Report for proposed 132 kVpower lines between the Lebowakgomo and Dithabaneng; Dithabaneng and Dwaalkop substations; and proposed Boynton substation

Limpopo Province

Farms: Voorspoed 458KS, Doornvlei 456KS, Mphatlele 457KS

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Palaeontological Desktop Impact Assessment

Commissioned by: Texture Environmental Consultants

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B. Executive summary

Outline of the development project: Texture Environmental Consultants has appointed Dr H. Fourie, a palaeontologist, to undertake a Desktop Paleontological Impact Assessment of –
Section 1: The new 132 kV power line between the existing Lebowakgomo substation and the new Dithabaneng substation.
Section 2: The new 132 kV power line between the Dithabaneng substation and the new Dwaalkop substation.
Section 3: The 132 kV loop-in-loop-out (LiLo) line from the Middelpunt-Dithabaneng 132 kV line to the proposed Boynton substation.

The National Heritage Resources Act 25 of 1999 requires that all heritage resources, that is, all places or objects of aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance are protected. Fossil heritage of national and international significance is found within all provinces of the RSA. Heritage resources may not be excavated, damaged, destroyed or otherwise impacted by any development without prior assessment and without a permit from the relevant heritage resources authority.

The main aim of the assessment process is to document resources in the development area and identify both the negative and positive impacts that the development brings to the receiving environment. The PIA will make recommendations for protection or mitigation of these resources.

This report prescribes to the Heritage Impact Assessment of Section 38 of the National Heritage Resources Act 25 of 1999.

For this study resources such as geological maps, scientific literature, fossil collections, satellite images, aerial maps and topographical maps were used. It provides an assessment of the observed or inferred palaeontological heritage within the study area, with recommendations (if any) for further specialist palaeontological input where this is considered necessary.

A Desktop Palaeontological Impact Assessment is generally warranted where rock units of HIGH palaeontological sensitivity are concerned, levels of bedrock exposure within the study area are adequate; large scale projects with high potential heritage impact are planned; and where the distribution and nature of fossil remains in the proposed area is unknown. The specialist will inform whether further monitoring and mitigation are necessary.

Types and ranges of heritage resources as outlined in Section 3 of the National Heritage Resources Act, 1999 (No 25 of 1999):
(i) (i) objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens.

It is proposed to comment and recommend on the impact of the development on fossil heritage mitigation or conservation necessary.

Outline of the geology and the palaeontology:
The geology was obtained from map 1:250 000, 2428 Nylstroom Geological Series.
Figure 1: Excerpt of map 1:250 000 Nylstroom

Legend to Map and short explanation

Vmd – (light blue) Malmani Subgroup of the Chuniespoort Group of the Transvaal Supergroup. Dolomite, chert, limestone, chert breccia with interbedded shale, sandstone and quartzite.

Vd – (stippled purple) Duitschland Formation of the Chuniespoort Group of the Transvaal Supergroup. Limestone, dolomite, chert, shale, quartzite, diamictite, hornfels and conglomerate.

Vt – (brown) Timeball Hill Formation of the Pretoria Group of the Transvaal Supergroup. Shale, hornfels, subordinate schist and Nooitgedacht Quartzite Member.

Vsi – (light brown) Silverton Formation of the Pretoria Group of the Transvaal Supergroup. Carbonaceous and calcareous shale, hornfels, limestone and quartzite.

Vm – (purple) Magaliesberg Formation of the Pretoria Group of the Transvaal Supergroup. Quartzite.

Vg – (green) Rustenburg Layered Suite of the Bushveld Complex. Gabbro, norite, anorthosite.

Mining activities:

An - Andalusite

Ls – Limestone and dolomite

Pt – Platinum group metals

Cr - Chrome

CA – Attapulgite clay

Ti Fe – Titanium, iron

Summary of findings: The desktop palaeontological impact assessment scope was undertaken during August and September of 2012 and the following is reported:

The geology is very complex with the Wonderkop fault (--f--) present to the east. Rock formations present fall within the Bushveld Complex and the Transvaal Supergroup. The Bushveld Complex is not known to yield any fossils. The Karoo Supergroup is completely absent and therefore the area has a palaeontological sensitivity of possibly LOW. Although the Karoo Supergroup is absent, the Pretoria Group, Time Ball Hill shale formation is known to contain 'algal microfossils'

diagenetic in origin. Stromatolites are common in the Malmani dolomites, accepted to be the fossil remnants of the simplest single-celled organisms. The author of this report is not sure of the sensitivity value of these fossils if any. Here assumed to be LOW. There is evidence of mining activity past and present.

