Palaeontological Assessment Erf 1897, Blue Downs (3418BA Mitchell's Plain & 3318DC Bellville)

Graham Avery
Iziko South African Museum

September, 2011

Contents

Executive Summary

Dr G Avery, Archaeozoologist, Iziko South African Museum was commissioned by Nicolas Baumann on behalf of Doug Jeffrey Environmental Consultants, to conduct a desktop survey of the palaeontological potential on Erf 1897 Blue Downs where the City of Cape Town proposes to develop 42.3ha for residential, business, institutional, transport and open spaces.

Applicant:	City of Cape Town
Proposed activity:	New housing
Location:	Blue Downs, Western Cape

A review of potential sources indicates that no palaeontological material is known from the surface of Erf 1897. This is confirmed in the heritage Impact Assessment, which found "No outcrops or exposures of calcrete or any other rock which might contain fossiliferous material". However, it is clear from the literature that sediments underlying the surface may contain fossils of Pleistocene and even Late Miocene age.

The area is of interest geologically and palaeontologically. Underlying sediments are obscured by loose white Witzand Formation cover sands. Details of the underlying sediments are derived from boreholes and observations of exposures. They cover deposition through the Miocene, Pliocene Pleistocene and Holocene periods. Over time the area has been subjected to fluctuating lower and higher sea levels ranging between -130 m and +100 m (indicating that there were times when the Cape Flats would have been submerged and the Cape Peninsula islands). During periods of lower sea level sand on newly-exposed areas was blown inland, forming and adding to dune plumes which extended kilometers inland. Riverine and wetland facies developed on these land surfaces, creating a stack of past climatic and environmental events. During periods of inundation during the Miocene and Pliocene marine facies developed.

Terrestrial fossils have been recovered from Swartklip (Middle Pleistocene) and from sand mines near Macassar (Late Pleistocene). Wetlands have the potential to yield microfossils and pollens. Marine facies include molluscs and microfossils.

Observations are made regarding the occurrence of sub-surface archaeological material.

The occurrence of sub-fossils (<10,000 ka-thousand year old) in Witzand Formation cover sands is unlikely. However, any excavation for foundations and/or infrastructure that penetrates into underlying older Pleistocene sediments may encounter fossils and will require on-site monitoring by an appropriately qualified person. In this context it is recommended that the developer consider establishing the extent to which such penetration may take place (or not) before construction.

Provided that the recommendations of this assessment are complied with, there is no palaeontological reason why the proposed development should not proceed.

Since fossils of this age are rarely found and are known to occur sparsely within the sediments, it is important for any subsurface excavation to be carefully monitored so that information and/material can be recorded appropriately. Collaboration between the contractor and a suitably-qualified palaeontologist/archaeozoologist will be required during excavations for foundations and infrastructure. Access to a geologist familiar with the Cenozoic sediments of the area may also be necessary from time to time.

Location of Erf 1897

The survey area falls on 1:50 000 topographical maps 3418 BA Mitchell's Plain and 3318 DC Bellville (Figures 1, 2).

