A PALAEONTOLOGICAL DESKTOP STUDY OF THE AREA PROPOSED TO BE DEVELOPED - PART 78 OF THE FARM ONGEGUNDE VRYHEID 746 (ROCKY COAST FARM), CAPE ST FRANCIS

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INTRODUCTION

Following the Phase 1 Archaeological Impact Assessment (AIA) report by Dr. Johan Binneman, which forms part of the EIA process, SAHRA recommended a desktop palaeontological assessment of the area proposed to be developed by Rocky Coast Farm (Pty) Ltd, as given in the document PEL07/593/15. The present study was then commissioned by HilLand Associates, the company appointed as Environmental Assessment Practitioners (EAP) by Rocky Coast Farm (Pty) Ltd. The Phase 1 AIA of Dr Binneman is referred to as background. It should be noted that the present report refers only to Alternative 1 (the preferred alternative). However, all comments and discussion in this report can be applied equally to Alternative 2, given that the latter proposal is spatially more extensive and in the same part of the property.

The aim of this study was to gather and order the relevant published and unpublished information pertaining to the geological and palaeontological record of the study area. This would allow an impression of the likelihood that palaeontological materials are preserved in the study area and how the proposed development may affect such deposits and materials. Recommendations are based on this assessment.

A study of Late Pleistocene palaeontological deposits near the coastal town of Oyster Bay, about 10km from the area of proposed development, serves as an important point of reference (Carrion *et al*. 2000).

GEOLOGICAL & PALAEONTOLOGICAL BACKGROUND

Geology

The oldest deposits of the study area are exposed as a rocky coastline, which provided the farm name of the present study area, and consists of sedimentary rocks of the Cape Supergroup (Fig. 1, arrow no. 1; Maud & Botha 2000; see also Fig. 7 in AIA). These rocks are seldom fossiliferous and can be excluded for practical purposes from further consideration in the present study. However, they form the base on which younger deposits, of mid-Cainozoic age and younger, have been deposited (Maud & Botha 2000). These younger deposits can be fossil-bearing.

The Cainozoic deposits of the coastal rim of southern Africa have been classified according to the various regions where they are exposed, which are separated by areas where such deposits are less well developed or not visible. Along the southern coast in the area to the east of Cape Town Cainozoic deposits are

included in the Bredasdorp Group, around Knysna they are included in the Knysna Formation and Wilderness Dune Cordons and towards Port Elizabeth they are included in the Algoa Group. Although these deposits are grouped into geographically separate lithostratigraphic entities, they appear to have accumulated synchronously in the various regions. Thus, it is reasonable to apply information pertaining to one of the areas to another, including the present study area (Illenberger 1996; Maud & Botha 2000; Bateman *et al.* 2004; Marker & Holmes 2005).

In the Knysna area the oldest Cainozoic deposits are the Knysna Formation and date to the Eocene (Marker & Holmes 2005). These earlier Cainozoic deposits are not known to produce vertebrate fossils.

