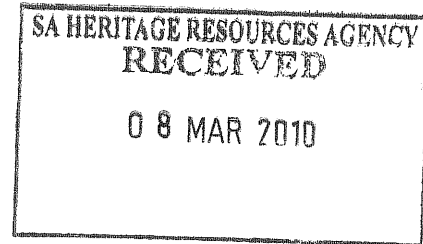


# PALAEONTOLOGICAL IMPACT ASSESSMENT: DESKTOP STUDY

## Farms 36 and 37, Theesecombe, Port Elizabeth (Eastern Cape Province)

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### 1. SUMMARY

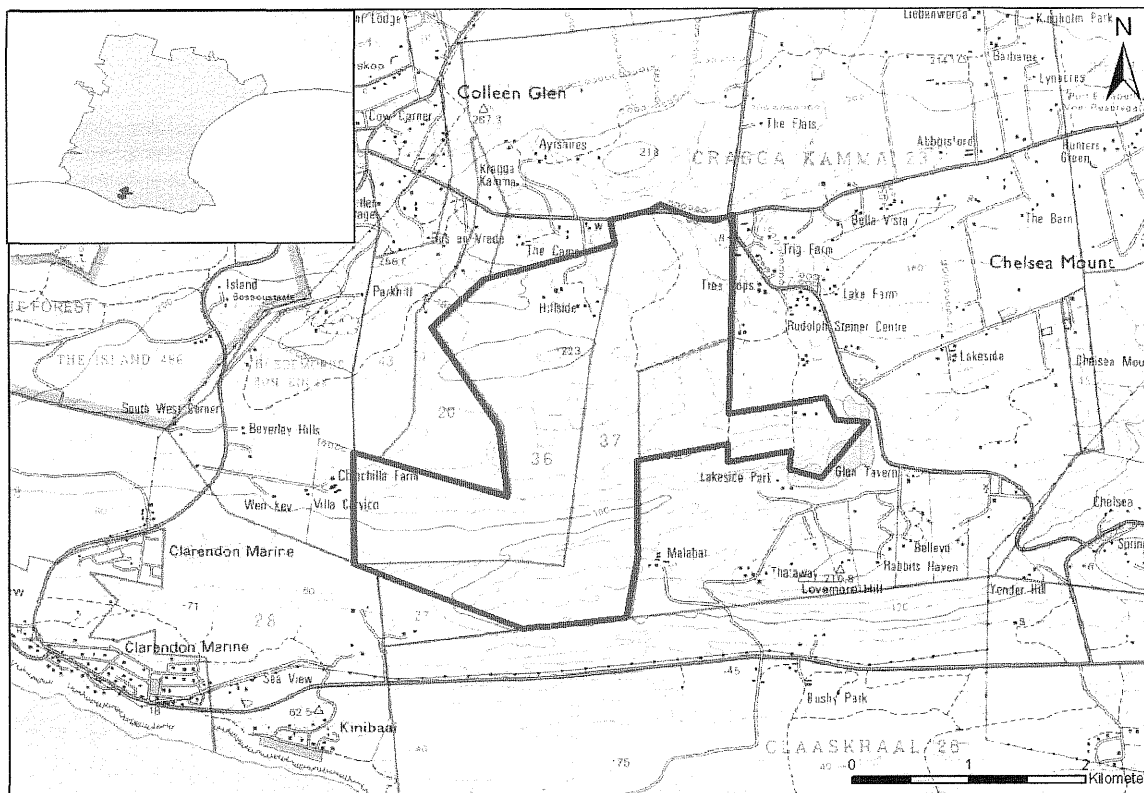
The study area at Theesecombe, some 7km west of Port Elizabeth, is largely underlain by Late Pliocene to Holocene coastal aeolianites of the Nanaga and Schelm Hoek Formations (Algoa Group) that are in general only sparsely fossiliferous. A small, linear outcrop of Ordovician quartzites of the Peninsula Formation in the northwest is likewise of low palaeontological sensitivity. There are therefore no objections to the proposed development on palaeontological grounds, and no further palaeontological mitigation is recommended. However, should substantial fossil remains be exposed during excavations, these should be recorded and safeguarded by the ECO responsible. The ECO should also notify SAHRA at the earliest opportunity so that any appropriate mitigation can be implemented, at the developer's expense.

