Palaeontological Impact Assessment for the proposed Kudu Power Station power lines to the Oranjemund MTS, Northern Cape Province.

Desktop Study

For

Landscape Dynamics

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Expertise of Specialist

The Palaeontologist Consultant is: Prof Marion Bamford
Qualifications: PhD (Wits Univ, 1990); FRSSAf, ASSAf
Experience: 30 years research; 20 years PIA studies

Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by Landscape Dynamics (Pty) Ltd, on behalf of their client Eskom. The views expressed in this report are entirely those of the author and Landscape Dynamics and no other interest was displayed during the decision making process for the project.

Specialist: …….. Prof Marion Bamford……..

Signature: …….

Executive Summary

Eskom and NamPower propose to construct two 400kV transmission lines from the Kudu power station near Oranjemund, Namibia, to a new MTS on the South African side of the Orange River, a distance of less than 5km. The National Heritage Resources Act (Act 25 of 1999) and the National Environmental Management Act (Act 107 of 1998) of South Africa requires that the proposed development must be preceded by the relevant impact assessment, in this case for palaeontology.

This whole region, the Gariep Belt, where the African plate was sub-ducted below the South American plate, around 770-730 million years ago, was tectonically and volcanically active and did not provide good conditions for the preservation of any marine or invertebrate fossils. If, in the extremely unlikely event of any trace fossils or invertebrate fossils being found once excavations for foundations for the towers, power station and infrastructure have begun, they should be removed and protected, and a palaeontologist called to assess their significance.

Palaeontological Impact Assessment for the proposed Kudu Power Station power lines to the Oranjemund MTS, Northern Cape Province.

1. Background

Eskom and NamPower have been tasked to provide a transmission solution to the proposed Kudu Gas Power Station in Southern Namibia. The power station will be producing 800-1050MW power that will be evacuated via the Nampower and Eskom Transmission works. The Kudu Power Station is located in Namibia approximately 40km north of the Oranjemund MTS. NamPower is responsible for the environmental authorisation on the Namibian side. Eskom must obtain environmental authorisation for the part of the project situated on the South African side, from the Oranjemund Substation (situated east of Alexander Bay, adjacent to the Orange River). The property description is the farm Groot Derm 10-Namaqualand RD.

The project components are the following:-

- Establishment of the existing 400kV at Oranjemund MTS as follows:-
  - 400kV yard and equipment including busbar;
  - Installation of a 1X315MVA 400/220kV transformer
  - Create at least 4X 400kV line bays to allow for potential development.
- Construction of 2X 400kV lines from the Orange River to Oranjemund Substation – approximately 5km of which a 6km wide corridor (3km for each line) should be investigated.

It was again confirmed with Eskom that there are no real alternatives to the powerline route, apart from slight deviation within a reasonable corridor because of the fact that it must align with lines coming in from the Kudu Power Station from the Namibian side of the project.

The National Heritage Resources Act (Act 25 of 1999) and the National Environmental Management Act (Act 107 of 1998) requires that the proposed development must be preceded by the relevant impact assessment, in this case for palaeontology.

This report complies with the requirements of the NEMA and environmental impact assessment (EIA) regulations (GNR 982 of 2014). The table below provides a summary of the requirements, with cross references to the report sections where these requirements have been addressed.

Table 1: Specialist report requirements in terms of Appendix 6 of the EIA Regulations (2014)

A specialist report prepared in terms of the Environmental Impact Regulations of 2014 must contain:	Relevant section in report
Details of the specialist who prepared the report	Prof Marion Bamford
The expertise of that person to compile a specialist report including a curriculum vitae	Palaeontologist (PhD Wits 1990) CV attached
A declaration that the person is independent in a form as may be specified by the competent authority	Page 2

