Palaeontological Desktop Assessment of the proposed new 9 km-long section of the Helios power line near Brandvlei, Northern Cape Province.

Report prepared for HCAC Consultants
by
Palaeo Field Services
PO Box 38806
Langenhovenpark
9330

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Summary

The proposed development footprint is underlain by early-mid Permian shales and mudrocks of the Ecca Group Whitehill and Tierberg Formations, considered to be of low to high palaeontological sensitivity, respectively. It is capped by superficial deposits considered to be of moderate to high palaeontological sensitivity where unweathered gravelly alluvial deposits and pan sediments occur. For that reason, thinly laminated grayish black to black mudrock exposures (Whitehill Formation), water courses, depression margins and pan dune deposits located within the development footprint are considered to be potentially palaeontologically sensitive. It is advised that a Phase 1 Palaeontological Impact Assessment is conducted for the structure locations **marked HEL/8TRA 2 to HEL/8TRA 16** before the start of any excavations so that potential palaeontological remains can be identified, recorded and removed.

Introduction

The report is a preliminary assessment of potential palaeontological impact with regard to planned power line infrastructure development located about 86 km due west of Brandvlei on the farm Sous 226 in the Northern Cape Province (**Fig. 1**). The assessment is required as a prerequisite for new development in terms of the National Heritage Resources Act 25 of 1999. The Act identifies what is defined as a heritage resource, the criteria for establishing its significance and lists specific activities for which a heritage specialist study may be required. In this regard, categories of development relevant to the proposed development are listed in Section 34 (1), Section 35 (4), Section 36 (3) and Section 38 (1) of the Act, which also include the protection of geological and paleontological sites as well as palaeontological objects and material, meteorites and rare geological specimens. According to the SAHRIS Palaeo Sensitivity Map of South Africa (2016), the proposed development footprint is located within an area considered to be of moderate to high palaeontological sensitivity and for that reason requires at least a palaeontological desktop assessment.

Methodology

Geological maps were used to pin point fossil-bearing rocks within the study area. The palaeontological significance of the affected area is evaluated using existing field data, database information and published literature. Potential impact on

palaeontological heritage recources was determined by the scale of the proposed development and the palaeontological sensitivity of the relevant rock units that may be affected.

Locality data

1:50 000 scale topographic map 3019BC Boegoefontein

1:250 000 scale geological map 3018 Loeriesfontein

Site coordinates (**Fig. 2**): A) 30°29'50.53"S 19°33'37.75"E to B) 29 30°25'52.26"S 19°36'38.74"E.

The study area is located 86 km due west of Brandvlei on the farm Sous 226.

Background

According to the 1:1 Ma geological map of SA and the 1:250 000 scale geological map 3018 Loeriesfontein, the footprint is for the most part underlain by early-mid Permian Ecca Group shales (Karoo Supergroup) of the non-marine Tierberg Formation (*Pt*), that are intruded by Jurassic age dolerite intrusions, and to lesser extent by marine mudrocks of the early Permian Ecca Group Whitehill Formation (*Pw*) (**Fig. 3**). Fossils from the Tierberg Formation are poorly represented. They are mainly represented by sparsely distributed and generally not diverse assemblages of trace fossils and rare bone fragments (Anderson 1976; De Beer et al. 2002; Viljoen 2005; Johnson *et al.* 2006). The ichnoassemblages include arthropod trackways and associated resting impressions, fish swimming trails, horizontal epichnial furrows often attributed to gastropods, as well as a variety of different kinds of small burrows. Plant remains, including fossilized wood becomes more abundant in the upper layers of the formation (Ryan 1967; Wickens 1996). Impressions of *Gondwanidium validum* and pieces of *Dadoxylon* have been discovered between Douglas and Belmont, south of Kimberley (McLaren 1976). Sponge spicules, fish scales and disarticulated microvertebrate remains from calcareous concretions have also been recorded (Zawada 1992, Bosch 1993).

Fossils in the Whitehall Formation include complete skeletons of primitive bony fish (palaeoniscoids), aquatic mesosaurid reptiles, crustaceans (upper part of the formayion), fossil wood, leaves (Glossopteris) sponge spicules, insect wings and trace fossils (Oelofson and Aroujo 1987; Cole and Basson 1991; MacRae 1999; Modesto 2006; Johnson *et al.* 2006).

