Phase 1 Palaeontological Impact Assessment of two new irrigation pivots on Portion 12 of the farm Buffelsvlei 69, Colesberg, Northern Cape Province.

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Summary

A phase 1 Palaeontological Impact was carried out for the development of two new irrigation pivots covering a 20 ha area on Portion 12 of the farm Buffelsvlei 69, Colesberg, Northern Cape Province. The study area is capped by well-developed superficial sediments resulting in very low outcrop visibility. As a result of the low topography terrain and well-developed superficial overburden, the underlying sedimentary bedrock sediments are not considered palaeontologically vulnerable. There are no major palaeontological grounds to suspend the proposed development, provided that all excavation activities are confined to within the confines of the development footprint. However, fresh exposures of Beaufort Group sediments resulting from large scale excavations may well be of palaeontological interest. Should fossils be encountered during such excavations, it must be protected and their locality marked. The South African Heritage Resources Agency or National Museum in Bloemfontein should then be notified immediately so that the appropriate steps can be taken to collect and remove the material.

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Introduction

A phase 1 Palaeontological Impact was carried out for the development of two new irrigation pivots covering a 20 ha area on Portion 12 of the farm Buffelsvlei 69, Colesberg, Northern Cape Province (**Fig. 1**). The assessment is required as a prerequisite for new development in terms of the National Environmental Management Act and is also called for in terms of the National Heritage Resources Act (NHRA) 25 of 1999. The region's unique and non-renewable palaeontological heritage sites are 'Generally' protected in terms of the National Heritage Resources Act (Act No 25 of 1999, section 35) and may not be disturbed at all without a permit from the relevant heritage resources authority. As many such heritage sites are threatened daily by development, heritage legislation require impact assessment reports that identify all heritage resources including palaeontological sites in the area to be developed, and that make recommendations for protection or mitigation of the impact of these sites.

Terms of Reference

- Identify and map possible heritage sites and occurrences using available resources.
- Determine and assess the potential impacts of the proposed development on potential heritage resources;
- Recommend mitigation measures to minimize potential impacts associated with the proposed development.

Methodology

The heritage significance of the affected area was evaluated 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. Aerial photographs (incl. Google Earth) were consulted and geological maps were used to determine fossil-bearing rocks within the study area.

Locality data

1:50 000 scale topographic map 3025 CA Colesberg

1:250 000 scale geological map 3024 Colesberg

The affected area is situated on open, flat terrain, about 5 km north of Colesberg, next to the R717 provincial road en route to Philippolis (**Fig. 2 & 3**).

Pivot 1 centroid coordinates: 30°40'38.23"S 25° 8'13.35"E

Pivot 2 centroid coordinates: 30°40'49.16"S 25° 8'7.40"E

Background

From oldest to youngest, the deposits of the Karoo Supergroup in the region are assigned to Lower Beaufort Group rocks, represented by the Late Permian Adelaide Subgroup (*Pa*), dykes and sills of resistant Jurassic dolerites (*Jd***)** and superficial (Quaternary) deposits made up of alluvium and residual soils of varying depth (Le Roux 1993; Johnson et al. 2006.) (**Fig. 4**). The Adelaide Subgroup contains some of the richest Permo-Triassic tetrapod fauna from Pangaea/Gondwana and provides key evidence for evolution of mammalian characteristics among therapsids. The rocks in this outcrop area are assigned to one of eight different biostratigraphic units or assemblage zones (Rubidge 1995), namely the *Dicynodon* Assemblage Zone, (Kitching 1995). The sediments assigned to this AZ are associated with stream deposits consisting of floodplain mudstones and subordinate, lenticular channel sandstones (McCarthy and Rubidge, 2005; Johnson et al, 2006). The biozone is characterized by the presence of a distinctive and fairly common dicynodont genus (**Fig. 5 & 6**). Dicynodonts are well-known herbivorous therapsids from the Karoo Basin with at least 35 dicynodont genera recorded in the Beaufort Group. 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. Other vertebrate fossils include fish, amphibians and amniotes. Molluscs, insects, plant (*Dadoxylon, Glossopteris*) and trace fossils (arthropod trails, worm burrows) also occur. A small collection of fossils found in the area, housed at the Colesberg Museum include therapsids, petrified wood and palaeoniscoid fish from Suffolk Hill located about 3km to the southwest of the study area (**Fig. 7**).

