

**Phase 1 Heritage Impact Assessment of a proposed  
new sand quarry on the farm Glen Thorne 2163 near  
Glen, Free State Province.**

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## **Executive Summary**

A Phase 1 Palaeontological Impact Assessment was carried out for a proposed new 3 ha sand quarry next to the Modder River the farm Glen Thorne 2163 near Glen, Free State Province. The study area is underlain by well-developed, homogenous and geologically recent (Holocene –Recent) alluvial overburden (river sand). A pedestrian survey of the terrain revealed no evidence of fossil-bearing terrace gravels or secondary paleo-donga (gully) infill deposits. Except for a small number of root casts and calcrete nodules, no evidence was found for the accumulation and preservation of intact fossil material within the alluvial overburden covering the footprint. Investigation of exposed sections within the study area revealed no evidence of *in situ* Stone Age archaeological material, prehistoric structures, graves or historically significant structures older than 60 years. The potential for disturbance or destruction of Quaternary palaeontological resources is considered negligible during the operational phase of the development project, but potentially high if mining activities are to be conducted outside and further south of the demarcated development footprint. Sedimentary rocks, made up of potentially fossil-bearing Adelaide Subgroup strata, are largely shielded by the Quaternary overburden and will not be affected by the development. The terrain is not considered palaeontologically or archaeologically vulnerable and is assigned a rating of Generally Protected C (GP.C), provided that all excavation activities are confined to within the confines of the development footprint. In the event of chance exposure of subsurface finds not observed during the survey (e.g. graves), the relevant heritage authorities must be informed as soon as possible.

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## **Introduction**

A Phase 1 Palaeontological Impact Assessment was carried out for a proposed new 3 ha sand quarry on the farm Glen Thorne 2163 near Glen, Free State Province (**Fig. 1 & 2**). 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 m<sup>2</sup> in extent. The task involved identification of possible archaeological and paleontological sites or occurrences in the proposed zone, an assessment of their significance, possible impact by the proposed development and recommendations for mitigation where relevant.

## **Methodology**

The heritage significance of the affected area was evaluated on the basis of existing field data, database information, maps 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.

## **Site Information**

The affected area covers 3 ha of riverbank deposits next to the Modder River on the farm Glen Thorne 2163, about 18 km north of Bloemfontein (**Fig. 3 & 4**).

1:50 000 scale topographical map: 2826CD Glen

1:250 000 scale geological map: Winburg 2826

### **Site coordinates (Fig. 2):**

28°56'38.88"S 26°18'39.27"E

28°56'37.51"S 26°18'42.71"E

28°56'45.95"S 26°18'49.46"E

28°56'47.17"S 26°18'47.66"E

## Geology

The geology of the region has been described by Nolte (1995) and Johnson (2006). It is situated within the Beaufort Group, Adelaide Subgroup (Karoo Supergroup), and is primarily represented by late Permian, Balfour Formation sedimentary rocks, which are made up of alternating sandstone and mudstone layers (*Pa*) associated with stream and floodplain deposits (**Fig. 5**). Dykes and sills of resistant Jurassic dolerites (*Jd*) determine the relief in the region. Superficial deposits in the region consist mainly of and shallow to well-developed, windblown sand, alluvium (river courses) and residual soils of varying depth.

## Background

The local palaeontological footprint is represented by Late Permian and Late Cenozoic (Quaternary) fossils (Broom 1909 a, b; Kitching 1977; Churchill *et al* 2000; Rossouw 1999, 2000, 2006). In terms of the biostratigraphy of the Beaufort Group the sedimentary strata underlying the affected area are assigned to the *Dicynodon* Assemblage Zone (AZ) (Kitching 1995) (**Fig. 6**), a biozone characterized by the presence of a distinctive and fairly common dicynodont genus as well as plant (*Dadoxylon*, *Glossopteris*) and trace fossils (arthropod trails, worm burrows) (**Fig. 7 & 8**). The remains of mammal fossils stretching as far back as the Middle Pleistocene are regularly discovered around Bloemfontein, especially within alluvial deposits associated with the Modder River and its tributaries.

