

**Phase 1 Palaeontological Impact Assessment of a
proposed new quarry on Portion 9 (of 6) of the farm
Mimosa Glen 885, Bloemfontein, FS Province.**

Report prepared for Proper Consulting Engineers

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Executive Summary

A Phase 1 Palaeontological Impact Assessment was conducted for the proposed development of a new quarry, situated about 10 km north of Bloemfontein, on the farm Mimosa Glen 885. The study area situated within the outcrop area of the Karoo Supergroup, which is primarily represented by late Permian, Beaufort Group (Adelaide Subgroup) sedimentary rocks, consisting of alternating sandstone and mudstone layers. A pedestrian survey of the terrain indicates that both the preferred and alternative site options are located on dolerite bedrock that is capped by a veneer of palaeontologically sterile soils. Potential palaeontological impact resulting from excavations within the proposed area is considered very low. The affected area is assigned a site rating of Generally Protected C (GP.C).

Introduction

A Phase 1 Palaeontological Impact Assessment was conducted for the proposed development of a new quarry, situated about 10 km north of Bloemfontein, on the farm Mimoso Glen 885 (**Fig. 1**). The survey is required as a prerequisite for new development in terms of the National Heritage Resources Act 25 of 1999. In terms of Section 38 of the National Heritage Resources Act 25 of 1999, the survey is required as a prerequisite for any development that will change the character of a site exceeding 5 000 m² in extent. An initial site visit took place in October 2015. The task involved identification of possible archaeological sites or occurrences in the proposed area of impact, an assessment of their significance, possible impact by the proposed development and recommendations for mitigation where relevant.

Methodology

The palaeontological significance of the affected area was evaluated through a desktop study and carried out on the basis of existing field data, database information and published literature. This was followed by a field assessment by means of a pedestrian survey. A Garmin Etrex Vista GPS hand model (set to the WGS 84 map datum) and a digital camera were used for recording purposes.

Field Rating

Site significance classification standards as prescribed by SAHRA (2005) were used for the purpose of this report (**Table 1**).

Site Information

The study area includes a preferred as well as an alternative site, which is located near an existing quarry, about 10 km north of Bloemfontein on the farm Mimoso Glen 885 (**Fig. 2**). The impact zone will cover a 5 ha area, which is largely made up of open grassland underlain by shallow residual soils and weather-resistant dolerite bedrock (**Fig. 3**).

1 to 50 000 topographical map: 2826 CD Glen

1 to 250 geological map 2826 Winburg

GPS coordinates of the proposed site (**Fig. 2**):

- A) 28°59'14.17"S 26°15'41.62"E
- B) 28°59'8.61"S 26°15'42.58"E
- C) 28°59'10.90"S 26°15'53.64"E
- D) 28°59'16.00"S 26°15'52.50"E

Local Geology

The geology of the region has been described by Nolte (1995) and Johnson (2006). The study area situated within the outcrop area of the Karoo Supergroup, which is primarily represented by late Permian, Beaufort Group (Adelaide Subgroup) sedimentary rocks, consisting of alternating sandstone and mudstone layers. These sedimentary rocks form the base on which younger, superficial deposits of Quaternary age have been deposited (Partridge *et al.* 2006). Superficial sediments consist mainly of well-developed, residual soils and alluvial deposits near river drainages. Dykes and sills of resistant Jurassic dolerite intrusions are present in the region.

Background

The local palaeontological footprint is primarily represented by Late Permian Karoo vertebrate fauna and Late Cenozoic (Quaternary Period, comprising the Pleistocene and Holocene Epochs) mammalian fossils. The Karoo geological strata within the affected area are assigned to the *Dicynodon* Assemblage Zone (AZ) (**Fig. 4**). Therapsids from this biozone occur generally well-preserved in mudrock horizons and are usually found as dispersed and isolated specimens associated with an abundance of calcareous nodules (Kitching 1995). Other vertebrate fossils include fish, amphibians and amniotes. Molluscs, insects, plant (*Dadoxylon*, *Glossopteris*) and trace fossils (arthropod trails, worm burrows) are also occur in the biozone.

