

Palaeontological Heritage Study for upgrade of Melkhout electrical substation

Prepared for: SRK Consulting (South Africa) (Pty) Ltd.

Ground Floor, Bay Suites,
1a Humewood Rd, Humerail, Port Elizabeth, 6001
P O Box 21842, Port Elizabeth, 6000

Compiled by: Robert Gess
Rob Gess Consulting

c/o Box 40
Bathurst
6166
robg@imagnet.co.za

November 2018

Contents:

page 1: **Title**

page 2: **Contents**

page 3: **Background**

page 4: **Stratigraphy, Age, Origin and Palaeontology of Strata**

page 6: **Site Visit**

page 8: **Conclusion**

Background

SRK Consulting were contracted by Eskom to conduct an Environmental Impact Assessment for extensions to the Melkhout Substation situated to the north of Humansdorp, Eastern Cape, South Africa. The extensions are to allow expanded battery storage and impact 3 erven: Portion 4 of Farm 346; Erf 499; and Portion 30 of Farm 347. Of these the first two are municipally owned whilst the latter is privately owned.

SRK subcontracted Rob Gess Consulting, who carried out a site visit on 20th October 2018.

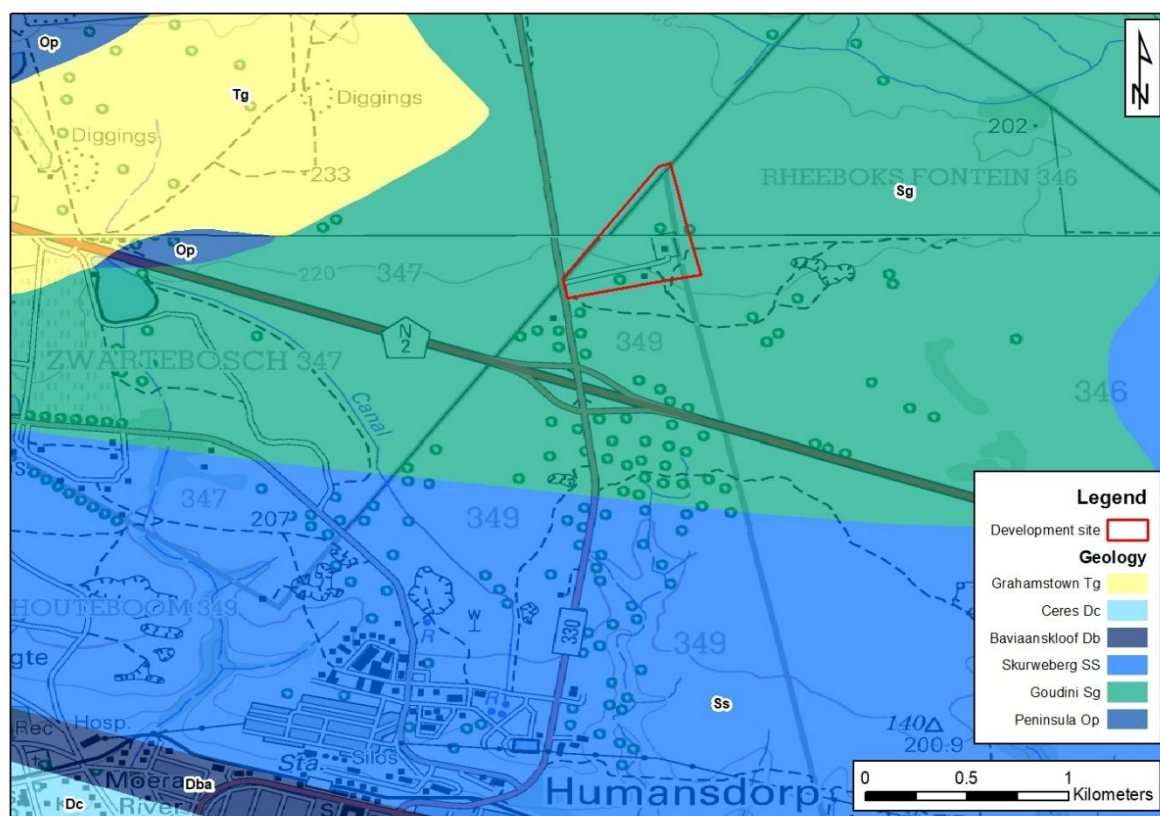


Figure 1. Topographic map of the area of the proposed development with its position and geological survey map data superimposed.

