and 2363, Kakamas South settlement, Kai! Garib Municipality, Mgcawu District Municipality, Northern Cape Province.

**Butler, E., 2019.** Recommended Exemption from further Palaeontological Studies for Proposed formalisation of Gamakor and Noodkamp low-cost Housing Development, Keimoes, Gordonia Rd, Kai !Garib Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province.

**Butler, E., 2019.** Recommended Exemption from further Palaeontological Studies for proposed formalisation of Blaauwskop Low-Cost Housing Development, Kenhardt Road, Kai !Garib Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province.

**Butler, E., 2019.** Palaeontological Desktop Assessment of the proposed mining permit application for the removal of diamonds alluvial and diamonds kimberlite near Windsorton on a certain portion of Farm Zoelen's Laagte 158, Registration Division: Barkly Wes, Northern Cape Province.

**Butler, E., 2019.** Palaeontological Desktop Assessment of the proposed Vedanta Housing Development, Pella Mission 39, Khâi-Ma Local Municipality, Namakwa District Municipality, Northern Cape.

**Butler, E., 2019.** Palaeontological Desktop Assessment for The Proposed 920 KWP Groenheuwel Solar Plant Near Augrabies, Northern Cape Province

**Butler, E., 2019.** Palaeontological Desktop Assessment for the establishment of a Super Fines Storage Facility at Amandelbult Mine, Near Thabazimbi, Limpopo Province

**Butler, E., 2019.** Palaeontological Impact Assessment for the proposed Sace Lifex Project, Near Emalahleni, Mpumalanga Province

**Butler, E., 2019.** Palaeontological Desktop Assessment for the proposed Rehau Fort Jackson Warehouse Extension, East London

**Butler, E., 2019.** Palaeontological Desktop Assessment for the proposed Environmental Authorisation Amendment for moving 3 Km of the Merensky-Kameni 132KV Powerline

**Butler, E., 2019.** Palaeontological Impact Assessment for the proposed Umsobomvu Solar PV Energy Facilities, Northern and Eastern Cape

**Butler, E., 2019.** Palaeontological Desktop Assessment for six proposed Black Mountain Mining Prospecting Right Applications, without Bulk Sampling, in the Northern Cape.

**Butler, E., 2019.** Palaeontological field Assessment of the Filling Station (Rietvlei Extension 6) on the Remaining Portion of Portion 1 of the Farm Witkoppies 393JR east of the Rietvleidam Nature Reserve, City of Tshwane, Gauteng

**Butler, E., 2019.** Palaeontological Desktop Assessment of The Proposed Upgrade of The Vaal Gamagara Regional Water Supply Scheme: Phase 2 And Groundwater Abstraction

**Butler, E., 2019.** Palaeontological Desktop Assessment of The Expansion of The Jan Kempdorp Cemetery on Portion 43 Of Farm Guldenskat 36-Hn, Northern Cape Province

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