Palaeontological Impact Assessment for the proposed Alexander Project, near Kriel, Mpumalanga Province.

Desktop Study

For

Synergistics Environmental Services
(Synergistics)

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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 Synergistics Environmental Services (Synergistics), an SLR group company. The views expressed in this report are entirely those of the author and Synergistics 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 underground mining project to the south of Kriel, Mpumalanga Province, the Alexander project, concludes that there is very little likelihood of any fossils of scientific interest being found during the early stages of the development because the No. 4 coal seam targeted for the Alexander project is underground.

Once mining operations have begun the personnel should look out for fossils in the shales between the 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.

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1. Background

Anglo American Inyosi Coal (Pty) Ltd (AAIC) is proposing to establish a new underground coal mine through the Alexander Project ('the project'). The Alexander coal resource lies within the current AAIC prospecting right areas (proposed Alexander mining right area) and covers an area of approximately ~ 7,300ha. The project will involve the development of surface and underground facilities. In broad terms the proposed Alexander Project will comprise an underground mine, a waste rock dump, topsoil stockpiles, mine related facilities such as workshops, stores and various support infrastructure and services. Further to this, the proposed project will require construction of an overland conveyor to transport run-of mine coal from the proposed Alexander incline shaft to the stockpile area at the Elders Colliery from where it will be transported via the Elders overland conveyor to Goedehoop Colliery for beneficiation purposes.

The proposed project is located approximately 12 km northwest of Bethal and directly to the south and south-east of Kriel in the Mpumalanga Province. The Alexander resource lies between the R547 provincial road to the west and the R35 provincial road to the east, with the R545 provincial road bisecting the resource in a north-west to south-east direction. See Figure 1.1 for the locality of the project. A number of farms would be impacted by the development and they are summarized below (i.e. not all portions are listed): Aangewys 81 Alexander 102, Caley 77, Dorstfontein 71, Elandsfontein 75, Kafferstad 79, Onverwacht 70, Rensburgshoop 74, Witbank 80, Witbank 576, Witrand 103. The overland ROM conveyor line will be on several farms: Elandsfontein 75, Legdaar 78, Middelkraal 50, Rensburgshoop 74, Schoon-Vlei 52, Vlakkuilen 76.

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.

This report complies with the requirements of the NEMA and environmental impact assessment (EIA) regulations (GNR 982 of 2014). The table below provides a summary of the requirements, with cross references to the report sections where these requirements have been addressed.

Table 1.1: Specialist report requirements in terms of Appendix 6 of the EIA Regulations (2014)

A specialist report prepared in terms of the Environmental Impact Regulations of 2014 must contain:	**Relevant section in report**
Details of the specialist who prepared the report	Prof Marion Bamford
The expertise of that person to compile a specialist report including a curriculum vitae	Palaeontologist (PhD Wits 1990) CV attached
A declaration that the person is independent in a form as may be specified by the competent authority	Page 1

An indication of the scope of, and the purpose for which, the report was prepared	Section 1 (page 1
The date and season of the site investigation and the relevance of the season to the outcome of the assessment	n/a Seasons make no difference to buried coals
A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 2 (p. 3)
The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	See table 1.2 (p. 5)
An identification of any areas to be avoided, including buffers	n/a
A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	n/a
A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 6 (p. 8)
A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	n/a
Any mitigation measures for inclusion in the EMPr	Section 8 (p. 9)
Any conditions for inclusion in the environmental authorisation	Section 8 (p. 9)
Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 8 (p. 9)
A reasoned opinion as to whether the proposed activity or portions thereof should be authorised and	Section 7 (p.8)
If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 7 & 8 (p. 8,9)
A description of any consultation process that was undertaken during the course of carrying out the study	n/a
A summary and copies if any comments that were received during any consultation process	n/a
Any other information requested by the competent authority.	n/a

2. 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.