Palaeontological Significance

The Middle Permian shales and siltstones of the Tierberg Formation (Ecca Group) are of low palaeontological sensitivity. Fossil assemblages from this unit mainly comprise trace fossil assemblages, fragmentary fish remains and plant remains that include petrified wood and leaves.

Superficial sediments are made of downwasted bedrock sediments, Kalahari Group pedocretes, aeolian sand and alluvium, as well as remnants of Tertiary and Quaternary (Miocene to Pleistocene) fluvial systems related to infill deposits (drainage depressions) of the Carnarvon Leegte and associated gravel terraces of the palaeo-Sak River which was once part of the ancient Koa Valley, situated about 140 km due west of the study area (De Wit *et al*. 2000) **(Fig. 4**). Fossils associated with these Late Cenozoic drainage systems include mammals, reptiles, fish, molluscs, petrified wood and ichnofossils (De Wit *et al.* 2000; De Wit 1999; De Wit and Bamford 1993). Anthracothere and fossil wood remains, suggesting subtropical environments during the Lower to Middle Miocene, have been recovered from basal alluvial gravels in the Geelvloer Palaeovalley near Brandvlei located 120 km due south of the study area, where it links up with the Koa Valley palaeodrainage system through Commissioners Pan (**Fig. 5**). Several mammal types including Miocene Gomphothere tooth fragments, a giraffid ossicone, bovid, rhinocerotid and tortoise remains as wlll as crocodile teeth fragments have been recovered from gravels at Bosluispan in the upper reaches of the Koa Valley. Younger sediments associated with Plio-Pleistocene drainage systems (alluvium, pan sediments) in the region may also occasionally yield vertebrate fossil remains. Mammalian teeth and bones of mainly grazers have been recovered from basal gravels in the Carnavon Leegte (Maglio & Cooke 1978) while Late Pleistocene faunal remains associated with Stone Age artefacts have been recovered from pan sediments at Bundu Farm near Copperton (De Wit 1999; Kiberd 2006).

Impact Statement

The desktop investigation indicates that the footprint area is in part underlain by early-mid Permian shales and mudrocks of the Ecca Group Whitehill and Tierberg Formations, considered to be of low to high palaeontological sensitivity, respectively. It is capped by superficial deposits considered to be of moderate to high

palaeontological sensitivity where unweathered gravelly alluvial deposits and pan sediments occur. For that reason, thinly laminated grayish black to black mudrock exposures (Whitehill Formation), water courses, depression margins and pan dune deposits located within the development footprint are considered to be potentially palaeontologically sensitive (**Fig. 6)** It is advised that a Phase 1 Palaeontological Impact Assessment is conducted for the structure locations **marked HEL/8TRA 2 to HEL/8TRA 16** (**Table 1)** before the start of any excavations so that potential palaeontological remains can be identified, recorded and removed.

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DECLARATION OF INDEPENDENCE

I, Lloyd Rossouw, declare that I act as an independent specialist consultant. I do not have or will not have any financial interest in the undertaking of the activity other than remuneration for work as stipulated in the terms of reference. I have no interest in secondary or downstream developments as a result of the authorization of this project.

30 / 08 / 2017

Tables & Figures

Table 1. Potentially sensitive structure locations.

Structure loc. number	Coordinates	
HEL/8TRA 2	30°29'44.33"S	19°33'37.08"E
HEL/8TRA 3	30°29'38.20"S	19°33'37.19"E
HEL/8TRA 4	30°29'31.75"S	19°33'37.29"E
HEL/8TRA 5	30°29'24.62"S	19°33'37.42"E
HEL/8TRA 6	30°29'17.94"S	19°33'37.53"E
HEL/8TRA 7	30°29'11.52"S	19°33'37.64"E
HEL/8TRA 10	30°28'55.57"S	19°33'36.68"E
HEL/8TRA 11	30°28'48.91"S	19°33'36.63"E
HEL/8TRA 12	30°28'43.29"S	19°33'36.58"E
HEL/8TRA 13	30°28'37.18"S	19°33'42.41"E
HEL/8TRA 14	30°28'30.65"S	19°33'48.65"E
HEL/8TRA 15	19°33'48.65"E	19°33'55.01"E
HEL/8TRA 16	30°28'16.88"S	19°34'1.78"E

Figure 1. Map of the Helios development footprint (portion of 1:50 000 scale topographic 3019BC Boegoefontein).