Field Assessment

The study area is capped by well-developed superficial sediments resulting in very low outcrop visibility (**Fig. 8**). A pedestrian survey of the terrain revealed no evidence for the accumulation and preservation of intact fossil material within the geologically

recent overburden covering the footprint. As a result of the low topography terrain and well-developed superficial overburden, the underlying sedimentary bedrock sediments are not considered palaeontologically vulnerable.

Impact Statement and Recommendation

The terrain is not considered palaeontologically vulnerable because of the low topography terrain and well-developed superficial overburden, which will largely be affected by the development (planting and irrigation of crops). There are no major palaeontological grounds to suspend the proposed development, provided that all excavation activities are confined to within the confines of the development footprint. However, fresh exposures of Beaufort Group sediments resulting from large scale excavations may well be of palaeontological interest. Should fossils be encountered during such excavations, it must be protected and their locality marked. The South African Heritage Resources Agency or National Museum in Bloemfontein should then be notified immediately so that the appropriate steps can be taken to collect and remove the material.

References

Johnson, M.R. *et al.* 2006. Sedimentary rocks of the Karoo Supergroup. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) The geology of South Africa, pp. 461-499. Geological Society of South Africa, Marshalltown.

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Figures

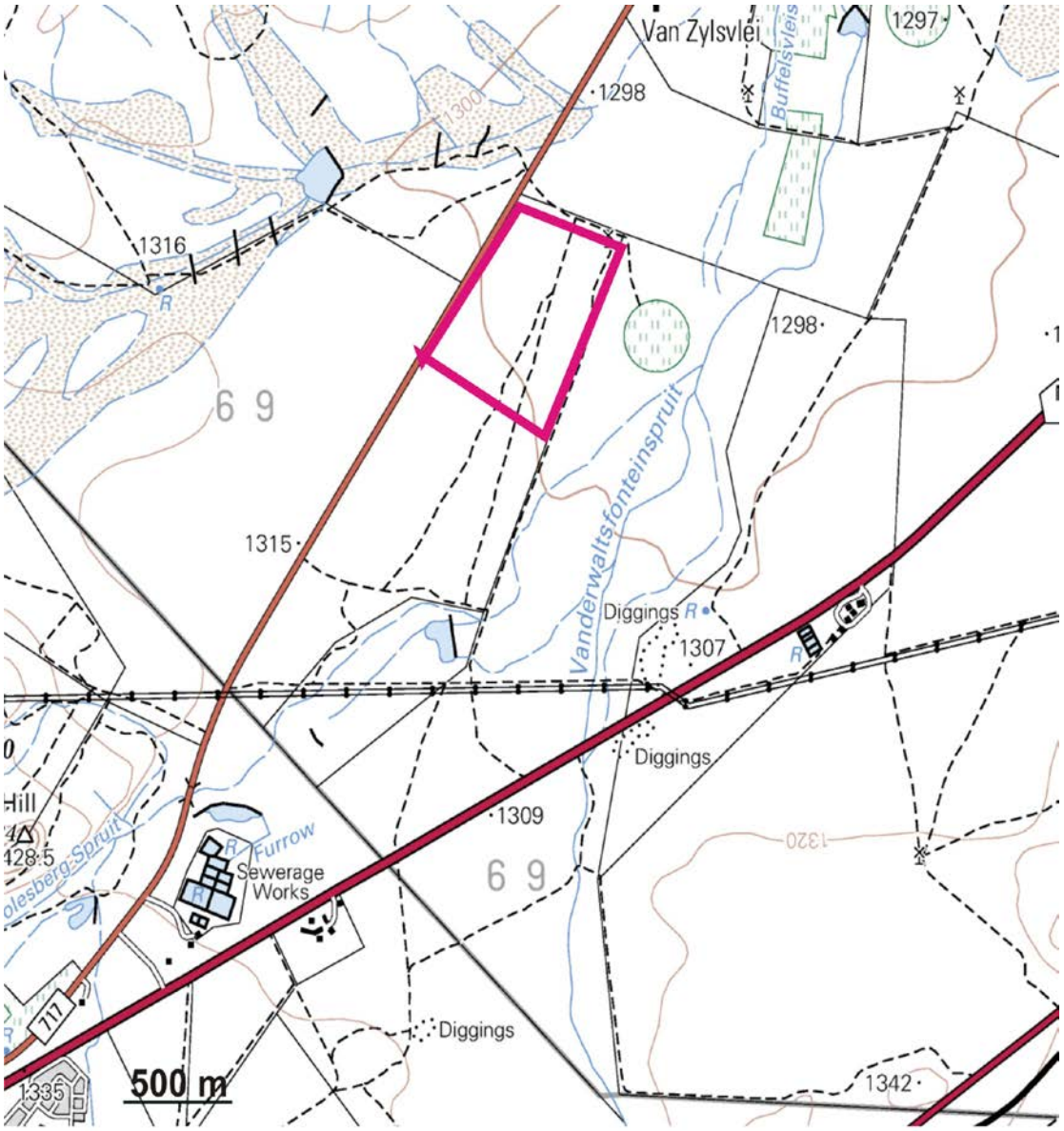

Figure 1. Map of the development footprint for the proposed new irrigation pivots on the farm Buffelsvlei 69 (portion of 1:50 000 scale topographic 3025CA Colesberg).

