THE SEARCH FOR THE SLAVE SHIP *MEERMIN*. DEVELOPING A METHODOLOGY FOR FINDING INTER TIDAL SHIPWRECKS

by

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"The Search for the Slave Ship *Meermin*. Developing a methodology for finding inter tidal shipwrecks."

I declare that "The Search for the Slave Ship *Meermin*. Developing a methodology for finding inter tidal shipwrecks" is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

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Date

SUMMARY

This thesis is about the development of a survey methodology to find inter tidal shipwrecks. The discussion not only revolves around methodology, but also contextualises the development of said methodology by describing the attempt to find the slave shipwreck *Meermin*. Inevitably this leads into a discussion on maritime archaeology in South Africa as well as the archaeology of slave ships. Furthermore the author explains in brief the use of magnetometers since this was the main instrument type used in the search. The excavation of the targets found during the magnetometer surveys are also examined. Finally the thesis ends with a review of the other impacts the *Meermin* project has had in both the academic and public archaeological spheres in South Africa.

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There are many people and institutions to thank for helping in my search for the *Meermin*. I hope that I do not forget to mention anyone. This is not because of any malicious intent, but rather my failing memory. I want to start by thanking Iziko Museums for allowing me to pursue this project and for part payment of my study fees. Similarly the Slave Wrecks Project also helped with payment of fees and I thank my partners for that. Other institutions that played a part were The South African Heritage Resources Agency, Council for Marine Geoscience, South African National Space Agency, Xcalibur Geophysics and the Western Cape Archives Repository. Special mention needs to be made of Anglo American's Exploration Division for the loan of the handheld magnetometer and especially Ockert Terblanche who introduced me to the intricacies of Geosoft and Richard Joone for allowing him to do it. Cape Nature Conservation and the manager Roelof Jalving and Game Rangers Piet Swart and Oom Nicky need special mention for helping find our way on De Mond Nature reserve. The project would have not been possible without the grant from the National Lotteries Distribution Trust Fund. This fund also allowed me to employ John Visser and Santino Campbell who endured countless hours with me on the beach. An honourable mention needs to be made of Andrew Alexander who left us so unexpectedly and far too early for hopefully a better place. Other friends who helped include John Gribble, Jonathan Sharfman, Nik Mavridinov, Shawn Berry, Tara van Niekerk and last but not least Jake Harding who is still suffering with me. I also want to thank Jill Gribble and Margeaux Hendricks for correcting my appalling grammar. My gratitude to Lungile Gadizweni for translating the abstract into Xhosa. My thanks also to my supervisor Dr. Natalie Swanepoel for her patience and forbearance in seeing me through this. Finally to my wife and my family I owe an enormous debt for standing by me and suffering through this with me – especially my wife for also helping with the final layout of the document. Any mistakes in this document are my own and I take full responsibility for it.

ABSTRACT

This thesis describes the development of a methodology to find inter tidal shipwrecks. The discussion revolves around finding a particular shipwreck – that of the Dutch slaver *Meermin*. The story of the revolt on the *Meermin* helps to focus the search and development of the methodology to find inter tidal shipwrecks as the *Meermin* was wrecked in this zone. The thesis contextualises the search and the story by discussing not only maritime archaeology in South Africa, but also looking at slave ship archaeology and the history of slavery at the Cape. One of the key techniques for finding shipwrecks is the use of magnetometers. The discussion defines the types of magnetometers available to archaeologists and how magnetometry was applied during the search for the *Meermin*. This inevitably includes an examination of the shipwrecks wrecked in the area of the *Meermin* episode as well as the way this region has changed over time. The results of the magnetometer searches (which included airborne, handheld and marine magnetometers) are discussed as well as the ground truthing of the results. The latter involved excavation and the development of excavation strategies, and excavation results are scrutinized. In the final analysis the search for the *Meermin* is further contextualised by considering the various impacts the project has had in other spheres.

ABSTRAK

Hierdie tesis beskryf die ontwikkeling van 'n metodologie waarmee skeepswrakke in die inter-gety sone opgespoor kan word. Die Hollandse slaweskip, *Meermin*, is die fokus van die diskussie. Die storie van die slawe opstand op die *Meermin* help om die ontwikkeling en soektog na skeepswrakke in die inter-gety sone te verskerp, aangesien dit in hierdie sone was waarin die *Meermin* gestrand het. Die soektog en storie van die *Meermin* word gekontekstualiseer deur die bespreking van die ontwikkeling van maritieme argeologie in Suid Afrika, die argeologie van slawe skepe en 'n kort geskiedenis van slawerny aan die Kaap. Magnetometers is een van die belangrikste tegnieke gebruik vir die opspoor van skeepswrakke. Die tipes magnetometers wat deur argeoloë gebruik word, word gedefinieër asook hoe magnetometers gedurende die soektog na die *Meermin* gebruik is. Daar word ook gekyk na die ander skepe wat in die area van die *Meermin* gestrand het en die veranderinge wat deur die jare in die streek plaasgevind het. Die resultate van die magnetometer soektogte (insluitend vliegtuig, draagbare en mariene magnetometers) word bespreek so wel as die opgrawings van die resultate. Hierdie opgrawings het noodwendig gelei tot die ontwikkeling van opgrawings tegnieke. Die resultate van die opgrawings word bespreek. Die finale analise kontekstualiseer die soektog na die *Meermin* met 'n bepeinsing van die menige impakte wat die projek gehad het.

ISICATSHULWA

Le thisisi icacisa ngenkqubela kulwazi-nkqubo lokufumana iinqanawa ezaphuka phakathi kokuzala nokurhoxa kolwandle. Ingxoxo zimalunga nokufunyanwa kwenqanawa ethile eyaphukayo – kanye leyo yayithutha amakhoboka amaHolani i-*Meermin*. Ibali lovukelo kwi-*Meermin* liyasinceda siqwalasele uphando nenkqubela kulwazi-nkqubo lokufumana iinqanawa ezaphuka phakathi kokuzala nokurhoxa kolwandle njengoko i-*Meermin* yaqhekeka kanye kulo mmandla. Ithisisi le isicacisela kanye ngophando nembali ngokuxoxa hayi ngobunzululwazi ngezakudala emanzini eMzantsi Afrika nje kuphela, koko iphinde ijonge ngobunzululwazi ngezakudala kwinqanawa yokuthutha amakhoboka nembali yobukhoboka eKapa. Obunye bobuqili obuphambili ekufumaneni iinqanawa eziqhekekileyo kukusetyenziswa kwezixhobo zokulinganisa iintshukumo. Ingxoxo ibalula iindidi zezixhobo zokulinganisa iintshukumo ezisetyenziswa ziinzululwazi ngezakudala nendlela ekwasetyenziswa ngayo ukulinganiswa kwentshukumo ngethuba kuphandwa i-*Meermin*. Ngokuqhelekileyo oku kuquka ukucutyungulwa kweenqanawa ezaqhekekayo ziqhekeka kummandla wesehlo esisodwa se-*Meermin* kunye nendlela le ngingqi eguquke ngayo emveni koko. Iziphumo zophando ngezixhobo zokulinganisa iintshukumo (ziquka ezo zasesibhakabhakeni, ezibanjwa ngesandla nezasemanzini) ziyaxoxwa kunye neziphumo zenyani yenene. Le yokugqibela iquka ukwembiwa nenkqubela kwindlela zokomba, iziphumo zokomba nazo ziqwalaselwe. Kuye kwaphinda kwacaciswa kwintlahlela yokugqibela kuphando lwe-*Meermin* kuqwalaselwa iimpembelelo ezithile umsebenzi othe wangquzulena nazo nakwezinye iindawo.

KEY WORDS

Shipwreck, slave ship, slavery, maritime archaeology, inter tidal zone, magnetometer, revolt, map, probe, pump, treasure hunting, excavation, coffer dam.

CHAPTER 1: INTRODUCTION

The original idea of searching for the wreck of the slave ship ***Meermin*** was inspired by the celebrations of the 300th anniversary of the Dutch East India Company (VOC) in 2002. The author was part of a Maritime sub-committee that looked into not only how the maritime contribution of the VOC to the formation of South Africa could be commemorated but also how the VOC's negative contributions, for example, its exploits into slavery, could be acknowledged. The story of the ***Meermin*** seemed to admirably fit the goals of the committee. The first idea was to build a replica of the ***Meermin***. This proved to be too costly and the building of a scale model was proposed. The proposal was unfortunately unsuccessful, but it did introduce the author to the ***Meermin*** story. When the newly formed flagship institution Iziko Museums (where the author was and is still employed) tasked curators to find relevant and exciting projects in line with its vision of "African Museums of Excellence", it was a short step for the author to propose an archaeological project to search for the wreck of the ***Meermin***. Fortunately, the basic concept was accepted and funding was eventually obtained from the National Lotteries Distribution Trust Fund. Archival accounts note that the wreck happened close inshore in what is known as the inter tidal zone in the vicinity of modern day Struisbaai. This represents an archaeological problem as the survey methodology for finding sites in the inter tidal zone is still under developed. Therefore a secondary goal of this project quickly became to develop a new methodology for finding inter tidal shipwrecks on the South African coastline by using locally available technology.

The challenges for finding shipwrecks in the inter tidal zone are different from those encountered when surveying for wrecks in deeper waters. In deeper waters it is often easier to find shipwrecks by using instruments such as towed magnetometers and side scan and multi-beam sonar (Green 2002). Access to sites are often easier as one can dive on sites that are already fully or partially exposed. One does however, have to contend with a different environment in deeper water which includes difficulties such as water depth, currents, water pressure and consequently the limited time one is able to spend on a site (Muckleroy 1978).

Ford (2011) defines the coast as the area where marine processes such as erosion, deposition and storm surge influence terrestrial processes and vice versa. He states that this zone can range from hundreds to thousands of metres in width depending on the slope and substrate of the coastal region. To define the working region even more we can describe the inter tidal zone as part of what is known as the littoral zone, the

> "marine ecological realm that experiences the effects of tidal and long shore currents and breaking waves to a depth of 5 to 10 metres (16 to 33 feet) below the low-tide level, depending on the intensity of storm waves. The zone is characterized by abundant dissolved oxygen, sunlight, nutrients, generally high wave energies and water motion, and, in the inter tidal subzone, alternating submergence and exposure"
> (https://www.britannica.com/science/littoral-zone accessed 23/8/2017).

The latter statement is especially true of shipwrecks and, in an area of high sand activity like the Struisbaai coast, shipwrecks get covered and uncovered periodically. The coast is a difficult environment for archaeologists in terms of preservation, access and methods (Ford 2011).

The methodology pioneered during the course of this project was developed by combining existing technologies in an innovative way. Many shipwrecks are in the shallow waters of the inter tidal zone and although this has made some of these wrecks more accessible the inverse is also true especially along the areas of the South African coastline that have long shallow inter tidal shelves typical of, for example, the Southern Cape. This presents a problem to maritime archaeologists who are seeking to locate such shipwrecks.

One should not discount the importance of South Africa's maritime past even if it largely transpired during the colonial period. Vasco da Gama's linking of Europe and Asia in the late 1490s initiated the Cape sea route (Axelson 1988). Less than 200 years later the Cape was colonised by the Dutch specifically because they needed a halfway house to the riches of the East, changing the history of South Africa forever. The same Dutch colonizers introduced slavery to South Africa, planting the seeds of the later tumultuous political history in the struggle for freedom under the apartheid government.

One result of the Dutch colony and therefore the Cape sea route is that South Africa has been left with a rich shipwreck resource. According to the South African Heritage Resources Agency (SAHRA) National Shipwreck Database there are in excess of 2000 shipwrecks recorded in historical documents. Only a small percentage of these however have been physically located (Gribble 2002), none as part of an archaeological investigation. Shipwrecks in South Africa have often been found accidentally as a result of development, but most were targeted by treasure hunters. This project is therefore not only the first attempt to locate a slave shipwreck, but also the first archaeological project focused on finding a particular shipwreck in South Africa. This can be contrasted with other world areas where considerable academic, financial and logistical resources have been expended to locate specific wrecks (see for example Kvarning 1993, Gesner 2000, Marsden ***et la.*** 2003 and Bruseth & Turner 2004).

Primarily this project has developed a methodology that can also be applied elsewhere in the world to locate and investigate inter tidal shipwrecks. The essence of the methodology is in the combination of techniques and the order in which these techniques are executed. Generally wrecks in the inter tidal zone are found accidentally by washing open in a storm event. In South Africa there has been no targeted search for shipwrecks in the inter tidal zone as stated above and the development of this methodology will hopefully show the way in which this untapped resource can be exploited in future.

In addition, this project contributed towards building a maritime archaeological competency in South Africa by showing that maritime archaeologists can source funding for basic archaeological research other than from treasure hunting and assist in extending the knowledge of the South African shipwreck resource.

The methodology developed in the course of this research was tested in the search for the wreck site of the ***Meermin***, a Dutch slave ship that ran aground on the Cape south coast in 1766 after a revolt by the slaves on board (Alexander 2007, Sleigh & Westra 2012). While the historical documentation pertaining to the wreck might indicate the area of the coastline where the wreck can be found, the inter tidal location can create unexpected problems for the archaeologist trying to find a particular shipwreck as the area in which the shipwreck occurs is inaccessible due to the shallow conditions.

Another complication is that the landscape of the region described in historical documents at the time of the wreck has changed dramatically. It is thus imperative that innovative survey techniques be developed in order to enhance our chances of locating such archaeological remains. This dissertation therefore looks at development and testing of effective magnetometry solutions for locating inter tidal shipwrecks within the technical constraints of what is available in the South African setting as well as finding the most effective way to ground truth the results. Focusing this research on a specific shipwreck helped determine the search area and placed the project in a historical context.

As stated previously the challenge in this project was to develop a methodology to apply geophysical techniques such as magnetometry in a novel way (for archaeology) in order to detect inter tidal shipwrecks, which are part of a changing environment, in an accurate and consistent manner. The geophysical results were ground truthed by adapting existing excavation and probing technologies in order to establish the presence or absence of shipwreck material as indicated by the measured magnetic signatures. The geophysical methods were backed up by archival research to demarcate the area of the physical search.

The area the search was conducted in is the southern Cape coast and specifically in Struisbaai as this seems to be the most likely location for the wreck of the ***Meermin***. The coastline is known for its wide coastal shelf (Goschen & Schuman 1990) and is also characterised by large mobile dunes driven by strong winds (Lubke & Herting 2001). The prevailing offshore wind is a north-westerly that blows mainly during winter. Offshore winds create better visibility underwater. This helped to determine the best time for conducting the marine part of the search.

Chapter Two reviews the current literature in order to place the project in context by looking briefly at the development of maritime archaeology in South Africa and internationally. A discussion on the archaeology of slave ships will follow to refine the contextualisation of the project. This will lead to the archival and historical research on the ***Meermin*** episode as this was crucial in the selection of the most likely area for the geophysical survey. Furthermore, the region's history will be discussed to determine the changes in the environment over time. I will also succinctly examine shipwrecks other than the ***Meermin*** that have occurred in the area, as this helped in the possible identification of shipwreck remains found during the survey.

Finally, magnetometry will be discussed and the different magnetic solutions as well as brief general descriptions of the types of magnetometers. One of the most successful geophysical methods for finding archaeological remains is the use of magnetometers (Smekalova ***et al.*** 2005). In maritime archaeology, magnetometers have been used since the 1970s and magnetometry is seen as a standard technique for locating shipwrecks (Green 2002). A magnetometer measures the earth's magnetic field. They come in many guises and types and some are more sensitive than others (Camidge ***et al.*** 2009; Oswin 2009; Schmidt 2007; Reeves 2005; Bonsall & Gimson 2004).

Chapter Three will discuss the actual geophysical survey and the different methodologies attempted. It will take the form of a chronological discussion of the different attempts and will briefly touch on the results. Different available magnetometry solutions were experimented with – the point of departure being the need to develop a methodology that was suitable to South African conditions not just related to the environment, but also with the equipment and expertise available locally. Marine-towed magnetometers, airborne magnetometers as well as handheld magnetometers were used in order to develop the best solution for pinpointing shipwrecks.

The more in-depth analysis of the results will be presented in Chapter 4 where the efficacy of the different methodologies by an examination of the magnetic signatures they generated is compared. A discussion of the process of ground truthing the magnetic signatures by excavation will follow. The shipwreck remains found will be briefly interpreted and compared to what is known about the ***Meermin***. The identification process of shipwreck remains included timber identification, as the types of timber used by the Dutch during this period was well known (Gawronski 1996). This was accomplished by excavating targets and obtaining timber samples from various structural members of shipwreck remains found.

The final chapter will be a reflective one in that it will look at the impact the project has had in South Africa and at large. The project has produced an international documentary, a travelling exhibition and has been the subject of at least three postgraduate degrees excluding this thesis. I will briefly analyse the significance of the documentary and exhibition and the importance of disseminating archaeology in the public domain. I will also discuss the potential for utilising the methodology developed during the project elsewhere, looking at the advantages and limitations in different environments.

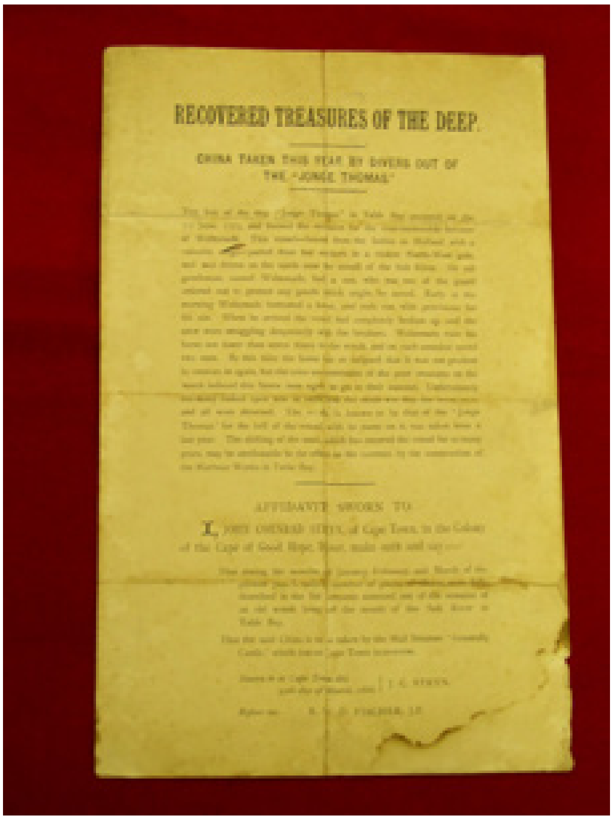
CHAPTER 2: DEFINING *MEERMIN*: HISTORY AND ARCHAEOLOGY

South Africa has a deep maritime past although it is not generally regarded as a maritime nation. With no indigenous shipbuilding industry or derivative maritime industry (that is, indigenous peoples did not exploit the ocean commercially – the commercial maritime industries like fishing, shipbuilding and coastal trading are a legacy from the colonial past) the history of the country has always been mostly inward looking. Even the history of slavery in South Africa has largely focused on what happened on land. In contrast, this project represents the first ever attempt in South Africa to locate the remains of a slave ship. As such, it needs to be contextualised against the broader history of maritime archaeology in South Africa and Africa, existing slave ship archaeology and the more particular history of slavery at the Cape and the specific history of the ***Meermin***.

2.1 SHIPWRECKS AND MARITIME ARCHAEOLOGY IN SOUTH AFRICA

Shipwrecks are important archaeological documents because of the remarkable preservation of, especially, organic materials. This level of preservation happens only in the most exceptional cases on terrestrial archaeological sites (Pearson 1987). The South African coastline has a rich resource of shipwrecks, only a small percentage of the more than 2000 shipwrecks having been physically located. (Gribble 2002). The long coastline presents a challenge for heritage managers in South Africa especially since the location of shipwreck resources is in its infancy. This is particularly because shipwrecks have always been surrounded by an aura of treasure. They have therefore not been exploited primarily as heritage resources but rather as economic ones. An example of this early exploitation in South Africa was the appointment of the well-known diving pioneer John Lethbridge in the early 18th century by the Dutch East India Company at the Cape (C.77, 1727 pp. 107–111). Although Lethbridge's appointment is better regarded as contemporary salvage, it would not be beyond imagination that he could have been employed to recover items from a 16th century wreck had the opportunity presented itself, creating a similar situation to that of the modern treasure hunter exploiting an old wreck. In the 18th century however maritime archaeology was an unknown concept. The shipwreck resource was therefore continually impacted by the hunt for treasure. There are several instances in the 19th century of divers attempting to take advantage of older shipwrecks and the need to manage the concomitant and inevitable conflict arising from the search for treasure. An example of this can be found in an affidavit sworn by a local Cape Town diver J.C. Steyn on 30 March 1886 regarding items recovered from what he believed to be the wreck of the ***De Jonge***

Thomas (figure 1). Other wrecks targeted by treasure hunters included for example the ***Middelburg***, ***Grosvenor***, and ***Birkenhead*** (Turner 1988). These so-called treasure wrecks popularised the recovery of items for commercial gain from shipwrecks and motivated South African heritage professionals to eventually become concerned with the indiscriminate plunder from shipwrecks. This prompted legislative reform in the 1970s and shipwrecks were protected in various ways by legislation from 1979 (Gribble 2002). The popular image of shipwrecks as treasure troves makes the association of shipwrecks with archaeological sites difficult and, in a way, a minor objective of this project is to show that through the application of scientific principles one can learn more from the past than just the recovery of riches. It is hoped the process of finding a shipwreck and the documentation of this process will show that there is more to shipwrecks than fortune and that the methodology developed will aid the management of this resource more successfully.


RECOVERED TREASURES OF THE DEEP.

CHINA TAKEN THIS YEAR BY DIVERS OUT OF THE "JONGE THOMAS."

Figure 1: J.C. Steyn certificate indicating items recovered by him from what he believed to be the wreck of De Jonge Thomas.

