

Palaeontological Impact Assessment of an existing
borrow pit at Qumanco, EC Province.



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Executive Summary

- The development footprint will impact on dolerites, Triassic-age Burgersdorp Formation strata (*Trb*) and partly overlying superficial deposits of Quaternary age.
- The borrow pit is largely located on a dolerite dyke which represent no palaeontological impact.
- Excavations away from the dolerite dyke will impact on potentially fossil-bearing Burgersdorp Formation strata (*Trb*).
- The overlying Quaternary deposits bear little palaeontological significance.
- There are no major palaeontological grounds to suspend the proposed development of the site.
- However, any developments that may destroy or damage subsurface fossils are of conservation and research interest.
- In such a case it is advised that newly uncovered material found during the course of excavation activities within footprint must be reported to SAHRHA, that excavations into *in situ* sedimentary bedrock should allow for inspection by a specialist at the appropriate time and that possible intact finds may require a Phase 2 rescue operation at the cost of the developer.

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Introduction

The report is a preliminary assessment of potential palaeontological impact with regard to proposed development of an existing borrow pit at Qumanco near the village of Ncora in the Eastern Cape Province. The assessment was carried out in accordance with National Heritage Resources Act 25 of 1999 with the aim to assess impact on potential palaeontological heritage resources. The palaeontological significance of the local and surrounding environment was evaluated through a desktop study and carried out on the basis of existing field data, database information and published literature.

Description of the Affected Area

Details of area surveyed

Locality data

The 1:50 000 topographical map of the area is 3127DD Nobokwe.

The footprint consist of an existing borrow pit, approximately 1.5 ha in size. It is situated next to a gravel road about 300m south of a residential area, and about 400m west of the KuBotane River.

Geology

The study area is largely underlain by Mesozoic sediments of the Beaufort Group (Karoo Supergroup; see 1: 250 000 scale geological map 3126 Queenstown, published by the Council for Geoscience, Pretoria, 1979; **Fig. 2**). From oldest to youngest the sediments in the region are assigned to the Beaufort Group rocks, represented by the Early Triassic Tarkastad Subgroup. Regionally, the Tarkastad Subgroup is represented by Burgersdorp Formation (*Trb*). These sedimentary rocks were intruded by an interconnected network of dykes, sills and inclined sheets of dolerite (*Jd*) during the Jurassic. Overlying superficial deposits consists of Quaternary river alluvium

made up of semi- to well-consolidated soils and gravels adjoining the nearby KuBotane River to the east..

Methodology

All structures and sites that were observed were recorded using a Garmin Etrex Vista GPS hand model (set to the WGS 84 map datum) and a digital camera.

Palaeontological Background

Karoo Sediments

The study area is underlain by Triassic-age Burgersdorp Formation strata (*Trb*) of the Tarkastad Subgroup (**Fig. 3**). These rocks are assigned to the *Cynognathus* Assemblage Zone (AZ), which overlies the *Lystrosaurus* AZ. The zone is characterized by the presence of *Cynognathus*, *Diadermodon* and *Kannemeyeria* and the absence of *Lystrosaurus*. Sediments assigned to this zone are well exposed in the Queenstown and Lady Frere districts and have been traced eastward as far as the Engcobo district. Rocks consist of blue-green, pale grayish green, dark red to very dark maroon mudstones that are in many instances more consolidated than those of the underlying *Lystrosaurus* AZ. Fossil-bearing lenticular sandstones with calcareous concretions are common. The fossil record of the *Cynognathus* AZ is summarized in Rubidge (1995) and MacRae (1999) and includes a variety of plants, trace fossils, amphibians, fish reptiles, synapsids, and occasional molluscs. Complete, articulated skeletons are rare, but well preserved therapsids occur in mudrock units as dispersed and isolated specimens. Fragmentary therapsid and amphibian fossils frequently occur in localized scatters or in conglomerates at the base of lenticular sandstones.