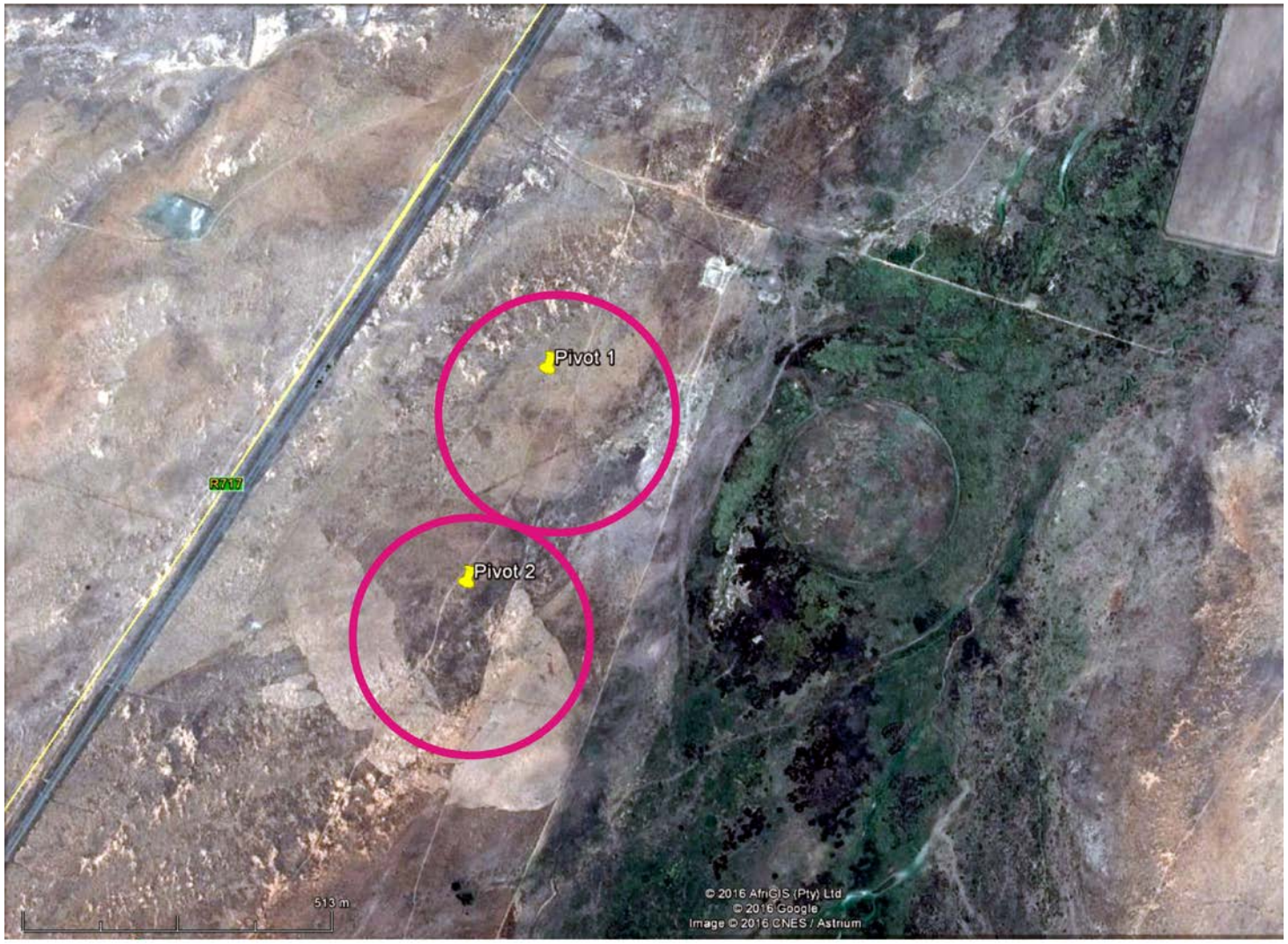

Figure 2. Aerial view of the study area.

Figure 3. General view of the study area, looking south towards Coleberg.

