PALAEONTOLOGICAL ASSESSMENT OF PART OF THE FARM OVER VLAKTE 125 MS, MUSINA LOCAL MUNICIPALITY, VHEMBE DISTRICT, LIMPOPO PROVINCE. IMPACTS BY PROPOSED EXPANSION OF THE EXISTING DAM

DESKTOP STUDY AND PROTOCOL FOR PALAEONTOLOGICAL FINDS

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EXECUTIVE SUMMARY

This study was carried out to assess the potential palaeontological impact of the proposed extension of an existing dam, forming part of coal mining activities on the remaining part of the farm Over Vlakte 125 MS. The regional 1:250 000 geological map shows the rocks underlying the farm to be Karoo-age shale, sandstone, grit and coal seams, forming part of the Ecca Group. Regional studies have identified a sporadic but extensive sandy Cenozoic regolith up to 2.5 m thick. This report indicates a high likelihood of finding fossils in the area proposed for the proposed dam extension. These predictions must be confirmed during ground truthing. It is important that at least one SACNASP-registered palaeontologist visit the area to identify the fossils *in situ* and to retrieve those exposed during excavation.

DESKTOP STUDY

The 1:250 000 geological map 2228 (Alldays) was consulted to establish the regional and local geology. The map indicates the entire farm is underlain by rocks of the Ecca Group of the Karoo Supergroup which lie unconformably on the Archaean basement rocks.

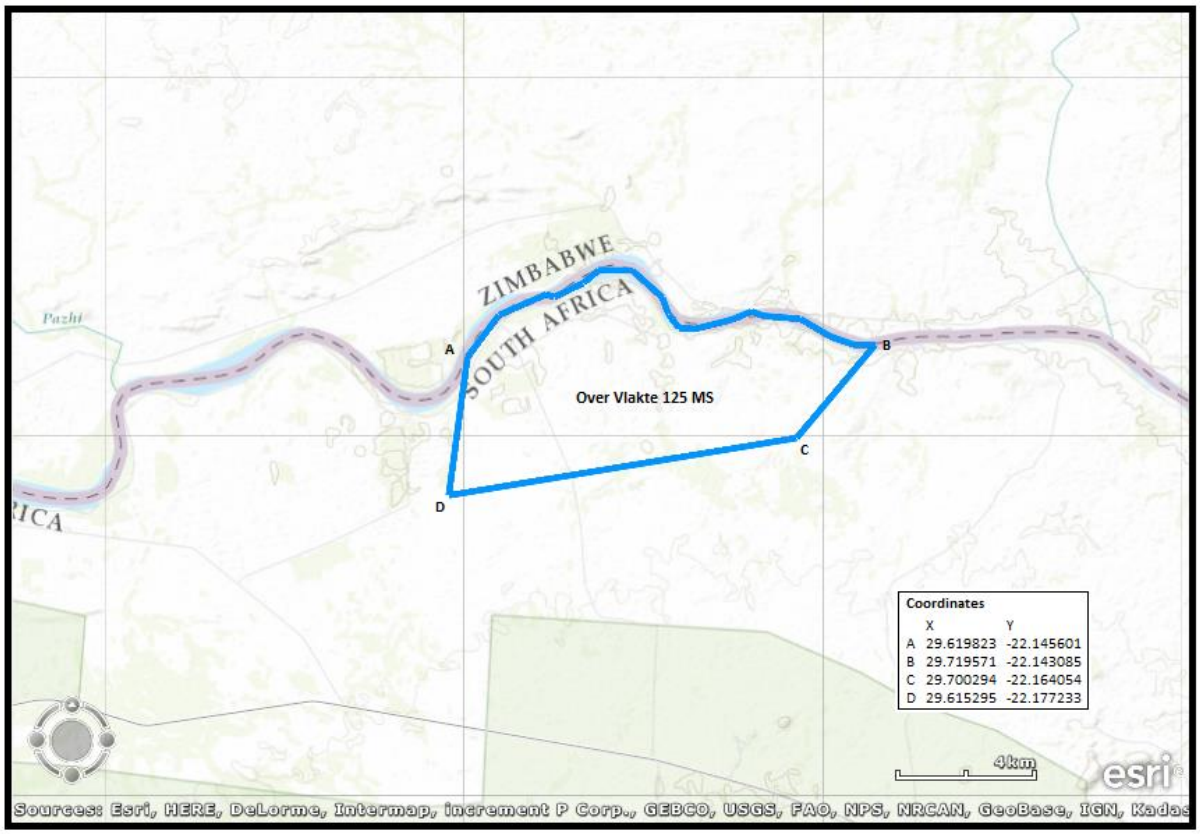

Fig. 1 – Location of the farm Over Vlakte 125 MS

GEOLOGY

The region is underlain by sedimentary rocks of the Karoo Supergroup.

