

**PALAEONTOLOGICAL DESKTOP ASSESSMENT FOR THE
CONSTRUCTION OF THE CEDARVILLE MIDDLE INCOME
HOUSING DEVELOPMENT IN THE MATATIELE LOCAL
MUNICIPALITY, ALFRED NZO DISTRICT MUNICIPALITY,
EASTERN CAPE PROVINCE.**

For:



DATE: 24 June 2015

By

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EXECUTIVE SUMMARY

Gideon Groenewald was appointed by NS Environmental (Pty) Ltd to undertake a desktop survey, assessing the potential palaeontological impact of the proposed construction of the Cedarville Middle Income Housing Development at the Town of Cedarville, Eastern Cape Province.

This report forms part of the Basic 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 site, a portion of commonage in Cedarville, Eastern Cape, falls within the jurisdiction of the Matatiele Local Municipality, Alfred Nzo Municipality (Figure 2.1). The land for housing development in ward 26 of Cedarville was identified by the Matatiele Local Municipality Council as a result of the high demand for high-middle income residential sites. The area identified is approximately 42ha in extent and an existing cemetery, approximately 7ha, already occupies the south western corner of the site.

The study site, a portion of commonage in Cedarville, Eastern Cape, falls within the jurisdiction of the Matatiele Local Municipality, Alfred Nzo Municipality and is underlain by deep soils, overlying Tertiary aged sedimentary rocks of the Tarkastad Subgroup and Quaternary aged Alluvium.

The deep soils expected in this area will not yield fossils and the only possibility for fossil recognition will be during excavation of trenches that are deeper than 1,5m. Due to the lower chances of finding significant fossils, a Medium Palaeontological Sensitivity is allocated to the site.

Recommendations:

- The EAP and ECO of the project must be informed of the fact that the Tarkastad Formation is highly sensitive for Palaeontological finds.
- Due to the presence of deep soils, it is recommended that a Medium Palaeontological Sensitivity is allocated to the development site and where trenches are deeper than 1,5m, there is a possibility of exposure of fossils.
- If fossils are recorded during excavation, a professional palaeontologist must be employed to record and rescue the fossils as part of a Phase 1 Palaeontological Impact Assessment.
- No further mitigation for Palaeontological Heritage is recommended at this stage.

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1. INTRODUCTION

1.1. Background

Gideon Groenewald was appointed by NS Environmental (Pty) Ltd to undertake a desktop survey, assessing the potential palaeontological impact of the proposed construction of the Cedarville Middle Income Housing Development at the Town of Cedarville, Eastern Cape Province.

This report forms part of the Basic 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. 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 Classes and Colour Coding

PALAEONTOLOGICAL SIGNIFICANCE/VULNERABILITY OF ROCK UNITS	
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.	
RED	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.
ORANGE	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.
GREEN	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.
BLUE	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.

GREY	<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.</p>
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1.3. Scope and Limitations of the Desktop Study

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

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

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

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

2. DESCRIPTION OF THE PROPOSED DEVELOPMENT

The study site, a portion of commonage in Cedarville, Eastern Cape, falls within the jurisdiction of the Matatiele Local Municipality, Alfred Nzo Municipality (Figure 2.1). The land for housing development in ward 26 of Cedarville was identified by the Matatiele Local Municipality Council as a result of the high demand for high-middle income residential sites. The area identified is approximately 42ha in extent and an existing cemetery, approximately 7ha, already occupies the south western corner of the site.



Figure 2.1 Satellite image showing the locality of the study area.

3. GEOLOGY

The study area is predominantly underlain by Triassic-aged rocks of the Tarkastad Subgroup, Karoo Supergroup with a small portion underlain by Quaternary-aged alluvium (Figure 3.1).