The Glen Thorne is located within a wider area where Anglo Boer War remnants, graveyards and historically significant structures, have been recorded (Dreyer 2004a, 2004b, 2004c, 2004d, 2005; Henderson 2006; Henderson *et al.* 2008; Rossouw 2012). It is also located close to but outside the south-western periphery of distribution of Late Iron Age stone-walled settlements in the Free State (Maggs 1976). The central Free State region between Bloemfontein and Kroonstad is generally rich in Stone Age open-site assemblages, the majority of which are linked to floodplain deposits (overbank sediments) associated with the Modder and Vet River systems (**Fig. 9**), as well as pan dunes and artesian springs (Brink 1987; Churchill *et al.* 2001, L. Rossouw 2006; De Ruiter *et al.* 2011). This may include capped occurrences and surface scatters of long,

high-backed blades from the early Middle Stone Age; typical Florisian retouched blades, trimmed points and Levallois core types; the characteristically large sidescrapers, sub-circular and end scrapers from the Lockshoek Industry (terminal Pleistocene); and the Smithfield Industries of the Holocene. Widespread traces of prehistoric human habitation, in the form of stone tool scatters and individual surface finds, have previously been recorded between Bloemfontein and the Modder River (Goodwin and van Riet Lowe 1929, Henderson *et al.* 2008; Rossouw 2012). The incidence of surface scatters usually decreases away from localized areas such as alluvial contexts and dolerite-shale contact zones when stone tools largely occur as contextually derived individual finds in the open veld. Stone tools are mostly made of hornfels, a fine-grained isotropic rock found in the hot-contact zone between the dolerites and shales in the area. As a result, stone tool factory sites are commonly found near dolerite-shale contact zones.

### **Field Assessment**

The study area is underlain by well-developed, homogenous and geologically recent (Holocene –Recent) alluvial overburden (river sand) (**Fig. 10**). A pedestrian survey of the terrain revealed no evidence of fossil-bearing terrace gravels or secondary paleodonga (gully) infill deposits. Except for a small number of root casts and calcrete nodules, no evidence was found for the accumulation and preservation of intact fossil material within the alluvial overburden covering the footprint. Investigation of exposed sections within the study area revealed no evidence of *in situ* Stone Age archaeological material, prehistoric structures graves or historically significant structures older than 60 years.

### **Impact Statement**

The proposed development will primarily affect geologically recent (Holocene –Recent) alluvial overburden. The potential for disturbance or destruction of Quaternary palaeontological resources is considered negligible during the operational phase of the development project, but potentially high if mining activities are to be conducted outside and further south of the demarcated development footprint. Sedimentary rocks, made up of potentially fossil-bearing Adelaide Subgroup strata, are largely shielded by the Quaternary overburden and will not be affected by the development.

## Recommendations

The terrain is not considered palaeontologically or archaeologically vulnerable and is assigned a rating of Generally Protected C (GP.C), provided that all excavation activities are confined to within the confines of the development footprint. In the event of chance exposure of subsurface finds not observed during the survey (e.g. graves), the relevant heritage authorities must be informed as soon as possible.

## References

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## Tables and Figures

**Table 1.** Summary of impacts at the proposed footprint.

| <b>Geological Unit</b>             | <b>Rock types and Age</b>  | <b>Potential Palaeontological &amp; Archaeological heritage</b>   | <b>Impact by Development</b> | <b>Heritage potential at the site</b> |
|------------------------------------|--|---|------------------------------|---------------------------------------|
| Regolith<br>(Superficial deposits) | Alluvium<br>Quaternary to Recent                                 | Large vertebrate skeletal remains;<br>freshwater molluscs,<br>coprolites,<br>microfossils<br>Stone Age sites<br>Graves<br>Historical structures | High                         | Very Low                              |
| Adelaide Subgroup<br>( <i>Pa</i> ) | Fluvial and lacustrine mudstones and sandstones.<br>Late Permian | <i>Dicynodon</i> Assemblage Zone<br>Therapsids,<br>amphibians,<br>fish, amniotes,<br>invertebrates,<br>plant fossils,<br>trace fossils.         | None                         | None                                  |

