

Phase 1 Paleontological Impact Assessment of a Cluster  
6 borrow pit site, 30 km northeast of Engcobo, EC  
Province.

Report prepared for CCS  
Environmental Consultants



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## **Executive Summary**

- A Phase 1 Palaeontological Impact Assessment was carried out at a borrow pit site northeast of Engcobo in the Eastern Cape.
- The site visit has indicated no evidence for potential palaeontological impact at the site.
- There is no indication for the accumulation and preservation of intact fossil material within the Quaternary sediments (topsoils) covering the underlying sedimentary rocks.
- The affected area is located near the top of the Burgersdorp Formation on igneous dolerite and related intrusive rocks.
- Dolerites are not fossiliferous and can be excluded from further consideration in the present assessment.
- There is a possibility of finding fossils in the contact metamorphic zones adjacent to the dolerite intrusions, but palaeontological impact is, on the whole, considered to be low.
- There are no major palaeontological grounds to halt development at the site.

## Introduction

At the request of Control Civil Services, a Phase 1 Palaeontological Impact Assessment was carried out at a borrow pit site northeast of Engcobo in the Eastern Cape. In terms of Section 38 of the National Heritage Resources Act 25 of 1999 the survey is required as a prerequisite for any development which will change the character of a site exceeding 5 000 m<sup>2</sup> in extent. A site visit and subsequent assessment took place in August 2012. The task involved identification of possible paleontological sites or occurrences in the proposed zone, an assessment of their significance, related impact by the proposed development and recommendations for mitigation where relevant.

## Description of the Affected Area

### Details of area surveyed

#### Locality data

1 : 50 000 scale topographic map: 3128 AC Xuka Drift

1 : 250 000 scale geological map 3128 Umtata

The site is located in a rural area 30 km northeast of Engcobo and 55 km east-northeast of Umtata (**Fig. 1**). The affected area consists of approximately 2.7 ha of high-relief terrain, which includes an existing quarry (**Fig. 2 & 3**).

The extent of the site is demarcated by the following coordinates:

NE	S31 28 16.5	E28 12 44.0
NW	S31 28 15.9	E28 12 38.2
W	S31 28 17.6	E28 12 36.4
SW	S31 28 20.7	E28 12 37.3

### Survey Method

A pedestrian survey was conducted in the affected area. A Garmin Etrex Vista GPS hand model (set to the WGS 84 map datum) and a digital camera, were used to record relevant data. Relevant palaeontological information was assimilated for the report and integrated with data acquired during the on-site inspection.

### Regional Geology

The geology of the area has been described by Karpeta and Johnson (1979), Johnson *et al.* (2006) and Partridge *et al.* (2006). The underlying geology of the region is

represented by sedimentary rocks of the Beaufort Group (Karoo Supergroup). Strata are made up of the upper argillaceous Burgersdorp Formation (*Trb*) of the Early Triassic Tarkastad Subgroup, and the Late Triassic Molteno Formation (*Trm*) (**Fig. 4**). The depositional histories of both formations indicate fluvial environments. The Burgersdorp formation is mainly represented by mudstones with subordinate, fine-grained lithic sandstones (**Fig. 5**). The overlying Molteno Formation comprises alternating medium to coarse-grained sandstones and grey mudrocks (**Fig. 6**). Fossil vertebrates are absent, but well-preserved plant and insect fossils are common silicified wood and leaves. Jurassic-age dolerite intrusions, in the form of sills and dykes, occur extensively in the area.

Valley-sediments are made up of geologically recent alluvial deposits and reworked colluviums. Unconsolidated alluvial and overbank sediments represent the bulk of the Quaternary component in the region.

### **Regional Palaeontology**

The palaeontology of the area has been described by Kitching (1977; 1995) and Kitching and Raath (1984). The Karoo geological strata around the affected area are assigned to the *Cynognathus* Assemblage Zone (AZ) which occupies the upper two thirds of the Burgersdorp Formation (**Fig. 4**). 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. The succession consists of blue-green and dark red to very dark maroon mudstones with subordinate intercalated fine- to medium-grained, lenticular sandstones (**Fig. 7**).

Fossil-bearing lenticular sandstones with calcareous concretions are common. The fossil record of the *Cynognathus* AZ 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.

