PALAEONTOLOGICAL DESKTOP ASSESSMENT FOR THE Mpact (Pty) Ltd Paper Mill DEVELOPMENT, EKURHULENI METROPOLITAN MUNICIPALITY, GAUTENG PROVINCE

For:

HIA CONSULTANTS

APELSER ARCHAEOLOGICAL CONSULTING CC
Cell: 0834593091

DATE: 31 January 2017

By

Gideon Groenewald
Cell: 078 713 6377

EXECUTIVE SUMMARY

Gideon Groenewald was appointed by APELSER ARCHAEOLOGICAL CONSULTING CC to do a Desktop Palaeontological Heritage Resources Impact Assessment or the extension of the Mpact (Pty) Ltd Paper Mill yard, situated on Portion 228, New Era, Extension 1 in Springs, Ekurhuleni Metropolitan Municipality, Gauteng Province.

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

The proposed development of an extension of the Mpact (Pty) Ltd yard at Springs on Portion 228, New Era, Extension 1 in Springs, Ekurhuleni Metropolitan Municipality, Gauteng Province, is underlain by highly significant Permian aged sediments of the Vryheid Formation.

The fact that no outcrops will be present on the site of the development it will be fruitless to visit the site for a Phase 1 Palaeontological Impact Assessment (PIA) before excavation for foundations or levelling of ground extends to at least 1.5m depth. If such an excavation is planned, the "Chance Find Protocol" provided as an Appendix to this document, will be applicable. No further assessments or action is recommended at this stage and the development can proceed on the proviso that the actions and precautions prescribed in the "Chance Find Protocol" must be included in in the EMPr documents that must be provided for the attention of the SAHRA officials for final approval of the ROD in the EIA process.

Recommendations:

1. The EAP as well as the ECO for this project must be made aware of the fact that due to the possible presence of significant plant fossils at the study site, the entire study area must be regarded as of Very Highly sensitive for Palaeontological Heritage.
2. From the Google image surveys it is clear that no outcrops are presently exposed in the study area and it is recommended that a suitably qualified palaeontologist must prepare a "Chance Find Protocol" for the project and that the recommendations for a Phase 1 Palaeontological Impact Assessment be followed as soon as the first excavations for foundations or any clearance of topsoil commence.
3. These recommendations must be worked into the EMPr of the project so that any recording of plant or vertebrate fossils during excavation can be recorded timeously and reported to SAHRA for appropriate conservation of a representative sample.
4. These recommendations as well as the "Chance Find Protocol" must be included into the EMPr of the Project for the attention of SAHRA officials before the Project commences.

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1. INTRODUCTION

1.1. Background

Gideon Groenewald was appointed by APELSER ARCHAEOLOGICAL CONSULTING CC to do a Desktop Palaeontological Heritage Resources Impact Assessment for the extension of the Mpact (Pty) Ltd Paper Mill yard, situated on Portion 228, New Era, Extension 1 in Springs, Ekurhuleni Metropolitan Municipality, Gauteng Province.

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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 (2628 East Rand). The known fossil heritage within each rock unit is inventoried from the published scientific literature and previous palaeontological impact studies in the same region.

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

Table 1.1 Palaeontological sensitivity classification and colour coding

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) and Groenewald et al, (2014).	
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	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 implacement 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.

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 developer proposes to increase the extent of the Mpact (Pty) Ltd Yard on Portion 228, New Era Extension 1 in Springs (Figure 2.1).