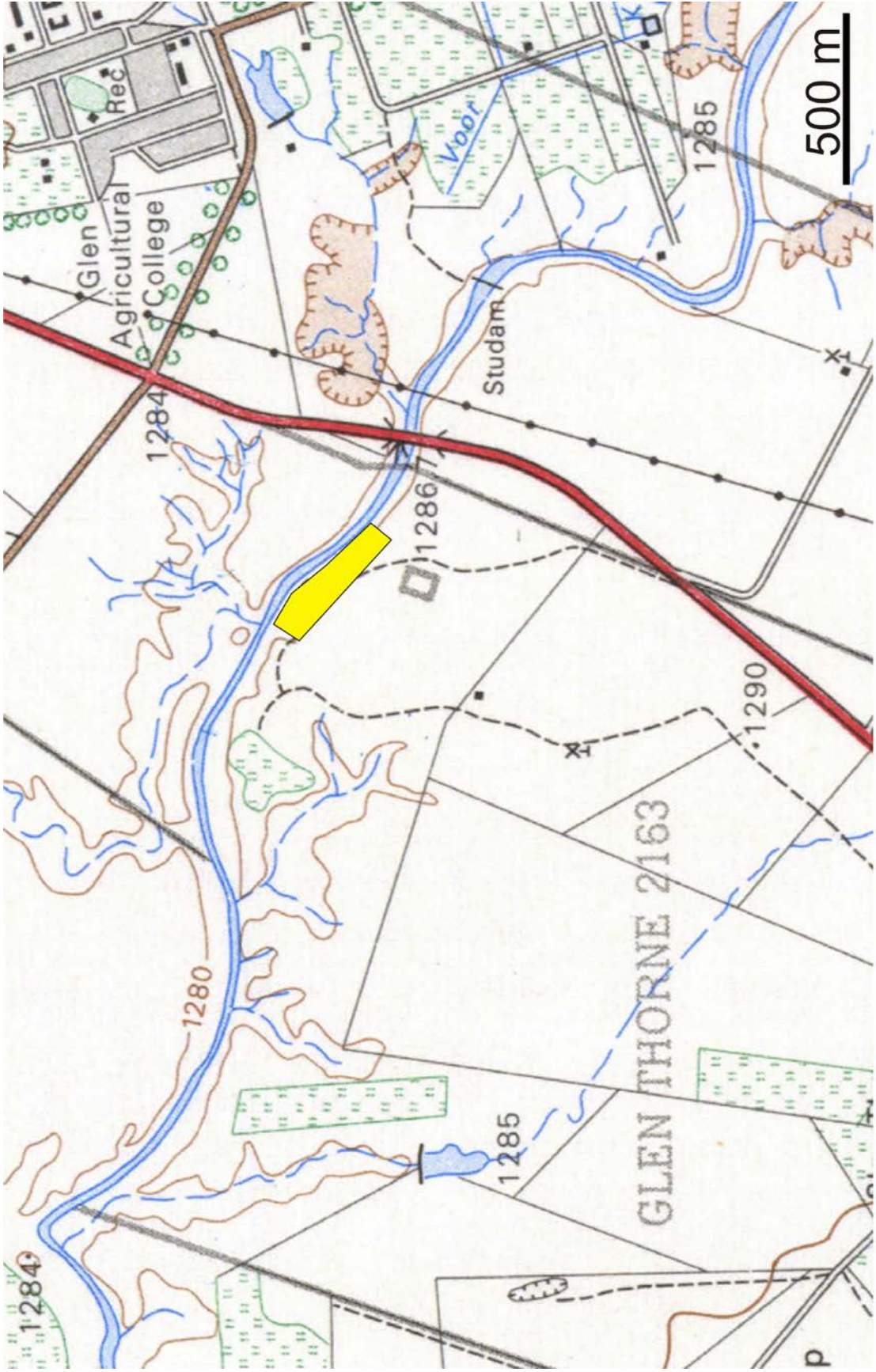


Figure 1. Map of the study area on the farm Glen Thorne 2163 (portion of 1:50 000 scale topographic 2826CD Glen).