Recommendation: The impact of the development on fossil heritage is LOW and therefore no mitigation or conservation measures should be necessary.
Section 1: The proposed 132 kV power line between the existing Lebowakgomo and the new Dithabaneng substations close to the Tudumo/Chunies River on the farm Voorspoed 458. Alternative 1 is preferred.
Section 2: The proposed132kV power line between the new Dithabaneng and the new Dwaalkop substation, general poor land use practices are present on the farm Doornvlei 456. Alternative 1 is preferred.
Section 3: The 132 kV loop-in-loop-out line from Dithabaneng to the proposed Boynton substation. Protected trees and streams are present as well as old agricultural land on farm Mphatlele 457. The building of the Boynton substation is not opposed.

Malamani dolomite (Vmd) is to the north of the new substations and should not be affected by the new development.

Stakeholders: Developer – Eskom.
Environmental – Urgeneg Consultants responsible for compiling the Environmental Impact Assessment (EIA) as well as the Heritage Impact Assessment Phase 1 study (HIA), Texture Environmental Consultants.

C. Background information
Outline of development
Eskom intends to construct new 132 kV power lines, substations and associated 132 kV loop-in-loop-out power lines in Lebowakgomo and Chuniespoort in the Limpopo Province of South Africa. The proposed development area is situated approximately sixty kilometres to the east of Mokopane (Potgietersrus) and fifteen kilometres to the east of Lebowakgomo, previous capital of the Lebowa homeland. The Chuniespoort and Strydpoort mountains are to the north. The Tudumo and Chunies River runs in a north-south direction.

Section 1: From Lebowakgomo substation to the east, past the hospital. It then turns towards Legwareng from Lebokwakgomo. It still follows a route to the south to Dithabaneng substation. Two alternatives were investigated. Alternative 1 follows the existing power line. This is the Silverton Formation which does not yield fossils. Alternative 1 is preferred.
Section 2: Two alternatives were investigated. From Dithabaneng substation route alternative 1 follows the route south to Makurung. Alternative 2 exits to the west and then south towards Makurung and both end at the new Dwaalkop substation which will be constructed in the Bushveld Complex devoid of fossils. Alternative 1 is preferred.
Section 3: Building of the Boynton substation. Mine development will have more impact. The Bushveld Complex is present here devoid of fossils.
Only the already existing Lebowakgomo substation is present in Malmani dolomites.
Rezoning/ and or subdivision of land: Eskom aquires the servitude.
Name of developer and consultant: Urgeneg Consultants, Texture Environmental Consultants and Eskom.
Terms of reference: Dr H. Fourie is a palaeontologist commissioned to do a desktop palaeontological impact assessment to ascertain if any palaeontological sensitive material is present in the development area. This study will advise on the impact on fossil heritage mitigation or conservation necessary, if any.
Legislative requirements: South African Heritage Resources Agency (SAHRA) for issue of permits if necessary. National Heritage Resources Act no: 25 of 1999.

D. Description of property or affected environment
Location and depth:
Figure 2: Map of Transvaal Supergroup (Eriksson 1999)

