FINAL BASIC ASSESSMENT REPORT FOR THE PROPOSED PROSPECTING IN SEA CONCESSION AREA 10B BY TRANS ATLANTIC DIAMONDS (PTY) LTD

Trans Atlantic Diamonds (Pty) Ltd
Office 1603 Portside
4 Bree Street
Cape Town, Western Cape, 8001

TRANS ATLANTIC DIAMONDS

Appendix 4:

Heritage Specialist Study

Anchor Environmental Consultants
8 Steenberg House, Silverwood Close, Tokai, South Africa
www.anchorenvironmental.co.za

ANCHOR environmental

MARITIME ARCHAEOLOGICAL IMPACT ASSESSMENT FOR PROSPECTING RIGHTS APPLICATION: SEA CONCESSION AREA 10B, WEST COAST, WESTERN & NORTHERN CAPE PROVINCES

Assessment conducted under Section 38 (8) of the
National Heritage Resources Act (No. 25 of 1999) as part of a Basic Assessment

Prepared for

Anchor Environmental Consultants (Pty) Ltd

On behalf of

Trans Atlantic Gem Sales DMCC

Draft for Comment: 29 August 2022

ACO Associates cc
Archaeology and Heritage Specialists

Prepared by

John Gribble

ACO Associates cc

Physical: c/o 8 Jacobs Ladder St James, 7945
john.gribble@aco-associates.com
Cell: 078 616 2961

EXECUTIVE SUMMARY

ACO Associates cc has been commissioned by Anchor Environmental Consultants (Pty) Ltd on behalf of Trans Atlantic Gem Sales DMCC, to undertake a desktop maritime archaeological impact assessment to support a prospecting right application for Sea Concession Area 10B, which extends from 8 km south of the border between the Western and Northern Cape (southern boundary) to 13 km south of the Groenrivier Lighthouse (northern boundary). The concession area is located between 1000 m and 5000 m below the high water mark.

The proposed prospecting will entail geophysical surveys and grab, core and drill seabed sampling. Of these activities the seabed sampling has the potential to affect submerged heritage resources.

This desktop maritime heritage impact assessment provides an assessment of the maritime and underwater cultural heritage potential of the concession area, within a study defined as a 1 km buffer around the concession area boundary.

Findings:
Although there have been no specific studies of the submerged prehistory of the West Coast, the archaeological evidence for a hominin presence in the vicinity of the study area in the Earlier, Middle and Later Stone Age is plentiful. The past occupation and exploitation of the continental shelf by hominins during periods of lower sea level suggests that archaeological sites and materials can be expected on and within the current seabed that comprises the concession area.

Extensive cemented crusts or “hardgrounds” formed on formations exposed at the seabed during the Neogene and Quaternary. Sea level oscillated repeatedly, dropping to ice-age palaeoshorelines resulting in these hardgrounds being eroded during the ice-age/glacial shallowing episodes and re-cemented again during interglacial deepening. This has produced a wide array of multiphase phosphorite nodules and phosphatic shell casts of various ages. The bones and teeth of sharks and other fishes, the skulls of extinct whale species and the occasional remains of land-living animals that roamed the ice-age exposed shelf are also phosphatized and reworked into the latest, loose sediments from the Last Transgressive Sequence on the seabed.

The marine shell fossils which occur in the Last Transgression Sequence are predominantly the species expected on the West Coast Shelf, but unexpected species and “extralimitals” (species beyond their normal home range) are quite common. Cold water Agulhas extralimitals have mainly been found during diamond sampling/mining off northern Namaqualand but they can be expected to be more abundant further south such as in Concession Area 14A, as well as more species occurring. In addition to dating the incursions on Agulhas current influence, the individual shells are snapshot archives of the palaeoceanographic conditions at the time, as revealed by incremental analyses of stable isotopes and trace elements

The maritime history of the West Coast dates to almost the first days of the Dutch settlement in Table Bay but there are relatively few recorded wrecks in the vicinity of the concession area.

Neither of the two historical wrecks in the area – the *Zulu Coast 1* and *Pembroke Castle* – are within Concession Area 10B or the study area created for this assessment and while the possibility exists for the remains of currently unknown and unrecorded wrecks to be present in the concession area, this is so remote that it has been discounted.

Conclusions:
This assessment of the heritage resources of Concession Area 10B indicates that there may be some potential for submerged prehistoric archaeological material in sediments to be affected by prospecting.

Although the significance of prospecting-related impacts on such material is assessed to be very low, it is recommended that:

- any core or drill sample sections which contain alluvial material, particularly where organic remains are present, are retained for palaeoenvironmental assessment; and
- the possibility is considered of retaining samples of the coarser fraction (i.e. gravel and stone bigger than c. 20 mm) of grab samples for assessment by an archaeologist for the presence of prehistoric lithic material.

These actions would result in the changing of the impact status from negative to positive because of a potential benefit to archaeological research and knowledge that could accrue from access to such information.

With regard to palaeontological resources, fossils found during the processing of grab, core or drill samples must have the details of context recorded, be kept for identification by an appropriate specialist and, if significant, to be deposited in a curatorial institution such as the IZIKO SA Museum. The identification of extralimital, Agulhas “sub-fossil” shell species in the loose shells of the Last Transgression Sequence requires a level of seashell knowledge. The best outcome for a set of cores from this poorly-known area is that they are the subject of a detailed study, possibly as for a B.Sc. Honours or M.Sc. project, with radiocarbon dates.

It is suggested that TAGS engage with the archaeologist and palaeontologist prior to the geotechnical campaign to discuss and agree these proposed mitigation measures.

There appears to be little or no potential for the either of the two historical shipwrecks in the vicinity to be located within the concession area and this heritage receptor was scoped out of the assessment of impact.

In the unlikely event that shipwreck material or seabed debris is identified in the geophysical data to be collected as part of prospecting, or during the prospecting itself, the find must be reported to the archaeologist and SAHRA and then avoided during the sampling programme.

Based on the above, it is our reasoned opinion that the proposed prospecting activities in Concession Area 10B are likely to have a very low impact on submerged prehistoric, palaeontological heritage resources, and no impact on maritime and underwater cultural heritage resources.

Provided the recommendations to mitigate and offset potential impacts are implemented, the proposed prospecting can be considered to be archaeologically and palaeontologically acceptable.

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SPECIALIST DECLARATION

I, John Gribble, declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- There are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24(F) of the Act.

Signature of the specialist

ACO Associates cc

Name of company (if applicable):

30 August 2022

Date

GLOSSARY

Archaeology: Remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures.

Early Stone Age: The archaeology of the Stone Age between 700 000 and 2 500 000 years ago**.**

Heritage: That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999.

Holocene: The most recent geological time period which commenced 10 000 years ago.

Hominin: A member of the tribe Hominini which comprises those species regarded as human, directly ancestral to humans, or very closely related to humans.

Late Stone Age: The archaeology of the last 20 000 years associated with fully modern people.

Marine Isotope Stages: Alternating warm and cool periods in the Earth's paleoclimate, deduced from oxygen isotope data reflecting changes in temperature derived from data from deep sea core samples.

Middle Stone Age: The archaeology of the Stone Age between 20 000-300 000 years ago associated with early modern humans.

Pleistocene: A geological time period (of 3 million – 10 000 years ago).

Quaternary: The current and most recent of the three periods of the Cenozoic Era spanning the period from ± 2.5 million years ago to the present.

SAHRA: South African Heritage Resources Agency – the compliance authority which protects national heritage.

ABBREVIATIONS

BA	Basic Assessment
DMRE	Department of Mineral Resources and Energy
EA	Environmental Authorisation
EEZ	Exclusive Economic Zone
HIA	Heritage Impact Assessment
LSA	Late Stone Age
MPRDA	Mineral and Petroleum Resources Development Act, 2002 (No. 28 of 2002)
MSA	Middle Stone Age
NEMA	National Environmental Management Act (No. 107 of 1998)
NHRA	National Heritage Resources Act
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
UNCLOS	United Nations Convention on the Law of the Sea

1 INTRODUCTION

ACO Associates cc has been commissioned by Anchor Environmental Consultants (Pty) Ltd (Anchor) on behalf of Trans Atlantic Gem Sales DMCC (TAGS), to undertake a desktop maritime archaeological impact assessment to support a prospecting right application for Sea Concession Area 10B, which extends from 8 km south of the border between the Western and Northern Cape (southern boundary) to 13 km south of the Groenrivier Lighthouse (northern boundary) (Figure 1). The concession area is located between 1000 m and 5000 m below the high water mark.

TAGS is applying to the Department of Mineral Resources and Energy (DMRE) for a right to undertake offshore prospecting activities, in terms of Section 16 of the Mineral and Petroleum Resources Development Act, 2002 (No. 28 of 2002) (MPRDA), as amended.

The proposed prospecting activities require Environmental Authorisation (EA) in terms of the National Environmental Management Act, 1998 (No. 107 of 1998) (NEMA), as amended, and an applicant must also comply with Chapter 5 of NEMA with regards to consultation and reporting. For DMRE to consider an application for EA for the proposed prospecting operations, a Basic Assessment (BA) process must be undertaken.

2 PROJECT DESCRIPTION

TAGS's plans to prospect for diamonds, other gemstones, precious metals and ferrous and base metals such as rare earths. The prospecting programme is anticipated to be completed within five years.

Prospecting will be conducted in the following four phases (see Plate 1):

- **Geophysical / Acoustic Survey:** Acoustic equipment is used to ensonify the seabed and the sound energy reflected from the seabed, travels back to a receiver where the received signals are used to create an image or map of the seafloor. This seabed mapping allows the identification of important rock types, target areas for prospecting and highlights sensitive areas such as reefs which need to be avoided.
- **Van Veen Grab sampling:** A Van Veen grab (clamshell bucket) collects surface seabed sediment samples that are analysed to identify benthic macrofauna (small animals such as worms, mussels, and crustaceans) and sediment types. Sampling will be done at 20–50 sites and will disturb a total seabed surface area of 5 m^2 and a total volume of sediment 1.5 m^3. Results from this survey will be used to describe and monitor the baseline benthic communities in the area during and after prospecting and mining.
- **Core sampling:** Core samples will be collected at 100–200 sites. A seabed corer collects seafloor sediment cores used to determine the structure of the seafloor, sediment layers and types of sediment (i.e., sand, gravel and/ or rock and the hardness of the rock). This information is used to engineer the drilling tool. Geotechnical sampling is also used to determine whether there are materials that can be mined in the area and whether it will be economically viable. The core samples will disturb a total surface area of 1.57 m^2 and collect a total volume of 4.71 m^3.

- **Drilling:** Target areas will be sampled using a drill with a surface area of 5m^2. Drilling will be done in three steps:
    - Step 1 - an initial 150 samples will be collected and analysed.
    - Step 2 - an additional 150 samples will be collected during follow-up sampling. Should these follow-up samples indicate that there could be a potential resource, only then will Step 3 (resource development phase) commence.
    - Step 3 - an additional 60 samples will be collected in a resource area of 500 m x 300 m. Approximately 20 resource development areas will be required. This equates to 1,200 samples. In total, 1,500 samples will be collected and will cover a surface area of 7.500 m^2.

A total surface area of 7,507 m^2 (0.75 ha) of seabed will be disturbed during all phases of the proposed prospecting.

The information acquired during prospecting will be used for understanding the seafloor topography and resource evaluation, to determine if mining within Concession Area 10B is economically viable and to identify target areas for mining.

Of the prospecting activities to be undertaken as part of this application it is the seabed coring which has the potential to affect submerged heritage resources.

It is understood that the prospecting right will not provide the required environmental authorisation (EA) to TAGS for mining activities and that any future intention to undertake mining within the application area will require a further application for EA, accompanied by the necessary impact assessment and public consultation process.

3 TERMS OF REFERENCE

As part of the BA process, TAGS has appointed specialists to assess the potential risks of prospecting on the marine environment, heritage resources, commercial fisheries and socio-economic resources within Concession Area 10B.

ACO Associates has been commissioned to produce a Heritage Impact Assessment (HIA) to identify heritage resources which may be impacted by the prospecting activities in the concession area, to assess their significance and provide recommendations for mitigation, as required by the NEMA, as amended.

This document therefore includes the following:

- A desk-top level literature review to assess the potential for maritime archaeological sites, and submerged pre-colonial sites within the concession area; and
- A comment from a palaeontologist regarding the potential for impacts to palaeontological features and material arising from the prospecting in the concession area.

The results of the studies listed above are integrated in this HIA report, along with an assessment of the sensitivity and significance of any heritage resources, an evaluation of the

potential impacts on them arising from prospecting activities in and on the seabed, and recommendations for measures to mitigate any negative impacts of these activities on them.

The HIA must be submitted for comment to the South African Heritage Resources Agency (SAHRA), the relevant statutory commenting body under the NEMA.

Figure 1:The location of Concession Area 10B on the West Coast. The yellow and red lines which bisect the concession area mark the outer edges of South Africa's territorial waters and maritime cultural / contiguous zone respectively (Source: Google Earth).