Figure 2. Aerial view of the study area.



Figure 3. General view of degraded terrain covering the western half of the study area, looking west (top) and east (center). General view of the overgrown eastern half of the study area, looking towards the Modder River (bottom).

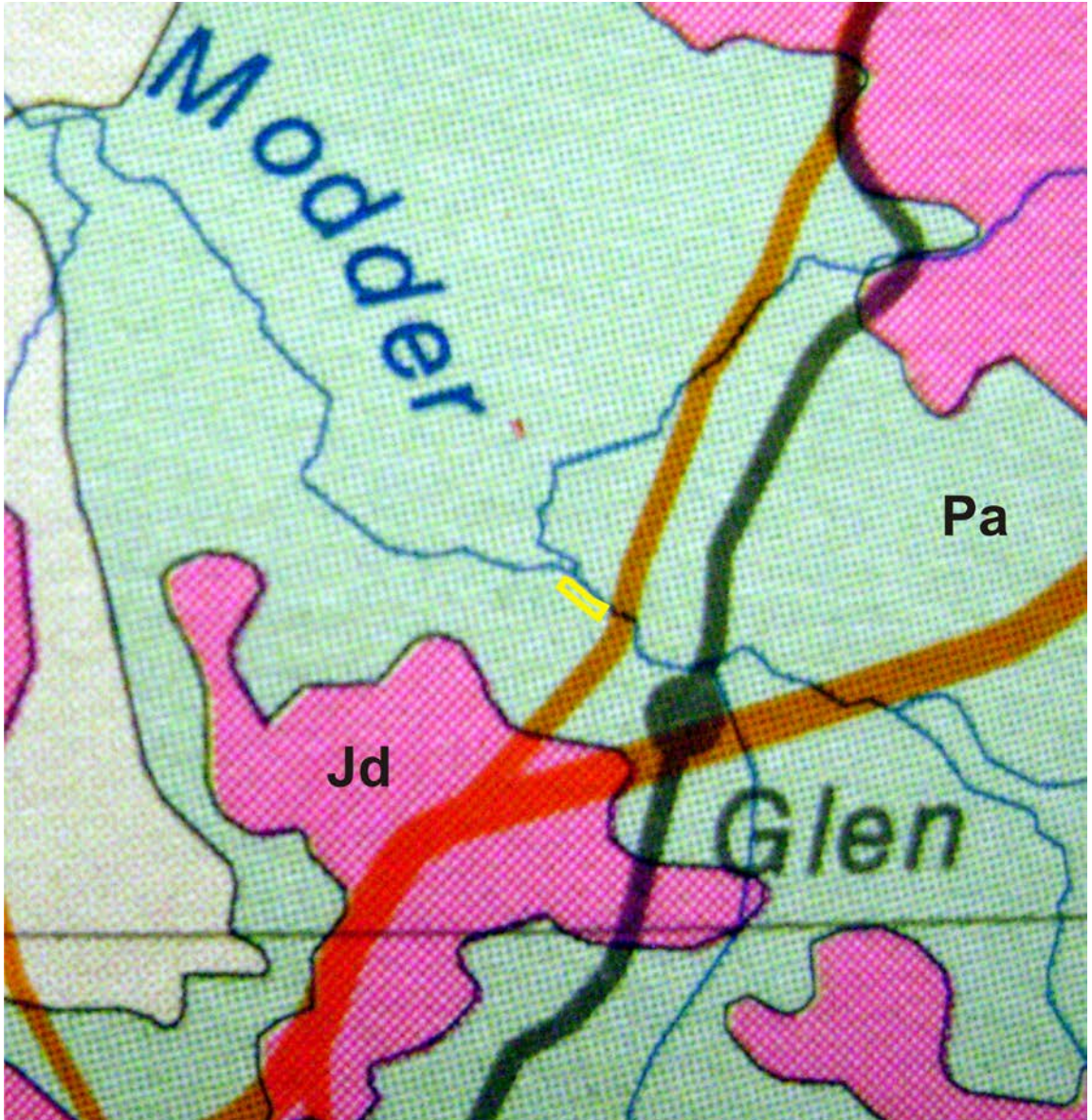