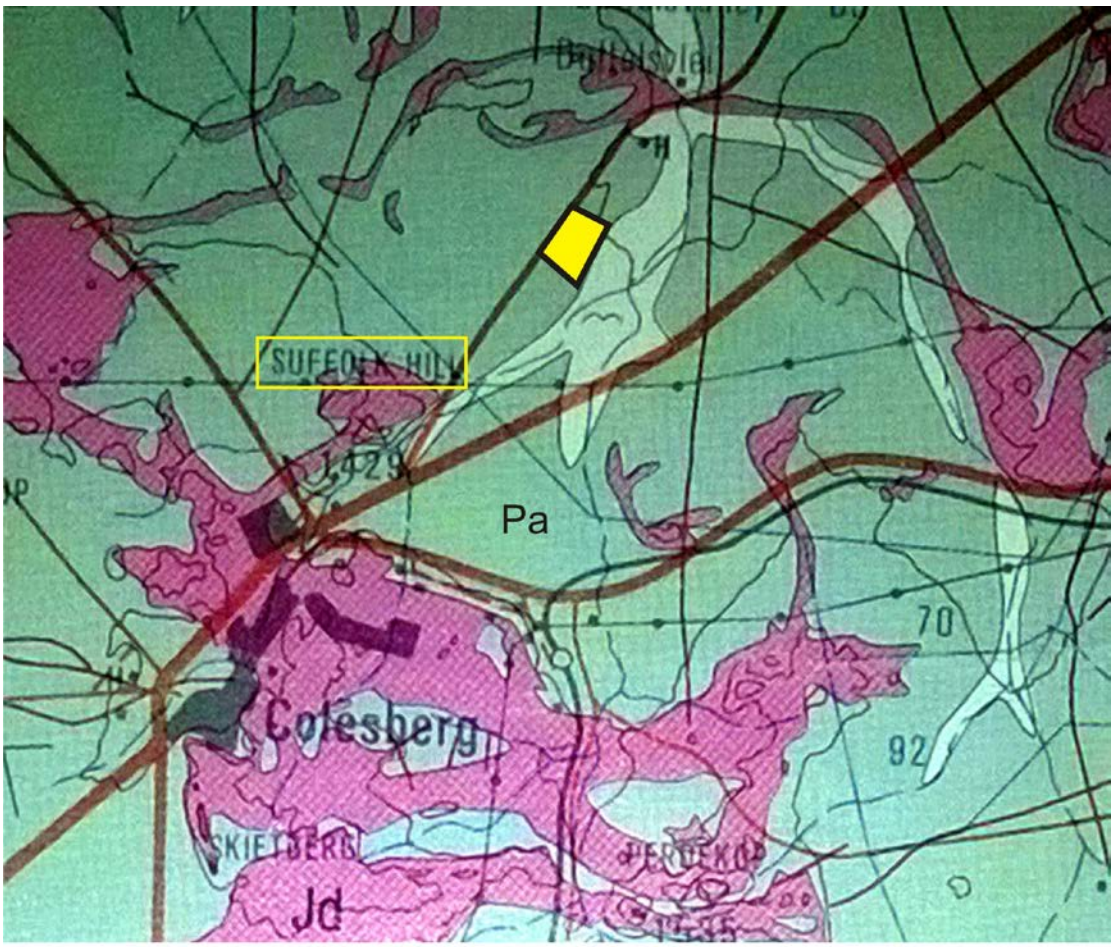

Figure 4. According to the 1:250 000 scale geological map of the region (3024 Colesberg), the region is underlain by fossiliferous sedimentary rocks the Late Permian Adelaide Subgroup (*Pa*) and dykes and sills of resistant Jurassic dolerite (*Jd*).

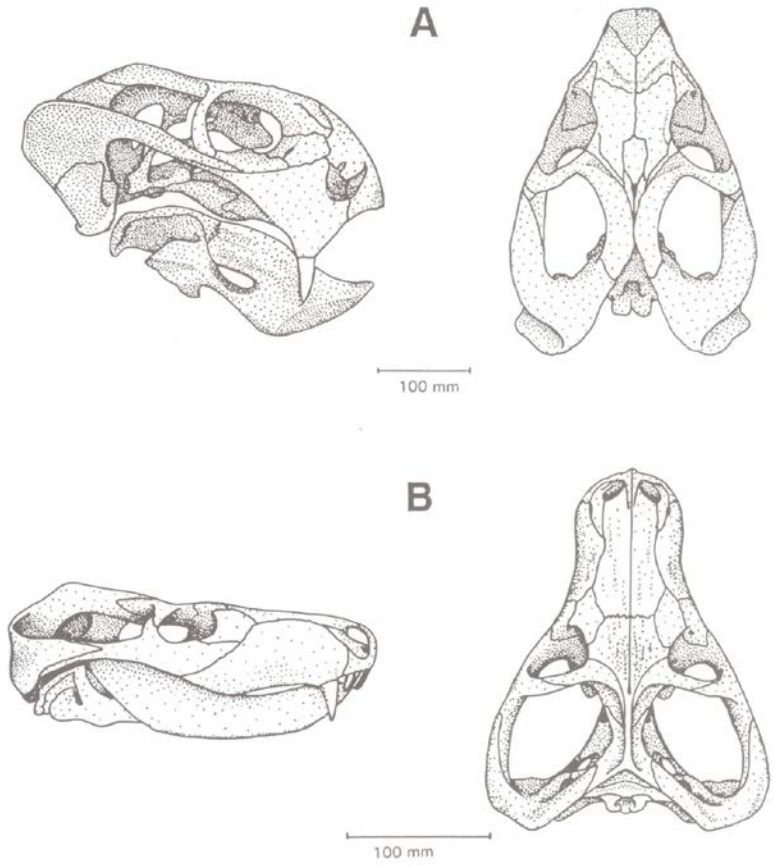

Figure 5. Lateral and dorsal views of biozone-defining fossils of the Dicynodon AZ.
(A) Dicynodon (B) Theriognathus