The Modder River is a southern tributary of the Vaal River and its alluvial deposits are associated with abundant Quaternary mammalian fossils. A number of palaeontological localities, such as the ones at Erfkroon and Mitasrust, have been found eroding out of Pleistocene alluvial terraces and dongas along the river (**Fig. 5**). The river's fossil-bearing potential has been known for almost 150 years, with a frontlet

and horn cores of *Syncerus antiquus* recovered as far back as 1839 (Cooke 1955) and the remains of *Megalotragus priscus* discovered around the turn of the previous century (Broom 1909).

The upper calcretized layers of the Florisian fossil locality at Erfkroon, which is located 60 kilometers west and downstream from Mimosa Glen on the northern bank of the Modder River presumably represent palaeosols formed under semi-arid to arid conditions with ages ranging between 25 000 and 113 000 years ago (Churchill *et al.* 2000). The association between the age of the younger overbank sediments at Erfkroon and the fossiliferous overbank sediments at Mitasrust, as well as the likelihood of more arid environmental conditions indicated by these sediments, suggest a Last Glacial age (possibly between Isotope Stage 4 and Isotope Stage 2) for the Mitasrust fossils (Rossouw 2006).

Field Assessment

A pedestrian survey of the terrain indicates that both the preferred and alternative site options are located on dolerite bedrock that is capped by a veneer of palaeontologically sterile soils.

Impact Statement and Recommendations

The study area is not palaeontologically significant as it is located exclusively on an interconnected network of dolerite intrusions. The superficial sediments in and around the study area are also not considered to be fossiliferous. Potential palaeontological impact resulting from excavations within the proposed area is considered very low. The affected area is assigned a site rating of Generally Protected C (GP.C).

References

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Tables and Figures

Table 1. Field rating categories for heritage sites as prescribed by SAHRA.

Field Rating	Grade	Significance	Mitigation
National Significance (NS)	Grade 1	-	Conservation; national site nomination
Provincial Significance (PS)	Grade 2	-	Conservation; provincial site nomination
Local Significance (LS)	Grade 3A	High significance	Conservation; mitigation not advised
Local Significance (LS)	Grade 3B	High significance	Mitigation (part of site should be retained)
Generally Protected A (GP.A)	-	High/medium significance	Mitigation before destruction
Generally Protected B (GP.B)	-	Medium significance	Recording before destruction
Generally Protected C (GP.C)	-	Low significance	Destruction

Table 2. Summary of Impacts.

Geological Unit	Rock types and Age	Potential Palaeontological heritage	Palaeontological Significance	Degree of Impact	Palaeontological potential at the site
Superficial deposits	Residual soils Quaternary to Recent	Large vertebrate skeletal remains; coprolites, microfossils	High	High	Very low
Karoo Dolerite	Intrusive igneous bedrock. Jurassic	None	Low	High	Very low
Adelaide Subgroup sedimentary bedrock	Fluvial and lacustrine mudstones and sandstones. Late Permian	<i>Dicynodon</i> Assemblage Zone Therapsids, amphibians, fish, amniotes, invertebrates, plant fossils, trace fossils.	High	None	Very low