Figure 4. Portion of the 1:250 000 scale geological map Winburg 2826 showing the underlying geology around the affected area (yellow rectangle).

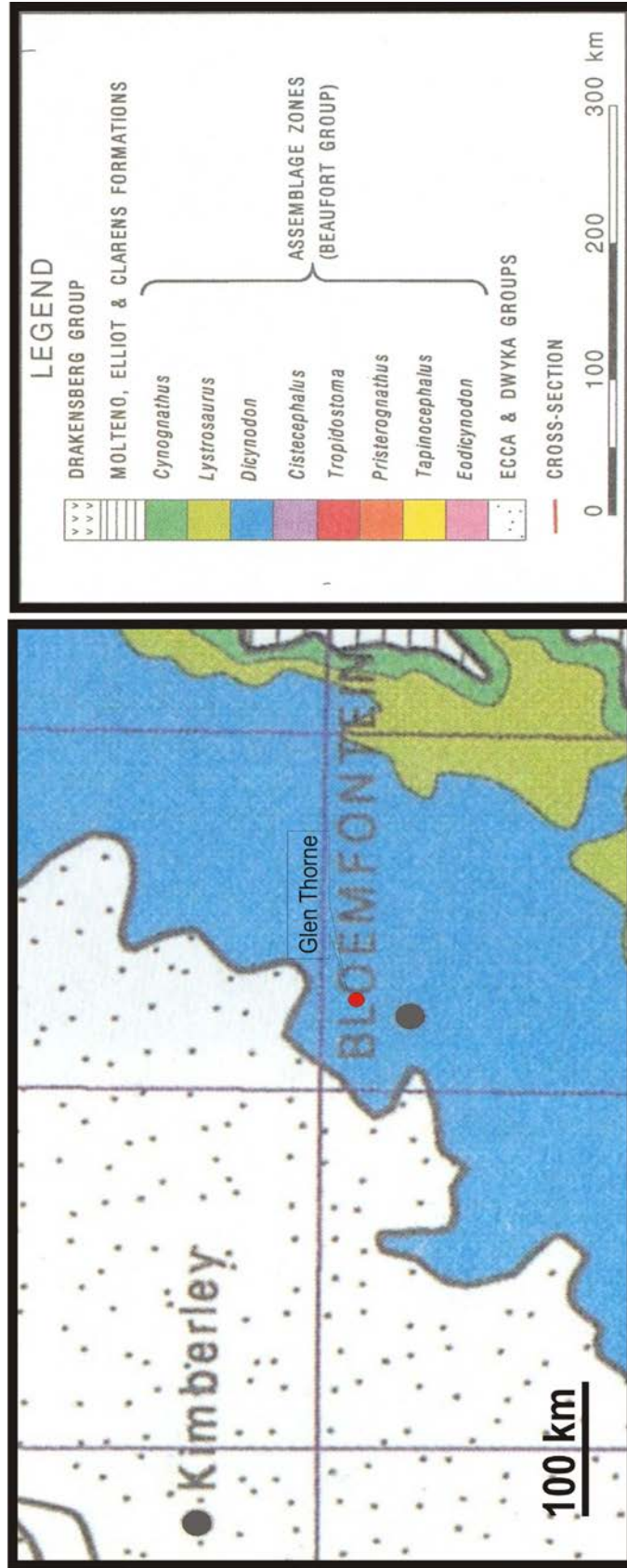


Figure 5. Geographical distribution of vertebrate biozones of the Beaufort Group around Bloemfontein (Rubidge 1995).