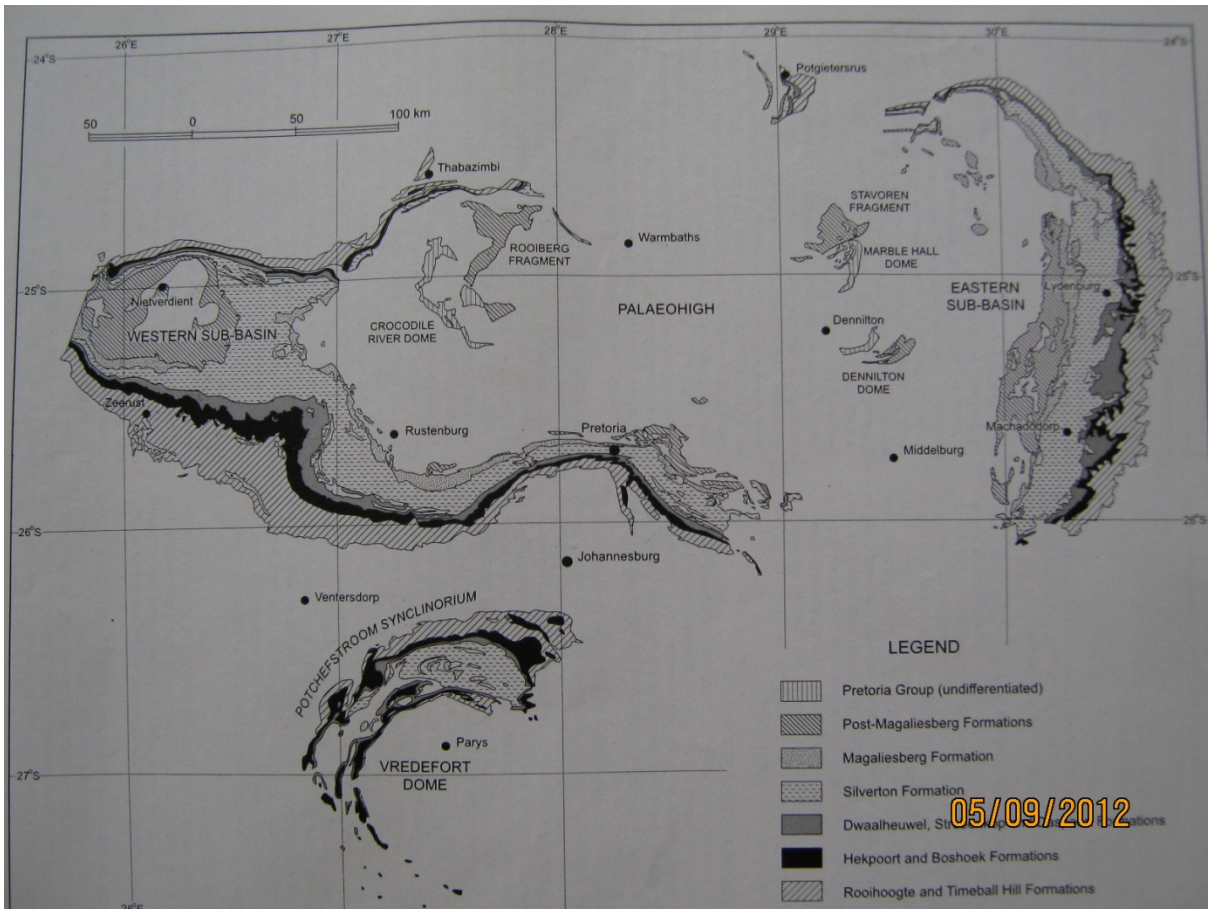