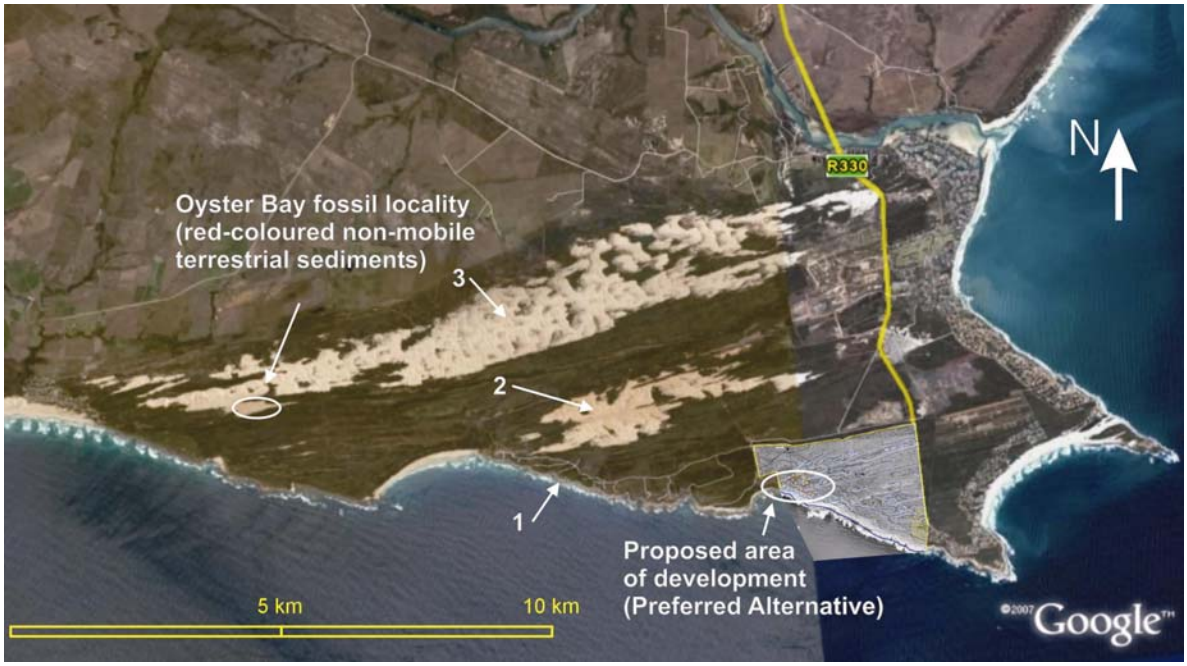


Figure 1. A satellite photograph of the Cape St. Francis headland, showing the area of proposed development ('Preferred alternative'), (1) the rocky coastline (Cape Supergroup), (2) red-coloured non-mobile dunes (?early Last Glacial deposits), (3) white mobile sands (modern/Holocene) and the Oyster Bay fossil locality.

During the early Pliocene a major tectonic uplift event in southern Africa, which exceeded 400 m to the east of the study area, caused major incision along the rivers entering the Indian Ocean (Partridge & Maud 2000). Thus, there is almost no sedimetary evidence in the southern Cape from this time period. In the Bredasdorp area the Wankoe Formation is of late Pliocene age (Maud & Botha 2000), but it is only later, during Early and Middle Pleistocene, that the record improves. During the Pleistocene, a time postdating c. 2.6 million years, sedimentary deposition along the southern Cape coast was largely controlled by eustatic sea level fluctuations associated with glacial-interglacial cycles. Thus, wind deposition resulted in a sequence of aeolianites (dune rock) that span the

last million years, or slightly more (Maud & Botha 2000). These aeolianites seemed to have formed just after high sea stands (interglacials/interstadials), when the sea level was dropping, but not yet distant (Bateman *et al.* 2004). The ages of aeolianites in the Agulhas and Wilderness areas have been dated to >200 000, 160 – 188 000, 104 – 128 000, 88 – 90 000 and 68 – 80 000 years ago (Bateman *et al.* 2004). During the Last Glacial the continental shelf adjacent to the study area, which is in the eastern portion of the Agulhas Bank, would have been exposed as dry land due to lowered sea level. It is estimated that the coastline would have been displaced about 80 km to the south of Cape Agulhas at the maximum of the Last Glacial at c. 20 000 years ago (Maud & Botha 2000). During times of lowered sea level, the area around the present study area would have had a terrestrial character and not a coastal one, as today. Thus, changes in sea level are crucial for understanding fossil deposits in coastal areas and the past environments that they represent.

The Oyster Bay fossil site is situated about 10 km from the present study area (Fig. 1). It consists of a fossil-bearing red terrestrial sand deposit that contains cultural material referred to the Howiesons Poort sub-stage of the Middle Stone Age. This gives the deposit an approximate age of around 60 - 70 000 years ago (Wurz 2002). - This time is associated with the initiation of the Last Glacial period and witnessed a drop in sea levels, which explains the terrestrial character of the Oyster Bay red sands (see below). - The red terrestrial sand deposit at Oyster Bay overly an older aeolianite, which is exposed as high-lying ridges. According to the geological ages of similar aeolianites, as mentioned above, the Oyster Bay aeolianites may reflect interstadials of the Last Interglacial, when sea levels were relatively high, but receding (*vide* Bateman *et al.* 2004), or possibly earlier interglacials and interstadials. It is noteworthy that in the area between the proposed site for development and the Oyster Bay fossil site, there is another red-coloured exposure visible on the satellite photograph (Fig. 1, arrow no. 2). It is likely that similar terrestrial deposits to those of the Oyster Bay fossil site, are preserved here.

Modern mobile sands cover the whole area and form a bypass dunefield across the Cape st. Francis headland (Fig. 1, arrow no. 3; Burkinshaw *et al.* 2000). The Oyster Bay-Cape St. Francis headland bypass dunefield is the best remaining example of such a dune system, but since the 1960's it has suffered due to poorly planned developments in the Cape St. Francis area (La Cock & Burkinshaw 1996).