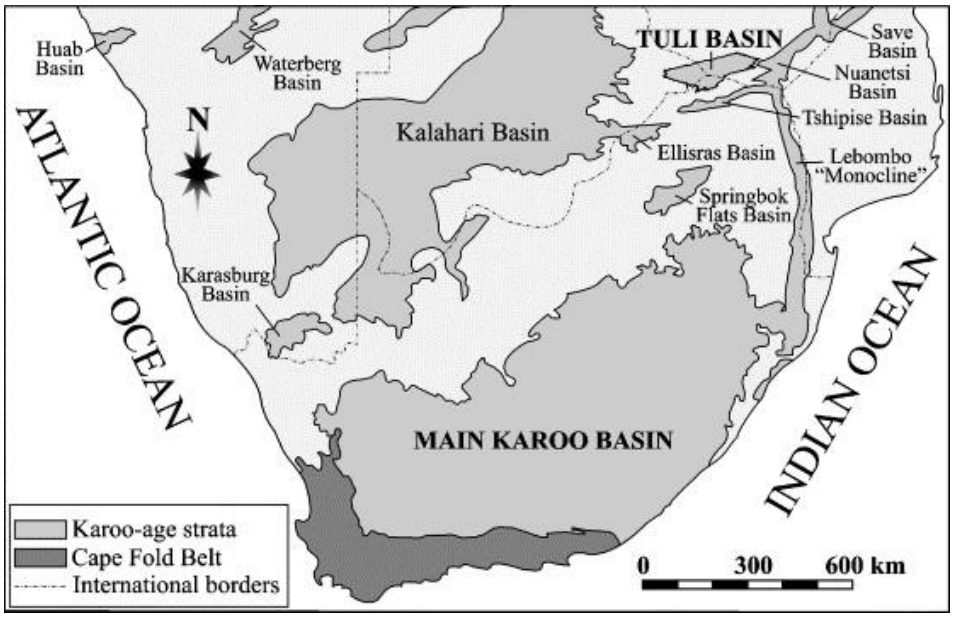

Fig. 2 - Location of Karoo rocks in southern Africa

The Karoo Supergroup

Rocks of Karoo age were laid down between the late Carboniferous and mid Jurassic. Deposition was on a stable floor, the Kaapvaal Craton to the north and the Namaqua-Natal Metamorphic Belt to the south. The main Karoo Basin is approximately 700,000 km^2 in extent, but must have been significantly more extensive during Permian times. The Karoo Supergroup reflects changing sedimentary environments, from glacial, fluvial, lacustrine, through to aeolian. Sedimentation abruptly ceased with the extrusion of extensive basaltic lavas, heralding the break-up of the Gondwana landmass.

The main Karoo Basin covers much of the Free State, KwaZulu Natal and Northern Cape, but smaller depositories, developed in the north. Towards the end of Karoo times, these basins became blanketed by aeolian deposits of the Clarens Formation. The study area is underlain by such a depositary, the Tuli Block, which extends over the Limpopo River into both Botswana and Zimbabwe.

The Tuli Basin

Only the lower and middle Karoo successions are present in the study area, the equivalent of the Dwyka and Ecca Groups of the main Karoo Basin.

Tshidzi Formation

The Permo-Carboniferous Tshidzi Formation was deposited unconformably on the Palaeoproterozoic Soutpansberg Group and Archaean basement rocks in the area. It consists of diamictites at the base, reworked and overlain by red micaceous grits. The sedimentary environment is interpreted as glacial to fluvioglacial and is equivalent to the Mbizani Formation of the Dwyka Group in the main Karoo Basin (Bordy, 2002)

Madzaringwe Formation

The micaceous grits grade upwards to laminated shale of the Madzaringwe Formation and includes lenses of grit in the lower sequence. Higher in the sequence the shales alternate rhythmically with well-developed coal seams. Up to six laterally persistent seams are present (Brandl 2002). The sedimentary environment is interpreted as braided river, wetlands and lacustrine, the region becoming regularly flooded. The Madzaringwe Formation is broadly equivalent to the Ecca Group of the main Karoo Basin (Bordy, 2002)

Mikambeni Formation

These shales and siltstones represent a shallow lacustrine environment, with thin coal stringers and carbonaceous shales. They are correlated with Middle Ecca of the main Karoo Basin (Bordy, 2002)

