



TITLE: PALAEOLOGICAL IMPACT ASSESSMENT FOR THE PROPOSED PERSEUS-KRONOS 765KV TRANSMISSION POWER LINE AND SUBSTATIONS UPGRADE, NORTHERN CAPE AND FREE STATE PROVINCES

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DECLARATION OF INDEPENDENCE

This report has been compiled by Professor Marion Bamford, lead Palaeontologist for NGT Consulting. The views expressed in this report are entirely those of the author and NGT Consulting no other interest was displayed during the decision making process for the project.

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EXECUTIVE SUMMARY

No fossils occur in the Marydale Group, Ventersdorp Group or the granites. There is a low chance of finding fossils in the Dwyka and Ecca Groups; as these are diamictites and deep water deposits the chances are even lower. There is a slightly greater chance of fossils occurring in the Prince Albert Formation and Whitehill Formations, but again reports are rare for the northern Karoo.

Based on the low chance of fossils occurring in the area it is recommended that once the route has been selected and the sites for road access and excavation of foundations of towers have been determined; a geologist or environmentalist is engaged to monitor the work. If fossils are found by the geologist or environmental officer monitoring the construction work then a palaeontologist should be engaged to check the potential fossils and decide what should be removed and preserved (with the relevant permit from SAHRA or HWC). The rescued fossils would then be housed and catalogued in a recognized institution such as the McGregor Museum in Kimberley or Iziko Museum in Cape Town.

CONTENTS

ACKNOWLEDGEMENT OF RECEIPT	2
COPYRIGHT	3
DECLARATION OF INDEPENDENCE	3
EXECUTIVE SUMMARY	4
CONTENTS	5
LIST OF FIGURES	5
LIST OF TABLES	5
1. BACKGROUND	6
2. METHODS	6
2.2 Stages	7
3. A GEOLOGICAL AND PALAEOLOGICAL CONTEXT OF THE SITE	8
4. CONCLUSIONS	10
5. RECOMMENDATIONS	10
6. REFERENCES	12

LIST OF FIGURES

Figure 1 – Google map to show the proposed routes between Copperton (Kronos substation and Dealesville (Perseus substation). The distance is approximately 370km.	7
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Figure 2 – Geological map sections of the proposed routes. Abbreviations of the rock types are explained in Table 1. Map enlarged from the Geological Survey 1: 1 000 000 map 1984.	9
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LIST OF TABLES

Table 1 – Abbreviations for the geological formations, lithology and approximate ages taken from Brandl et al. (2006), Cornell et al. (2006), Johnson et al. (2006), McCourt et al. (2000), van der Westhuizen and de Bruijn (2006).....	10
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1. BACKGROUND

Eskom Holding SOC Limited proposes to construct a 765kV transmission power line for the “Proposed Northern Alignment 765kV Power Line Project”. A section of this line is to run from the existing Perseus Substation near Dealesville in the Free State Province to the Kronos substation south of the town of Copperton in the Northern Cape Province. The total length of the power line would be approximately 370km. For this purpose; three alternative alignments have been identified, one of which will be selected as the most viable proposition.

The geology is mostly made up of sedimentary material and shale, with some tillite occurring sporadically in smaller deposits. The terrain is classified as plains in the southwest, changing to slightly irregular plains and pans in the northeast. The original vegetation is classified as Orange River Nama Karoo in the southwest, changing to Kimberley horn Bushveld in the northeast.

2. METHODS

The published geological and palaeontological literature, unpublished records and databases were consulted to determine if there are any records of fossils from the sites and the likelihood of any fossils occurring there. The National Heritage Resources Act (Act 25 of 1999) and the National Environmental Management Act (Act 107 of 1998) requires that proposed developments must be preceded by the relevant impact assessment, in this case for palaeontology.

2.1 Stages

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 conducted 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 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 only if they are of minimal or no scientific importance but a representative collection could be made if deemed necessary.



Figure 1 – Google map to show the proposed routes between Copperton (Kronos substation and Dealesville (Perseus substation). The distance is approximately 370km.