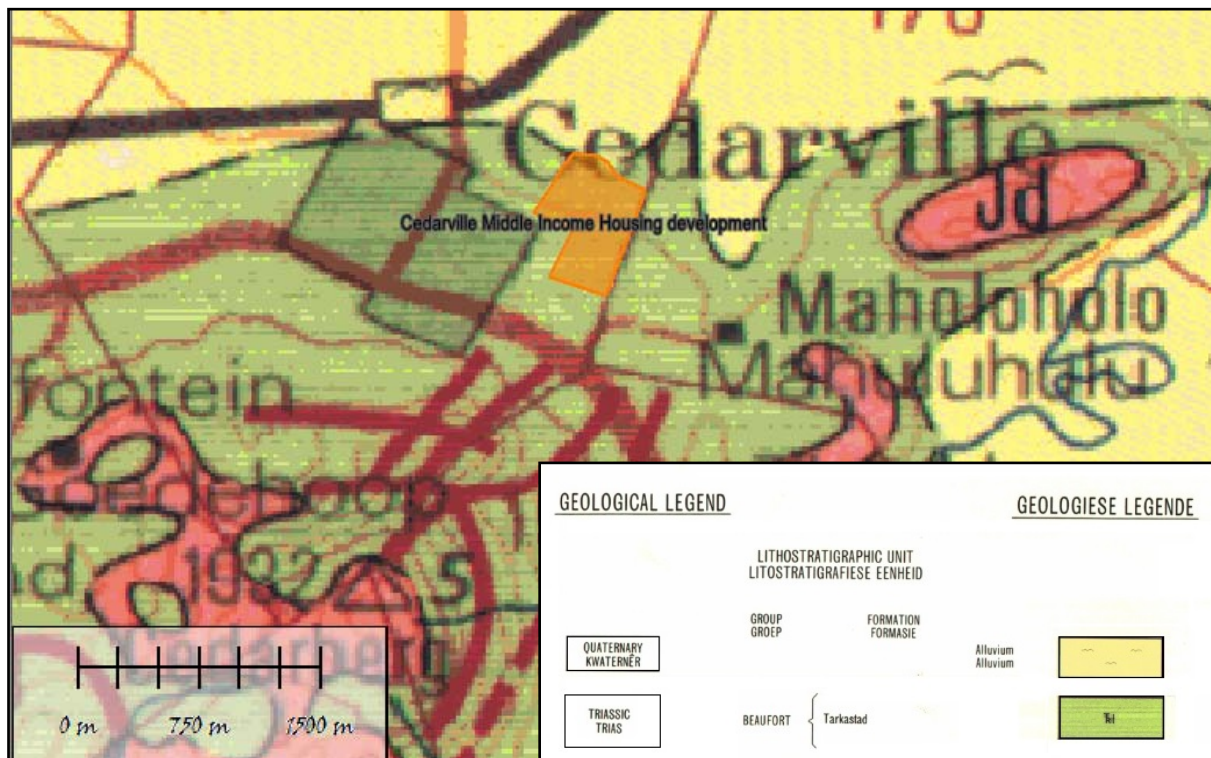


Figure 3.2 Geology of the Study Area.

3.1. Tarkastad Subgroup (Trt)

The Tarkastad Subgroup consists of a lower Katberg Formation and upper Burgersdorp Formation. The Katberg Formation is a predominantly arenaceous unit, interpreted as a braided fluvial deposit. The Burgersdorp Formation is predominantly argillaceous, interpreted as a meandering fluvial to lacustrine deposit (Johnson et al 2006; Groenewald 1996).

4. PALAEOONTOLOGY OF THE AREA

4.1. Tarkastad Subgroup (Trt)

The Triassic Tarkastad Subgroup is associated with the *Lystrosaurus* and *Cynognathus* Assemblage zones. This group of rock represent an important sedimentological and tectonic event in the geological history of the Karoo Supergroup with major deposition of sandstone with associated vertebrate fossils as well as well-defined casts of vertebrate burrows (Groenewald 1996; Rubidge (ed), 1995).

5. PALAEOONTOLOGICAL 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 fresh bedrock excavation envisaged (Figure 5.1). The different sensitivity classes used are explained in Table 1-1 above.

