
**PALAEONTOLOGICAL IMPACT ASSESSMENT
OF THE PROPOSED TRUCK STOP
DEVELOPMENT AT PALMIET 585, VREDE,
FREE STATE**



Prepared by:

Elize Butler

Karoo Palaeontology

National Museum

Bloemfontein

Prepared for:
Dejager Coffee Cc
PO Box 88
Warden
9890

30 May 2015

Prepared by:

Elize Butler

Karoo Palaeontology Department

National Museum

P. O. Box 266

Bloemfontein

9300

Tel: 051-447-9609

Fax: 051-447-6273

Email: elize.butler@nasmus.co.za

EXECUTIVE SUMMARY

The development of a truck stop is proposed on Portion 4 of Palmiet 585, Vrede, Free State. Due to Section 35 of the National Heritage Resources Act, a palaeontological impact assessment is required to detect the presence of fossil material at the proposed development site.

The development area is primarily underlain by Early Jurassic dolerites of the Karoo Dolerite Suite. These rocks have a very low Palaeontological vulnerability. The rock units are associated with intrusive igneous activities and no life would have been possible during emplacement of the rocks. **Dolerites are thus not fossiliferous and the palaeontological impact is thus insignificant.**

It is therefore recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required for the commencement of this development.

Contents

1. INTRODUCTION.....	4
1.1. Objective.....	5
2. BACKGROUND TO THE GEOLOGICAL AND PALAEOLOGICAL HISTORY.....	6
3. GEOGRAPHICAL LOCATION OF THE SITE.....	8
3.1. Site visit.....	10
4. METHODS.....	12
4.1 Assumptions and Limitations.....	12
5. FINDINGS AND RECOMMENDATIONS.....	13
6. REFERENCES.....	14

1. INTRODUCTION

Dejager Coffee Cc appointed DeJong Design Studios Cc for the planning and upgrade of the proposed truck shop and associated facilities on Portion 4 of Palmiet 585, Vrede in the Free State (Fig. 1)

This development will involve the upgrade and construction of new buildings and will include substantial excavations into the superficial sediment cover as well as locally into the underlying bedrock. These excavations will modify the existing topography and may disturb damage or destroy scientific valuable fossil heritage exposed at the surface or buried below ground. Palaeontological material is unique and non-renewable and is protected by the National Heritage Resources Act (Act No. 25 of 1999, section 35, see Appendix 1). A Palaeontological Impact Assessment of the proposed development is therefore necessary to certify that palaeontological material is either removed, or is not present.



Figure 1. Satellite image of the development area on portion 4 of Palmiet 585, Vrede, Free State. (Modified from Google Earth, 2015).

1.1.Objective

To conduct a Palaeontological Impact Assessment for the mixed development on Portion 4 of Palmiet 585, Vrede in the Free State, to determine the impact on potential palaeontological material at this site.

When a palaeontological desktop study is conducted, the potentially fossiliferous rocks (i.e. groups, formations, members, etc) represented within the study area are determined from geological maps. The known fossil heritage within each rock unit is collected from published scientific literature; Fossil sensitivity map; consultations with professional colleagues, previous palaeontological impact studies in the same region and the databases of various institutions may be consulted. This data is then used to assess the palaeontological sensitivity of each rock unit of the development area. The likely impact of the proposed development on local fossil heritage is subsequently established on the basis of

- the palaeontological sensitivity of the rocks concerned and
- the nature and scale of the development itself (extent of new bedrock excavated)

When rocks of moderate to high palaeontological sensitivity are present within the development area, a field-based assessment by a professional palaeontologist is necessary. Based on this desktop data as well as a field examination of representative exposures of all major sedimentary rock present, the impact significance of the planned development is considered with recommendations for any further studies or mitigation.

2. BACKGROUND TO THE GEOLOGICAL AND PALAEOONTOLOGICAL HISTORY

The area **surrounding** Palmiet 585 is situated within the Beaufort Group, Adelaide Subgroup (Karoo Supergroup), and is primarily represented by late Permian, Balfour Formation sedimentary rocks (Muntingh,1989), while the **development area itself** is situated on **Karoo Dolerite** (Fig. 2).

The flood plains of the Beaufort Group (Karoo Supergroup) are internationally renowned for the early diversification of land vertebrates and provide the worlds' most complete transition from early "reptiles" to mammals.

The Karoo Supergroup strata are between 310 and 182 million years old and span the Upper Carboniferous to Middle Jurassic Periods. During this period the basin developed from an inland sea flooded by a melting ice cap, to a giant lake (Ecca Lake) fed by seasonal meandering (and periodically braided) rivers. The lake progressively shrank as it filled with sediment and the basin's rate of subsidence stabilised.