3. A GEOLOGICAL AND PALAEOLOGICAL CONTEXT OF THE SITE

The oldest rocks occurring in the region are in the western part, around Kronos, to the south of Prieska, and are too old to contain any fossil material (Fig 2, Table 1). The Doornfontein Formation and Prieskapoort Subgroup are Archaean in age (3500-2700Ma) and pre-date any body-fossils. Algae were present at this time but are rarely preserved in any recognisable form. The same applies to the two formations in the Ventersdorp Group. Granites in the area are somewhat younger but as they are extrusive volcanic rocks they do not contain any fossils.

In the central region and eastern part are sediments of the Karoo Supergroup in the northern part of the main Karoo Basin. However they are from the oldest deposits and from glacial or deep water facies so fossils are very rare.

The Dwyka Group is Late Carboniferous to Early Permian in age and in the northwestern part of the Karoo basin overlies the glaciated Precambrian bedrock (Visser, 1989). It is considered to have been deposited in a marine basin and comprises a number of different lithofacies types, including massive diamictites, stratified diamictites, massive carbonate-rich diamictite facies, conglomerate facies, sandstone, mudrock with stones and mudrock facies. The latter contains rare examples of fossil pollen, spores, plant remains, arthropod and fish trackways (Anderson and McLachlan, 1976; Anderson, 1981). These fossils have been recovered from sites in the southwest of the Karoo basin and northwest near the South African-Namibian border.

The Prince Albert Formation (base of the Ecca Group) is made up of grayish to olive-green micaceous shale and grey silty shale, sandstones and mudrocks. From near Douglas Anderson and McLachlan, 1976) have reported marine fossils (cephalopods, lamellibranchs and brachiopods), plant remains, palaeoniscid fish fragments and coprolites. This is well north of the proposed routes for powerlines.

The Whitehill Formation comprises mudrocks (which weather out with a white colour) and black carbonaceous pyrite-bearing shale (Johnson et al., 2006). A few fossils have been reported from close to the SA-Namibia border and include plant fragments, rare insect wings

(Anderson and McLachlan, 1977), palaeoniscid fish, *Notocharis tapscotii* (arthropod) and the marine(?) reptile *Mesosaurus* (Oelofen and Araujo, 1987) near Kimberley and Nieuwoudtville.

The Tierberg Formation (Early Permian) mostly comprises well-laminated dark shales and represent settling in deep low energy environments (Johnson et al., 2006). Thickness of this unit varies from 350-700m and the surface exposure is extensive in the Northern Cape Province. Rare fossils have been recorded from this formation and include trace fossils and sponge spicules. There are no vertebrate fossils preserved and terrestrial plants are extremely rare.