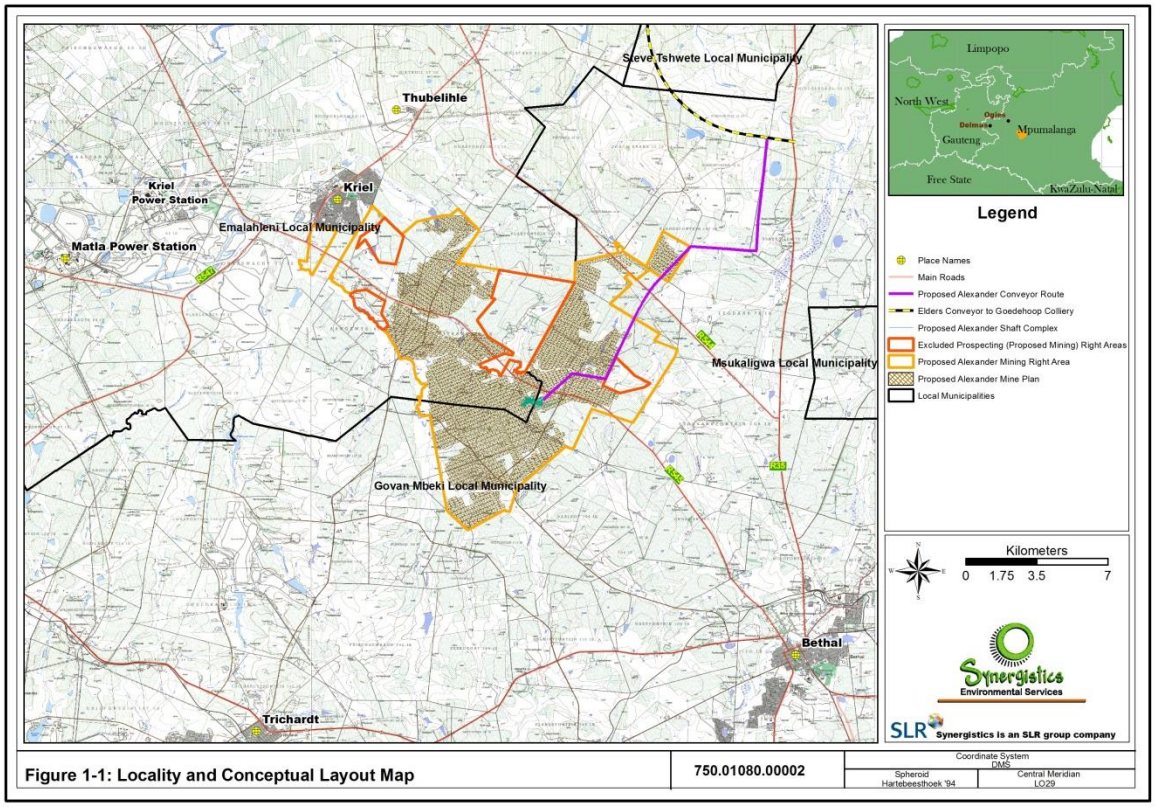

Figure 1.1: Locality of proposed Alexander project mine and infrastructure. Map provided by Synergistics.

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.

3. 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.

4. Geology and Palaeontology

<u>Project location and geological setting</u>

Geology
The ancient rocks outcropping in the northern part of the proposed coal mining area are the Lebowa Granite Suite and the Selons River Formation of the Rooiberg Group. They do not contain coal and are too old to be fossiliferous rocks. The coal mining area is in the Vryheid Formation of the Highveld

