

**Archaeological Impact Assessment
with comment on Palaeontology by Dr John Almond**

**Proposed Moquini Beach Hotel, Erf 14796, Mossel Bay, Eden,
Western Province**

prepared for

Mr. Dale Holder

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Executive Summary

In accordance with the National Heritage Resources Act (Act 25 of 1999), an Archaeological Impact Assessment (AIA) was conducted for the above-named project on 18 May 2010. Apart from a pipeline and disused road running through the property, the sediments in the study area appear relatively undisturbed. The area along and immediately adjacent to the disused road is vegetated by a mix of indigenous and exotic species with rooikrans dominating. Aside this swathe, coastal Fynbos covering the remainder of the property is in pristine condition.

Archaeological investigation was restricted by dense, impenetrable vegetation cover, but a large part of the proposed development footprint was accessible on foot and open to archaeological inspection and assessment.

Two very ephemeral scatters of marine shell were recorded, but due to context and make-up, the age of their deposition is uncertain. A recent poacher's heap of Alikreukel (Olicroc) shells casts further doubt as to the archaeological origins of the afore-mentioned occurrences. No further archaeological or tangible heritage related resources were identified in the study area, but it is possible that such materials occur under dense vegetation. Archaeological monitoring of vegetation clearing and earthmoving activities will avoid or minimize negative impact on currently undetectable archaeological resources.

According to Dr John Almond, "... an independent desktop study for this restricted development is not necessary ... In any case, monitoring by a qualified archaeologist should also pick up any important fossil or subfossil remains and I do not consider specialist palaeontological mitigation to be necessary." Further comments by Dr Almond are given below.

Provided that the recommended mitigation measure – as approved by Heritage Western Cape - is implemented, there are no objections to the approval of the proposed project.

It is recommended that;

- *Archaeological monitoring should be conducted by a professional archaeologist during vegetation clearing and earthmoving activities so as to avoid or minimize negative impact on potential subsurface archaeological and palaeontological resources.*

Note that;

- *In the event that vegetation clearing and earthmoving activities expose archaeological or paleontological materials, such activities must stop and Heritage Western Cape must be notified immediately.*
- *If archaeological materials are exposed during vegetation clearing and/or earth moving activities, then they must be dealt with in accordance with the National Heritage Resources Act (No. 25 of 1999) and at the expense of the developer.*

- *In the event of exposing human remains during construction, the matter will fall into the domain of Heritage Western Cape (Mr. Nick Wiltshire) or the South African Heritage Resources Agency (Ms Mary Leslie) and will require a professional archaeologist to undertake mitigation if needed.*

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1. Introduction

1.1 Background

Because the proposed development triggers Section 38 of the National Heritage Resources Act (Act 25 of 1999), Mr Dale Holder of Cape EAPrac (see details on title page), on behalf of the client, appointed CHARM to conduct an Archaeological Impact Assessment (AIA) of the affected property in Danabaai on the Cape South Coast (Figure 1). Dr John Almond was appointed to conduct a Desktop Palaeontological Impact Assessment (PIA) and his comments are included in this report.

Apart from a pipeline and disused road, the affected property is currently undeveloped. The proposed development includes the construction of a hotel and apartment complex, infrastructure, associated services and a boardwalk to the beach. Bulk services exist on the property. Development activities will include large scale earthmoving operations that could have a permanent negative impact on palaeontological, archaeological and tangible heritage related resources.

A layout plan of alternative 1 – preferred option - was provided by Mr Holder and is presented in Figure 2. Coordinate data for boundary points of the property are given in Table 1 (also see Figure 3), and further details and specifications can be obtained from Mr Holder.

1.2. Purpose and Scope of the Study

Objectives of the Archaeological Impact Assessment and heritage scoping study are:

- To assess the study area for traces of archaeological and heritage related resources;
- To identify options for archaeological mitigation in order to minimize potential negative impacts; and
- To make recommendations for archaeological mitigation where necessary
- To identify heritage resources and issues that may require further attention, and to complete the Heritage Western Cape (HWC) Notification of Intent to Develop (NID) form.

Terms of Reference (ToR):

- a) Locate boundaries and extent of the study area.
- b) Literature review of earlier archaeological work in and near study area
- c) Conduct a survey of the study area to identify and record archaeological and heritage related resources.
- d) Assess the impact of the proposed development on above-named resources.
- e) Recommend mitigation measures where necessary.
- f) Prepare and submit a report to the client that meets standards required by Heritage Western Cape in terms of the National Heritage Resources Act, No. 25 of 1999
- g) Prepare and submit HWC NID form.

A Heritage Western Cape (HWC) Notice of Intent to Develop (NID) form was completed, signed by the author and submitted with this document.

1.3 Study Area

Erf 14796, Mossel Bay is 4.5ha in extent and is situated in the western part of the coastal village of Danabaai, and approximately 11km WSW of Mossel Bay, Western Province (Figure 1). The study area was accessed by vehicle by taking the Danabaai turnoff (Flora Road) from Louis Fourie Road and then by following Heideweg to where it meets the affected property (see red direction arrows in the inset in Figure 1).

The study area is perched atop a high dune of Holocene age and bedrock (beach rock) lies deep beneath the surface sands. The southern boundary of the study area runs parallel with and near the apex of a coastal dune with an elevation of between 40 and 60m above mean sea level (Figure 3). The dune descends steeply to the beach below. A shallow linear depression lies in the lee of this dune – roughly along the middle of the property - from where the dune sands slope up gently to the northern boundary of the property. Only soft geological deposits comprised of aeolian dune sands were seen (Plates 1 through 4). Apart from a pipeline and disused road running through the property, the sediments in the study area appear relatively undisturbed.

The area along and immediately adjacent to a disused road is vegetated by a mix of indigenous and exotic species with rooikrans dominating (Plate 1). Aside this swathe of disturbed vegetation, coastal Fynbos covering the remainder of the property is in pristine condition (Plates 2 & 3).

The study area is disturbed by recent human activities associated with a pipeline and a disused road (Figure 3 and Plate 4). Examples of the affected environment – disturbances, vegetation, topography, and so on - are shown in Plates 1 through 4.