There are no records of vertebrate fossils found in alluvial valley sediments in the region. A small scatter of stone tool artifacts about 2 km south of the study area (S31 29 33.5 E28 12 16.5), point to early human occupation in the region (**Fig. 8**). It is

noted that hundreds of Middle and Later Stone Age artifacts have been recorded previously from alluvial contexts around Cofimvaba and Qumbu (**Fig. 9**).

## **Results of Survey**

Results are summarized in **Table 1**. The affected area is located near the top of the Burgersdorp Formation on igneous dolerite and related intrusive rocks. Several dolerite outcrops were recorded within the affected area (**Fig. 10**). This is effectively illustrated by the existing dolerite quarry with a contact metamorphic zone, located in the southeast corner of the demarcated area (**Fig. 11**).

Investigation of exposed topsoils suggests little evidence for the accumulation and preservation of intact fossil material within the Quaternary sediments (topsoils) covering the underlying sedimentary rocks (**Fig. 12**).

## **Statement of Significance**

The site is primarily underlain by intrusive igneous dolerites. Dolerites are not fossiliferous and can be excluded from further consideration in the present assessment. There is a possibility of finding fossils in the contact metamorphic zones adjacent to the dolerite intrusions, but palaeontological impact is, on the whole, considered to be low.

## **Recommendations**

The area demarcated for development has been suitably recorded, mapped and documented in accordance with the types and ranges of heritage resources as outlined in Section 3 of the National Heritage Resources Act (No 25 of 1999).

There are no major palaeontological grounds to halt development at the site. The site can be accessed for further development.

## **References**

- Karpeta, W.P. and Johnson, M.R. 1979. The geology of the Umtata area. *Geological Survey*. Dept. of Mines.
- Johnson *et al.* 2006. Sedimentary rocks of the Karoo Supergroup. **In:** M.R. Johnson, *et. al.* (eds). *The Geology of South Africa*. Geological Society of South Africa.
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- Partridge, T.C. *et al.* 2006. Cenozoic deposits of the interior. **In:** M.R. Johnson, *et. al.* (eds). *The Geology of South Africa*. Geological Society of South Africa.

