

APPENDIX L: PALAEOLOGICAL STUDY

**Palaeontological Impact Assessment for the proposed
Coal mine on farm Commissiekraal 90HT, in the
eMadlangeni Local Municipality and Amajuba District
Municipality of the KwaZulu Natal Province**

Desktop Study

For

SLR Consulting (Africa) (Pty) Ltd.

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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 year PIA studies

Declaration of Independence

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

Specialist: Prof Marion Bamford.....

Signature:



Executive Summary

The desktop Palaeontological Impact Assessment for the proposed mining project on the farm Commissiekraal, KwaZulu Natal, concludes that there is very little likelihood of any fossils of scientific interest being found during the early stages of the development because the coal seams are underground.

Once mining operations have begun the personnel should look out for fossils in the shales between coal seams. This information will be built into the mine's training and awareness plan and procedures. If any fossil plants are found they should be removed and protected, and a palaeontologist called to assess their significance.

Palaeontological Impact Assessment for the proposed Coal mine on farm Commissiekraal 90HT, in the eMadlangeni Local Municipality and Amajuba District Municipality of the KwaZulu Natal Province

Background

As requested by William Berry of SLR Consulting (Africa) (Pty) Ltd, on behalf of their client, Tholie Logistics, here is a desktop palaeontological assessment for the proposed mining project.

Tholie Logistics currently hold the prospecting right for coal on the farm Commissiekraal 90HT. The project area is located approximately 28 km north of Utrecht, 28 km east of Wakkerstroom and 36 km west of Paulpietersburg in the eMadlangeni Local Municipality and Amajuba District Municipality of the KwaZulu Natal Province. Tholie Logistics proposes to develop an underground coal mining operation and establish related surface infrastructure to support the mining operation. The surface infrastructure that could be established as part of the proposed Commissiekraal Coal Mine includes:

- Decline shaft
- Ventilation shafts
- Substation
- Workshops, wash bay and stores
- Offices and parking
- Change house
- Diesel storage facilities
- Pollution control infrastructure
- Support infrastructure and services.

The average depth of minerals below surface is 72.5m.

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.

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.

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.

Geology and Palaeontology

Project location and geological setting

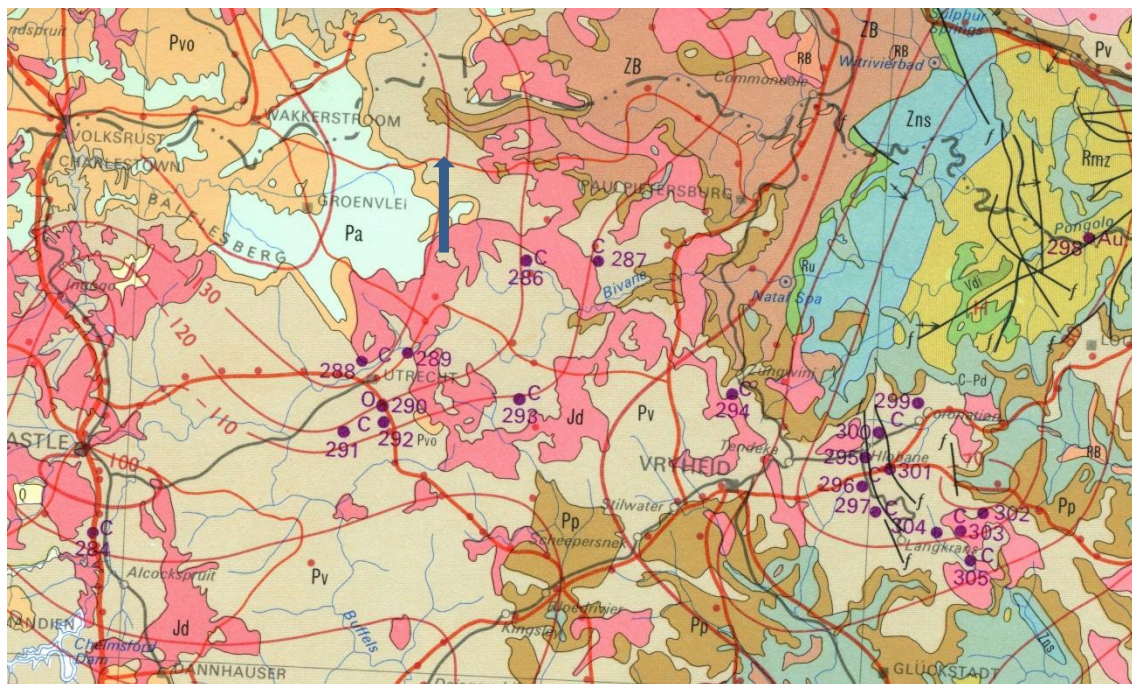


Figure 1. Geological map of the area between Wakkerstroom, Paulpietersburg and Utrecht. The approximate location of the proposed underground mine is indicated with the arrow. Abbreviations of the rock types are explained in Table 1. Map enlarged from the Geological Survey 1: 1 000 000 map 1984.