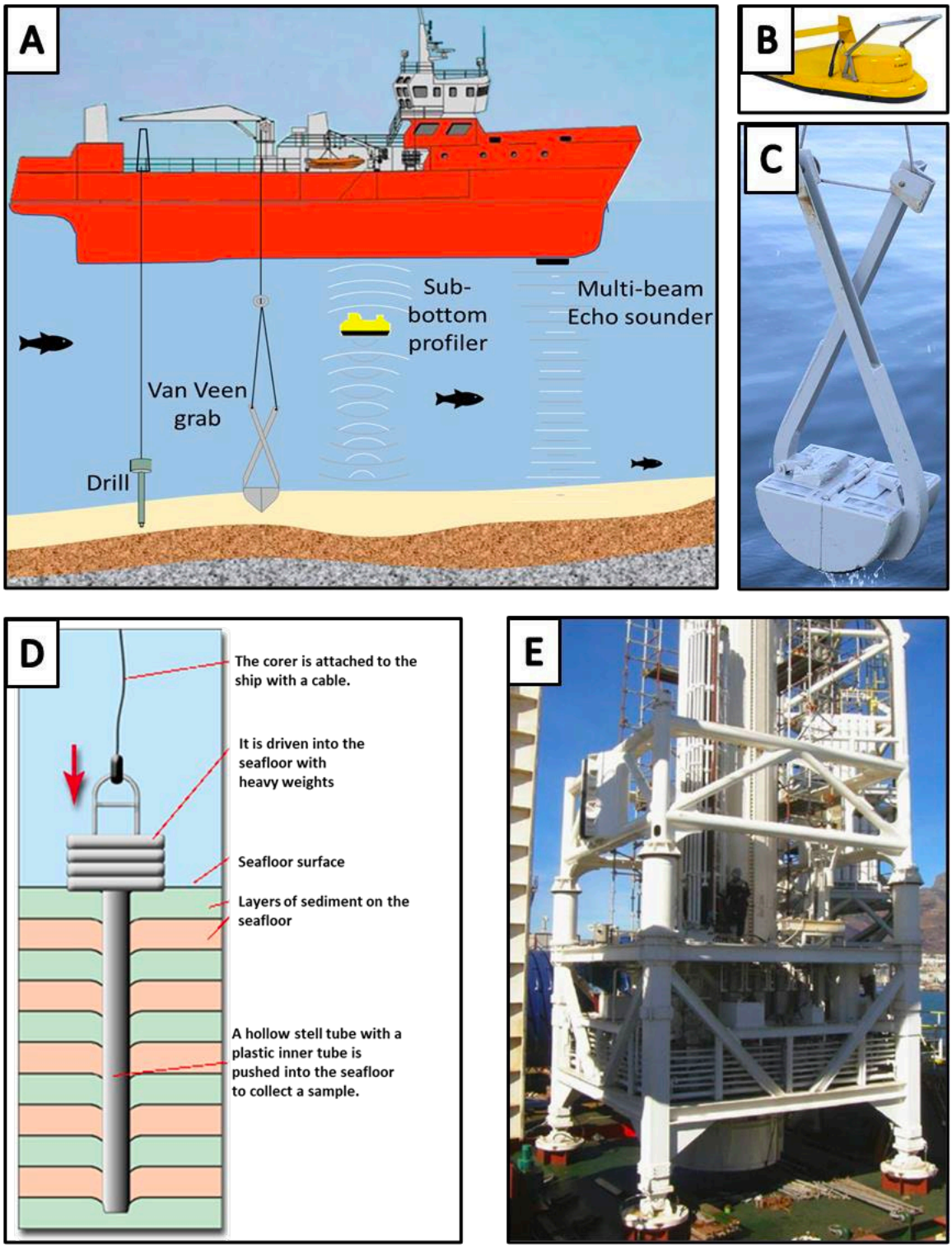

Plate 1: The survey sampling methods that will be used during prospecting in Area 10B. (A) & (B) - acoustic survey equipment, (C) - Van Veen grab, (D) – seabed corers and (E) - a seabed drill rig (After: Anchor Environmental BID, June 2022).

4 RELEVANT LEGISLATION

4.1 National Heritage Resources Act (No 29 of 1999)

The National Heritage Resources Act (NHRA) came into force in April 2000 with the establishment of SAHRA, replacing the National Monuments Act (No. 28 of 1969 as amended) and the National Monuments Council as the national agency responsible for the management of South Africa's cultural heritage resources.

The NHRA reflects the tripartite (national/provincial/local) nature of public administration under the South African Constitution and makes provision for the devolution of cultural heritage management to the appropriate, competent level of government.

Because national government is responsible for the management of the seabed below the mean high water mark, however, the management of maritime and underwater cultural heritage resources under the NHRA does not devolve to provincial or local heritage resources authorities but remains the responsibility of the national agency, SAHRA.

The NHRA gives legal definition to the range and extent of what are considered to be South Africa's heritage resources. According to Section 2(xvi) of the Act a heritage resource is "any place or object of cultural significance". This means that the object or place has aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance.

In terms of the definitions provided in Section 2 of the NHRA, maritime and underwater cultural heritage can include the following sites and/or material relevant to this assessment:

- Material remains of human activity which are in a state of disuse and are in or on land [which includes land under water] and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures (Section 2(ii));
- Wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the Republic, a defined respectively in sections 3, 4 and 6 of the Maritime Zones Act, 1994 (Act No. 15 of 1994), and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation (Section 2(ii)); and
- Any movable property of cultural significance which may be protected in terms of any provisions of the NHRA, including any archaeological artefact or palaeontological specimen (Section 2(xxix)).

Of the heritage resource types protected by the NHRA, the proposed prospecting in Concession Area 10B has the potential to impact the following:

- Submerged pre-colonial archaeological sites and materials;
- Maritime and underwater cultural heritage sites and material, which are principally historical shipwrecks; and

- Palaeontological features and material, which are defined by the NHRA as the fossilised remains or fossil trace of animals or plants which lived in the geological past.

As per the definitions provided above, these cultural heritage resources are protected by the NHRA and a permit from SAHRA is required to destroy, damage, excavate, alter, deface or otherwise disturb any such site or material.

It is also important to be aware that in terms of Section 35(2) of the NHRA, all archaeological objects and palaeontological material is the property of the State and must, where recovered from a site, be lodged with an appropriate museum or other public institution.

4.2 Maritime Zones Act (No 15 of 1994)

South Africa's Maritime Zones Act of 1994 is the national legislative embodiment of the international maritime zones set out in the United Nations Convention on the Law of the Sea (UNCLOS). The Act defines the extent of the territorial waters, contiguous zone, exclusive economic zone (EEZ) and continental shelf (which together comprises of some 4.34 million square kilometres of seabed) and sets out South Africa's rights and responsibilities in respect of these various maritime zones.

Under the terms of Sections 4(2) and 6(2) of the Maritime Zones Act respectively, "any law in force in the Republic, including the common law, shall also apply in its territorial waters" and "subject to any other law the Republic shall have, in respect of objects of an archaeological or historical nature found in the maritime cultural zone, the same rights and powers as it has in respect of its territorial waters". The NHRA applies, therefore, within South Africa's territorial waters (12 nautical miles seaward of the baseline) and to the outer limit of the maritime cultural zone (24 nautical miles seaward of the baseline) (see Figure 1 above).

Concession Area 10B lies wholly within South Africa's territorial waters. Any offshore activities that have the potential to disturb or damage cultural heritage resources located in or on the seabed within the territorial waters require the involvement of SAHRA, as a commenting body in respect of the NEMA basic assessment process (see below) and as permitting authority where impacts to sites or material cannot be avoided and mitigation will be required.

4.3 National Environmental Management Act (Act No 107 of 1998)

The National Environmental Management Act (No 107 of 1998) (NEMA) provides a framework for the integration of environmental issues into the planning, design, decision-making and implementation of plans and development proposals that are likely to have a negative effect on the environment.

Regulations governing the environmental authorisation process have been promulgated in terms of NEMA and include the EIA Regulations (GNR R326/2017) and Listing Notices (LN) 1-3 (R327, R325 and R324) that list activities requiring an EA.

The proposed prospecting in Concession Area 10B triggers activities listed in LN3 and requires an application for EA that follows the Basic Assessment process.

The BA process aims to identify and assess all potential environmental impacts (negative and positive) and the BA report should recommend how potential negative impacts can be effectively mitigated and how benefits can be enhanced.

5 METHODOLOGY

This desktop HIA provides an assessment of the maritime and underwater cultural heritage potential of Concession Area 10B within the study area defined in Section 5.1 below.

The report includes a short description of what comprises South Africa's maritime and underwater cultural heritage and the maritime history of west coast, and a discussion of potential maritime heritage resources of the concession area within that wider context. This includes potential pre-colonial archaeological sites and materials in offshore, submerged contexts.

The HIA draws information from readily available documentary sources and databases, including SAHRA's Maritime and Underwater Cultural Heritage database, a database of underwater heritage resources maintained by ACO Associates, and from relevant primary and secondary sources. It aims to identify as accurately as possible the maritime heritage resources within the concession area.

Recent reports from the wider area by the palaeontologist Dr John Pether have been used to assess the potential for prospecting to impact on submerged palaeontological resources (see Section 6.2 below).

An assessment of the potential impacts of the proposed prospecting on maritime and underwater cultural heritage resources is provided and this is supported by recommendations for measures to mitigate possible impacts arising from prospecting operations in the concession area.

5.1 Maritime Study Area

The study area for this HIA is defined as a 1 km buffer around the concession area boundary (Figure 2).

5.2 Limitations

South Africa's record of maritime and underwater cultural heritage resources is based on a mix of information derived in the main from historical documents and other secondary sources and from very limited primary sources such as geophysical data and other field-based observations and site recordings. Similarly, direct evidence for submerged pre-colonial archaeological sites and materials on the South African continental shelf is very limited, but sites found in similar offshore contexts elsewhere in the world and the known terrestrial archaeology of the West Coast illustrate the potential for such sites around our coast.

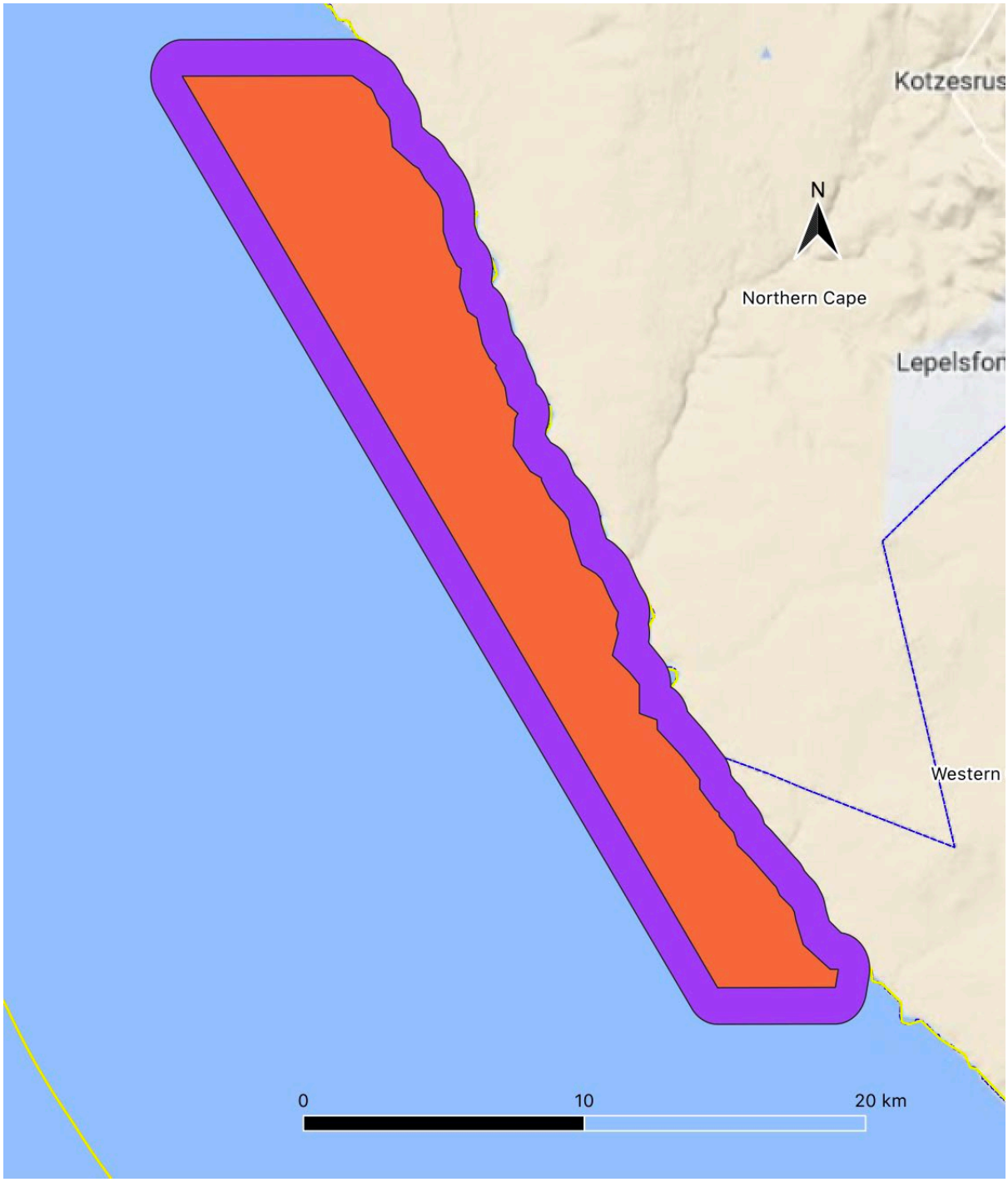

Figure 2: The 1 km buffer (purple polygon) around Concession Area 10B (orange polygon) that defines the Study Area used for this HIA (Source: Google Earth).

