PALAEONTOLOGICAL DESKTOP ASSESSMENT FOR THE PROPOSED UPGRADE OF THE DAVEL TO NERSTON RAIL LINE IN THE MPUMALANGA PROVINCE

For:

HIA CONSULTANTS

DATE: 15 February 2014

By

GIDEON GROENEWALD

EXECUTIVE SUMMARY

Gideon Groenewald was appointed by PGS Heritage to undertake a desktop survey, assessing the potential palaeontological impact of the proposed upgrade of the Davel to Nerston Rail Line in Mpumalanga Province.

This report forms part of the Environmental Impact Assessment and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999. In accordance with Section 38 (Heritage Resources Management), a Heritage Impact Assessment (HIA) is required to assess any potential impacts to palaeontological heritage within the development footprint of the project.

Transnet in collaboration with Swaziland Railway identified the construction and upgrade of the railway line between Davel in Mpumalanga and Richards Bay in KwaZulu-Natal, connecting via the Swaziland rail network, as a strategic project. This report specifically pertains to the Mpumalanga rail line from Davel to Nerston (DEA Ref. number: 14/12/16/3/3/2/553).

The section between Davel and Nerston is underlain by Jurassic dolerite, Permian Vryheid Formation sediments and ancient metamorphic and igneous rocks. The proposed alternative routes on the Davel to Nerston section is underlain by ancient metamorphic and igneous rocks, with a very small section underlain by Permian Vryheid Formation sediments. The areas underlain by the Vryheid Formation has been allocated a High Palaeontological Sensitivity. Sections underlain by igneous and metamorphic rocks were allocated a Low Palaeontological Sensitivity.

It is recommended that

1. The developer as well as the EAP must be informed of the fact that sections of the proposed upgrading of the railway line is underlain by rocks with a High Palaeontological Sensitivity .
2. A qualified palaeontologist must be appointed to
    - apply for a collection and destruction permit for palaeontological material that might be present in all the areas where a High Palaeontological Sensitivity is indicated
    - undertake a Phase 1 Palaeontological Impact Assessment in areas with a High Palaeontological Sensitivity to record the presence of fossils
    - prepare a protocol document for the monitoring of the sensitive areas during construction
    - make the necessary arrangements with the developer and contractors to visit the sites during construction for regular inspection and reporting to SAHRA
    - make the necessary arrangement with the appropriate Institute for Palaeontological Research, as approved by SAHRA, where the fossils will be curated.
3. The developer must inform the palaeontologist and SAHRA of any fossils found during the construction phase of the development.

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1. INTRODUCTION

1.1. Background

Gideon Groenewald was appointed by PGS Heritage to undertake a desktop survey, assessing the potential palaeontological impact of the proposed upgrade of the Davel to Nerston Rail Line in Mpumalanga Province.

This report forms part of the Environmental Impact Assessment and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999. In accordance with Section 38 (Heritage Resources Management), a Heritage Impact Assessment (HIA) is required to assess any potential impacts to palaeontological heritage within the development footprint of the project.

Categories of heritage resources recognised as part of the National Estate in Section 3 of theHeritage Resources Act, and which therefore fall under its protection, include:

- geological sites of scientific or cultural importance;
- objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens;
- objects with the potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage.

1.2. Aims and Methodology

Following the *"SAHRA APM Guidelines: Minimum Standards for the Archaeological & Palaeontological Components of Impact Assessment Reports"* the aims of the palaeontological impact assessment are:

- to identify exposed and subsurface rock formations that are considered to be palaeontologically significant;
- to assess the level of palaeontological significance of these formations;
- to comment on the impact of the development on these exposed and/or potential fossil resources and
- to make recommendations as to how the developer should conserve or mitigate damage to these resources.

In preparing a palaeontological desktop study the potential fossiliferous rock units (groups, formations etc.) represented within the study area are determined from geological maps.The known fossil heritage within each rock unit is inventoried from the published scientific literature and previous palaeontological impact studies in the same region.