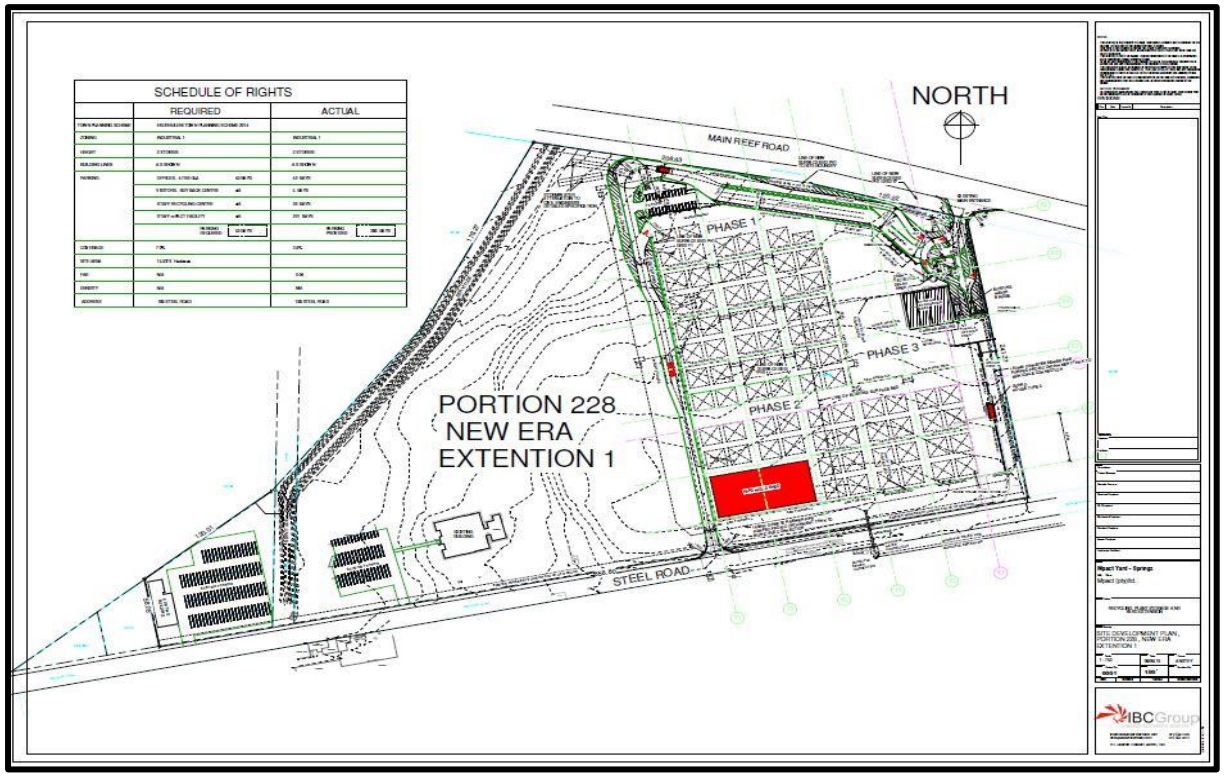

Figure 2.1 Locality and Layout of the Mpact (Pty) Ltd Yard site

3. GEOLOGY

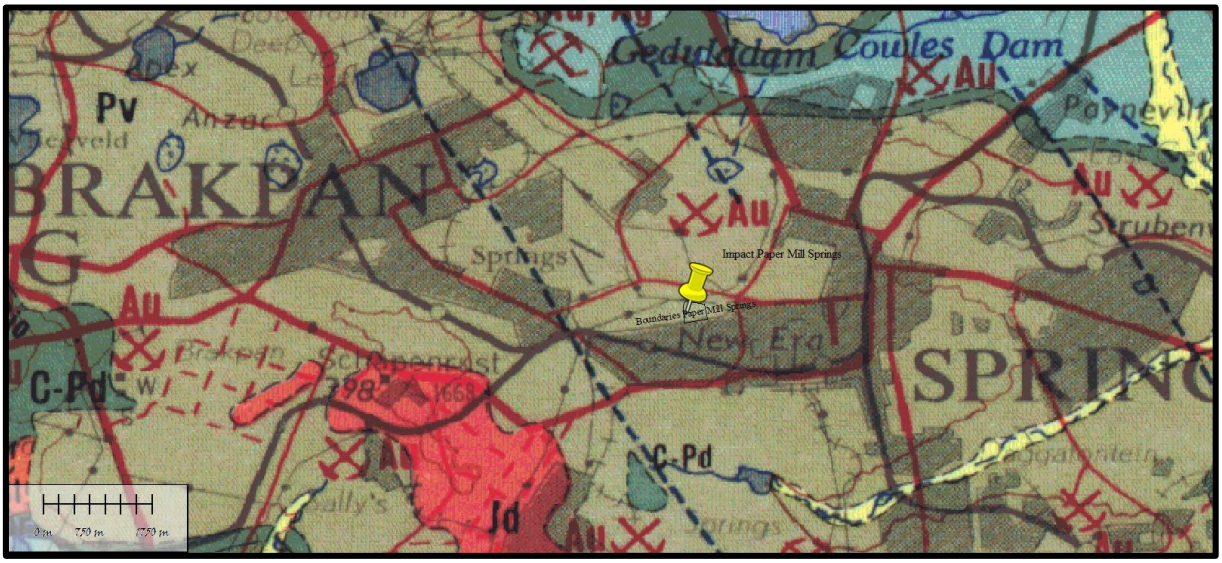

Figure 3.1 Geology underlying the Mpact (Pty) Ltd yard extension. The Vryheid Formation underlies the entire proposed development.

