# PHASE 1 PALAEONTOLOGICAL IMPACT ASSESSMENT FOR THE CONSTRUCTION OF A PV FACILITY ON THE FARM BRAKFONTEIN 897, SOUTH OF VRYBURG, NORTH WEST PROVINCE

For:

# **HIA CONSULTANTS**



DATE: 23 January 2015

By

**GIDEON GROENEWALD** 

#### **EXECUTIVE SUMMARY**

Gideon Groenewald was appointed by PGS Heritage to undertake a Phase 1 PIA, assessing the potential palaeontological impact of the Brakfontein PV facility project south of Vryburg in the, North West 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 study area is located on the farm Brakfontein 897, approximately 80km south of Vryburg in the, North West Province and the development entails the construction of a Photo-Voltaic (PV) facility for the generation of electricity for supply to the main grid of ESKOM.

The study area is underlain by rocks of the Vaalian aged Reivilo Formation, Ghaap Group, Transvaal Supergroup. The palaeontological sensitivity was predicted after identifying potentially fossiliferous rock units; ascertaining the fossil heritage from the literature and evaluating the nature and scale of the development itself. The palaeontological sensitivity can be described as significant due to the potential abundance of Vaalian aged Stromatolites known to occur within the Reivilo Formation.

The proposed site of the Brakfontein PV Facility is underlain by Vaalian aged dolomite of the Reivilo Formation, Ghaap Group, Transvaal Supergroup. Well-defined stromatolite structures were observed. The potential for finding well-defined stromatolites still remains high during excavation of PV Panel foundations in areas underlain by dolomite. The area has been allocated a Moderate Palaeontological significance and the ECO must report the presence of stromatolites where excavation of panel foundations expose fossil-rich beds.

It is recommended that:

- 1. The ECO of the project be informed of the possibility of finding well-defined stromatolite structures in the study area.
- 2. An application for a collection and destruction permit be made to SAHRA to allow for the collection and destruction of stromatolite structures during excavation of PV panel foundations.
- 3. If any exceptionally well-defined stromatolites are observed during excavations, the developer must employ a qualified palaeontologist to record these fossils and collect representative samples for further study at an appropriate institute suggested by SAHRA.

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## 1. INTRODUCTION

#### 1.1. Background

Gideon Groenewald was appointed by PGS Heritage to undertake a Phase 1 PIA, assessing the potential palaeontological impact of the Brakfontein PV facility project south of Vryburg in the, North West 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.

## 1.1. 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.

Prior to the field investigation a preliminary assessment (desktop study) of the topography and geology of the study area was made using appropriate 1:250 000 geological maps in conjunction with Google Earth. Potential fossiliferous rock units (groups, formations etc) were identified within the study area and the known fossil heritage within each rock unit was inventoried from the published scientific literature, previous palaeontological impact studies in the same region and the author's field experience.

Priority palaeontological areas were identified within the development footprint to focus the field investigator's time and resources. The aim of the fieldwork was to document any exposed fossil material and to assess the palaeontological potential of the region in terms of the type and extent of rock outcrop in the area.

The likely impact of the proposed development on local fossil heritage was determined on the basis of the palaeontological sensitivity of the rock units concerned and the nature and scale of the development itself. The different sensitivity classes used are explained in Table 1.1 below.

## Table 1.1 Palaeontological Sensitivity Analysis Outcome Classification

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

When rock units of moderate to high palaeontological sensitivity are present within the development footprint, palaeontological mitigation measures should be incorporated into the Environmental Management Plan.

## 1.2. Scope and Limitations of the Phase 1 Investigation

The scope of a phase 1 Investigation includes:

- an analysis of the area's stratigraphy, age and depositional setting of fossil-bearing units;
- a review of all relevant palaeontological and geological literature, including geological maps, and previous palaeontological impact reports;
- data on the proposed development provided by the developer (e.g. location of footprint, depth and volume of bedrock excavation envisaged) and
- where feasible, examination of fossil collections from the study area (e.g. museums).
- do an on-site investigation to assess the identified palaeontological sensitive areas within the development footprint/study area rather than formal palaeontological collection. The investigation should focus on the sites where bedrock excavations would definitely require palaeontological monitoring.

The results of the field investigation are then used to predict the potential of buried fossil heritage within the development footprint. In some investigations this involves the examination of similar accessible bedrock exposures, such as road cuttings and quarries, along roads that run parallel to or across the development footprint.

## 2. DESCRIPTION OF THE PROPOSED DEVELOPMENT

The study area is located on the farm Brakfontein 897, approximately 80km south of Vryburg in the, North West Province (Figure 2.1).

The aim of the project is to construct a PV Facility for the generation of power.



Figure 2.1 Locality of the study area

## 3. GEOLOGY

The study area is underlain by rocks of the Vaalian aged Reivilo Formation, Ghaap Group, Transvaal Supergroup.

#### 3.1. The Reivilo Formation

The Reivilo Formation consists of Vaalian aged, chert poor, stromatolitic dolomites.

The areas underlain by dolomites are also prone to have a very high possibility of Cenozoic aged carbonaceous cave breccias.