The likely impact of the proposed development on local fossil heritage is determined on the basis of the palaeontological sensitivity of the rock units concerned and the nature and scale of the development itself, most notably the extent of fresh bedrock excavation envisaged.The different sensitivity classes used are explained in Table 1.1 below.

Table 1.1 Palaeontological Sensitivity Analysis Outcome Classification

Sensitivity	Description
Low Sensitivity	Areas where a negligible impact on the fossil heritage is likely. This category is reserved largely for areas underlain by igneous rocks. However, development in fossil bearing strata with shallow excavations or with deep soils or weathered bedrock can also form part of this category.
Moderate Sensitivity	Areas where fossil bearing rock units are present but fossil finds are localised or within thin or scattered sub-units. Pending the nature and scale of the proposed development the chances of finding fossils are moderate.A field-based assessment by a professional palaeontologist is usually warranted.
High Sensitivity	Areas where fossil bearing rock units are present with a very high possibility of finding fossils of a specific assemblage zone. Fossils will most probably be present in all outcrops and the chances of finding fossils during a field-based assessment by a professional palaeontologist are very high. Palaeontological mitigation measures need to be incorporated into the Environmental Management Plan

1.3. Scope and Limitations of the Desktop Study

The study will include: i) an analysis of the area's stratigraphy, age and depositional setting of fossil-bearing units; ii) a review of all relevant palaeontological and geological literature, including geological maps, and previous palaeontological impact reports; iii) data on the proposed development provided by the developer (e.g. location of footprint, depth and volume of bedrock excavation envisaged) and iv) where feasible, location and examination of any fossil collections from the study area (e.g. museums).

The key assumption for this scoping study is that the existing geological maps and datasets used to assess site sensitivity are correct and reliable. However, the geological maps used were not intended for fine scale planning work and are largely based on aerial photographs alone, without ground-truthing. There is also an inadequate database for fossil heritage for much of the RSA, due to the small number of professional palaeontologists carrying out fieldwork in RSA. Most development study areas have never been surveyed by a palaeontologist.

These factors may have a major influence on the assessment of the fossil heritage significance of a given development and without supporting field assessments may lead to either:

- an underestimation of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or
- an overestimation of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by weathering, or are buried beneath a thick mantle of unfossiliferous "drift" (soil, alluvium etc.).

2. DESCRIPTION OF THE PROPOSED DEVELOPMENT

Transnet SOC Limited (hereafter referred to as Transnet) is a government (state) owned company (SOC) and is the custodian of South Africa's railway, ports and pipelines, thereby responsible for delivering reliable freight transport and handling services that satisfy customer demand.

As such, Transnet in collaboration with Swaziland Railway identified the construction and upgrade of the railway line between Davel in Mpumalanga and Richards Bay in KwaZulu-Natal, connecting via the Swaziland rail network, as a strategic project. The aim of the project is to unlock the potential of a multinational strategic rail corridor and divert general freight traffic off the dedicated heavy haul Richards Bay coal line which runs from Ermelo through rural KwaZulu-Natal to Richards Bay.

The project activities will consist of various works, including the upgrading of existing railway sections (including re-building certain sections), construction of an entirely new rail link from Lothair in South Africa to Sidvokodvo in Swaziland and construction of new rail yards. These proposed works trigger a number of listed activities as specified in the National Environmental Management Act (NEMA), 107 of 1998, the National Water Act (NWA), 36 of 1998 and the National Environmental Management: Waste Act (NEM:WA), 59 of 2008.

Due to the magnitude of the proposed project, which stretches over a distance of approximately 570 km including Swaziland, it was decided that three applications will be compiled as follows:

1. Davel yard and connections, DEA ref no 14/12/16/3/3/2/551;
2. Mpumalanga rail line from Davel to Nerston, DEA ref no 14/12/16/3/3/2/553;
3. KwaZulu-Natal railway line from Golela to Nsezi, DEA ref no 14/12/16/3/3/2/552.