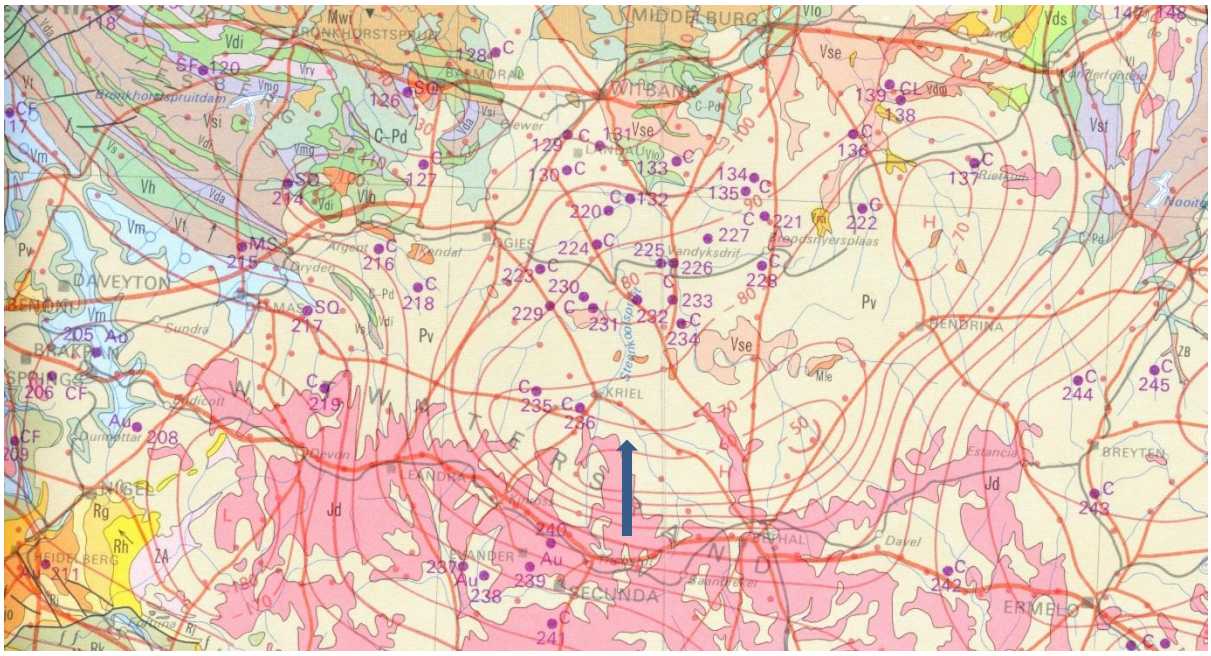

Figure 1.2 Geological map of the area between Kriel and Bethal. The approximate location of the proposed underground mine is indicated with the arrow. Abbreviations of the rock types are explained in Table 1.2. Map enlarged from the Geological Survey 1: 1 000 000 map 1984.

Table 1.2: Explanation of symbols for the geological map and approximate ages (Eriksson et al., 2006; Johnson et al., 2006; Snyman, 1998).

Symbol	Group/Formation	Lithology	Approximate Age
Jd	Jurassic	Dolerite dykes, intrusive	Jurassic, approx. 180 Ma
Pa	Adelaide and Estcourt	Mudstone, sandstone	Beaufort
Pvo	Volksrust	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
Mle	Lebowa Granite Suite	Harzburgite, norite, gabbro, granophyre	2052 Ma
Vse	Selons Rivier, Rooiberg Group	Red porphyritic rhyollite	>2100 Ma

Coalfield (Snyman, 1998). There are five coal seams in this area with numbers 5, 4 and 2 being fairly thick and 1 and 3 very thin. The strata in between the coal seams comprise sandstones and mixed sand stones and shales. Shale and siltstone bands occur between seams 5 and 4 and above seam No. 2. The dolerite dykes are common to the south of the proposed mining area and they would have destroyed any fossiliferous material that might have been present.

Palaeontology

Coal are formed by the burial of peats and over time the compaction and alteration of the organic material caused by increasing temperatures and pressures. Coal, therefore, are the product of fossil plants but within the coal seams the plant material is unrecognisable. 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. There are two shale and sandstone bands only and the distribution of the fossils within these bands would be 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, however, no records of fossils plants from this area, most likely because the deposits are far below the surface, more than 30m.

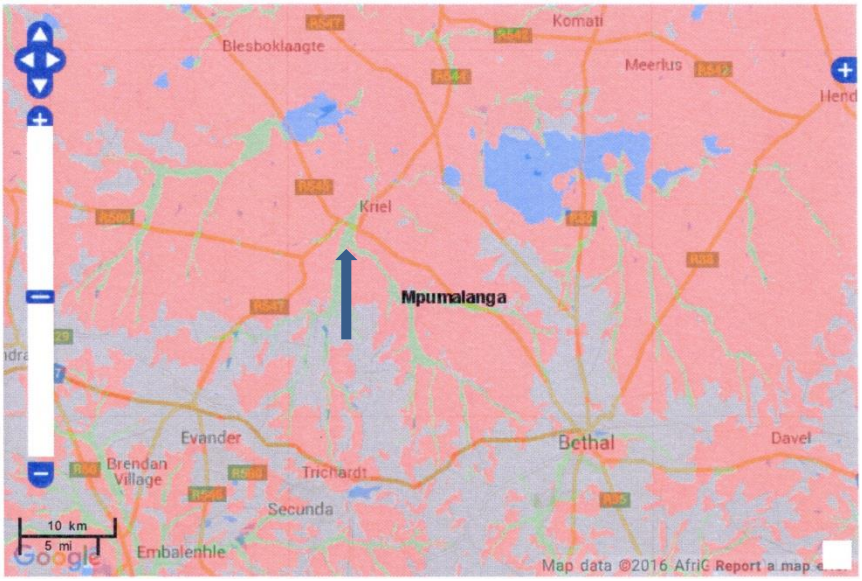

Figure 1.3 SAHRIS palaeosensitivity map of the Kriel – Bethal area. Arrow indicates location of the proposed mine (Map downloaded from SAHRIS website).