Table 1. Coordinate data for boundary points, photo localities and observations (see Figure 3 and Plates 1 through 4)

Name	Description img=image snd=sound	Datum: WGS 84 Lat/Lon dec.degrees	Datum: WGS 84 SA National	Grid:
1	img7156 snd7156	S34.20505 E22.03031	23 Y0089370 X3786831	
2	img7157-61 snd7161	S34.20575 E22.02844	23 Y0089542 X3786911	
3	img7162 snd7162	S34.20591 E22.02843	23 Y0089543 X3786929	
4	img7163-5 snd7165	S34.20613 E22.02840	23 Y0089545 X3786953	
5	img7166-8 snd7168	S34.20643 E22.02836	23 Y0089548 X3786987	
6	img7169-73 snd7173	S34.20658 E22.02867	23 Y0089520 X3787003	
7	donax scatter img7174-5 snd7175	S34.20673 E22.02877	23 Y0089510 X3787019	
8	img7176-7 snd7177	S34.20686 E22.02873	23 Y0089514 X3787034	
9	shell scatter img7178-81 snd7181	S34.20691 E22.02761	23 Y0089617 X3787040	
10	img7182-3 snd7183	S34.20690 E22.02715	23 Y0089660 X3787039	
11	img7184-5 snd7185	S34.20740 E22.02550	23 Y0089811 X3787096	
12	img7186-9 snd7189	S34.20705 E22.02568	23 Y0089795 X3787058	
13	img7190-2 snd7192	S34.20683 E22.02552	23 Y0089810 X3787033	
14	img7193-6 snd7196	S34.20644 E22.02676	23 Y0089696 X3786989	
15	img7197 snd7197	S34.20590 E22.02624	23 Y0089745 X3786930	
16	img7198-7201 snd7201	S34.20572 E22.02771	23 Y0089609 X3786908	
17	img7202 snd7202	S34.20642 E22.02800	23 Y0089582 X3786986	
18	mod shell & pnrma img7203-11 snd7211	S34.20681 E22.02669	23 Y0089703 X3787030	
19	img7212 snd7212	S34.20675 E22.02692	23 Y0089681 X3787023	
20	img7213-5 snd7215	S34.20599 E22.02512	23 Y0089848 X3786940	
A	boundary point	S34.20601 E22.02517	23 Y0089843 X3786942	
B	boundary point	S34.20569 E22.02838	23 Y0089548 X3786905	
C	boundary point	S34.20693 E22.02874	23 Y0089513 X3787041	
D	boundary point	S34.20755 E22.02572	23 Y0089791 X3787113	

1.4 Approach to the Study

A great deal of earlier archaeological work was conducted in the surrounding area between Mossel Bay and Vleesbaai (e.g., Deacon 1989, Halkett and Hart 1996, Kaplan 1993, 2004, 1998, 1997, Marean 2009, Nilssen 2005, 2009, Nilssen et al 2007, Thompson 2006). Studies include research and cultural resource management projects. The vast bulk of the archaeological record relates to the Stone Age and Pottery/Herder periods and includes a variety of occupation settings and types in caves and open environments. Apart from stratified occupation horizons in caves, sites also consist of stone and artefact scatters as well as shell midden deposits, which are usually in close proximity to the shoreline. The current study, however, focuses on a patch of landscape that is quite different from those referred to above and therefore, the study was entered without expectations of what might be found. No earlier archaeological work was conducted on or in the immediate vicinity of the affected property.

On behalf of the client, Mr Dale Holder of Cape EAPrac provided a locality map and coordinate data for the study area. The site was first visited with Mr Holder, after which the AIA was conducted independently. The entire study was conducted on foot, but due to dense and impenetrable vegetation, only a limited area of the property was studied. Nevertheless, the area of the proposed development footprint was adequately covered for an archaeological assessment.

Survey tracks were fixed with a hand held Garmin Camo GPS to record the search area (Figure 3, gpx tracking file submitted to HWC and is available from author). Photo localities were also fixed by GPS (Figure 3, Plates 1 through 4 and Table 1). Digital audio notes and a high quality, comprehensive digital photographic record were also made (full data set available from author). Localities of photographs are established by matching the numbers on photographs with those of waypoints in Figure 3. Directions of views are indicated with compass bearing names like E is east; WSW is west south west, and so on. Bearing names on panoramic views indicate the bearing at the position of the label.

2. Results

On 18 May 2010, in approximately 3.5 hours of survey, a distance of 4km was walked covering an area of about 2.4ha, of which an average of some 30% provided good archaeological visibility (Figure 3 and Plates 1 through 4). Apart from the areas along the existing pipeline and disused road, sediments in the study area are relatively undisturbed.

Two very low density scatters of marine shell were recorded at waypoints 7 and 9 (Figure 3, Plate 4 and Table 1). Waypoint 7 is a point along an intermittent scatter of exclusively *Donax* (white mussel) shell that stretches along the eastern edge of the dune apex and in a roughly N-S trajectory. The scatter is about 30m long and 5m wide. Shell is scattered on the surface and there is no evidence for their eroding out of the dune. It is suspected that this material does not originate from a shell layer in the dune and it is likely that the material is modern. At waypoint 9, near complete shells of one *Alikreukel* (Turbo) and one Venus Ear (*Haliotis* sp) were recorded. The depositional environment is identical to that described for waypoint 7, but in this case the scatter is restricted to two shells and a few small adiaagnostic fragments. The occurrence is no more than 2m² in extent. Like 7, waypoint 9 is likely of modern origin.

Waypoint 18 represents a modern poacher's dump of some 40 Alikreukel shells (Figure 3 and Plate 4). The context of this observation is like that of waypoints 7 and 9.

Dr John Almond's comments regarding a desktop Palaeontological Impact Assessment are taken directly from correspondence and are as follows.

According to the 1: 250 000 geological map 3322 Oustshoorn the development footprint is underlain by "fixed dune and dune rock" of what would now be referred to the Algoa Group. These probably comprise vegetated dunes of the Holocene Schelm Hoek Formation, in which case the appended document by John Pether (2008) should suffice to alert developers to possible palaeontological remains exposed during development (Appendix A). At depth, older Pleistocene dune sands (e.g. Nahoon Formation) or shelly coastal sediments (Salnova Formation) may be encountered (Maud & Botha 2000, Roberts et al. 2006). In any case, monitoring by a qualified archaeologist should also pick up any important fossil or subfossil remains and I do not consider specialist palaeontological mitigation to be necessary. In my view an independent desktop study for this restricted development is not necessary.

3. Sources of Risk, Impact Identification and Assessment

The proposed development includes the construction of a hotel and apartment complex, infrastructure, associated services and a boardwalk to the beach. Bulk services exist on the property. Vegetation clearing and earthmoving activities associated with the proposed development may have a permanent negative impact on archaeological resources in the study area. Earthmoving activities will penetrate sediments unaffected by previous disturbances and although results of the study suggest that the presence of subsurface archaeological materials is unlikely, their presence cannot be ruled out.