Each of the three sections will go through the EIA process separately, although concurrently (as far as possible) in order to simplify the public participation process and to reduce any potential confusion. **This report specifically pertains to application 2 as mentioned above, i.e. the Mpumalanga rail line from Davel to Nerston (Ref. number: 14/12/16/3/3/2/553).**

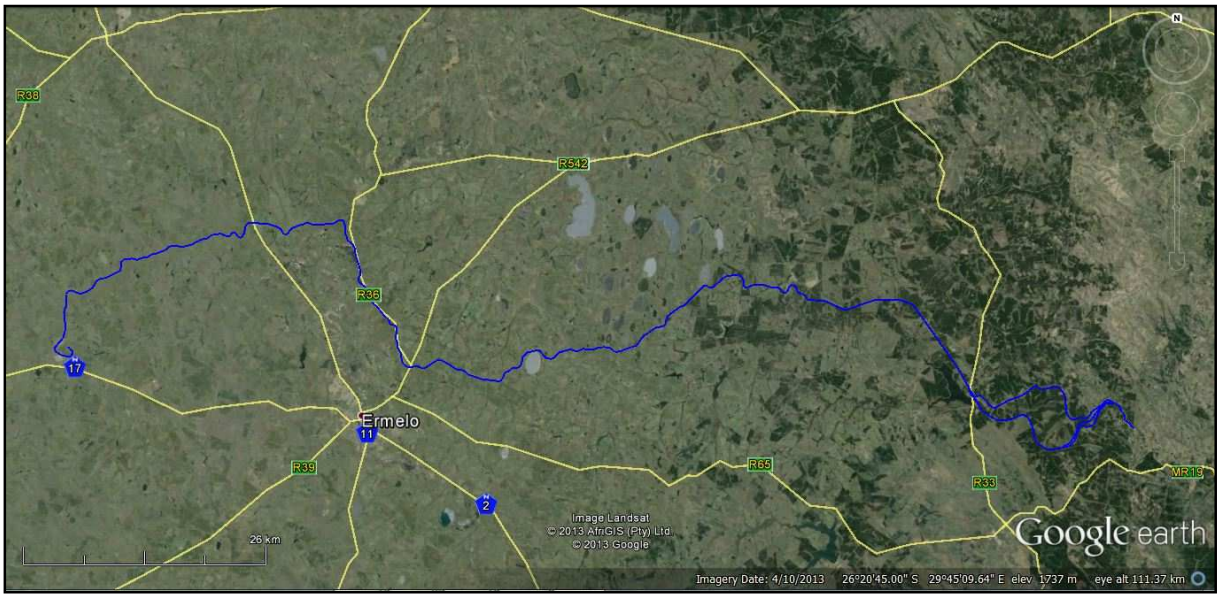


Figure 2.1 Locality of the proposed Mpumalanga rail line from Davel to Nerston

3. GEOLOGY

The section of the proposed upgrading of the railway line between Davel and Nerston is underlain by Randian aged granites, Permian aged sedimentary and Jurassic volcanic rocks of the Karoo Supergroup.

The two proposed alternative routes close to the Swaziland border are underlain by Swazian and Randian aged intrusive rocks.

3.1. Swazian and Randian aged intrusive rocks and Granites (Zb, Rp, Rt, Rpg)

The ancient rocks of these units comprise very old lava deposits, gabbros and ultrabasic rocks including pyroxinite and norite.

3.2. Karoo Supergroup

3.2.1. Ecca Group - Vryheid Formation (Pv)

The Permian aged Vryheid Formation is a thick sequence of sedimentary rocks dominated by light grey sandstones with interbedded grey shale and thick, economically important coal seams. These sandstones were deposited along ancient sandy shorelines behind which lay vast swamplands. Burial of vegetation in the swamps eventually formed coal which is mined at various localities in the area.

3.2.2. Karoo Dolerite (Jd)

Numerous sections in the western part of the proposed route are underlain by extensive dolerite sills.

