

Proposed development of new Themba lethu
Secondary School, Kokstad, Eastern Cape

PALAEONTOLOGICAL IMPACT ASSESSMENT

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For:

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1. Executive summary

There is a very low probability of finding fossils in the study site. This is firstly because of the general paucity of fossils in the Beaufort Group in the Eastern Cape in the Kokstad area. Secondly, the study site is situated on a dolerite sill that exposed the overlying mudstone to thermal metamorphism which would make the preservation of fossils improbable.

The Chance Palaeontological Finds Procedure (p. 15-16) should be followed if fossiliferous rocks are exposed during the pre-construction phase and at any point during construction.

2. Introduction

The palaeontological heritage of South Africa is unsurpassed and can only be described in superlatives. The South African palaeontological record gives us insight in *i.a.* the origin of life, mammals, dinosaurs and humans. Fossils are also used to identify rock strata and determine the geological context of the subregion with other continents and to study evolutionary relationships, sedimentary processes and palaeoenvironments.

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The Beaufort Group contains thousands of fossils including approximately 70% of all known synapsid (also known as mammal-like reptile) fossils in the world. Synapsids have played a crucial role in our understanding of the origin of mammals and the Permo-Triassic terrestrial palaeoenvironment including the existence of Gondwanaland.

The Heritage Act of South Africa stipulates that fossils and fossil sites may not be altered or destroyed. The purpose of this document is to detail the probability of finding fossils in the study area which may be impacted by the proposed development.

3. Terms of reference for the report

According to the South African Heritage Resources Act (Act 25 of 1999) (Republic of South Africa, 1999), certain clauses are relevant to palaeontological aspects for a terrain suitability assessment.

- **Subsection 35(4)** No person may, without a permit issued by the responsible heritage resources authority-
- (a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any 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 assist 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.

South Africa's unique and non-renewable palaeontological heritage is protected in terms of the NHRA. According to this act, 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.

As areas are developed and landscapes are modified, heritage resources, including palaeontological resources, are threatened. As such, both the environmental and heritage legislation require that development activities must be preceded by an assessment of the impact undertaken by qualified professionals. Palaeontological Impact Assessments (PIAs) are specialist reports that form part of the wider heritage component of:

- Heritage Impact Assessments (HIAs) called for in terms of Section 38 of the National Heritage Resources Act, Act No. 25, 1999 by a heritage resources authority.
- Environmental Impact Assessment process as required in terms of other legislation listed in s. 38(8) of NHRA;
- Environmental Management Plans (EMPs) required by the Department of Mineral Resources.

HIAs are intended to ensure that all heritage resources are protected, and where it is not possible to preserve them in situ, appropriate mitigation measures are applied. An HIA is a comprehensive study that comprises a palaeontological, archaeological, built environment, living heritage, etc specialist studies. Palaeontologists must acknowledge this and ensure that they collaborate with other heritage practitioners. Where palaeontologists are engaged for the entire HIA, they must refer heritage components for which they do not have expertise on to appropriate specialists. Where they are engaged specifically for the palaeontology, they must draw the attention of environmental consultants and developers to the need for assessment of other aspects of heritage. In this sense, Palaeontological Impact Assessments that are part of Heritage Impact Assessments are similar to specialist reports that form part of the EIA reports. The standards and procedures discussed here are therefore meant to guide the conduct of PIAs and specialists undertaking such studies must adhere to them. The process of assessment for the palaeontological (PIA) specialist components of heritage impact assessments, involves:

Scoping stage in line with regulation 28 of the National Environmental Management Act (No. 107 of 1998) Regulations on Environmental Impact Assessment. This involves an **initial assessment** where the specialist evaluates the scope of the project (based, for example, on NID/BIDs) and advises on the form and extent of the assessment process. At this stage the palaeontologist may also decide to compile a **Letter of Recommendation for Exemption from further Palaeontological Studies**. This letter will state that there is little or no likelihood that any significant fossil resources will be impacted by the development. This letter should present a reasoned case for exemption, supported by consultation of the relevant geological maps and key literature.