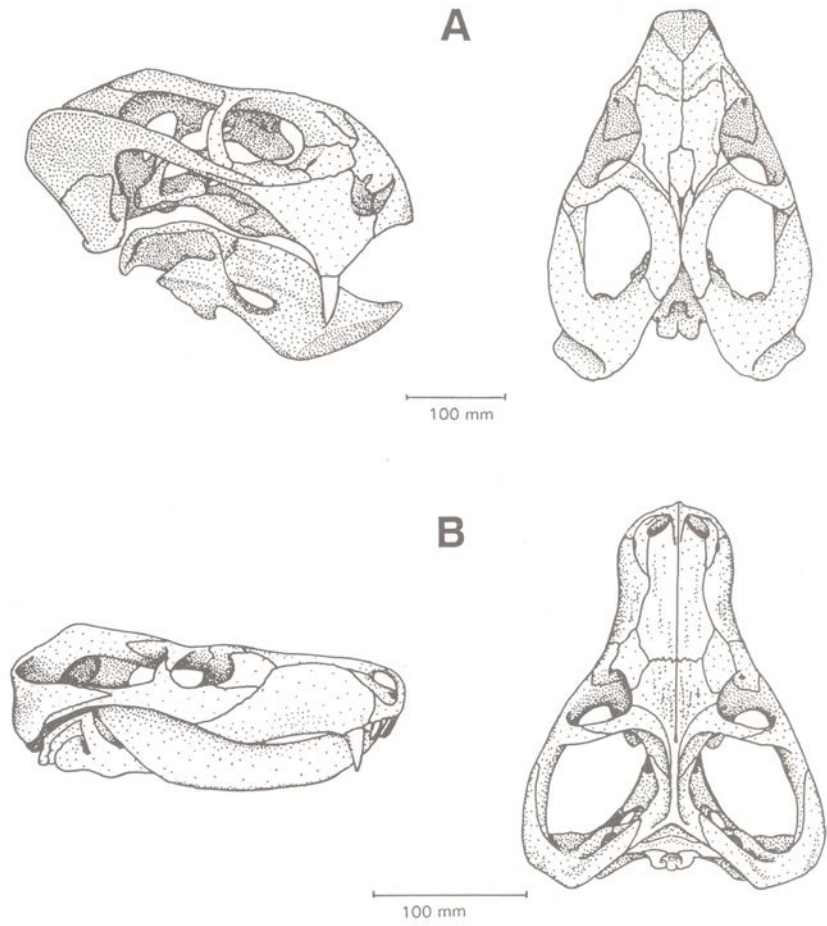


Figure 6. Lateral and dorsal views of biozone-defining fossils of the Dicynodon AZ. (A) Dicynodon (B) Theriognathus (Kitching 1995).