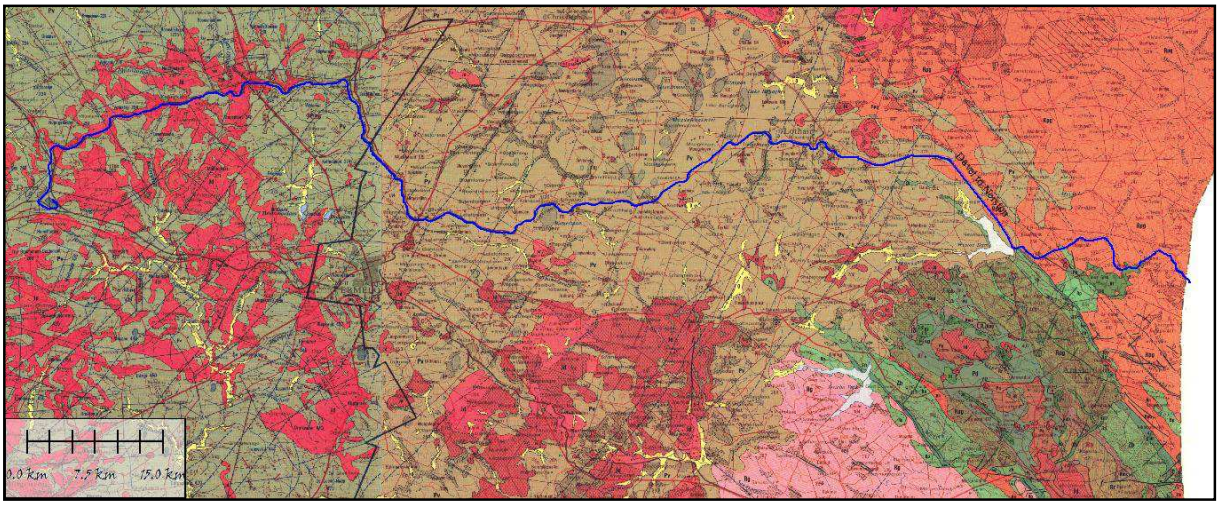
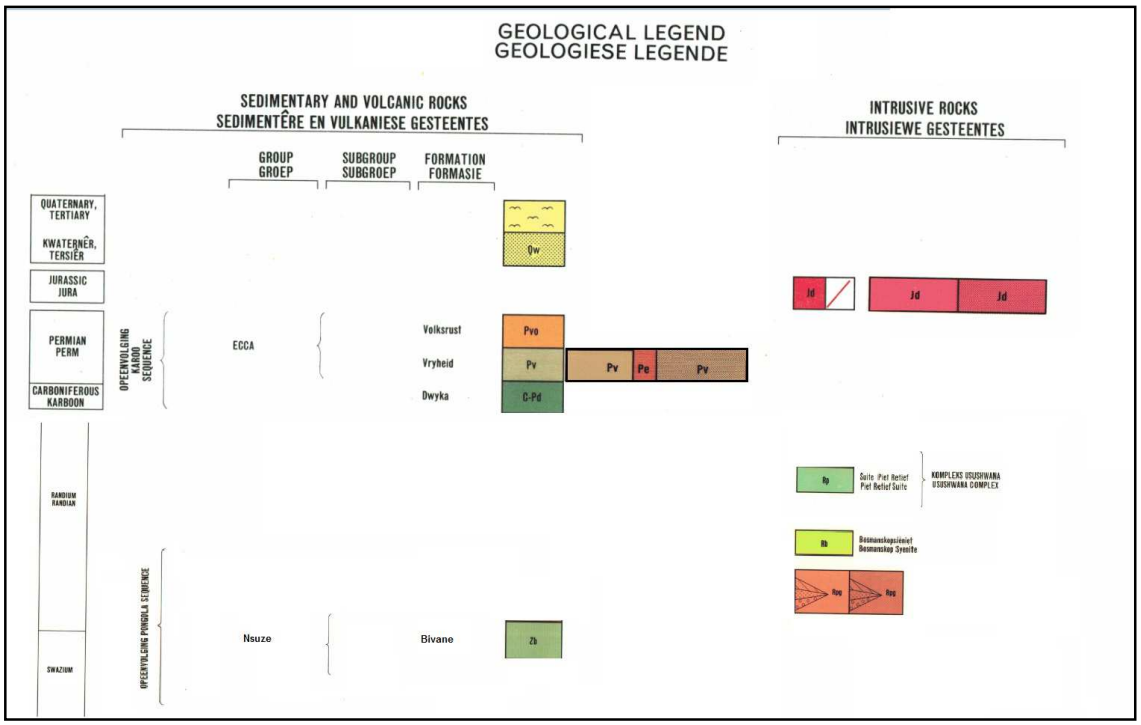