Table 1. Geology and potential fossil heritage in and around the affected area.

Geological Unit	Rock types and Age	Fossils Recorded / Biostratigraphy
Superficial deposits	Valley sediments, alluvium. Quaternary to Recent	Vertebrate skeletal remains; freshwater molluscs, coprolites, pollen and phytoliths
Karoo Dolerite (<i>Jd</i>)	Intrusive igneous bedrock. Jurassic	No fossils
Upper Beaufort Group Tarkastad Subgroup Burgersdorp Formation (<i>Trb</i>)	Fluvial and lacustrine mudstones and sandstones. Early Triassic	<i>Cynognathus</i> Assemblage Zone

Post-Karoo Sediments

The site is partially covered by Quaternary valley sediments and alluvium. There is currently no record of Quaternary palaeontological exposures in the vicinity and the likelihood of finding fossil vertebrate fauna in the geologically recent superficial deposits is low.

Results of Survey

Impact on potential palaeontological resources within the footprint is summarized in **Table 2**. The borrow pit is largely located within an interconnected network of igneous bedrock (dolerite) intruding through Burgersdorp Formation strata (**Fig. 4 and 5**). The pedestrian survey revealed no evidence of fossil exposures within or in the immediate vicinity of the borrow pit.

Statement of Significance

The borrow pit is largely located on a dolerite dyke which represent no palaeontological impact. Excavations away from the dolerite dyke will impact on potentially fossil-bearing Burgersdorp Formation strata (*Trb*). However, the high temperatures and pressures created by the basalt eruptions that produced the dolerite intrusions, resulted in regional metamorphism of nearby sediments, which may have effectively contributed to the destruction of fossils in the original sedimentary rocks. The overlying Quaternary deposits bear little palaeontological significance.

Table 2. Assessment of impact within the footprint.

Geological Unit	Palaeontological significance of footprint (surface features)	Palaeontological significance of footprint (subsurface finds)	Potential Impact	Irreplaceable loss of heritage resources?	Suggested Mitigation
<i>Superficial deposits, Alluvium</i>	low	low	none	no	none
Karoo Dolerite (<i>Jd</i>)	low	low	none	no	none
Burgersdorp Formation (<i>Trb</i>)	low	Medium	Medium	no	monitoring of fresh exposures / excavations

Recommendation

There are **no major palaeontological grounds to suspend the proposed development of the site**, but given the nature of fossil distribution in Karoo sedimentary rocks, it is not possible to exactly predict the buried fossil content of an area other than in general terms unless fresh exposures indicate otherwise. Therefore, any developments that may destroy, or damage subsurface fossils are of conservation and research interest. In such a case it is advised that newly uncovered material found during the course of excavation activities within footprint must be reported to SAHRHA, that excavations into *in situ* sedimentary bedrock should allow **for inspection by a specialist at the appropriate time** and that possible intact finds may **require a Phase 2 rescue operation at the cost of the developer.**