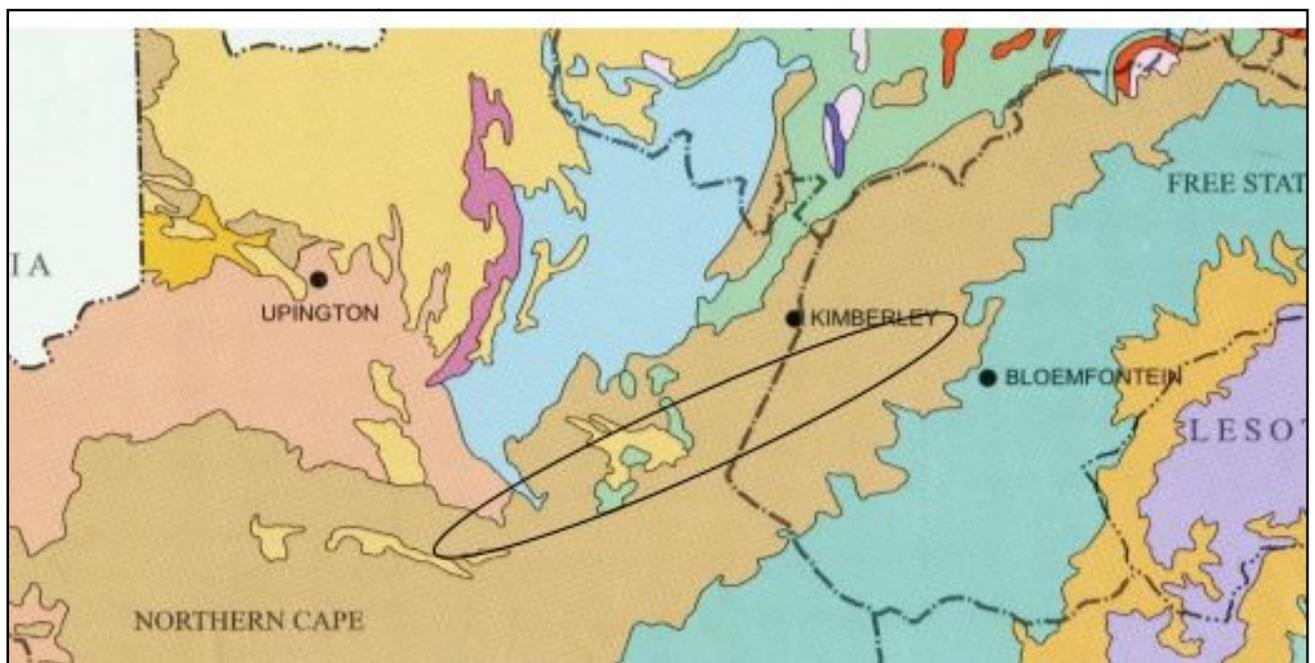


Figure 2 – Simplified geological map with oval outline indicating the wide area within which the proposed routes between Perseus and Kronos substations would lie. Colour code: tan = Dwyka and Eccca Groups; yellow = Kalahari Group (Quaternary); light green = Ventersdorp Supergroup; blue = Transvaal Supergroup. Map from the Council for Geoscience, 1990.

Table 1 – Abbreviations for the geological formations, lithology and approximate ages taken from Brandl et al. (2006), Cornell et al. (2006), Johnson et al. (2006), McCourt et al. (2000), van der Westhuizen and de Bruijn (2006).

Symbol	Group/Formation	Lithology	Approximate Age
Jd	Jurassic dykes	Intrusive dolerite	183 Ma
Pt	Tierberg Fm, Eccca Group	Argillaceous shales	Early Permian
Ppr	Prince Albert Fm, Eccca Group	Shales, mudstones, sandstones	Early Permian
Ppw	Whitehill-Prince Albert Fms, Lower Eccca	Mudrocks, shales, sandstones	Early Permian
C-Pd	Dwyka Group	Diamictites, tillites, shales	Late Carboniferous-Early Permian
Mke	Granite undifferentiated	granite	1080-1090 Ma
Rsk	Skalkseput Granite	Biotite-muscovite granite	ca 2970-2700 Ma
Val	Allanridge Fm, Ventersdorp Group	andesite	3000-2100 Ma
Vbt	Bothaville Fm, Ventersdorp Group	Conglomerate, sandstone	3000-2100 Ma
Rdo	Doornfontein Fm Marydale Group	Amphibolites, iron formation	Archaean greenstone belts; 3500-2700 Ma
Zpr	Prieskaaport Subgroup, Marydale Group	Conglomerate, subgreywacke, lava	Archaean greenstone belts; 3500-2700 Ma

4. CONCLUSIONS

No fossils occur in the Marydale Group, Ventersdorp Group or the granites. There is a low chance of finding fossils in the Dwyka and Eccca Groups, as these are diamictites and deep water deposits the chances are even lower.

5. RECOMMENDATIONS

There is an extremely low chance of finding fossils in the sediments of the Dwyka and Eccca Group because these are deep water marine deposits and there are reports of isolated finds

from elsewhere in this stratum. There is a slightly greater chance of fossils occurring in the Prince Albert Formation and Whitehill Formations but again reports are rare for the northern Karoo.

Based on the low chance of fossils occurring in the area it is recommended that once the route has been selected and the sites for road access and excavation of foundations of towers have been determined; a geologist or environmentalist is engaged to monitor the work. If fossils are found by the geologist or environmental officer monitoring the construction work, then a palaeontologist should be engaged to check the potential fossils and decide what should be removed and preserved (with the relevant permit from SAHRA or HWC). The rescued fossils would then be housed and catalogued in a recognized institution such as the McGregor Museum in Kimberley or Iziko Museum in Cape Town.

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