This is especially important when we consider the lag in the development of maritime archaeology in South Africa. Only since the late 1980s has there been a concerted effort to improve the situation (Deacon 1988, Smith 1988, and Werz 1993). While the impact on shipwrecks in the 18th and 19th centuries were relatively minor, the resource was significantly affected by the development of scuba diving technology during World War II, which effectively opened up the underwater world to more people. Although this meant that science now had access to hitherto unknown areas, it also made the underwater realm available to the commercial world including treasure hunters. Early attempts at maritime archaeology (Meide 2014) only really came to fruition in the 1960s with work done by George Bass and others (Bass 1966). Although Bass was not the only active archaeologist underwater, it was his work that attracted the most attention. Underwater archaeology in South Africa was not as well developed at this stage. It was not that there was no awareness of shipwreck material, but rather that there was a lack of understanding of the implications and importance of shipwrecks to the study of the past.

In South Africa, some of the earliest ventures in the post-world War II era included widely publicised treasure hunts like that of Tromp van Diggelin in the 1950s (Boshoff 2014). Underwater clubs were formed, the oldest being the Atlantic Underwater Club founded in 1953 (http://www.bellvilleunderwaterclub.co.za/?page_id=125 accessed 21/8/2017). The members of the latter club especially, devoted their time to the hunt for shipwrecks and even published a list of wrecks (Rawe & Crabtree 1978). This list was a shortened version of the work of R.F. Kennedy, a librarian at the Johannesburg Public Library in 1955. The latter work did much to popularise the diving on shipwrecks amongst the burgeoning dive community. Some of the earliest treasure hunting took place in Cape Town during the 1960s with the recovery of items from the wreck of the ***Fame*** (1822). The treasure hunters did donate some of the items to the newly formed South African Cultural History Museum (now part of Iziko Museums) thereby starting the Museum's shipwreck collection. Treasure Hunters can probably grudgingly be thanked, for if it were not for their activities it would have taken longer for maritime archaeology to make inroads in South Africa. It is necessary, however, to point out that the treasure hunters of 1960s South Africa were not the professional businessmen we find in the treasure hunting community today.

There was admittedly little interest from the archaeological profession in South Africa at the time as their overall focus was mostly on the Stone Age (Shepherd 2003). This is surprising given the nationalist atmosphere prevailing in South Africa at the time. This could likely have been due to museum personnel not recognising shipwrecks as archaeological sites, but only as the repositories of interesting artefacts for their displays (Boshoff 2014). The discovery in the late 1970s of Portuguese wrecks on the Eastern Cape coast and the subsequent melting down of historically valuable brass guns, made museum institutions sit up and take notice (Bell-Cross 1980). This event launched an era of legislative interventions that resulted in a system of permits that attempted to control the recovery of items from shipwrecks by shifting the responsibility to museums

(Sharfman ***et al.*** 2012). Permit applicants had to obtain cooperation from a museum before a permit could be issued with up to 50% of artefacts supposedly going to museums. In a sense this opened the floodgates as there were suddenly many applications and recoveries from shipwrecks. Unfortunately the permit system was not very successful, since museums never received the required and promised 50% of items recovered. Museums usually ended up with a responsibility to care for unconserved artefacts, largely out of context and with little or no research data attached – an inevitable result of non-systematic and unscientific recovery (Boshoff 2014).

Shipwrecks were still not seen as important archaeological resources and museums were often fooled by the approaches of treasure hunters with promises of new collections and exhibitions (Gribble 2002). Museums were not driving the research and cooperation with treasure hunters has never been shown to work effectively (see for example Johnston 1993 and Throckmorton 1998). An example is the case of the ***Oosterland*** (Werz 1992) where, although it was under some archaeological control, the collection was eventually divided and in some cases lost with a limited number of objects ending up in the Iziko Museums collection. What this project did show however was that with archaeological involvement there was more control and therefore a larger collection made available to the museum. Unfortunately the museum only ended up with the collection but with none of the field records or research material pertinent to this shipwreck. This was not the case with the other collections generated by the National Monuments Act permitting system as the museum did not end up with even 50% of any of the artefacts recovered (Boshoff 2014). The result of this situation is that representative samples were not obtained, making future analysis and research of collections difficult at best. As with all archaeology the larger the collection or sample, the better the information extracted. This is especially significant, as the information that could potentially be extracted from the collections could have doubled if there had been access to all the artefacts recovered. Instead, treasure hunters generally retained the bulk of the artefacts, which in most cases were dispersed through auctions and other commercial avenues.

Even with the depredations from treasure hunting, maritime archaeology is arguably still better established in South Africa than in the rest of Africa. The exception being Egypt although their focus is more on ancient traditions such as the work in Alexandria and the Dashur boats (Khalil 2008). In the rest of Africa, investigating European expansion is at the forefront of maritime archaeology efforts. Typically this means that the research undertaken focuses on, for example, the trade networks of European East India Companies (see for example Bax & Martin 1974, Playford 1996, Gibbs 2002 and Parthesius 2012). A brief but not exhaustive overview follows to contextualise the state of maritime archaeology in Africa, but also to show where South Africa stands in relation to the rest of the continent. One clear difference that will emerge is that expatriates from Europe and the USA often drive projects in the rest of Africa whereas in South Africa there is a stronger local establishment.

In Ghana, for example, Cook (2012) has done excellent work on the wreck of the Dutch West India Company ship, ***Groeninen*** and Horlings (2012) reported on how this work lent itself to the mitigation and management of the Maritime Cultural Resource in this country. Their work and the study done by Pietruszka (2011) of two shipwrecks and the impact these wrecks had on the broader underlying socio political and economic structures of African-European exchange on the West African Coast is part of the Syracuse University's Central Region Project headed by Christopher De Corse (see also Cook ***et al.*** 2016). In Sierra Leone, a group of Polish dive enthusiasts has been studying a shipwreck, reportedly from the 18th century, off Banana Island (Wytykowski 2012). At the time of writing this text, it was not certain whether they are a legitimate archaeological enterprise or a treasure hunting group although the latter seems more probable and bears future investigation. In Namibia, the discovery of a 1530s Portuguese shipwreck jump-started maritime archaeology in that country, quite possibly because of the rich haul of artefacts found on the wreck and the attempts by the Namibian government to manage the process by insisting that the collection stay in the country (Chirikure ***et al.*** 2010).

On the East African Coast at Mombasa, Kenya, the Texas A&M Institute of Nautical Archaeology executed one of the earliest maritime archaeological projects in Africa in the 1970s (Lane 2012). This was the 1697 wreck of the ***Santo Antonio de Tanna*** more commonly known as the 'Mombasa Wreck'. Although this project had enormous potential it did not help the development of maritime archaeology in Kenya much. Lane (2012) goes on to describe several other shipwreck projects along the East African coast and off the islands of Madagascar, Mauritius and the Seychelles. He also mentions recent work in Tanzania by the University of Ulster to train local divers and heritage practitioners in maritime archaeology. Jeffrey and Parthesius (2013) similarly describe efforts by the Dutch Centre for International Heritage Activities (CIE) to build capacity in underwater cultural heritage in Tanzania.

Tanzania does not allow treasure hunting. Further down the coast in Mozambique however the Mozambique government is playing an uneasy tightrope-game with academics and treasure hunters (Duarte 2012). For many years the Portuguese treasure hunting company Archeonautas, has had concessions on the Mozambique coast especially around the historically sensitive Ilha de Mozambique. Recent efforts by CIE (Jeffrey & Parthesius 2013) focused on workshops to create awareness of the importance of underwater cultural heritage amongst the inhabitants of Ilha de Mozambique. A new development in Mozambique involves the intervention of the Slave Wrecks Project and the eventual banning of Archaeonautas (Lubkeman ***et al.*** 2015). Thus, the intervention of a scientific project has brought new direction to maritime archaeology in Mozambique by prohibiting treasure hunters and creating opportunities for science through the auspices of the Slave Wrecks Project.

The factors that are a common denominator in the African projects (excluding Egypt) are that they are mostly to do with Cultural Resource Management, capacity building and single shipwreck investigations. As in South Africa, the infrastructure for maritime archaeology is limited or even non-existent and therefore an emphasis on capacity building is necessary. Very few of the single shipwreck investigations involved the search for a particular shipwreck and were often the result of accidental discoveries that turned into excavation projects. The different projects were characterised by the traditional maritime archaeology focus on particular vessels, cargoes and trade, reflecting the common threads in maritime archaeology internationally. This too has been the norm in South Africa although projects such as the search for the ***Meermin*** examined in this dissertation is changing the landscape of maritime archaeology in South Africa by looking at a slave ship instead of an East Indiaman.

2.2 BRIEF OVERVIEW OF SLAVE SHIP ARCHAEOLOGY

In the late 1990s, McGhee (1997) lamented the traditional approaches in maritime archaeology and stated that the sub-discipline at that stage had not yet engaged with imperialism, colonialism, and its effects in the wider arena of world history despite the international character of shipwrecks. He criticises the lack of studies by maritime archaeologists into slave shipwrecks as a 'moral disgrace'. McGhee's comments are borne out to some extent by a review of African Diaspora archaeology done by Orser (1998). Nowhere in his review does Orser mention shipwrecks or maritime archaeology indicating that he does not recognise the potential of the resource. In another examination on the archaeology of slave resistance and rebellion Orser and Funari (2001) do not mention the potential for the archaeology of shipboard revolt and the resulting shipwrecks. This lack of work on the ships themselves is perhaps evidence of amnesia amongst maritime archaeologists relating to this period and a deficiency in the approach of historians to the subject of slavery (but see Dow 1927; Eltis 1999, Postma 1999).

The situation seemed to change in the new millennium with quite a few slave-related shipwreck projects appearing. In a 2008 review Webster notes that the only two slave ships excavated before the millennium were the ***Henrietta Marie*** and the

Fredensborg. The Mel Fisher Organization, a treasure hunting group, found the ***Henrietta Marie*** during their search for the treasure ship ***Atocha***. Unfortunately, the investigation was always of lesser importance than the group's main focus – treasure. Over the years however various people did a substantial amount of work and a travelling exhibition was put together (Moore & Malcolm 2008). It is of concern that the artefacts belong to a treasure hunting company who can at any moment decide to sell them.

Another slave shipwreck project was that focusing on the Danish slaver ***Fredensborg*** (Svalesen 2000) discovered by a group of sports divers off the coast of Norway. The motive for investigating the shipwreck was not scientific as the group wanted to recover the cargo of ivory carried by the ship (Svalesen 1995). Fortunately, this changed as the project progressed and the history of the ship and wreck was eventually well documented possibly due to the influence of the Norwegian Maritime Museum in Oslo. This project is something of an anomaly as it started out as a treasure hunting exercise, but through the discovery of the history surrounding the vessel it became a more scientifically acceptable venture, especially since the collections were not sold.

The Webster (2008) review identifies several other slave ship projects for example those investigating the French slavers ***Adelaide*** and ***Le Utile*** and the Danish vessel ***Havmanden***. The review includes other related projects such as the search for the ***Trouvadore*** in the Turks and Caicos Islands and the wreck of the ex-slaver ***James Matthews*** (Henderson 2009). The latter vessel along with the ***Queen Anne's Revenge*** is perhaps the best documented of the shipwrecks mentioned even if it was not a slaver at the time of wrecking. The ***Queen Anne's Revenge*** was originally a French slave ship captured by the pirate known as Blackbeard and wrecked in the Beaufort inlet in North Carolina, USA. It has been the subject of an investigation by the State of North Carolina and East Carolina University (Wilde-Ramsing & Ewen 2012) The Trouvadore is one of the more interesting projects as the history of the ship relates directly to descendants of survivors. As such, the project had the involvement of the community in the wreck investigation as one of its main aims (Sadler 2008).

In an African context, the remains of enslaved individuals originating from a ship-wreck were discovered on reclaimed land in the 1940s in Cape Town. Cox and Sealy (1997) indicated in their investigation of the possible origin of the remains that they were likely to be from the Portuguese slaver ***Paquet Real*** that sank in 1818. The wreck is also believed to be under reclaimed land (Turner 1988). The contention that the remains are from the Paquet Real is not firmly proven and was based on the information available at the time. This accidental discovery is probably the first investigation in South Africa of slave ship related remains.

Another little-known project is the investigation into the French slaver ***Le Coureur*** (1818) in Mauritius (Metwali ***et al.*** 2007). This 19th century slaver was wrecked whilst trying to escape a Royal Navy anti-slavery patrol and has been investigated by the Mauritius Museum Society. The ***Le Coureur*** project is the first examination of a slave shipwreck in an African context.

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The slavery angle is especially important in a South African setting as we seek to broaden the representativeness of our museums and topics of investigation. The methodology developed in the course of this research was tested in the search for the wreck site of the ***Meermin***, a Dutch slave ship that ran aground on the Cape south coast in 1766 after a revolt by the slaves on board (Alexander 2007, Sleigh & Westra 2012). As the ***Meermin*** wreck is the focus of the project, it is appropriate to look at a short history of the ***Meermin*** and slavery at the Cape. To contextualise the project better, it is important to relate the events leading up to the wrecking of the ***Meermin***. By exposing this story, it should become obvious why the ***Meermin*** is an ideal candidate on which to test a new methodology, not only because of our social and historical context but also as a challenging subject for testing the combinations of technology proposed in this project.

2.3 SLAVERY AT THE CAPE AND THE REVOLT ON THE MEERMIN

South Africa has had a turbulent history of oppression and freedom (Dubow 2007). Even archaeology was not immune to it as an academic boycott was initiated against South African archaeologists at the 1986 World Archaeology Congress (Ucko 1987). In 1994 apartheid ended and South Africa elected its first democratic government. The changing political climate and resulting changes in the heritage industry in South Africa after the political transition in 1994 (Mpulwana ***et al.*** 2002) provoked the selection of the wreck of the ***Meermin*** (it being a slave ship). Bredekamp (2006) quoting Deacon (Deacon ***et al.*** 2003) makes the argument that heritage, culture and identity are at the core of the transformation agenda in South Africa, underlining the role of projects like that of the ***Meermin***.

The ***Meermin*** is not a classic 'treasure ship' and the wreck is potentially not artefact rich because extensive contemporary salvage took place (C516 Ff. 112 –113, 182), but still has the potential to uncover the hidden heritage of slavery in South Africa. The history of slavery has been well researched in South Africa by historians for example Shell (1997), Worden (1985) and Boeseken (1977) to name a few prominent texts. Archaeologists in South Africa have also examined slavery see for example Hall (1993), Sealy ***et al.*** (1993), Markell ***et al.*** (1995), Cox ***et al.*** (2001) and Malan (2008).

The first cargo of slaves arrived in 1658 and by the beginning of the 18th century there were more slaves at the Cape than Europeans, mainly because of a policy decision in 1717 by the VOC that entrenched slavery as the major form of labour in the Cape Colony (Worden & Groenewald 2005). Cape Town in the 18th century was a slave-based economy (Shell 1992). Slaves were a highly valuable commodity and were controlled by stringent laws and regulations that would be considered inhumane and draconian to people living in the 21st century. The VOC government owned its own slaves, ostensibly to do public works. The Company slaves were kept in a lodge (now known as The Slave Lodge Museum and currently part of Iziko Museums). The slaves were sourced from the Far East (often the more skilled workers) and places like Madagascar and Mozambique. During the 18th century the VOC often organised slaving voyages to Madagascar to supplement the Company slaves held at the Slave Lodge in Cape Town, Robben Island and at Company outposts (Worden & Groenewald 2012).

As this history deals mostly with the Indian Ocean slave trade, it is doubly important to look at the shipwreck resource pertinent to this route since very little is known of the types of vessels used in this trade particularly by the Dutch. This is in contrast to the Atlantic Ocean slave trade where research has been done on the ships used by the Dutch West India Company (Daalder ***et al.*** 2001, Postma 1999). The East African slave trade and therefore the Malagasy slave trade has not had a similar investment of research in the ships used. This is another reason why the search for the ***Meermin*** is so important.

In 1759 the Dutch government at the Cape requested a ship to replace the ageing ship Hector (C137: 1759 pp. 221-241). In 1761 the newly built ***Meermin*** arrived at the Cape to be stationed there until the end of her career in 1766 (Bruin ***et al.*** 1987). The vessels stationed at the Cape were used for multiple tasks such as the transport of timber from Table Bay to False Bay, the provisioning of the various company outposts and then of course for obtaining slaves, especially from Madagascar. In fact, the request for a new vessel from the government at the Cape in 1759 to their masters in Holland mentions the slave trade with Madagascar as one of the main functions for the new vessel (C137: 1759 pp. 221-241). The ***Meermin*** was certainly used for this as she was in Madagascar in 1762/63 to purchase slaves (VOC Archief 1763, pp. 322-381). The ***Meermin*** however, is important not only because it was a slaver, but also because of the way in which the shipwreck occurred (Alexander 2003 & 2007, Sleigh & Westra 2012). The ***Meermin*** was wrecked after being taken over by the slaves on board and as such can be seen as an early example of the resistance to oppression in South Africa. This is the reason that the ***Meermin*** was selected to focus the development of a new methodology for finding inter tidal shipwrecks. The ship was also wrecked very close to the shoreline in common with many shipwrecks on the Southern African coastline.

Fortunately for posterity, the VOC kept very good records that survive in the Cape Archives repository. These include Incoming and Outgoing Letters, the minutes of the Council of Policy and the Court Proceedings of cases heard at the Cape. All of these documents help in sketching the career of the ***Meermin*** and the events leading up to her wrecking. A brief summary of the events is given below.

The ***Meermin*** set out in December 1765 to Madagascar to purchase slaves (Sleigh & Westra 2012). In January 1766 she was on her way back to the Cape after a successful slaving voyage (CJ390: 1766). One of the officers on board had purchased indigenous weapons in Madagascar. His servant gave these weapons to some of the Malagasies to clean. As they received the weapons they seized the opportunity and revolted, killing half of the Dutch crew. The rest of the crew scurried below decks and battened down the hatches! A standoff now ensued. The Malagasies realised after three days that they did not know how to sail or navigate the ship. A truce with the Dutch ensured that they were on their way again. The Malagasies insisted that they sail back to Madagascar, but their lack of navigation skills counted against them as the Dutch sailed slowly towards the Cape.

After several days they eventually anchored in Struisbaai close to Cape Agulhas on the Cape south coast. Farmers in the area saw the ship from the shore and were immediately suspicious, as she was not flying a flag (C516: 1766/67). The slaves sent two boats full of people ashore to ascertain whether it was Madagascar. As they landed they were captured by the farmers, leaving the ship anchored offshore without any means of reaching the shore. One of the Dutch sailors was sent ashore with this group to help them steer the boats. He informed the farmers of the situation aboard the ship. They notified the local magistrate who organised the farmers into a commando to try to win back the ship.

The ship was at anchor for six days. The people on board the ship then constructed a small craft in which some of the slaves went ashore. They reportedly saw a black sheep herder and a house that appeared to be Malagasy in origin (CJ390: 1766). This convinced them that this was indeed Madagascar. They returned to the ship with the news. During this time the captain and crew of the ship wrote two notes that they sealed in bottles and tossed overboard (figure 2). In the notes they asked the farmers to help them by lighting three signal fires, as this was one of the instructions that the slaves had for the first group that had gone ashore, to confirm that they had reached Madagascar (C516: 1766/67 pp. 84).

After hearing the news from the second Malagasy expedition ashore and seeing the signal fires, the anchor cable was chopped and the slave leader and some of the slaves went ashore. As soon as they landed, they were attacked by the farmers who shot and killed the leader and some of the people with him. When the slaves on the ship saw this, they started fighting with the sailors again. In the meantime, the ship drifted towards the shore and ran aground. The slaves were convinced that their situation was now hopeless and surrendered.

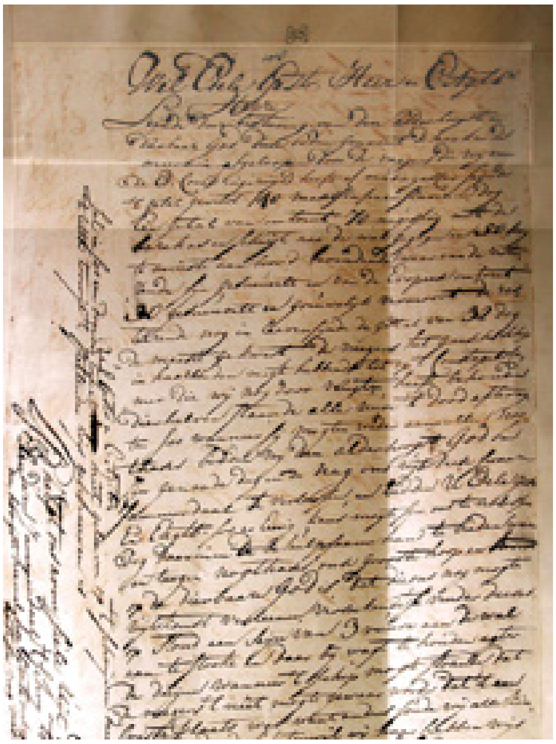

Figure 2: The letter written by the sailors on the Meermin*. They put the letter in a bottle and tossed it overboard. The letter was found by the people onshore. (C516: 1766/67)*

The ship ran aground in the mouth of the Zoetendals River Valley (C144: 1766, pp. 140–144). According to the master shipwright, sent over from Cape Town to inspect the damage, the ship was lying in soft sand in the surf zone with a sandbank building up on the stern side of the vessel (C144: 1766, pp. 181–228). He also noted extensive structural damage to the ship. One of the reports mentions that the ship was lying in the river mouth. The Dutch word 'kil' is used as in – '… in het kil is te komen geleggen'. This word is an Old Dutch word for waterway or river and in the translation of the above phrase means '… it came to rest in the river/waterway' meaning the ship had run aground in the river mouth (Beets & Heinsius 1941).

Since the ship was accessible at low tide, as many of the goods as possible still on board the vessel were salvaged after the slaves had been recaptured. After a few days the weather worsened and the salvage operation was discontinued. The more serviceable items were sent overland to Cape Town. The rest were auctioned off on the beach.