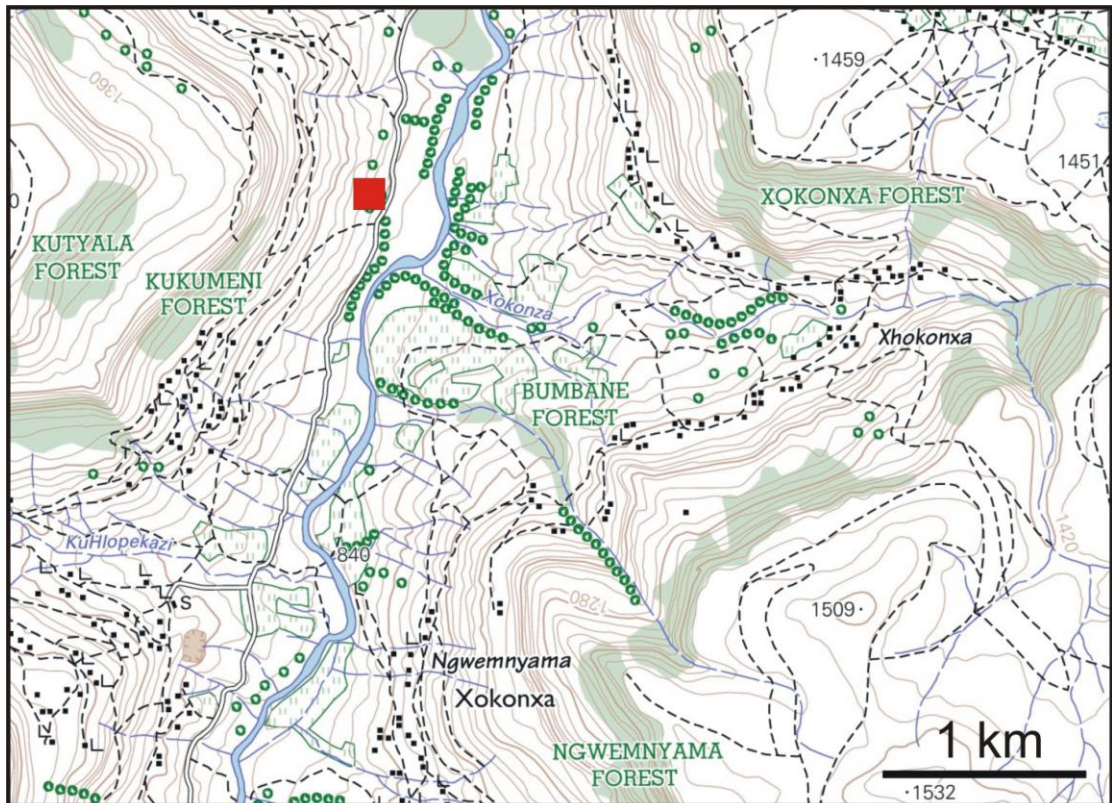


Figure 1. Portion of 1:50 000 topographic map of the study area and surroundings.



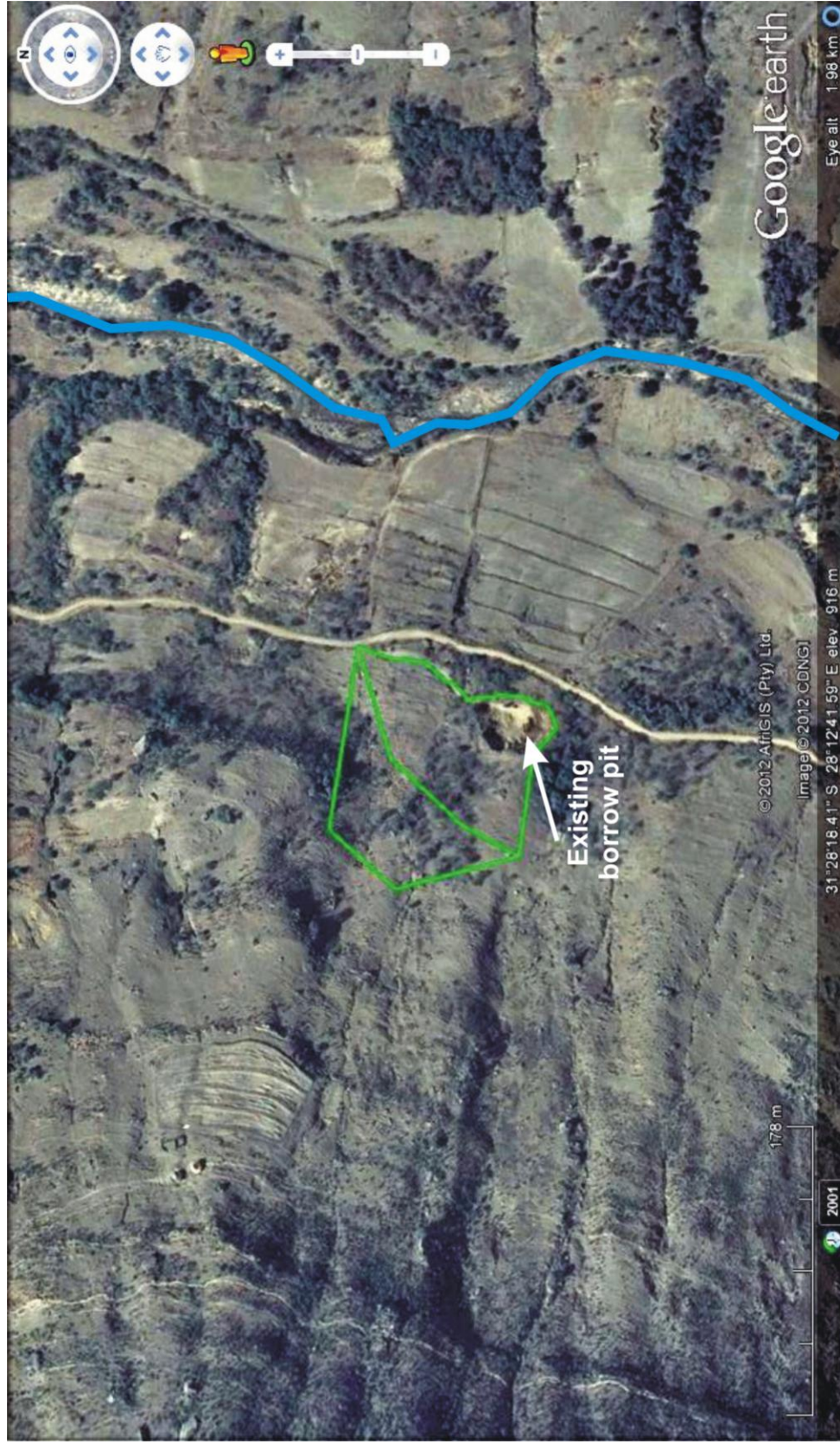


Figure 2. Aerial view of the survey area and its surroundings.