Palaeontology

The last million years of large mammal evolution witnessed the appearance of modern faunas. This time can be divided in to three successive evolutionary stages, the Cornelian, Florisian and the modern (Fig. 2; Hendey 1974; Brink 2005). Ancestors of modern forms appear either as immigrants from further north in Africa or evolve *in loco*. Examples of the former are the hartebeest (*Alcelaphus buselaphus*), which appears in the fossil record younger than 0.6

million years ago and various local forms of the plains zebra (including the Cape quagga) (*Equus burchelii* & *E. quagga*). Black wildebeest (*Connochaetes gnou*) is the prime example of a locally evolved form (Brink 1993; 2005).

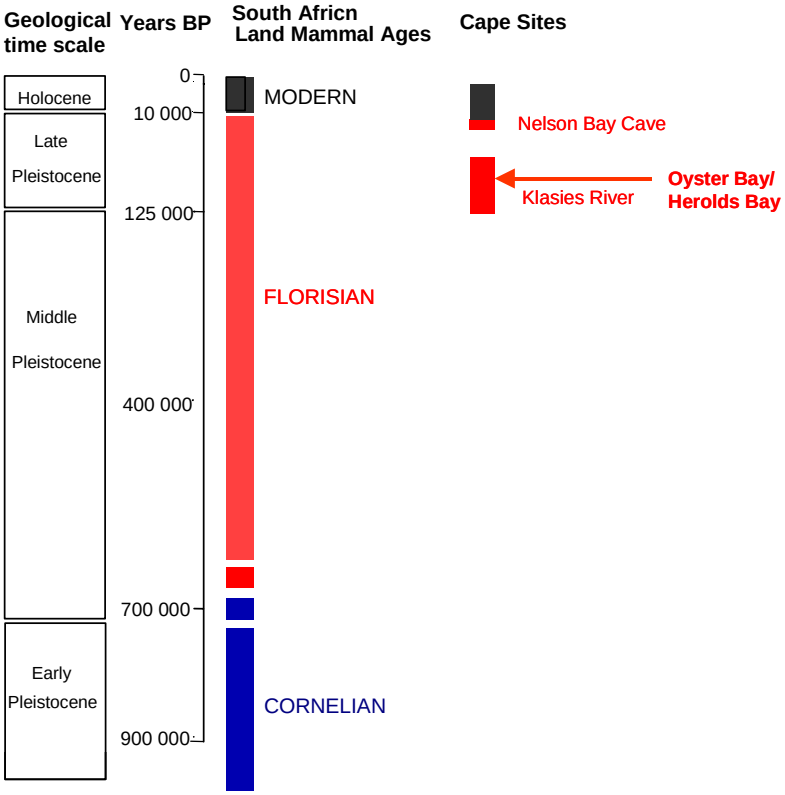
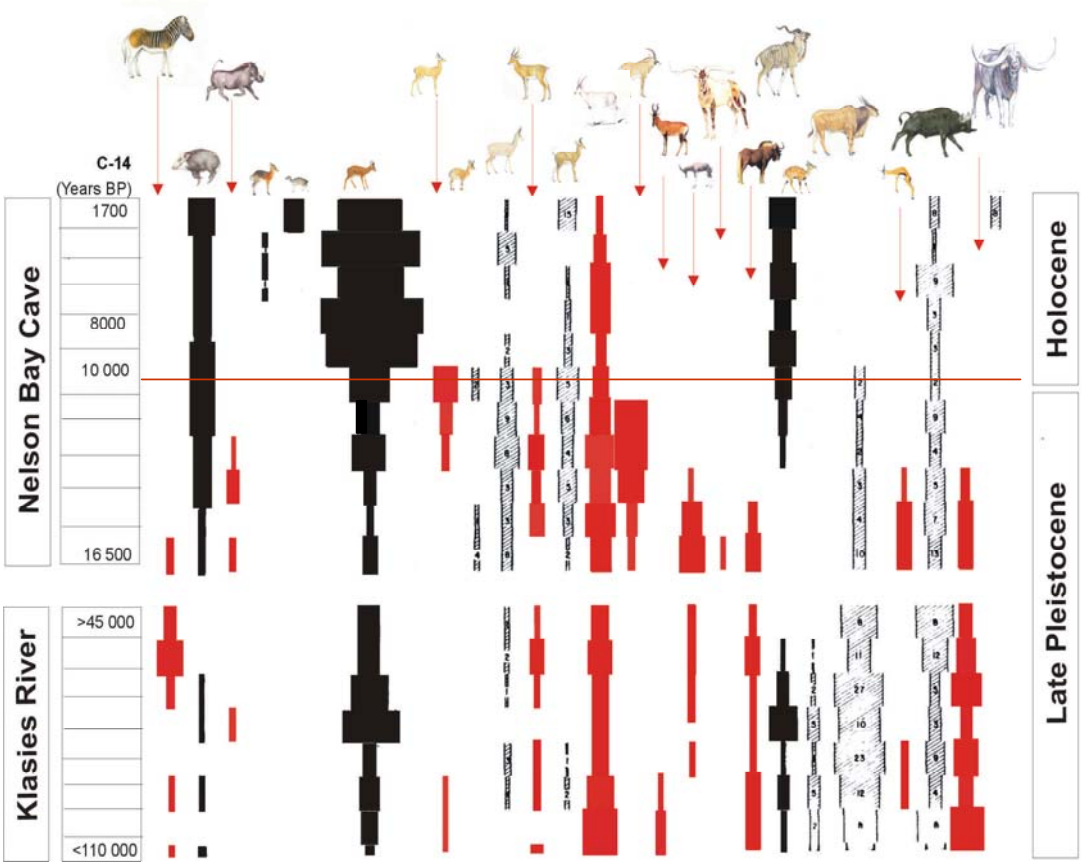