### 2. INTRODUCTION & BRIEF

It is proposed to rezone and subdivide Farms 36 and 36, Theesecombe located south of the Kragga Kamma Road and west of Lakeside road, some 7km west of the outskirts of Port Elizabeth, Eastern Cape Province (Fig. 1). On the 746 ha property it is planned to develop two residential nodes (c. 300 units on Farm 37 and c. 100 units on Farm 36), a lodge / boutique hotel and a nature reserve. A palaeontological desktop study for the project has been requested by SAHRA in accordance with the requirements of the National Heritage Resources Act, 1999. This report was accordingly commissioned by Belinda Clark of the GEN Integrated Environmental Management Unit, Port Elizabeth.

### 3. GEOLOGICAL BACKGROUND

The geology of the study area is indicated on the 1: 250 000 sheet 3324 Port Elizabeth (Council for Geoscience, Pretoria; Toerien & Hill 1989) (Fig. 2). The greater part of this area is underlain by lime-rich coastal deposits of the **Algoa Group** (Le Roux 1990, Maud & Botha 2000, Roberts *et al.*, 2006). These range in age from Late Pliocene to Recent, corresponding to roughly the last two and a half million years or so.



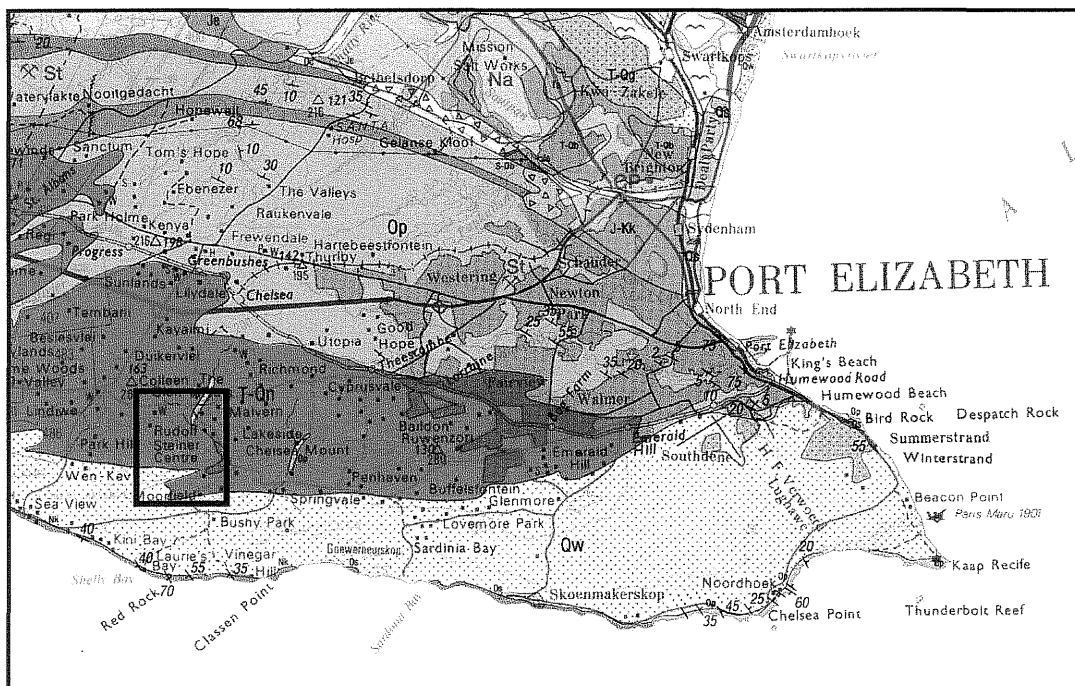
**Fig. 1. Location of study area to the west of Port Elizabeth (Extracted from BID document prepared by CEN IEM Unit, PE)**