Symbol	Group/Formation	Lithology	Approximate Age
Jd	Jurassic	Dolerite dykes, intrusive	Jurassic, approx. 180 Ma
Pa	Adelaide and Estcourt	Mudstone, sandstone	Beaufort
Pvo	Volkstrust	shale	Middle Permian, Upper Ecca
Pv	Vryheid	Shales, sandstone, coal	Lower Permian, Middle Ecca
C-Pd	Dwyka	Tillite, sandstone, mudstone, shale	Upper Carboniferous to Lower Permian
ZB	unnamed	Potassic granite and granodiorite	Basement, >3000 Ma

Table 1: Explanation of symbols for the geological map and approximate ages (Eriksson et al., 2006; Johnson et al., 2006; Snyman, 1998).

Geology

The project area falls within the Utrecht Coalfield which lies in north-western KwaZulu Natal, south of the Highveld and Ermelo Coalfields and east of the Kliprivier Coalfield. The Utrecht Coalfield covers an area of approximately 6 000 km² extending from just north-east of Newcastle to Wakkerstroom in the north-west and Paulpietersburg in the north-east.

The Utrecht Coalfield was cut-off from the Vryheid Coalfield by erosion and from the Klipriver Coalfield by a high density dolerite intrusion (Snyman, 1998). The coalfield was developed following the retreat of the Dwyka glaciers which deposited diamictites. The *Glossopteris* flora colonized the marginal river and lake systems forming layers of coal between the shales and mudstones that filled the Karoo Basin. These sediments, which constitute the Vryheid Formation, contain several economically exploitable coal seams. Numerous coal seams are developed in this area, namely the top downwards: Eland, Fritz, Alfred, Rider, Upper Gus, Lower Gus, Dundas and Coking Seams (Snyman, 1998). The Gus Seams are the most significant of these seams.

Dolerite sills and dykes are abundant and are known to cause substantial displacements in strata. The main intrusive body in the project area is the Zuinguin Dolerite. Evidence of an east-west striking fault was found on the northern extremity of the project area.

The project area is mostly underlain by the Gus Seams. The inter-seam parting thickness ranges from more than 3 m in the south to being nearly absent in the north, where the Upper Gus and Lower Gus form one seam.

Palaeontology

Coals are formed by the burial of peats and over time the compaction and alteration of the organic material caused by increasing temperatures and pressures. Coals, therefore, are the product of fossil plants but within the coal seams the plant material is unrecognizable. In the shales and mudstones closely associated with the coal seams it is possible to find fossilized wood, leaf impressions, insect impressions, cuticle and pollen. The distribution of the fossils is very patchy and unpredictable. Vertebrate fossils very seldom occur with the plant fossils.

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 no records of fossils plants from this area, most likely because the deposits are far below the surface (Table 2).