Figure 2. The succession of south African Land Mammal Ages over the last million years, in relation to the geological time scale. The approximate temporal positions of the vertebrate faunas form the Klasies River Main site, Nelson Bay Cave, Herolds Bay and Oyster Bay are given (modified after Brink 2005).

The fossil record of the southern and eastern Cape reflects the geological history of the area and in particular the fluctuations of the sea level associated with the glacial-Interglacial cycles. During glacials the interior of southern Africa acted as a source area for dispersals of grazing ungulates into the Cape coastal zone, where the exposure of the continental platform (Agulhas Bank) offered additional habitat for plains game (Brink 2005). This allowed some regional differentiation in coastal populations and fluctuations in faunal composition that are well illustrated by the faunal record of Klasies River and of Nelson Bay Cave (Klein 1983). This composite sequence (Fig. 3) gives an impression of the palaeo-environmental response to sea level fluctuations. The base of the Klasies River sequence records interglacial conditions, reflecting a more closed habitat, reminiscent of the modern environments, but with the addition of the Florisian extinct species. With the onset of the Last Glacial there is a faunal shift that reflects more inland

conditions, as the sea level drops. This phase is terminated at the end of the Pleistocene, when the sea level is restored to its present-day level, approximately at 12 – 10 000 years ago. In this time four grazing ungulates became extinct in the Cape ecozone – a giant buffalo (*Syncerus antiquus*), a giant wildebeest (*Megalotragus priscus*), large form of plains zebra (*Equus capensis*) and a hartebeest-like antelope (*Damaliscus niro*). This marks the beginning of the Holocene and of essentially modern conditions and faunas (Fig. 3).

The Holocene faunas are characterised by closed-habitat forms, such as the Cape Grysbok (*Raphicerus melanotis*), common duiker (*Sylvicapra grimmia*), bushbuck (*Tragelaphus scriptus*) and bushpig (*Potamochoerus larvatus*)



Modified after Klein (1983)

Figure 3. A composite faunal frequency list, indicated by Minimum Number of Individuals, of the Klasies River Main Site and Nelson Bay Cave, spanning the Last Interglacial, the Last Glacial and the Holocene (the present interglacial). This diagram shows the shift from coastal Fynbos (during the Last Interglacial, with Florisian extinct forms) to terrestrial (during the Last Glacial) and back to coastal (in the Holocene without the Florisian extinct forms) in the palaeo-environment, as it would have been in the vicinity of the area of proposed development.

The Oyster Bay fossil fauna reflects early Last Glacial conditions in the vicinity of the present study area (Fig. 1; Table 1; Carrion *et al.* 2000). The fauna is remarkably diverse and indicative of an ecotone environment that is mainly terrestrial in character, with a minor marine component as seen in the limited presence of the Cape fur seal (*Arctocephalus pusillus*). Three ecological categories can be identified; open grassland habitat, (*E. burchellii/quagga*, *Syncerus antiquus*, *C.gnou*, *A. buselaphus*, *D. pygargus*), closed habitat (*Potamochoerus larvatus*, *Tragelaphus strepsiceros*, *T. scriptus*, *Raphicerus melanotis*) and the presence of large water bodies in the proximity of the site (*Hippopotamus amphibius*, *Redunca arundinum*).

The association of typical grassland species with indicators of closed habitat compares well with other Cape sites of end-Last Interglacial/early Last Glacial deposits, such as Klasies River and Herolds Bay Cave (Brink & Deacon 1982; Klein 1983). The overall environmental picture differs markedly from the modern-day, being more terrestrial and reflecting a receded coastline due to a lowered sea level.