Over almost the entire central and northern portion of the study area there are coastal aeolianites (ancient or “fossil” dune sands) of the **Nanaga Formation** (Fig 2, T-Qn) of Pliocene to Early Pleistocene age that crop out extensively to the west of Port Elizabeth (Le Roux 1992). The sediments here comprise large-scale cross-bedded, calcareous sandstones and sandy limestones that may reach thicknesses of 150m or more (Maud & Botha 2000). These beds are partially to well-consolidated, although unconsolidated sands also occur west of Port Elizabeth (Le Roux 2000). The upper surface of the aeolianites weathers to calcrete and red, clay-rich soil. The age of the palaeodunes decreases towards the modern coastline, reflecting marine regression (relative sea level fall) during the period of deposition. The more highly elevated, inland outcrops may even be Miocene in age (Roberts *et al.*, 2006). Typically the ancient dunes are preserved as undulating ridges of rounded hills trending parallel to the modern shoreline (Le Roux 1992). The Nanaga outcrop is largely covered by indigenous forest in the southern part of the study area.

A small area in the southwestern corner and perhaps along the southern edge of the study area is mapped as modern aeolian sands of the **Schelm Hoek Formation** (Algoa Group; Q-w in Fig. 2; see also Le Roux 1990, fig. 1, Le Roux 2000, Illenberger 1992). These still active dune sands are of Holocene age (last 6500 years; Illenberger 1992), are up to 100m thick with an average of 30m, and extend up to 6km from the coast. In addition to unconsolidated, well-sorted, calcareous aeolian sands the Schelm Hoek Formation contains abundant shell middens of the Late Stone Age (Roberts *et al.*, 2006). Palaeosols

(ancient soil horizons) and peats are absent according to Le Roux (2000, Table 3) whereas Illenberger (1992) records the presence of fossil soils.

A thin NE-SSW-trending strip of the **Peninsula Formation** (Table Mountain Group, Cape Supergroup) is indicated as extending into the NE corner of the study area on the 1: 250 000 geological map (pale blue **Op** in Fig. 2). The Peninsula Formation is a predominantly fluvial succession of Mid to Late Ordovician age with minor shallow marine to estuarine intercalations ((Broquet 1992, Hiller 1992, Thamm & Johnson 2006). These sedimentary rocks are resistant-weathering sandstones and quartzites that might be expected to form a prominent ridge at outcrop, emerging above the more recessive-weathering Nanaga aeolianites. However, there is no sign of any such ridge on satellite images of the area (BID document, Fig. 2) and the geological map may be inaccurate.



**Fig. 2. Geological map of the study area west of Port Elizabeth – outlined in black box (Abstracted from the 1: 250 000 sheet 3324 Port Elizabeth, Council for Geoscience, Pretoria). T-Qn (orange-brown) = Nanaga Formation Qw (pale yellow) = Aeolian sand Op (pale blue) = Peninsula Formation**

#### **4. PALAEOLOGICAL HERITAGE**

The sparse palaeontological record of the Pliocene to Early Pleistocene **Nanaga Formation** is summarised by Le Roux (1992). The fossil biota consists of fragmentary marine shells, foraminifera (shelled protozoans *cf* McMillan 1990), and a small range of terrestrial snails (*eg Achatina, Tropidophora, Trigonephrus, Natalina*). Presumably, a wide range of fossils such as occur in younger dune sands (see below) might also occur here, albeit only rarely.