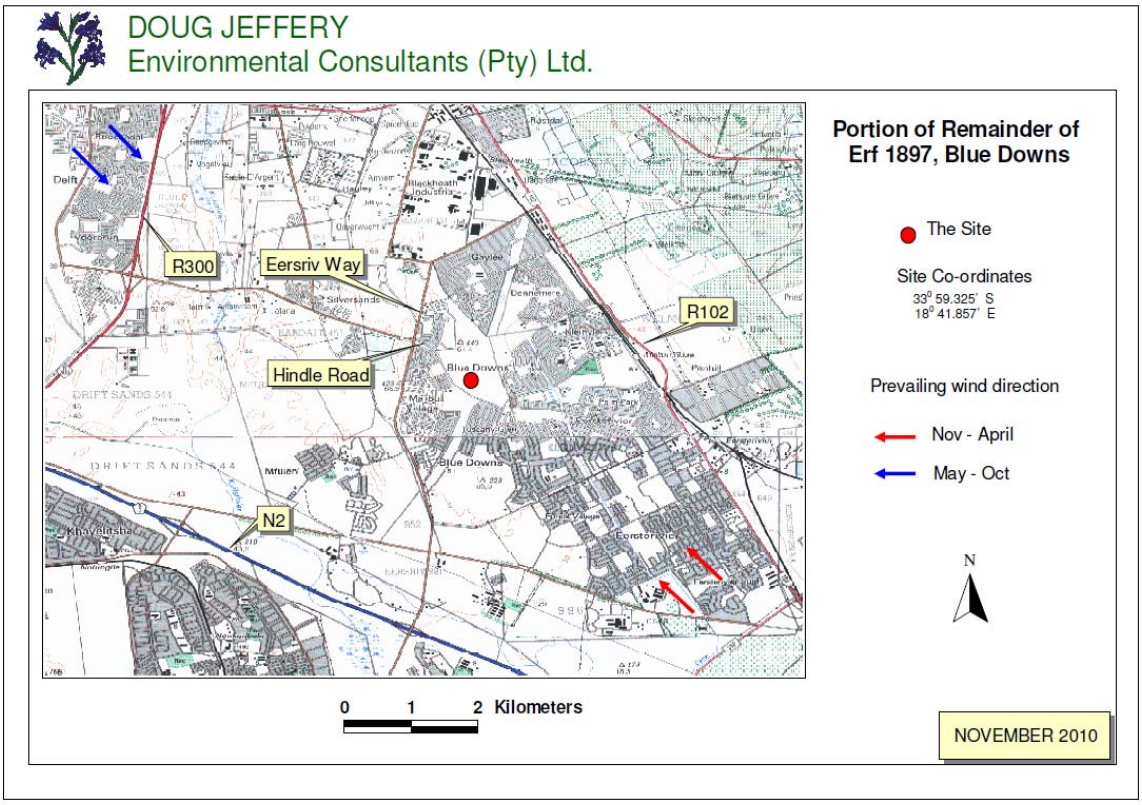

Figure 1: The location of Erf 1897, Blue Downs (3418 BA Mitchell's Plain and 3318 DC Bellville Scale 1:50 000)