Stratigraphy, Age, Origin and Palaeontology of Strata

- Stratigraphy is the sequence of rock layers, from the lowest (oldest) to the highest (youngest). Conformably deposited rocks are ones which are continually deposited, layer upon layer, with only limited periods of disruption or erosion between them.
- An anticline is a fold in (once horizontal) geological strata in which the strata are thrust up in the middle and down on the sides. If this is cut through, along a horizontal plane, older rocks are exposed in the middle flanked by progressively younger ones.

The study area is situated within strata of the Cape Supergroup. More specifically portions of the **Table Mountain Group** exposed due to horizontal truncation of an anticline, and flanked by strata of the stratigraphically higher Bokkeveld Group. These rocks represent sediments deposited in the Agulhas Sea, which had opened to the south of the current southern African landmass in response to early rifting between Africa and South America. The Table Mountain Group constitutes the first of three subdivisions of the Cape Supergroup. It consists of quartzitic sandstones derived from coarse sands deposited within the Agulhas Sea, and along its coastal plane. It was deposited during the Ordovician, Silurian and earliest Devonian Periods, approximately 500-400 million years ago.

The Development is planned to be constructed overlying strata of the Silurian aged **Goudini Formation**, the lowermost formation of the **Nardouw Subgroup**, which forms the upper portion of the Table Mountain Group (Figure 2). This Formation comprises a series of thin reddish to brownish weathering quartzose sandstone interbedded with siltstone or shale units. Around Humansdorp it reaches approximately 250 metres in overall thickness and frequently (though not in this case) weathers to form valleys. The quartzites have been interpreted as fluviially deposited, though the siltstones suggest intermittent marine incursions. Trace fossils have been recorded from this unit in the Western Cape, however body fossils are yet to be located.

Truncation of the folded strata of the Cape Supergroup occurred during the Cretaceous and early Tertiary Periods. Following the Cretaceous Period, the sea level changed and was higher than we see today, leaving evidence in the rocks of a sea shore that was much further inland. Over millions of years the waves carved a broad shelf around our coast, which today forms the coastal plain of the Eastern Cape. During the Tertiary, mudstones and shales near the surface were leached of silica, iron and magnesium from these rocks was carried in solution by groundwater and deposited near the ground surface due to steady evaporation of mineral rich waters. This led to the formation of a hard mineralised capping layer, often consisting of silicified and/or feruginised soil. Resultant silcretes are referred to as the **Grahamstown Formation**. Though occasional occurrences of root and stem impressions have been recorded from the Grahamstown Formation it is generally considered unfossiliferous.