Table 2 summarizes the potential impact of the proposed development on archaeological resources with and without mitigation.

Table 2. Potential impact on and loss of archaeological resources.

	With Mitigation	Without Mitigation
Extent	Local	Local
Duration	Permanent	Permanent
Intensity	Medium	High
Probability	Low to None	Unknown
Significance	Unknown	Unknown
Status	Unknown	Unknown
Confidence	High	High

Provided that the recommended mitigation measure - as approved by Heritage Western Cape - is implemented, it is recommended that the proposed activity be approved.

4. Required and Recommended Mitigation Measures

The following measures are required:

- In the event that vegetation clearing and earthmoving activities expose archaeological or paleontological materials, such activities must stop and Heritage Western Cape must be notified immediately.
- If archaeological materials are exposed through earthmoving activities, then they must be dealt with in accordance with the National Heritage Resources Act (No. 25 of 1999) and at the expense of the developer(s) and/or property owner(s).
- Unmarked human burials may occur anywhere in the landscape and are often exposed during earthmoving activities. Human remains are protected by law and, if older than 60 years, are dealt with by Heritage Western Cape (Mr. Nick Wiltshire 021 483 9685) or the State Archaeologist at the South African Heritage Resources Agency (Mrs. Mary Leslie who can be reached at 021 462 4502).

It is recommended that;

- Archaeological monitoring should be conducted during vegetation clearing and earthmoving activities in order to avoid or minimize impact on potential subsurface archaeological materials. Archaeological monitoring will also cover the palaeontological record as proposed by Dr Almond.

References

Deacon, H.J. 1989. Archaeological Impact Assessment Mossqass Project – Vleesbaai. Report prepared for Mossqass. Department of Archaeology, University of Stellenbosch.

Halkett, D.J. and Hart, T.J.G. 1996. Phase 1 Archaeological Investigation of land at the mouth of the Gouritz River. Prepared for The Grootrug Partnership by the Archaeology Contracts Office, University of Cape Town.

Kaplan, J. 1993. The state of archaeological information in the coastal zone from the Orange River to Ponta do Ouro. Report prepared for the Department of Environment Affairs and Tourism. Agency for Cultural Resource Management.

Kaplan, J. 2004. Phase 1 Archaeological Impact Assessment: proposed development Phase II and Phase III Nautilus Bay, Mossel Bay. Prepared for Hilland Associates. Agency for Cultural Resource Management.

Kaplan, J. 1998a. Archaeological study portion of portion 8 of the Farm Buffelsfontein No. 250 Boggomsbaai, southern Cape. Report prepared for CODEV. Agency for Cultural Resource Management.

Kaplan, J. 1997. Archaeological Study: Proposed Pinnacle Point Development. Prepared for Codev by the Agency for Cultural Resource Management.

Marean, C.W. 2009. Comments on Archaeological Sites and Geological Localities at Nautilus Bay near Mossel Bay – prepared for Heritage Western Cape as a response to “Phase 1 Archaeological Impact Assessment Proposed development Phase II and Phase III Nautilus Bay Mossel Bay”. Prepared for Hilland Associates by Jonathan Kaplan.

Maud, R.R. & Botha, G.A. 2000. Deposits of the South Eastern and Southern Coasts. Pp. 19-32 in Partridge, T.C. & Maud, R.R. (Eds.) The Cenozoic of Southern Africa. Oxford Monographs on Geology and Geophysics No 40. Oxford University Press. Oxford, New York.

Nilssen, P.J. 2005. Archaeological Monitoring of vegetation clearing and all earthmoving activities during development at Pinnacle Point, Mossel Bay. Progress report to HWC. MAPCRM cc, Great Brak River.

Nilssen, Peter, Curtis Marean & Royden Yates. 2007. Archaeological Conservation Management Plan: Pinnacle Point Resort (Pty) Ltd, a portion of Remainder Erf 2001 and Erf 343, Pinnacle Point, Mossel Bay, Western Cape Province. prepared for Heritage Western Cape & Pinnacle Point Resorts (Pty) Ltd.

Nilssen P.J. 2009. Archaeological Impact Assessment with comment on Paleontology: Construction of Sewer Pipelines for Mossdustria and Erf 6422, District Mossel Bay, Western Cape Province. prepared for Mr. Alex Erens of PD Naidoo & Associates

Pether, J. 2008. Fossils in dunes and cover sands. Unpublished general information document, 4 pp. J. Pether, Geological and Palaeontological Consultant, P.O. Box 48318, Kommetjie, 7976. jpether@iafrica.com.

Pether, J. 2010. Palaeontological Impact Assessment (desktop study): proposed development, Amanzi Moya Estate, Remainder Vleeschbaai 251, Vleeschbaai, Mossel Bay Municipality, Eden District, Western Cape – with fossil find procedures.

Roberts, D.L., Botha, G.A., Maud, R.R. & Pether, J. 2006. Coastal Cenozoic deposits. Pp. 605 – 628 in Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) The geology of South Africa. Geological Society of South Africa, Johannesburg & Council for Geoscience, Pretoria.

Thompson, Erin. 2006. Artifact Accumulation Formation Processes and their Affect on Studies of Early Hominin Land Use as Reflected in an Acheulean Assemblage near Mossel Bay, South Africa. Unpublished Masters Dissertation.

Figures and Plates (on following pages)