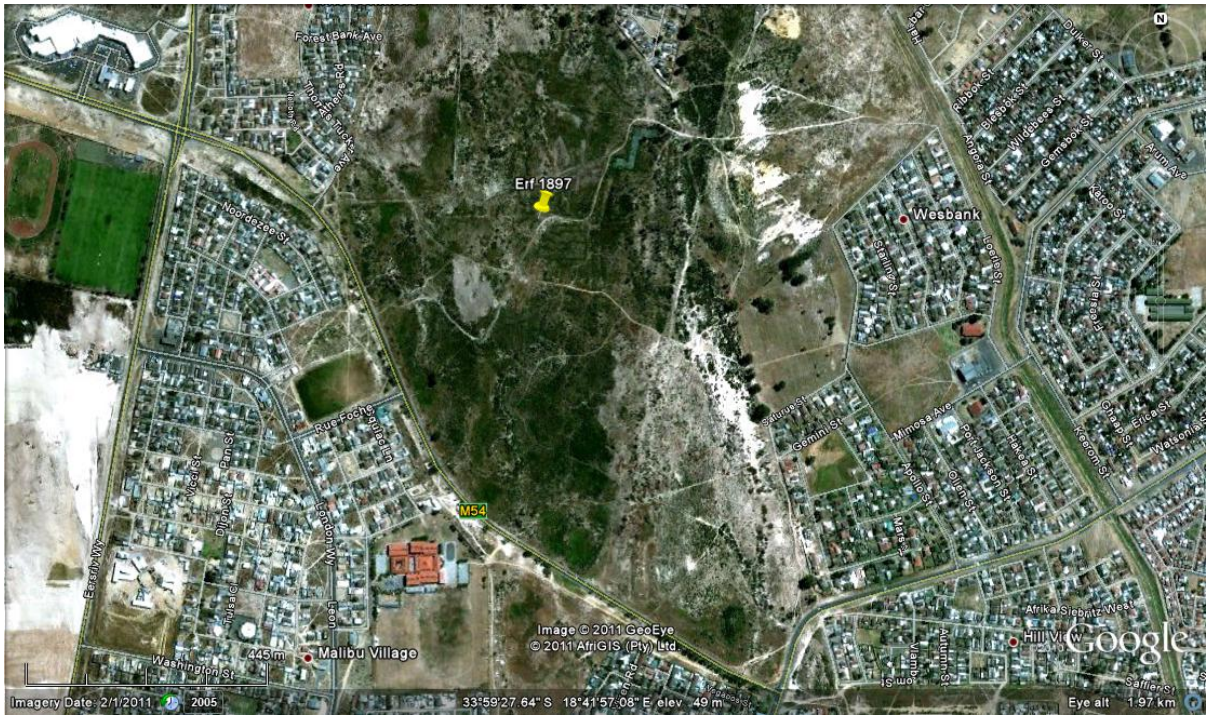

Figure 2. Google Earth view of Erf 1897 and developed surrounds

Method

A desktop study was conducted by Dr Graham Avery, Archaeozoologist in the Cenozoic Studies Section, Natural history Collections Department, Iziko South African Museum. Reference to the Heritage Impact Assessment (Webley, 2011) has been made, since that survey commented on the surface potential. Consequently no field survey was considered necessary.

Results of Survey

No surface palaeontological material is recorded (Webley, 2011). However, it is possible that fossils (and artefacts) could be encountered during any excavation that cuts into older underlying sediments. Overall, sandy sediments built up over at least 7 Ma (million years) (Rogers, 1982) exist on the Cape Flats. The known occurrence of palaeontological and palynological material within the sediment body is recorded. Details specific to Erf 1987 are lacking, as are details of the depths to which excavations for foundations and infrastructure will reach.

Sub-surface Archaeological potential

In addition to the findings of the Heritage Impact Assessment (Webley, 2011), Middle Stone Age artefacts and ostrich eggshell are recorded on ancient land surfaces in the coastal cliffs near Swartklip (Roberts, et al., 2009) (Figure 3) and on harder calcareous Pleistocene palaeo-surfaces exposed at the base of sand mining operations in the Macassar area (GA, pers. obs.).