The question now remains as to what can be expected to be left of the ***Meermin***. Sleigh and Westra (2012) contend that nothing remains of the wreck as there is a document in the Dutch Archives in The Hague mentioning the sale of the hull of the vessel for a large sum of money. Several questions arise from this contention. Firstly selling the hull of a shipwreck was a fairly common practice, as demonstrated by the sale of the hull of the French Slaver ***La Jardinaire*** that was wrecked in the same area in April 1794 (C.223, pp. 178–268). In 1795 there is a report that the buyers of the wreck of the ***La Jardinaire*** recovered 12 iron cannons (C.230, pp. 43–76). Secondly there was a report from a farmer in January 1794 (before the wrecking of ***La Jardiniare***) of cannons on the beach that washed open periodically. In the report it is mentioned that these guns could be from the ***Meermin*** or another earlier wreck, the ***Schonenberg*** (wrecked in 1722) (C.221, pp. 101–123). This implies that the main guns were never recovered from the ***Meermin*** and this is reflected in the inventories taken by the VOC at the time of wrecking. The only guns mentioned in the inventories as recovered from the ***Meermin*** are the swivel guns which would be bronze guns of a small calibre.

This is important because the possibility of iron guns and perhaps anchors increases the probability of a larger magnetic signature. Because the ***Meermin*** did not run aground in a storm, it is safe to assume that not all the anchors on board were used. We know from inventories of scrapped vessels similar to the ***Meermin*** that they carried between 4 and 5 anchors. This is evident in the inventory of the hoeker ***Termijen*** in 1760 (C.138, pp.390–419) and the hoeker ***Neptunus*** in 1779 (C.157, pp. 386–423). As there are no reports of anchors being recovered it is safe to assume that the items are still under the sand.

So there is a good likelihood of being able to detect the ***Meermin*** magnetically. We do however have to determine a search area as it is probable that the area where the event happened has changed over the years. In the next section, the location and possible changes in the environment will be discussed. This section will also look at the data that has informed the demarcation of the search area.

2.4 DEMARCATING THE SEARCH AREA

The ***Meermin*** was wrecked on the southern Cape coast in the Struisbaai area. From the archival documents we can determine an approximate position as there are references to landmarks in the letters written by the Magistrate from Swellendam (Le Sueur) to the Council of Policy in Cape Town (CJ 516). The letters mention that the ship came to rest in the mouth of the ‘Soetendals Valleij’ (valley). The name ‘Soetendals Valleij’ refers to the wreck of the DEIC (Dutch East India Company) ship ***Soetendal*** that was wrecked in the area in 1673 (Burrows 1994).

One of the earliest references to the area as Soetendals Valleij can be found in the Council of Policy minutes of 1712 reporting on escaped slaves that the Dutch government believed to have crossed one of the main mountain ranges, the Hottentots

Holland. The minutes instruct a commando to search in particular areas up to the Soetendals Valleij where they mention the 'river runs into the sea' (C.30, pp.15–16). During the ***Meermin*** episode, the shipwright sent from Cape Town to investigate the wreck mentioned that the ship was grounded in the river or small stream (C144, pp. 181–228). The river was not named, but one can assume that it is the modern day Heuningnes River as it is the only river in Struisbaai that exits into the sea. It is important to note is that the Soetendals Valleij drains into the Heuningnes River (Bickerton 1984). The river mouth is therefore the primary landmark in establishing a position for the shipwreck.

The Heuningnes River is the southernmost estuary in Africa. The drainage system traverses calcified dune sand and coastal limestone of the Bredasdorp beds with the estuary situated on unconsolidated sands (Bickerton 1984). Admiralty charts from the 19th century indicated considerable sand drifts along the coast (Walsh 1968). This wind-driven sand movement often caused the river mouth to be blocked, flooding the interior that consisted of agricultural land. In 1939 the Department of Forestry of the Union of South Africa started purchasing land on either side of the river mouth with the aim of stabilising the drift sands (Bickerton 1984). This process started in 1942 with the planting of Marram grass (***Amnophilia arenia***) on the bare sand. Sand traps were also constructed with brushwood. This caused steep dunes on either side of the river mouth to be eroded by the river and the sea. Aerial photographs from 1938 to 1981 clearly show the change from completely mobile drift sands to densely vegetated dunes on either side of the river mouth (Lubke & Hertling 2001).

Bickerton (1984) indicates that the estuary mouth could have deviated to the degree that its present position is at least 2km from its position at the end of the 19th century. The flood plains and salt marshes could possibly indicate previous river courses. It is important however to look at old maps to see how the river mouth has changed. The two oldest maps that clearly show the river mouth date from the 1770s about 10 years after the ***Meermin*** episode. The first published map was by the Swedish naturalist Anders Sparrman. He was in the Cape during the period 1772 to 1776 and travelled into the interior (Sparrman 1789). One of the results was a map of his travels that clearly shows Soetendals Valleij draining straight into the ocean (figure 3).

The VOC sent several expeditions inland both northward and southward throughout its period of rule (Liebenberg 2012). Some of the expeditions produced maps. Very few of them were published. Pieter Cloete allegedly produced one of the more important maps for this project from his journal of a voyage he made with the then Governor of the Cape, Hendrik Swellengrebel, in the year 1776. There is some doubt to his authorship as he was quite young in 1776 and the map is ascribed to the then surveyor at the Cape, C.F. Brink (Brommer ***et al.*** 2009). Cloete's map is more detailed than Sparrman's and clearly also shows the river running into the ocean (figure 4). Both maps show the river running in a straight line and do not show the characteristic bend in the river evident today.

Figure 3: Map by Anders Sparrman of his journey through the Cape and published in 1785 The map shows the Heuningnes River running straight from the ocean (Sparrman 1785).

Figure 4: Map believed to be by Hendrik Cloete dated to 1776. The map very clearly shows the Heuningnes River and the location of the river mouth ten years after the Meermin episode (Brommer et al. *2009)*

The next map that shows the river mouth clearly is by J.C. Frederici compiled in 1789/90. This map is more accurate than the other maps and shows the river in more or less the correct position (Liebenberg 2012). Frederici's map is seen as the best map of the south coast of the Cape Colony from the 18th and beginning 19th centuries. It again shows the river going straight into the sea from a large inland wetland named Soetendals Valleij.

An admiralty map of surveys done in 1826 and 1854 (Hydrographic Office 1855) also shows the river as running straight and names the river the 'Honing' or Honey River. At this point it is important to mention that maps, especially nautical charts, do not always show the river, but focus rather on the coastline. This is probably because the Heuningnes River is not a major river, but rather small in size. It is difficult to see from the sea and it had no economic significance. Coastlines were the most important features to mapmakers from the 17th to the 18th centuries and it is only when the British Admiralty started a significant programme of mapping in the 19th century that this changed (Tooley 1969). It is safe to assume that the current position of the river mouth is not quite where it was in 1766 as the current river course has a noticeable bend before running into the ocean (figure 5). This bend is as a result of the river closing and opening up periodically in historical times as the winds moved the sand (Bicketon 1984, Walsh 1968). When the dune reclamation project and the process of keeping the river mouth open started in the 1940s, it froze the position of the river mouth to what it was at the time. This aided in estimating and deciding the size of the search area for the ***Meermin***, which was established to be at least 2 km on either side of the current river mouth on the beach and 200 m offshore.

Figure 5: Aerial photo of the current location of the river mouth. One can clearly see the bend that was not visible on the old maps. Original search area outlined in red.

2.5 THE SHIPWRECK RESOURCE AT STRUISBAAI

There is a good likelihood that wrecks other than the ***Meermin*** exist in the search area. Burrows (1994) lists 29 wrecks in the Struisbaai area although he places the ***Meermin*** closer to Cape Agulhas. The 29 wrecks consist of one from the 17th century, two from the 18th century and the majority from the 19th century. Turner's work (1988) lists 35 shipwrecks – two from the 17th century, six from the 18th century and the rest from the 19th century. The SAHRA National database (Table 1) lists 40 shipwrecks in the area with a similar distribution of dates as Burrows' list although with three 18th century ships. What this succinct analysis of the shipwreck resource in the area indicates is that there was a high likelihood of finding predominantly 19th century shipwrecks in the search for the ***Meermin***. If an 18th century shipwreck were found, it could only be one of a possible six shipwrecks of which the ***Meermin*** is one.

As stated above the sand in the area of the Heuningnes River is very mobile. This has resulted in the wrecks all being covered by several metres of sand. One of the best techniques for detecting buried shipwrecks is to use an instrument known as a magnetometer discussed in section 2.7. The next section however will describe the ***Meermin*** in more detail.

2.6 SHORT DESCRIPTION OF THE MEERMIN

The ***Meermin*** was a type of ship known as a 'hoeker', a specific type of ship that has its roots in the 14th century (Hoving 1995). The ship type was developed for catching cod and haddock by using lines with baited hooks – from there the name 'hoeker'. Originally the ship type had only one or two masts, but in the 17th century the Dutch East India Company (VOC) built several of these vessels as cargo carriers, sometimes with three masts. This type of ship was very popular with the VOC from about 1665 to 1670. The hoekers' type of construction withstood the warping effects of the Eastern waters better than the 'fluits' – the ship type of choice up to then. The VOC built several hoekers up to the 1790s (Haalmeijer & Vuik 2002). A number of these hoekers were constructed during the 18th century for the Cape service (Bruin ***et al.*** 1987). Groenewegen's copper plate prints published in 1789 show two views of the type of hoeker used by the VOC (figure 6). However, the best impression we have of what the ***Meermin*** actually looked like can be found in a ship's draft done in 1760 by J. de Vlaming. It is unusual to have a draft of what was viewed as a common ship at the time. It is therefore important to understand how this document came to be created.

The first ship plans were published as part of treatises on shipbuilding (Ferreiro 2007). In the Netherlands this was originally represented by two main treatises,

TABLE 1. Shipwrecks in the Struisbaai Area (SAHRA National Shipwreck Database)

SHIP NAME	AREA	PLACE	VESSEL CATEGORY	TYPE	NATIONAL-ITY	DATE WRECK
South American	Struisbaai	3.2 km west of De Mond	Wooden Sailing Vessel	Ship (?)	American	1889/09/17
Mackay	Struisbaai (Struisbaai Plaat)	De Mond (1.5 km from Heuningnesrivier)	Wooden Sailing Vessel	Barque	British	1871/09/12
Meermin	Struisbaai	De Mond / Mouth of Heuningnes River	Wooden Sailing Vessel	Hooker (Cape Packet)	Dutch	1766/02/22
Elizabeth A Oliver	Struisbaai	Die Plaat (near)	Iron-Framed Wooden Sailing Vessel	Barque (Full-rigged)	British	1873/01/14
Isaac	Struisbaai	Eastern corner of bay	Sailing Vessel	Sloop		1847/03/06
Keyzerlyk	Zoetendals Vlei	Mouth of the Zoetendals Vlei	Wooden Sailing Vessel			1871/12/09
Schoonberg	Schoonberg Bay	Northumberland Point (reef off point)	Wooden Sailing Vessel	East Indiaman	Dutch	1722/12/20
Port Fleetwood	Struisbaai	On Beach	Wooden Sailing Vessel	Schooner	British	1845/01/05
Flamingo	Struisbaai	Schoonberg Bay	Wooden Sailing Vessel		American	1844/12/03
Osmond	Struisbaai	Struisbaai				1872/01/01
Dora K	Struisbaai	Struisbaai	Motor Vessel	Fishing Vessel	South African	1974/06/01
Convenance	Struisbaai	Struisbaai				1871/05/22
Elizabeth Oliver	Struisbaai	Struisbaai				1881/01/14
Fleetwood	Struisbaai	Struisbaai	Wooden Sailing Vessel		British	1846/09/15
Malagas	Struisbaai	Struisbaai	Motor Vessel			1965/01/01
Ospray	Struisbaai	Struisbaai	Sailing Vessel	Schooner		1853/04/08
Hemba	Struisbaai	Struisbaai	Iron Vessel	Ship (?)		1870/09/14
Eliza and Ann	Struisbaai	Struisbaai				1870/09/21
Jupiter	Struisbaai	Struisbaai	Wooden Sailing Vessel	Yacht	Dutch / Cape	1686/01/01
Perekop	Agulhas	Struisbaai	Sailing Vessel	Barque		1862/07/14
Barrys 1	Struisbaai	Struisbaai	Wooden Sailing Vessel	Schooner	South African	1848/04/04
Elise	Struisbaai	Struisbaai	Sailing Vessel	Schooner	German	1879/06/12
Equator	Struisbaai	Struisbaai	Composite Sailing Vessel	Brig	British	1856/02/07
C P	Struisbaai	Struisbaai	Sailing Vessel	Barque	French	1874/10/05
Nossa Senhora dos Milagros	Agulhas	Struisbaai	Wooden Sailing Vessel	East Indiaman	Portuguese	1686/04/16
Venerable	Struisbaai	Struisbaai	Wooden Sailing Vessel	Brig	British	1840/02/22
Albert	Struisbaai	Struisbaai				1857/02/13
Lizzie	Struisbaai	Struisbaai				1861/10/01
Zoetendal	Struisbaai	Struisbaai and De Mond (between)	Wooden Sailing Vessel	Flute (East Indiaman)	Dutch	1673/08/23
Eastern Empire	Struisbaai	Struis Point		Ship	British	1869/06/26
Amersham	Arniston	Struis Point	Sailing Vessel	Barque	British	1869/09/19
Bodiam Castle	Struisbaai	Struis Point	Wooden Sailing Vessel	Schooner	British	1852/08/13
Dundrennan	Struisbaai	Struis Point	Iron Vessel		British	1895/04/06
Ellen	Struis Point	Struis Point	Wooden Sailing Vessel	Barque	British	1861/09/01
Sparfel	Struisbaai	Struis Point	Wooden Sailing Vessel	Schooner	French	1869/09/04
Zuidam	Agulhas	Struis Point (West of)	Motor Vessel	Fishing Vessel	South African	1990/02/09
Drei Thurme	Struisbaai	Struis Point	Sailing Vessel	Brig	German	1854/12/30
La Jardiniere	Struisbaai	Zoetendalsvlei	Wooden Sailing Vessel	Frigate	French	1794/04/04
Lord Hawkesbury	Struisbaai	Zoetendalsvlei	Wooden Sailing Vessel	Whaler	British	1796/05/26
Edward	Agulhas	Zoetendalsvlei & Schoonberg Bay	Wooden Sailing Vessel	Ship	British (?)	1809/01/01

those by Witsen (1671) and by Van Yk (1697). This was however unusual and it was not till the 1740s that ships' plans started appearing on a more regular basis in the Netherlands. Criticism of the sailing characteristics of Dutch ships compared with those of British ships prompted the VOC in 1727 to hire English shipwrights like Charles Bentam (Hoving & Lemmers 2001). By this time the British had established the use of ships' plans as well as dockyard models of proposed ships. The main idea behind having a ship's plan was standardisation and quality control. There was an understandable outcry from Dutch shipwrights that lasted for several years. They contended that their methods were as good as if not better than the British. Led by the Rotterdam family Udemans, several treatises were written and ships' plans produced (Hoving & Lemmers 2001). One of the Dutch nautical architects of this period was J. De Vlaming. He produced a manuscript of different Dutch ship types. One of the plans he produced in the manuscript was that of the ***Meermin*** (figure 7).

Figure 6: A VOC Hoeker as etched by Groenewegen in 1788. This etching gives a good idea what the Meermin *could have looked like under full sail.*

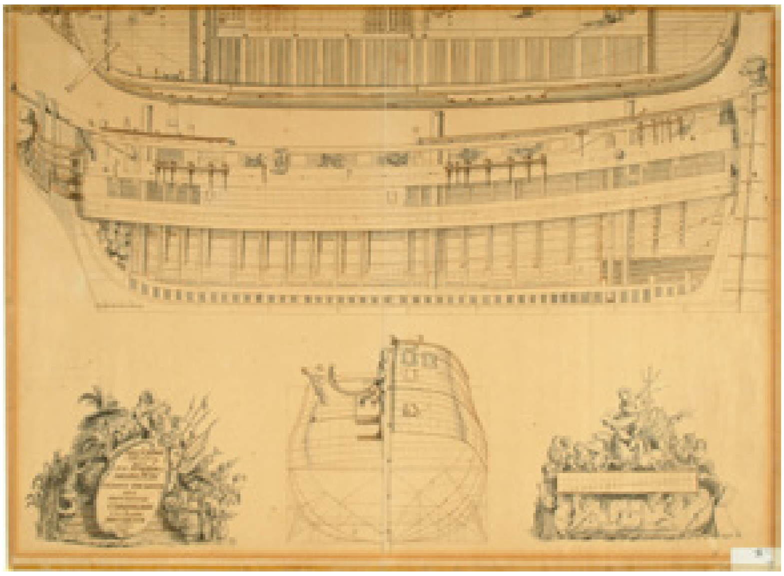

Figure 7: The draft of the Meermin *by J De Vlaming dated 1760.*

The significance of the ***Meermin*** plan is that it is not a building plan as alluded to by Sleigh and Westra (2012). The date on the plan is 1760. The ***Meermin*** was launched in 1759 (Bruin ***et al.*** 1987). It is, therefore, more than likely that the plan was a representation of the ship after she was built. De Vlaming was not officially associated with any of the shipyards in Amsterdam (Hoving & Lemmers 2001) and there is a strong indication in the unpublished manuscript in the Maritime Museum in Amsterdam that he was attempting to show the skill of Dutch Naval architecture through his work. We can therefore accept the plan of the ***Meermin*** as a factual representation of the actual ship itself after she was launched (Hoving e-mail correspondence 27/03/2006). Although there was an indication that the ***Meermin*** was destined to be a slaver, as this was the requirement from the Council of Policy at the Cape upon requesting the new vessel (C137: 1759, pp. 221-241), we also know that this was not her sole function at the Cape.

As far as we know, the Dutch did not build specialised slave ships (Postma 1990). This may have been different for the Dutch West India Company (WIC) as there is clear evidence for slave ship contracts (Balai 2011). The same cannot be said for the VOC. Ships were however modified for the slave trade (Westra & Armstrong 2006). There is mention of special portholes with bars fitted in the hold housing slaves for ventilation and that men and women were kept apart by a partition. The only modification that was asked by the Cape Government in the 1759 request (C137: 1759, pp. 221-241) was the addition of a side loading bay for timbers as one of the main tasks for Cape based vessels was to deliver timber to Simon's Town. This feature is not apparent on the De Vlaming plan and may have been added as a later modification. The possibility of finding a feature like this is slim as it would have been part of the top structures of the vessel that was most likely broken up after the auction on the beach.

At best, the features one can expect will be the lower parts of the ship including the keel, keelson, frames inner planking and outer planking as well as sacrificial planking. Another feature that can be useful for identification is the long mast step under the main mast. The room and space between the frames can also be taken from the De Vlaming plan. Yet another interesting feature is the fairly long retaining strap that connects the stem to the keel. This is most likely to be of iron as are the fastenings. De Vlaming shows some of these fastenings and the pattern of the fastenings could also contribute to an eventual identification. So by looking closely at the plan and measuring the remains found one could determine a possible identification. Another step is to look at the type of timber any particular wreckage is constructed of.

We know that the Dutch used mainly oak for the construction of their ships (Gawronski 1996). They imported the oak mainly from Germany and would have used it in all the major members of the ship especially the frames (Hoving e-mail correspondence 27/03/2006). The Dutch also used a system of sacrificial planking applied to the outer hull planking in order to protect the vessel against marine molluscs (Van Duivenvoorde 2015). The internal modifications one could expect for the carrying of slaves was most likely pine (Westra & Armstrong 2006) although it is likely that oak was also used. There is also a slim chance that, as the modifications were most likely done at the Cape, indigenous South African timbers could have been used. Clearly, any wreckage with oak main members needs closer investigation but to do this the targets found need to be excavated and exposed.

Section 2.7 will give a brief overview of the history of magnetometry as well as discuss some of the different types of magnetometers available for archaeological survey.

2.7 A BRIEF BACKGROUND TO MAGNETOMETRY

Einstein considered the detailed understanding of the Earth's magnetic field as one of the five most important unsolved problems (Courtillot & Le Mouel 2007). One could say that this search for knowledge of magnetism started in the first century AD with the Chinese who invented the compass, and truly came into its own in the 20th century with the development of magnetometers. Oddly enough South Africa also featured in the early part of the 20th century with a magnetic survey of the dikes in the Pilansberg conducted by Hans Gelletich (De Beer 2011).

The most common and important instrument for measuring magnetic fields is the magnetometer. Magnetometers have been used for geological prospecting (Ambrose 1945, Bartington & Chapman 2004), the study of meteorite impact craters (Arifin ***et al.*** 2010), marine geology (Lyengar ***et al.*** 1992), searching for unexploded ordinance (Munschy ***et al.*** 2007) as well as for the mapping of magnetic soil anomalies (Mathe & Levesque 2003). They have been mounted on helicopters (Lundberg 1947), aircraft (Reeves 2005), all-terrain vehicles (Athens ***et al.*** 2011) and many different forms of frames, carts and staffs (Gaffney & Gater 2006). This versatile instrument is therefore used by many disciplines and has obviously developed over the years into different types using different principles of physics. The primary interest for the purposes of this dissertation is in the magnetometer's application in archaeology and the least complicated methods of operation thereof.

Some of the earliest archaeological explorations were carried out by E. Thellier in 1938 with samples from various periods from France and Germany (Thellier 1938, Abrahamsen 1973). It is however in the 1960s with pioneers like E.K. Ralph that magnetometry as an archaeological tool came into its own (Ralph 1964). From 1962 to 1976 she documented 49 sites in 13 countries and plotted the measurements by hand (McGovern ***et al.*** 1995). The magnetometer eventually became an indispensable tool especially for finding buried settlements measuring remnant magnetism (for example as found in ceramics and fire pits where the magnetic field at the time was fixed in the object or feature by the application of heat) and induced magnetism (disturbances created by, for example, the digging and infilling of ditches) (Gaffney & Gater 2003, Schmidt 2007). Magnetometers have been and still are used on a wide variety of sites ranging from settlement, industrial, ritual and garden sites from nearly all periods of human history from the Palaeolithic to Historical periods (Aspinall *et al.* 2008). In South Africa magnetometers on land based sites have mainly been used for Archaeomagnetic dating by using a SQUID system (for example Thackeray *et al.* 2002, Herries *et al.* 2006 and Neukirch *et al.* 2012). Magnetometry is however not currently a widely used method for the location of new sites on land in Africa other than in Egypt (Smekalova *et al.* 2005) and one study at Zilum in Nigeria (Magnavita & Schleifer 2004).