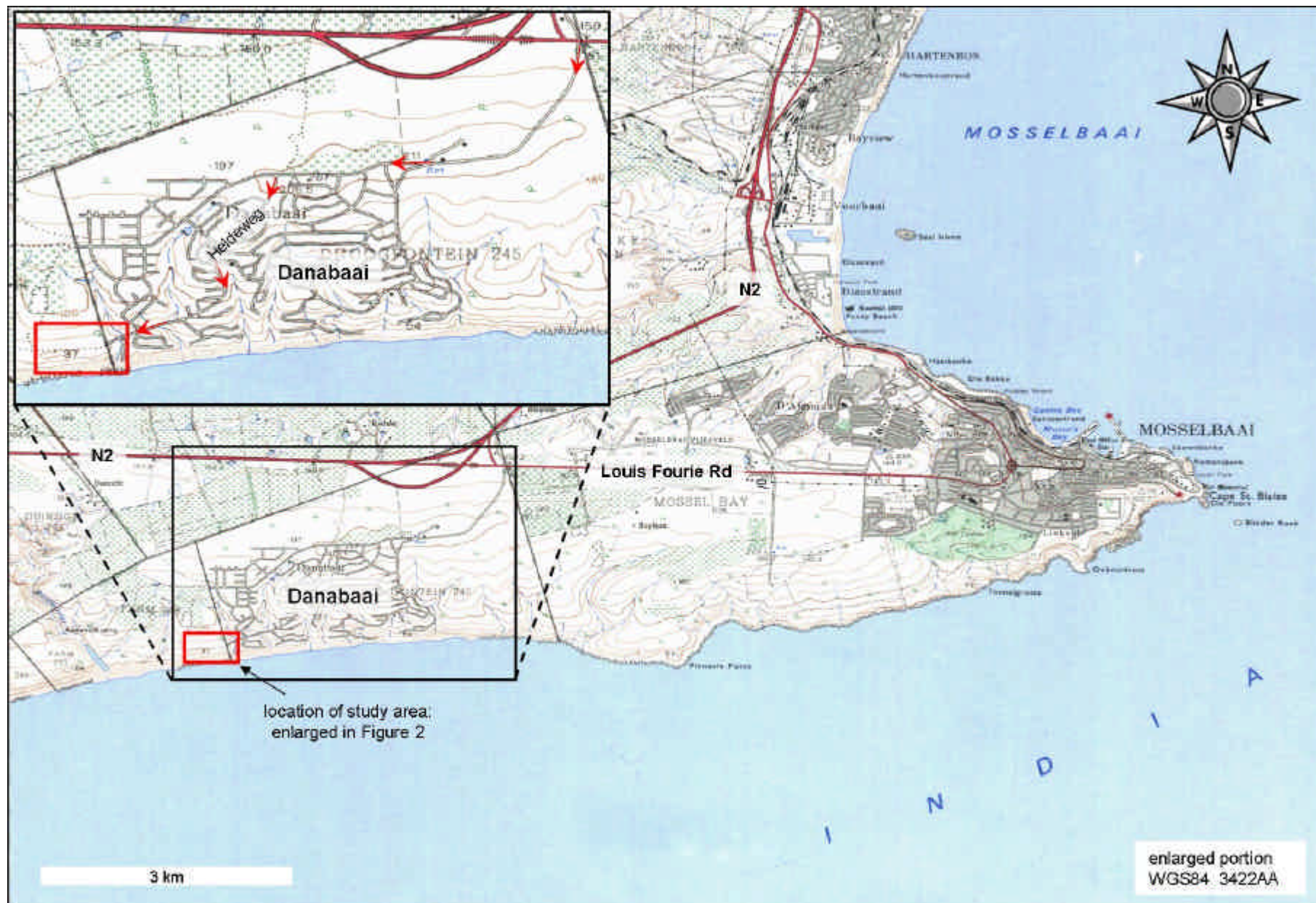


Figure 1. General location of study area relative to Mossel Bay, Western Cape Province. Map courtesy Surveys and Mapping.



Figure 2. Layout plan of proposed development and showing boundary points, waypoints and survey tracks. Courtesy Cape EAPrac.

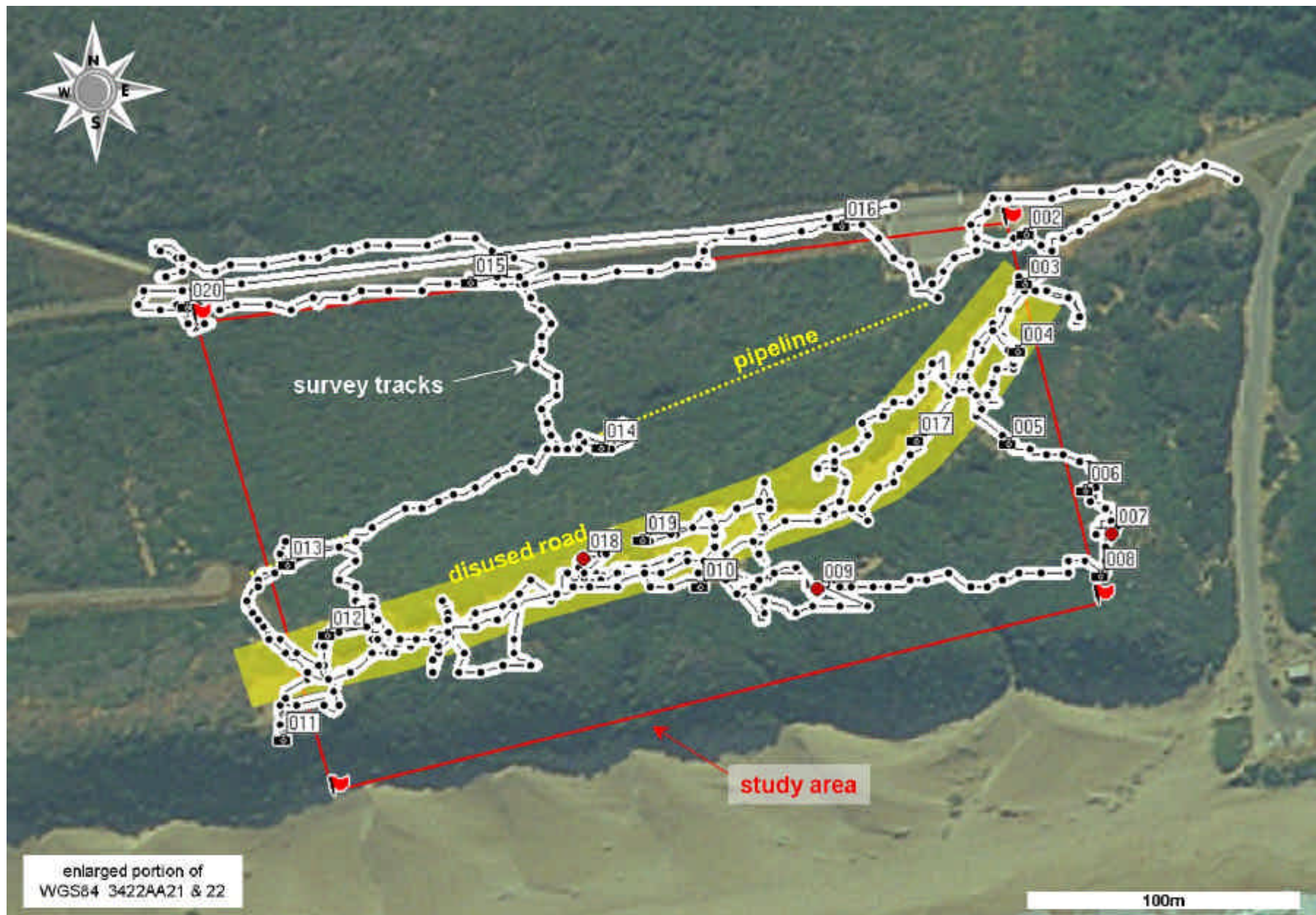


Figure 3. Enlarged area indicated in Figure 1 with boundary, vegetation, topography, disturbances, walk tracks and waypoints. Surveys & Mapping.