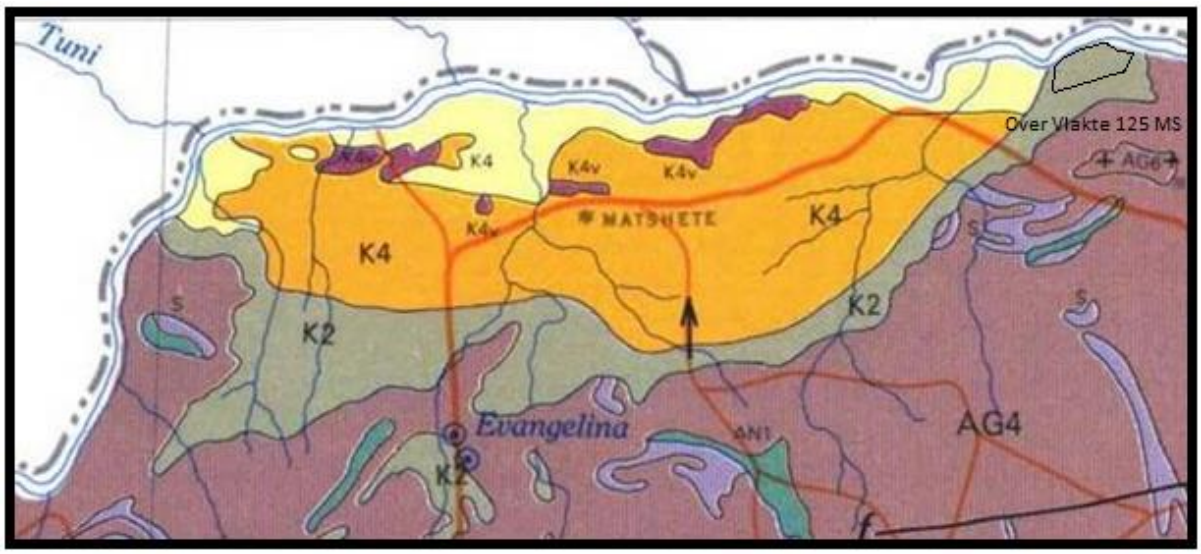

Fig. 3 – Geological map of the area showing the location of the farm Over Vlakte 125 MS

Legend			
	Map description	Brandl, 2002	Main Karoo Basin
	Unconsolidated superficial deposits, conglomerate, marl, limestone, sandstone, high-level gravel		
K4v	Basalt, limburgite, pyroclasts, minor sandstone	Letaba Formation	Drakensberg Stage
K4	1. Sandstone, shale, mudstone, marl, coal	Clarens Formation Bosbokpoort Formation Klopperfontein Formation Solitude Formation Fripp Formation	Cave Sandstone Stage Red Beds Stage Molteno Stage
K2	Shale, sandstone, grit, coal	Mikambeni Formation Madzaringwe Formation Tshidzi Formation	Ecca Series
AG4	Migmatite, gneiss, ultrametamorphic rocks	Limpopo belt of metamorphism and granitization	
		Archaean complex	

PALAEONTOLOGY

Rocks of the Karoo Supergroup are internationally acclaimed for their rich palaeontological heritage. In particular the Karoo documents the catastrophic End Permian Extinction and subsequent proliferation of life, early dinosaurs and the emergence of mammals. Since the Karoo hosts a number of coal seams, and coal is formed from plant remains it follows that these rocks host a well-documented palaeoflora. Fossil plants offer an opportunity to study palaeoecology and have been allocated a very high palaeontological sensitivity by the South African Heritage Resource Agency (SAHRA).

Tshidzi Formation

The glacial deposits of the Tshidzi Formation contain rare palynomorphs (microscopic plant and animal structures) and unspecified plant remains (typically *Glossopteris* sp) associated with thin coal seams.

Madzaringwe Formation

The marshy flood-prone overbank area provided a suitable environment for the accumulation of peat and development of coals. Fossil leaves of *Glossopteris* and to a lesser extent, *Gangamopteris* and *Equisetales* are common, usually associated with coal seams (Van Eeden, 1955).

Mikambeni Formation

The shales and siltstones are very similar to those of the Madzaringwe Formation, but fewer coals are developed. *Glossopteris* fossils are common in siltstone units near the top of the succession, 37 species being identified by Kovács-Endrödy (1983).