The Beaufort group consists of largely fluvial sediments which were deposited on the floodplains of these rivers. The land became progressively more arid and was covered with windblown sand just before the end of the basin's cycle. Finally the subcontinent was inundated with basaltic lava to form the capping basalts of the Jurassic aged Drakensberg Group. The development of the **Early Jurassic Dolerite Suite** preceded the break-up of the Gondwana supercontinent and is described by Johnson (1984). During the Jurassic the volcanic Drakensberg were formed and cracks in the earth's crust were filled with molten lava that cooled to form dolerite dykes. Magma injected horizontally between sediments, cooled down and formed horizontal stills of dolerite.

The dolerites are responsible for thermal metamorphism (baking) of the adjacent Karoo bedrocks. The dolerite outcrops in themselves is of no palaeontological significance because these are high temperature igneous rocks emplaced at depth within the Earth's crust (Almond et al. 2008).

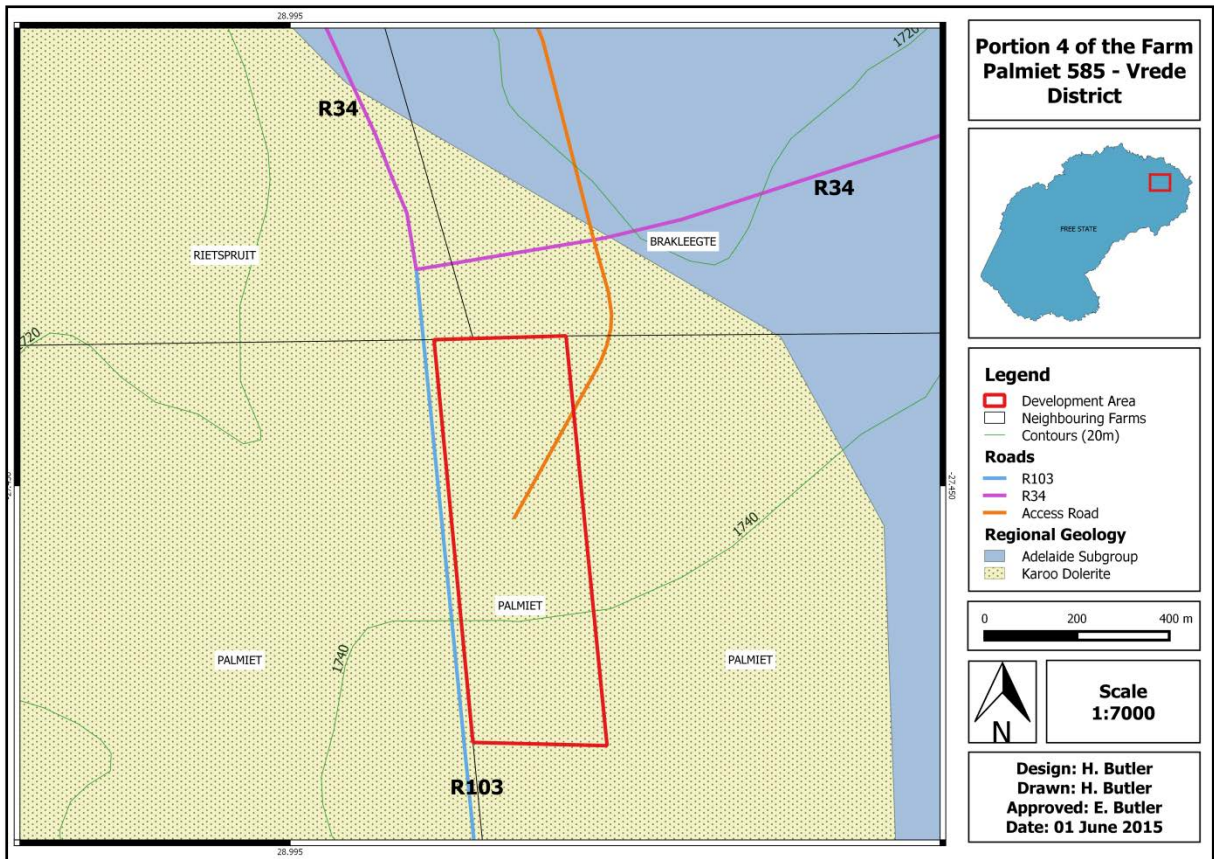


Figure 2. Surface geology of the Vrede development area (outlined in red) as well as the immediate environment. The development site is underlain by the Karoo dolerite Suite (indicated in yellow). (Adapted from the 2728 Frankfort 1:250 000 Geology Map, Geological Survey, 1996)

3. GEOGRAPHICAL LOCATION OF THE SITE

The development area on portion 4 of Palmiet 585, Vrede District, Free State is 16 km northwest of Vrede and consists of 28.2516 hectare. The existing development area forms a prominent landmark on the turnoff to Vrede, near the N3, Grassland meander between Johannesburg and Durban. The property lies next to the R34 off-ramp to Vrede, where the R34 (from the south) and R103 (from the north) roads meet. The R103 and R34 link with the north-eastern leg of the N3 national road.