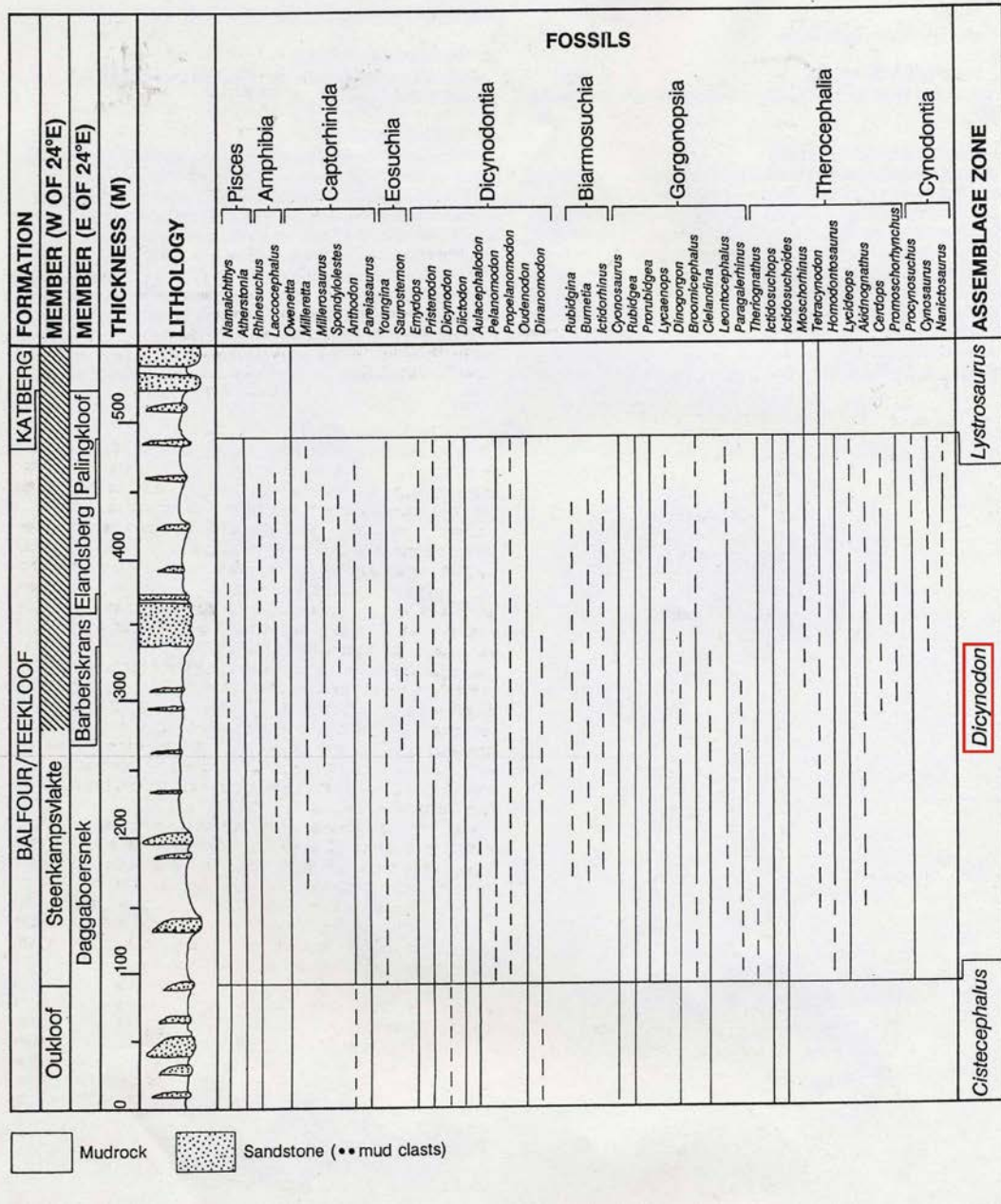


Figure 7. Stratigraphic section showing the ranges of vertebrate taxa present in the Dicynodon AZ (Kitching 1995).





Artist: Estie Esterhuizen

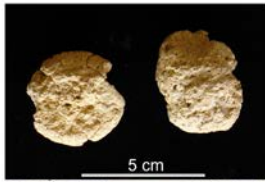


Figure 8. Artist impression of two extinct Florisian bovids *Pelorovis antiquus* (top left), *Megalotragus priscus* (top right) and fossilized hyena coprolites (below center left). Their fossilized remains are regularly recovered from ancient overbank sediments of the Modder River (bottom left & right).



Figure 9. MSA surface scatters: core and parallel flake blade (bottom left & right) exposed as a result of donga erosion along the Modder River.  
Scale 1 = 10 mm.