TABLE 1. A CHECKLIST OF TAXA PRESENT IN THE OYSTER BAY ASSEMBLAGE

Rodentia

Bathyergus suillus (dune molerat)

Carnivora

Arctocephalus pusillus (Cape fur seal)
cf. *Hyaena brunnea* (brown hyaena)

Perissodactyla

Equus burchellii/quagga (plains zebra)

Artiodactyla

Potamochoerus porcus (bushpig)
Hippopotamus amphibius (hippopotamus)
Taurotragus oryx (eland)
Tragelaphus strepsiceros (kudu)
T. scriptus (bushbuck)
Syncerus antiquus (extinct giant buffalo)
S. caffer (Cape buffalo)
Redunca arundinum (reedbuck)
Hippoptragus leucophaeus (blue antelope)
Connochaetes gnou (black wildebeest)
Alcelaphus buselaphus (hartebeest)
Damaliscus pygargus (bontebok)
Raphicerus melanotis (grysbok)
Antidorcas sp (springbok)

It appears that the Oyster Bay faunal remains are largely the product of human subsistence activities, in spite of some carnivore interference with the original death assemblage, as is evident in the presence of numerous hyaena coprolites and occasional hyaena tooth impressions on specimens. Numerous Middle Stone Age stone implements are found in apparent association with the fossil bone remains, while there is often hammer stone damage on bones. In addition the limited presence of terrestrial carnivores in the faunal assemblage support the case for humans as the main primary sampling agents.

The Oyster Bay fossil assemblage compares well with other early Last Glacial assemblages, such as Herolds Bay and the Howiesons Poort levels of Klasies River. It probably reflects a restricted period of time at the end of the Last Interglacial or early Last Glacial. The presence of Howiesons Poort stone artefacts in the Oyster Bay terrestrial sediments supports this age estimate.

DISCUSSION

The likelihood of fossil material in the proposed area of development

The following indicators should be taken into account when assessing the likelihood of finding Pleistocene fossil-bearing deposits in the area proposed for development (see document PEL07/593/15):

- the proximity of the Oyster Bay fossil site
- the presence near the proposed area of development of a red sand patch, presumably of terrestrial origin indicative of lowered sea levels and consequently of a Last Glacial age (*sensu lato*) (Fig. 1).
- the Phase 1 AIA suggests that there is abundant archaeological remains, most of which are covered by the sands of the modern (Holocene) headland bypass dune system, which has now become vegetated in part and largely stabilized in the area of proposed development (Alternative 1). In spite of this the Phase 1 AIA reports the presence of a bone fragment in the vicinity of a ‘calcrete ridge’.

Given the above, it is very likely there are buried fossil-bearing deposits in the area of proposed development. Furthermore, one may predict that such deposits will vary in geological age from the Middle Pleistocene to the Holocene, with the older deposits more deeply buried and more consolidated by carbonates. It can also be predicted that there will be some spatial variability in the occurrence of Pleistocene and Holocene deposits and that the area earmarked for development (the Preferred alternative), *i.e.* the vegetated sandy dune area, may in fact contain a good record of the local stratigraphic sequence and that the vegetated sands may overly terrestrial red sands of Glacial age. If this is the case, such terrestrial red sands, as at the Oyster Bay fossil site, are likely to be unconsolidated and particularly vulnerable to disturbance.

RECOMMENDATIONS

If the proposed development is to proceed, it will be necessary to limit the damage to potentially existing fossil deposits by limiting disturbance. Therefore, all future construction work in the area proposed for development will have to be monitored by a site monitor, who will have to be a trained person and who will have be appointed by the developer. If any palaeontological materials are exposed during construction, all work in that area is to be stopped and SAHRA is to be informed. The developer must allow time for the recovery and recording of the fossil materials by a professional. The developer will have to cover the costs of such recoveries.

It is noted in the proposal document that excavations for electrical cabling is planned. It is here suggested that solar panels as a source of electricity should be investigated, as it would limit disturbance of the substrate.

The option of wireless telecommunication connections should be investigated, instead of digging trenches for cabling.

In the proposal document it is mentioned that prospective homeowners will have to construct ‘sewage conservancy tanks’ for their houses in the proposed area of development. The excavations necessary for such tanks will impact on the substrate and the planners will need to devise ways to limit this kind of impact.

The excavations of foundations for the envisaged homes will also impact on the substrate. In order to limit disturbance of the substrate the use of columns, instead of conventional foundations, should be considered.

Invasive gardening, *i.e.* any kind of excavation or landscaping, must not be allowed.

No water reservoirs are to be stored below ground (*contra* document PEL07/593/15).

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