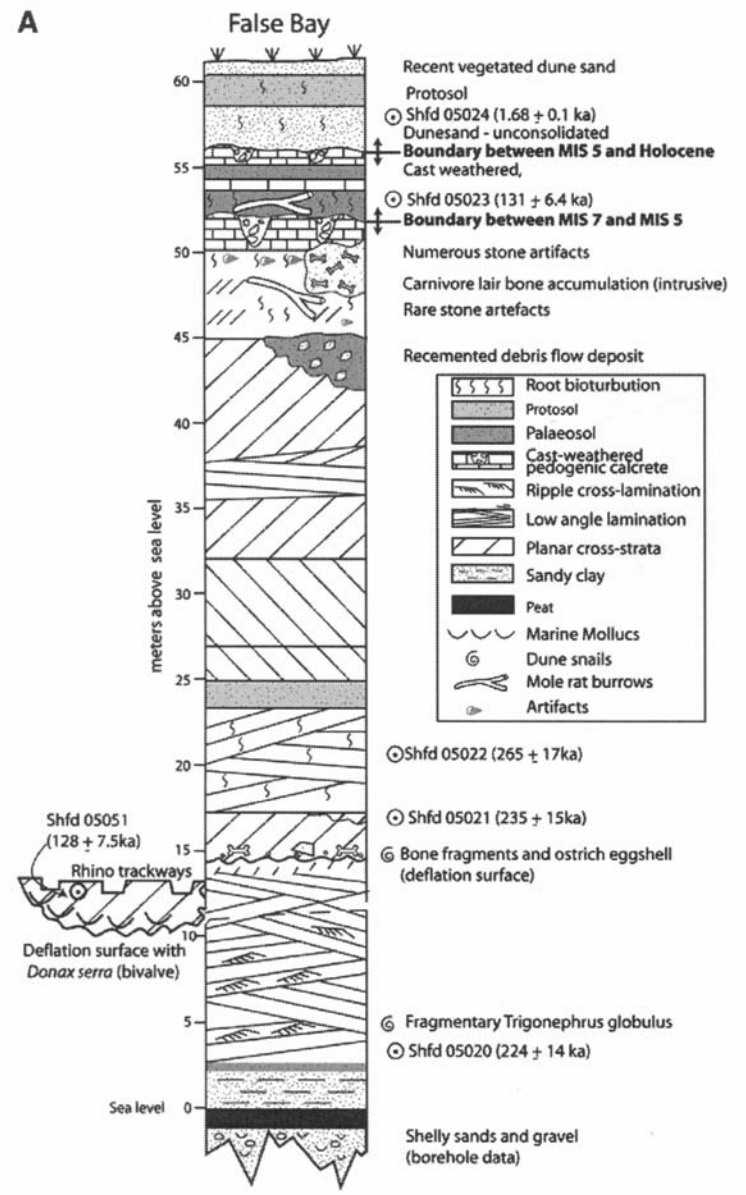

Figure 3. Vertical section (Figure 4 of Roberts et al. (2009) illustrating a composite section of Holocene and Pleistocene sediments on the False Bay coast and the occurrence of fossils.

Geological and Palaeontological potential

Apart from the engineering services report (Element Consulting Engineers 2010) provided by N. Baumann, no geotechnical records were found for Erf 1897. The engineering services report does not provide sub-surface detail, however, so extrapolation of current knowledge for the Cape Flats and the nearby coastal area of False Bay (Rogers, 1982, Roberts, et al., 2009, Theron, et al., 1992, Theron, 1984, Meyer and De Beer, 1981, Klein, 1975), which incorporate bore hole, geophysical, palaeontological and archaeological records, are used to assess potential (Table 1).

Table 1. Cenozoic Formations of the Western Cape (Theron, et al., 1992)

			LITHOLOGY	FORMATION	
QUATERNARY		HOLOCENE	Aeolian, calcareous, quartzose sand	*Witzand*	SANDVELD GROUP
		PLEISTOCENE	Aeolian, calcrete-capped calcareous sandstone Littoral, calcrete-capped coquina Fluvial gravel, marine clay and littoral sand Aeolian, quartzose sand with intermittent peaty layers	*Langebaan†* *Velddrif†* *Milnerton* *Springfontyn**	
NEOGENE		PLIOCENE	Quartzose and muddy sand and shelly gravel, phosphate-rich	*Varswater*	
	MIOCENE	LATE	Conglomeratic sandy phosphorite	*Saldanha*	
		MIDDLE	Angular quartzose gravelly sand and peaty clays	*Elandsfontyn**	

At the time: † Formation rank not yet approved by SACS; * Not yet approved by SACS

Palaeontological occurrences are unlikely to exist in sediments of the Holocene Witzand Formation. However, palaeontological exposures of Middle Pleistocene age are visible in semi-cemented aeolianites at Swartklip (Wolfgat) (Klein, 1975) on the coast. Roberts et al. (2009) (Figure 4) describe the False Bay Dune Plume, which extends ~15 km inland up to a height of 60 m, and show the extent of the main outcrops of Pleistocene sediments. Blue Downs is near the eastern boundary of these outcrops and it is probable that similar, and earlier, sediments underlie Erf 1897. In places Pleistocene deposits could be within 1 m to 2m of the surface, viz. Philippi (Theron, 1984).