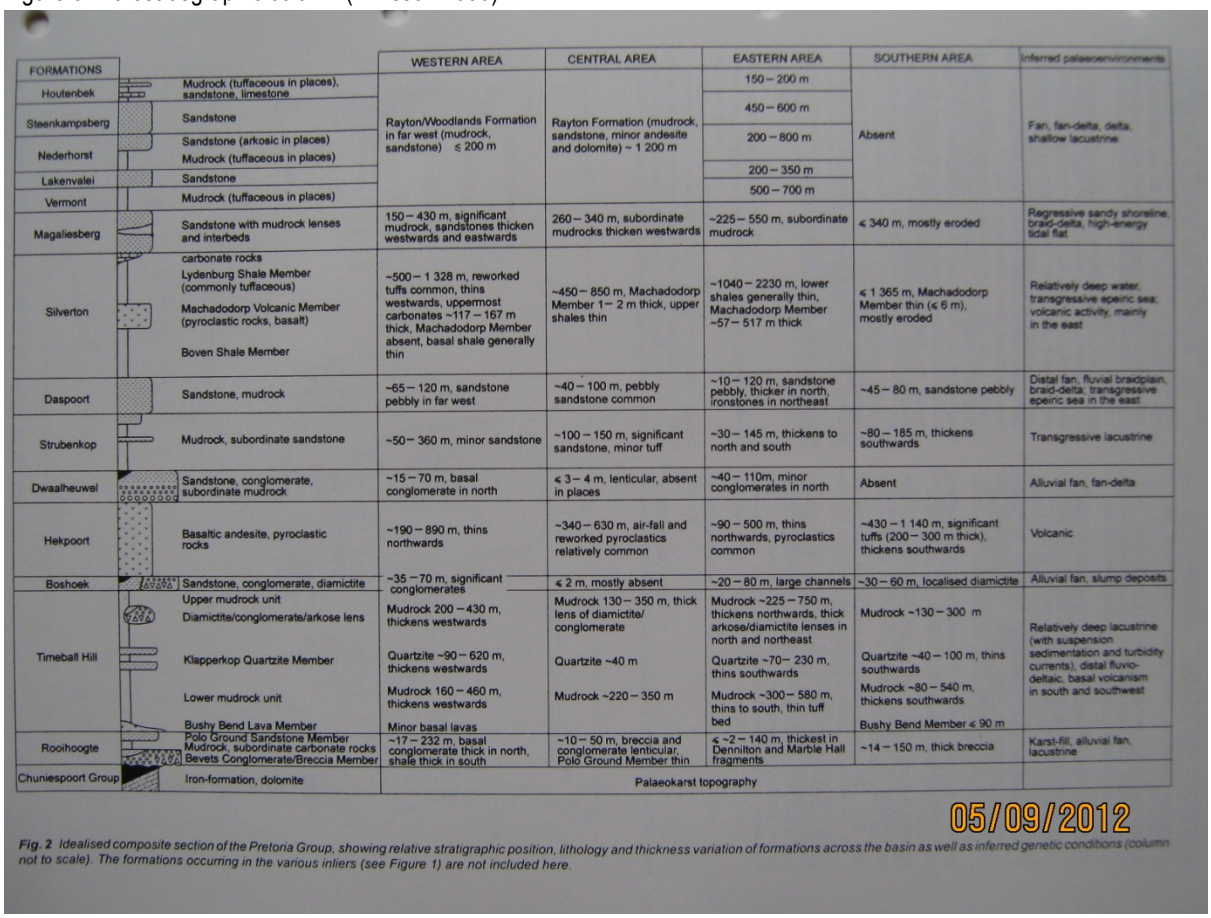