References

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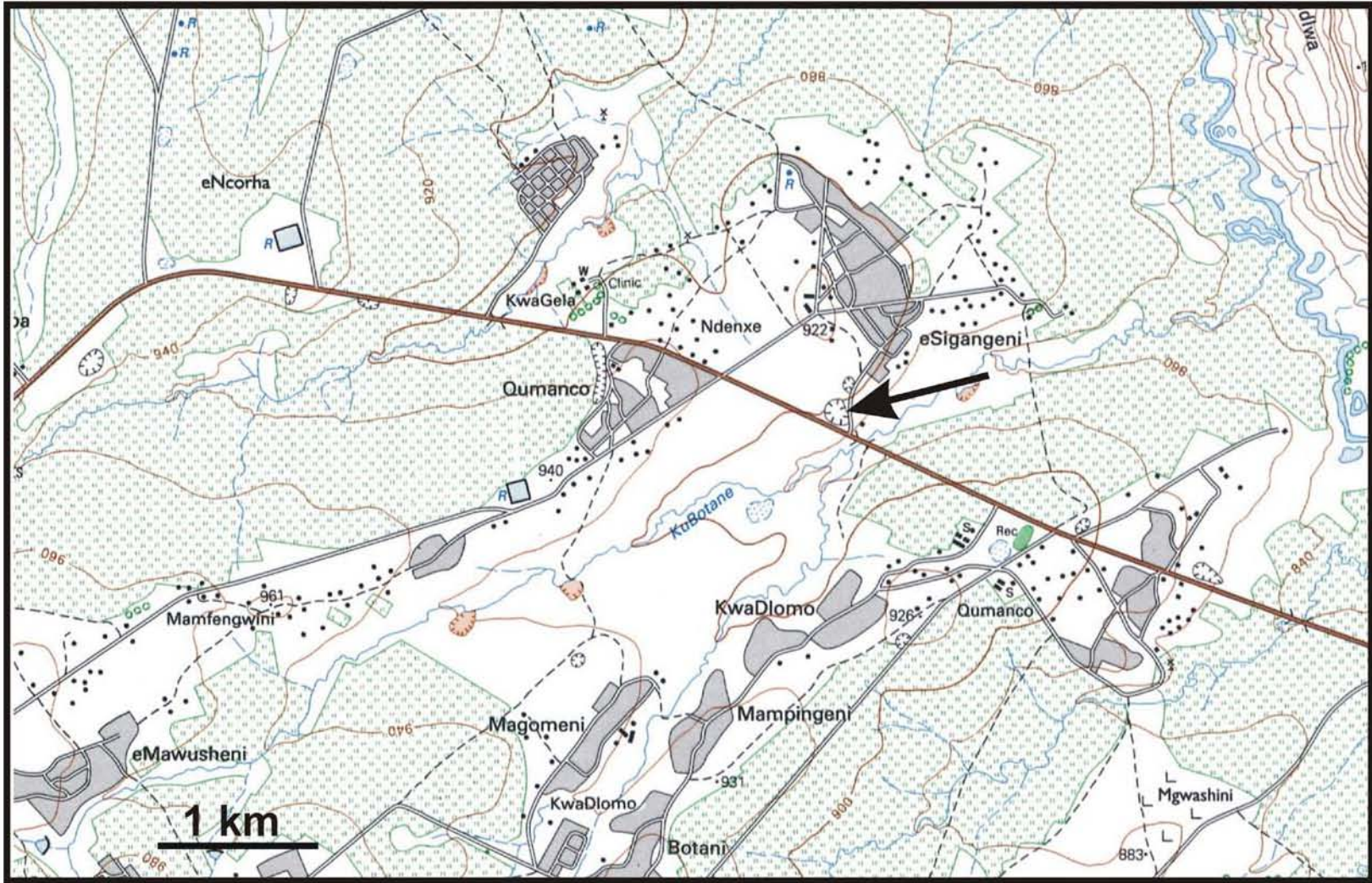
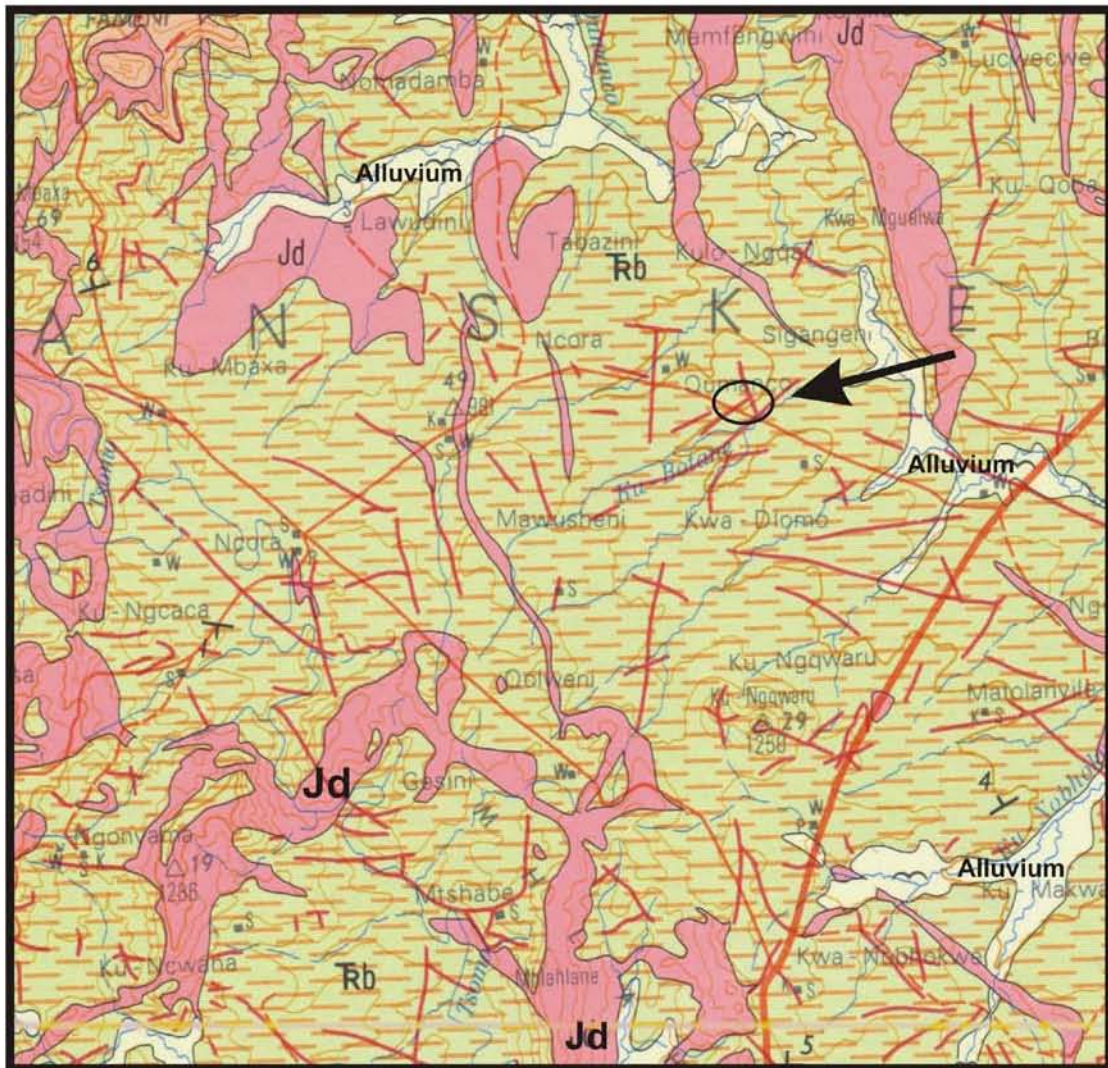