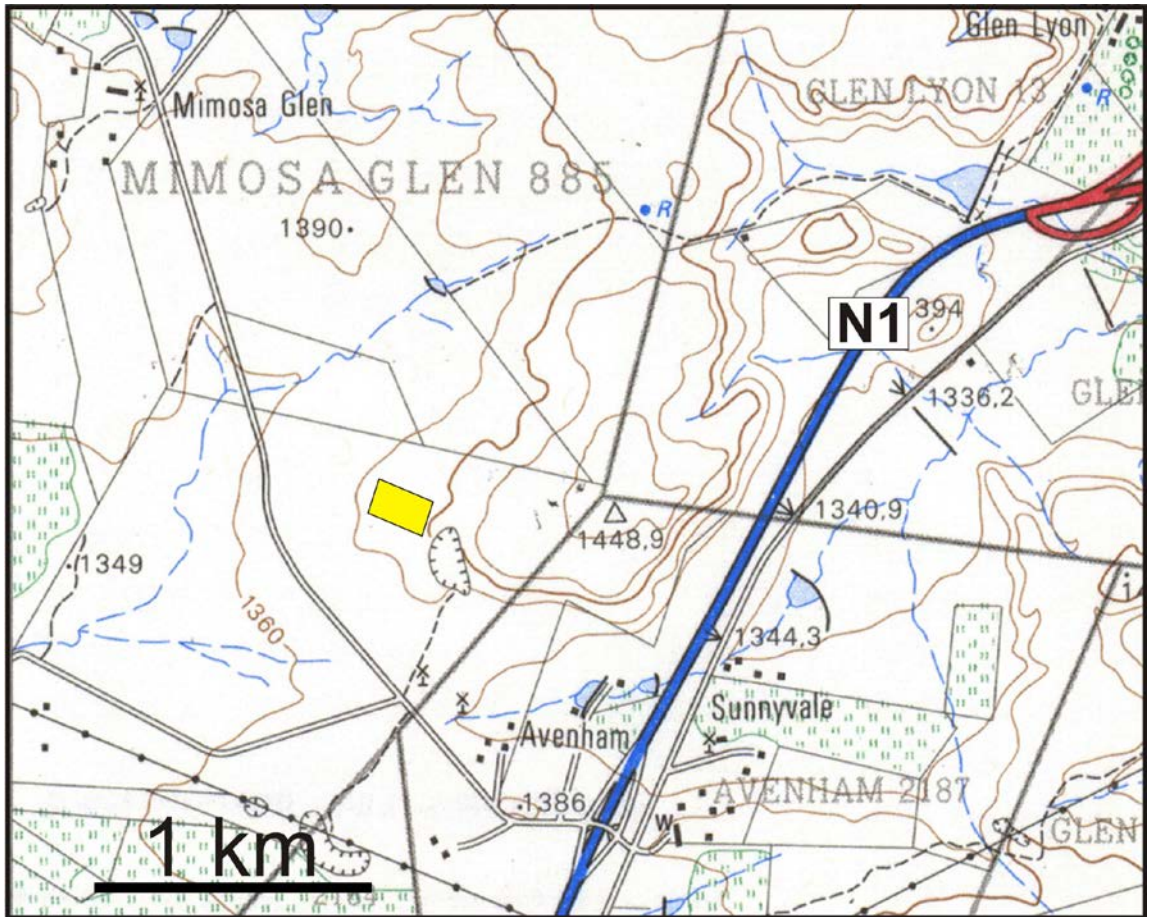


Figure 1. Location of study area marked by a yellow rectangle (portion of 1:50 000 scale topographic map 2826 Glen).