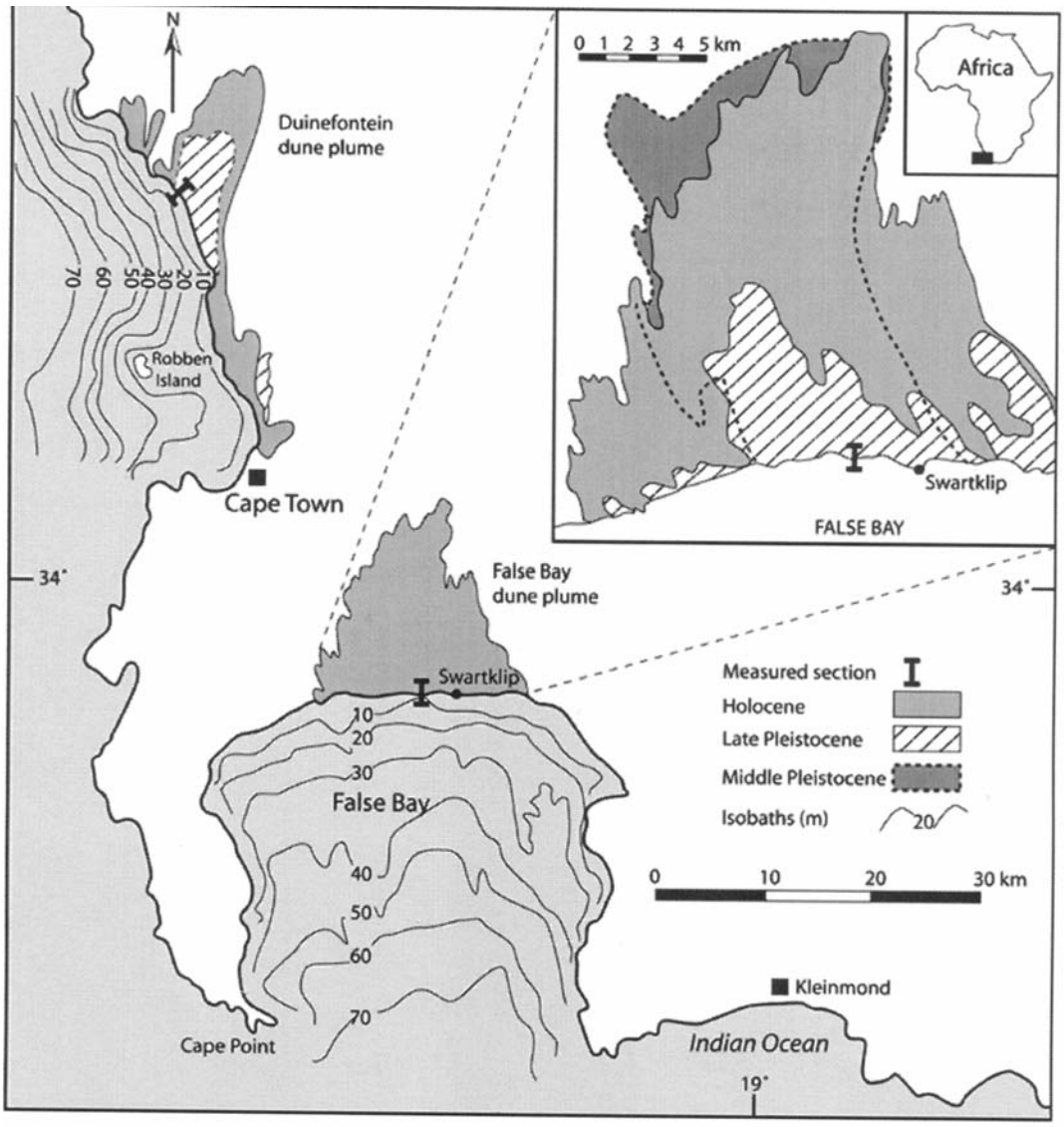

Figure 4. Location and inland extent of False Bay Dune Plume (Figure 2 of Roberts et al. (2009)

Meyer and De Beer (1981) indicate that bedrock elevation in False Bay ranges between 11 m and 37 m below mean sea level and cite Gerber's (1977) reference to the existence of several calcrete and peat layers in the Cape Flats Aquifer within a few metres of the surface. On the western side of the plume Roberts et al. (2009) mention marine sandy clays and peats with an estuarine/lagoonal molluscan fauna outcropping at 2 m above mean sea level. Some 15 m of marine shelly gravels extend below mean sea level (Rogers, 1982, Roberts, et al., 2009).

The sediments overlying the basement rocks in the Cape Flats area have been summarized (Rogers, 1982, Roberts, et al., 2009, Theron, et al., 1992, Theron, 1984, Pether, 2007) (Table 1). The surface comprises the Recent Witzand Formation of loose aeolian sands deposited mainly during the Holocene (last 10 ka-thousand years). Remnants are scarce in the Witzand sand dunes, the most common being of land snails, tortoises and molerats. In low-lying wetland (present and previous), peats formed under Holocene conditions may yield pollens. These are underlain by Upper and Middle and Pleistocene sands.