The development area at Palmiet 585 has been utilized over the past 50 years as a truck stop and is characterized as an area of very low relief (Fig.3).

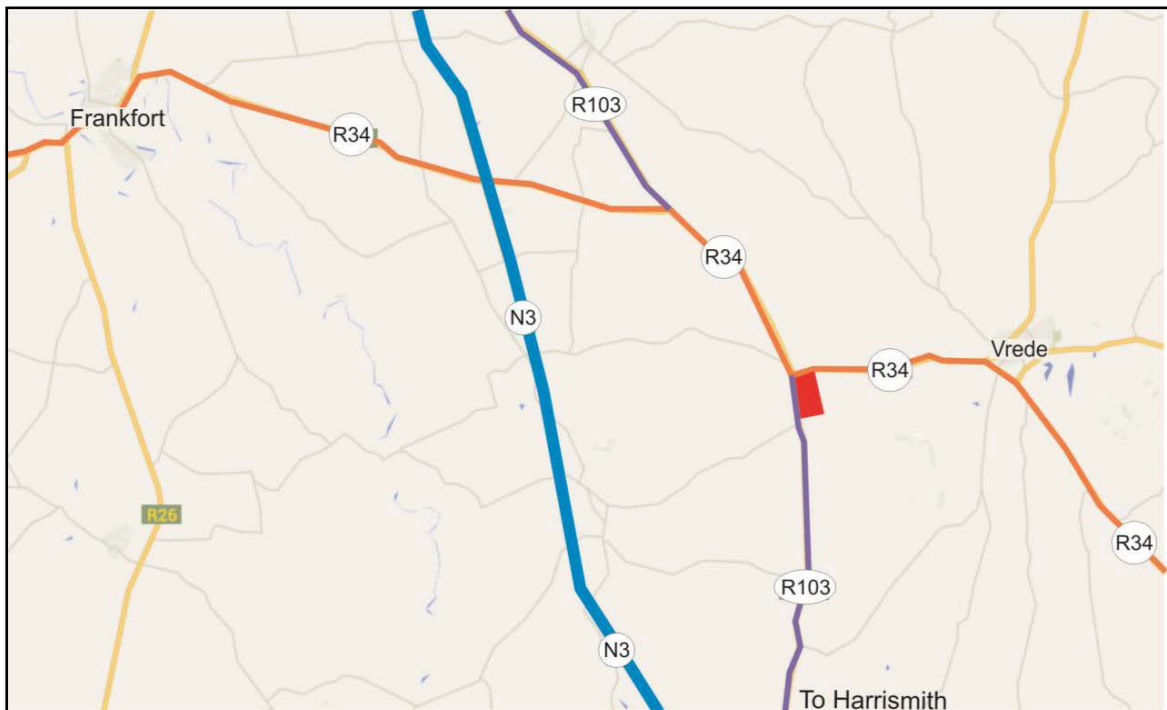


Figure 2: Location of development area (red square) in the Vrede district. Roads in the area are: N3 National road indicated in blue; R34 north of the site is shown in orange and the R103 (south of the site) is indicated in purple. Local roads are indicated in yellow.