Magnetometers were also used in the study of underwater sites from quite early on (Hall 1966, Green 1970, Arnold & Clausen 1976) and is currently one of the best tools available to locate shipwrecks (for example Broadwater 1980 & 1988, Anderson 2010, Passaro 2010, Evans & Voisin 2011, Moffat *et al.* 2011 and Palmer *et al.* 2014). In South Africa the magnetometer unfortunately featured prominently in the arsenal of treasure hunters (Turner 1988). There were, however, also some archaeological applications such as the search for the remains of the *São Gonçalo* (Smith 1986) and the search for shipwrecks around Robben Island (Werz 1993).

One of the main techniques used during this project is that of airborne magnetometry. The first aeromagnetic survey was carried out in 1921 from a balloon by Lundberg (Gaffney & Gater 2006) and has since been developed to be used in helicopters and airplanes. It has mainly been used for geophysical mapping (Behrendt & Klitgord 1980) and detection of unexploded ordnance (Doll *et al.* 2008). In maritime archaeology one of the more well-known wrecks found by an aerial magnetometer was that of the HMS *Pandora* (Henderson 1983). There is one other larger scale instance of airborne magnetometry being used in archaeology, namely a survey done on the Missouri National Recreational River (Molyneaux 2002) with the aim of collecting archaeological data as well as extensive geophysical information. The archaeological data were collected mainly for the management of cultural resources in the area.

Aeromagnetic techniques have never been used in South Africa for the detection of archaeological remains. Shipwrecks are actually the ideal resource to look for using this technique as they often contain large quantities of ferrous metals. The challenge is to see whether the method can also detect wooden shipwrecks. This is not as unlikely as it may seem as wooden ships during the period of the *Meermin* used iron fastenings extensively and as Gearhart (2004) has shown, these can be very detectable.

Magnetic surveys depend on the contrast in the magnetic properties between an archaeological feature and its surrounding context or environment (Schmidt 2007). This contrast or local disturbance to the earth's magnetic field is known as an anomaly and it is caused by what is known as either induced or remnant magnetism (Smekalova ***et al.*** 2005) as mentioned above.

Magnetic detection is enhanced by using a gradiometer configuration. A gradiometer is two magnetometer sensors in series (Gaffney & Gater 2006). The theory is that the two sensors measure two different parts of the magnetic field at the same time and therefore will eliminate any natural variation in the continually changing magnetic field of the earth (diurnal changes). If a gradiometer configuration is not available a second magnetometer is often placed in a static position as a base station. The data from the base station and the roving magnetometer sensor are combined to do a diurnal correction.

All magnetometers are not alike and can basically be divided into two broad categories – vector and scalar magnetometers (Hrvoic & Hollyer 2009). In very rudimentary terms a vector magnetometer can be described as measuring in a specific direction – the magnetometer sensor has to be aligned in a specific direction for it to measure effectively. An example of this type is a fluxgate magnetometer. Scalar magnetometers on the other hand measure regardless of direction and include, for example, proton precession magnetometers, overhauser magnetometers and optically pumped magnetometers (for example caesium vapour magnetometers).

All of these types of magnetometers have been used in archaeology. There have been several surveys as to which type is better, for example, Gambetta ***et al.*** (2008), Becker ***et al.*** (2007) and Camidge ***et al.*** (2009). In maritime archaeology, scalar magnetometers seem to dominate, especially Overhauser and Caesium Vapour magnetometers. These two types of magnetometers were the types that were used in this project. This was determined by the availability of the instruments (whether they could be locally sourced) as well as how effective they were in detecting anomalies. Of the two, the Caesium Vapour instrument is often regarded as the more sensitive (Camidge ***et al.*** 2009).

2.8 SOFTWARE

The purpose of this short discussion is not to give a comprehensive overview of what is available, but rather to relate some of the methods used at different times and what I found eventually to be the most useful in analysing the magnetic data. Magnetometers generate data in numerical format. Often the range of data is enormous. To interpret the information effectively the data has to be visualised in a graphic format. In its simplest form, data was collected in analogue format by running a paper trace through a recording device with a needle that reacts to the signals sent from the magnetometer (figure 8). This creates a graph of simple spikes and valleys. An anomaly would for example register as a spike on the graph. The problem with this kind of representation is that it is very difficult to discriminate between different types of magnetic signals. How, for example, do you see whether a spike or series of spikes represents dipoles that are significant in the detection and identification of shipwreck signatures (Gearhart 2004)? It is clear that better visual representation is needed.

Figure 8: Anologue paper trace of the magnetic signatures found during the Meermin *beach survey with a magnetometer towed on surfboard.*

Magnetic data can only be visualised as the result of a series of processing functions (Bright *et al*. 2014). This can range from hand drawn contour charts (McGovern ***et al.*** 1995) to using software and creating a range of different visual representations of the data. Contour maps for many years became the primary display method for magnetic maps (Nabighian ***et al.*** 2005). The big change happened in the 1980s when the contour maps were filled with colour. This eventually led to the adoption of grey and colour gradational and shaded relief images that we see commonly today. Software now interprets the data by using a variety of algorithms and can even produce three-dimensional images from the data. Gridding and contouring software such as Geosoft and Surfer are readily available and bring a degree of flexibility and portability of data between computers (Reynolds 2011). Specialist geophysical software such as Geosoft can import and export data to and from Geographical Information Software like ArcGIS. A note of caution though is that the use of gridding software with filtering capability can cause the data to be over filtered with the potential loss of important anomalies. So, often less is more.

Although one can use specialised geophysical software, it is possible to utilise Geographical Information System (GIS) software to visualise magnetic data (Bright ***et al.*** 2014; Nabighian ***et al.*** 2005). The US National Park Service Submerged Resources Center developed a custom scripted tool for the GIS software package, ArcGIS. This was in response to a contract from the US Bureau of Ocean Energy Management's office of Renewable Energy for a way to assess magnetic data submitted by developers as part of impact assessments (Bright ***et al.*** 2014). The eventual outcome of this year long intensive theoretical research, field-testing and software programming was the development of a way to assess magnetic data sets not just visually but also quantitatively. This means that as well as visualising magnetic data, they can also predict the depth and potential mass of the anomaly detected. This form of data assessment has a lot of promise especially if developed further to be applied in Open Source GIS packages like QGIS since ArcGIS is prohibitively expensive and not always available to archaeologists working on a small budget.

During the ***Meermin*** project, a range of methods were used, from a paper trace, to software ranging from basic spreadsheets to the free software added by manufacturers of magnetometers, to general gridding software and specialised geophysical software. One of the software packages used in the early part of this project is relatively easily obtainable and not overly expensive. This is the contouring, gridding and mapping software 'Surfer' produced by Golden Software. Essentially the software interpolates xyz data into a regularly spaced grid (http://www.golden-software.com/products/surfer/features accessed 8/02/2017). As applied to magnetic data the x and y would be the positional coordinates and the z the magnetic reading in Nanotesla or Gamma. One can then create either a regular contour map or a colour gradient chart. Surfer, however, has limitations as it does not have extensive filtering capabilities. It therefore makes it difficult for a relatively novice user to remove unwanted noise without extensive programming experience.

On the other hand, a specialist geophysical software package, like Geosoft's Oasis Montaj, has built in filters and automated scripts that help in interpreting large volumes of spatially orientated geophysical data and provides the functionality required to manage, manipulate, visualise and map this data (http://www.geosoft.com/products/oasis-montaj/overview accessed 23/03/17). The downside is that like ArcGIS, Geosoft is prohibitively expensive. Fortunately, the project was able to get a free educational licence from Geosoft upon request. Geosoft was especially useful in interpreting the handheld magnetometer data, and once one understands the basic concepts of gridding, fairly easy to use on a basic level.

The author did not have the skills nor access to professional GIS software at the time and therefore did not make much use of it other than the geo referencing of one or two historical maps used in the identification of shipwreck sites (next section). It was possible however to use the widely available Google Earth GIS software to superimpose results from the different surveys undertaken. This easily available software is increasingly being used by archaeologists to find and visualise sites geographically (Myers 2010, Kamaris *et al.* 2011, Sadir & Rodier 2012) and although not as customisable or arguably as accurate as other professional GIS packages it is still useful in analysing geographic data for archaeologists with limited access to software like ArcGIS. In the case of the ***Meermin*** project, it was useful for evaluating the accuracy of the various surveys.

The next chapter discusses the application of magnetometers in the search for the ***Meermin***. This will follow a chronological progression as the project developed, with different instruments sourced as their existence in South Africa became known to the author. There will also be an analysis of the magnetic signatures and a comparison of the instruments and methodologies.

CHAPTER 3: THE SEARCH FOR THE *MEERMIN*

Developing the methodology during the ***Meermin*** project was a heuristic process in the best tradition of underwater archaeology. Like the development of this sub-discipline of Archaeology that was characterised by trial and error and innovation in creating a workable methodology (Bass 1966), we had to find our way by using what was at hand and apply it to the problem before us. Sometimes we were successful, but often the system we applied was not effective. Below this exploratory approach will be discussed to reveal the development of the final methodology.

As the museum does not own a boat or a magnetometer, the instruments were sourced locally either by hiring or by donation of usage. This was the ***modus operandi*** for the airborne system as well as the handheld magnetometer. It was vital to create partnerships for a successful project with partners like the Council for Marine Geoscience, The South African National Space Agency, Cape Nature Conservation (the area we operated in is a nature reserve) and the South African Heritage Resources Agency. Funding was supplied by a grant from the National Lotteries Distribution Trust fund. The chapter will begin by sketching out some of the background that eventually led to the development of a complete methodology for finding inter tidal shipwrecks. It will then explore the actual magnetometer surveys developed, and what the results of the various surveys were. Lastly, there will be a short discussion on the processing of magnetic data

Data processing can be done in many different ways, some more expensive than others. It is a benefit if one has the services of a professional geophysicist, but it is important to be able to do one's own analysis because archaeology often has different requirements from exploration geophysics as applied by mining companies like Anglo American. For the archaeologist, and especially the archaeologist in South Africa, it involves a steep learning curve particularly if the outcome is to develop a methodology that can be applied elsewhere. A geophysicist is not always available. At the very least the archaeologist should be able to do basic analysis of the data with available software from proprietary software packaged with magnetometers, to general gridding software and finally specialised geophysical software.

3.1 IN THE BEGINNING

Archival evidence indicated that the wreck of the ***Meermin*** could be very close to the shore and indeed on the beach, as it was stated that the ship was grounded a musket shot from the shore (CJ 516). After corresponding with Mr. John Austin of the Black Powder Society, now the Black Powder Shooting Union of South Africa, (http://www.bpsu.co.za/ accessed 29/06/16) it was suggested that Mr. W.S. Curtis of the Crimean War Society in the UK, be consulted since he had done research on the range of muskets (e-mail correspondence 29 June 2004). Mr. Curtis stated that the effective range of a musket was between 200 and 150 yards (182 to 137 metres). The Dutch East India Company Shipwright reported in March 1766 (C 144) that, after the initial grounding, the ship was later on driven three or four ship lengths closer to the shore. Given that the ***Meermin*** was about 30 m long it would place her nearly on the beach or at least in the surf zone. It was therefore prudent to focus most of the search in this area.

A logical first step was to visit the area at De Mond Nature Reserve to determine the nature of the terrain. The game rangers were interviewed (R. Jalving & P. Swart pers. comm.) on the visibility or absence of shipwreck remains in the estuary. It seemed that one particular wreck assemblage appeared and disappeared every four to five years. Colloquially known as 'Die Maggie' the manifestation of this wreck was even reported in the local newspaper (figure 9). This wreckage could be that of the ***McKay***. This will be discussed in the next chapter. Interviews with members of the public and some of the scientists who worked in the De Mond area also indicated that this particular wreckage often opened up (S. Lambert, F. Spamer & K. Spencer pers. comm.). What was interesting however is that their memory of the position of the wreck differed anything from 400 to 200 m from the actual position. We could determine the actual position as the wreck was open on a site visit in November 2002. At a later visit in 2004, the wreckage was covered in sand and attempts to probe it with a 1.5 m stainless steel rod proved fruitless indicating that the site was either covered in a large volume of sand or that the positioning was inaccurate.

Foto: Stoefie Rossouw

Figure 9: The wreck known as "die Maggie" from Die Burger 11/07/1998.

These first visits indicated the need for some form of remote sensing. A first effort involved the use of a metal detector. This proved singularly unsuccessful as later tests indicated that the instrument had only a 50 cm penetration range.

3.2 FIRST MAGNETOMETER SURVEY

Initial attempts to acquire a magnetometer from the University of Stellenbosch were unsuccessful. The author had used a proton magnetometer for his honours degree project in the late 1980s as a student in the department of Archaeology (Boshoff 1989) so was aware of the existence of this instrument. Unfortunately, the Archaeology department at Stellenbosch University was dissolved when the head of the department retired in 2000 (Schrire 2010) and the instrument became part of the department of Geology's holdings. At the time, they did not see their way clear to lending the instrument to the project.

It was however possible to hire a marine proton magnetometer from a local diver for one day. The procedure was to tow the magnetometer, lashed onto a foam body board, along the beach from the Heuningnes River mouth towards Struisbaai. This was a five person operation. Two people walked behind the vehicle, one to control the cable and one to take relevant GPS readings with a handheld instrument (figure 10). An operator sat in the back of the vehicle to monitor the magnetometer readings. Another person would drive the 4 x 4 and finally, the last person would photograph the process.

Figure 10: Magnetometer being towed behind a vehicle on a surfboard.

Five possible targets were identified (Table 2). Of these, one was the visible wreckage we had found in 2002 (the identification of the different assemblages found will be discussed in the next chapter). Some of the hits were closely spaced indicating the likelihood of it being a shipwreck. Closer to the Struisbaai Plaat area, little if any magnetic anomalies were found.

TABLE 2. Positions obtained by Surfboard Survey

LMK	LONGITUDE E	LATITUDE S
1	20.1150	-34.7000
2	20.1088	-34.7197
3	20.1080	-34.7200
4	20.1072	-34.7202
5	20.1069	-34.7205
6	20.1002	-34.7236
7	20.0930	-34.7277
8	20.0922	-34.7283
9	20.0872	-34.7316

The next day saw a return to the various magnetometer targets with a 2 m stainless steel probe. The idea was to knock the probe in as far as possible to see if there was any material present under the sand. This was a singularly unsuccessful exercise and highlighted the possibility that the targets were potentially under more than 2 m of sand.

The visible wreckage found in 2002 was also investigated. The tops of the frames were visible (figure 11). Digging was nearly impossible as the wreckage was so close to the water. One dug to a depth of about 30 cm before the excavation became inundated with water (digging efforts and solutions will be discussed in the next chapter).

Although there was some success with the survey, there were still major shortcomings. Firstly only one survey line could be done more or less in the middle of the beach and only on one side of the river mouth. This is due to the tidal and wave action that restricted where the vehicle could travel. Additionally there was no ready access to the other side of the river mouth with a vehicle. Positioning was also marginal as the survey had to rely on a normal hand held consumer grade GPS unit. Later it was discovered that the positioning of this unit had an error of approximately 15 m. This was a critical error where a target was potentially covered in anything from 3 to 4 m of sand. The magnetic data recorded was also relatively primitive as the instrument used a paper trace and therefore did not store the information digitally

(Figure 12). This limited the interpretation of the data to a simple graph that was not reproducible. Obviously a more comprehensive type of survey was needed.

Figure 11: Meermin *wreck 1 top of frames exposed.*

Figure 12: Recording the Magnetometer data in the back of the vehicle.

3.3 SECOND MAGNETOMETER SURVEY

The next stage of the survey required different sensors as well as a method of recording the data more reliably than had previously been the case. Research indicated that the Hermanus Magnetic Observatory (now the South African National Space Agency or SANSA) were in possession of mobile magnetometers. There are three configurations for handheld magnetometers. The first is where a magnetometer is used as a base station and is stationary. In this configuration, the magnetometer is used mainly for diurnal corrections. The second configuration is when the sensor is in mobile mode. This means that the instrument is moved from point to point and a reading taken by pressing a key. The third configuration is a walking mode magnetometer where the instrument takes continuous readings at a set rate (GEM Systems 2008). SANSA had a mobile magnetometer and a base station magnetometer available. Below follows a discussion based on a report generated by SANSA of the survey commissioned and planned by the author (Opperman 2004).

The mobile instrument and base station were Geometrics Proton Precession Magnetometers, model G856 (Geometrics 2007). Both instruments are capable of storing up to 12700 data points that can be downloaded to a computer via an RS232 port. The G856 has measurement resolution 0.1 nT (Nano Tesla) and absolute accuracy of 0.5 nT. The PPM instruments are able to observe magnetic gradients of up to 1000 nT/m (Opperman 2004).

Two lines of approximately 1.5 km were surveyed to the west and east of the river mouth at spring low tide. The survey was conducted using the base and roving magnetometer. A handheld Global Positioning System (GPS) receiver was used to record locations of points of significance. The survey grid constituted a single line in an east-west axis, extending approximately 1.5 km on each side of the river mouth. Start and end positions of the western leg were respectively (20:07:07 E, 34:42:55 S) and (20:06:16 E, 34:43:18 S). The line-of-sight distance between these points was 1478 m with mean (true north) direction 241.35°. This line was measured with a tape measure and marked with wooden pegs at two-metre intervals. GPS positions of any points of significance along the survey line were noted (Opperman 2004).

The PPM sampling rate for the first 100 m was set at 0.2 Hz (five seconds), taking three measurements at each point. Thereafter it was decreased to 0.1 Hz (10 seconds), taking one measurement at each point, maintaining the 2 m distance. This was done due to time restrictions imposed by the incoming tide. A total distance of 1650 m was surveyed – 172 m longer than the calculated line-of sight distance between the start and end points. Start and end positions of the eastern survey line were respectively (20:08:02 E, 34:42:30 S) and (20:07:16 E, 34:42:48 S) with a two-metre spacing maintained by physical pacing. The line of sight distance between these points was 1295 m and mean direction 244.64°. The eastern leg survey coincided with the incoming tide, making it difficult to survey close to the low tide surf zone.

Between 13:08:30 UTC (Universal Time Coordinated) and 13:34:50 UTC (end position 20:07:35 E, 34:42:42 S) the grid size was increased to five metres. A detour was made to investigate a flat area ('the valley') in the dunes between the estuary and the sea (20:07:32 E, 34:42:41 S) as surface signs of wreckage were visible (Figure 13). The effect of two large sections of exposed metal on the magnetometer was investigated.

Figure 13: Remains from unknown shipwrecks most likely to be from the 20th century. (scale 10cm intervals)

The differential magnetic variation between the two instruments was very small; typically less than 1 nT, giving a good indication of the survey stability and low instrument noise level (Opperman 2004). A small sinusoidal variation, possibly attributed to a temperature gradient, was visible when superimposed onto the differential. The differentials observed at the known anomalies were substantially large (tens of nT), but were detectable as 1 to 2 nT signals from a distance of one to three metres from the exposed ferromagnetic object. From these observations and knowledge of the PPM's absolute accuracy (0.5 nT), the following qualitative ranges of anomaly probability were derived:

- 1.0 nT Noise
- 1.0–1.2 nT Low probability (L)
- 1.4–1.8 nT Medium probability (M)
- 1.8 nT High probability (H)

The measured differentials were classified using these ranges (Opperman 2004).

The approximate geographic locations of high probability for the Western and Eastern legs are respectively given in Table 3. The approximate location of each point on the survey line was calculated from known coordinates and headings. Although some results were obtained it was clear that a more detailed survey was necessary as the target area was not covered in its entirety. The positioning was also problematic due to the use of a handheld GPS receiver rather than a differential system.

TABLE 3. Approximate locations of high probability anomalies on Western leg

NUMBER	LONGITUDE APPROXIMATE	LATITUDE APPROXIMATE	APPROXIMATE DISTANCE FROM START (M)	ABSOLUTE DIFFERENTIAL (NT)
1	20.1180 E	-34.7155 S*	66	2.2
2	20.1147 E	-34.7172 S**	428	2.2
3	20.1111 E	-34.7186 S*	784-788	2.2- 2.4
4	20.1111 E	-34.7188 S*	802-808	2.0- 2.4
5	20.1080 E	-34.7200 S*	1100	3.4
6	20.1055 E	-34.7211 S*	1362	4.2

**Calculated from initial position, heading and distance*
***GPS fix*

3.4 MARINE SURVEY

During the period 18 to 21 May 2004, the Marine Geoscience Unit (MGU) of the Council for Geoscience, undertook a magnetometer survey in the Struisbaai area. In total, a 275 m x 3600 m (i.e. 0.99 km^2) area of seafloor, or 43.2-line km, were surveyed. The survey was conducted using SAHRA's 7.5 m semi-rigid ski-boat. The discussion that follows is based on a report generated by MGU on the survey commissioned and planned by the author (Van den Bossche ***et al.*** 2004).

A CSI Max, MSK differential GPS receiver was used to provide accurate navigational data during the survey (CSI Wireless 2004). This system is a combined 12 channel GPS with integrated MSK beacon receiver that delivers sub-meter horizontal positioning accuracy and has a maximum update rate of 5 Hz. An Odom Echotrac Model 3100 single frequency, digital survey echo sounder was used to collect the bathymetric data during the survey (http://www.odomhydrographic.com/products/single-beam-echo-sounders/ accessed 29/06/16). The narrow beam transducer has an operating frequency of 200 kHz and is capable of collecting bathymetric data with an accuracy of 0.01% of the depth. Digital outputs to the navigation computer program were achieved via an RS232 connection with a baud rate of 9600 (Van den Bossche ***et al.*** 2004). Analogue charts (paper records) were printed by an onboard thermal printer along with appropriate annotations. Depth data was collected and downloaded at 1-second intervals to provide a high degree of accuracy. The echo sounder was calibrated for the speed of sound in the water column using the standard 'bar-check' method (Calder 1975), and the recorded depth data was post-processed and corrected for tidal variation using the appropriate tide tables (http://www.satides.co.za/ accessed 6/07/2016).