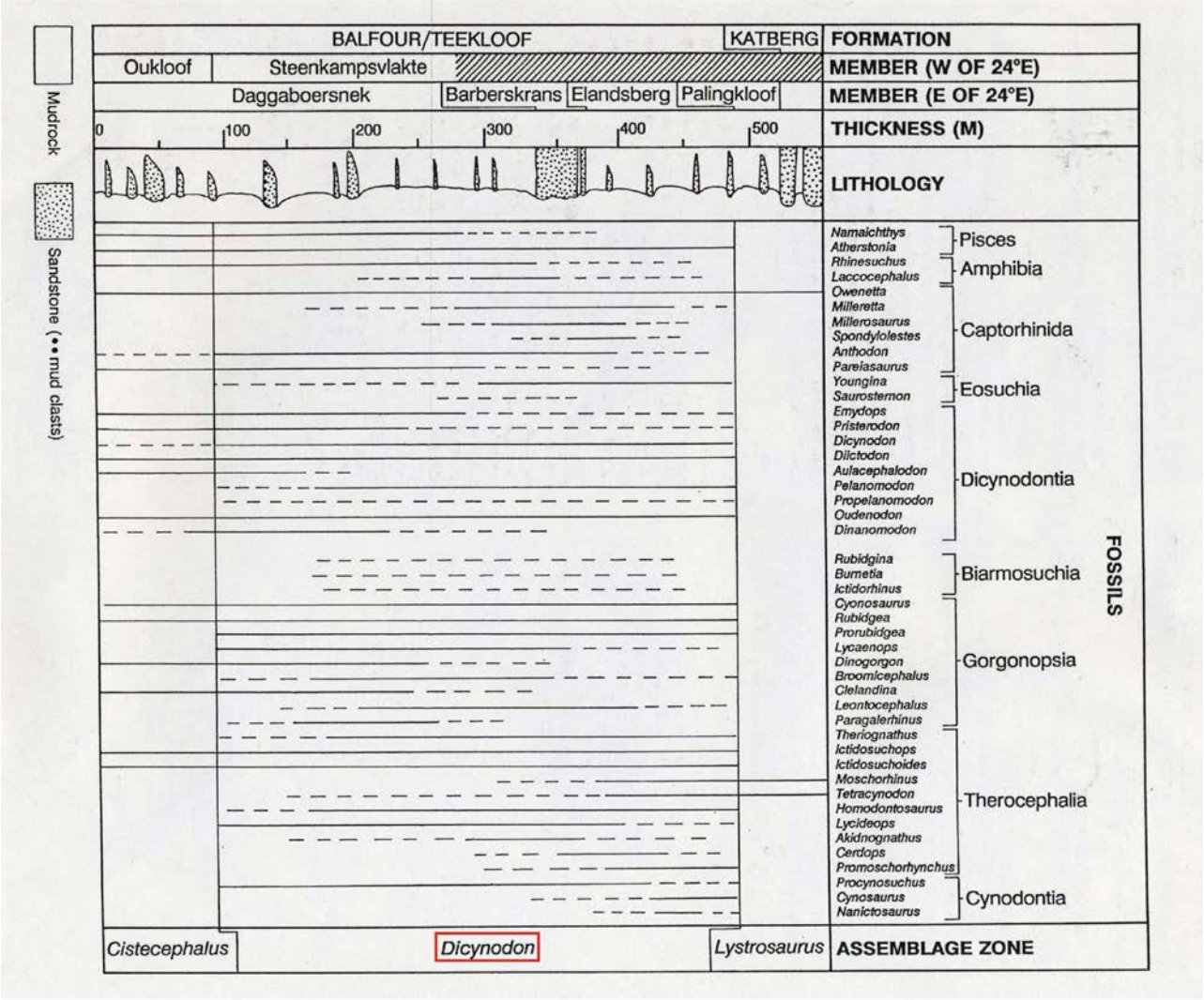

Figure 6. Stratigraphic section showing the ranges of vertebrate taxa present in the Dicynodon AZ.