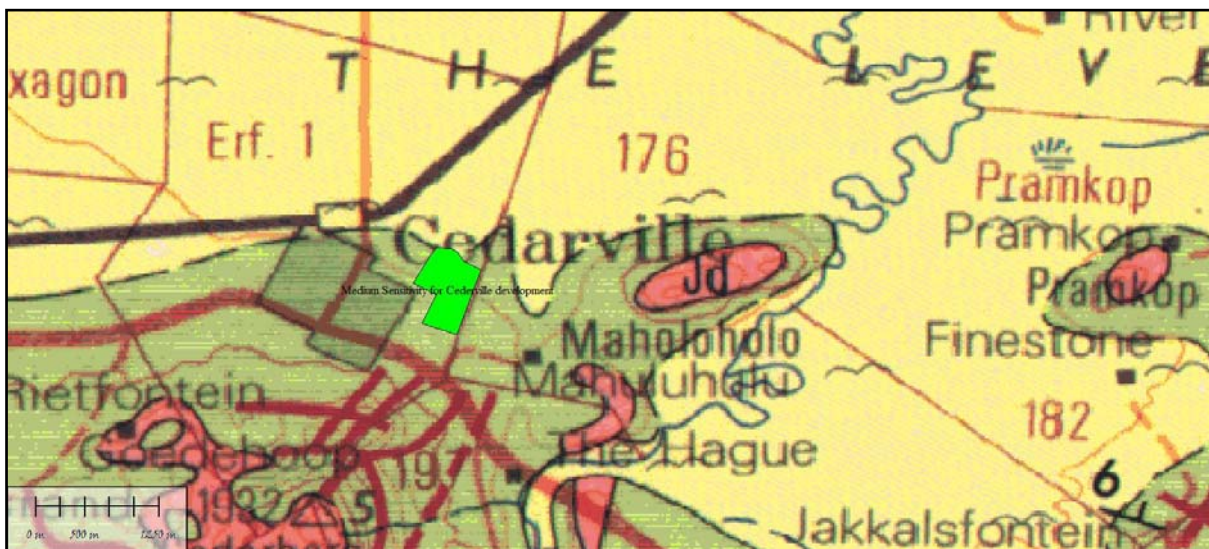


Figure 5.1 Palaeontological Sensitivity of the study area. For colour coding see Table 1-1

Google image interpretation and the authors experience of the region indicates that the entire development site is underlain by relatively deep soils (deeper than 1,5m) and it is unlikely that bedrock will be exposed before excavation of foundations for the buildings. The excavation of trenches for installation of infrastructure, such as water reticulation and sewerage works might require excavation of deeper than 1,5m. In cases of exposure of bedrock, where excavation is deeper than 1,5m, fossils might be exposed.

6. CONCLUSION AND RECOMMENDATIONS

The study site, a portion of commonage in Cedarville, Eastern Cape, falls within the jurisdiction of the Matatiele Local Municipality, Alfred Nzo Municipality and is underlain by deep soils, overlying Tertiary aged sedimentary rocks of the Tarkastad Subgroup and Quaternary aged Alluvium.

The deep soils expected in this area will not yield fossils and the only possibility for fossil recognition will be during excavation of trenches that are deeper than 1,5m. Due to the lower chances of finding significant fossils, a Medium Palaeontological Sensitivity is allocated to the site.

Recommendations:

- The EAP and ECO of the project must be informed of the fact that the Tarkastad Formation is highly sensitive for Palaeontological finds.
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- No further mitigation for Palaeontological Heritage is recommended at this stage.

7. REFERENCES

Groenewald, G.H., 1996. Stratigraphy of the Tarkastad Subgroup, Karoo Supergroup, South Africa: Unpublished Ph.D. Thesis, University of Port Elizabeth, South Africa, 145 p.

Johnson MR , Anhaeusser CR and Thomas RJ (Eds), 2006. The Geology of South Africa. GSSA, Council for Geoscience, Pretoria, 691pp.

Rubidge, B.S. (Ed.). 1995. Biostratigraphy of the Beaufort Group (Karoo Supergroup). SACS Biostratigraphic Series, vol. 1.

8. QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

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

9. DECLARATION OF INDEPENDENCE

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



Dr Gideon Groenewald
Geologist