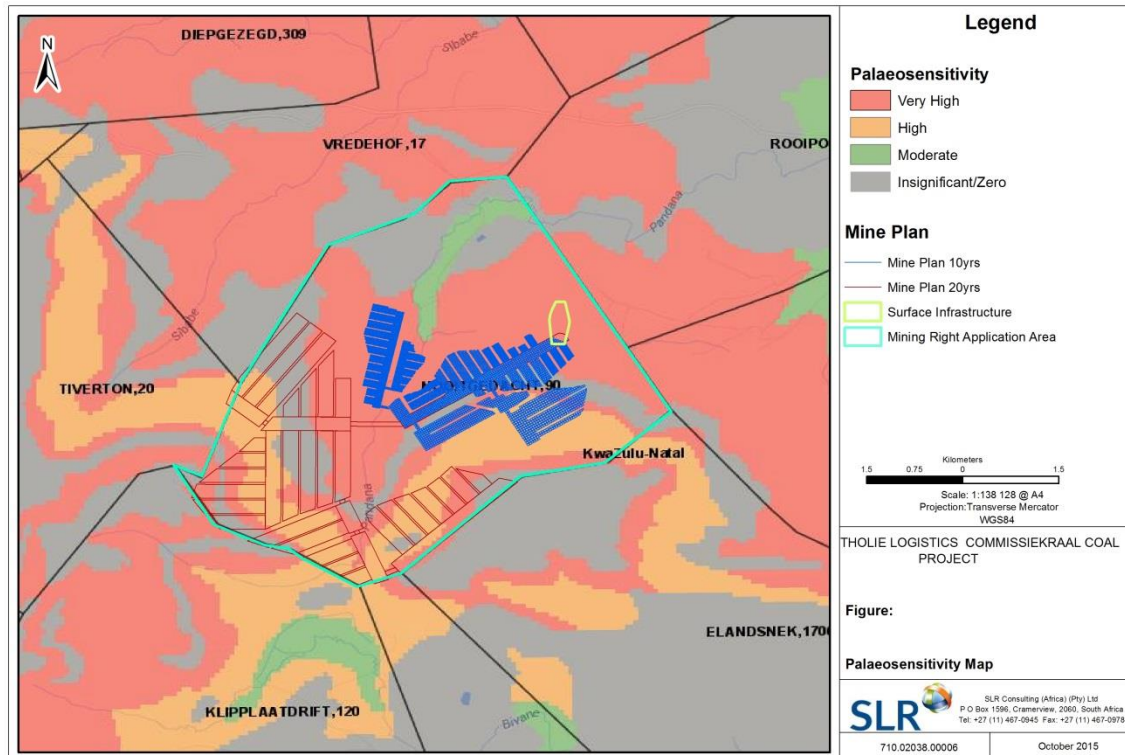


Table 2: SAHRIS palaeosensitivity scheme

Colour	Sensitivity	Required Action
RED	VERY HIGH	field assessment and protocol for finds is required
ORANGE/YELLOW	HIGH	desktop study is required and based on the outcome of the desktop study, a field assessment is likely
GREEN	MODERATE	desktop study is required
BLUE	LOW	no palaeontological studies are required however a protocol for finds is required
GREY	INSIGNIFICANT/ZERO	no palaeontological studies are required
WHITE/CLEAR	UNKNOWN	these areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

Impact assessment

The surface activities would not impact on the fossil heritage as the coals and any associated fossil plants are below ground. The impact is nil.

Once mining activities start excavations could encounter fossils, however these are not expected to be of significant scientific interest. Therefore the SEVERITY/NATURE of environmental impact would be L (according to the scheme in Table 3).

DURATION of the impact would be permanent: H.

Since only the possible fossils within the mine will be affected the SPATIAL SCALE will be localized within the site boundary and any fossils found are not expected to be of regional or national interest: L.

Proposed mining will be only of the coal seams, and not the shales in between so 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

Assumptions and uncertainties

Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the coal seams and associated shales are typical

of other deposits in the Karoo Basin, so no fossil animals will occur there. Coal is made from fossil plants but compressed and altered to such an extent that the original plant material is unrecognisable. Fossil plants may be associated with the adjacent shales and shale lenses but are assumed to be the same as other coal deposits and therefore very common. Until the coal seams and shales are exposed and examined this remains an uncertainty, but a minor one.

Recommendation

While it is possible that plant fossils occur in the proposed mining and infrastructure area they will not be detected until excavations and mining operations begin. A site visit is therefore not feasible until such stage.

If fossil plant material is discovered during the development or mining operations, then it is strongly recommended that a professional palaeontologist, preferably a palaeobotanist, be called to assess the importance and to rescue them if necessary (with the relevant Amafa permit).

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. Given the shortage of such qualified people in South Africa and the stringent safety laws for access by the mining companies, any long term monitoring of the fossils is impractical. Nonetheless a monitoring programme is outline below.

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

Monitoring Programme for Palaeontology –to commence once the mine is operational.

1. The following procedure is only required if and when underground mining commences. The surface activities would not impact on the fossil heritage as the coals and any associated fossil plants are below ground.
2. When mining operations commence the shales and mudstones (of no economic value) that will be cut through in order to reach the coal seams. Any overburden must be given a cursory inspection by the mine geologist or designated person before being stored or used by the mine. Any fossiliferous material should be put aside in a suitably protected place. This way the mining activities will not be interrupted.
3. Photographs of similar fossil plants must be provided to the mine to assist in recognizing the fossil plants in the shales and mudstones. This information will be built into the mine's training and awareness plan and procedures.
4. On a regular basis, to be agreed upon by the mine management and the qualified palaeontologist/palaeobotanist sub-contracted for this project, the person should visit the mine to inspect the selected material and check overburden removed where feasible. The frequency of inspections should be monthly. However, if the

geologist/deputy is diligent and extracts the fossil material then inspections can be less frequent.

5. Fossil plants considered to be of good quality or scientific interest by the palaeobotanist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the mine property a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits.
6. If any underground inspection is deemed necessary then the normal safety procedures that the mine management endorses, must be followed by the palaeontologist and associated mine employees.
7. If no good fossil material is recovered then the site inspections by the palaeontologist can be reduced to annual events until mining operations cease. Annual reports by the palaeontologist must be sent to SAHRA.

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