Figure 3: Lithostratigraphic column (Eriksson 1999)

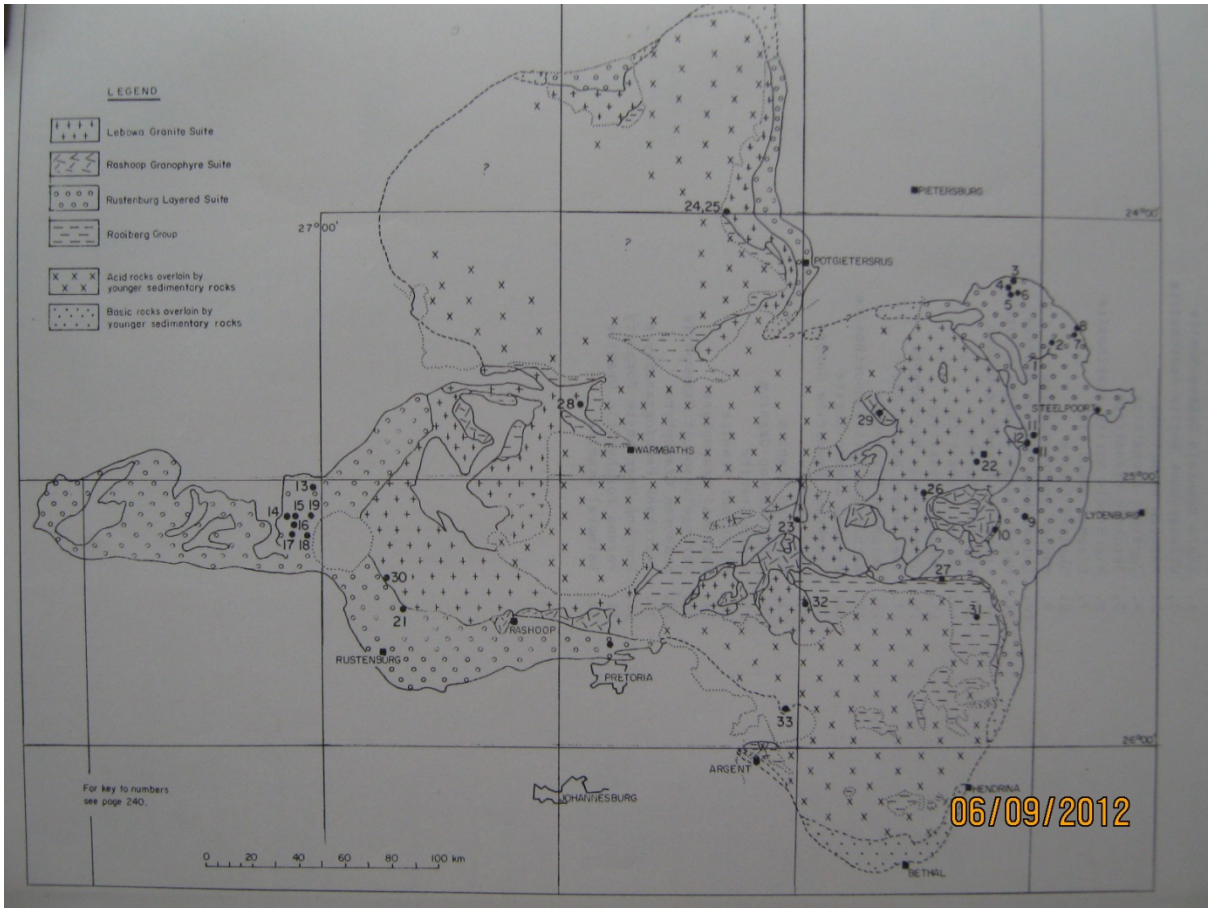


FORMATIONS		WESTERN AREA	CENTRAL AREA	EASTERN AREA	SOUTHERN AREA	Inferred palaeoenvironments
Houtenbek	Mudrock (tuffaceous in places), sandstone, limestone	Rayton/Woodlands Formation in far west (mudrock, sandstone) ⩽ 200 m	Rayton Formation (mudrock, sandstone, minor andesite and dolomite) ~ 1 200 m	150 – 200 m	Absent	Fan, fan-delta, delta, shallow lacustrine
Steenkampsberg	Sandstone			450 – 600 m		
Nederhorst	Sandstone (arkosic in places) Mudrock (tuffaceous in places)			200 – 800 m		
Lakenvalei	Sandstone			200 – 350 m		
Vermont	Mudrock (tuffaceous in places)			500 – 700 m		
Magaliesberg	Sandstone with mudrock lenses and interbeds	150 – 430 m, significant mudrock, sandstones thicken westwards and eastwards	260 – 340 m, subordinate mudrocks thicken westwards	~225 – 550 m, subordinate mudrock	⩽ 340 m, mostly eroded	Regressive sandy shoreline, braid-delta, high-energy tidal flat
Silverton	carbonate rocks Lydenburg Shale Member (commonly tuffaceous) Machadodorp Volcanic Member (pyroclastic rocks, basalt) Boven Shale Member	~500 – 1 328 m, reworked tuffs common, thins westwards, uppermost carbonates ~117 – 167 m thick, Machadodorp Member absent, basal shale generally thin	~450 – 850 m, Machadodorp Member 1 – 2 m thick, upper shales thin	~1040 – 2230 m, lower shales generally thin, Machadodorp Member ~57 – 517 m thick	⩽ 1 365 m, Machadodorp Member thin (⩽ 6 m), mostly eroded	Relatively deep water, transgressive epeiric sea; volcanic activity, mainly in the east
Daspoort	Sandstone, mudrock	~65 – 120 m, sandstone pebbly in far west	~40 – 100 m, pebbly sandstone common	~10 – 120 m, sandstone pebbly, thicker in north, ironstones in northeast	~45 – 80 m, sandstone pebbly	Distal fan, fluvial braidplain, braid-delta; transgressive epeiric sea in the east
Strubenkop	Mudrock, subordinate sandstone	~50 – 360 m, minor sandstone	~100 – 150 m, significant sandstone, minor tuff	~30 – 145 m, thickens to north and south	~80 – 185 m, thickens southwards	Transgressive lacustrine
Dwaalheuwel	Sandstone, conglomerate, subordinate mudrock	~15 – 70 m, basal conglomerate in north	⩽ 3 – 4 m, lenticular, absent in places	~40 – 110m, minor conglomerates in north	Absent	Alluvial fan, fan-delta
Hekpoort	Basaltic andesite, pyroclastic rocks	~190 – 890 m, thins northwards	~340 – 630 m, air-fall and reworked pyroclastics relatively common	~90 – 500 m, thins northwards, pyroclastics common	~430 – 1 140 m, significant tuffs (200 – 300 m thick), thickens southwards	Volcanic
Boshoek	Sandstone, conglomerate, diamictite	~35 – 70 m, significant conglomerates	⩽ 2 m, mostly absent	~20 – 80 m, large channels	~30 – 60 m, localised diamictite	Alluvial fan, slump deposits