An indication of the scope of, and the purpose for which, the report was prepared	Section 1
The date and season of the site investigation and the relevance of the season to the outcome of the assessment	n/a Seasons make no difference to fossils
A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 2
The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	See table 3
An identification of any areas to be avoided, including buffers	n/a
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;	n/a
A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 6
A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	n/a
Any mitigation measures for inclusion in the EMPr	Section 7
Any conditions for inclusion in the environmental authorisation	Section 7
Any monitoring requirements for inclusion in the EMPr or environmental authorisation	n/a
A reasoned opinion as to whether the proposed activity or portions thereof should be authorised and	Section 7
If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 7
A description of any consultation process that was undertaken during the course of carrying out the study	n/a
A summary and copies if any comments that were received during any consultation process	n/a
Any other information requested by the competent authority.	n/a

2. Methods and Terms of Reference

1. In order to determine the likelihood of fossils occurring in the affected area geological maps, literature, palaeontological databases and published and unpublished records must be consulted.

2. If fossils are likely to occur then a site visit must be made by a qualified palaeontologist to locate and assess the fossils and their importance.

3. Unique or rare fossils should either be collected (with the relevant South African Heritage Resources Agency (SAHRA) permit) and removed to a suitable storage and curation facility, for example a Museum or University palaeontology department or protected on site.

4. Common fossils can be sacrificed if they are of minimal or no scientific importance but a representative collection could be made if deemed necessary.

The published geological and palaeontological literature, unpublished records of fossil sites, catalogues and reports housed in the Evolutionary Studies Institute, University of the Witwatersrand, and SAHRA databases were consulted to determine if there are any records of fossils from the sites and the likelihood of any fossils occurring there.