Figure 1. 1 : 50 000 scale topographic map of the study area (3127DD Nobokwe).



— Dolerite dyke ○ Borrow Pit **Rb** Burgersdorp Formation Rocks

Figure 2. Portion of the 1 :250 000 scale geological map 3126 Queenstown showing bedrock geology in the study area. From oldest to youngest, strata consist of upper Beaufort Group rocks, namely the Triassic Burgersdorp Formation (*Trb*) of the Tarkastad Subgroup, Jurassic age dolerite intrusions (*Jd*) and Quaternary river alluvial sediments.

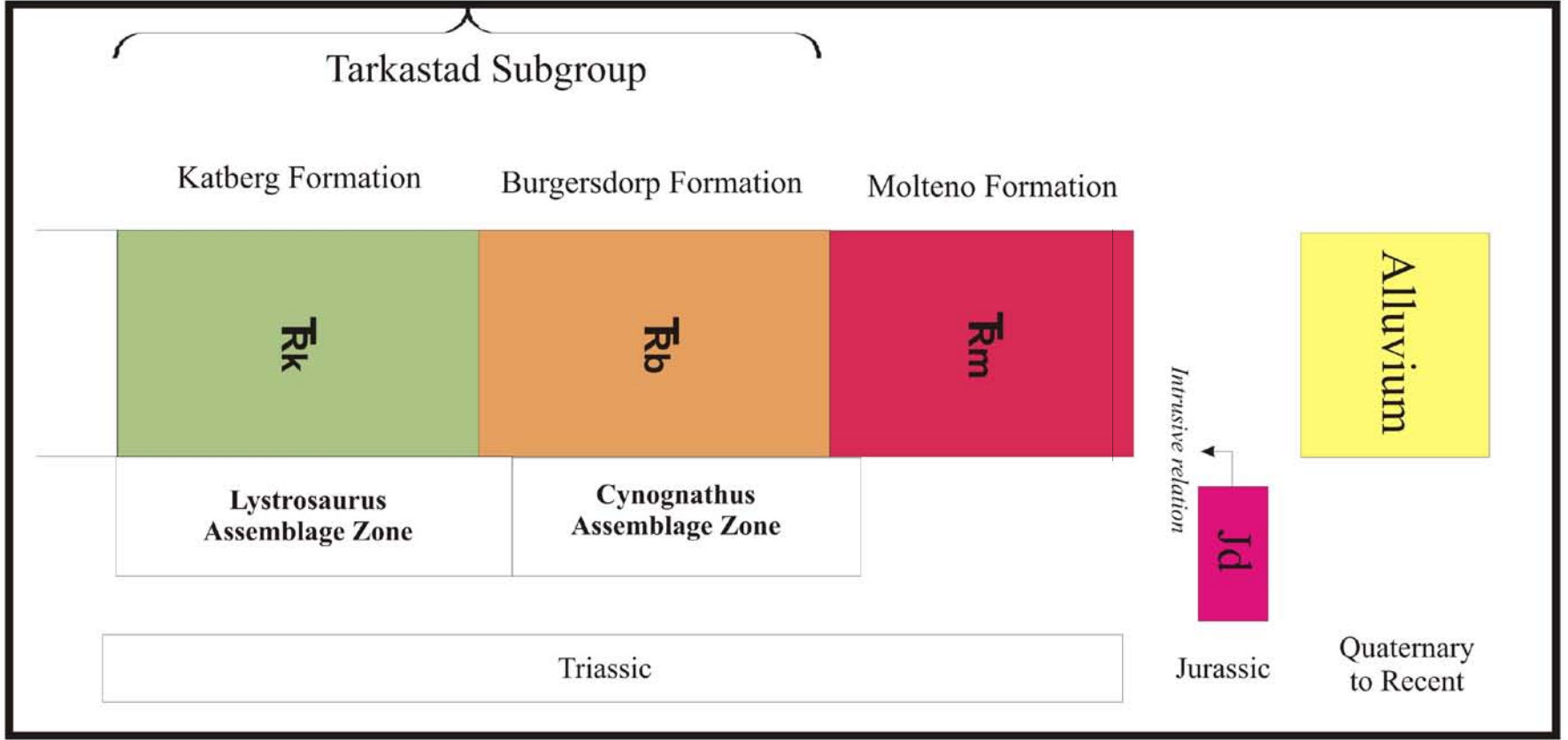


Figure 3. Stratigraphic section and schematic representation of regional geology.



— Dolerite intrusions (dykes)

Figure 4. Aerial map showing alignment of dolerite intrusions at the site.



Figure 5. Borrow pit exposures. Consolidated Burgersdorp Formation mudrock (above) and an exposed dolerite dyke (below).