Plate 1. Examples of the surrounding environment, exposures, topography and vegetation cover (see Figure 3 and Table 1).

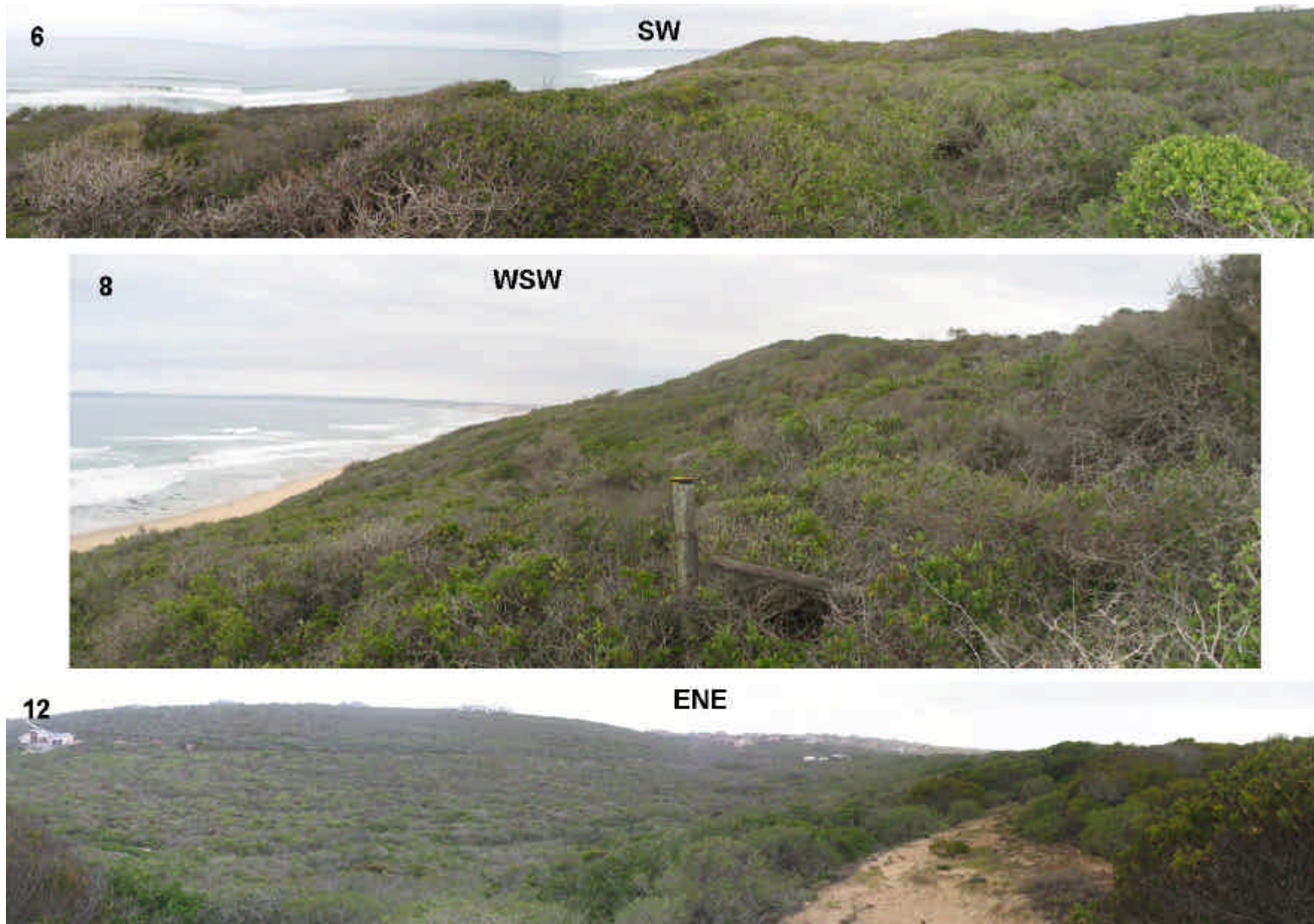


Plate 2. Examples of the surrounding environment, disturbances, topography and vegetation cover (see Figure 3 and Table 1).