While every effort has been made to ensure the accuracy of the information presented below, the reliance on secondary data sources means that there are considerable gaps and inaccuracies in this record and the locations of most of the wrecks referred to in the following sections are approximate.

The potential also exists for currently unknown and/or unrecorded maritime heritage sites to be encountered within the concession area in the course of prospecting activities.

6 UNDERWATER CULTURAL HERITAGE

South Africa has a rich and diverse underwater cultural heritage. Strategically located on the historical trade route between Europe and the East, South Africa's rugged and dangerous coastline has witnessed more than its fair share of shipwrecks and maritime dramas in the last 500 years. At least 2,500 vessels are known to have sunk, grounded, or been wrecked, abandoned or scuttled in South African waters since the early 1500s.

This doesn't include the as yet unproven potential for shipwrecks and other sites that relate to pre-European, Indian Ocean maritime exploration, trade and interactions along the South African east coast, or the potential for wrecks of vessels which simply disappeared between Europe and the East to be present in our waters.

The record of South Africa's long association with the sea is much broader that historical shipwrecks. It extends far back into prehistory and is represented around the South African coast by thousands of pre-colonial shell middens and large numbers of tidal fish traps. These reflect a continuum of human human exploitation of marine resources since the Middle Stone Age (MSA), more than 150,000 years ago into the present.

The pre-colonial element of our coastal maritime heritage also has a largely unexplored, but increasingly acknowledged manifestation in the submerged, offshore environment, consisting of pre-colonial terrestrial archaeological sites and palaeolandscapes which are now inundated by the sea.

This assessment considers the potential for submerged prehistoric archaeological resources, palaeontological resources and historical shipwrecks in Concession Area 10B.

6.1 Submerged Prehistory

Since the start of the Quaternary, approximately 2.6 million years ago, the world has been subject to a series of cooling and warming climatic cycles in which sea level was generally lower than it is today.

During the last 900,000 years, global sea levels have fluctuated substantially on at least three occasions, the result of increased and decreased polar glaciation. The dropping of sea levels was caused by the locking up in the polar ice caps of huge quantities of seawater as global temperatures cooled. The most extreme recent sea level drop occurred between circa 20,000 and 17,000 years ago when during Marine Isotope Stage 2 (MIS) at the height of the last glaciation, the sea was more than 120 m lower than it is today (Waelbroeck *et al*, 2002; Rohling *et al*, 2009).

As with the MIS 2 low sea level stand, those which corresponded with MIS 4 (~70,000 years ago), MIS 6 (~190,000 years ago), MIS 8 (~301,000 years ago) and MIS 12 (~478,000 years ago) would have "added a large coastal plain to the South African land mass" (Van Andel, 1989:133) where parts of the continental shelf were exposed as dry land (see Cawthra *et al*, 2016) (Figure 3).

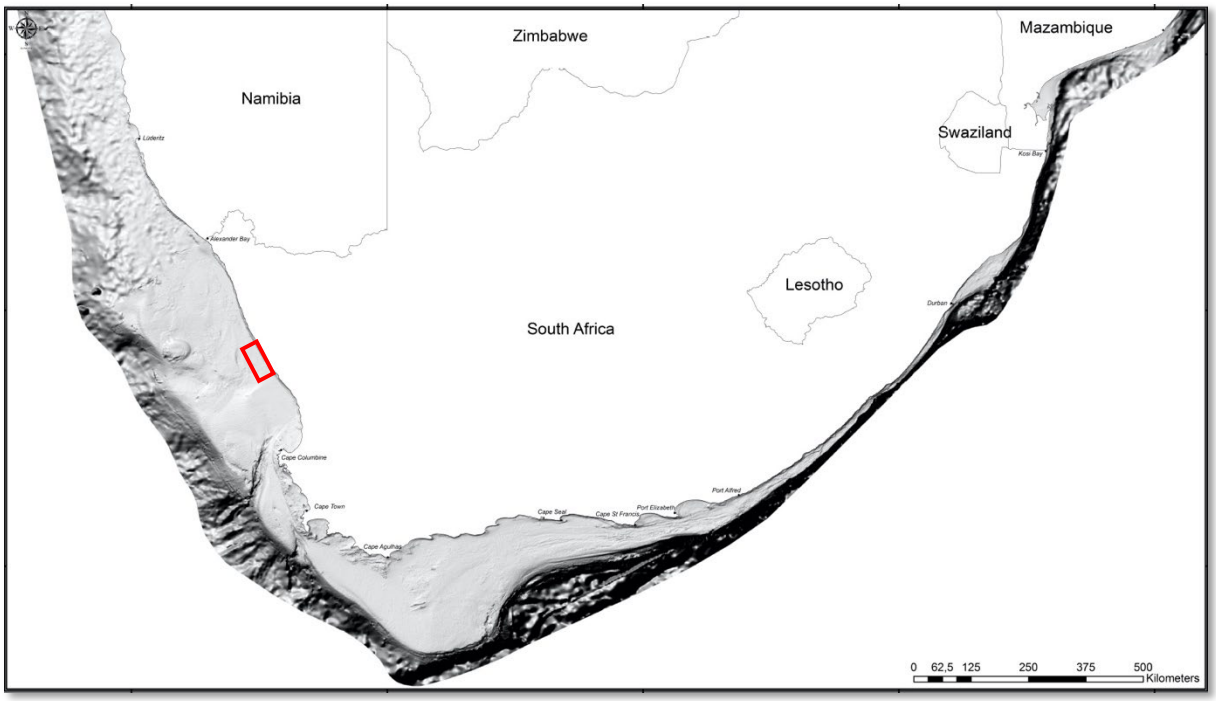

Figure 3: Shaded relief map showing the entire extent of the South African continental shelf. The approximate location of Concession Area 10B is marked by the red box (After De Wet 2012:106).

The exposure of the continental shelf would have been most pronounced on the wide Agulhas Bank off the southern Cape coast, and it is estimated that a new area of land, as much as 80,000 km^2 in extent, was exposed during the successive glacial maxima (Fisher *et al*, 2010)

The exposed continental shelf was quickly populated by terrestrial flora and fauna, and also by our human ancestors who were dependant on these resources (Compton, 2011). As a result, for periods numbering in the tens of thousands of years, on at least three occasions during the last 500,000 years, our ancestors inhabited areas of what is now seabed around the South African coast. This means that a large part of the archaeological record of the later Earlier, Middle and early Late Stone Age is located on the continental shelf and is now "inundated and for all practical purposes absent from [that] record" (Van Andel, 1989:133-134).

Until relatively recently there was little or no access to the submerged prehistoric landscapes and sites on the continental shelf, although discoveries in various parts of the world of drowned, formerly terrestrial landscapes is providing increasing evidence for the survival of prehistoric archaeological sites on and within the current seabed (see Benjamin *et al*, 2011).

Well-known example of such evidence include archaeological material and late Pleistocene faunal remains recovered in the nets of fishing trawlers in the North Sea between the United Kingdom and the Netherlands throughout the 20th century (Peeters *et al*, 2009; Peeters, 2011) and the University of Birmingham's archaeological interpretation of 3D seismic data, collected in the same area by the oil and gas industry, which has revealed well-preserved prehistoric landscape features across the southern North Sea (Fitch *et al*, 2005, Gaffney *et al*, 2010).

Closer to home, there is archaeological evidence for a prehistoric human presence in what is now Table Bay. In 1995 and 1996 during the excavation of two Dutch East India Company shipwrecks, the *Oosterland* and *Waddinxveen*, divers recovered three Early Stone Age (ESA) handaxes from the seabed under the wrecks. The stone tools, which are between 300,000 and 1.4 million years old, were found at a depth of 7-8 m below mean sea level and were associated with Pleistocene sediments from an ancient submerged and infilled river channel (Figure 4). Their unrolled and unworn condition indicate that they had not been carried to their current position by the ancient river and suggests that they were found more or less where they were dropped ESA hominins more than 300,000 years ago (possibly during MIS 8 (~301,000 years ago) or MIS 12 (~478,000 years ago)), when the sea level was at least 10 m lower than it is today (Werz and Flemming, 2001; Werz *et al*, 2014).

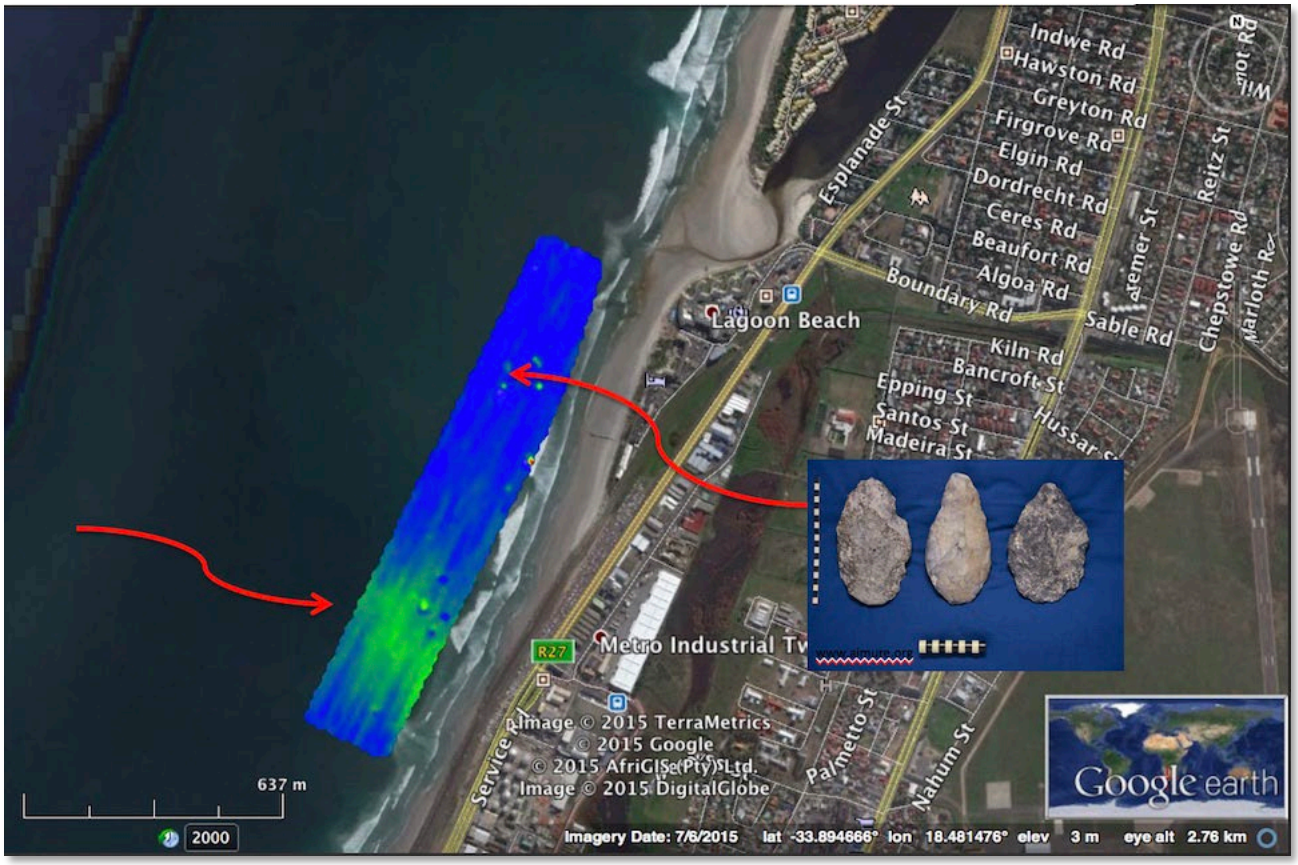

Figure 4: Location of the find of Table Bay ESA handaxes (inset) off Milnerton (top arrow) overlain on magnetometer data which shows the submerged palaeo-channel (green) of the Salt River (bottom arrow).

6.1.1 Submerged Prehistory Potential of Concession Area 10B

There have been no specific studies of the submerged prehistory of the West Coast. However, the archaeological evidence for a hominin presence along the coast in the vicinity of the study area during the Earlier, Middle and Later Stone Age (LSA) is plentiful.

Diepkloof Rock Shelter, inland of Elands Bay and south-east of the concession area, for example, contains evidence of a nearly continuous human occupation for nearly 85,000 years (see Parkington and Poggenpoel, 1987; Texier et al, 2010), while Elands Bay Cave, on the

coast at the mouth of the Verloren Vlei, preserves archaeological evidence of the Pleistocene / Holocene transition during the LSA (Parkington, 1988).