A Palaeontological Desktop Study – the palaeontologist will investigate available resources (geological maps, scientific literature, previous impact assessment reports, institutional fossil collections, satellite images or aerial

photos , etc) to inform an assessment of fossil heritage and/or exposure of potentially fossiliferous rocks within the study area. A Desktop studies will conclude whether a further field assessment is warranted or not. Where further studies are required, the desktop study would normally be an integral part of a field assessment of relevant palaeontological resources.

A Phase 1 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 project area is unknown. In the recommendations of Phase 1, the specialist will inform whether further monitoring and mitigation are necessary. The Phase 1 should identify the rock units and significant fossil heritage resources present, or by inference likely to be present, within the study area, assess the palaeontological significance of these rock units, fossil sites or other fossil heritage, comment on the impact of the development on palaeontological heritage resources and make recommendations for their mitigation or conservation, or for any further specialist studies that are required in order to adequately assess the nature, distribution and conservation value of palaeontological resources within the study area.

A Phase 2 Palaeontological Mitigation involves planning the protection of significant fossil sites, rock units or other palaeontological resources and/or the recording and sampling of fossil heritage that might be lost during development, together with pertinent geological data. The mitigation may take place before and / or during the construction phase of development. The specialist will require a Phase 2 mitigation permit from the relevant Heritage Resources Authority before Phase 2 may be implemented.

A **'Phase 3' Palaeontological Site Conservation and Management Plan** may be required in cases where the site is so important that development will not be allowed, or where development is to co-exist with the resource. Developers may be required to enhance the value of the sites retained on their properties with appropriate interpretive material or displays as a way of promoting access of such resources to the public.

The assessment reports will be assessed by the relevant heritage resources authority, and depending on which piece of legislation triggered the study, a response will be given in the form of a Review Comment or Record of Decision (ROD). In the case of PIAs that are part of EIAs or EMPs, the heritage resources authority will issue a comment or a record of decision that may be forwarded to the consultant or developer, relevant government department or heritage practitioner and where feasible to all three.

4. Details of study area and the type of assessment:



Figure 1: Google Earth photo of study area (black polygon)

The study area is situated in an open area between formal and informal settlements east of Kokstad in Eastern Cape Province. The study site is situated on a hilly terrain that slopes towards the southeast. A railway track forms the southern border of the study site.

The relevant literature and geological maps for the region in which the development is proposed to take place, have been studied and the site was visited on 28 August 2021 for a Palaeontological Impact Assessment.

5. Geological setting of the study area



The study site falls within the red polygon

Figure 2: Geological Map of the study area (adapted from the 3028 KOKSTAD 1: 250 000 Geology Map, Council for Geoscience, 2002)

LEGEND:

	Lithology	Stratigraphy	Age
Jd	Dolerite		Jurassic
Pa	Grey, greenish grey and brownish red mudstone	Adelaide Subgroup of the Beaufort Group of the Karoo Supergroup	Permian

The study area is mainly underlain by mudstone of the Adelaide Subgroup of the Beaufort Group of the Karoo Supergroup that has been intruded by a dolerite sill (see Fig. 2). Dolerite is exposed in the southeastern part of the study site (see Figs. 2, 5 & 6).

The Adelaide Subgroup consists of alternating bluish-grey, greenish-grey or greyish-red mudrocks and fine- to medium-grained sandstones. Palaeocurrent evidence suggests that the sediments comprising the Adelaide Subgroup originated from a source southeast of the study site during the Permian. The mudrocks represent overbank deposits that settled from suspension on floodplains adjacent to meandering rivers. The area was subject to large-scale dolerite intrusions during the Jurassic (Johnson *et al.*, 2009).