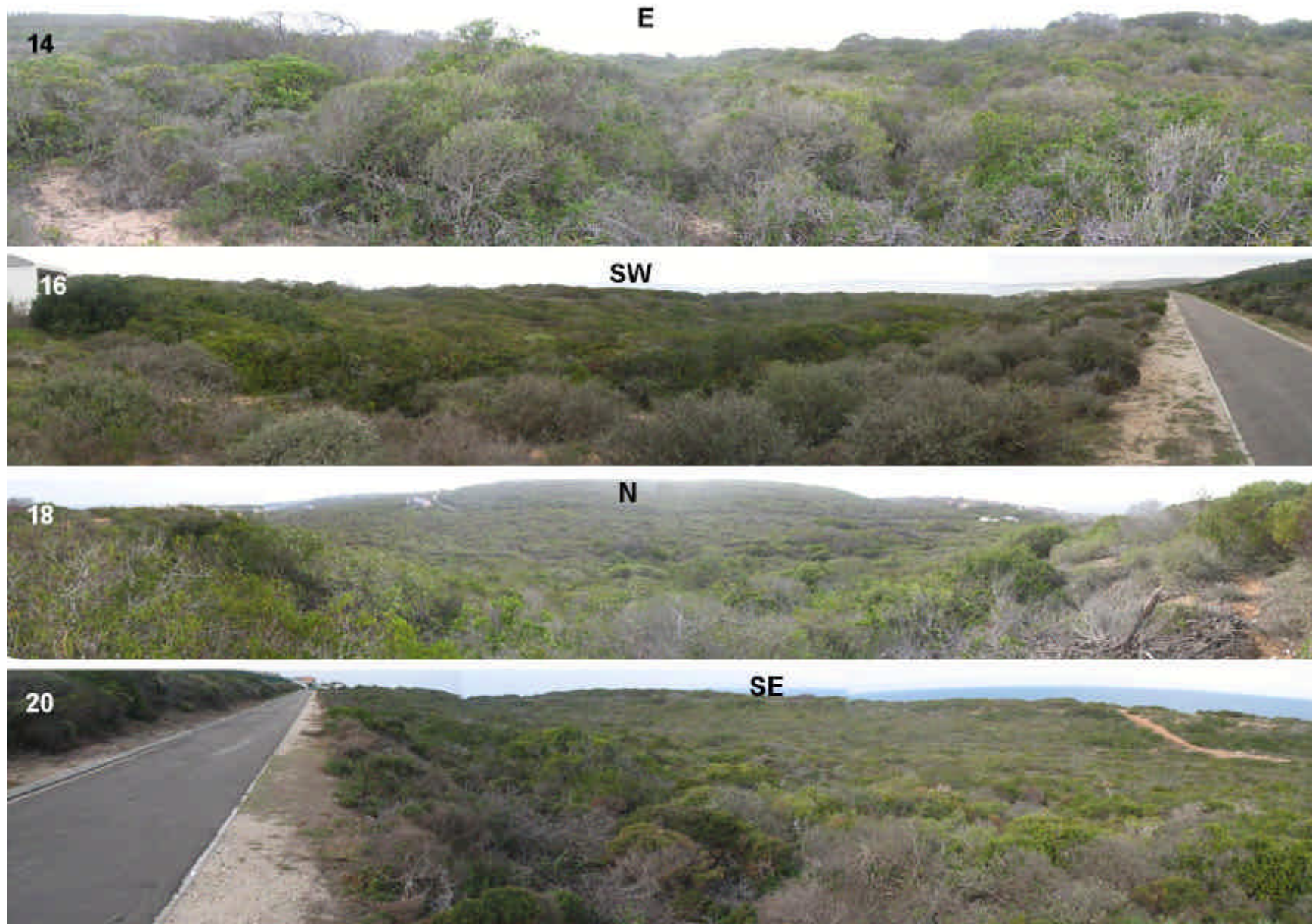


Plate 3. Examples of Examples of the surrounding environment, disturbances, topography and vegetation cover (see Figure 3 and Table 1).

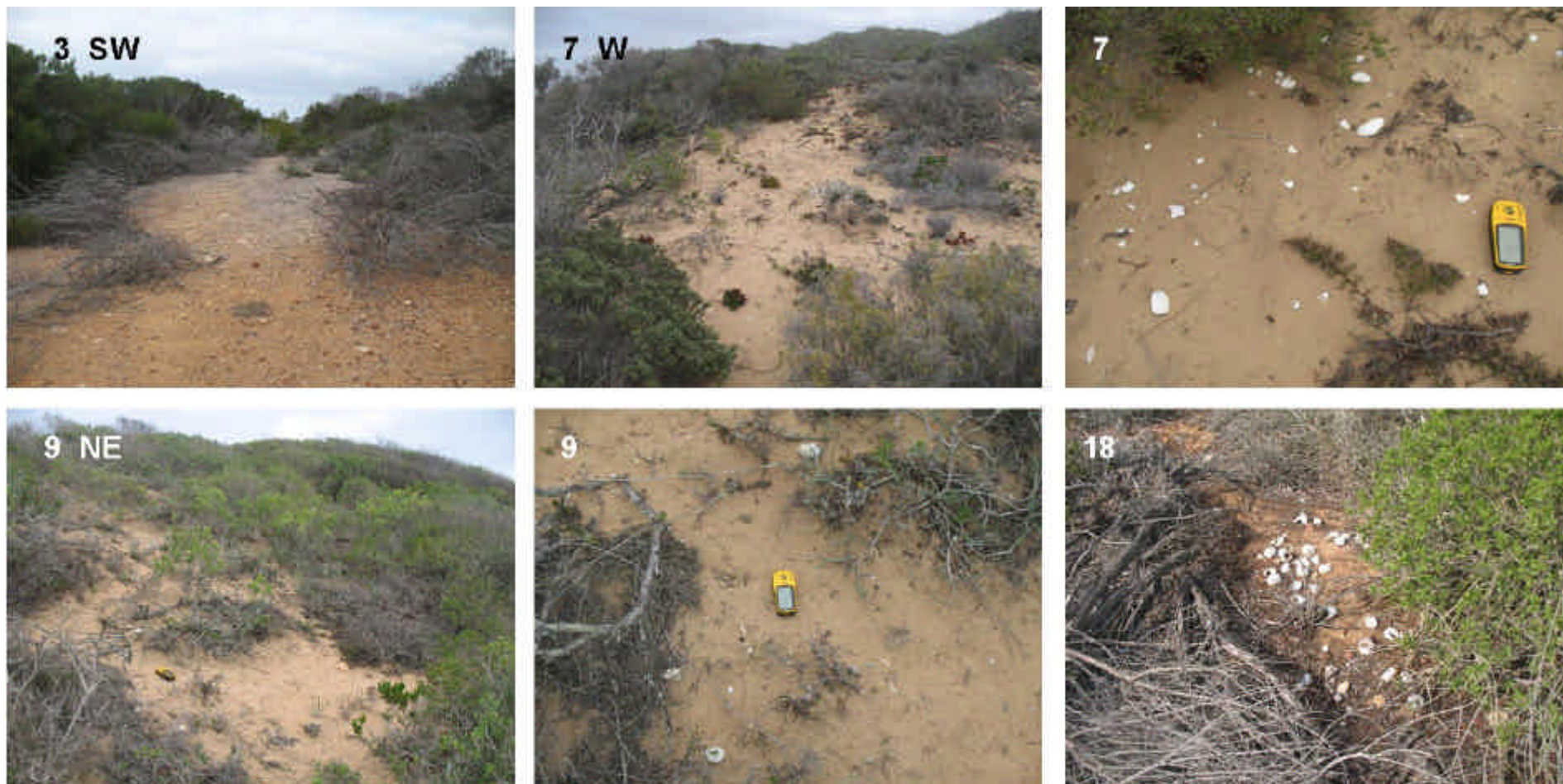


Plate 4 Examples of the surrounding environment, disturbance, exposures and shell scatters (see Figure 3 and Table 1).