Further south at Hoedjiespunt in Saldanha Bay, four hominid teeth, four or five small fragments of cranium, and two postcranial bones from one or two individuals have been found in an ancient hyena lair and are associated with uranium series dates on ostrich eggshell fragments which imply an ESA / MSA age of 130,000 to 180,000 years for the hominids (Berger and Parkington, 1996).

Nearby, at Churchaven on the Langbaan Lagoon a set of fossilized human footprints were discovered in an aeolianite slab in 1995. They are thought to be those of a female human (hence their nickname “Eve’s footprints”) and have been dated to approximately 117,000 years ago, during the MSA and very close to the start of the last glaciation when sea levels would have been starting to drop (see http://www.sawestcoast.com/fossileve.html).

LSA coastal shell middens are ubiquitous along the West Coast, as are numerous MSA shell middens; the latter being some of the earliest evidence in the world for the exploitation by our ancestors of marine resources. Older, ESA lithics are also commonly found along on the West Coast. Examples of both these types of sites been reported from the Tronox Namaqua Sands mining area around Brand se Baai, immediately to the south of the concession area (David Halkett ACO Associates, pers. comm.).

As discussed in the previous section, the maximum sea level low stand during the Quaternary, when hominins would have been present on the South African landscape, was -120 m. Thus, any areas of South Africa’s current seabed shallower than -120 m have the potential to have been used by our ancestors and to preserve in seabed sediment the archaeological evidence of that use.

The whole of Concession Area 10B lies in less than 100 m of water and there is thus the potential for the preservation within the area of submerged pre-colonial archaeological material (see Figure 5).

Although no geophysical data are yet available for Concession Area 10B, seabed sediment mapping by O’Shea (1971) further up the coast at Kleinzee indicates that a channel cut by the palaeo-Buffels River extends offshore to the west of Kleinzee while further up the coast, “submerged fluvial channels extending seawards from Langklip Bay and between Hondeklip Bay and the Swartlintjies River are clearly indicated by the bathymetry” (Hattingh, 2015:5).

These channels and their associated sediment bodies have the potential for associated, now submerged, archaeological material and palaeoenvironmental evidence and are illustrative of the likely situation with many of the other major rivers that feed into the Atlantic along the West Coast and which have submerged palaeo-channels extending offshore, including the Olifants River south of Concession Area 10B. These channels are an important target for diamond mining as they are often the source of and contain diamondiferous gravel.

Figure 5: Seabed bathymetry of Concession Area 10B showing that the area lies above the -100 m contour and thus has the potential for preserving submerged pre-colonial archaeological remains (Source: Trans Atlantic Diamonds (Pty) Ltd).

During times of lower sea level in the past, the palaeo-rivers along the West Coast would have flowed across the exposed continental shelf and these ancient river courses, whose channels are today buried under more recent seabed sediment, would have been an important focus for hominin activity on the exposed continental shelf.

As demonstrated in Table Bay, there is the potential for the occurrence of ancient, submerged archaeological material in association with palaeo-river channels. This may take the form of archaeological artefacts or, where ancient alluvial sediment within these channels has

survived post-glacial marine transgressions, there is the potential to recover palaeoenvironmental data (pollens, foraminifera and diatoms, for example) which can contribute contextual information to our understanding of the ancient human occupation of South Africa.

6.2 Seabed Geology and Palaeontology

The following description of the geology of the affected formations on the continental shelf and their palaeontological potential in the vicinity of the concession area is drawn from previous reports and comments provided by Dr John Pether (2021).

The seabed geology of the continental shelf within Concession Area 10B shows successively younger formations seawards from the coast. Cretaceous and Paleogene units comprise the main bulk of the bedrock geology of the area and are succeeded by cappings of Miocene and Pliocene units.

These bedrock formations comprise the “footwall” to overlying, much younger late Quaternary to present-day deposits which, for the most part, form a more or less soft veneer over the continental shelf.

Seabed sediment distribution on the inner continental shelf is patchy and largely determined by the topography of the bedrock, with mini-basins of sediments interspersed by bedrock high outcrops. The oldest seabed deposits preserved occur in deeper, local bedrock depressions and palaeochannels in the Precambrian bedrock, beneath the latest Quaternary basal gravels.

Pether (2021) suggests that there are several permutations for what type of seabed deposits might be preserved, and these largely depend on the space (depth) within the depressions and position on the shelf. These may include earlier-Quaternary marine conglomerates and sandstones as remnants that escaped erosion during the latest transgression from the Last Ice Age (Last Glacial Maximum) low sea level.

Pether’s idealized sequence in a deeper bedrock depression on the inner shelf may include all or part of the following (refer to Figure 6):

- Unit 1 - a gravel deposited during the MIS5/6 transgression ~135 ka.
- Unit 2 - a succeeding muddy shelf sand deposited during the Last Interglacial sea level highstand.
- Unit 3 - a shelly, variously-cemented sandstone deposited during the subsequent regression (MIS 5a and 4), constituting the basal unit of the Last Regression Sequence.
- Unit 4 - Subsequent terrestrial deposits that may include colluvium, pan deposits and dune sands, with land snails, possible animal remains and perhaps archaeological material, capped by a soil and/or incipient calcrete (MIS 3 and 2).
- Unit 5 - an erosion surface overlain by the basal gravel of the Last Transgression Sequence (early MIS 1).
- Unit 6 - succeeding shelly sand fining up to muddy shelf sand (current interglacial highstand, later MIS 1).

For the most part, however, the inner-shelf bedrock is overlain only by the Last Transgression Sequence basal gravel (Unit 5) and the shelf upward-fining sediments (Unit 6).

6.2.1 Palaeontology of Concession Area 10B

During the later Neogene and Quaternary, the continental shelf of the West Coast was dominated by upwelling processes, with high organic productivity and authigenic mineralization of seabed rocks, clays and biogenic particles by phosphatization and glauconization. Extensive cemented crusts or “hardgrounds” formed on formations exposed at the seabed.

Sea level oscillated repeatedly, during the period, dropping to ice-age palaeoshorelines as much as 140 m below present sea level. The seabed hardgrounds were eroded during the ice-age/glacial shallowing episodes and re-cemented again during interglacial deepening.

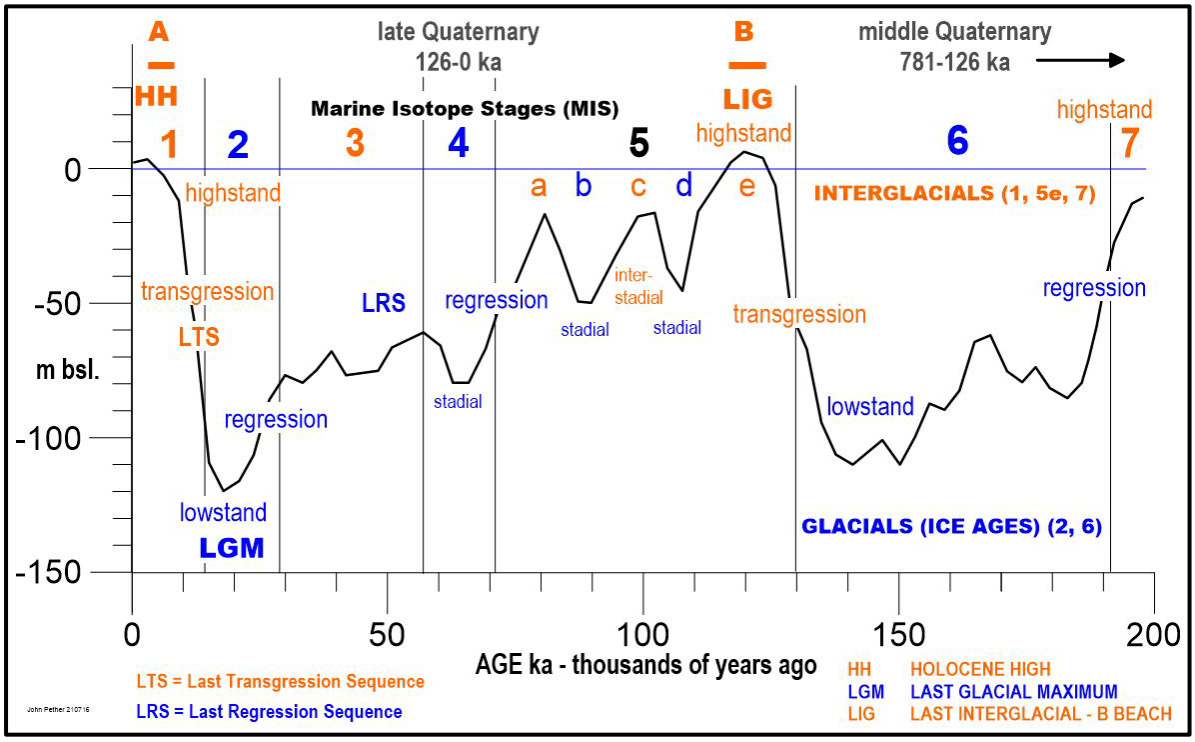

Figure 6: Sea level history and palaeoclimatic nomenclature for the last 200 ka (After Pether, 2021)

This has produced a wide array of multiphase phosphorite nodules and phosphatic shell casts of various ages. The bones and teeth of sharks and other fishes, the skulls of extinct whale species and the occasional remains of land-living animals that roamed the ice-age exposed shelf are also phosphatized and reworked into the latest, loose sediments from the Last Transgressive Sequence (Unit 5) on the seabed.

Samples of this reworked material turns up in bottom-trawl fishnets, scientific dredging and during diamond-mining operations and the specimens which have been donated to scientific institutions have been invaluable contributions to our knowledge of the palaeontological potential of the continental shelf.

The marine shell fossils which occur in the Last Transgression Sequence are predominantly the species expected on the West Coast Shelf, but unexpected species and “extralimitals” (species beyond their normal home range) are quite common. For instance, the Last Ice Age palaeoshoreline gravels are dominated by a “Venus shell” clam, *Tawera philomela*. This cold-water species, along with others, reached the Cape coast from the mid-Atlantic islands of Tristan da Cunha and Gough, apparently thrived here and then became extinct locally during the last deglaciation (Pether, 1993). During the subsequent deglaciation/warming, several warm-water species from the south and east coasts “invaded” the western shelf temporarily.

This shows a more marked influence of Agulhas water rounding the Cape and affecting the Benguela System during the global-warming steps of the last deglaciation (Pether, 1994). These Agulhas extralimitals have mainly been found during diamond sampling/mining off northern Namaqualand but they can be expected to be more abundant further south such as in Concession Area 10B, as well as more species occurring. In addition to dating the incursions on Agulhas influence, the individual shells are snapshot archives of the palaeoceanographic conditions at the time, as revealed by incremental analyses of stable isotopes and trace elements.

6.3 Maritime History of the South African Coast

In 1498 the Portuguese captain Vasco da Gama finally pioneered the long-sought sea route around Africa from Europe to the East. Since then, the southern tip of the African continent has played a vital role in global economic and maritime affairs, and until the opening of the Suez Canal in 1869, represented the most viable route between Europe and the markets of the East (Axelson, 1973; Turner, 1988; Gribble, 2002; Gribble and Sharfman, 2013).

The South African coast is rugged, and the long fetch and deep offshore waters mean that the force and size of seas around the South African coast are considerable, a situation exacerbated by prevailing seasonal winds.

The geographical position of the South African coast on the historical route to the East and the physical conditions mariners could expect to encounter in these waters have, in the last five centuries, been responsible for the large number of maritime casualties which today form the bulk of South Africa’s maritime and underwater cultural heritage (Gribble, 2002).

At least 2,500 vessels are known to have sunk, grounded, or been wrecked, abandoned or scuttled in South African waters since the early 1500s. More than 1,900 of these wrecks are more than 60 years old and are thus protected by the NHRA as archaeological resources. This list is by no means complete and does not include the yet unproven potential for shipwrecks and other sites that relate to pre-European, Indian Ocean maritime exploration, trade and interactions along the South African east coast.

For obvious historical reasons, the earliest known South African wrecks are Portuguese, dating to the sixteenth century when that country held sway over the route to the East. Due to the later, more prolonged ascendancy of first the Dutch and then the British in European trade with the East and control at the Cape, the majority of wrecks along the South African coast

are Dutch and British. However, at least 36 other nationalities are represented amongst the other wrecks that litter the coast.

Da Gama's maritime incursion into the Indian Ocean laid the foundation for more than 500 years of European maritime activity in the waters off the South African coast. The Portuguese and other European nations who followed their lead around the Cape and into the Indian Ocean, however, joined a maritime trade network that was thousands of years old and in which east and south-east Africa was an important partner.

This trade spanned the Indian Ocean and linked the Far East, South-East Asia, India, the Indian Ocean islands and Africa. Archaeological evidence from Africa points to an ancient trade in African products – gold, skins, ivory and slaves – in exchange for beads, cloth, porcelain, iron and copper. The physical evidence for this trade includes Persian and Chinese ceramics excavated sites on African Iron Age like Khami, Mapungubwe and Great Zimbabwe (see Garlake, 1968, Huffman, 1972, Chirikure, 2014), glass trade beads found in huge numbers on archaeological sites across eastern and southern Africa (Wood, 2012).