Figure 2. Aerial view of the proposed development footprint.

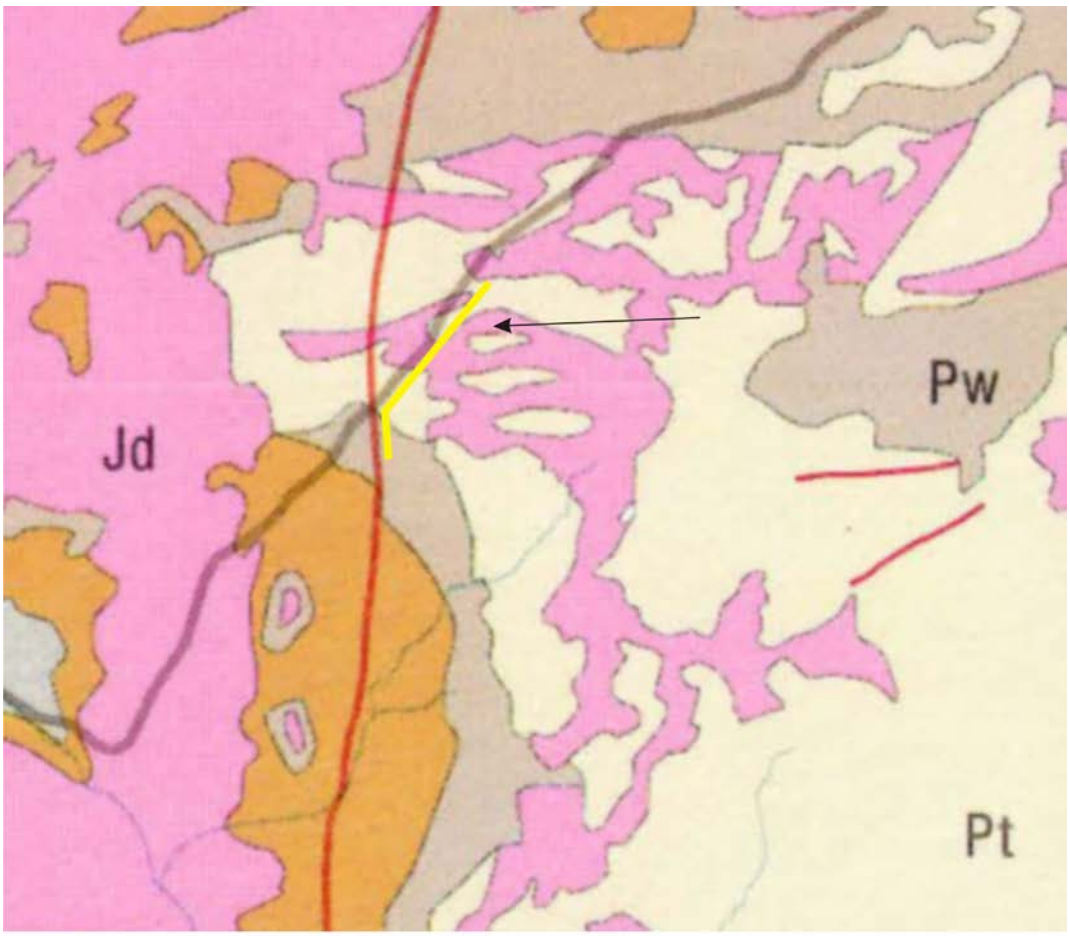

Figure 3. Portion of 1:1Ma scale geological map of the area, showing that the Helios footprint is underlain by early-mid Permian shales and mudrocks of the Ecca Group Whitehill (*Pw*) and Tierberg Formations (*Pt*). Superficial sediments are made up of downwasted bedrock sediments, Kalahari Group pedocretes, Quaternary aeolian sand and alluvium. Remnants of Tertiary and Quaternary (Miocene to Pleistocene) fluvial systems related to infill deposits (drainage depressions) of the Carnarvon Leegte and associated gravel terraces of the palaeo- Sak River are common in the area (not shown on map).

Figure 4. Tertiary Sak River and Koa Valley fluvial systems (green and yellow line, respectively). Helios footprint marked by red star.