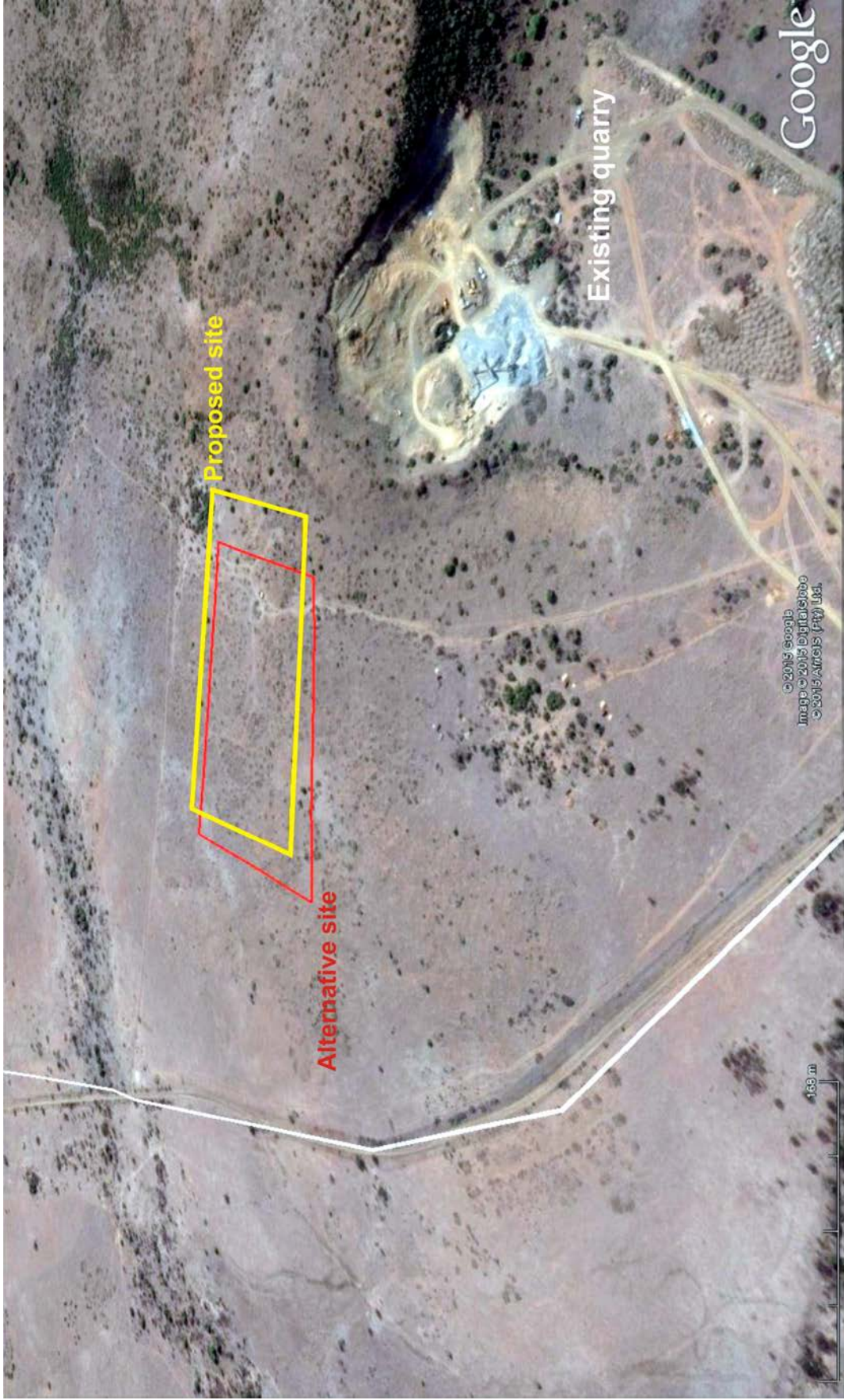


Figure 2. Aerial view of the study area, looking north.