Figure 3.1 Geology of the Mpumalanga rail line between Davel and Nerston



4. PALAEONTOLOGY AND PALAEONTOLOGICAL SENSITIVITY OF THE STUDY AREA

4.1. Swazian and Randian aged intrusive rocks and Granites (Zb, Rp, Rt, Rpg)

Due to the age and igneous as well as metamorphic character of these rock units it is very unlikely that fossils will be found. A Low Palaeontological Sensitivity is allocated to these units.

4.2. Karoo Supergroup

4.2.1. Ecca Group -Vryheid Formation (PV).

The Vryheid Formation is well-known for the occurrence of coal beds that resulted from the accumulation of plant material over long periods of time. Plant fossils described by Bamford (2011) from the Vryheid Formation are; *Azaniodendron fertile, Cyclodendron leslii, Sphenophyllum hammanskraalensis, Annularia sp., Raniganjia sp., Asterotheca spp., Liknopetalon enigmata, Glossopteris > 20 species, Hirsutum 4 spp., Scutum 4 spp., Ottokaria 3 spp., Estcourtia sp., Arberia 4 spp., Lidgetonnia sp., Noeggerathiopsis sp. and Podocarpidites sp.*

According to Bamford (2011) “Little data have been published on these potentially fossiliferous deposits. Around the coalmines there is most likely to be good material and yet in other areas the exposures may be too poor to be of interest. When they do occur fossil plants are usually abundant and it would not

be feasible to preserve and maintain all the sites, however, in the interests of heritage and science such sites should be well recorded, sampled and the fossils kept in a suitable institution.

Although no vertebrate fossils have been recorded from the Vryheid Formation, invertebrate trace fossils have been described in some detail by Mason and Christie (1985). It should be noted, however, that the aquatic reptile, *Mesosaurus*, which is the earliest known reptile from the Karoo Basin, as well as fish (*Palaeoniscus capensis*), have been recorded in equivalent-aged strata in the Whitehill Formation in the southern part of the basin (MacRae, 1999; Modesto, 2006). Indications are that the Whitehill Formation in the main basin might be correlated with the mid-Vryheid Formation. If this assumption proves correct, there is a possibility that Mesosaurus could be found in the Vryheid Formation.

The late Carboniferous to early Jurassic Karoo Supergroup of South Africa includes economically important coal deposits within the Vryheid Formation of Natal. The Karoo sediments are almost entirely lacking in body fossils but ichnofossils (trace fossils) are locally abundant. Modern sedimentological and ichnofaunal studies suggest that the north-eastern part of the Karoo basin was marine. In KwaZulu-Natal a shallow basin margin accommodated a prograding fluviodeltaic complex forming a broad sandy platform on which coal-bearing sediments were deposited. Ichnofossils include U-burrows (formerly *Corophioides*) which are assigned to ichnogenus *Diplocraterion* (Mason and Christie, 1985).

A High Palaeontological Sensitivity is allocated to the areas underlain by the Vryheid Formation.

4.3. Karoo Dolerite

Due to the igneous character of the rocks no fossils will be present. A Low Palaeontological Sensitivity is allocated to the sections underlain by these units.