Figure 3.1 Geology of the study area

## 4. PALAEONTOLOGY OF THE STUDY AREA

#### 4.1. Reivilo Formation

Range of shallow marine and lacustrine stromatolites (some very large), oolites, pisolites in carbonates, filamentous and coccoid organic walled microfossils (eg cyanobacteria) in siliciclastics / carbonates as well as cherts of banded iron formations (BIF): Schmidtsdrift, Campbell Rand & Asbestos Hills Subgroups.

The Cenozoic aged cave breccias that can be associated with the dolomites of the Ghaap Group can contain extremely important fossil remains, including the remains of Homonins.

#### 5. PRELIMINARY ASSESSMENT RESULTS

The palaeontological sensitivity was predicted after identifying potentially fossiliferous rock units; ascertaining the fossil heritage from the literature and evaluating the nature and scale of the development itself. The palaeontological sensitivity can be described as significant due to the potential abundance of Vaalian aged Stromatolites known to occur within the Reivilo Formation.

#### 6. FIELD INVESTIGATION

Dr Gideon Groenewald, an experienced fieldworker, visited the site of the Brakfontein PV facility on Tuesday 15 January and Wednesday 16 January 2015 to assess the potential impact of the construction of the PV facility on the palaeontological heritage of the site. The topography of the study area is mainly a flat crest area on the plateau. No indication of cave breccias were observed during the field investigation.

#### 7. PHOTOGRAPHIC RECORD

During the field investigation a photographic record was compiled of observations made (Table 7.1)

Table 7.1 Photographic record of observations

No	GPS	Description	Photo
1	27 33 52,5S 24 25 41,9E	General view of the study area	
2	27 34 58,3S 24 25 32,5E	Outcrop limited to surface exposure of dolomite	
3	27 35 17,4S 24 25 39,7E	Open veld with limited outcrop of dolomite on the surface	
4	27 35 19,1S 24 25 39,7E	Small scale stromatolites in dolomite	

5	27 35 6,5S 24 25 34,6E	Stromatolite structures in dolomite	
6	27 35 2,8S 24 25 32,5E	Small outcrops with good examples of stromatolites	
7	27 35 3,2S 24 25 31,7E	Stromatolite structures	
8	27 35 2,9S 24 25 32,5E	Surface weathering of stromatolitic dolomite	
9	27 34 57,3S 24 25 31,8E	Excavation for pylon anchors exposed examples of stromatolites in dolomite – see below	

10	27 34 57,3S 24 25 31,8E	Examples of stromatolites in dolomite exposed during excavation for pylon anchors	
11	27 34 49,1S 24 25 22,9E	Surface weathering of stromatolitic dolomite	
12	27 34 42,7S 24 25 15,4E	Small dome-like structures with weathering surface of dolomite	
13	27 34 39,2S 24 25 11,6E	Small stromatolite structures	
14	27 34 39,5S 24 25 11,5E	Local area with deep soil, possibly termite mound site associated with local sinkhole structure. No fossil remains observed.	

15	27 34 40,3S 24 25 13,0E	Small weathering features, no big dome structures present.	
16	27 34 40,3S 24 25 13,0E	General outcrop of stromatolitic dolomite with small-scale structures.	
17	27 34 40,5S 24 25 13,9E	Small scale stromatolites on rocks excavated for pylon foundations	
18	27 34 40,5S 24 25 13,9E	Small dome-like carbonate growths in hand specimen.	
19	27 34 42,7S 24 25 16,0E	Larger dome-like structure in dolomite	

20	27 34 45,3S 24 25 19,0E	Large scale dome-like structures in stromatolitic dolomite	

## 8. PALAEONTOLOGICAL SENSITIVITY AND SIGNIFICANCE

The desktop study suggests that the study area is underlain by sedimentary deposits of the Vaalian aged Reivilo Formation of the Ghaap Group, Transvaal Supergroup, and it was expected that it would thus be highly sensitive from a palaeontological heritage perspective. The field investigation results confirmed the presence of very well defined, albeit small-scale, stromatolites in the dolomite layers. It is therefore recommended that the study area maintains a Moderate palaeontological sensitivity, as illustrated in Figure 8.1. The ECO of the project must record the presence of well-defined stromatolite structures.



Figure 8.1 Palaeontological sensitivity of the study area

## 9. CONCLUSION AND RECOMMENDATIONS

The proposed site of the Brakfontein PV Facility is underlain by Vaalian aged dolomite of the Reivilo Formation, Ghaap Group, Transvaal Supergroup. Well-defined stromatolite structures were observed. The potential for finding well-defined stromatolites still remains high during excavation of PV Panel foundations in areas underlain by dolomite. The area has been allocated a Moderate Palaeontological significance and the ECO must report the presence of stromatolites where excavation of panel foundations expose fossil-rich beds.

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#### 10. REFERENCES

Johnson MR, Anhausser CR and Thomas RJ. 2006. The Geology of South Africa. Geological Society of South Africa.

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

#### **11. 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).

#### 12. 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.

Kently

Dr Gideon Groenewald Geologist