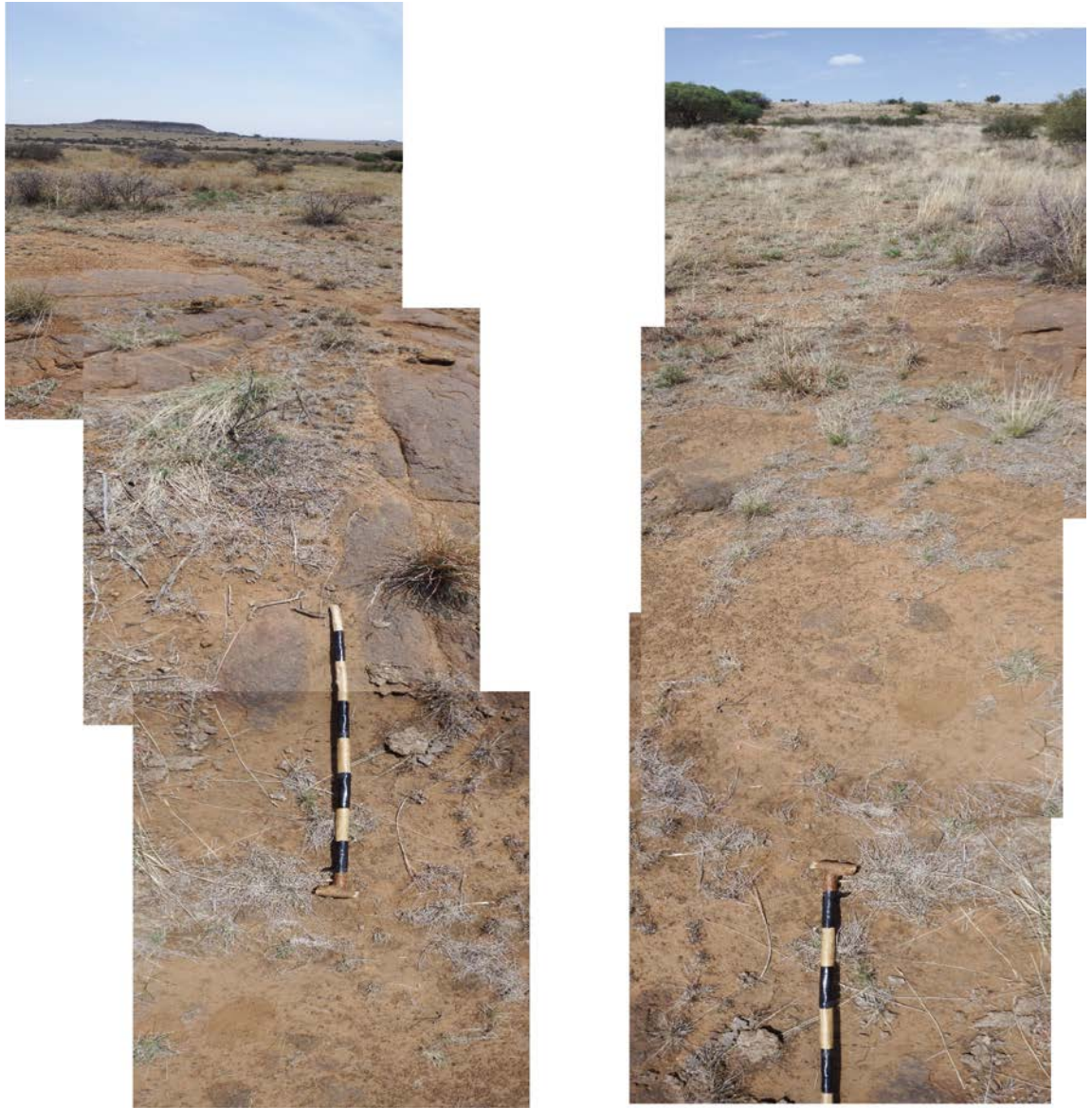


Figure 3. General view of the study area along a transect, looking west (left) and east (right). Scale 1 = 10 cm).