Appendix A

(on following page)

FOSSILS IN DUNES and coversands

Palaeontological Potential in Sand Mines

A GENERAL INFORMATION DOCUMENT

Prepared for Heritage Western Cape by John Pether

Pether, J. 2008. Fossils in dunes and coversands. *Unpub. general information document, prepared for Heritage Western Cape.* (Mr J. Pether, Geological and Palaeontological Consultant, P. O. Box 48318, Kommetjie, 7976. jpether@iafrica.com).

Introduction

The intent of this document to inform about the potential of finding fossils in the younger, generally uncemented sands that cover coastal plains around the Cape Coast. These dunes and “driftsands” are mined in numerous places to supply sand for construction purposes. For instance, in the Cape Town area, the thicker old dunes on the False Bay coast between Strandfontein and Macassar are mined extensively.

The “clean” sands that are mined are generally regarded as unfossiliferous. Indeed, for the most part they are, but occasionally alert personnel have noticed fossils in places in the old dunes and have saved them from destruction. Some of this valuable material has been passed on to museums where it is now kept safe for public display and scientific study. Indeed, some of southern Africa’s world-famous fossil sites are in dune-field contexts.

Importantly, fossil bones are rare and irreplaceable. As such, they form part of the collection of rare heritage objects from an area. As heritage objects that inform us of the history of a place, fossils are public property that the State undertakes to acquire and conserve on our behalf (the National Heritage Resources Act No. 25 of 1999) and actually on behalf of the global community.

By providing information about the fossils that occur in dunes, it is hoped to spark the interest and participation of citizens involved in mining dunes, to help in the spotting and saving of the fossils. The few finds rescued in the past from dunes have been the skulls and bones of large animals which are more easily seen, such as rhino, large bushpigs, elephant and hippo. Below I hope to convince that there are more fossils in dunes than generally meets the eye.

What are Fossils

Fossils are the remains of past life that are found buried within sediments (sands, muds and gravels) that have accumulated in the past. Generally they are skeletons, the durable, harder parts of organisms e.g. bones and teeth of animals being the most well-known. Shells are skeletons of clams and snails. The most common fossils found in dune sands are the shells of land snails (terrestrial gastropods) that lived on them. The remains of plants are fossils, for instance, charcoal layers from veld fires occur in dunes. Remains of decayed plant roots are very common, sometimes partially calcified.

Importantly, fossils occur on all size scales, down to the microscopic. Tiny bits of worn down shell form part of the dune sand, but a lot of these are in fact entire skeletons of pin-head size marine animals, called foraminifera, which have blown from the beaches. Freshwater ponds and vleis occur in places between dunes and these form local organic-rich layers. Apart from preserved plant fragments, these “mucky” waste layers contain the microscopic pollen and spores from plants in the wider area, deposited as dust in the standing water - a record of the vegetation of past times.

A special category of fossils are called “trace fossils” or “spoorfossiele”. As evident in the name, these are not remains of the organism, but traces of its activity. The most famous examples would be dinosaur spoor in old rocks, but a recent example that hit the headlines worldwide was the discovery of human footprints in older cemented dunes at Langebaan, dated at about 120 000 years BP (or 120 ka - kilo-years/annum, BP - Before Present). In the softer sands of the young dunes, trace fossils are seen in section on the vertical faces. Most of these are the large burrows made by moles and the traces made by burrowing insects (ants, wasps, dung-beetles etc.). Footprints are quite often seen in section, manifesting as sharply contorted dune laminations.

The Dunes and Coversands

Loose pale sands have been piled up into dunes practically everywhere around the southern Africa coastline. In places, often called “Die Witzand”, these are easily-recognized “dune fields” of actively blowing sands, sculpted into various dune forms by the wind. Mostly though, over large areas the pale sands have been overgrown to various degrees by vegetation and stabilized. The original dune forms have been softened and various plant communities occur, from pioneer plants colonizing new dunes, to mature Strandveld and dune thicket covering older dunes and, of course, out-of-control, invasive alien species that were originally introduced to South Africa to “tame” the coastal tracts of loose, blowing sand.

These young, recently active, loose dune sands have been called the “Witzand Formation”. We see the sand blowing off sandy beaches into adjacent dune fields today. Close to the coastline, the younger “Witzand” sand dunes are thought to have blown off sandy beaches mainly during the last 12000 years (12 ka), during the duration of time called the “Recent” or the Holocene Epoch. Larger tracts of windblown sand, as old dune plumes up to several km in length, can be readily distinguished on aerial photographs of the coastal plains. More widespread cover sands have been left behind by migrating dunes and sandsheets in the past. Much of this older sand relates to the lower sea-levels associated with the Last Ice Age, geologically not so long ago, 12-80 ka BP, when sea-level dropped slowly to levels down to -120 m below present and vast areas of the coast that is now offshore, were exposed as dry land. During these times, when our present-day coastline was “high and dry in the hills”, dunes marched inland from distant sandy beaches that are now submerged on the inner continental shelf.

Even older dune sands are found beneath the aforementioned coversands, or poking through them in places. These are usually cemented to various degrees and are called “aeolianites”. Typically they have a capping “crust” of calcarous rock called calcrete and within them are deeper calcretes with weathered zones and plant-root fossils that mark stable periods when plants grew and soil formation took place. These aeolianites are 100s of ka to several million years old. Where rich in shell-fragment content they have been mined for lime.

Fossils in the Sands

Speaking broadly, the history of dunes in the Cape has not so much been influenced by aridity, but by inter-related factors of changing sea-level, changes in sand supply and climate/windiness changes. Dunes have accumulated quite rapidly in shifting localities, but their surfaces were also rapidly colonized by vegetation and animals when, for some reason, the rate of sand delivery diminished. Thus, some fossils of animals are expected – these are not the dunes of a vast, sparsely-inhabited sand-sea like the arid Namib Desert. Although fossils will be very scarce within the main bulk of the dune sands, they will be found in greater numbers in association with the surfaces that represent pauses in sand accumulation. These old buried surfaces, called palaeosurfaces, are usually marked by various degrees of soil formation. This can vary from very immature soil layers, grey-coloured with more organic content (from plants) than the main dune sand, to more developed soils with additional “fines” content from the weathering-breakdown of sand mineral grains (often pinkish and with powdery lime content). These are sure to be noticed as they degrade the quality of the building sand and it is undesirable to include them in the “product”.