6. Site visit



Figure 3: Facing southwest from 30°31'55.63"S 29°26'22.09"E



Figure 4: Facing south from 30°31'56.65"S 29°26'22.87"E



Figure 5: Facing southwest from 30°31'58.31"S 29°26'29.08"E



Figure 6: Facing west from 30°31'56.30"S 29°26'25.44"E

7. Palaeontological potential of the study area



Study site is indicated by the white polygon

Figure 7: Palaeosensitivity map (SAHRA, 2021) of the area where the planned development is going to take place

KEY		
COLOUR	SENSITIVITY	REQUIRED ACTION
Red	Very High	Field assessment and protocol for finds are required.
Grey	Zero	No palaeontological studies are required.

The area in which the study site is located has rocks that are considered to have either Insignificant or Very High Palaeontological Sensitivity (SAHRA, 2021) (see Fig. 7). No fossils were found during the site visit.

The largest part of the study area is on mudstone of the Beaufort Group that is considered to have Very High Palaeontological Sensitivity (Groenewald, 2012) and is known to be highly fossiliferous in the western and northern parts of the Main Karoo Basin.

The fossil record of the Beaufort Group in the Eastern Cape is however relatively sparse (Karpeta & Johnson, 1979) which impedes the biostratigraphic subdivision of the Eastern Cape (Rubidge, 1995). Most of the few fossils that

have been collected in this geological unit in the Eastern Cape were fossil wood (Kitching, 1977; Dingle *et al.*, 1983).