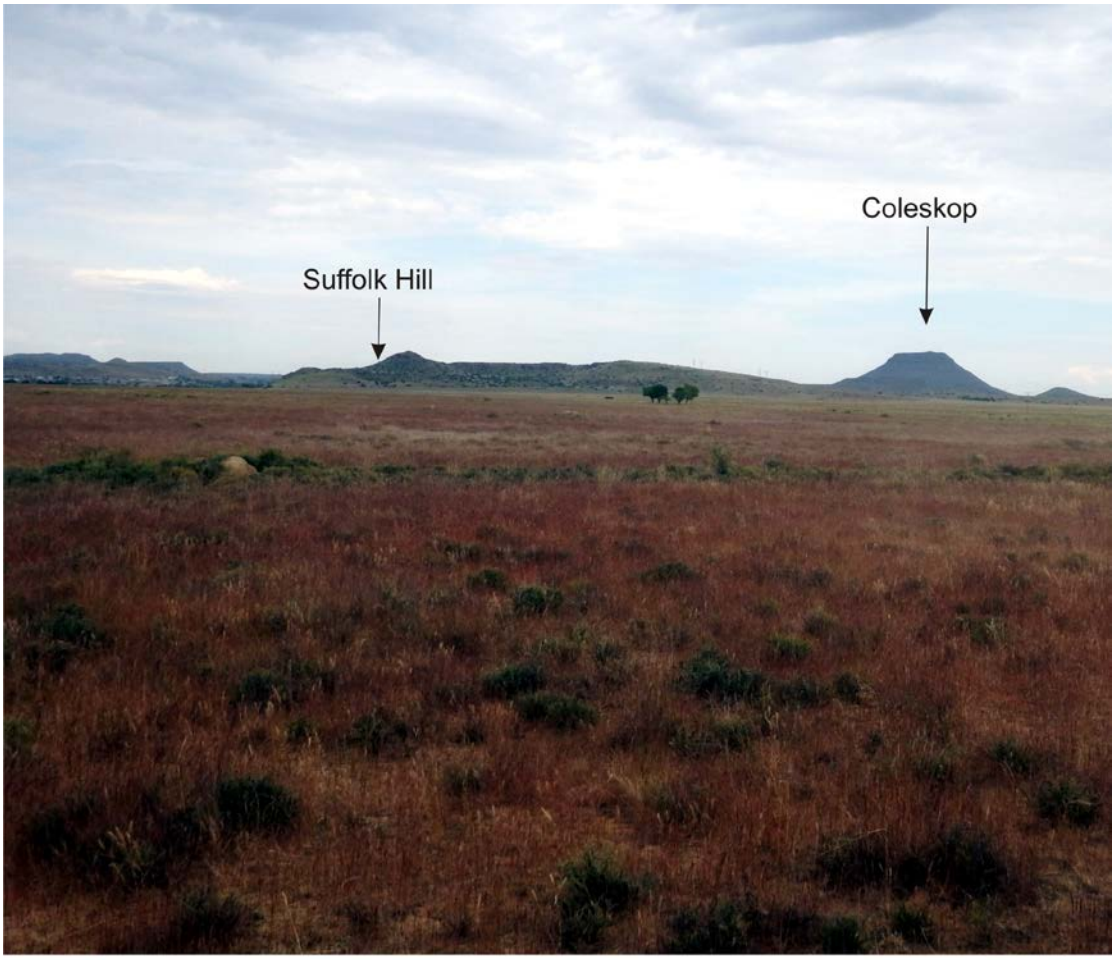

Figure 7. The study area, looking southwest towards Suffolk Hill, located about 3km to the southwest.

Figure 8. Small dolerite (top) and channel sandstone (below) exposures.