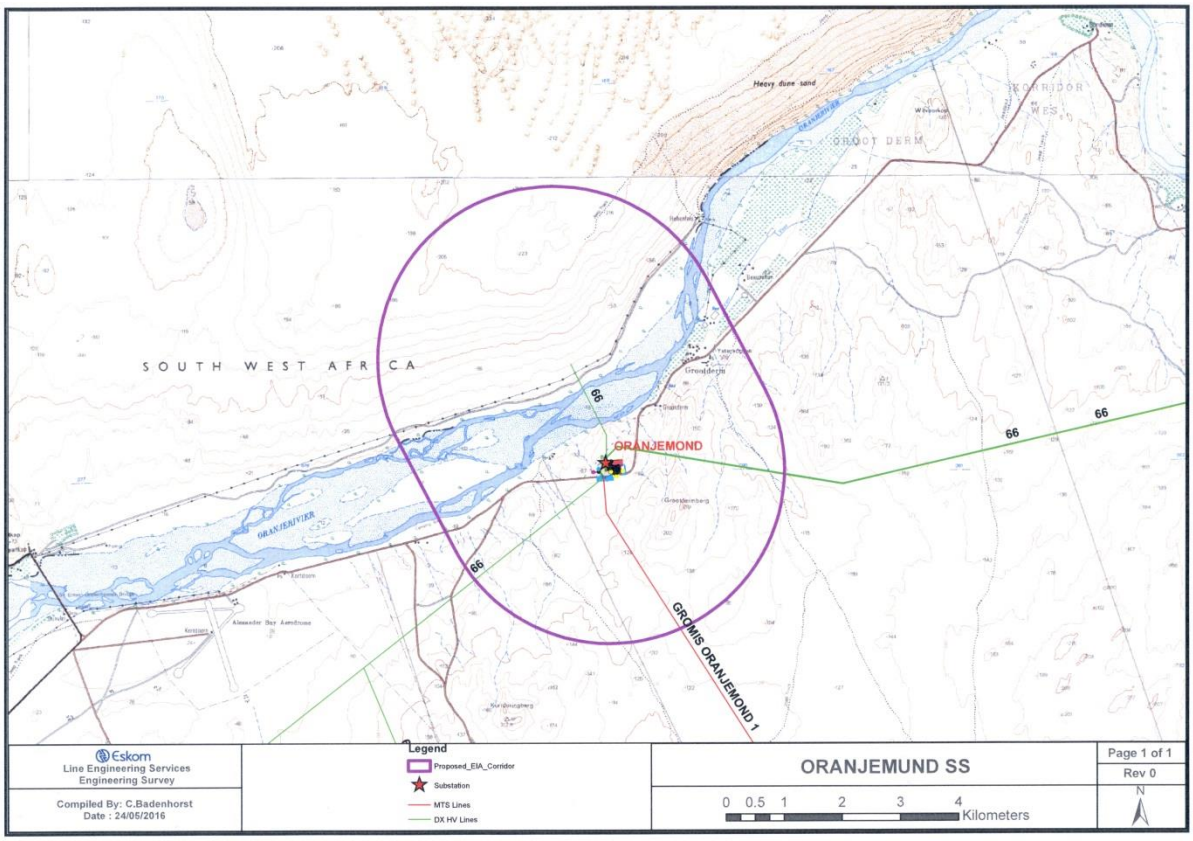

Figure 1. Map showing the proposed site for the Oranjemund power station and the buffer zone. Map supplied via Landscape Dynamics.

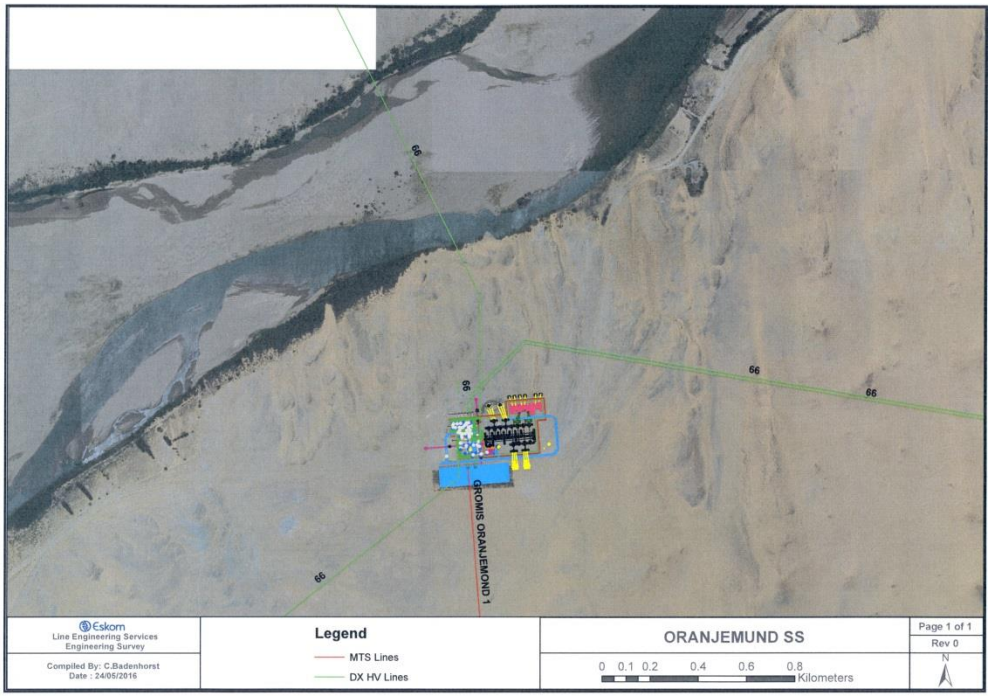

Figure 2. Google image of the proposed power station at Oranjemund with the incoming and outgoing power lines shown in green. Map provided via Landscape Dynamics.

3. Consultation Process

No consultations were carried out during the desktop study. Apart from reviewing interested and/or affected party (IAP) comments received by the EIA consultant during the EIA process, no other consultation took place as part of the paleontological study.