There is shipwreck evidence on the East African coast for this pre-European Indian Ocean trade (see for example Pollard et al 2016) and clear archaeological and documentary evidence that this trade network extended at least as far south as Maputo in Mozambique. This suggests that there is the potential for shipwrecks and other sites that relate to pre-European, Indian Ocean maritime exploration, trade and interactions to exist along the South African east coast and offshore waters.

The more than 2,500 historical shipwrecks that make up the bulk of South Africa's underwater cultural heritage are a thus huge, cosmopolitan, repository of information about mainly global maritime trade during the last five centuries and potentially much further back into the past. These sites contain a wealth of cultural material associated with that trade and clues to the political, economic, social and cultural changes that accompanied this trade, and which contributed to the creation of the modern world.

6.3.1 Maritime Heritage of the West Coast and Concession Area 10B

The maritime history of the West Coast dates to almost the first days of the Dutch settlement in Table Bay. The Dutch settlers were quick to recognise and exploit the rich marine resources of the West Coast and fishing and sealing flourished, with the catches transported down the coast to supply the VOC settlement in Table Bay. This industry led to the development of fishing villages at Saldanha Bay and Lamberts Bay: the former, together with places like Elands Bay, also later becoming ports for the export of grain and other produce from the Swartland and Cederberg (Ingpen 1979).

For a period during the 18th century an international ship-based whale fishery developed in and around St Helena Bay (Sleigh, 1993) and then in the early nineteenth century the West Coast islands became the focus of an international 'white gold' rush to exploit their rich guano resources. The guano was soon depleted but the discovery of rich copper deposits in Namaqualand and the Richtersveld led to the use of Alexander Bay, Robbe Bay (now Port Nolloth) and Hondeklip Bay by the early 1850s and the development of local, coasting shipping

services to support this new industry (The Nautical Magazine and Naval Chronicle 1855: 297-303; Ingpen 1979).

Except for Saldanha Bay, the West Coast historically lacked good harbours. Combined with the regular coastal fogs, a largely rocky shoreline and dangerous inset currents this took its toll on shipping over the years.

According to SAHRA's Maritime and Underwater Cultural Heritage database, the national record of underwater cultural heritage curated on the South African Heritage Resources Information System (SAHRIS) (http://www.sahra.org.za/sahris), there are at least 89 shipping casualties recorded between the Berg and Orange Rivers, many of which were vessels involved in coastal trade and fishing.

Two of these maritime casualties took place close to Concession Area 10B and may lie shoreward of the eastern boundary of the concession area (Figure 9). Both wrecks are discussed below and included in Table 1.

Table 1: Shipwrecks in the vicinity of Concession Area 10B.

Ship Name	Approximate Position	Place	Event Type	Vessel Category	Nationality	Year	Notes
Pembroke Castle	-31.1024S 17.7218E	Groen River (south of)	Wrecked	Iron barque	British	1890	Wrecked in fog
Zulu Coast 1	-31.1821S 17.7720E	Groen River Mouth (near)	Wrecked	Motor coaster	South African	1953	Wrecked in fog about 60 km south of Hondeklip Bay

The *Pembroke Castle* was a 410 ton iron barque bult in Glasgow in 1863 and owned, at the time if its loss, by Simpson Brothers. The vessel was *en route* from South America to Port Nolloth to load copper ore when it ran aground a short distance south of the Groen River in thick fog. All aboard got off safely, but the vessel became a total wreck. A subsequent court of enquiry Captain Thomas of the *Pembroke Castle* was found responsible for the loss and lost his captain's ticket for six months (Reck, no date).

Two references to the loss suggest different potential locations for the wreck of the *Pembroke Castle*. According to records held by ACO and the SAHRA database, the wreck is off the Brak River mouth, within the 1 km study area buffer and shoreward of the concession area. Reck (no date) reports that the wreck is close to Morral Point, also known as Island Point, approximately 8 km south of the Groen River and 5,5 km north of the concession area.

The *Zulu Coast 1* (previously *Carrick Coast* and *Zulu*) (Plate 2) was a South African registered motor coaster of 380 tons, commanded by Captain Patterson and operated by Coast Ltd. on behalf of the Thesen Line. She left Cape Town for Port Nolloth with 400 tons of general cargo on 6 April 1953. Late the following afternoon she ran aground in thick fog. The vessel was hard aground, and the engine room flooded. She developed a severe list to port and any hope of refloating her was quickly abandoned. The crew of 14 were rescued the following day (Reck, no date; Ingpen, 1979).

The location of the wreck is not clear. The position in the ACO wreck database shown on Figure 7 below was supplied by Van der Bosche and places it inshore of the southern portion of Concession Area 10B. Ingpen (1979) and the *Carrick Coast* entry on http://www.clydeships.co.uk, however, suggest the wreck occurred north of the Groen River, which would place it at least 15 km north of the concession area.

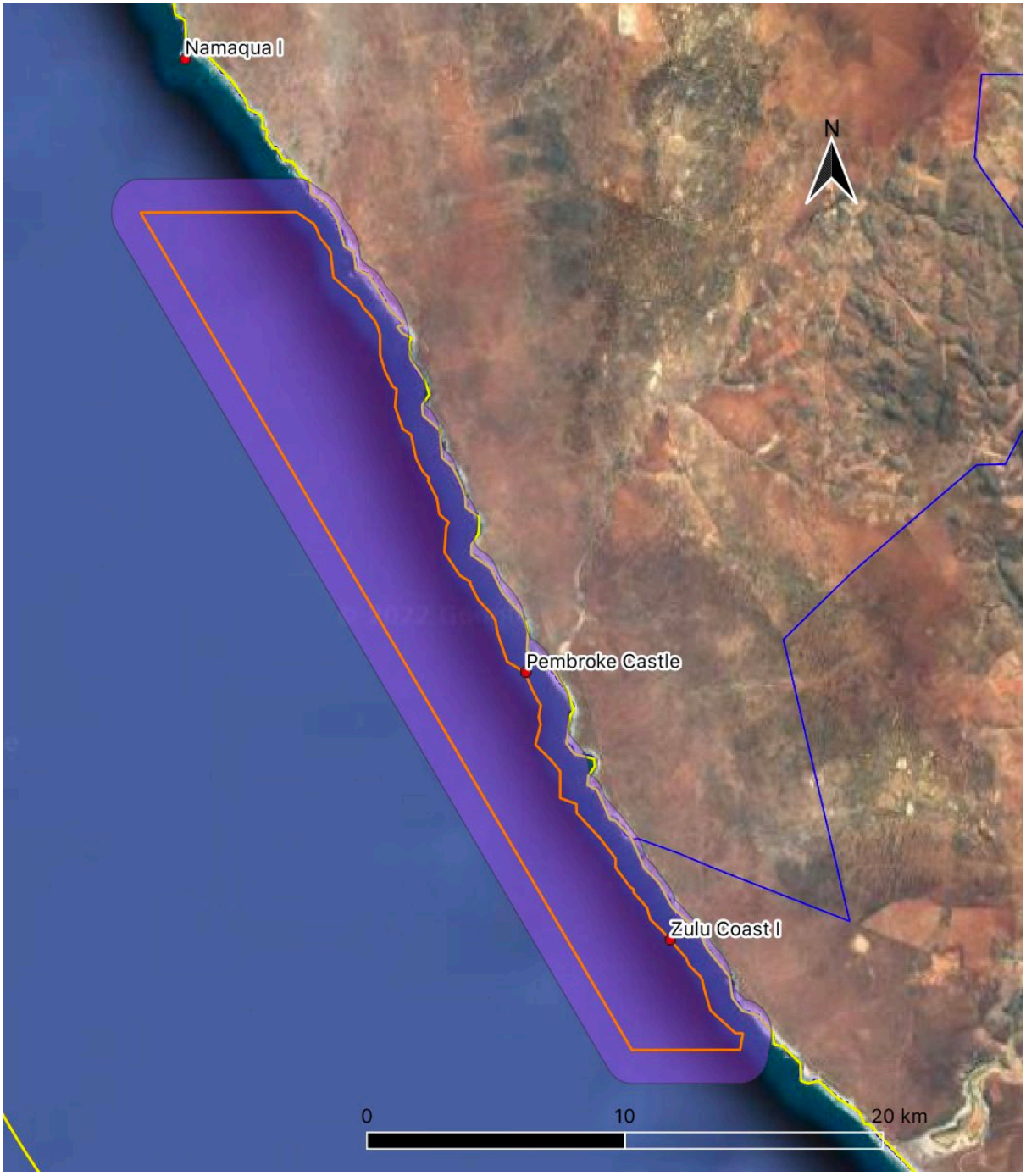

Figure 7: Known historical wrecks around Concession Area 10B. Reck (ND) reports that the *Pembroke Castle* is wrecked close to the *Namaqua 1*, north of and outside the concession area and 1 km study area buffer, while Ingpen and http://www.clydeships.co.uk suggest that the Zulu Coast 1 was wrecked north of the Groen River, which would place it at least 15 km north of the concession area (Source: Source: Google Earth).

Plate 2: *Zulu Coast 1* (ex *Carrick Coast* and *Zulu*) (Source: http://www.clydeships.co.uk/view.php?ref=812#v)

Both the *Pembroke Castle* and *Zulu Coast 1* are older than 60 years of age and thus protected by the NHRA as heritage resources. For the purposes of this impact assessment, however, the descriptions of the loss of both vessels, namely the fact that they ran ashore and grounded, indicates that it is unlikely that either of these wrecks lies within Concession Area 10B.

Lastly, it must be stated that although unlikely, the possibility does exist for the remains of currently unknown and unrecorded wrecks to be present in the concession area. The historical records contain many references to vessels that were lost without trace between their points of departure and arrival. Where survivors of such events were subsequently rescued, the loss was recorded, but in many cases, vessels simply never arrived at their destination and could thus lie anywhere along their intended route. The potential for the occurrence of such unrecorded wrecks was illustrated in 2008 when a 16th century Portuguese wreck, since identified as the *Bom Jesus*, was unexpectedly found during the diamond mining south of Oranjemund in Namibia (see Alves 2011).

7 IMPACT ASSESSMENT

Potential impacts associated with prospecting in Concession Area 10B relate to submerged prehistoric and maritime archaeological heritage resources, and possibly, palaeontological features and fossil material.

In all cases impacts can arise where interventions on and in the seabed intersect with heritage resources – either directly where sites or material are damaged or disturbed by activities such as the grab, core and drill sampling and being proposed, or indirectly where downstream effects of seabed activities can affect sites or material. That said, the small footprint of the sampling associated with the proposed prospecting is very unlikely to cause downstream effects on the surrounding seabed.

The three proposed sampling methods have the following potential footprints on and in the seabed:

- Grab sampling will be undertaken using a Van Veen clamshell grab. This grab typically samples the upper 20 cm of seabed sediment and has a physical footprint, per sample, of 0,1 m^2. The footprint of the proposed maximum of 50 samples will be very small,

disturbing a total seabed area of 5 m^2 and recovering a total volume of approximately 1.5 m^3 of sediment.

- Seabed core sampling will be undertaken using coring apparatus deployed from a dedicated sampling vessel. The potential coring methods are all based on the insertion of a plastic sleeve or casing, varying between 7 and 15 cm in diameter, into the seabed, using either high frequency, resonant energy generated inside the sonic head or vibration from the coring head. When the sleeve is extracted from the seabed it contains a sediment core which provides a record of the stratigraphy of the top 3-5 m of the seabed.
- The seabed drilling rig used for this type of sampling is typically deployed on several spud feet which stabilise the unit on the seafloor. A central rotary drill is then used to extract a sleeved seabed sediment core. The drill rig proposed for the prospecting in Concession Area 10B will have a footprint on the seabed of 5m^2, although it is principally the feet and the drill itself which disturb the seabed. Up to 1,500 samples will be collected across approximately 20 resource development areas with a resultant maximum seabed footprint of 7.500 m^2.

It is difficult to quantify the impacts on cultural heritage resources of seabed activities such as prospecting because the locations and extent of these resources – particularly submerged prehistoric and palaeontological resources - are generally poorly understood and the nature of the environment limits the potential for identifying such sites and monitoring the intrusive activities.

The potential impacts associated with seabed prospecting are assessed for the three heritage resource classes - submerged prehistory, palaeontology and shipwrecks/maritime heritage - in the following sections. The assessment is based on the methodology set out in Appendix 1 below.

7.1 Submerged Prehistory

The past use by our hominin ancestors of the exposed continental shelf is beyond doubt and the evidence of this presence is possible wherever archaeological material and palaeoenvironmental evidence has survived post-glacial marine transgressions.

Although no geophysical data for the concession area are presently available, there is the potential for this material to be found on, or associated with, just such surviving palaeo-landsurfaces or in association with any now submerged palaeo-channels within Concession Area 10B.

The small footprint of the seabed interventions associated with prospecting means that the potential for interaction with or impact on submerged prehistoric archaeological material in Concession Area 10B will be small, although the likelihood that prospecting will target features like the palaeo-beach deposits, as a source particularly of diamondiferous gravels, does increase the potential for interactions and impacts.