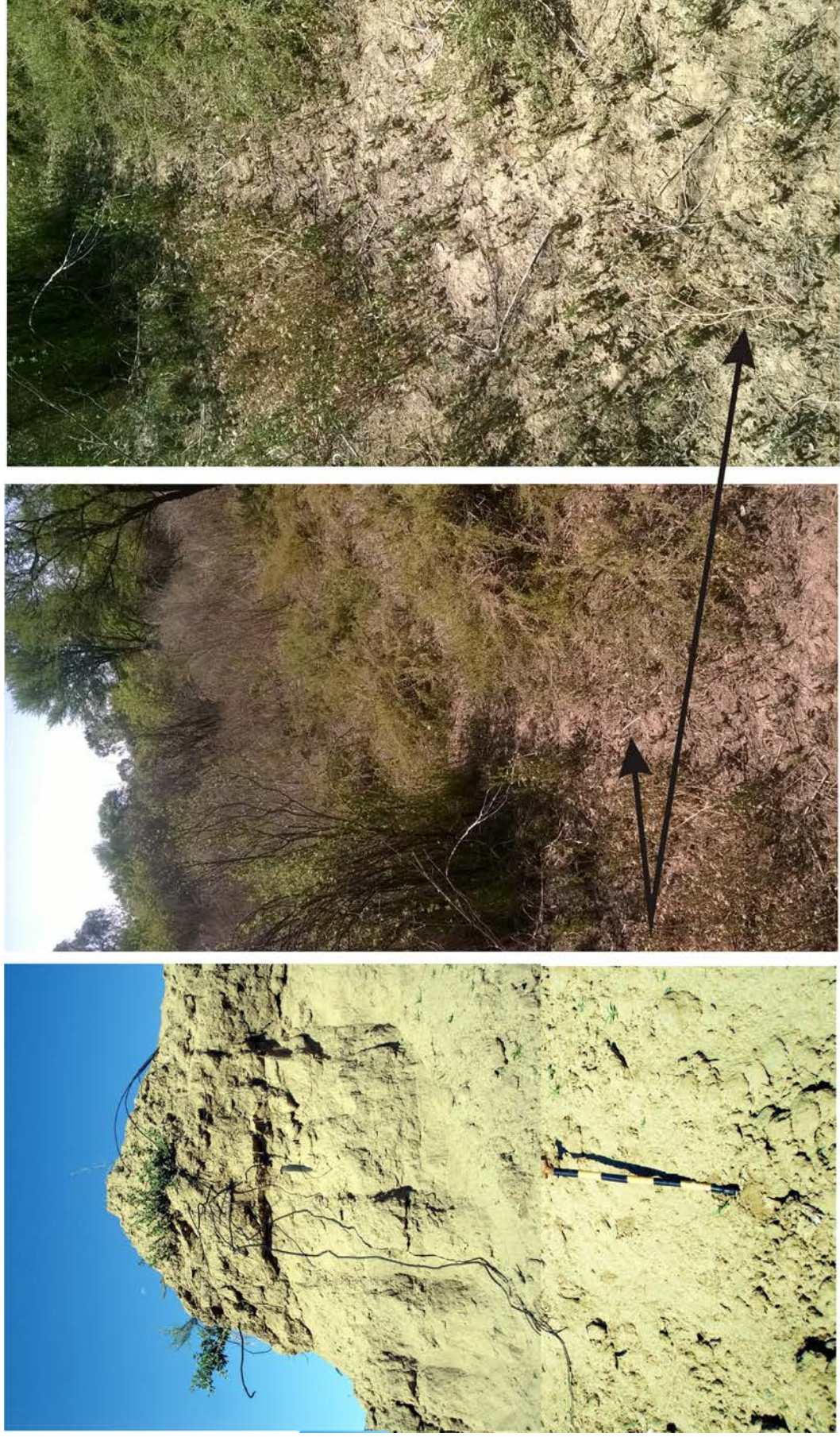


Figure 10. The study area is underlain by a well-developed, homogenous alluvial overburden (river sand).  
scale 1 = 10 cm.