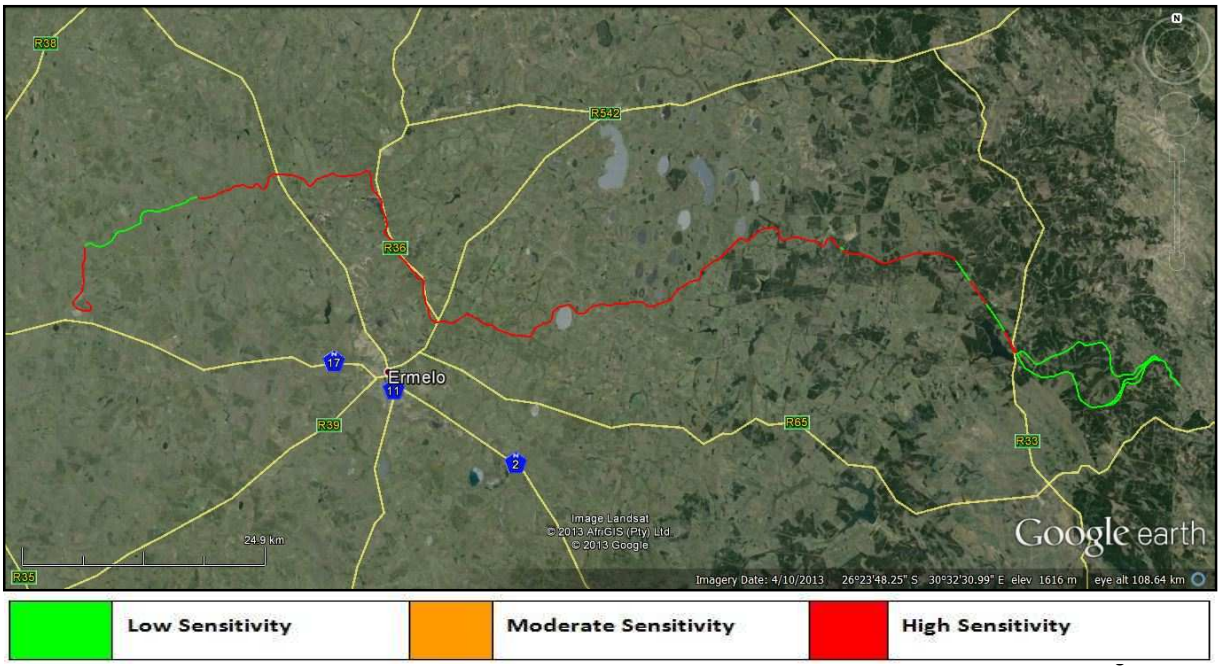


Figure 4.1 Palaeontological sensitivity of the Mpumalanga rail line from Davel to Nerston

5. CONCLUSION AND RECOMMENDATIONS

The section between Davel and Nerston is underlain by Jurassic dolerite, Permian Vryheid Formation sediments and ancient metamorphic and igneous rocks. The proposed alternative routes on the Davel to Nerston section is underlain by ancient metamorphic and igneous rocks, with a very small section underlain by Permian Vryheid Formation sediments. The areas underlain by the Vryheid Formation has been allocated a High Palaeontological Sensitivity. Sections underlain by igneous and metamorphic rocks were allocated a Low Palaeontological Sensitivity.

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6. REFERENCES

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7. QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

Dr Gideon Groenewald has a PhD in Geology from the University of Port Elizabeth (Nelson Mandela Metropolitan University) (1996) and the National Diploma in Nature Conservation from Technicon RSA (the University of South Africa) (1989). He specialises in research on South African Permian and Triassic sedimentology and macrofossils with an interest in biostratigraphy, and palaeoecological aspects. He has extensive experience in the locating of fossil material in the Karoo Supergroup and has more than 20 years of experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the southern, western, eastern and north-eastern parts of the country. His publication record includes multiple articles in internationally recognized journals. Dr Groenewald is accredited by the Palaeontological Society of Southern Africa (society member for 25 years).

8. DECLARATION OF INDEPENDENCE

I, Gideon Groenewald, declare that I am an independent specialist consultant and have no financial, personal or other interest in the proposed development, nor the developers or any of their subsidiaries, apart from fair remuneration for work performed in the delivery of palaeontological heritage assessment services. There are no circumstances that compromise the objectivity of my performing such work.

Dr Gideon Groenewald
Geologist