Ambient magnetic total field data were collected during the survey using a high-sensitivity, Omni directional SeaSPY Magnetometer towed behind the survey vessel. The instrument is extremely robust and highly accurate with a minimum detection limit of 0.2 nT and relies on the Overhauser effect to measure the earth's magnetic field (http://www.marinemagnetics.com/products/seaspy accessed 29/06/16). Disturbances, or anomalous values in the ambient magnetic field, induced by ferrous metallic objects lying on the seafloor, were the primary monitoring objective of the survey team.

A Marine Magnetics, Sentinel Base Station (http://www.marinemagnetics.com/ products/sentinel accessed 29/06/16) was also deployed for the duration of the survey, in close proximity to the survey area. This instrument collects data that is used to compensate for low frequency, potentially high amplitude, diurnal variations in the earth's magnetic field. Typically, the recordings obtained from the base station allow for any potential diurnal variations in the field, to be removed from the marine magnetometer data during post-processing.

The magnetometer and bathymetric data were collected along pre-determined grid lines that were set up with a 25 m line spacing interval (Figure 14). This distance was chosen in order to achieve a suitable compromise, between maximising the magnetometer coverage/detection between lines, and to fit the time allocation for the project (Van den Bossche ***et al.*** 2004). The survey speed was generally kept between 3.0 and 6 knots and was continually adjusted to optimise the geophysical data quality (Camidge ***et al.*** 2009).

From the RAW magnetic data, one noticeable magnetic anomaly ('spike') was observed towards the easternmost section of the survey area, on line Meer17a (Figure 15). This anomaly presents as a ~3 nT positive 'spike', which may be indicative of a shipwreck target. The magnetic value, together with the proximity of the magnetometer to the seafloor (~5 m altitude) at the position of the anomaly, reinforces its potential significance (Van den Bossche ***et al.*** 2004).

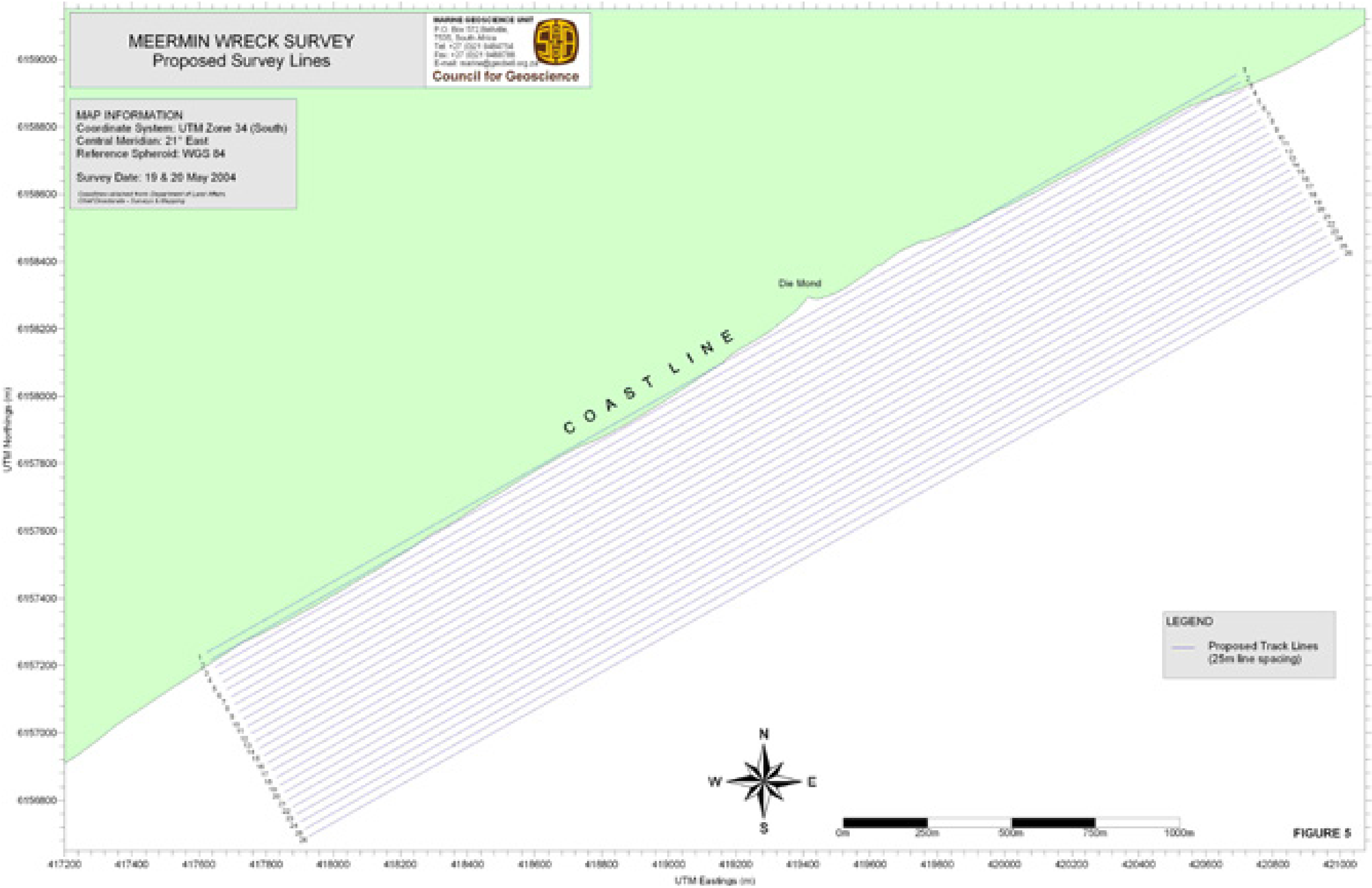

Figure 14: The line spacing for the Marine survey. The lanes are 25m apart.

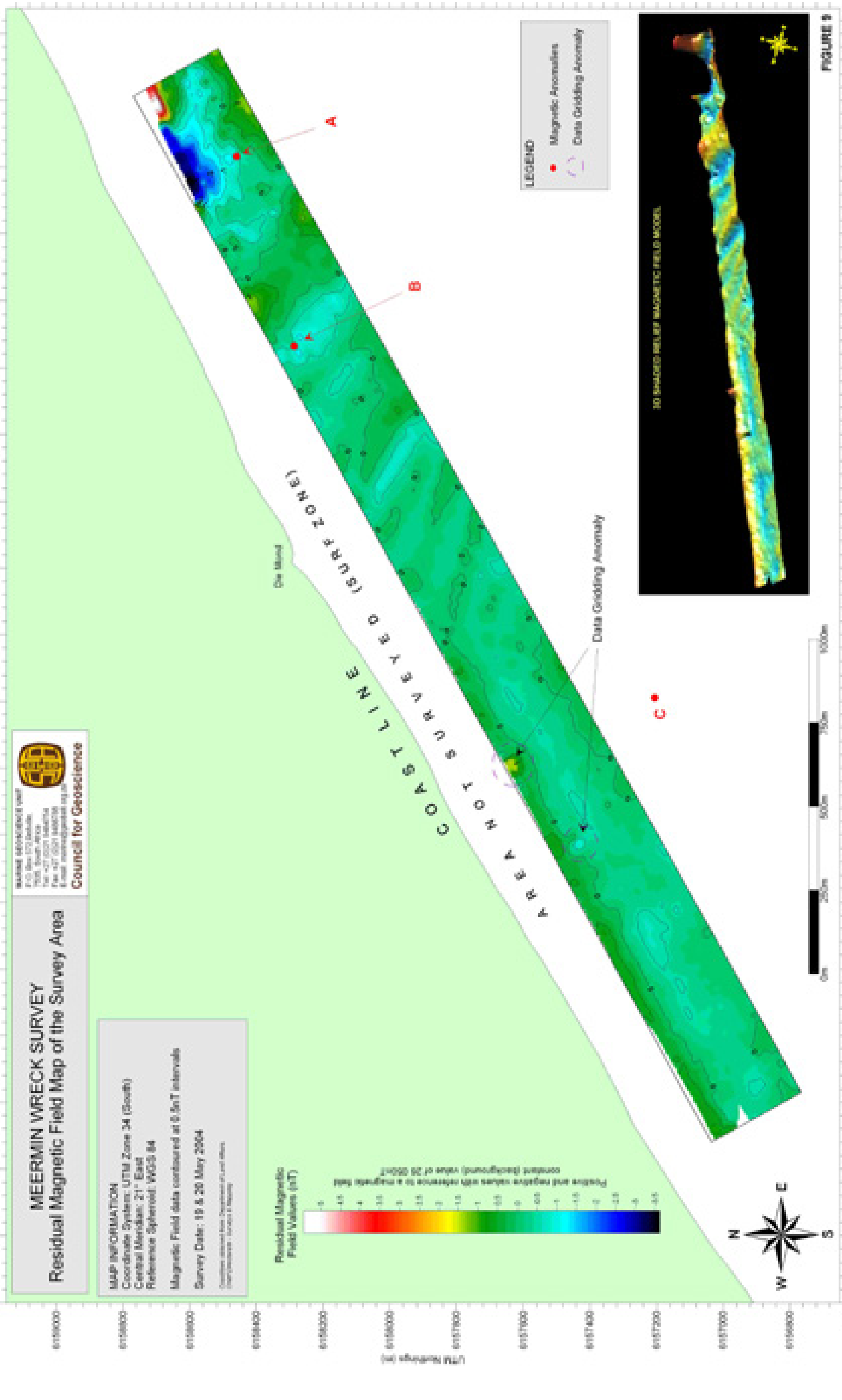

Figure 15: Marine survey results.

What appears to be a further potentially significant, but small anomaly, can be observed on the inshore edge and centre of the survey area. As this anomaly is not present on the RAW data profiles, and after consultation with the processing geophysicist (Mr Trevor Grace of Southern Exploration Services), it has been concluded that this is not a magnetic target anomaly, but rather a data processing/gridding artefact. This has been attributed to the coincidence of the survey lines in this area together with the presence of a tie line, causing a false magnetic gradient (and thus an apparent anomaly) in this area. This is often observed in magnetic survey data, where adjacent lines coincide (Camidge ***et al.*** 2009).

Table 4 below provides a summary of the most noticeable anomalies detected (Van den Bossche ***et al.*** 2004).

TABLE 4. Marine Survey list of magnetic anomalies and their geographical positions

ANOMALY ID & VALUE (NT)	LINE NAME	POSITION (NORTHINGS/EASTINGS)*		POSITION (LAT/LONG)**	
(A) ~ 3nT	Meer17a	6158459.6	420632.6	-34.7128 S	20.1332 E
(B) ~ 3nT	Meer12b	6158287.2	420063.5	-34.7143 S	20.1270 E
(C) ~ 2.5nT	M-off 50a	6157205.9	419012.0	-34.7240 S	20.1154 E

** Grid coordinates based on WGS 84, UTM Zone 34 South (CM 21)*
*** Geographical Lat/Long positions based on WGS 84.*

Anomaly (B) presents as a ~3 nT anomaly, where the depth of the sensor at the time of this recording was ~ 3 m above the seafloor. This suggests that it is unlikely that this target comprises a significant amount of ferrous metal, or by inference, a viable survey/investigation target.

Anomaly (C) appears significant on the RAW magnetometer plots, especially when considering that the magnetometer altitude was 8 m above the seafloor. Having examined the track chart closely, however, it is considered likely that this anomaly may have been caused due to the proximity of the survey vessel when turning onto the line. In addition, it occurs outside of the main survey area and therefore has no surrounding data coverage to support its presence as a potential magnetic target. Data processing was done using the proprietary software for the Sea Spy Magnetometer

3.5 AIRBORNE SURVEY 1

The marine magnetometer survey was limited because of an inability to get close inshore due to the shallow waters. This excluded a relatively large area from the survey. In late 2004 the author was made aware of the possibility of using an airborne magnetometer to cover this area. The Council for Geoscience in Pretoria had such a system that they operate with Southern Exploration Surveys in Hermanus.

A Geometrics 823 Cs cesium vapor magnetometer with an instrument resolution of 0.001 nT and a total noise envelope on collected airborne data not exceeding 0.5 nT sampled at ten times a second was used (http://www.geometrics.com/geometrics-products/geometrics-magnetometers/g-823-cesium-sensor-and-internal-cm-201-counter-module/accessed 29/06/16). A SATLOC real-time differential GPS recording once a second to an accuracy of less than 3 m in x and y and 5 m in Z was utilized (Whitehead *et al*. 1998). The data were recorded digitally. This system does not require a base station for differential correction. At the start and end of each flight, the pilot would fly over a known point to verify the GPS position. This position was plotted out after each day's flying.

Navigation was controlled by the SATLOC GPS. A navigation light bar guides the pilot throughout the survey and the GPS is preprogrammed via the mission control software to contain a complete flight plan. A highly focused Riegl laser altimeter was utilised (http://www.riegl.com/ accessed 29/06/16). The altimeter is linear throughout its range and self-calibrating. Data acquisition was directly onto an onboard PC 104 with solid-state memory. All data was merged using GPS time as a link, which was common to all collected data. Time was controlled on the PC by a standalone Garmin GPS linked directly to the PC.

The aircraft flew at 130 knots per hour at a height of 30 m with a line spacing of 35 m and a tie line spacing of 400 m. Line direction was 66 degree Azimuth. The data has been corrected to WGS 84 height. Area coverage can be seen below (Figure 16) with main targets showing up as red or yellow.

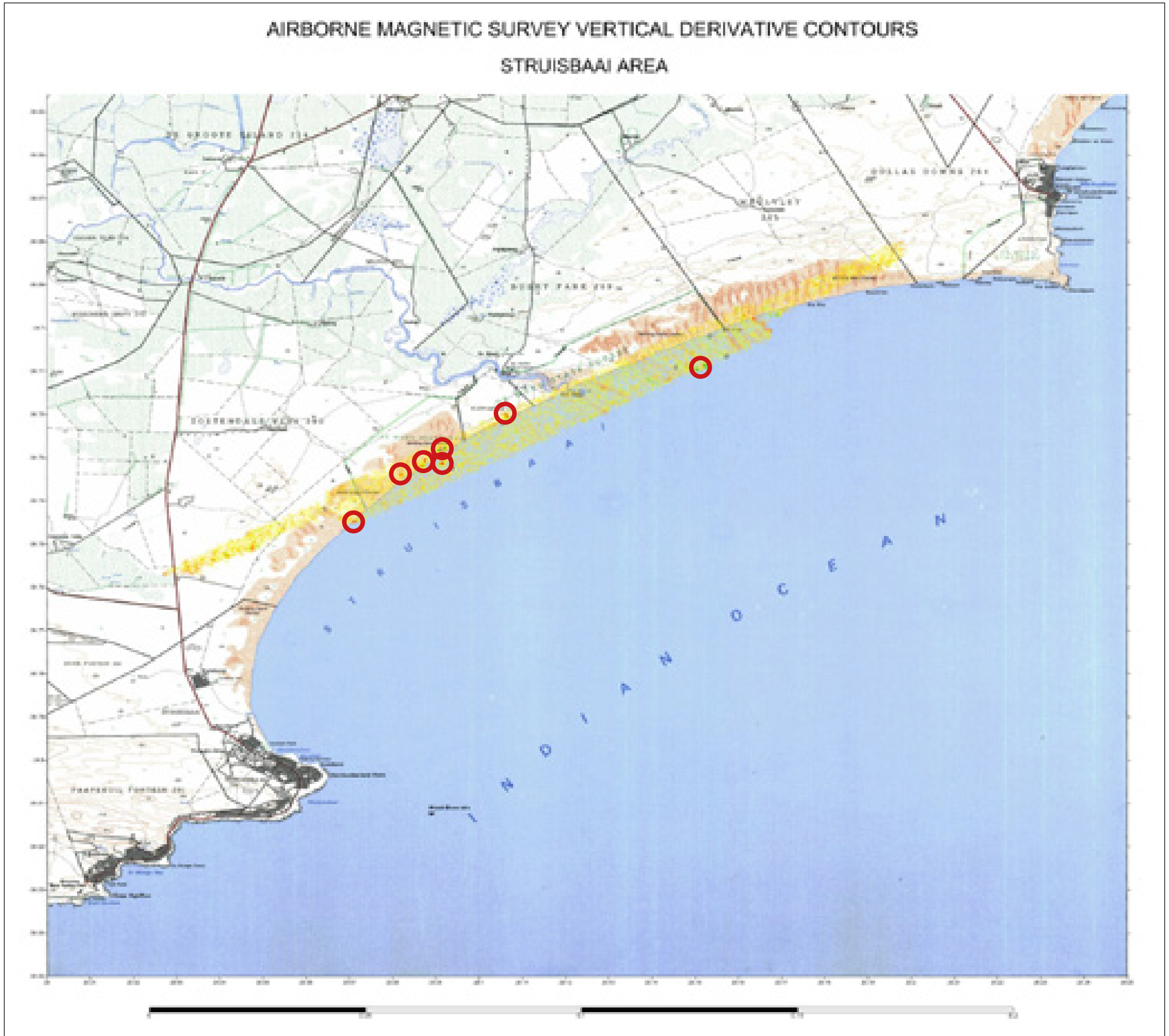

Figure 16: Targets acquired by the first airborne survey superimposed on a 1:50 000 map.

A total of 22 potential targets were found. These were graded by Southern Exploration surveys with A+ representing the strongest likelihood of shipwreck remains and C the least likely as potential targets (Table 5 below).

TABLE 5. First Airborne Survey Targets

TARGET	EAST LL	SOUTH LL	GRADE
1	20.1924	-34.6855	B
2	20.1914	-34.6858	C
3	20.1899	-34.6862	C
4	20.1835	-34.6879	B
5	20.1613	-34.6972	B+
6	20.1635	-34.6977	B
7	20.1066	-34.7203	B+
8	20.0914	-34.728	A+
9	20.0915	-34.7313	A+
10	20.0874	-34.7305	A+
11	20.0867	-34.7318	A
12	20.0855	-34.7314	B
13	20.0846	-34.7297	B
14	20.082	-34.734	A
15	20.0865	-34.7351	B
16	20.0868	-34.7369	B-
17	20.0712	-34.7448	B+
18	20.068	-34.7369	C
19	20.0515	-34.7477	C
20	20.0476	-34.7509	B+
21	20.0482	-34.7492	C
22	20.0328	-34.7551	C

3.6 NEW HANDHELD SURVEY

It is necessary to note at this stage that the new handheld magnetometer survey differs from the first handheld survey not only in the instruments used but also in methodology. The first handheld survey was primarily an attempt to find targets whereas the second handheld survey's objectives were to fine-tune identified targets. The data generated by the airborne survey was presented in the form of points on a map. The analysis done showed the targets as simple dipoles similar to those found by Gearhart in his comparative study of capped petroleum wells and shipwrecks in the USA (Gearhart 2004). Generally, when investigating a magnetic anomaly one would focus on the central point created by the dipoles (provided that the location information is correct). The technique used in the ***Meermin*** project for determining which targets to investigate by excavation was to use what is known as surface terrain models (Gearhart 2011) that is expressed in the form of a colour gradient chart as mentioned in the section on software. The software available (Geosoft) gave the author the flexibility to apply different filtering methods to enable more accurate placing of targets. Gearhart (2011) mentions the use of contour maps and the noting of the orientation of the dipole to the earth's magnetic field to help distinguish between debris and shipwrecks. Contour maps are a simple and efficient way to distinguish anomalies, but the author found that surface terrain models with the concomitant smoothing of the data provide a better image of the anomalies visible. Although shipwrecks were indicated by the data it was difficult to locate the remains under several meters of sand. The location of the site needed to be fine-tuned. The solution that presented itself was to use a handheld walking magnetometer and do detailed lanes over the identified targets. The complexity of the targets increase dramatically with a decrease in sensor distance to target (Gearhart 2011).

This complexity is easier to understand with a surface terrain model than contouring as will be seen below in Chapter 4. As the system used with SANSA was not adequate, it was necessary to investigate the availability of a superior instrument in South Africa. Purchasing a new instrument was not viable and it seemed as if it was not possible to hire one. Investigation found that the Anglo American Corporation's exploration division had a Geometrix G858 cesium vapor walking magnetometer available. They kindly agreed to lend the instrument as well as an operator to the project for one field trip. In August 2005 it was possible to get the instrument and operator out to Struisbaai and survey three of the identified targets (figure 17).

Figure 17: Handheld magnetometer survey with the assistance of Anglo American.

The procedure was to mark the target acquired by the airborne survey temporarily. Lanes were then set out on either side of the target with a spacing of two metres. The operator then walked the lanes collecting the data at a 1-second sample rate. No base station was used for the survey. An important detail for the survey was to use non-magnetic markers. Rattan stakes were used as they were easy to place due to the fact that this was on a beach and the sand therefore easily penetrated. In addition, as the operator finished a lane the stake for that lane was removed in order to prevent accidental re-survey of any of the lanes. It was not possible to survey all the targets at once due to time constraints and the availability of the instrument. The first survey managed to locate and record three sites. The three sites were then ground truthed by probing and excavation (see below). Later on, in 2007, three more sites were surveyed using the Anglo American instrument and ground truthed. The next chapter will describe the results of each target individually including the magnetic signature and the excavation findings. Suffice it to say that each target surveyed with the handheld instrument delivered a shipwreck.