Not unexpectedly, the most common fossils in the dunes are land snail shells, tortoise shells/bones and the bones of moles. These occur anywhere in the dune sand, but as mentioned, are more common in and below a palaeosurface “soil”. This is particularly noticeable for the more common snail shells. Although these fossils are relatively common, a representative collection should be made where they occur - they may not be the same species that are now (or were historically) in the area.

The fossil bones of larger animals are scarce, but a careful search along a palaeosurface layer often produces results. In many cases these appear to be isolated finds, but often what appears to be a

single bone leads to further finds at the spot, such as a scatter of bones accumulated by hyaenas, which may include quite a variety of animals.

A particular kind of palaeosurface is formed where the wind scours away previously-deposited dune sand, producing a scoop-shaped palaeosurface called a “blowout”. The fossils that were sporadically distributed within the dune are then concentrated on the bottom of the blowout. Typically, such concentrations appear mainly as a litter of land snail shells, but a careful look usually reveals fossils of the other animals that lived on the dunes: tortoises, lizards, moles, rabbits, rodents, birds, etc. and sometimes the bones of larger animals like antelopes, zebra and ostriches (and their eggshells).

More dramatically, and better evidence of climate change, is when a blowout subsequently becomes a pond of standing water, due to increased rainfall, lack of a drainage outlet between surrounding dunes and rising local water table. This occurs on a variety of scales, from a mere small boggy area, to ponds, to vleis. As one can imagine, the original wind concentration of dune-biota fossils is then overlain by muddy, organic-rich deposits. These are the real fossil bonanzas of the dunefield setting, for they preserve a great variety of stuff. Firstly, as sources of water, they attract the larger herbivores from the surrounding area, their predators and, in turn, the scavengers. Larger vleis are mysteriously detected by hippos, which plod over the dunes to take up residence. Then there is the fossil record of the pond/vlei life itself, a lot of which also turns up rather mysteriously, like the frogs, aquatic snails and small fish. The best bet is for their eggs being inadvertently brought in by birds, a sample of which are also entombed. Microfossils include the ostracods (microscopic crustaceans with often very specific requirements) and the diatoms (minute plants with glass shells). More locally, reeds, leaves, fruiting bodies and root masses are preserved in the muds. Ancient ponds and vleis, as natural traps of windborne material, also provide a glimpse of the greater, surrounding vegetation, in the form of pollen capsules from near and far, and windborne charcoal fragments from fires, usually of fairly close origin.

A further palaeosurface should be mentioned. This is the main or bottom surface underlying the loose dunes and on which they formed. This is a long-lived, hard surface and may have been covered by dune and uncovered again several times, before finally being overlain by the current dune sand. This surface is an absolute must as a target for fossil hunting and rescue. It can be formed on any older formation, often on the calcrete capping on top of even older dunes.

Ancestral South Africans were around during the times of dune and coversand formation, hunting, foraging for veldkos and camping, for the last million years. Thus it is perfectly possible that some of the fossils found in the dunes may be associated with past human activities. Man-made (anthropogenic) fossil accumulations are a special heritage category called the archaeological record. The occurrence of stone tools, charcoal from cooking hearths and perhaps bits of pottery, gives away the fact that these are records of the way of life of ancient people that periodically lived along the coast. In most cases these archaeological occurrences are visible on or shallowly buried in the loose windblown sands, are of “Late Stone Age” or early historical age, and should be identified during the archaeological impact assessment. More material dating from earlier times could be concentrated at depth on the aforementioned palaeosurfaces and in blowouts, mixed with non-archaeological material.

Rescuing the Fossils

Although fossils are scarce in dune sands, they nevertheless do occur, particularly in palaeosurface contexts and in interdune deposits that are locally present. Unfortunately, much of the fossil material is obscure to a casual inspection. Hitherto, the rescue of some conspicuous fossils has been almost entirely dependent on the involvement and interest of dune-mining personnel, to spot and recover them. Although this is praiseworthy, the *ad hoc* collection of fossils is not desirable, as the contextual information is inadequate or altogether lacking. Recovery of fossils noticed should be carried out by a qualified person, to ensure acquisition of the mandatory attendant information on its context.

Thus, on mine personnel noticing a fossils, a designated contact person should be informed*. The recovery of the fossils should then be done promptly, to ensure minimal disruption of mining schedules/production.

Concerns that fossil finds will disrupt production are real. However, in the majority of cases the exposed, sparse fossil material can be rescued or sampled quickly. If need be, usually it is possible to shift the sand-loading spot temporarily to another position along the mining face. If the mining plan cannot accommodate a temporary (4-8 hours) “no go” at the fossil spot, or a delay in having the fossils professionally excavated is unavoidable, then the position of the material should be noted and photographed. The fossils and enclosing sand should then be carefully removed in bulk and “stockpiled” in a safe area, where it can be dealt with later.

Fossils and the Mine Environmental Management Plan

Ideally, the arrangements for dealing with fossil finds should be formally included in the Environmental Management Plan (EMP) of the mine, with designated persons, agreed action protocols and agreed costing estimates. Such a “palaeontological mitigation” arrangement must be simple and straightforward and cost-effective. Its success hinges on the mutual co-operation and involvement of mine management, the guys at the mining face, the appointed heritage professional and the heritage authorities. At present, understandings and agreements with mine owners/management that personnel are allowed to look out for fossils and report them, and periodic inspection arrangements, are not in place.

A appeal is made to the owners and managers of sand mines to include the above as part of a “Heritage Conservation Plan” with the mine EMP.

A periodic inspection of mine faces (e.g. at least quarterly) should be carried out by a qualified person. Any screened-off coarser fractions and “waste” material should also be inspected, the latter “dirty” or soil-sand layers being of greater fossil potential. The prime motivation is to rescue the uncovered fossils, so that they are not lost and their heritage and scientific value can be realized for the broader community, which is the purpose of the heritage legislation.

The palaeontology of the dune mines, with report-backs on the significance of fossils and other features found in the mine, may be regarded as an enhancement of the mining environment.

Feedback is not just courtesy, but is vital for maintaining interest and involvement. After all, that is the real purpose of rescuing the fossils - to find out and tell people of the land’s history, hidden right under their feet. Some of the wonder will never rub off, which makes earth scientists. Also, the successful finding of fossils should receive publicity that would enhance the company's image, demonstrating social responsibility and respect for the national heritage.

***Contact for reporting fossils: Iziko SA Museum, 021-481 3800.**

Ask for Graham Avery, Deano Stynder, Derek Ohland, Roger Smith.

John Pether, for Heritage Western Cape
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