The Langebaan Formation has proved to be fossiliferous in a number of areas in the South Western Cape. At Swartklip in False Bay (Klein, 1975) a 150 ka (chronology updated from ~65 ka) hyaena accumulation, intruded into earlier Varswater Formation sediments, has yielded over 3000 bones. Molerat burrows, animal track ways and root traces are also evident in the coastal exposures (Roberts 2009). Stone artefacts occur on palaeo land surfaces (see above).

Pliocene Varswater Formation and underlying Late and Middle Miocene Saldanha and Elandsfontyn Formation sediments (3 Ma to 10 Ma) with intercalated soil and peat horizons, reflecting periods of palaeoenvironmental stability and sediments are located below mean sea level and are mainly of marine origin, reflecting very ancient changing sea level stands (Figure 5). Peat (lignite) deposits of probable Miocene age occur and may yield pollens. The most notable was a 20 m deep deposit at Noordhoek (Theron, 1984, Coetzee, 1978).

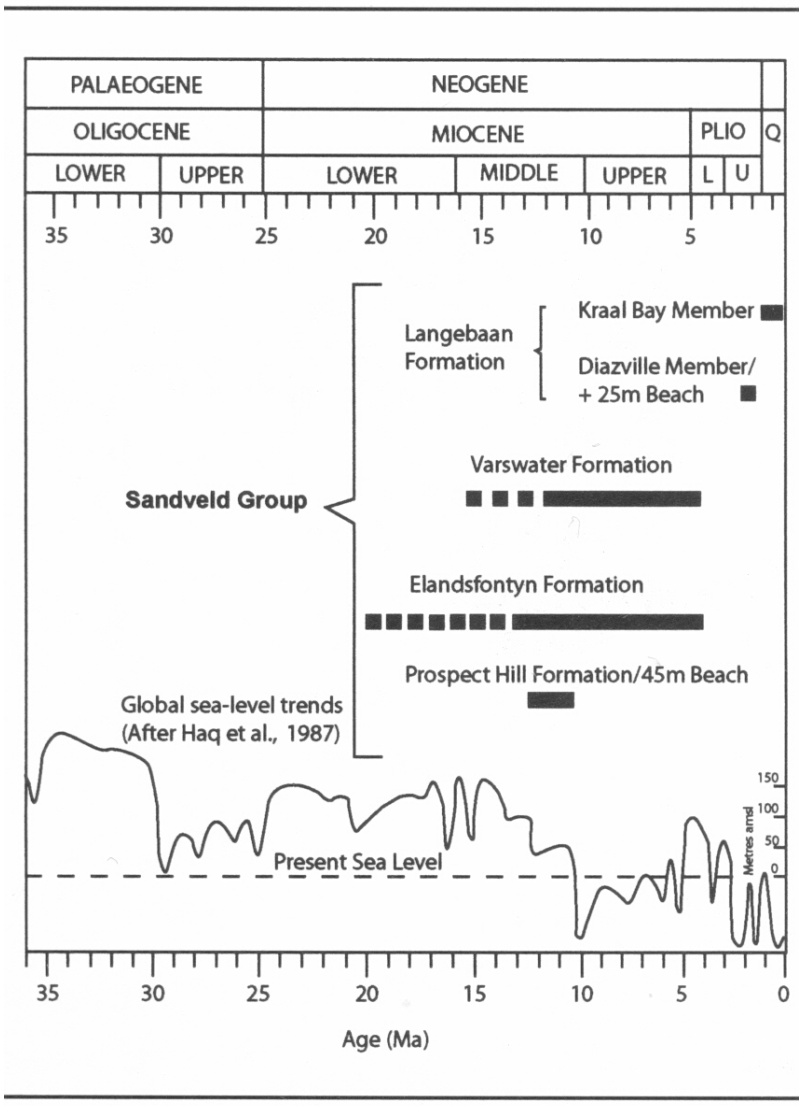

Figure 5. Illustration of changing sea levels (Figure 3 of Roberts and Brink (2002). Note that Miocene and Pliocene sea levels reached much higher stands (>100 m) above present sea level than those of the Pleistocene (see Figure 6) by which time a 100 ka periodicity of high/low sea levels coinciding with warmer (interglacial) and colder (glacial) conditions had developed.