The study area is underlain by Permian aged sedimentary rocks of the Vryheid Formation (Pv), Ecca Group, of the Karoo Supergroup (Figure 3.1).

3.1. Karoo Supergroup, Ecca Group, Vryheid Formation (Pv)

Vryheid Formation
The Permian aged Vryheid formation consists mainly of interbedded coarse-grained sandstone and dark grey mudstone and shale. In large parts of the outcrop areas close to the study area this formation is extensively mined for economic quantities of coal (Johnson et al, 2009). The Vryheid Formation might be a time-equivalent of the Whitehill Formation in the south of the Karoo Basin.

4. PALAEONTOLOGY OF THE AREA

4.1. Karoo Supergroup, Ecca Group, Vryheid Formation (Pv)

Vryheid Formation

The Vryheid Formation is well-known for the occurrence of coal beds that resulted from the accumulation of plant material over long periods of time. Plant fossils described by Bamford (2011) from the Vryheid Formation are; *Azaniodendron fertile, Cyclodendron leslii, Sphenophyllum hammanskraalensis, Annularia sp., Raniganjia sp., Asterotheca spp., Liknopetalon enigmata, Glossopteris > 20 species, Hirsutum 4 spp., Scutum 4 spp., Ottokaria 3 spp., Estcourtia sp., Arberia 4 spp., Lidgetonnia sp., Noeggerathiopsis sp. and Podocarpidites sp.*

According to Bamford (2011) "Little data have been published on these potentially fossiliferous deposits. Around the coalmines there is most likely to be good material and yet in other areas the exposures may be too poor to be of interest. When they do occur fossil plants are usually abundant and it would not be feasible to preserve and maintain all the sites, however, in the interests of heritage and science such sites should be well recorded, sampled and the fossils kept in a suitable institution.

Although no vertebrate fossils have been recorded from the Vryheid Formation, invertebrate trace fossils have been described in some detail by Mason and Christie (1985). It should be noted, however, that the aquatic reptile, *Mesosaurus*, which is the earliest known reptile from the Karoo Basin, as well as fish (*Palaeoniscus capensis*), have been recorded in equivalent-aged strata in the Whitehill Formation in the southern part of the basin (MacRae, 1999; Modesto, 2006). Indications are that the Whitehill Formation in the main basin might be correlated with the mid-Vryheid Formation. If this assumption proves correct, there is a possibility that Mesosaurus could be found in the Vryheid Formation (Catuneanu et al 2005).

The late Carboniferous to early Jurassic Karoo Supergroup of South Africa includes economically important coal deposits within the Vryheid Formation of Natal. The Karoo sediments are almost entirely lacking in body fossils but ichnofossils (trace fossils) are locally abundant. Modern sedimentological and ichnofaunal studies suggest that the north-eastern part of the Karoo basin was marine. In KwaZulu-Natal a shallow basin margin accommodated a prograding fluviodeltaic complex forming a broad sandy platform on which coal-bearing sediments were deposited. Ichnofossils include U-burrows (formerly *Corophioides*) which are assigned to ichnogenus *Diplocraterion* (Mason and Christie, 1985).

5. PALAEONTOLOGICAL SENSITIVITY

The likely impact of the proposed development on local fossil heritage is determined on the basis of the palaeontological sensitivity of the rock units concerned and the nature and scale of the

development itself, most notably the extent of bedrock excavation envisaged (Figure 5.1). The different sensitivity classes used are explained in Table 1.1 above.