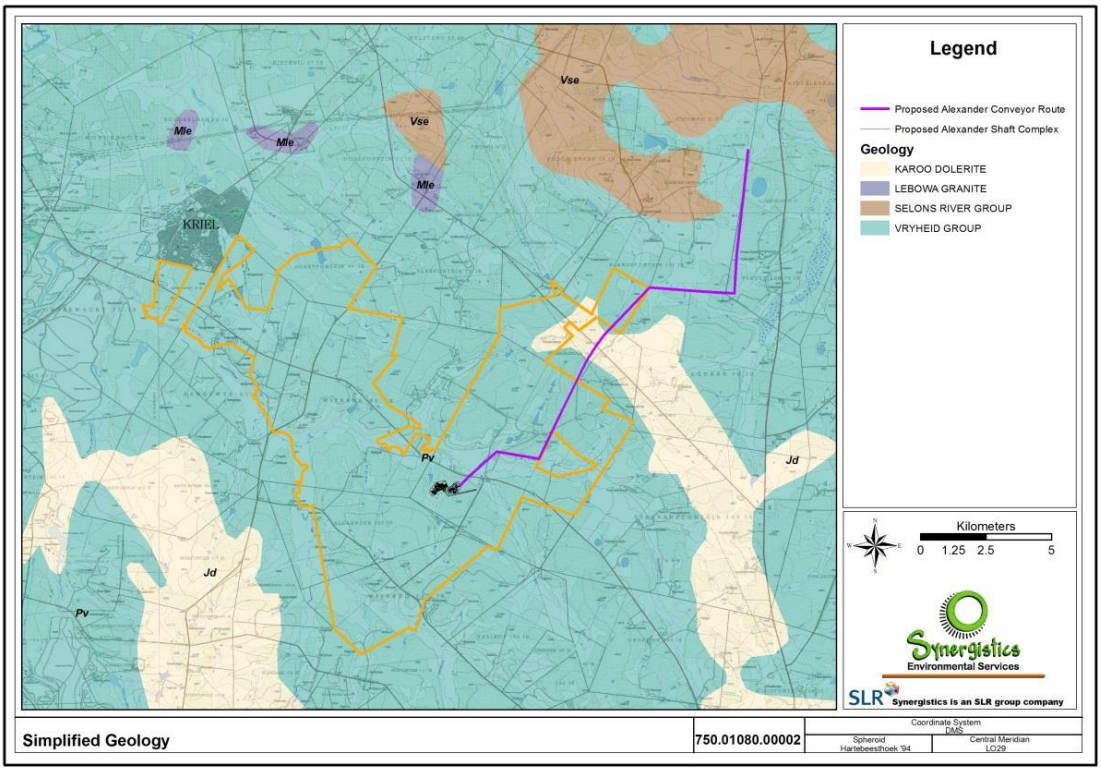

Figure 1.4 Detailed geology map indicating the Vryheid Formation that comprises coal deposits and potentially plant fossils. (Map provided by Synergistics).

5. Impact assessment

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

Once mining activities start there would be minor deterioration of the site and no impact on people. Therefore the SEVERITY/NATURE of the environmental impact would be L (according to the scheme in Table 1.3.

DURATION of the impact would be permanent: L.

Since only the possible fossils within the mine will be affected the SPATIAL SCALE will be localised within the site boundary: L.

Proposed mining will only be of the No. 4 coal seam, and not the shales in between but these would be removed in many places to access the coal seam below. However, the PROBABILITY of affecting any fossils is unlikely or seldom: L

TABLE 1.3: 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

6. 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 unrecognizable. 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.

7. 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 SAHRA 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 outlined 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.

8. **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 coal 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 seam must be given a cursory inspection by the mine geologist or designated person before being added to the waste rock dump 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 (for example see Figure 1.5). 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 the dumps 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 that are 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.

9. References

Cadle, A.B., Cairncross, B., Christie, A.D.M., Roberts, D.L., 1993. The Karoo Basin of South Africa: the type basin for the coal bearing deposits of southern Africa. *International Journal of Coal Geology* 23, 117-157.

Erikssen, P.G., Altermann, W., Hartzer, F.J., 2006. The Transvaal Supergroup and its pre-cursors. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. pp 237-260.