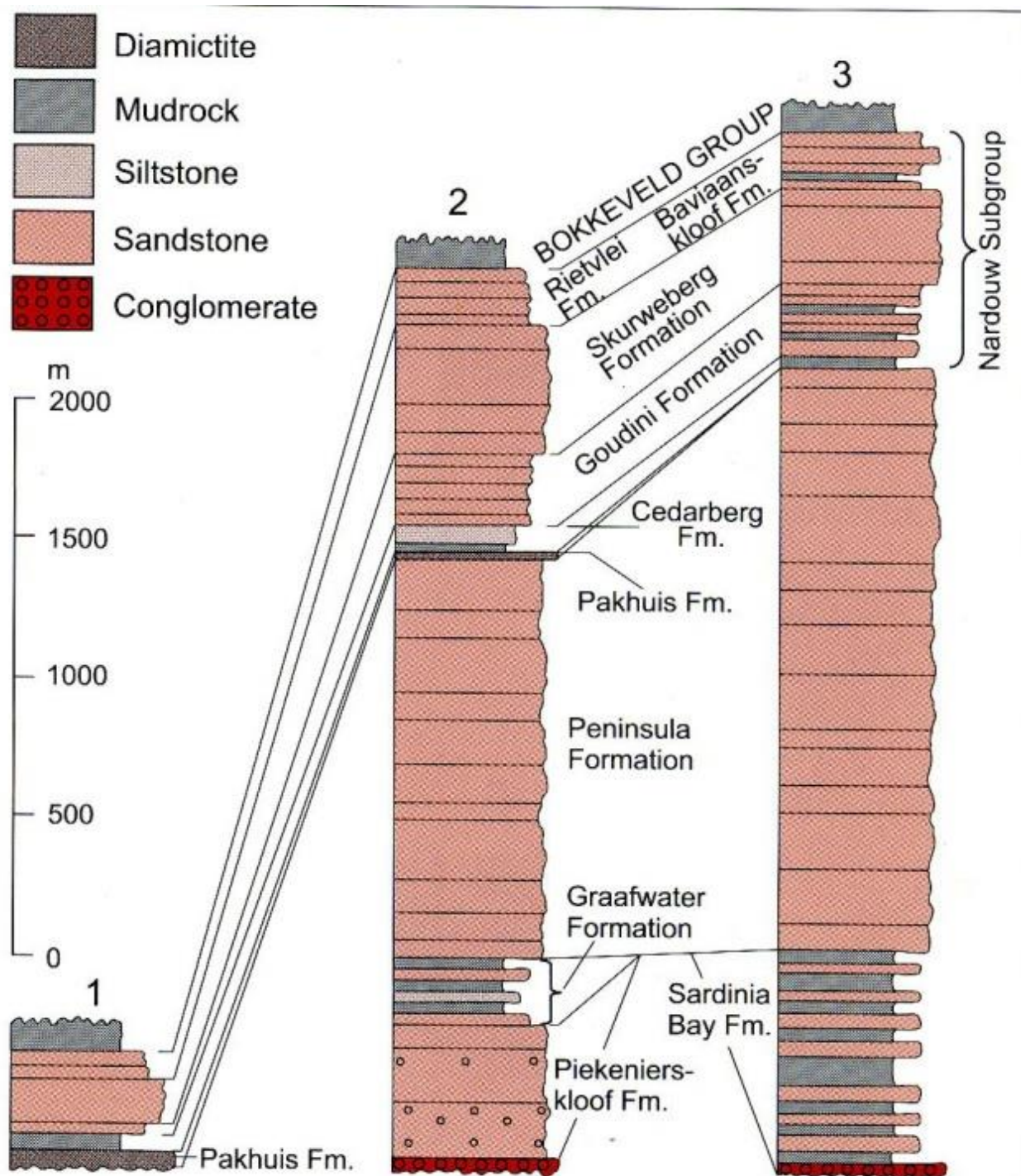


Figure 2: Stratigraphy of the Table Mountain Group, 3 represents the Eastern Cape (Johnson *et al.*, 1999)

Site Visit

The proposed development site was visited and surveyed by the palaeontologist, on foot, on 20 October 2018. Mapping of the area as overlying the Goudini Formation was confirmed. Strata in the area are near vertically tilted due to the folding and weathering has reduced the natural outcrop to a series of parallel approximately north-south trending low quartzitic outcrops. These are separated by negatively weathering heathy areas overlying the more mud rich units. Patchy development of iron rich silcrete was noted over the mud-rich units, particularly adjacent to the quartzitic ridges.

Fresher outcrop of material was evidenced adjacent to Eskom's access road and in heaps of rock alongside the existing substation – indicating that previous construction has intercepted fresh strata. This material included chunks of marine mudstone very similar to those of the overlying Bokkeveld Group, which are sometimes rich in marine invertebrate fossils.



Figure 3: Vertically tilted quartzitic strata forming roughly north south trending linear outcrops immediately north west of the development site.



Figure 4: Iron rich silcrete cementing soils overlying weathered mudstone adjacent to quartzitic strata.



Figure 5: Piles of rock adjacent to the existing substation, excavated during its construction.



Figure 6: Cross bedding in quartzite excavated during construction of existing substation.



Figure 7: marine type mudstone excavated during construction of existing substation

Conclusion and Recommendations

It is apparent that mudstone, of a type associated with marine invertebrate fossils in the overlying lower Bokkeveld Group, are interbedded with quartzite layers characteristic of the Goudini Formation (Nardouw Subgroup, Table Mountain Group, Cape Supergroup), underlying the proposed development site.

Piles of rock waste from previous construction phases, adjacent to the existing substation indicate that fairly fresh mudstone is likely to be disturbed. Nonetheless none of the material currently available for examination bore any evidence of palaeontological material. Indeed palaeontological material is not known to be abundant in the Nardouw Subgroup and has previously been confined to trace fossils associated with the quartzites. Ongoing research by the author has, however, revealed important palaeontological assemblages in units of the Cape Supergroup formerly considered to be devoid of fossils. This is often far more important that their collection from units well-known for their palaeontological heritage.

In conclusion it is considered unlikely that fossils will be disturbed, however the possibility exists and any fossils recovered would be of great significance.

It is therefore recommended that the Environmental Officer be instructed to pay particular attention to mudstone removed from the excavation site and to examine it carefully for any impressions of marine invertebrates (such as brachiopods and other sea shells as well as, for example trilobite segments and heads). Any suspected fossils should be put to one side and photographed. Photos should be sent to an appropriate palaeontologist for evaluation.