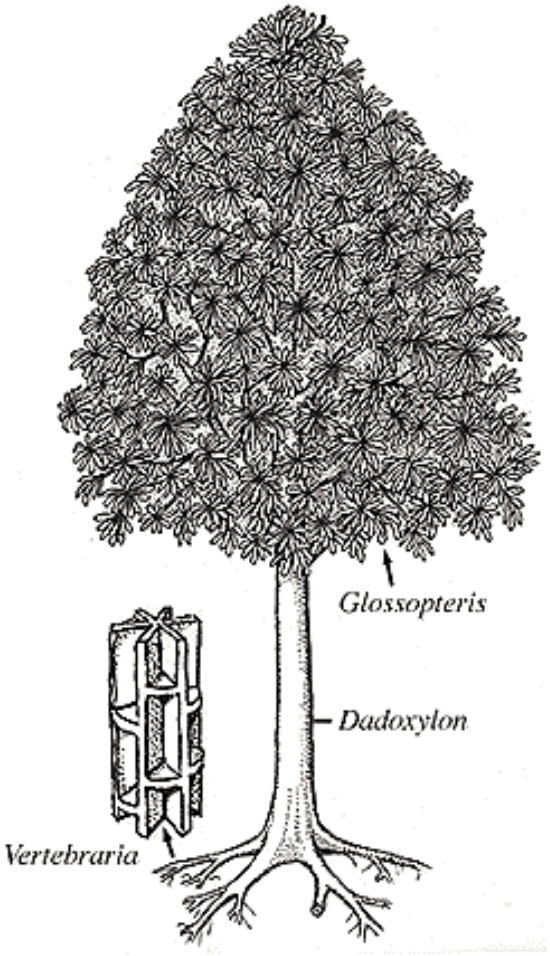

Fig. 4 - Reconstruction of *Glossopteris* (leaves), *Dadoxylon (*stem) and *Vertebraria* (roots), considered to be part of the same plant. (From Arens, *et.al.* 1998)

South African Palaeontology Legislation

SOUTH AFRICAN NATIONAL HERITAGE RESOURCE ACT NO 25/1999

This Palaeontological Assessment forms part of the Heritage Impact Assessment (HIA) and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999. A HIA is required under Section 38 (Heritage Resources Management) to assess any potential impact to the palaeontology of the area by a proposed development. The term *palaeontological* in this context is defined by the NHRA as "…any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rocks intended for industrial use and any site which contains such fossilised remains or traces" (NHRA, 1999, p.10). The following clauses detailed below are relevant to palaeontological aspects for a terrain suitability assessment.

Subsection 35 (4)

- No person may, without a permit issued by the responsible heritage resource authority:
- (a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological of palaeontological site or meteorite;
- (b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;
- (c) trade in, sell for private gain, export or attempt to export from the republic any category of archaeological or palaeontological material or object, or any meteorite; or
- (d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assists with the detection or recovery of metals or archaeological material or objects, or use such equipment for the recovery of meteorites.

Subsection 35 (5)

- When the responsible heritage resources authority has reasonable cause to believe that any activity or development which will destroy, damage or alter any archaeological or palaeontological site is under way, and where no application for a permit has been submitted and no heritage resources management procedures in terms of section 38 has been followed, it may:
- (a) serve on the owner or occupier of the site or on the person undertaking such development an order for the development to cease immediately for such period as is specified in the order;
- (b) carry out an investigation for the purpose of obtaining information on whether or not an archaeological or palaeontological site exists and whether mitigation is necessary;
- (c) if mitigation is deemed by the heritage resources authority to be necessary, assist the person on whom the order has been served under paragraph (a) to apply for a permit as required in subsection (4); and

- (d) recover the costs of such investigation from the owner or occupier of the land on which it is believed an archaeological or palaeontological site is located or from the person proposing to undertake the development if no application for a permit is received within two weeks of the order being served.

Recommendations

In mitigation, at least one recognised palaeontologist should be on site to collect fossils that may be exposed during excavation of the dam extension. Any fossils such obtained should be deposited with a recognised authority such as the Council for Geoscience, Bernard Price Institute for Palaeontology or the Department of Geology and Mining, University of Limpopo. An appropriate institution such as those listed above, should also direct the unlikely event of salvaging fossil fauna.

Conclusion

This desktop study indicates that there is a very high likelihood of the occurrence of fossils, typically palaeoflora of *Glossopteris*, *Dadoxylon* and *Vertebraria* within the lower Karoo strata. A SACNASP-registered palaeontologist should visit the site to investigate the possibilities of a Cenozoic cover and collect any fossils which are encountered during excavation.

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