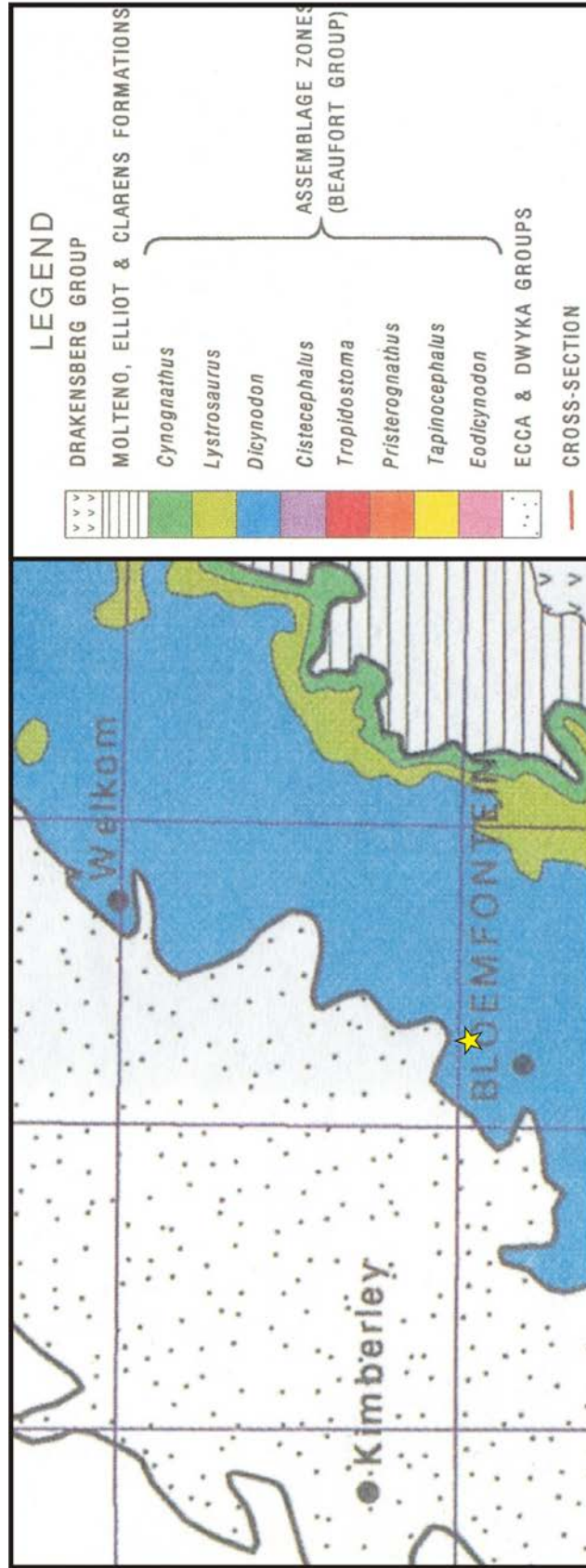


Figure 4. Geographical distribution of vertebrate biozones of the Beaufort Group around Bloemfontein (map after Rubidge 1995). The study area is marked by the yellow star.

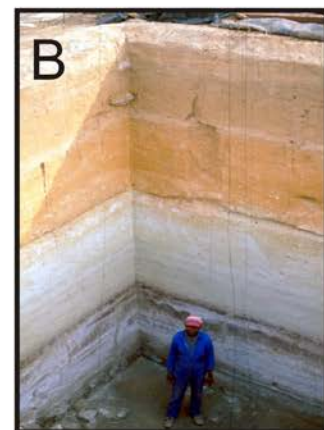
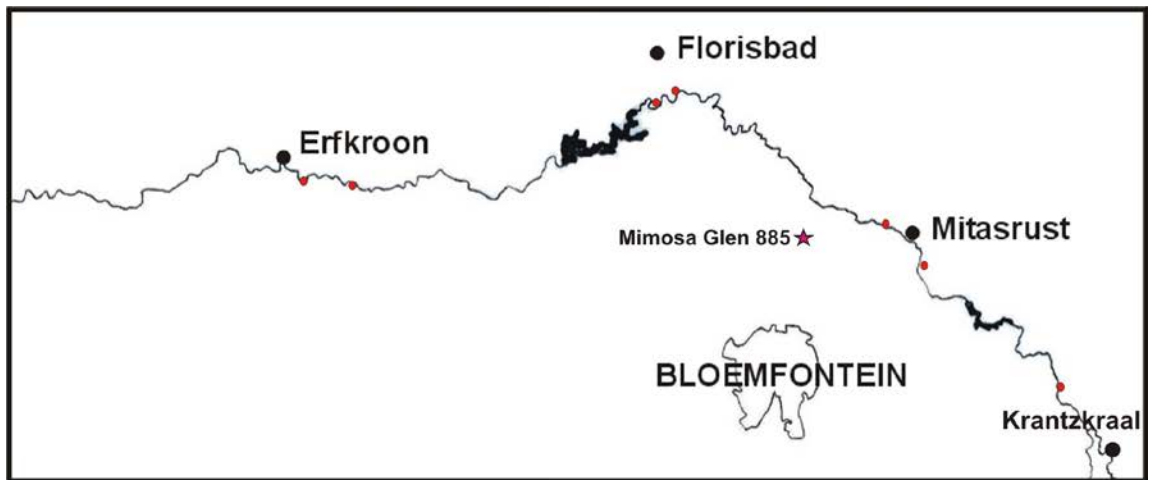


Figure 5. Examples of a Quaternary palaeontological sites recorded along the Modder River and its tributaries to the north and east of Bloemfontein. Fossiliferous overbank deposits at Erfkroon (A), archaeological excavations at Florisbad (B), and a metacarpal bone of an the extinct giant buffalo (*Pelorovis antiquus*) found near Mitasrust (C).