If impacts on submerged prehistoric archaeological resources occur, they will be negative because the finite and non-renewable nature of these resources means that they cannot recover if disturbed, damaged or destroyed.

7.1.1 Impacts of Grab Sampling

The potential impacts of grab sampling in Concession Area 10B on prehistoric heritage resources on or in the seabed will be localised. Where impacts do occur, they will be irreversible/permanent because the finite and non-renewable nature of heritage resources means that they cannot recover if disturbed, damaged or destroyed.

The intensity of impact will be low, given the very limited physical intrusion into or disturbance of the seabed by the grab and the probability of occurrence is possible.

The significance of the impact is assessed to be very low but where impacts do occur their effects will be negative.

The lack of concrete information about the presence of submerged prehistoric resources in the concession area means that the level of confidence in this assessment of impacts is low.

In respect of mitigation measures, it is suggested that:

- samples of the coarser fraction (i.e. gravel and stone (20 mm +)) of sorted seabed sediment from each grab sample are retained or assessment by an archaeologist for the presence of prehistoric lithic material.

Access to such samples for archaeological assessment may offset any impacts of grab sampling and would result in the changing of the impact status from negative to positive because of a potential benefit to archaeological research and knowledge that could accrue from access to such information. It is suggested that TAGS engage with the archaeologist and palaeontologist prior to the geotechnical campaign to discuss and agree this proposed mitigation.

The assessment of impacts on submerged prehistoric resources from grab sampling can be summarised as follows:

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	Low 1	Long-term (Irreversible) 3	Low 5	Possible	VERY LOW	-ve	Low
Proposed mitigation measures: • The coarser fraction (i.e. gravel and stone (20 mm +)) of sorted seabed sediment from each grab sample is retained for assessment by an archaeologist for the presence of prehistoric lithic material. This could offset any potential impacts.								
With mitigation	1	1	3	5	Possible	VERY LOW	+ve	Low

7.1.2 Impacts of Seabed Coring

The physical intrusion of cores into the seabed is very small, and the potential impacts of core sampling in Concession Area 10B on prehistoric heritage resources on or in the seabed will be localised. Where impacts do occur, they will be irreversible/permanent because the finite and non-renewable nature of heritage resources means that they cannot recover if disturbed, damaged or destroyed.

The intensity of impact will be low, given the very limited physical intrusion into or disturbance of the seabed of the coring and the probability of occurrence is possible.

The significance of the impact is assessed to be very low but where impacts do occur their effects will be negative.

The lack of concrete information about the presence of submerged prehistoric resources in the concession area means that the level of confidence in this assessment of impacts is low.

In respect of mitigation measures, it is suggested that:

- any core samples sections which contain alluvial material, particularly where organic remains are present, are retained and are subject to palaeoenvironmental assessment.

Access to such samples for palaeoenvironmental assessment may offset the potential impacts of core sampling and would result in the changing of the impact status from negative to positive because of a potential benefit to archaeological and palaeoenvironmental research and knowledge that could accrue from access to such information. It is suggested that TAGS engage with the archaeologist and palaeontologist prior to the geotechnical campaign to discuss and agree this proposed mitigation.

The assessment of impacts on submerged prehistoric resources from core sampling can be summarised as follows:

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	Low 1	Long-term (Irreversible) 3	Low 5	Possible	VERY LOW	-ve	Low
Proposed mitigation measures: • Core sample sections which contain alluvial material, particularly where organic remains are present, are retained and subject for palaeoenvironmental assessment. This could offset any potential impacts.								
With mitigation	1	1	3	5	Possible	VERY LOW	+ve	Low

7.1.3 Impacts of Seabed Drilling

The physical intrusion of the drill into the seabed is very small and, although the footprint of the drill rig is larger, the potential impacts of core sampling in Concession Area 10B on prehistoric heritage resources on or in the seabed will be localised. Where impacts do occur,

they will be irreversible/permanent because the finite and non-renewable nature of heritage resources means that they cannot recover if disturbed, damaged or destroyed.

The intensity of impact will be low, given the very limited physical intrusion into or disturbance of the seabed by the drill sampling and the probability of occurrence is possible.

The significance of the impact is assessed to be very low but where impacts do occur their effects will be negative.

The lack of concrete information about the presence of submerged prehistoric resources in the concession area means that the level of confidence in this assessment of impacts is low.

In respect of mitigation measures, it is suggested that:

- any drill sample sections which contain alluvial material, particularly where organic remains are present, are retained and are subject to palaeoenvironmental assessment.

Access to such samples for palaeoenvironmental and archaeological assessment may offset the potential impacts of core sampling and would result in the changing of the impact status from negative to positive because of a potential benefit to archaeological and palaeoenvironmental research and knowledge that could accrue from access to such information. It is suggested that TAGS engage with the archaeologist and palaeontologist prior to the geotechnical campaign to discuss and agree this proposed mitigation.

The assessment of impacts on submerged prehistoric resources from core sampling can be summarised as follows:

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	Low 1	Long-term (Irreversible) 3	Low 5	Possible	VERY LOW	-ve	Low
Proposed mitigation measures: • Core sample sections which contain alluvial material, particularly where organic remains are present, are retained and subject for palaeoenvironmental assessment. This could offset any potential impacts.								
With mitigation	1	1	3	5	Possible	VERY LOW	+ve	Low

7.2 Palaeontology

7.2.1 Impacts of Grab Sampling

The palaeontological impact of grab sampling in Concession Area 10B will be localised.
Where impacts do occur, they will be irreversible/permanent because the finite and non-renewable nature of heritage resources means that they cannot recover if disturbed, damaged or destroyed.

The intensity of impact will be low, given the very limited physical intrusion into or disturbance of the seabed of the grab sampling and the probability of occurrence is possible.

The significance of the impact is assessed to be very low but where impacts do occur their effects will be negative.

The lack of concrete information about the possible presence or distribution of palaeontological resources in the concession area means that the level of confidence in this assessment of impacts is low.

In respect of mitigation measures, the small volumes of the grab samples greatly reduce to likelihood of capturing the sparse fossils reworked from the older, pre- late Quaternary formations and the “extralimitals” in the Last Transgression Sequence.

Any fossils such as petrified bone and teeth and shell casts, usually phosphatic, found during the processing of the grab samples must have the details of context recorded and must be kept for identification by an appropriate specialist and if significant, to be deposited in a curatorial institution such as the IZIKO SA Museum.

Such work would offset the potential impacts of the prospecting activities and would result in the changing of the impact status from negative to positive because of a potential benefit to palaeontological research and knowledge that could accrue from such information. It is suggested that TAGS engage with the palaeontologist prior to the geotechnical campaign to discuss and agree this proposed mitigation.

The assessment of impacts on palaeontological resources from grab sampling can be summarised as follows:

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	Negligible (Low) 1	Long-term (Irreversible) 3	Low 5	Possible	VERY LOW	-ve	Low
Suggested mitigation measures: • Any fossils found during the processing of grab samples must have the details of context recorded, must be kept for identification by an appropriate specialist and, if significant, be deposited in a an appropriate institution.								
With mitigation	1	1	3	5	Possible	VERY LOW	+ve	Low

7.2.2 Impacts of Core and Drill Sampling

The palaeontological impact of core and drill sampling in Concession Area 10B will be localised. Where impacts do occur, they will be irreversible/permanent because the finite and non-renewable nature of heritage resources means that they cannot recover if disturbed, damaged or destroyed.

The intensity of impact will be low, given the very limited physical intrusion into or disturbance of the seabed of the core and drill sampling and the probability of occurrence is possible.

The significance of the impact is assessed to be very low but where impacts do occur their effects will be negative.

The lack of concrete information about the possible presence or distribution of palaeontological resources in the concession area means that the level of confidence in this assessment of impacts is low.

In respect of mitigation measures, the small volumes of the core and drill samples greatly reduce to likelihood of capturing the sparse fossils reworked from the older, pre- late Quaternary formations and the “extralimitals” in the Last Transgression Sequence. However, the potential for extralimital Agulhas species to be present in the recovered samples is important as these specimens have context in the geological and faunal succession in the core, unlike the specimens usually selected from the loose, mixed shells crossing the oversize screens on sampling/mining vessels. It is also possible that a core or two might intersect rarely preserved lagoonal deposits which are important for providing points on the sea-level curve applicable to the West Coast (Runds *et al*., 2018).

It is therefore suggested that a set of cores from this poorly-known area are the subject of a detailed study (possibly as a B.Sc. Honours or M.Sc. project), with radiocarbon dates.

Any fossils such as petrified bone and teeth and shell casts, usually phosphatic, found during the processing of the grab samples must have the details of context recorded and must be kept for identification by an appropriate specialist and if significant, to be deposited in a curatorial institution such as the IZIKO SA Museum.

Such work would offset the potential impacts of the prospecting activities and would result in the changing of the impact status from negative to positive because of a potential benefit to palaeontological research and knowledge that could accrue from such information. It is suggested that TAGS engage with the palaeontologist prior to the geotechnical campaign to discuss and agree this proposed mitigation.

The assessment of impacts on palaeontological resources from core and drill sampling can be summarised as follows:

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	Negligible (Low) 1	Long-term (Irreversible) 3	Low 5	Possible	VERY LOW	-ve	Low
Suggested mitigation measures: • Any fossils found during the processing of grab samples must have the details of context recorded, must be kept for identification by an appropriate specialist and, if significant, be deposited in a an appropriate institution; • The possible detailed study and dating of a set of cores, possibly as a B.Sc. Honours or M.Sc. project should be considered.								
With mitigation	1	1	3	5	Possible	VERY LOW	+ve	Low

7.3 Maritime Heritage

As indicated above, it is unlikely that the remains of either the *Zulu Coast 1* or *Pembroke Castle* are located within the concession area. The potential for currently unknown historical wrecks or maritime debris to be are present on the seabed in the concession area is also so low that it can probably be discounted.

There is thus unlikely to be any impact arising from prospecting activities on maritime heritage resources and they are scoped out of this impact assessment.

7.4 Summary of Impact Significance Ratings for Heritage Receptors

The results of the impact assessment for the heritage receptors in Concession Area 10B can be summarised as follows:

Impact	Consequence	Probability	Significance	Status	Confidence
Impacts on Submerged Prehistoric Heritage Resources – Grab, Core & Drill Sampling	Low 5	Possible	VERY LOW	-ve	Low
With Mitigation	5	Possible	VERY LOW	+ve	Low
Impacts on Palaeontological Resources – Core Sampling	Low 5	Possible	VERY LOW	-ve	Low
With Mitigation	5	Possible	VERY LOW	+ve	Low
Impacts on Maritime Archaeological Resources: Grab, Core and Drill Sampling	No impacts expected - Scoped out				

8 CONCLUSIONS AND RECOMMENDATIONS

This assessment of the heritage resources of Concession Area 10B indicates that there may be some potential for submerged prehistoric archaeological material in sediments to be affected by prospecting.

Although the significance of prospecting-related impacts on such material is assessed to be very low, it is recommended that:

- any core or drill sample sections which contain alluvial material, particularly where organic remains are present, are retained for palaeoenvironmental assessment; and
- the possibility is considered of retaining samples of the coarser fraction (i.e. gravel and stone bigger than c. 20 mm) of grab samples for assessment by an archaeologist for the presence of prehistoric lithic material.

These actions would result in the changing of the impact status from negative to positive because of a potential benefit to archaeological research and knowledge that could accrue from access to such information.

With regard to palaeontological resources, fossils found during the processing of grab, core or drill samples must have the details of context recorded, be kept for identification by an

appropriate specialist and, if significant, to be deposited in a curatorial institution such as the IZIKO SA Museum. The identification of extralimital, Agulhas “sub-fossil” shell species in the loose shells of the Last Transgression Sequence requires a level of seashell knowledge. The best outcome for a set of cores from this poorly-known area is that they are the subject of a detailed study, possibly as for a B.Sc. Honours or M.Sc. project, with radiocarbon dates.

It is suggested that TAGS engage with the archaeologist and palaeontologist prior to the geotechnical campaign to discuss and agree these proposed mitigation measures.

There appears to be little or no potential for the either of the two historical shipwrecks in the vicinity to be located within the concession area and this heritage receptor was scoped out of the assessment of impact.

In the unlikely event that shipwreck material or seabed debris is identified in the geophysical data to be collected as part of prospecting, or during the prospecting itself, the find must be reported to the archaeologist and SAHRA and then avoided during the sampling programme.

8.1 Acceptability of the Proposed Activity with Respect to Heritage Resources

It is our reasoned opinion that the proposed prospecting activities in Concession Area 10B are likely to have a very low impact on submerged prehistoric, palaeontological heritage resources, and no impact on maritime and underwater cultural heritage resources.

Provided the recommendations to mitigate and offset potential impacts are implemented, the proposed prospecting can be considered to be archaeologically and palaeontologically acceptable.

9 REFERENCES

Alves, F.J.S. 2011. *The 16th century Portuguese shipwreck of Oranjemund, Namibia: Report on the missions carried out by the Portuguese team in 2008 and 2009*. Trabalhos da DANS, 45. Lisbon

Axelson, E., 1973, *The Portuguese in South-East Africa, 1488-1600*. Wits University Press. Johannesburg.