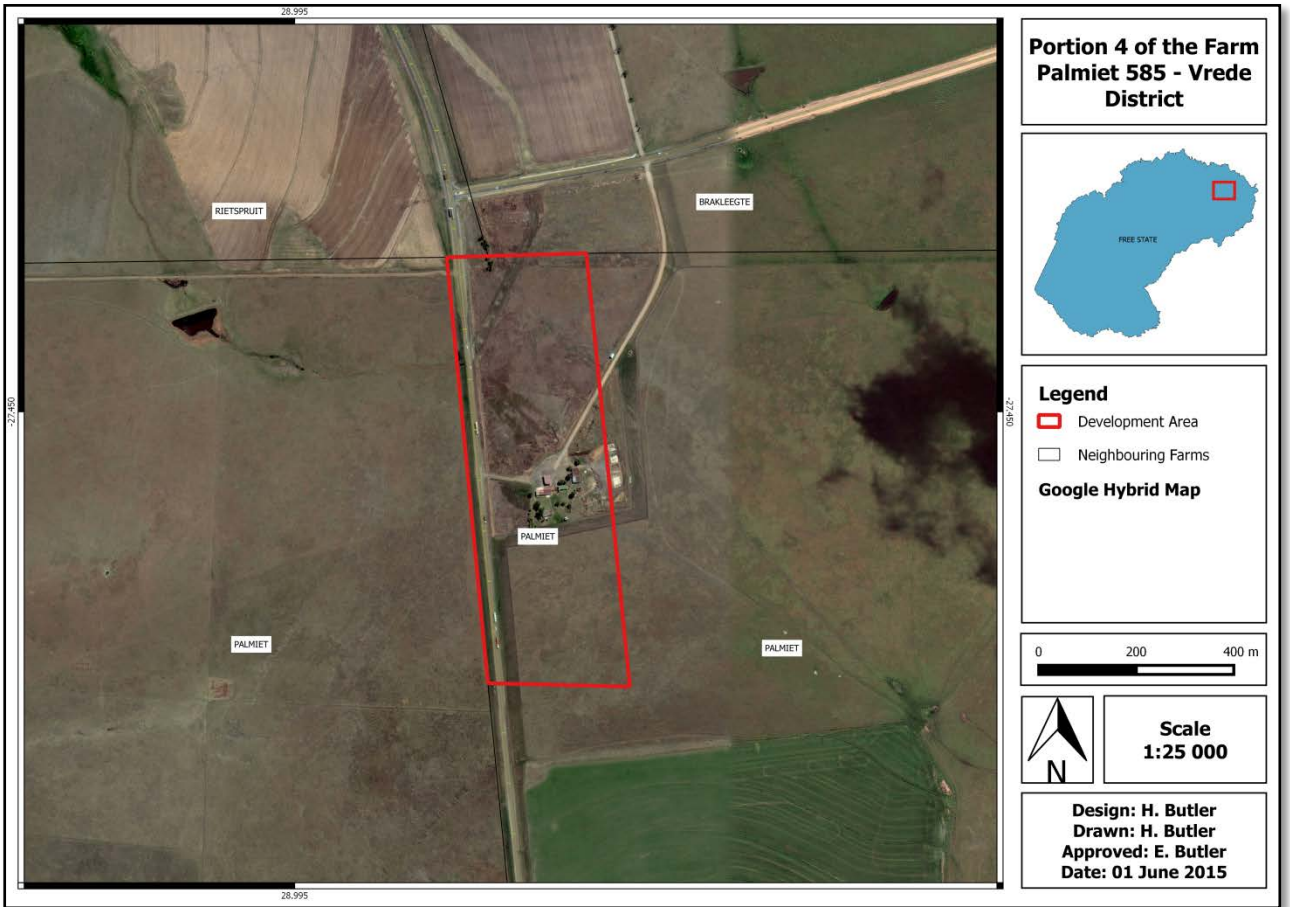


Figure 3. Google Hybrid Map of the development area on portion 4 of Palmiet 585, Vrede, Free State indicating the low relief (Modified from Google Earth Shape file).

3.1. Site visit





4. METHODS

A Palaeontological Impact Assessment was conducted to assess the potential risk to palaeontological material (fossils, trace fossils) in the proposed areas of development. The author's experience, aerial photos (using Google, 2015), topographical and geological maps were used to assess the proposed area of development.

4.1 Assumptions and Limitations

The accuracy and reliability of desktop Palaeontological Impact Assessments as components of heritage impact assessments are normally limited by the following restrictions:

- Old fossil databases that have not been kept up-to-date or are not computerized. These databases do not always include relevant locality or geological information. South Africa has a limited number of professional palaeontologists that carry out fieldwork and most development study areas have never been surveyed by a palaeontologist.
- The accuracy of geological maps where information may be based solely on aerial photographs and small areas of significant geology have been ignored. The sheet explanations for geological maps are inadequate and little to no attention is paid to palaeontological material.
- Impact studies and other reports (*e.g.* of commercial mining companies) - is not readily available for desktop studies.

Large areas of South Africa have not been studied palaeontologically. Fossil data collected from different areas but in similar Assemblage Zones might however provide insight on possible occurrence of fossils in an unexplored area. Desktop studies of this nature therefore usually assume the presence of unexposed fossil heritage within study areas of similar geological formations. Where considerable exposures of bedrocks or potentially fossiliferous superficial sediments are present in the study area, the reliability of a palaeontological impact assessment may be significantly improved through field assessment by a professional palaeontologist.