4. Geology and Palaeontology

Project location and geological setting

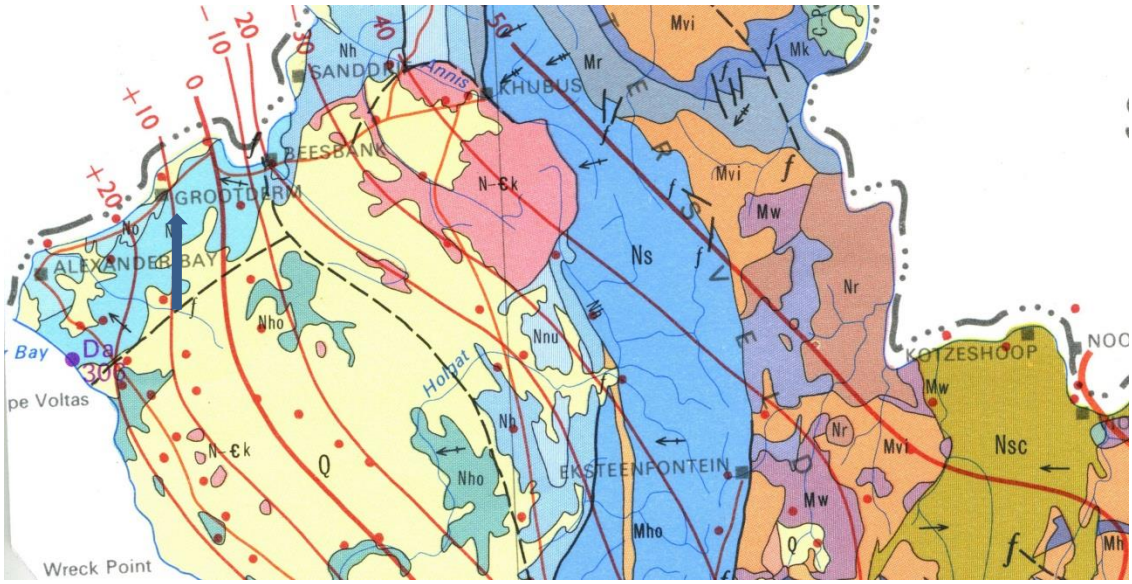

Figure 3: Geological map of the area Groot Derm, just south of the Orange River where the powerlines from Kudu will connect with the new powerstation. The approximate location of the proposed power station is indicated with the arrow. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 1 000 000 map 1984.

Symbol	Group/Formation	Lithology	Approximate Age
Q	Quaternary alluvium	Alluvium, sand, calcrete	Quaternary 2.5 Ma to present
Nho	Holgat Fm, Port Nolloth Group, Gariep Supergroup	Schist, gneiss, arenite, calcrete	Ca 730 Ma
No	Oranjemund Fm, Gariep Supergroup	Schist, phyllite, dolomite	
Ng	Grootderm Fm, Gariep Supergroup	Schist, andesite, basalt	Ca 770 Ma

Table 2: Explanation of symbols for the geological map and approximate ages (Gresse et al., 2006).