The modern coastal aeolianites of the **Schelm Hoek Formation** are generally unfossiliferous to sparsely fossiliferous. However, local concentrations of a wide range of

Holocene palaeontological material may occasionally be found here (Engelbrecht *et al.*, 1962, Illenberger 1992, Le Roux 2000, Roberts 2006. See also useful summary by Pether 2008, appended with this report). These include, for example, mammal bones and teeth (*eg* in hyaena dens, burrows), tortoise remains, ostrich egg shell, terrestrial snails (*eg* the dune snails *Achatina*, *Trigonephrus*), comminuted shell debris (molluscs, echinoid spines, calcareous algae), plant remains (charcoal, rootlets, peats), trace fossils (*eg* burrows, mammalian footprints, Stone Age tools), and various groups of microfossils (foraminiferans, pollens, spores). Vertebrate fossils are rare; elephant tusks have been recorded from dunes to the west of Port Elizabeth (Le Roux 2000). In anthropogenic shell middens mollusc taxa such as the edible white mussel *Donax* predominate. The southern part of the study area is mantled in forest and will not be disturbed by development.

The palaeontological sensitivity of the **Peninsula Formation** as a whole is considered to be low (Almond 2008b). Age-diagnostic organic-walled microfossils (*eg* acritarchs) are likely to occur in finer mudrocks within the marine-influenced, heterolithic parts of the succession, but these fossils have yet to be successfully isolated. Body fossils are unknown from this formation, although impressions of rounded mudflakes have occasionally been misinterpreted as moulds of shells. So far only a modest range of trace fossils have been recorded from the Peninsula Formation, mostly in association with heterolithic subunits that are attributed to shallow marine or estuarine settings. They include Ordovician forms of the trilobite burrow *Cruziana* (*Rugosa* Group) recorded, for example, from Bettys Bay (Potgieter & Oelofsen 1983), arthropod trackways attributed to trilobites and water scorpions (eurypterids), complex annulated “worm burrows” of the ichnogenus *Arthropycus*, a small range of horizontal burrows (*Palaeophycus* *etc*), *Skolithos*-dominated “pipe rock”, and the large (up to 25cm wide) cylindrical burrow *Metaichna* (See reviews in Rust 1967, Almond 2008a).

## 5. CONCLUSIONS & RECOMMENDATIONS

The study area is entirely underlain by sedimentary rocks that are all of low to very low palaeontological sensitivity (Almond 2008b). There are therefore no objections to the proposed development on palaeontological grounds, and no further palaeontological mitigation is recommended. However, should substantial fossil remains be exposed during excavations, these should be recorded and safeguarded by the ECO responsible. The ECO should also notify SAHRA at the earliest opportunity so that any appropriate mitigation can be implemented, at the developer’s expense.

## 6. ACKNOWLEDGEMENTS

Ms Belinda Clark and Dr Mike Cohen of the CEN Integrated Environmental Management Unit, Port Elizabeth are thanked for commissioning this study and for kindly providing the necessary background information.

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## **QUALIFICATIONS & EXPERIENCE OF THE AUTHOR**

Dr John Almond has an Honours Degree in Natural Sciences (Zoology) as well as a PhD in Palaeontology from the University of Cambridge, UK. He has been awarded post-doctoral research fellowships at Cambridge University and in Germany, and has carried out palaeontological research in Europe, North America, the Middle East as well as North and South Africa. For eight years he was a scientific officer (palaeontologist) for the Geological Survey / Council for Geoscience in the RSA. His current palaeontological research focuses on fossil record of the Precambrian - Cambrian boundary and the Cape Supergroup of South Africa. He has recently written palaeontological reviews for several 1: 250 000 geological maps published by the Council for Geoscience and has contributed educational material on fossils and evolution for new school textbooks in the RSA.

Since 2002 Dr Almond has also carried out palaeontological impact assessments for developments and conservation areas in the Western, Eastern and Northern Cape under the aegis of his Cape Town-based company *Natura Viva* cc. He is a long-standing member of the Archaeology, Palaeontology and Meteorites Committee for Heritage Western Cape (HWC) and an advisor on palaeontological conservation and management issues for the Palaeontological Society of South Africa (PSSA), HWC and SAHRA. He is currently compiling technical reports on the provincial palaeontological heritage of Western, Northern and Eastern Cape for SAHRA and HWC. Dr Almond is an accredited member of PSSA and APHAP (Association of Professional Heritage Assessment Practitioners – Western Cape).