Benjamin, J., Bonsall, C., Pickard, C. and Fischer, A. 2011. *Submerged Prehistory*. Oxbow Press. Oxford.

Berger, L. & Parkington, J. 1996. A new Pleistocene hominid bearing locality at Hoedjiespunt South Africa. *American Journal of Physical Anthropology* 98:601-9.

Carstens, P.R. 2011. *Port Nolloth: the making of a South African seaport*. Bloomington Indiana: Xlibris

Cawthra, H.C., Compton, J.S., Fisher, E.C., Machutchon, M.R. and Marean, C.W. 2016. Submerged shorelines and landscape features offshore of Mossel Bay, South Africa. In Harff, J., Bailey, G. and Luth, F. (eds). *Geology and Archaeology: Submerged Landscapes of the Continental Shelf*. Geological Society, London, Special Publications, 411, 219– 233.

Chirikure, S. 2014. Land and Sea Links: 1500 Years of connectivity between southern Africa and the Indian Ocean rim regions, AD 700 to 1700. *African Archaeological Review*, 31:4, 705-724.

Compton, J.S. 2011. Pleistocene sea-level fluctuations and human evolution on the southern coastal plain of South Africa. *Quaternary Science Reviews* 30: 506-527.

Firth, A. 2013. Marine Archaeology, in Newell, R.C. and Woodcock, T.A. (Eds). Aggregate Dredging and the Marine Environment: an overview of recent research and current industry practice. The Crown Estate.

Fisher, E.C., Bar-Matthews, M., Jeradino, A. and Marean, C.W., 2010, Middle and Late Pleistocene paleoscape modeling along the southern coast of South Africa, in *Quaternary Science Reviews*, Vol 29, pp 1382-1398.

Fitch, S., Thomson, K. and Gaffney, V. 2005. Late Pleistocene and Holocene depositional systems and the palaeogeography of the Dogger Bank, North Sea. *Quaternary Research*, 64, 185-196.

Franklin, J., Potts, A.J., Fisher, E.C., Cowling, R.M., and Marean, C.W. 2015. Paleodistribution modelling in archaeology and paleoanthropology. *Quaternary Science Reviews* 110, 1-14.

Gaffney, V.L., Thomson, K and, Fitch, S. (Eds). 2007. *Mapping Doggerland: The Mesolithic Landscapes of the Southern North Sea*. ALSF Project report for English Heritage.

Gaffney, V., Fitch, S., and Smith, D., 2010, *Europe's Lost World: The Rediscovery of Doggerland*, Research Report 160, London, Council for British Archaeology.

Garlake, P.S. 1968. The Value of Imported Ceramics in the Dating and Interpretation of the Rhodesian Iron Age. *The Journal of African History* 9:1, 13-33.

Gribble, J. 2002. The Past, Present and Future of Maritime Archaeology in South Africa. *International Handbook of Underwater Archaeology* (eds Ruppe and Barstad). New York. Plenum Press.

Gribble, J. and Athiros, G., 2008. *Tales of Shipwrecks of the Cape of Storms*. Tokai. Historical Media.

Gribble, J. and Sharfman, J. 2013. Maritime Legal Management in South Africa. *Online Encyclopaedia of Global Archaeology*, pp 6802-6810.

Hattingh, J. 2015. *Independent Technical Report on the 7B Marine Diamond Concession, South Africa*. Unpublished report for Zone One Diamonds (Pty) Ltd and MZA Diamond Resources (Pty) Ltd. Creo Design (Pty) Ltd. Stellenbosch.

Huffman, T.N. 1972. The Rise and Fall of Zimbabwe. *The Journal of African History* 13:3, 353-366.

Ingpen, B.D., 1979, South African Merchant Ships: An illustrated recent history of coasters, colliers, containerships, tugs and other vessels, A.A. Balkema, Cape Town.

O'Shea, D. O'C., 1971, An outline of the inshore submarine geology of southern S.W.A and Namaqualand, Unpublished M.Sc thesis, University of Cape Town.

Parkington, J. 1988. The Pleistocene/Holocene transition in the Western Cape, South Africa, observations from Verlorenvlei. *BAR International Series*. 405: 197–206.

Parkington, J., and Poggenpoel, C. 1987. Diepkloof Rock Shelter. In: Parkington, J., Hall, M. (Eds.), *Papers in Prehistory of the Western Cape, South Africa*, vol. 332. BAR International, pp. 269–293.

Peeters, H., Murphy, P., and Flemming, N. (eds), 2009, *North Sea Prehistory Research and Management Framework*. Amersfoort.

Peeters, H., 2011, How Wet Can It Get? – Approaches to submerged prehistoric sites and landscapes on the Dutch continental shelf, in Benjamin, J., Bonsall, C., Pickard, C., and Fischer, A. (eds). *Submerged Prehistory*. Oxbow Books. Oxford and Oakville.

Pether, J. 1993. Relict shells of Subantarctic Mollusca from the Orange Shelf, Benguela Region, off southwestern Africa. *The Veliger* 36 (3): 276-284.

Pether, J. 1994. Molluscan evidence for enhanced deglacial advection of Agulhas water in the Benguela Current, off southwestern Africa. *Palaeogeography, Palaeoclimatology, Palaeoecology* 111: 99-117.

Pether, J. 2021. *Brief Palaeontological Assessment (Desktop Study): Proposed Trans Atlantic Diamonds (Pty) Ltd. Marine Exploration Coring and Environmental Benthic Sampling in Sea Concession 12b, Inner Continental Shelf off Olifantsrivier Mouth to Klipvley Karoo Kop, Western Cape*. Unpublished report for Trans Atlantic Diamonds (Pty) Ltd.

Pollard, E., Bates, R., Ichumbaki, E.B. and Bita, C. 2016. Shipwreck Evidence from Kilwa, Tanzania. *The International Journal of Nautical Archaeology* 45:2, 352–369.

Reck, K.W. no date. *Southern African Wrecks: West Coast*. Self-published by the author.

Rohling, E.J., Grant, K., Bolshaw, M., Roberts, A. P., Siddall, M., Hemleben, Ch., and Kucera, M., 2009, Antarctic temperature and global sea level closely coupled over the past five glacial cycles. *Nature Geoscience*, 2 July 2009.

Runds, M.J., Bordy, E.M. & Pether, J. 2019. Late Quaternary sedimentological history of a submerged gravel barrier beach complex, southern Namibia. *Geo-Marine Letters* 39: 469-491.

Sleigh, D. 1993. *Die Buiteposte: VOC-Buiteposte onder Kaapse bestuur 1652-1795*. Protea Boekhuis. Pretoria.

Texier, PJ; Porraz, G; Parkington, J; Rigaud, JP; Poggenpoel, C; Miller, C; Tribolo, C; Cartwright, C; Coudenneau, A; Klein, R; Steele, and Verna, C. 2010. "A Howiesons Poort tradition of engraving ostrich eggshell containers dated to 60,000 years ago at Diepkloof Rock Shelter, South Africa". *Proceedings of the National Academy of Sciences*. 107 (14): 6180–6185.

The Nautical Magazine and Naval Chronicle 1855: 297-303.

Turner, M. 1988. Shipwrecks and Salvage in South Africa: 1505 to the Present. C Struik. Cape Town.

Van Andel, T.H.,1989, Late Pleistocene Sea Levels and the Human Exploitation of the Shore and Shelf of the Southern South Africa, *Journal of Field Archaeology* 16:2, 133-155.

Waelbroeck, C., Labeyrie, L., Michela, B.E., Duplessy, J.C., McManus, J.F., Lambeck, K., Balbon, E., and Labracherie, M., 2002, Sea-level and deep water temperature changes derived from benthic foraminifera isotopic records, *Quaternary Science Reviews*, 21: 295–305.

Werz, B.E.J.S and Flemming, N.C., 2001, Discovery in Table Bay of the oldest handaxes yet found underwater demonstrates preservation of hominid artefacts on the continental shelf, *South African Journal of Science* 97, 183-185.

Werz, B.E.J.S., Cawthra, H.C. and Compton, J.S., 2014, Recent Developments in African Offshore Prehistoric Archaeological Research, with an Emphasis on South Africa, In Evans, A.M., Flatman, J.C. and Flemming, N.C. (Eds) *Prehistoric Archaeology on the Continental Shelf: A Global Review,* Springer Science and Business Media, New York, 233-253.

Wood, M. 2012. Interconnections. Glass beads and trade in southern and eastern Africa and the Indian Ocean – 7th to 16th centuries AD. *Studies in Global Archaeology*, 17, 62 pp.

9.1 Online Sources

Carrick Coast (http://www.clydeships.co.uk)

Langebaan Footprints: A Walk With Eve (http://www.sawestcoast.com/fossileve.html).

Lloyds Register of Shipping 1845
(https://archive.org/details/HECROS1845/page/n135/mode/2up)

South African Heritage Resources Information System (SAHRIS)
(http://www.sahra.org.za/sahris).

APPENDIX 1: IMPACT ASSESSMENT METHODOLOGY

The significance of all potential impacts that would result from the proposed project is determined in order to assist decision-makers. The **significance** of an impact is defined as a combination of the **consequence** of the impact occurring and the **probability** that the impact will occur. The significance of each identified impact was thus rated according to the methodology set out below:

Step 1 – Determine the **consequence** rating for the impact by determining the score for each of the three criteria (A-C) listed below and then **adding** them. The rationale for assigning a specific rating, and comments on the degree to which the impact may cause irreplaceable loss of resources and be irreversible, must be included in the narrative accompanying the impact rating:

Rating		Definition of Rating	Score
A. Extent – the area over which the impact will be experienced			
Local		Confined to project or study area or part thereof (e.g. limits of the concession area)	1
Regional		The region (e.g. the whole of Namaqualand coast)	2
(Inter) national		Significantly beyond Saldanha Bay and adjacent land areas	3
B. Intensity – the magnitude of the impact in relation to the sensitivity of the receiving environment, taking into account the degree to which the impact may cause irreplaceable loss of resources			
Low	Site-specific and wider natural and/or social functions and processes are negligibly altered		1
Medium	Site-specific and wider natural and/or social functions and processes continue albeit in a modified way		2
High	Site-specific and wider natural and/or social functions or processes are severely altered		3
C. Duration – the time frame for which the impact will be experienced and its reversibility			
Short-term		Up to 2 years	1
Medium-term		2 to 15 years	2
Long-term		More than 15 years (state whether impact is irreversible)	3

The combined score of these three criteria corresponds to a **Consequence Rating**, as follows:

Combined Score (A+B+C)	3 – 4	5	6	7	8 – 9
Consequence Rating	Very low	Low	Medium	High	Very high

Step 2 – Assess the **probability** of the impact occurring according to the following definitions:

Probability– the likelihood of the impact occurring	
Improbable	< 40% chance of occurring

Possible	40% - 70% chance of occurring
Probable	> 70% - 90% chance of occurring
Definite	> 90% chance of occurring

Step 3 – Determine the overall **significance** of the impact as a combination of the **consequence** and **probability** ratings, as set out below:

		Probability			
		Improbable	Possible	Probable	Definite
Consequence	Very Low	INSIGNIFICANT	INSIGNIFICANT	VERY LOW	VERY LOW
	Low	VERY LOW	VERY LOW	LOW	LOW
	Medium	LOW	LOW	MEDIUM	MEDIUM
	High	MEDIUM	MEDIUM	HIGH	HIGH
	Very High	HIGH	HIGH	VERY HIGH	VERY HIGH

Step 4 – Note the **status** of the impact (i.e. will the effect of the impact be negative or positive?)

Step 5 – State the level of **confidence** in the assessment of the impact (high, medium or low). Impacts are also considered in terms of their status (positive or negative impact) and the confidence in the ascribed impact significance rating. The prescribed system for considering impacts status and confidence (in assessment) is laid out in the table below. Depending on the data available, a higher level of confidence may be attached to the assessment of some impacts than others. For example, if the assessment is based on extrapolated data, this may reduce the confidence level to low, noting that further ground-truthing is required to improve this.

Confidence rating	
Status of impact	+ ve (beneficial) or – ve (cost)
Confidence of assessment	Low, Medium or High

The significance rating of impacts is considered by decision-makers, as shown below. Note, this method does not apply to minor impacts which can be logically grouped into a single assessment.

- **INSIGNIFICANT**: the potential impact is negligible and **will not** have an influence on the decision regarding the proposed activity.
- **VERY LOW**: the potential impact is very small and **should not** have any meaningful influence on the decision regarding the proposed activity.
- **LOW**: the potential impact **may not** have any meaningful influence on the decision regarding the proposed activity.
- **MEDIUM**: the potential impact **should** influence the decision regarding the proposed activity.
- **HIGH**: the potential impact **will** affect a decision regarding the proposed activity.
- **VERY HIGH**: The proposed activity should only be approved under special circumstances.

Step 6 – Identify and describe practical **mitigation** and **optimisation** measures that can be implemented effectively to reduce or enhance the significance of the impact. Mitigation and optimisation measures must be described as either:

- **Essential**: must be implemented and are non-negotiable; and
- **Best Practice**: must be shown to have been considered and sound reasons provided by the proponent if not implemented.