3.7 SECOND AIRBORNE SURVEY

The detailed handheld survey indicated that the positioning of the targets from the airborne survey was not accurate and that the actual targets were anything from 5 to 15 m from the GPS point. In a normal magnetometer survey this is an acceptable error range, but when dealing with targets that are potentially several metres under sand, accuracy becomes more important. It was therefore considered prudent to conduct a second airborne survey with a different and potentially more accurate sensor array. This system was provided by Xcalibur Geophysics, a mining company that specialised in airborne magnetometry (http://www.xagsa.com/ accessed 3/4/2017).

Xcalibur used the Air Tractor crop dusting plane as a platform for their gradiometer system. Already this was different from the first survey in that a gradiometer instead of a single sensor was utilised. The gradiometer sensors they use are the Geometrics G822-A self-oscillating split-beam Caesium vapor oscillator with a sensitivity of ±1 pT. Compensation to remove aircraft effects from the sensor is done with a combination of RMS AARC500 and post flight compensation technology. Sample frequencies are 10 Hz, 20 Hz or 40 HZ. Most importantly the horizontal navigation is carried out using AGNAV systems (https://www.agnav.com/ accessed 3/4/2017) driven by real-time differential GPS. Vertical navigation is carried out with a laser or radar altimeter. This combination gives a navigational accuracy of better than 2 metres. The pilot monitors geophysical and navigation systems with a pilot's interface program displayed on a cockpit mounted touch screen.

The survey results clarified the magnetic signatures significantly (figure 18) from the work done by the Council for Geoscience (figure 16 above). This can be attributed to the use of better sensors, a lower flying aircraft (9 m above the

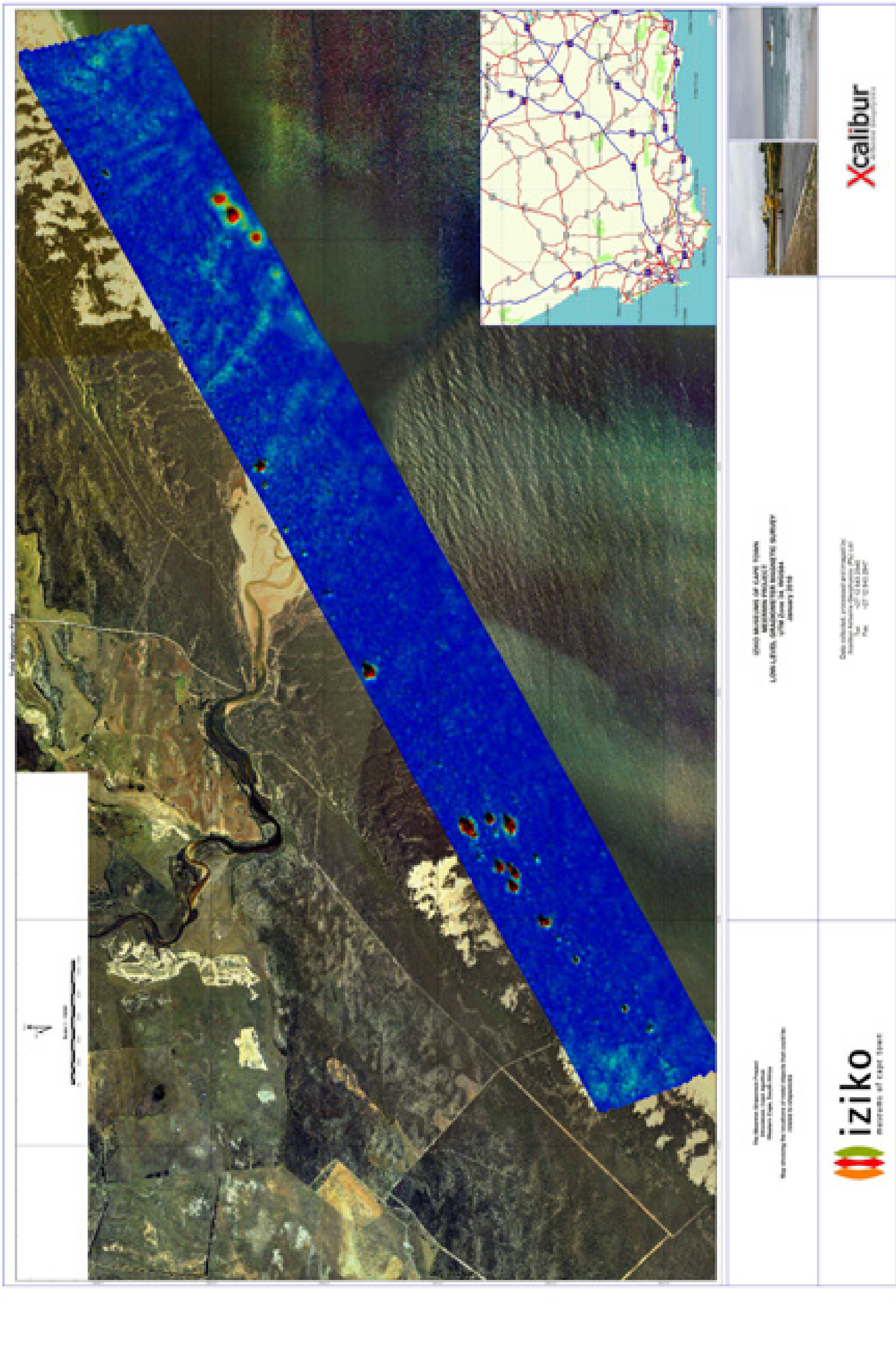

Figure 18: Second airborne survey targets.

deck as opposed to 30 m) and finally the processing of the data with specialised software – Geosoft Oasis Montaj as opposed to Surfer. The Xcalibur survey also picked up more anomalies especially one west of the river mouth that was not indicated on the Geoscience survey. In fact, the accuracy of the Xcalibur survey was proven during ground truthing when one of the targets was approached and turned out to be the two metre high metal signboard indicating the start of the De Mond Nature Reserve. This signboard had not been detected by the Geoscience survey.

3.8 RESULTS COMPARED

In the previous section the results of the two airborne surveys were briefly compared. This section will evaluate the data from the first handheld survey, the first magnetometer survey (vehicle and surfboard) and marine survey, with the second airborne survey (as the latter was deemed to be the most accurate). The marine survey cannot be compared to the first handheld and vehicle surveys as it did not cover the same ground. The marine survey will, therefore, be compared to the airborne survey. By comparing the first handheld survey (represented by human icons in figure 19) with vehicle and surfboard survey (represented by car icons in figure 20) similarity can be seen in targets with the first wreckage, that of the ***McKay***. The targets for the handheld survey only seem to indicate this one wreckage and in fact, shows a build-up of the signal until the target is passed. Similarly, the vehicle survey indicates a build-up till the target is reached. The two other targets in the handheld survey do not correlate with anything from the other surveys and could be natural magnetism as indicated by the airborne survey as will be seen below. On the eastern side of the river mouth, the handheld survey did pick the one target eventually proven to be the remains of the fishing trawler ***Dora K*** (discussed below). It was not possible to survey the eastern side with the vehicle as there was no vehicular access. The vehicle survey did pick up two anomalies later confirmed to be wreckage on the western side. These anomalies were not picked up by the handheld survey. So although there was some success with both the handheld and vehicle surveys, the accuracy of positioning was not good enough as stated above and not all the targets were picked by the two survey methods. As they were both single lane surveys there was also doubt as to the coverage and therefore the chances of missing targets. One can however say that as an initial exploratory method the single lane towed survey of a marine magnetometer on a surfboard behind a vehicle does have some merit. This should nevertheless be followed up by a more intensive survey as we have done in the search for the ***Meermin***.

The marine survey can be regarded as singularly unsuccessful. It did pick up a signal close to the remains of the ***Dora K***, but other than that did not prove to find anything of significance in the survey area. This probably confirms that most shipwrecks in the search area ended up on the beach. Different results may have been possible if the marine survey had been extended closer inshore, but as mentioned above this was not possible as it was deemed too dangerous because of the shallow underwater situation.

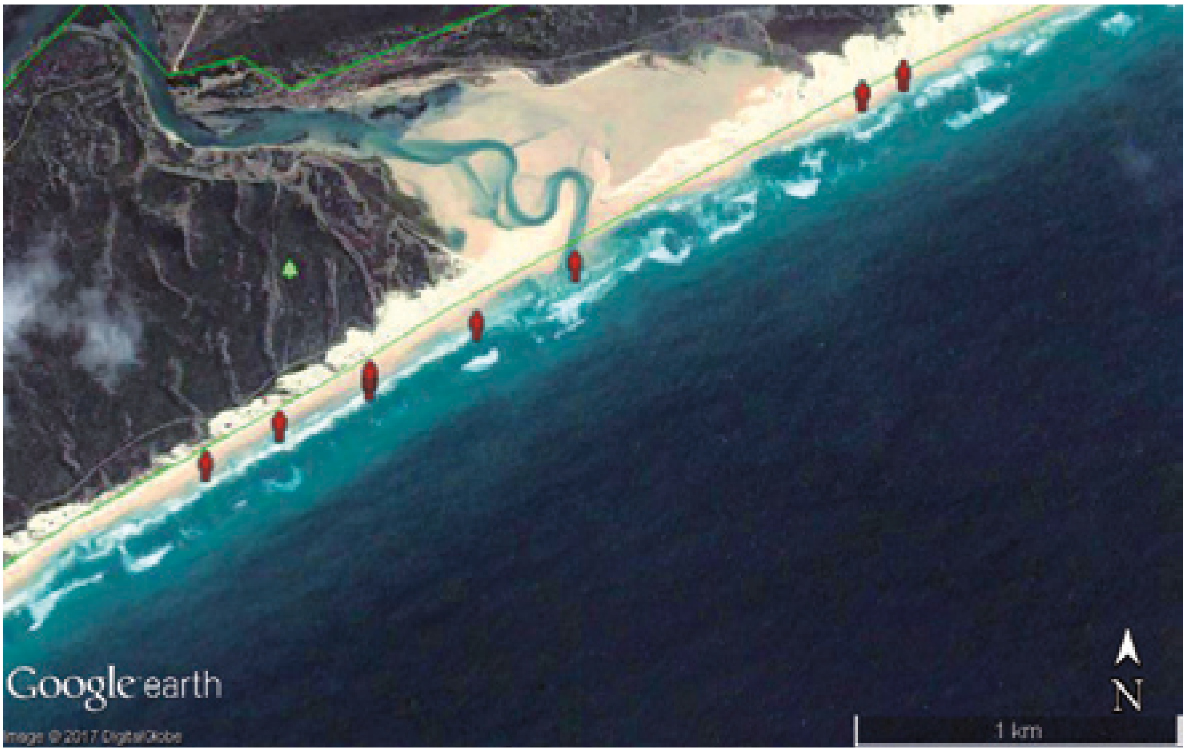

Figure 19: Google Earth image showing targets acquired by the first handheld survey. The human icons represent a magnetometer hit.

Figure 20: Magnetometer hits from the surfboard survey. The car icons represent the magnetometer hits.

The next chapter will describe the ground truthing of the best targets found with the surveys discussed above. This will include an analysis of the second hand-held magnetometer surveys of specific targets. The chapter will start by discussing the identification strategies followed by an explanation of the development of the most efficient excavation methodology for the conditions found in this area. Each shipwreck will be discussed and where possible identified.

CHAPTER 4: FINDING ANSWERS: TESTING THE SEARCH RESULTS

This chapter will discuss how the magnetic data was tested by means of excavation. This will include a discussion of how the excavation methodology evolved and what was eventually found to be the most effective way to investigate the magnetometer targets. The chapter will begin with an examination of the identification strategies for the shipwrecks found during the search (figure 21).

There are several ways to identify shipwrecks. It is important to distinguish the identification of a specific shipwreck as opposed to an accidentally found wreck. In the case of a specific shipwreck like the ***Meermin***, one gathers as much information as possible on the event and the ship itself before actually looking for and finding the wreck. This includes archival documents and environmental history as explained above. With an accidental find, a forensic investigation of the contents, structure and environment is important in determining identity. The information gathered can then be used in conjunction with archival documents to attempt identification. So in looking for a particular shipwreck the archival process is first, then the search and once located, the ground truthing of the remains found. In an accidentally discovered wreck, the process is reversed with one of the steps – that of searching for the wreck – rendered obsolete.

Archival documentation, especially in a South African context, is often a good indicator of where to find a particular shipwreck. If one is lucky one can actually find a map with the shipwreck indicated. There is one such example in the ***Meermin*** search – that of the wreck of the ***McKay***. This wreck was indicated on a 1872 map (Archdeacon 1872) and will be discussed below. This is however quite unusual and more often than not the location of a shipwreck is loosely described as is the case of the ***Meermin*** wherein the wreck is noted to have taken place in a river mouth as discussed above. Other archival material may include a contract for the building of a ship or, even better, a plan of the ship in question. A ship's manifest can give an indication of what was on board the vessel and, if that is not available, often a list of items recovered. Other obvious archival sources are the ship's journal (although this did not always survive) or the subsequent court inquiry as was the case with the ***Meermin***. A ship may have sailed to an exotic location like Madagascar as the ***Meermin*** did. This will have implications not only for potential material culture unique to the place but also possible remains such as pollen which in the Malagasy bio zone is exceptional in the world (Abromovich ***et al.*** 2002).

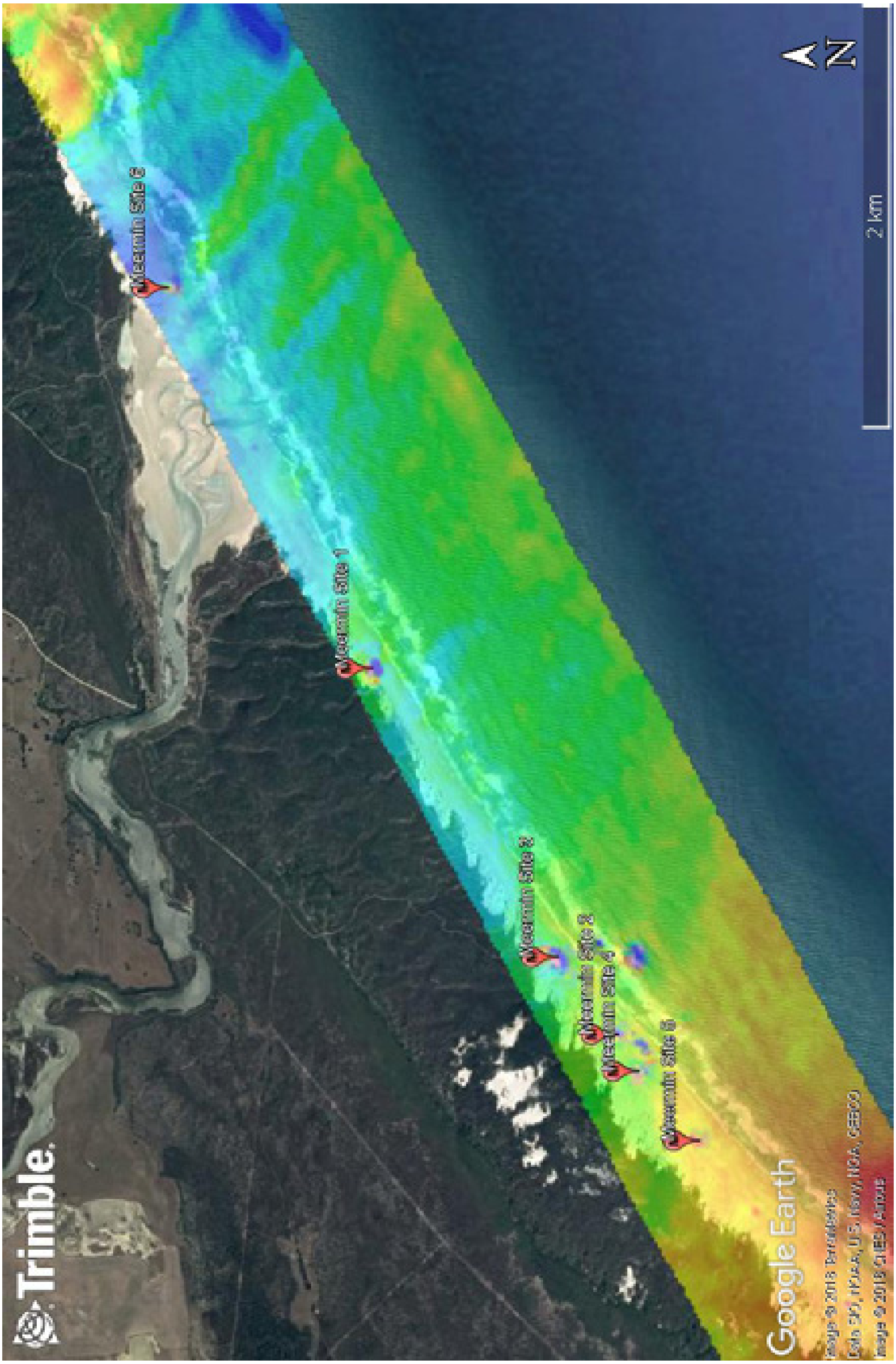

Figure 21: Google Earth image showing targets excavated.

As discussed in Chapter 1, it is known where the ***Meermin*** came from, approximately where she was wrecked, what she carried on board and an indication of what she looked like from the De Vlaming plan. There is strong evidence that the vessel was extensively salvaged as she was approachable from the shore at low tide. This makes the likelihood of finding the usual material culture like ceramics, glass or other items unlikely although not impossible. The ultimate artefact for identification would be an object with the ship's name on it. The bell was unfortunately removed, but the VOC often marked spare parts of ships for identification as in the case of the ***Radermacher*** that went missing in 1765. Her marked spare topmast washed up in Smitswinkel Bay in June 1765 (Sleigh & Westra 2012). In the case of the ***Meermin***, the finding of a Malagasy spear would be a clincher although highly unlikely. The most likely method for identifying the ***Meermin*** is thus the ship's structure as this is what would have remained behind especially the lower parts like the keel, keelson, floor timbers, inner or ceiling planking and outer hull planking. In order to identify the different parts of the ship, excavation was essential and as excavating the loose sand in a beach context is quite difficult, an effective strategy had to be developed in order to do so successfully.

4.1 EXCAVATION STRATEGIES

The first attempt to excavate wreckage at De Mond took place in September 2004 when an effort was made to open up the wreckage closest to the river mouth as this used to be the one wreck that often washed open and it was seen as the best chance of success. This was before the detailed handheld magnetometer survey. GPS positions obtained by the vehicle-towed search (as discussed above) were used and two baselines 5 m apart and 30 m in length were established. Test pits were spaced 3 m apart and the shovel tests were done at spring low tide. A 1.5 m stainless steel spike was used to probe beneath the sand. No hits were made with the probe. This indicated that if there was any wreckage it was most likely deeper than 1.5 m under the sand. The slumping effect of the sand when digging close to the water line made it impossible to dig holes deeper than 1 m. There were only two excavators and it became clear that either more people were needed or better equipment than just spades to open up the site.

This first foray into unearthing a shipwreck at Struisbaai prompted more detailed magnetometer surveys as discussed in Chapter 2. Clearly a better physical way to determine the depth of sand covering any given wreckage was needed. A new method would also assist the excavation process along with the handheld magnetometer data in where and how deep to dig to expose any possible wreckage. Fortunately in Australia the New South Wales Department of Urban Affairs and Planning's archaeology programme (Smith 1995) developed a simple method to establish sand depth over shipwrecks. This was a water probe system to locate shipwrecks previously detected by magnetometer survey. The probe consists of three to six metres of galvanized pipe connected to a water pump with a water reservoir that can be mounted on the back of a vehicle. The water pump directs a jet of water down the galvanized pipe forcing it down into the sand until it hits an obstruction.

This seemed to be an admirable solution to problems of determining sand depth encountered during the project so far. The system was scaled down to a single pump on a stand in the ocean (water source) dispensing with the water reservoir and vehicle. Testing indicated that the system was simpler and less complicated when excluding the latter two elements from the system. It was necessary to add a stopcock to the top of the probe in order to shut off the water supply as the probe had a tendency to get stuck once deeper down than two metres. This was the result of the suction force developed from the water jetted down the probe. Shutting down the water supply momentarily solved this problem and the probe could be extracted. A maximum probe length of four metres was used since it was deemed impractical to go deeper than that. The final system consisted of a five Horse Power pump on a custom built stand with a two metre to the three metre inlet pipe, a thirty metre delivery fire hose (extendable to sixty metres) and a four metre water probe with a stopcock (figure 22). Once this system was operational it was used on the targets acquired by the airborne survey and fine-tuned with the handheld magnetometer. The first target was the likely wreck of the *McKay*. This site was used to test, develop and fine-tune the strategy employed on the other targets.

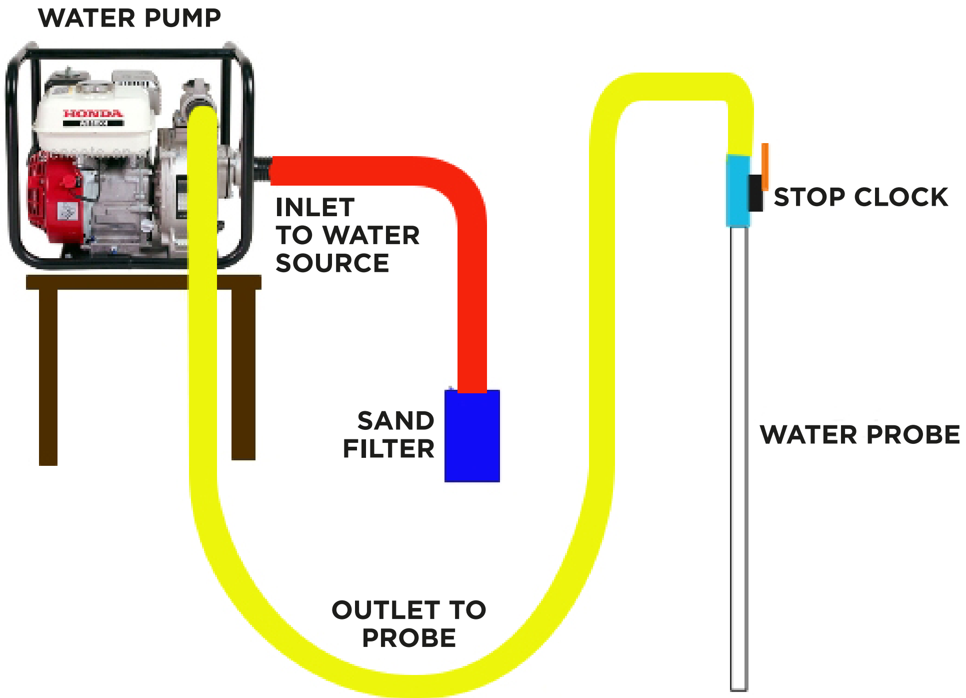

Figure 22: The probe system developed during the project.