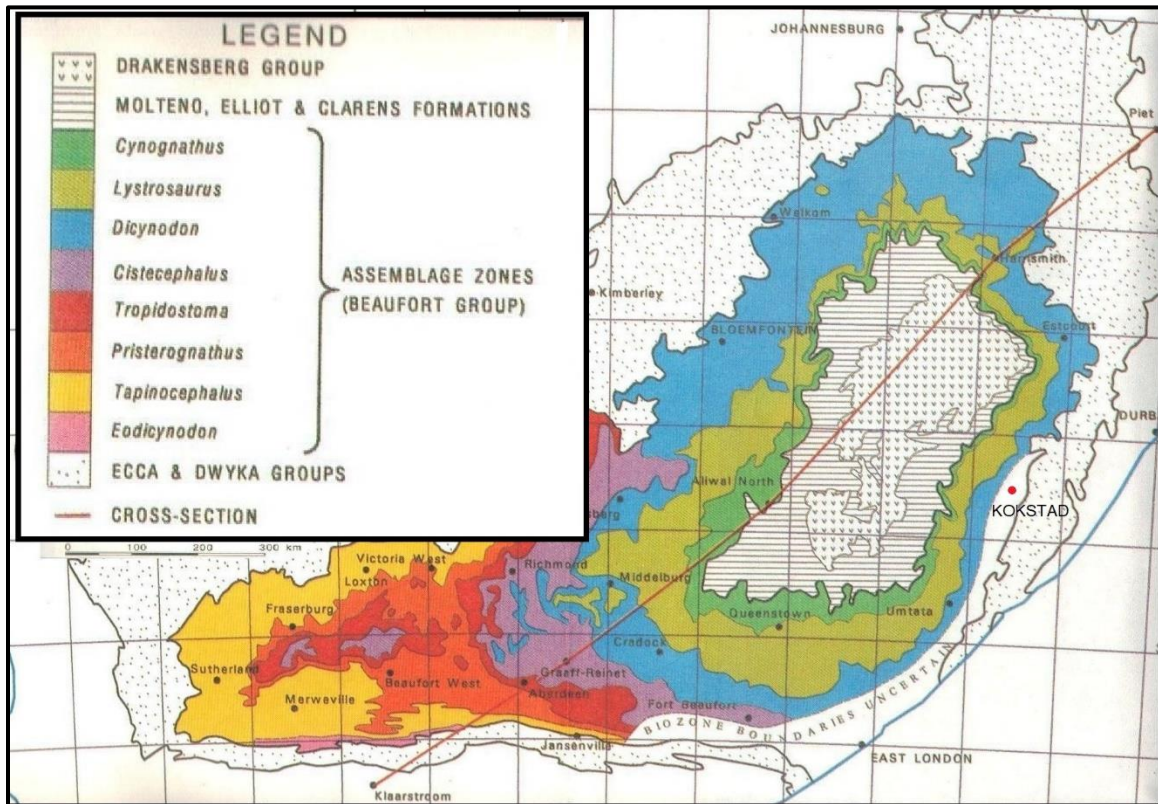


Figure 8: Biostratigraphy of the Beaufort Group of the Karoo Supergroup (adapted from: Rubidge, 1995)

The mudstone in the study site has been intruded by a dolerite sill (see Figs. 2, 5 & 6). The chances of finding any fossils in the study area are therefore extremely slim due to the thermal metamorphism the mudstone would have been exposed to during the intrusion of the dolerite.

References:

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Kitching, J.W. (1977). The distribution of the Karroo vertebrate fauna, with special reference to certain genera and the bearing of this distribution on the zoning of the Beaufort beds. Memoirs of the Bernard Price Institute for Palaeontological Research, University of the Witwatersrand, No. 1, 133 pp.

Rubidge, R.S. (ed.) (1995) Biostratigraphy of the Beaufort Group (Karoo Supergroup). South African Committee for Stratigraphy no.1, Council for Geoscience.

SAHRA (2021) Palaeosensitivity Map <http://www.sahra.org.za/sahris/map/palaeo>

8. Conclusion and recommendations:

The study area is situated on mudrocks of the Adelaide Subgroup of the Beaufort Group of the Karoo Supergroup that is renowned for its fossiliferous nature.

There is a very low probability of finding fossils at the study site however. This is firstly because of the general paucity of fossils in the Beaufort Group in the Eastern Cape specifically in the area around Kokstad. Secondly, the study site is situated on a dolerite sill that that would have exposed the adjacent potentially fossiliferous rock to thermal metamorphosis that would make the preservation of fossils improbable.

The Chance Palaeontological Finds Procedure should be followed if fossiliferous rocks are exposed during the pre-construction phase and at any point during construction.

PROCEDURE FOR CHANCE PALAEOLOGICAL FINDS

Extracted and adapted from the National Heritage Resources Act, 1999 Regulations Reg No. 6820, GN: 548.

The following procedure must be considered in the event that previously unknown fossils or fossil sites are exposed or found during construction of the road:

1. Surface excavations should continuously be monitored by the ECO and any fossil material be unearthed the excavation must be halted.
2. If fossiliferous material has been disturbed during the excavation process it should be put aside to prevent it from being destroyed.
3. The ECO then has to take a GPS reading of the site and take digital pictures of the fossil material and the site from which it came.
4. The ECO then should contact a palaeontologist and supply the palaeontologist with the information (locality and pictures) so that the palaeontologist can assess the importance of the find and make recommendations.
5. If the palaeontologist is convinced that this is a major find an inspection of the site must be scheduled as soon as possible in order to minimise delays to the development.

From the photographs and/or the site visit the palaeontologist will make one of the following recommendations:

- a. The material is of no value so development can proceed, or:
 - b. Fossil material is of some interest and a representative sample should be collected and put aside for further study and to be incorporated into a recognised fossil repository after a permit was obtained from SAHRA for the removal of the fossils, after which the development may proceed, or:
 - c. The fossils are scientifically important and the palaeontologist must obtain a SAHRA permit to excavate the fossils and take them to a recognised fossil repository, after which the development may proceed.
7. If any fossils are found then a schedule of monitoring will be set up between the developer and palaeontologist in case of further discoveries.

9. Declaration of Independence:

I, Jacobus Francois Durand declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed development, application or appeal in respect of which I was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.



Palaeontological specialist:

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