Timeball Hill	Upper mudrock unit Diamictite/conglomerate/arkose lens	Mudrock 200 – 430 m, thickens westwards	Mudrock 130 – 350 m, thick lens of diamictite/ conglomerate	Mudrock ~225 – 750 m, thickens northwards, thick arkose/diamictite lenses in north and northeast	Mudrock ~130 – 300 m	Relatively deep lacustrine (with suspension sedimentation and turbidity currents), distal fluvio-deltaic, basal volcanism in south and southwest
	Klapperkop Quartzite Member	Quartzite ~90 – 620 m, thickens westwards	Quartzite ~40 m	Quartzite ~70 – 230 m, thins southwards	Quartzite ~40 – 100 m, thins southwards	
	Lower mudrock unit	Mudrock 160 – 460 m, thickens westwards	Mudrock ~220 – 350 m	Mudrock ~300 – 580 m, thins to south, thin tuff bed	Mudrock ~80 – 540 m, thickens southwards	
	Bushy Bend Lava Member	Minor basal lavas			Bushy Bend Member ⩽ 90 m	
Rooihoogte	Polo Ground Sandstone Member Mudrock, subordinate carbonate rocks Bevets Conglomerate/Breccia Member	~17 – 232 m, basal conglomerate thick in north, shale thick in south	~10 – 50 m, breccia and conglomerate lenticular, Polo Ground Member thin	⩽ ~2 – 140 m, thickest in Dennilton and Marble Hall fragments	~14 – 150 m, thick breccia	Karst-fill, alluvial fan, lacustrine
Chuniespoort Group	Iron-formation, dolomite	Palaeokarst topography				

05/09/2012

Fig. 2 Idealised composite section of the Pretoria Group, showing relative stratigraphic position, lithology and thickness variation of formations across the basin as well as inferred genetic conditions (column not to scale). The formations occurring in the various inliers (see Figure 1) are not included here.

Figure 4: Map of Bushveld Complex (SACS 1980)



E. Description of Geology

Description:

The development is taking place in an area covered by mostly the Transvaal Supergroup and the Rustenburg Layered Suite of the Bushveld Complex.

The age of the Vaalian is approximately 2600 Ma to 2100 Ma. A maximum thickness of the Transvaal Supergroup reaches 2000m in the north-eastern section. An east-west elongated basin is filled with clastic, volcanic and chemical sedimentary rocks. The Chuniespoort Group is made up of chemical and biochemical sediments such as dolomite, chert, limestone and banded iron formation, carbonaceous shale is also present. At the top of the Malmani Subgroup is the Duitschland formation underlain by the Penge Formation. Sandstone is mostly absent. It is this formation that has great economic value for its lead, zink, dolomite, and manganese.

The Pretoria Group consists predominantly of quartzite and shale together with a prominent volcanic unit, and minor conglomerate, chemical, and volcanic members. Cave formation in the dolomite is a major concern in developing areas, especially in the Malmani Subgroup. Both the shale and quartzite of the Pretoria Group are utilised in the building industry. The Time Ball Hill shale formation is known to contain 'algal microfossils' diagenetic in origin. Stromatolites as they are known are preserved in the subordinate carbonate rocks in the Pretoria Group.