Johnson, M.R., van Vuuren, C.J., Visser, J.N.J., Cole, D.I., Wickens, H.deV., Christie, A.D.M., Roberts, D.L., Brandl, G., 2006. Sedimentary rocks of the Karoo Supergroup. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. Pp 461 – 499.

Snyman, C.P., 1998. Coal. In: Wilson, M.G.C., and Anhaeusser, C.P., (Eds). The Mineral Resources of South Africa: Handbook, Council for Geosciences 16, 136-205.

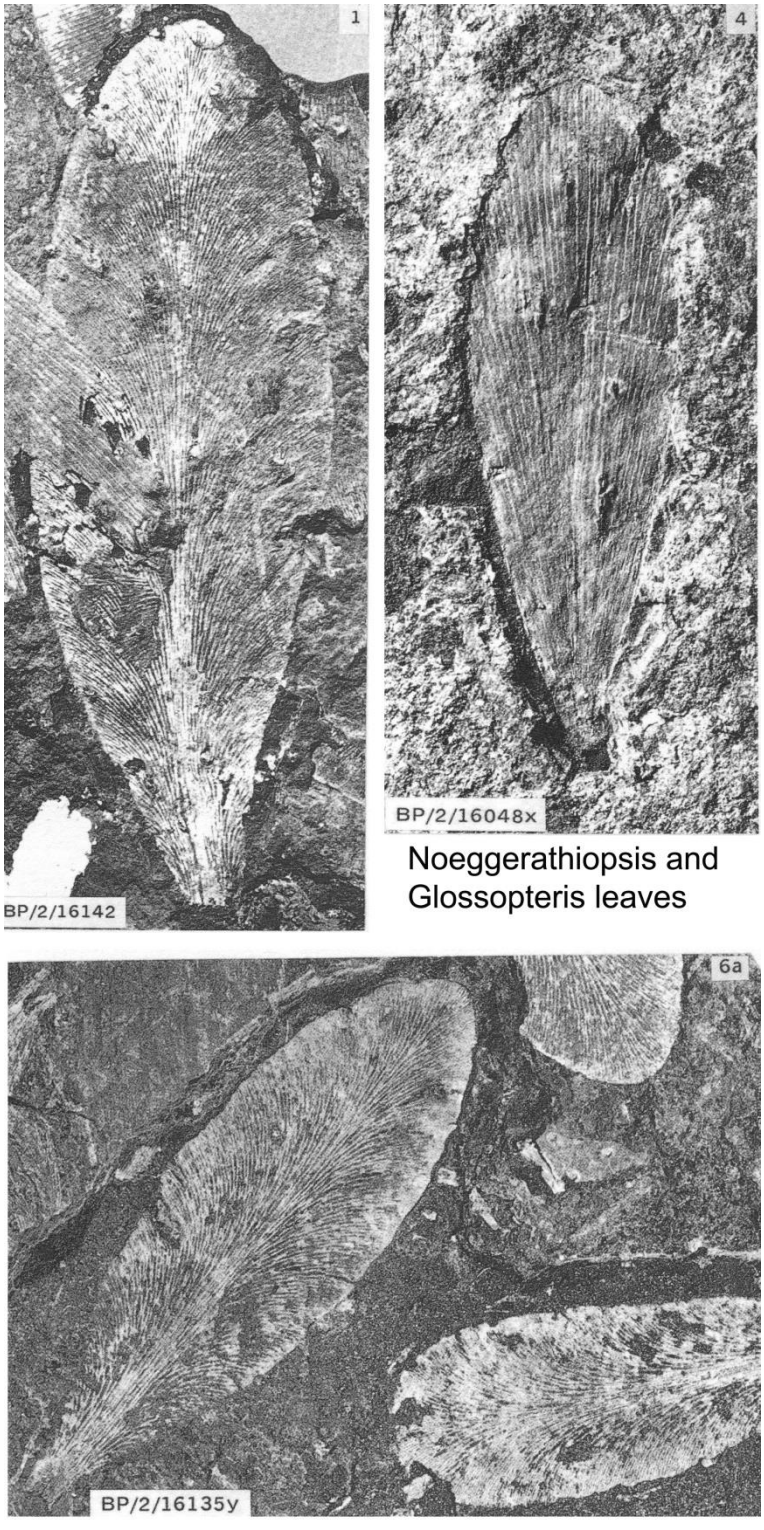

Figure 1.5: Examples of the most common fossil plants from the Volksrust Formation. Leaves range in length from 5-25cm long and often appear as shiny black leaves on dull black matrix so are difficult to see.