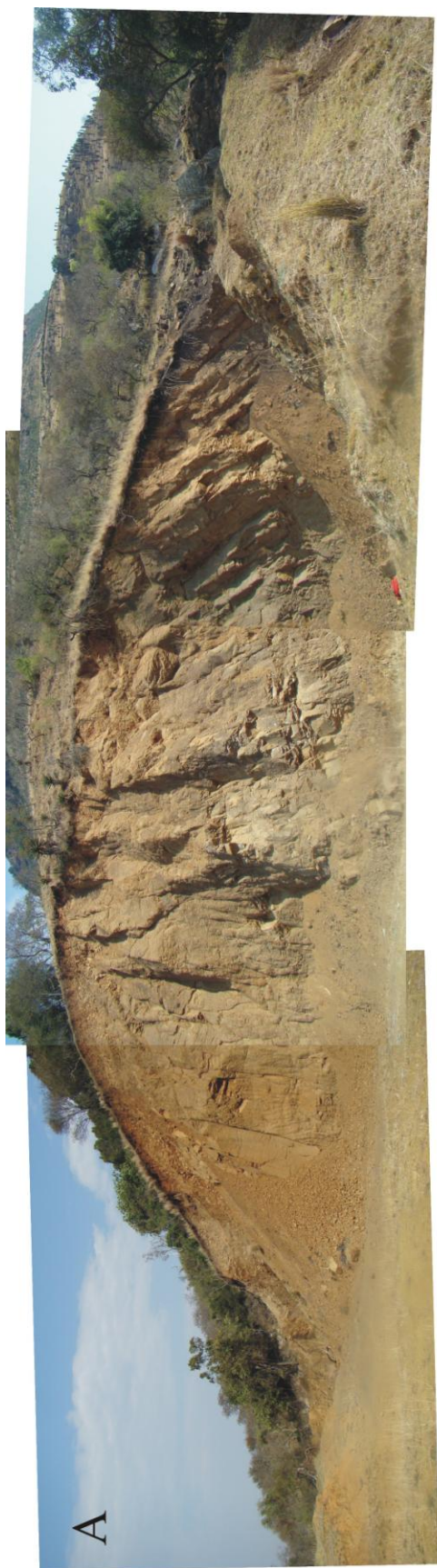


Figure 3. Existing borrow pit exposing dolerite outcrop (A) and general view of the site, looking east-southeast (B).