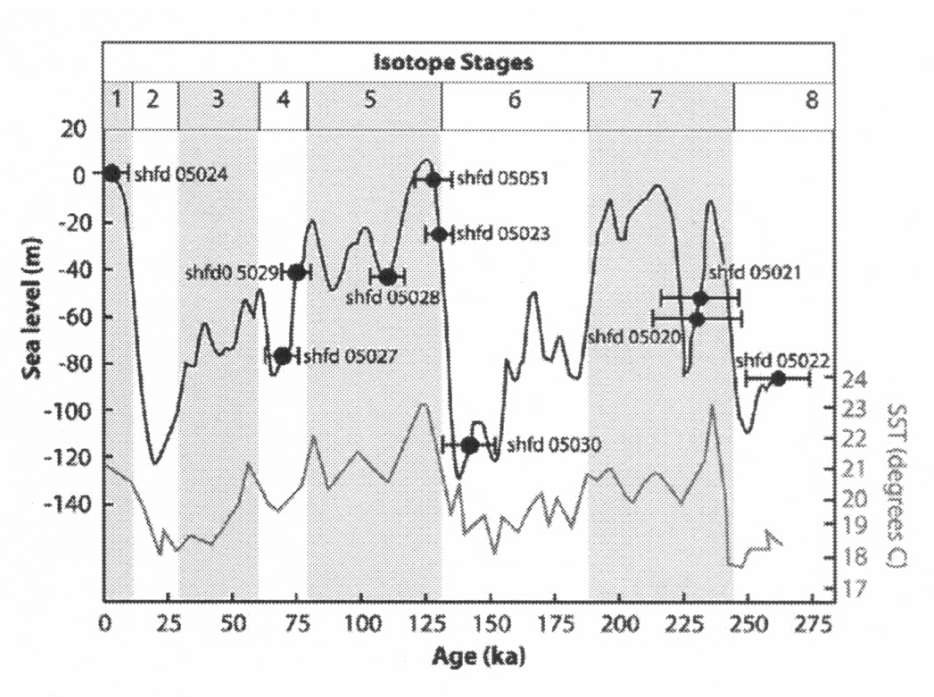

Figure 6. Pleistocene sea level change (Figure 7 of Roberts et al. (2009). Sharp dips in the curve at isotope stages 6 and 2 represent glacial peaks. Note the chronological scale is different to that in Figure 5

Comments

Webley (2011) reports no palaeontological material on the surface of Erf 1897. Sub-aerially, however, geological and palaeontological observations in the area indicate a long history of sedimentation under periods of sea level and environmental change and the presence of palaeontological and, possibly, palynological (pollen) material.

The depth of the Witzand sediments under Erf 1897 is unknown and it might be advisable to establish *a priori* the depth to which any excavations to be conducted during the proposed project on Erf 1897 would reach. If excavation will be confined to the Witzand Formation, the potential for finding palaeontological material would be minimal. However, foundations that need to extend to a hard base may well extend into Pleistocene sediments, which have greater potential.

The Holocene Witzand sediments on Erf 1897 are underlain by aeolianites from which recovery of rare and important fossil material is possible. On-site monitoring, by an appropriately qualified person, of excavations for foundations and infrastructure will be required. Fossils recovered would add to our knowledge of the local geological, faunal and vegetation history of the area.

No on-site geotechnical survey has been conducted. Knowledge of the depth of Witzand sediments on Erf 1897 before construction would, however, reveal whether Pleistocene sediments are likely to be intersected by construction excavations and thus whether monitoring and mitigation action will be required. The Engineering report (Element Consulting Engineers 2010) mentions existing sub-surface infrastructure. It is possible that the City of Cape Town Engineering Department may be able to provide further details if they hold reports from any previously conducted geotechnical investigations.

This potential cannot be ignored; although fossils are sparsely distributed, there is a real probability that fossils of Pleistocene age, at least, will be encountered during any excavation of depth for foundations or infrastructure. On-site monitoring during excavations will be required.

Conclusion

Palaeontological and archaeological remains are likely to be rare but, if encountered, must be recorded by an appropriately qualified person. As an example of potential, the richness of the Swartklip hyaena accumulation and its important contribution to knowledge of local biodiversity and glacial (Ice Age) palaeoenvironments should not be lost sight of.