4.2 *MEERMIN* SITE 1 (-34.7203 S 20.1066 E)

MAGNETOMETER RESULTS

The handheld magnetometer survey indicated a large magnetic anomaly (figure 23) approximately 60 m in length with central hotspots that could be a suggestion of ferric material. The anomaly is roughly aligned on an east to west axis and corresponds with a wreckage that opens up periodically at this site. There is also evidence of possible wreckage scatter in the northern section of the handheld survey. The anomaly is 20 m from the high water mark.

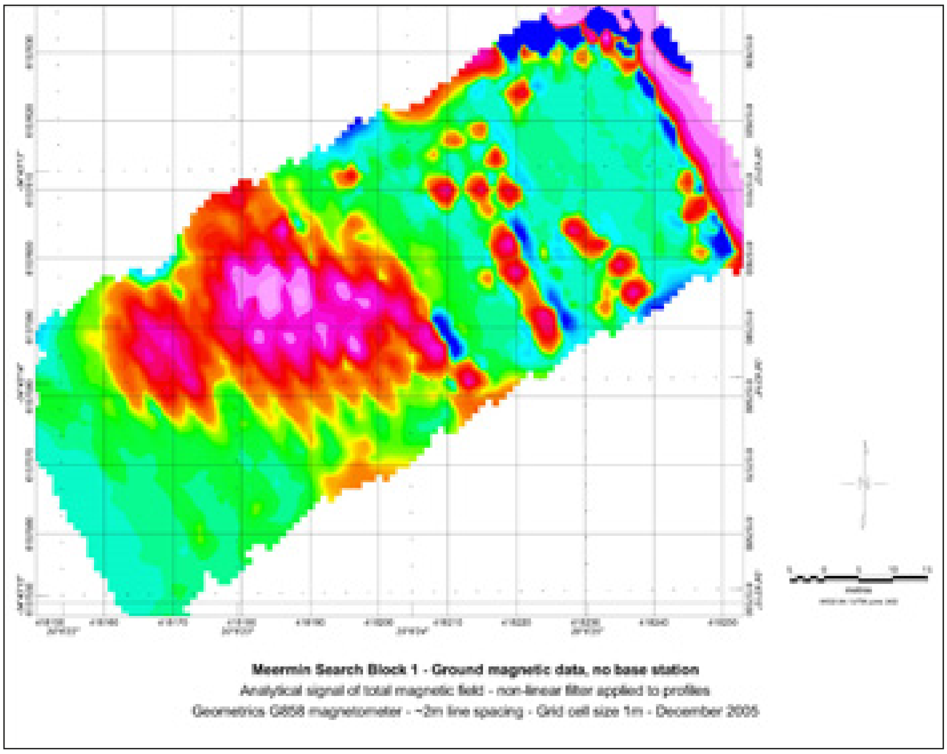

Figure 23: Magnetic anomaly Meermin *Site 1.*

EXCAVATION

In February 2006 a probe survey was conducted using the handheld magnetometer results as a guide. A rough outline of the wreckage was established (figure 24) and it was determined that there was a mean sand coverage of 2.5 m on top of the wreck. The actual wreckage was found to be closer to the water than indicated in the magnetic survey. The wreck was only five to ten metres away from the surf. As recounted above when the first attempt to excavate the site were made, it was similar to working in the dark without the aid of the handheld magnetometer or probe data. That experience also indicated that a more systematic excavation technique was needed to deal with the slumping effect of the sand. The method devised for the excavation in February 2006 involved the construction of a 2 m by 2 m cofferdam system built as a 20 mm square tubing frame with corrugated iron sheet sidewalls (figure 25). To try to stop the ingress of water from the surf a sandbag wall was constructed in front of the mini cofferdam. Somewhat inspired by the work on the ***La Belle*** in Texas (Bruseth & Turner 2004) the York Town shipwreck (Broadwater ***et al.*** 1985) and the work done in Oranjemund (Chirikure ***et al.*** 2010), there was hope that this technique would help in exposing the remains of the wreck so that it could be recorded and sampled properly.

The plan was to dig inside this structure with spades down to the wreckage in order to expose relevant parts for sampling. Excavation started at spring low tide in order to maximise the relative distance to water. Initially it seemed to work quite well (figure 26) but as the tide started to come in water kept on seeping through into the mini cofferdam and the pumps were not able to keep up with the ingress (figure 27). Eventually the mini cofferdam had to be dismantled and the idea abandoned. A depth of 1.5 m was reached before flooding stopped excavation. Clearly a quicker and more efficient way to excavate had to be found. The key was to remove as large amount of the overburden as quickly as possible without destroying the wreckage in the process. The answer seemed to be in the use of a backhoe or mechanical digger, a technique that had been utilised in archaeology previously (Anderson ***et al.*** 2001; Amesbury 2007; Anderson & McAllister 2012).

Figure 24: Wreck outlined by water probe. Red arrows indicate probe hits.

Figure 25: Corrugated iron cofferdam.

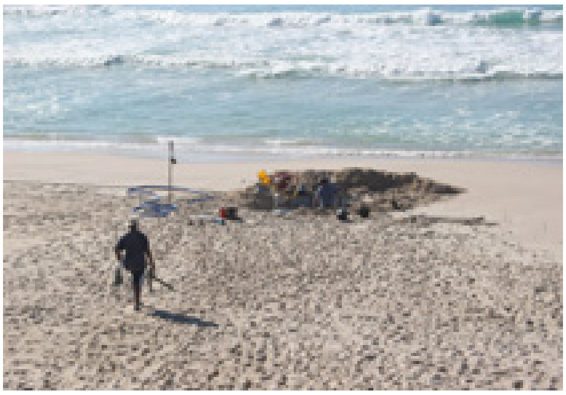

Figure 26: Digging inside cofferdam.

Figure 27: The sea takes over!

June 2006 saw a return to the site with a mechanical digger and after re-establishing the site location with a probe an area of roughly 4 m² was exposed (figure 28). Sand depth was an average of 2.5 m. The procedure required the digger to excavate as close to 2.5 m (guided by the archaeologist) as possible after which the wreckage would be opened up by spades. This was only partially successful on this site as water seepage quickly became a problem again. Fortunately the digger could keep the surf at bay as it created a large sand bank between the site and the surf. Unfortunately it was only possible to open up the very top of the wreckage as the tide started to rise rather quickly and it became dangerous for even the digger to operate (figure 29). It was nevertheless possible to sample the frames and outer hull planking. The procedure for sampling was to find a recognisable structural element and then to cut off a small wedge of material and hammer in a plastic tag with a sample number. This was done to ensure that if in future we (or anyone else) returned to the site we would know where the sample was taken from (figure 30). This was the method adopted for all the wrecks investigated at Struisbaai. The frame dimensions were sided 28 cm and molded 18 cm with spacing between frames approximately 17 cm. Plank width was 22 cm. It was not possible to get the plank thickness measurement. Since the keel or keelson could not be exposed these measurements are not final. This is also the reason why proper room and space measurements could not be made because if one is not able to get to the floor timbers room and space measurements become deceptive.

Figure 28: Digger/Backhoe on Meermin Site 1.

Figure 29: Incoming tide makes it impossible to continue with the Digger/Backhoe.

Figure 30: Plastic tag used to mark sampling areas on wreck.

Figure 31: Map by W.M Archdeacon March 1872 showing the location of the wreck of the McKay (red circle).

It must be mentioned here that excavation time was always limited by the incoming tide. Not just because of water ingress into the excavated sites, but also limiting the time the vehicles used, could spend on the beach without endangering them and the excavation team. There was typically no more than two hours for excavation and recording each of the sites.

IDENTIFICATION

The wreck at this site is the one that is periodically exposed by wave action. This seems to happen when there is a strong south easterly along with a spring tide. As reported above there are different versions by locals as to where the wreck lies. The position of the wreck nearly corresponds with that of the ***MacKay*** that is shown on the Archdeacon map of 1872 drawn one year after the wrecking of the vessel. If one georeference the Archdeacon map and superimposes it on a Google Earth image one can see that the position of the wreck is approximately 600 m south of what Archdeacon reported (figure 31). The map is relatively accurate with an error of ± 300 m. It is likely that the position on the map is therefore out by 300 m. It is also highly likely the wreck moved down the coast in the intervening ca. 141 years with the prevailing south westerly swell.

The ***MacKay*** was built in 1864. It is unclear where she was built as the Lloyds Register of 1871 states ‘Mirmei’ as yet an unknown location. She was however registered in Liverpool and her owner was listed as John Thomas of Carnarvon, Wales. Mirmei is possibly a location in Wales, but this is just speculation. The ***MacKay*** was a small barque of 384 tons and was listed as having iron fastenings with yellow metal sheathing. Her dimensions listed in Lloyds were:

- Length: 122.5 foot (37.3 m),
- Breadth: 28.6 foot (8.7 m)
- Depth: 16.7 foot (5 m).

The Lloyds Register does not list the type of timber used in her construction, but the samples sent away to the Stellenbosch University Forestry department indicated that both the frames and the planking were Gymnosperm or pine. They were not able to identify the type of pine, but using pine in construction is consistent with the date the vessel was built as the scarcity of hard woods such as oak meant that shipbuilders had to turn to the more abundant soft woods for ship construction, especially in the second half of the 19th century (MacGregor 1993).

Can this wreck be identified as that of the ***MacKay***? Fortunately, when the wreck washed open in 1998 a report was published in a local newspaper, ‘Die Burger’

(Rossouw 1998). At the time the wreck was nearly completely exposed unlike when we saw it first in 2002 and later on during excavation in 2006 (see figure 9). The report states that the length of the wreck exposed was approximately 34 m and the breadth 8.5 m. These measurements are very close to the registered dimensions recorded in Lloyds. In fact, the breadth is almost exactly the same and the smaller length can be attributed to the wreck not being entirely exposed. So the burden of proof indicates that this wreck is most likely that of the ***MacKay*** and not the ***Meermin*** as the construction and timber used, as well as the size of the vessel, are different. The ***Meermin*** was only 31.5 m long, but 9.7 m wide and constructed mainly of oak. Therefore, although they were approximately same size, the ***Meermin*** was shorter and wider than the *MacKay*.

4.3 *MEERMIN* SITE 2 (-34.7280 S 20.0914 E)

MAGNETOMETER RESULTS

The handheld magnetometer indicated a very large longitudinally shaped anomaly with a north westerly orientation. It is approximately 60 m in length and seems to be composed of a series of dipoles (figure 32). The dipoles could be explained by a sequence of iron fastenings as discussed by Gearhart (2004). The anomaly is approximately 50 m from the surf zone. This same anomaly was also detected by the vehicle survey indicating the strength of the disturbance to the magnetic field.

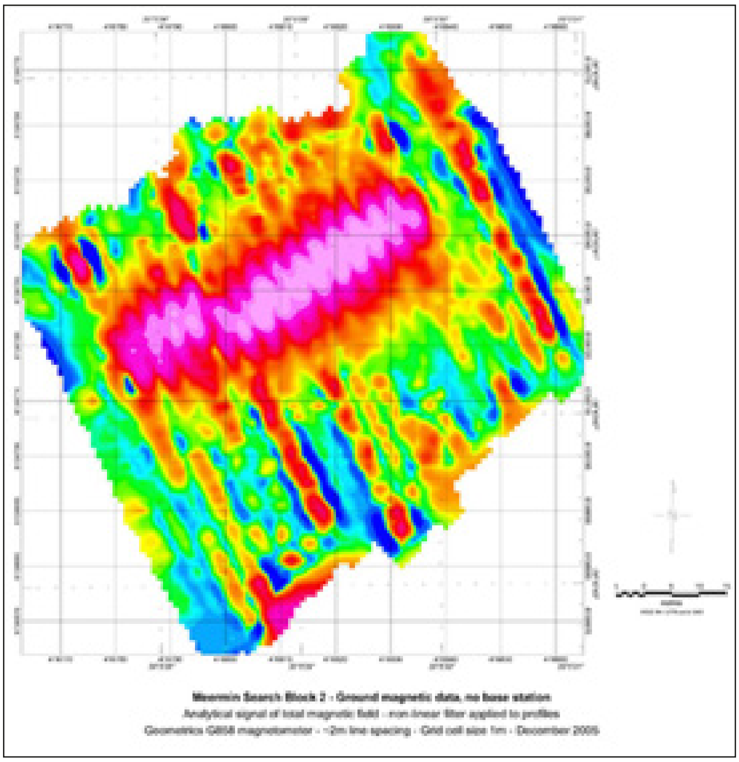

Figure 32: Magnetic signature Meermin *Site 2.*

EXCAVATION

The probe survey indicated that there was a mean sand overburden of 3 m over the wreckage. This increased the difficulty of the excavation, but as the site was relatively further away from the waterline, excavation was somewhat easier. Excavation revealed a massive keelson with a molded dimension of 1.06 m and sided measurement of 35 cm (figure 33). The keelson is composed of four timbers fastened by iron and scarphed on top of each other. The four timbers are, on average, 26 cm in depth. A floor timber or plank perpendicular to the keelson was also found. An area of approximately 2.5 m by 3 m was excavated, but it was not possible to expose the wreck further as the tide was starting to come in and it was still necessary to rebury the site.

IDENTIFICATION

Due to the size and construction of the keelson it was immediately apparent that it was not the wreck of the ***Meermin***. The ***Meermin*** had a single 'layer' keelson with a long central mast step that was also single layered. At best the ***Meermin*** keelson consisted of two timber layers. Judging from the size of the magnetic anomaly and especially the length we can contend that the keelson found at this site is nearly 60 m long making the ship it derived from nearly twice the size of the ***Meermin***. Timber analysis also indicated the keelson and the plank/floor timber to be also Gymnosperm or a species of pine. This and the construction of a multi-layered keelson places this wreckage firmly in the 19th century. MacGregor (1993) mentions that large 19th century Salem built packet ships often had keelsons composed of up to eight logs with two rows of three each, placed one above the other, and then two more above each other on the centre line. This means that there are four logs on top of one another in the centre line of the vessel nearly exactly what was found in this wreck. Therefore, with regard to identification, it is likely that this wreck dates to the second half of the 19th century and is possibly of American construction. One possible candidate for this wreck is that of the ***South American***, an American ship of 1694 tons built in 1876 in Boston, Massachusetts (Turner 1988). The ship was wrecked on 17 September 1889 in Struisbaai in thick fog. This is the only wooden ship of this size that was wrecked in the area. The keelson is large enough to fit a vessel of the size of the ***South American***. We do not have absolute proof that this is the identity of the keelson wreck as more corroborating evidence would be required to confirm the identification. This is however outside the scope of this thesis.

Figure 33: Large Keelson found on Meermin *Site 2.*

4.4 ***MEERMIN*** SITE 3 (-34.7306 S 20.0876 E)

MAGNETOMETER RESULTS

The magnetic signature for this wreckage showed as a broken up anomaly scattered in the north eastern corner of the survey block (figure 34). The anomaly is dominated by a 15 m signal with a north westerly orientation with smaller anomalies to the east and west of it. This larger anomaly was the target for the excavation.

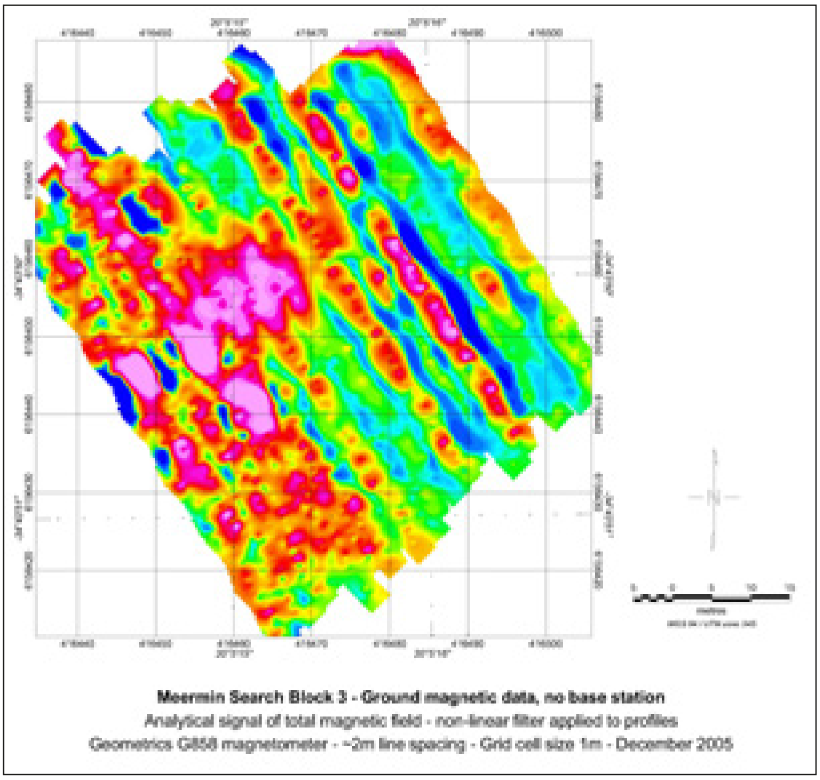

Figure 34: Meermin *Site 3 Magnetic signature.*

EXCAVATION

The sand covering this site was at a mean depth of two metres. The site consisted of what seemed to be the side of a vessel with standing and lodging knees and other members scattered within a radius of three metres (figure 35). This confirmed the fragmentary nature of the wreck as indicated by the magnetometer. The section also seemed to be upside down with possible deck planking below the knees which were inaccessible due to water seepage. The side planking was made up of hook scarph joints (figure 36). The remains of what could possibly be a frame, were 2.29 m to the south of the plank section. Iron fastenings were another clear feature of the site (figure 37). There seemed to be more remains deeper down, but water seepage made it difficult to open up more without damaging the wreck structure. Interestingly this is not too large a vessel as the knees were only 20 cm in width. The planks were also 30 cm wide and 20 cm thick. This wreckage was about 400 m south west of the large keelson and the size of the structural elements rules this out as part of the keelson assemblage.

IDENTIFICATION

All the timber members sampled (planks, knees, and frame) were identified as deriving from the Gymnosperm family and were therefore pine. This, as stated above, most likely places the wreckage in the 19th century. The ***Meermin*** was not constructed of pine. This was confirmed in correspondence with Arent Vos from the Rijksdienst voor Cultureel Erfgoed in Lelystad, the Netherlands in 2006. Drs Vos indicated that Dutch seagoing ships may have had some members made from pine, but that this would be mostly internal works and not structural members like knees and frames. The knees on this wreckage were also quite small whereas the De Vlaming draft (1761) indicated that the ***Meermin*** had knees much larger in size. All the indications are that the remains found here are of a smaller vessel than the ***Meermin***.

Figure 35: Standing and lodging knees with iron fastenings.

Figure 36: Side plank with hook and scarph joints indicated by red arrows.

Figure 37: Typical iron fastening on Meermin *Site 3.*

4.5 *MEERMIN* SITE 4 (-34.7316 S 20.0855 E)

MAGNETOMETER RESULTS

This site is located approximately 160 m south from Site 3 (figure 38). It has three distinct anomalies – two small disturbances in the western side of the survey block and one large longitudinal signature in the Eastern side of the block. The large anomaly is approximately 45 m in length. The smaller anomalies are close to the waterline whereas the larger anomaly is fairly high up on the beach. The focus was on the larger anomaly as it potentially had less interference from the incoming tide.

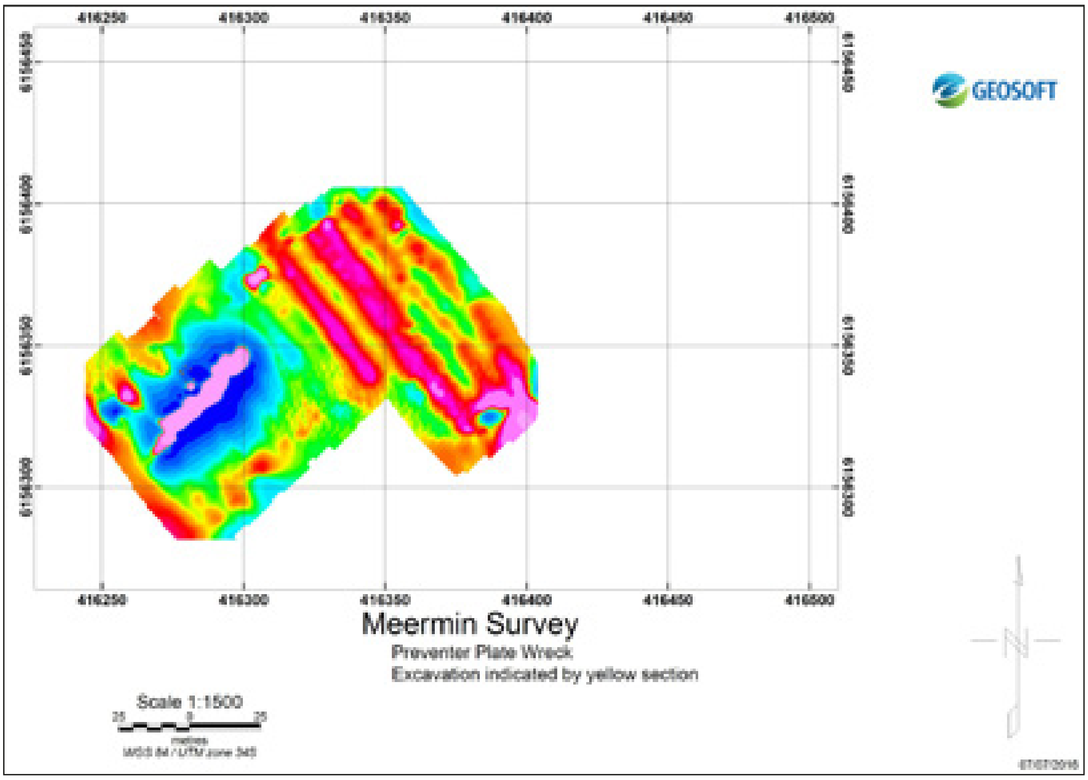

Figure 38: Meermin *Site 4 magnetic signature.*

EXCAVATION

Unexpectedly the site only had one metre of sand overburden. This made it easier in some respects as more of the wreckage could be uncovered, but the operator of the mechanical digger had to be more careful when excavating. The excavation uncovered the most interesting ship structure thus far in the project. The structure consisted of the upper part of a vessel lying on its side. The frames, outer hull planking as well as ceiling or inner planking were clearly visible. The most interesting feature of this find was the iron preventer plates (figure 39). The framing pattern consisted of butt jointed paired frames with an approximate sided dimension of 20 cm to 23 cm and molded dimension of 16 cm. The spacing between the frames was 20 cm giving us a room and space measurement of approximately 40 cm. The outer hull planking was 29 cm wide and 13 cm thick. The ceiling planking was much degraded and it was only possible to access part of it because it was mostly underneath the wreckage. The planking did seem to be between 29 cm and 40 cm wide. It was not possible to determine the thickness.