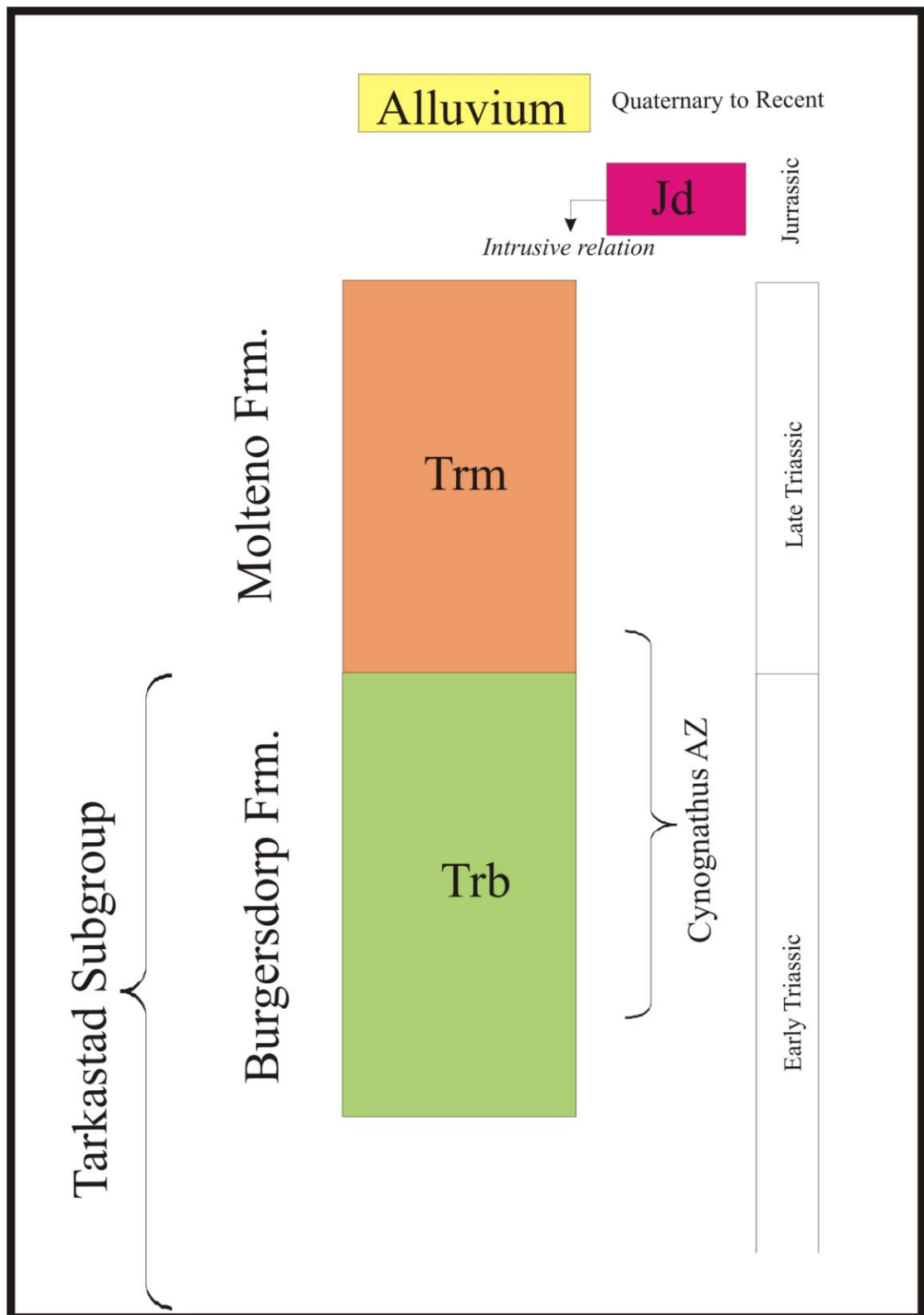


Figure 4. Schematic representation of the geology around the survey area.





Figure 5. The Burgersdorp formation is mainly represented by mudstones(1) with subordinate, fine-grained lithic sandstones (2).



Figure 6. The Molteno Formation comprises alternating medium to coarse-grained sandstones (above) and grey mudrocks.





Figure 7. The Cynognathus AZ occupies the upper two thirds of the Burgersdorp Formation. The succession consists of blue-green and dark red to very dark maroon mudstones with subordinate intercalated fine- to medium-grained, lenticular sandstones.





Figure 8. A stone tool scatter recorded about 2 km south of the study area (S31 29 33.5 E28 12 16.5).