The earliest (Late Miocene and Pliocene) deposits are unlikely to be disturbed by normal housing development.

Provided that the recommendations in this report are followed, current information indicates that the proposed development will not impact significantly on palaeontological remains. Appropriately conducted the development may provide opportunities to access rare fossil material and to better understand the local geological sequence.

From the palaeontological perspective the development can be allowed to proceed.

Recommendations

Bulk earth works and excavation for foundations/infrastructure should be monitored by a palaeontologist who also has knowledge of archaeology.

If possible, geotechnical information together with the proposed depths of excavations for foundations and/or infrastructure should be provided prior to the commencement of construction. This may enable a better estimation of the likelihood of cemented or semi-cemented Pleistocene deposits underlying the loose white sand of the Witzand Formation, which could contain fossils, being encountered.

Protocols for dealing with palaeontological monitoring/mitigation must be included in the Environmental Management Plan (EMP). Any bones are likely to be fragile and due care must be exercised.

Any material recovered will be lodged in the collections of Iziko South African Museum.

Funds must be available *a priori* to cover costs.

Heritage Permits Required

The primary heritage legislation that needs to be considered is The South African Heritage Resources Act 25 of 1999 and regulations (details at www.sahra.org.za).

Clearance in terms of the National Heritage Act of 1999 will be required before the development can proceed.

Although not required by the Act, it is suggested that, to obviate possible delays should fossil material be encountered, a permit be applied for ahead of any excavation. This would enable the monitor to readily recover material, should it be encountered during construction activities.

Acknowledgements

Mr. Nicolas Baumann provided locality information and copies of Webley's draft Heritage Impact Assessment and Element Consulting Engineers Engineering Services Report.

References

Coetzee, J.A., 1978. Climatic and biological changes in south-western Africa during the Late Cainozoic, Palaeoecology of Africa 10, 13-29.

Element Consulting Engineers, 2010. Proposed Residential Development for Remainder Erf 1897, Blue Downs (Site 3): Preliminary Engineering Services Report. For MSP Developments. 6 pp.

Gerber, A., 1977. 'n Ondersoek na die hydrouliese eienskappe van die ondergrondse waterbron in die Kaapse Vlakte, University of the Free State, Bloemfontein.

Meyer, R., De Beer, J.H., 1981. A geophysical study of the Cape Flats aquifer, Transactions of the Geological Society of South Africa 84, 107-114.

Klein, R.G., 1975. Paleoanthropological implications of the nonarchaeological bone assemblage from Swartklip I, South-Western Cape Province, South Africa, Quaternary Research 5, 275-288.

Pether, J., 2007. Fossils in dunes: Palaeontology in the Witzand Formation, a general information document, For Heritage Western Cape, p. 5.

Roberts, D., Bateman, M., D, Murray-Wallace, C.V., Carr, A., S, Holmes, P., J, 2009. West coast dune plumes: climate driven contrasts in dunefield morphogenesis along the western and southern South African coasts, Palaeogeography, Palaeoclimatology, Palaeoecology 271, 24-38.

Roberts, D.L., Brink, J.S., 2002. Dating and correlation of Neogene coastal deposits in the western Cape (South Africa): implications for neotectonism, South African Journal of Geology 105, 337-352.

Rogers, J., 1982. Lithostratigraphy of Cenozoic sediments between Cape Town and Eland's Bay, Palaeoecology of Africa 15, 121-137.

Theron, J.N., Gresse, P.G., Siegfried, H.P., Rogers, J., 1992. The Geology of the Cape Town Area. Explanation of Sheet 3318 Scale 1:250 000, Government Printer, Pretoria.

Theron, J.N., 1984. The Geology of Cape Town and Environs. Explanations of Sheets 3318CD and DC and 3418AB, AD and BA Scale 1:50 000, Government Printer, Pretoria.

Webley, L., 2011. Draft Report. Development of Erf 1897, Blue Downs, City of Cape Town, Western Cape Province, Archaeology Contract Office, University of Cape Town, p. 16.

Dr Graham Avery, Archaeozoologist

Iziko South African Museum

23 September 2011