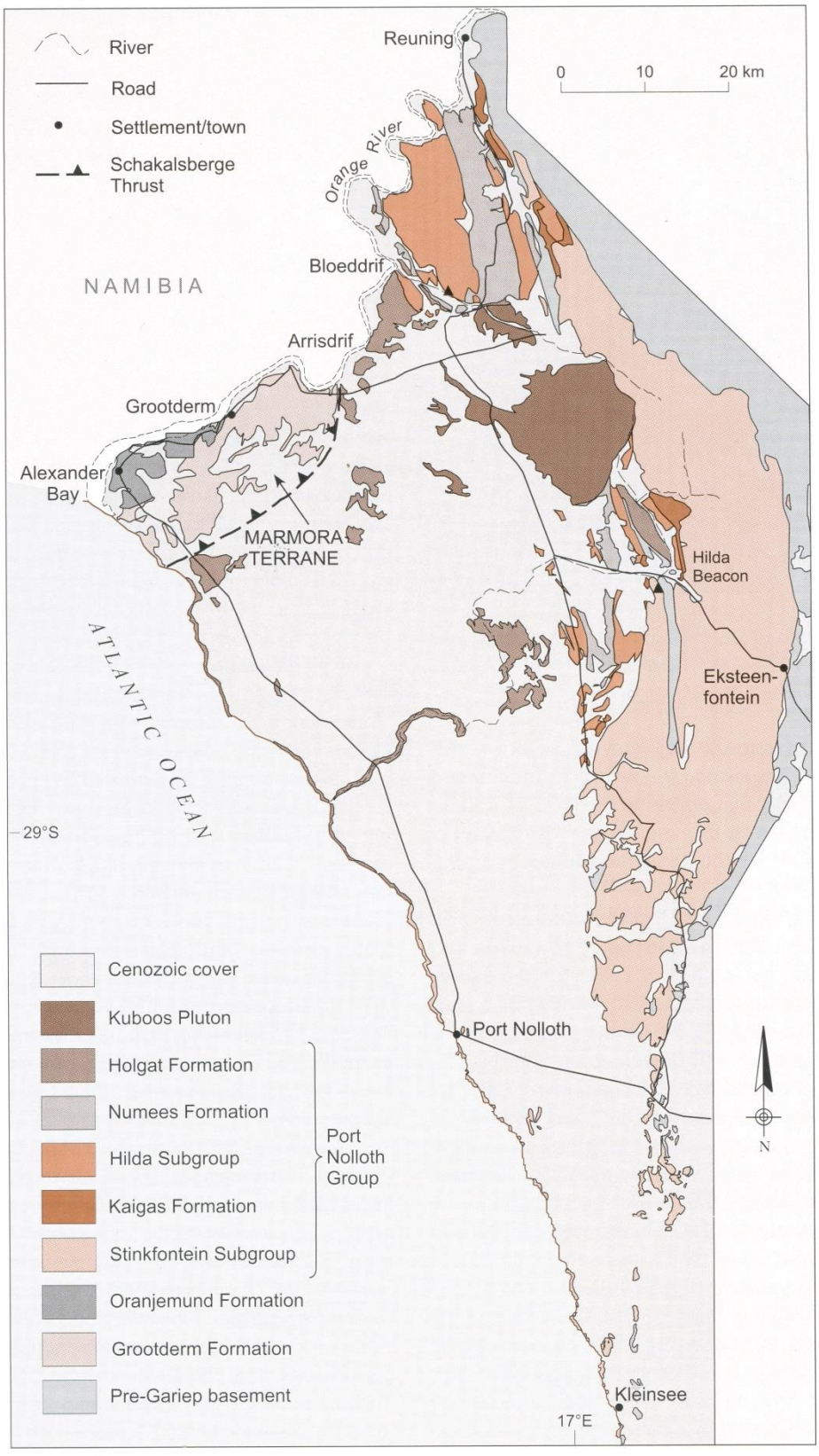

Figure 4: Map of the Namaqualand Neoproterozoic rocks (from Gresse et al., 2006, Fig 4). The proposed site falls on the region of the Grootderm and Oranjemund Formations in the Mamora Terrane.

Geology

The area for the proposed power station and transmission lies on the northern and southern banks of the Orange River, on the farm Groot Derm 10- Namaqualand RD. This is on the Neoproterozoic metavolcanic rocks of the Gariep Super Group in the Richtersveld region of the Northern Cape Province (Figures 3 and 4). The project is likely to intersect the Oranjemund and Grootderm Formations (Figure 4). The Grootderm Formation comprises a numer of aphyric, porphyric and amygdaloidal basalt flows (Frimmel et al., 1996; Gresse et al., 2006) as well as serpentinised picrate, hyaloclastite and tuff beds. These rocks have been metamorphosed to chlorite schist (ibid). Because of their igneous origin and alteration they do not contain any fossils. The other formation in close proximity is the Oranjemund Formation which comprises albite-rich quartz-chlorite, phyllite, feldspathic arenite and minor quartz arenite, all of which have been interpreted as having been formed in an oceanic sub-basin (Frimmel, 2000; Gresse et al., 2006). A range of radiometric dates has been given for these rocks and range from 770 to 730 Ma (Gresse et al., 2006).