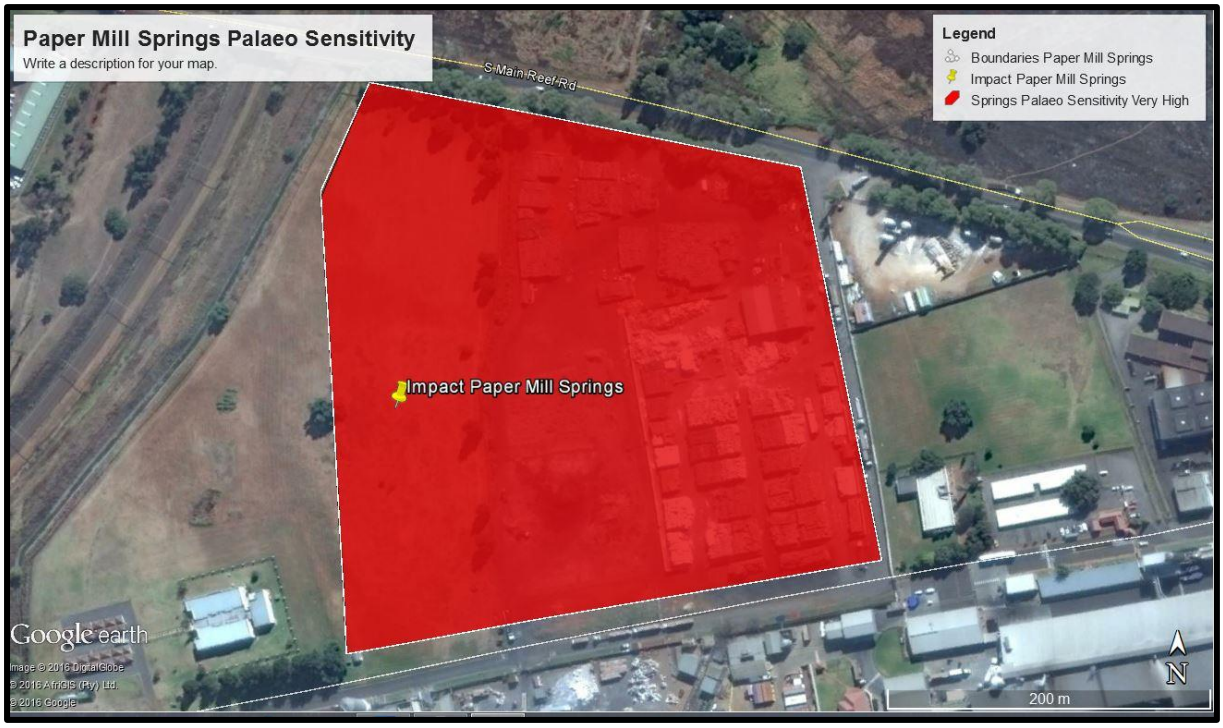

Figure 5.1 The Palaeontological sensitivity of the entire development site is rated as Very High. For explanation of colour coding see Table 1.1.

The Vryheid Formation of the Ecca Group is well-known for the extremely well-preserved plant remains that are associated with the deltaic and near shore deposits of this Formation in the northern part of the Karoo Basin. The entire study area is however situated in a disturbed urban environment and it is highly unlikely that any fossils will be present on the surface. Any attempt to do a Phase 1 Palaeontological Impact Assessment (PIA) before excavation or at least removal of the soil layer to more than 1.5m depth will be fruitless. It is however essential that a "Chance Find Protocol" be put in place for the start of the Excavations for this development if the excavation for any foundations or levelling of the land will exceed 1.5m. A "Chance Find Protocol" document is included as an Appendix to this Desktop Survey to ensure that the developer complies with the basic requirements of the NHA legislation in South Africa.

No further actions or impact assessments for Palaeontological Heritage are needed at this stage and the recommendation is that the development can proceed with the proviso that the recommendations and actions summarized in the "Chance Find Protocol" is adopted as part of the EMPr of the project implementation plan.

6. CONCLUSION AND RECOMMENDATIONS

The proposed development of an extension of the Mpact (Pty) Ltd yard at Springs on Portion 228, New Era, Extension 1 in Springs, Ekurhuleni Metropolitan Municipality, Gauteng Province, is underlain by highly significant Permian aged sediments of the Vryheid Formation.

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in in the EMPr documents that must be provided for the attention of the SAHRA officials for final approval of the Environmental Authorisation in the EIA process.

Recommendations:

1. The EAP as well as the ECO for this project must be made aware of the fact that due to the possible presence of significant plant fossils at the study site, the entire study area must be regarded as of Very Highly sensitive for Palaeontological Heritage.
2. From the Google image surveys it is clear that no outcrops are presently exposed in the study area and it is recommended that a suitably qualified palaeontologist must prepare a "Chance Find Protocol" for the project and that the recommendations for a Phase 1 Palaeontological Impact Assessment be followed as soon as the first excavations for foundations or any clearance of topsoil commence.
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4. These recommendations as well as the "Chance Find Protocol" must be included into the EMPr of the Project for the attention of SAHRA officials before the Project commence.

7. REFERENCES

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

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

Bamford M. 1999. Permo-Triassic Fossil Woods from the South African Karoo Basin. Palaeontologia Africana, 35-36, p25.

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

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

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

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

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