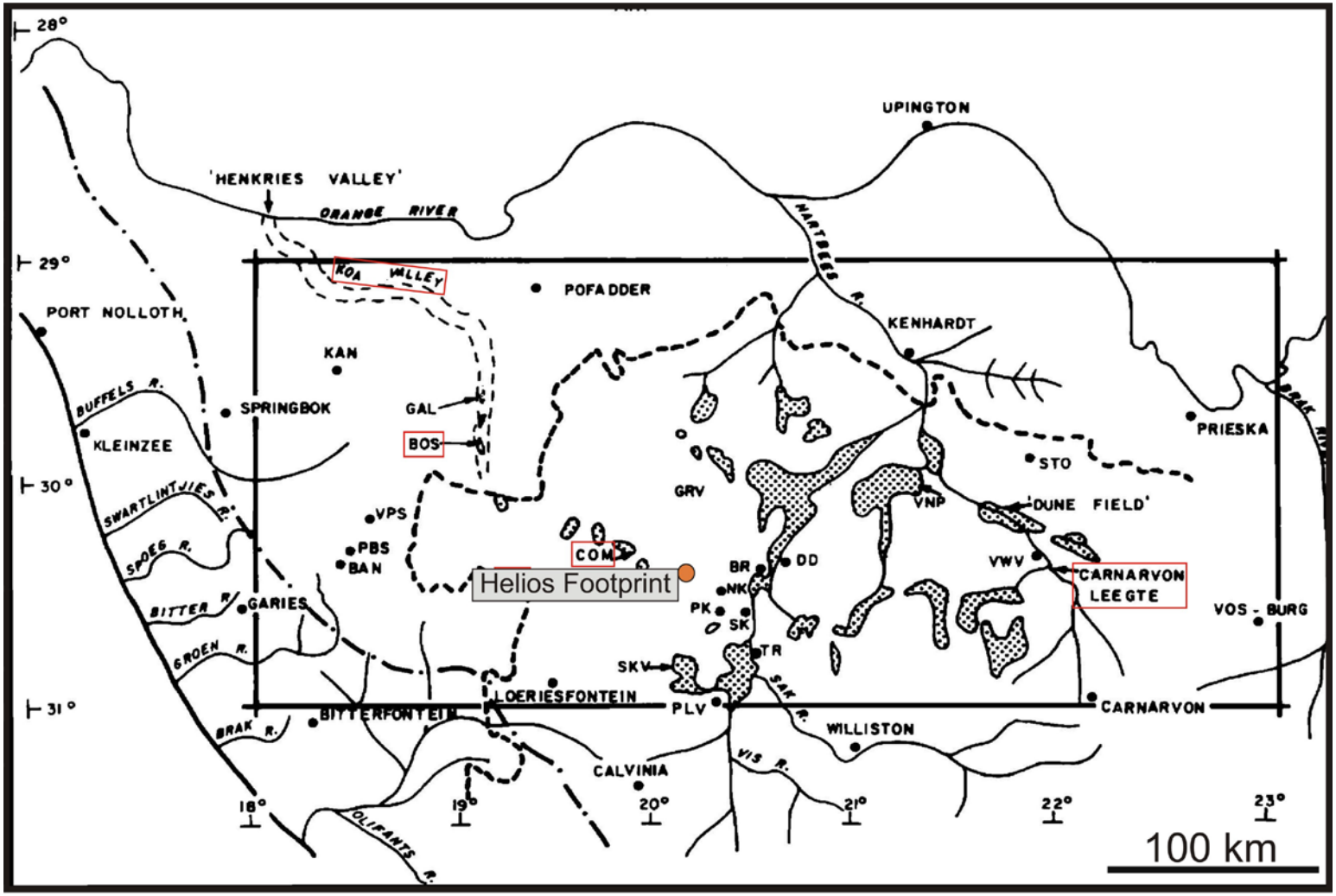

Figure 5. Sites and localities associated with potentially fossil-bearing Tertiary fluvial sediments, BR = Brandvlei, COM = Commisioners Pan; BOS = Bosluispan (after De Wit 1999).

Figure 6. Potentially sensitive areas include thinly laminated grayish black to black mudrock exposures, water courses, linear depressions and well-developed pan dune deposits.