Palaeontology

This whole region, the Gariep Belt, where the African plate was subducted below the South American plate, around 770-730 Ma, was tectonically and volcanically active and did not provide good conditions for the preservation of any marine or invertebrate fossils. The younger Nama Group and Vanrhynsdorp Group Formations occur far to the south and to the east of Oranjemund, respectively, contain a variety of early trace fossils of the Vendobionta (Gresse et al., 2006).

The SAHRIS palaeosensitivity map for the site indicates red (very sensitive and very high probability of fossils occurring there), orange (high probability), green (moderate) and grey (insignificant to zero). There are, however, no records of invertebrate or trace fossils from this area.

5. Impact assessment

The surface activities would only impact on the fossil heritage if there are any but the sand cover is likely to hide the hard rocks. The impact is nil.

Once excavation for foundations and infrastructure begin and the hard rock is affected there would be minor deterioration of the site and no impact on people. Therefore the SEVERITY/NATURE of the environmental impact would be L (according to the scheme in Table 2.

DURATION of the impact would be permanent: L.

Since only the possible fossils within the 6 km buffer will be affected the SPATIAL SCALE will be localised within the site boundary: L.

Proposed foundations will have a relatively small footprint and the PROBABILITY of affecting any fossils is unlikely or seldom: L

TABLE 3: CRITERIA FOR ASSESSING IMPACTS

PART A: DEFINITION AND CRITERIA		
Criteria for ranking of the SEVERITY/NATURE of environmental impacts	**H**	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.
Criteria for ranking the DURATION of impacts	**L**	Quickly reversible. Less than the project life. Short term
	M	Reversible over time. Life of the project. Medium term
	H	Permanent. Beyond closure. Long term.
Criteria for ranking the SPATIAL SCALE of impacts	**L**	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Local
	H	Widespread – Far beyond site boundary. Regional/ national
PROBABILITY (of exposure to impacts)	**H**	Definite/ Continuous
	M	Possible/ frequent
	L	Unlikely/ seldom

6. Assumptions and uncertainties

Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the rocks are not of a suitable type or age for the preservation of fossils as they are metavolcanic and altered. Stromatolites occur in the Vioolsdrift area and trace and invertebrate fossils occur in younger rocks to the east and south (Nama and Vanrhynsdorp Groups). Until the rocks are exposed, excavated and examined this remains an uncertainty, but a minor one.

7. Recommendation

While it is possible that trace or invertebrate fossils occur in the proposed powerline and power station area they will not be detected until excavations begin. A site visit is therefore not feasible until such stage.

If fossil material is discovered during the development or excavation operations, then it is strongly recommended that a professional palaeontologist, be called to assess the importance and to rescue them if necessary (with the relevant SAHRA permit). Good quality digital photographs could be sent to a palaeontologist.

If the fossil material is deemed to be of scientific interest then further visits by a professional palaeontologist would be required to collect more material.

As far as the palaeontology is concerned the proposed development can go ahead. Any further palaeontological assessment would only be required after development has commenced and if fossils are found by the geologist or environmental personnel.

8. References

Frimmel, H.E. 2000. The Pan-African Gariep Belt in southwestern Namibia and western South Africa. Geological Survey of Namibia 98, 176-190.

Frimmel, H.E., Hartnady, C.J.H., Koller, F., 1996. Geochemistry and tectonic setting of magmatic units in the Pan-African Gariep Belt, Namibia. Chemical Geology 130, 101-121.

Gresse, P.G., von Veh, M.W., Frimmel., H.E., 2006. Namibian (Neoproterozoic) to Early Cambrian successions. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. pp 395-420.