This Supergroup is underlain by the Ventersdorp and Witwatersrand and Pongola Supergroups and the Dominion Group.

The Bushveld Complex is a massive body of igneous origin and is intrusive in the Transvaal Supergroup. It is Vaalian in age. A total thickness of 8200 to 8700m has been measured. The main problem is the product of weathering which forms black turf. Rocks are used in road construction. The Rustenburg Layered Suite is so termed as it is intrusive in origin and the term is to be equivalent to a 'group'. It consists of mafic and ultramafic rocks and is rich in platinum and vanadium.

The Bushveld Complex is underlain by the Transvaal Supergroup. Both Complex and Supergroup are much older than the Karoo Supergroup which is Palaeozoic and Mesozoic in age.

F. Background to Palaeontology

Sensitivity: = LOW. When rock units of moderate to high palaeontological sensitivity are present within the development footprint, a field scoping study by a professional palaeontologist is usually warranted. The main purpose of a field scoping study would be to identify any areas within the development footprint where specialist palaeontological mitigation during the construction phase might be required.

Chemical sediments such as fine grained limestone and dolomite is made up of deposits of organically derived carbonate shells, particles or precipitate. Dolomite is magnesium-rich limestone formed from algal beds and stromatolites. These Early Proterozoic Transvaal stromatolitic dolomites formed and released free oxygen at around 2900-2400Ma. Stromatolites are common in the Malmani dolomites, accepted to be the fossil remnants of the simplest single-celled organisms. They are finely layered, concentric, mound-like structures formed by microscopic algal organisms (Norman and Whitfield 2006).

The Malmani dolomites are home to most of the cave systems that has yielded hominin fossils such as those at Mokopane's cave. Also home to Middle and Late Stone Age cultures.

Impact: LOW to none.

G. Methodology

The desktop palaeontological impact assessment scope was undertaken during August and September of 2012.
Assumptions and Limitations:-
The accuracy and reliability of the report is limited by the following constraints:

1. Most development areas have never been surveyed by a palaeontologist or geophysicist.
2. Variable accuracy of geological maps and associated information.
3. Poor locality information on sheet explanations for geological maps.
4. Lack of published data.

H. Statement of significance (Heritage value)

LOW to none

I. Final Recommendation

Section 1: Alternative 1
Section 2: Alternative 1
Section 3: Boynton substation

Sampling and collecting:
Wherefore a permit is need from the South African Heritage Resources Agency (SAHRA).

a. Objections: None.
b. Conditions of development: See final remarks.
c. Areas that may need a permit: None
d. Permits for mitigation: Not needed.

Final remarks

a. All the land involved in the development was assessed and none of the property is unsuitable for development.
b. All information needed for the Desktop Palaeontological Impact Assessment scope was provided by Texture Environmental Consultants, Ms R. Pretorius.

c. Areas that would involve mitigation and may need a permit from the South African Heritage Resources Agency: None, a letter of exemption may be suggested.
d. The following should be conserved: if any palaeontological material is exposed during digging, excavating, drilling or blasting, SAHRA must be notified. All development activities must be stopped and a palaeontologist should be called in to determine proper mitigation measures. Especially shallow caves.
e. Condition in which development may proceed: It is further suggested that a Section 37(2) agreement of the Occupational, Health and Safety Act 85 of 1993 is signed with the relevant contractors to protect the environment and adjacent areas as well as for safety and security reasons.

J. References

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Dr Fourie obtained a Ph.D from the Bernard Price Institute for Palaeontological Research, University of the Witwatersrand. Her undergraduate degree is in Geology and Zoology. She specialises in vertebrate morphology and function concentrating on the Therapsid Therocephalia. For the past seven years she carried out field work in the Eastern Cape. Dr Fourie has been employed at the Ditsong: National Museum of Natural History in Pretoria (formerly Transvaal Museum) for 17 years.

Declaration

I, Heidi Fourie, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed development project for which I was appointed to do a palaeontological scope. There are no circumstances that compromise the objectivity of me performing such work.

HFourie

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Heidi Fourie
2012/09/07