Essential mitigation and optimisation measures must be inserted into the completed impact assessment table. The impact should be re-assessed with mitigation, by following Steps 1-5 again to demonstrate how the extent, intensity, duration and/or probability change after implementation of the proposed mitigation measures.

Step 7 – Prepare a summary table of all impact significance ratings.

Finally, indicate whether the proposed development alternatives are environmentally suitable or unsuitable in terms of the respective impacts assessed by the relevant specialist and the environmentally preferred alternative.

APPENDIX 2: SPECIALIST CV – JOHN GRIBBLE

Name:	John Gribble
Profession:	Archaeologist
Date of Birth:	15 November 1965
Parent Firm:	ACO Associates cc
Position in Firm:	Senior Archaeologist
Years with Firm:	4
Years of experience:	30+
Nationality:	South African
HDI Status:	n/a

Education:

1979-1983	Wynberg Boys' High School (1979-1983)
1986	BA (Archaeology), University of Cape Town
1987	BA (Hons) (Archaeology), University of Cape Town
1990	Master of Arts, (Archaeology) University of Cape Town

Employment:

- ACO Associates, Senior Archaeologist and Consultant, September 2017 – present
- South African Heritage Resources Agency, Manager: Maritime and Underwater Cultural Heritage Unit, 2014 – 2017 / Acting Manager: Archaeology, Palaeontology and Meteorites Unit, 2016-2017
- Sea Change Heritage Consultants Limited, Director, 2012 – present
- TUV SUD PMSS (Romsey, United Kingdom), Principal Consultant: Maritime Archaeology, 2011-2012
- EMU Limited (Southampton, United Kingdom), Principal Consultant: Maritime Archaeology, 2009-2011
- Wessex Archaeology (Salisbury, United Kingdom), Project Manager: Coastal and Marine , 2005-2009
- National Monuments Council / South African Heritage Resources Agency, Maritime Archaeologist, 1996-2005
- National Monuments Council, Professional Officer: Boland and West Coast, Western Cape Office, 1994-1996

Professional Qualifications and Accreditation:

- Member: Association of Southern African Professional Archaeologists (No. 043)
- Principal Investigator: Maritime and Colonial Archaeology, ASAPA CRM Section
- Field Director: Stone Age Archaeology, ASAPA CRM Section
- Member: Chartered Institute for Archaeologists (CIfA), United Kingdom
- Class III Diver (Surface Supply), Department of Labour (South Africa) / UK (HSE III)

Experience:

I have more than 30 years of combined archaeological and heritage management experience. After completing my postgraduate studies, which were focussed on the vernacular architecture of the West Coast, and a period of freelance archaeological work in South Africa and aboard,

I joined the National Monuments Council (NMC) (now the South African Heritage Resources Agency (SAHRA)) in 1994. As the Heritage Officer: the Boland I was involved in day to day historical building control and heritage resources management across the region. In 1996 I become the NMC's first full-time maritime archaeologist in which role was responsible for the management and protection of underwater cultural heritage in South Africa under the National Monuments Act, and subsequently under the National Heritage Resources Act.

In 2005 I moved to the UK to join Wessex Archaeology, one of the UK's biggest archaeological consultancies, as a project manager in its Coastal and Marine Section. In 2009 I joined Fugro EMU Limited, a marine geosurvey company based in Southampton to set up their maritime archaeological section. I then spent a year at TUV SUD PMSS, an international renewable energy consultancy based in Romsey, where I again provided maritime archaeological consultancy services to principally the offshore renewable and marine aggregate industries.

In August 2012 I set up Sea Change Heritage Consultants Limited, a maritime archaeological consultancy. Sea Change provides archaeological services to a range of UK maritime sectors, including marine aggregates and offshore renewable energy. It also actively pursues opportunities to raise public awareness and understanding of underwater cultural heritage through educational and research projects and programmes, including some projects being developed in South Africa.

Projects include specialist archaeological consultancy for more than 15 offshore renewable energy projects and more than a dozen offshore aggregate extraction licence areas.

In addition to managing numerous UK development-driven archaeological projects, I have also been involved in important strategic work which developed guidance and best practice for the offshore industry with respect to the marine historic environment. This has included the principal authorship of two historic environment guidance documents for COWRIE and the UK renewable energy sector, and the development of the archaeological elements of the first Regional Environmental Assessments for the UK marine aggregates industry. In 2013-14 I was lead author and project co-ordinator on the Impact Review for the United Kingdom of the 2001 UNESCO Convention on the Protection of the Underwater Cultural Heritage. In 2016 I was co-author of a Historic England / Crown Estate / British Marine Aggregate Producers Association funded review of marine historic environment best practice guidance for the UK offshore aggregate industry.

I returned to South African in mid-2014 where I was re-appointed to my earlier post at SAHRA: Manager of the Maritime and Underwater Cultural Heritage Unit. In July 2016 I was also appointed Acting Manager of SAHRA's Archaeology, Palaeontology and Meteorites Unit.

I left SAHRA in September 2017 to join ACO Associates as Senior Archaeologist and Consultant.
I have been a member of the ICOMOS International Committee for Underwater Cultural Heritage since 2000 and have served as a member of its Bureau since 2009.

I have been a member of the Association of Southern African Professional Archaeologists for more than twenty years and am accredited by ASAPA's CRM section. Since 2010 I have been a member of the UK's Joint Nautical Archaeology Policy Committee.

I am a member of the Advisory Board of the George Washington University / Iziko Museums of South Africa / South African Heritage Resources Agency / Smithsonian Institution 'Southern African Slave Wrecks Project' and serve on the Heritage Western Cape Archaeology, Palaeontology and Meteorites Committee.

Books and Publications:

Gribble, J. and Scott, G., 2017, *We Die Like Brothers: The sinking of the SS Mendi*, Historic England, Swindon

Lloyd Jones, D., Langman, R., Reach, I., Gribble, J., and Griffiths, N., 2016, Using Multibeam and Sidescan Sonar to Monitor Aggregate Dredging, in C.W. Finkl and C. Makowski (eds) *Seafloor Mapping along Continental Shelves: Research and Techniques for Visualizing Benthic Environments, Coastal Research Library 13*, Springer International Publishing, Switzerland, pp 245-259.

Athiros, G. and Gribble, J., 2015, *Wrecked at the Cape Part 2*, The Cape Odyssey 105, Historical Media, Cape Town.

Gribble, J. and Sharfman, J., 2015, The wreck of SS Mendi (1917) as an example of the potential trans-national significance of World War I underwater cultural heritage, *Proceedings of the UNESCO Scientific Conference on the Underwater Cultural Heritage from World War I*, Bruges, 26-28 June 2014.

Gribble, J., 2015, Underwater Cultural Heritage and International Law. Cambridge by Sarah Dromgoole, in *South African Archaeological Bulletin*, 70, 202, pp 226-227.

Athiros, G. and Gribble, J., 2014, *Wrecked at the Cape Part 1*, The Cape Odyssey 104, Historical Media, Cape Town.

Gribble, J., 2014, Learning the Hard Way: Two South African Examples of Issues Related to Port Construction and Archaeology, in Dredging and Port Construction: Interactions with Features of Archaeological or Heritage Interest*, PIANC Guidance Document 124*, pp 97-107.

UK UNESCO 2001 Convention Review Group, 2014, *The UNESCO Convention on the Protection of the Underwater Cultural Heritage 2001: An Impact Review for the United Kingdom*, ISBN 978-0-904608-03-8.

Sadr, K., Gribble, J. and Euston-Brown, G, 2013, Archaeological survey on the Vredenburg Peninsula, in Jerardino et al. (eds), *The Archaeology of the West Coast of South Africa*, BAR International Series 2526, pp 50-67

Gribble, J. and Sharfman, J, 2013, Maritime Legal Management in South Africa, *Online Encyclopaedia of Global Archaeology*, pp 6802-6810.

Gribble, J., 2011, The UNESCO Convention on the Protection of the Underwater Cultural Heritage 2001, *Journal of Maritime Archaeology* 6:1 77-86.

Gribble, J., 2011, The SS Mendi, the Foreign Labour Corps and the trans-national significance of shipwrecks, in J. Henderson (ed.): *Beyond Boundaries, Proceedings of IKUWA 3, The 3rd International Congress on Underwater Archaeology*, Römisch-Germanische Kommission (RGK), Frankfurt.

Gribble, J., 2011, Competence and Qualifications, in Guèrin, U., Egger, B. and Maarleveld, T. (eds) *UNESCO Manual for Activities directed at Underwater Cultural Heritage*, UNESCO - Secretariat of the 2001 Convention, Paris.

Gribble, J. and Leather, S. for EMU Ltd., 2010, *Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector*. Commissioned by COWRIE Ltd (project reference GEOARCH-09).

Sadr, K and Gribble, J., 2010, The stone artefacts from the Vredenburg Peninsula archaeological survey, west coast of South Africa, *Southern African Humanities* 22: 19–88.

Gribble, J., 2009, HMS Birkenhead and the British warship wrecks in South African waters in *Proceedings of the Shared Heritage Seminar*, University of Wolverhampton, 8 July 2008

Gribble, J., Parham, D. and Scott-Ireton, D., 2009, Historic Wrecks: Risks or Resources? In *Conservation and Management of Archaeological Sites*, Vol. 11 No. 1, March, 2009, 16–28.

Gribble, J. and Athiros, G., 2008, *Tales of Shipwrecks at the Cape of Storms*, Historical Media, Cape Town.

Gribble, J., 2008, The shocking story of the ss Mendi, in *British Archaeology*, March/April 2008.

Gribble, J., 2007, The Protection of the Underwater Cultural Heritage: National Perspectives in light of the UNESCO Convention 2001 by Sarah Dromgoole, in *The International Journal of Nautical Archaeology*, 36, 1, pp 195-6.

Gribble, J., 2006, The Sad Case of the ss Maori, in Grenier, R., D. Nutley and I. Cochran (eds) *Underwater Cultural Heritage at Risk: Managing Natural and Human Impacts*, pp 41-43, ICOMOS, Paris

Gribble, J., 2006, Pre-Colonial Fish Traps on the South Western Cape Coast, South Africa, in Grenier, R., D. Nutley and I. Cochran (eds) *Underwater Cultural Heritage at Risk: Managing Natural and Human Impacts*, pp 29-31, ICOMOS, Paris.

Forrest, C.S.J., and Gribble, J., 2006, The illicit movement of underwater cultural heritage: The case of the Dodington coins, in *Art and Cultural Heritage: Law, Policy and Practice*, (ed B.T. Hoffman), New York, Cambridge University Press.

Forrest, C.S.J., and Gribble, J., 2006, Perspectives from the Southern Hemisphere: Australia and South Africa, in *The UNESCO Convention for the Protection of the Underwater Heritage: Proceedings of the Burlington House Seminar*, October 2005, JNAPC / NAS.

Gribble, J., 2003, "Building with Mud" – Developing historical building skills in the Karoo, in ICOMOS South Africa, in *The Proceedings of Symposium on Understanding and using urban heritage in the Karoo*, Victoria West, South Africa, 3-5 March 2002.

Forrest, C.S.J., and Gribble, J., 2002, The illicit movement of underwater cultural heritage: The case of the Dodington coins, *International Journal of Cultural Property*, Vol II (2002) No 2, pp 267-293.

Gribble, J. 2002, The Past, Present and Future of Maritime Archaeology in South Africa, *International Handbook of Underwater Archaeology* (eds Ruppe and Barstad), New York, Plenum Press.

Thackeray, F. and Gribble, J., 2001, Historical Note on an Attempt to Salvage Iron from a Shipwreck, *Looking Back*, Vol 40, November 2001, pp 5-7.

Gribble, J., 1998, Keeping Our Heads Above Water – the development of shipwreck management strategies in South Africa, *AIMA Bulletin*, Vol 22, pp 119-124.

Gribble, J. 1996, Conservation Practice for Historical Shipwrecks, *Monuments and Sites of South Africa*, Colombo, Sri Lanka, ICOMOS 11th General Assembly.

Gribble, J. 1996, National Databases on Monuments and Sites, *Monuments and Sites of South Africa*, Colombo, Sri Lanka, ICOMOS 11th General Assembly.

Sadr, K, Gribble, J, & Euston-Brown, G L, 1992 The Vredenburg Peninsula survey, 1991/1992 season, *Guide to Archaeological Sites in the South-western Cape*, Papers compiled for the South African Association of Archaeologists Conference, July 1992, by A.B. Smith & B. Mutti, pp 41-42.

Smith, AB, Sadr, K, Gribble, J, & Yates, R., 1992 Witklip and Posberg Reserve, *Guide to Archaeological Sites in the South-western Cape*, Papers compiled for the South African Association of Archaeologists Conference, July 1992, by A.B. Smith & B. Mutti, pp 31-40.

Smith, AB, Sadr, K, Gribble, J & Yates, R., 1991, Excavations in the south-western Cape, South Africa, and the archaeological identity of prehistoric hunter-gatherers within the last 2000 years, *The South African Archaeological Bulletin* 46: 71-91.