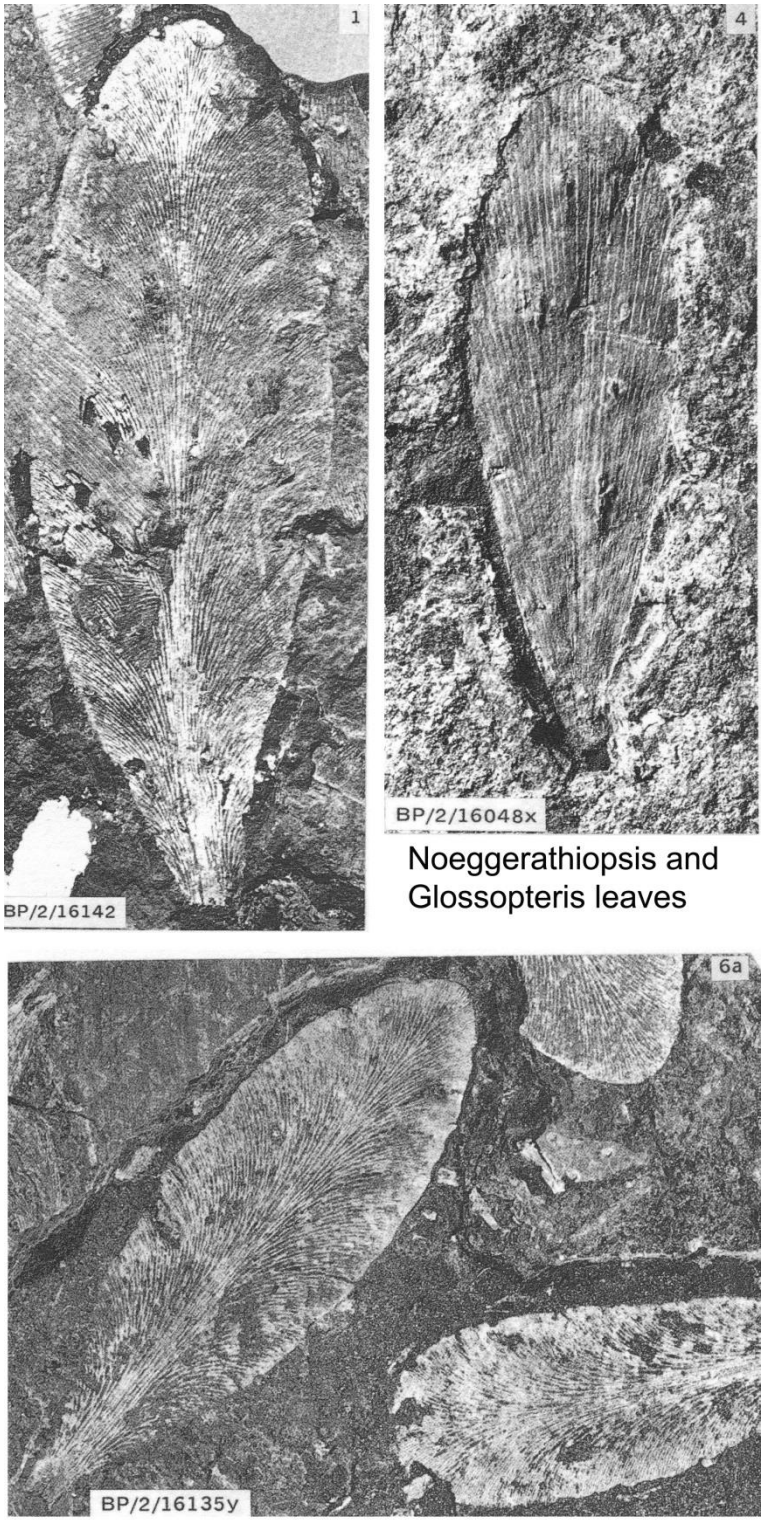

Figure 1.3: Examples of the most common fossil plants from the Volksrust Formation. Leaves range in length from 5-25cm long and often appear as shiny black leaves on dull black matrix so are difficult to see.

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