5. FINDINGS AND RECOMMENDATIONS

In contrast to the nearby Adelaide Formation, the development of the proposed truck station is of no palaeontological heritage significance since these igneous rocks are entirely unfossiliferous, and any fossils preserved within the adjacent country rocks are likely to have been baked, perhaps destroyed, during intrusion of hot dolerite magmas.

It is therefore recommended that exemption from further specialist palaeontological studies and mitigation be granted for this development.

However, care should be given to access routes, which would not be limited to dolerite. Should any substantial fossil remains (e.g. vertebrate bones and teeth, petrified wood, plant fossil assemblages) be encountered during excavation, these should be reported to SAHRA (South African Heritage Research Agency) for possible mitigation by a professional palaeontologist.

The specialist involved would require a collection permit from SAHRA. Fossil material must be curated in an approved collection (e.g. museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

6. REFERENCES

ALMOND, J.E., DE KLERK, W.J. & GESS, R. 2008. Palaeontological heritage of the Eastern Cape. Draft report for SAHRA, 20 pp. Natura Viva cc, Cape Town.

DUNCAN, A.R. & MARSH, J.S. 2006. The Karoo Igneous Province. Pp. 501-520 in Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (eds.) The geology of South Africa. Geological Society of South Africa, Johannesburg & the Council for Geoscience, Pretoria.

Johnson, M.R. *et. al.* 2006. Sedimentary Rocks of the Karoo Supergroup. **In:** M.R. Johnson, *et. al.* (eds). *The Geology of South Africa*. Geological Society of South Africa.

KENT, L.E. 1980. Part 1: Lithostratigraphy of the Republic of South Africa, South West Africa/Namibia and the Republics of Bophuthatswana, Transkei and Venda. SACS, Council for Geosciences, Pp 535-574.

KITCHING, J.W. 1977. The distribution of the Karoo vertebrate fauna, with special reference to certain genera and the bearing of this distribution on the zoning of the Beaufort beds. *Memoirs of the Bernard Price Institute for Palaeontological Research, University of the Witwatersrand, No. 1*, 133 pp (incl. 15 pls).

GRADSTEIN, F.M., J.G.OGG, M.D.SCHMITZ&G.M.OGG.(Coordinators). 2012. The Geologic Time Scale 2012. Boston, USA: Elsevier, 2 volumes plus chart, 1176 pp.

MCCARTHY, T. & RUBIDGE, B. 2005. The story of Earth and life: a southern African perspective on a 4.6-billion-year journey. 334pp. Struik, Cape Town.

QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

Elize Butler has an MSc in Palaeontology from the University of the Free State, Bloemfontein, South Africa. She has been working at the National Museum for the past 22 years and currently holds the position of Collection Manager of the Karoo Vertebrate Collection of the Palaeontology Department at the National Museum in Bloemfontein. Her current research interests comprise of Permo-Triassic vertebrate palaeobiology, with a special focus on gorgonopsians at the End-Permian Mass Extinction.

Declaration of Independence

I, Elize Butler, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed project, application or appeal in respect of which I was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise my objectivity in this work.

Sincerely

A handwritten signature in black ink that reads "Butler." The signature is written in a cursive style with a large initial 'B'.

Mrs. Elize Butler

Appendix 1. Section 25 of the National Heritage Resources Act 1999.

Heritage resources

The various categories of heritage resources are recognised as part of the National Estate in Section 3 of The National Heritage Resources Act. This include among others:

- geological sites of scientific or cultural importance;
- palaeontological sites;
- palaeontological objects and material, meteorites and rare geological specimens.

According to Section 25 of the National Heritage Resources Act 1999, dealing with archaeology, palaeontology and meteorites:

- The protection of archaeological and palaeontological sites and material and meteorites is the responsibility of a provincial heritage resources authority.
- All archaeological objects, palaeontological material and meteorites are the property of the State.
- Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.
- No person may, without a permit issued by the responsible heritage resources authority—
 - destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;
 - destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;
 - trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or

- bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.
- When the responsible heritage resources authority has reasonable cause to believe that any activity or development which will destroy, damage or alter any archaeological or palaeontological site is under way, and where no application for a permit has been submitted and no heritage resources management procedure in terms of section 38 has been followed, it may—
 - serve on the owner or occupier of the site or on the person undertaking such development an order for the development to cease immediately for such period as is specified in the order;
 - carry out an investigation for the purpose of obtaining information on whether or not an archaeological or palaeontological site exists and whether mitigation is necessary