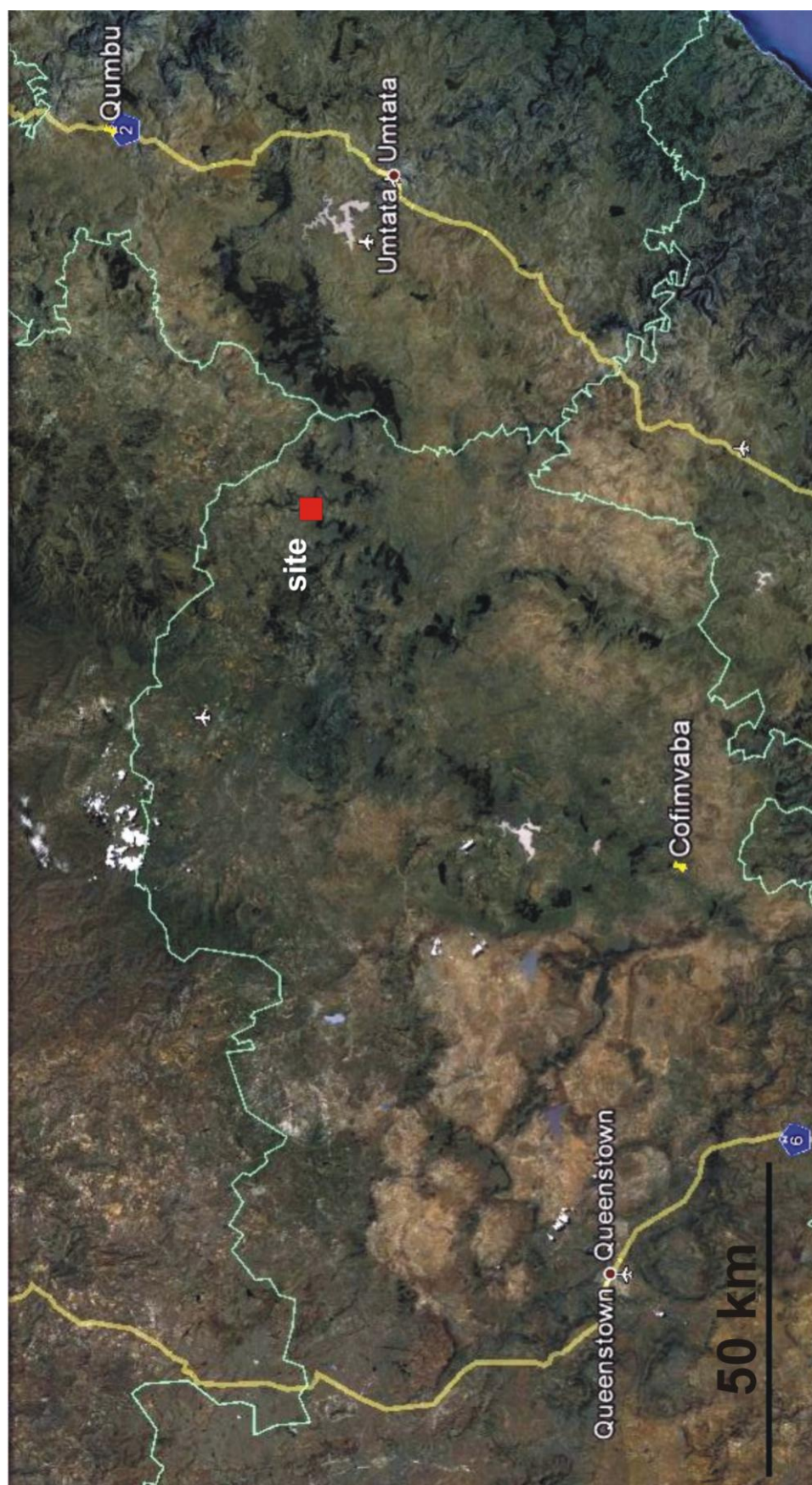


Figure 9. Aerial map showing region in general. Hundreds of Middle and Later Stone Age artifacts have been recorded previously from alluvial contexts around Cofimvaba and Qumbu.

Table 1. Impact table for operational phase of development.

Nature of impact	Status (Negative or positive)	Extent	Duration	Intensity	Probability	Reversibility	Irreplaceability	Significance (no mitigation)	Mitigation/Management Actions	Significance (with mitigation)	Confidence level
Operational Phase											
1.1 Impact of excavations on igneous dolerite	<b>Neutral</b> , no fossils	<b>Local</b> , i.e. within 1km of the site	<b>Permanent</b>	<b>Low</b> , since excavation will impact primarily on dolerite bedrock.	<b>Improbable</b>	<b>High</b> , since there should be no impact on <i>in situ</i> fossils	<b>Low</b> , since there should be no impact on <i>in situ</i> fossils	<b>Low</b> , since status of impact considered neutral	No mitigation required	<b>Low</b>	<b>High</b>
1.2. Impact of excavations on superficial (Quaternary) deposits	<b>Neutral</b> , destruction of <i>in situ</i> fossils unlikely	<b>Local</b> , i.e. within 1km of the site	<b>Permanent</b>	<b>Low</b>	<b>Improbable</b>	<b>High</b> , since there will be no impact on <i>in situ</i> fossils	<b>High</b> , fossils considered irreplaceable	<b>Low</b> , since there will be no impact on <i>in situ</i> fossils	No mitigation required	<b>Low</b>	<b>High</b>





Figure 10. Aerial view of the survey area indicating dolerite exposures (stars).





Figure 11. Different dolerite outcrops recorded at the site (S31 28 21.1 E28 12 41.7 and S31 28 17.8 E28 12 39.4)





Figure 12. Quaternary sediments (topsoils) unconformably covering the underlying sedimentary rocks.