Figure 39: Preventer plates indicated by red arrows.

The preventer plates had a distinctive pattern consisting of an iron bar forged in a loop around heavy conical iron fastenings. One full set of four plates and the beginning of a next set were exposed. The plates were 40 cm in length and spaced 40 cm apart with a distance of 3.7 m between sets. The second set still had part of the chain plate attached to it (figure 40).

Figure 40: Preventer plate with partial chain plate.

Water seepage was more pronounced on this site. On the previous sites, a 5 Hp pump was used and that proved to be difficult to operate especially with water seepage not creating enough water volume for the pump to extract. Therefore manual bailing of excess water was necessary. This was time-consuming and detracted from recording time. With this excavation the team experimented with a small 2 stroke water pump that worked admirably well. It was found that if a deeper hole was dug in front of the wreckage it created a sort of sump for water to flow in thereby controlling the influx of seepage better.

IDENTIFICATION

As a comparison the timber samples from this wreckage were combined with samples from two other known wrecks, that of the ***Brunswick*** a British East Indiaman wrecked in 1805 (Boshoff ***et al.*** 1994) and the ***Nieeuwe Rhoon*** a Dutch East Indiaman wrecked in 1776 (Lightley 1976). There were samples from a frame, keel, and a plank for both these wrecks. These are known wrecks from known nationalities with known dates and it was thought that it would help in at least placing the wreckage at Site 4 in a date range. Both the ***Brunswick*** and the ***Nieeuwe Rhoon*** samples were oak and according to the Stellenbosch University Forestry department were the same species of oak.

The Site 4 samples were somewhat different in that the ceiling and outer hull planking were Gymnosperm or pine. The frames were of oak and the same species as the samples from the two control shipwrecks. One can postulate that this indicates a different type of construction to that of standard British or Dutch East Indiaman ships. The framing pattern is also different from at least a Dutch type of construction as confirmed by Mr Ab Hoving (a world renowned expert on Dutch ship construction) when he was shown photographs of the wreckage on a visit to Amsterdam in 2008. Mr Hoving commented that in his opinion the construction looked similar to French type ship construction with the frames being doubled up with butt joints and the presence of filler frames (figure 41).

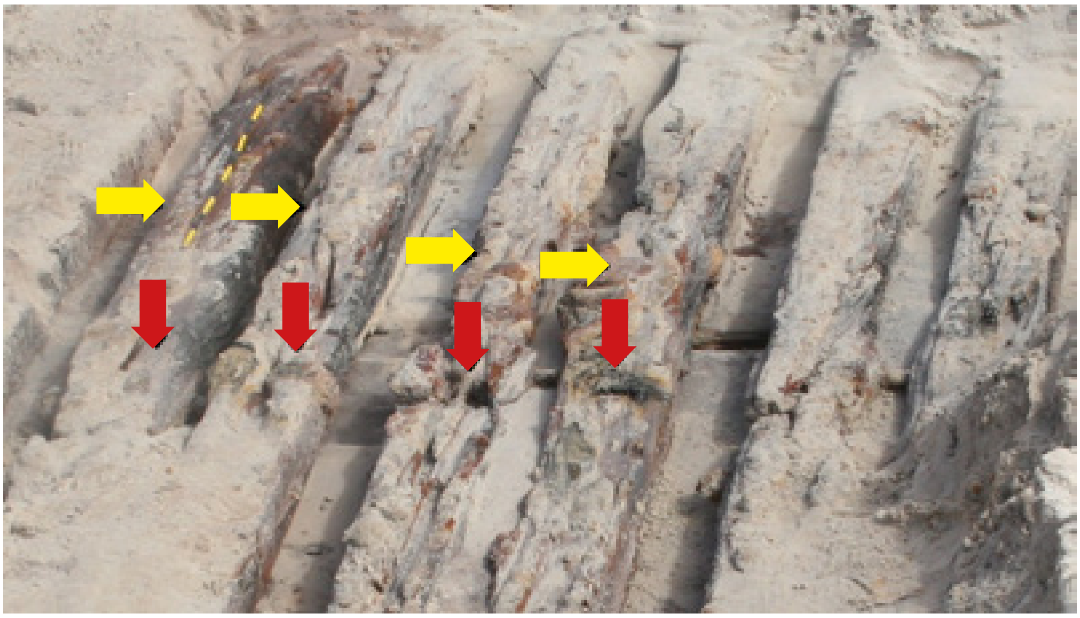

Figure 41: Doubled up butt joints with filler frames. (butt joints indicated by red arrows, frames by yellow arrows.)

Stanbury (2015) did a fairly detailed study of French ship construction with a focus on the Mermaid Atoll shipwreck that is suspected to be a French built vessel. One of her main sources is the work of the French Master Shipwright Blaise Olivier who went on a spying mission in 1737 to record observations in British and Dutch shipyards (Olivier & Roberts 1992). What we can extract from her analysis is that firstly, outer hull planking was sometimes built from fir or pine. Secondly, iron nails were used extensively in French shipbuilding much more so than in the British. In Site 4, we see extensive use of iron nails.

The other salient feature of the Site 4 wreckage, the preventer plates, seems to bear the French identification out. This is evident from the work of the well-known French naval architect, Jean Boudriot. In two of his works, the four-volume publication on a French 74 gun ship of the 18th century (1989) and his analysis of the notorious French slaver ***L'Aurore*** (1984), he clearly illustrates preventer plates nearly identical to the ones found on Site 4 (figure 42). Stanbury (2015) shows in the analysis of the Mermaid Atoll shipwreck a similar type of construction found in Canada on the French frigate ***Machault*** (1758 – 60). Olivier (Olivier & Roberts) observed the difference in chainplates between the French and English with the English using an iron strap instead of the two links and preventer plate the French favoured. The English only used preventer plates for three decked vessels (therefore larger ships) whereas the French used it more universally.

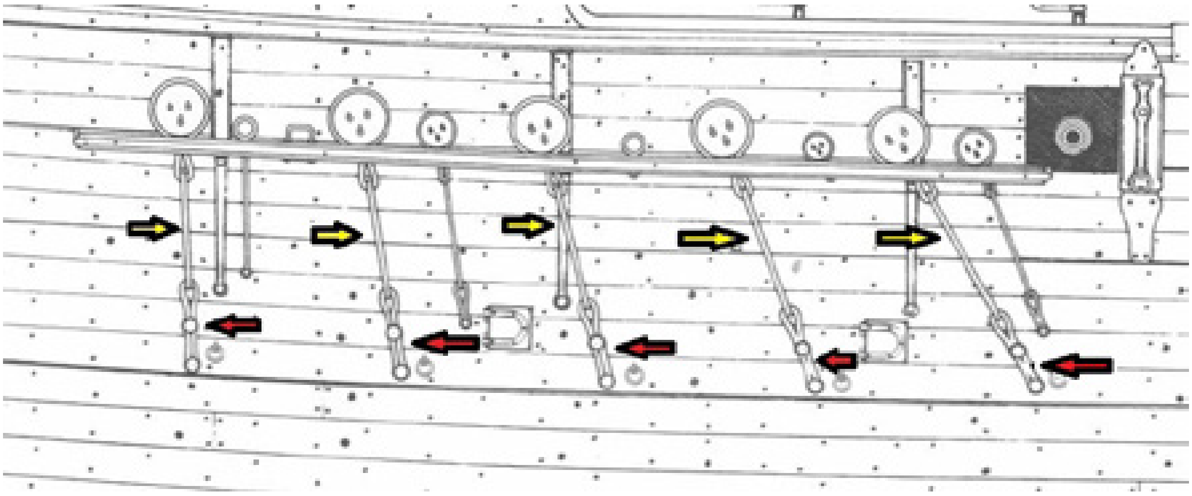

Figure 42: Preventer plates on French slaver L'Aurore *(1784) after Boudriot (1984). (Red arrows indicate preventer plates and yellow arrows indicate chain plates)*

The issue gets confused if one consults another 18th century shipbuilding source, that of the drafts done in 1768 by the Swedish Master shipwright Chapman (Chapman ***et al.*** 1937). Chapman drew a variety of ships plans of different types (much like the Dutch naval architects mentioned above). Of the more than 60 drafts of different ships, 17 show preventer plates similar to Site 4. Unfortunately, Chapman did not always denote the nationality of the ships he drew making it difficult to say whether the majority of these drafts were French. Two of the vessels with that preventer plate type, whose nationalities he does indicate, were a French frigate and, confusingly, a British East Indiaman.

This, therefore, brings the identification of Site 4 as a French built vessel into some doubt. We can however safely say that it is not the ***Meermin***, as the ***Meermin*** had different preventer plates (figure 43) with a different spacing. The framing pattern is also not Dutch. If we nonetheless accept the possibility that Site 4 is a French vessel it opens up an intriguing possibility. As mentioned in the above, one of the vessels that was wrecked in the same area as the ***Meermin*** on 4 May 1794, was the French slave ship ***La Jardiniere*** (C223 1794). It was mentioned that the ship wrecked in the mouth of the Zoetendaals valley as was the ***Meermin***. The captain of this ship was the famous French explorer Nicolas Baudin who is mostly known for having mapped part of the Australian coastline (Sooby 2013). Very little is known of Baudin's failed expedition in ***La Jardiniere*** and it provides a fascinating possibility for future research. I do not however say that Site 4 is the ***La Jardiniere***, but rather that this site needs more investigation as we can clearly see from the magnetic signature (figure 38) that there is significant potential for more remains to be excavated.

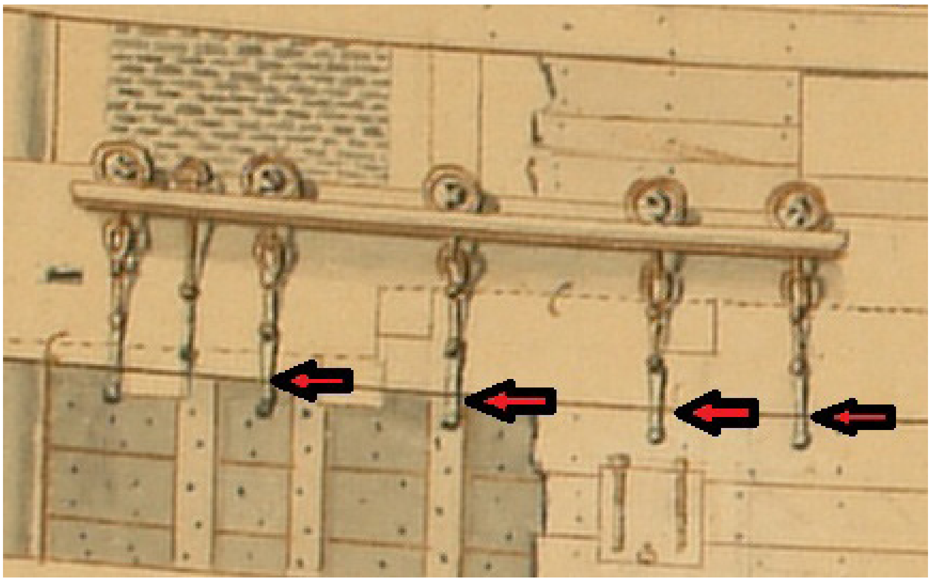

Figure 43: Detail of preventer plates from the Meermin draft by De Vlaming (1760). (red arrows indicate preventer plates)

4.6 *MEERMIN* SITE 5 (-34.7340 S 20.0821 E)

MAGNETOMETER RESULTS

This anomaly presented as three distinct disturbances: one small anomaly and two larger ones (figure 44). The two larger anomalies were 40 m and 20 m in size respectively with the larger anomaly almost in an easterly orientation. The smaller anomaly was orientated north west. It was decided to excavate the larger anomaly as it seemed to indicate the greatest likelihood of finding good structural remains.

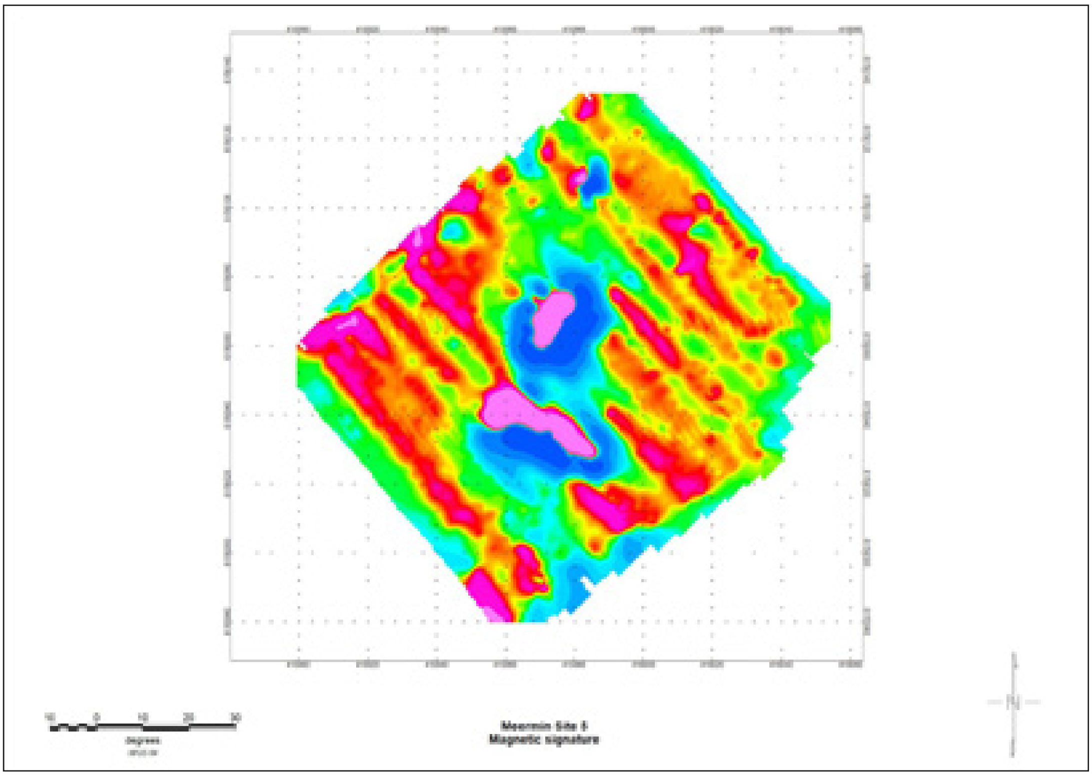

Figure 44: Meermin Site 5 magnetic signature

EXCAVATION

The wreckage was found under 1.5 m of sand. It consisted of a section of framing with outer hull planking (figure 45). The framing pattern was similar to Site 4 in that it was doubled up framing with interspersed butt joints. Iron fastenings were used to join the frames. The dimensions of the framing were: sided 20 cm to 23 cm and molded 20 cm. The spacing between the joined frames was 12 cm and between pairs 24 cm. This gave a room and space measurement of 56 cm. It is quite possible that the timber had degraded considerably accounting for the 12 cm space between the joined frames. The planking was difficult to access, but it was possible to get dimensions of the width of 66 cm and thickness of 18 cm. The planks had a small spacing of from 5 cm to 10 cm in between.

Figure 45: Framing and outer hull planking indicated by red arrows.

IDENTIFICATION

It was difficult to determine exactly which part of the ship this wreckage came from other than to say that it is part of the side of a vessel. It was not possible to open up more due to the normal constraints of time and tide. Although the dimensions of the frames are different from Site 4, the way in which Site 5 was constructed is similar. The difference in dimensions can possibly be explained by the fact that the Site 4 structure is higher up in the ship's side and Site 5 is lower down and therefore has slightly larger dimensions, for example, the room and space measurements of 40 cm for Site 4 as opposed to 56 cm for Site 5. The timber identifications were also similar for both sites with the frames from oak and the planking from pine. The two sites are 400 m apart and it is likely that Site 5 represents the first ‘strike’ of the ship which broke up and then possibly moved north with the south westerly swell. It is therefore likely that Site 4 and 5 represent parts from the same vessel.

4.7 *MEERMIN* SITE 6 (-34.7118 S 20.1261 E)

MAGNETOMETER RESULTS

This site represents the only significant anomaly found east of the river mouth (figure 46). It is located very close to the river mouth (400 m) and is nearly completely in the surf zone. The anomaly manifests as a massive spike reminiscent of a large iron or magnetic mass. Due to the proximity to the surf we were only able to survey a section of the site.

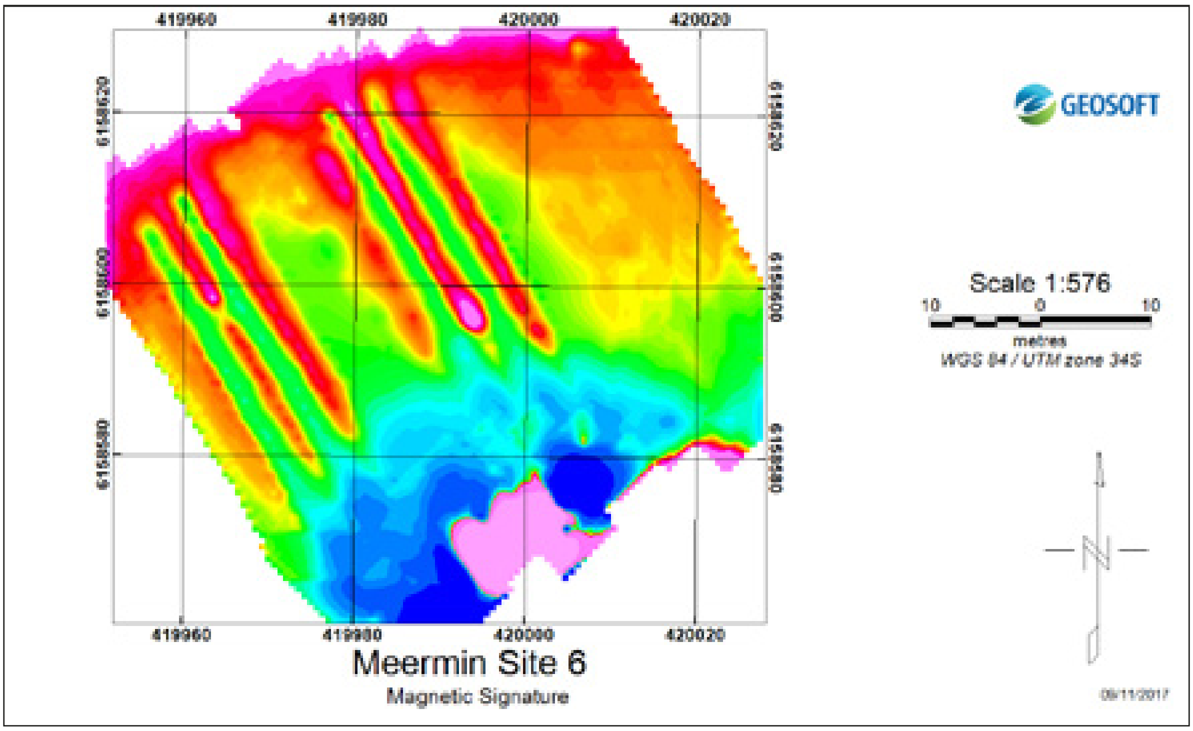

Figure 46: Meermin Site 6 magnetic signature

EXCAVATION

It was not viable to open up the site completely due to the fact that it was located in the surf zone (figure 47). A section of wreckage was located consisting of a 4 m galvanized iron strip that was identified as a rubbing strake possibly from a fishing trawler (figure 48).

Figure 47: Working in the surf zone

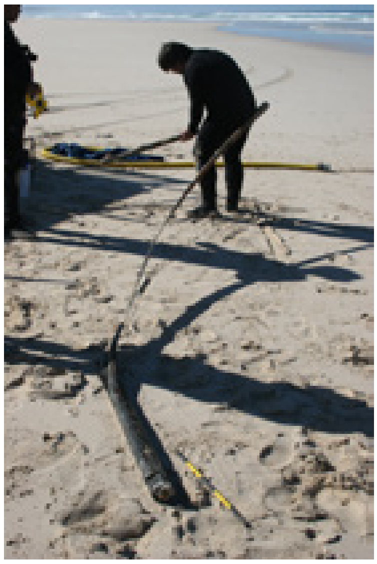

Figure 48: Rubbing strake recovered from site 6

IDENTIFICATION

This wreckage was clearly of 20th century origin as not only was the rubbing strake galvanized iron, but flakes of modern red paint was also detected. One of the nature conservation staff, Mr. Piet Swart, who had been at the De Mond Reserve for more than 20 years in 2007, remembered that there was an account of a fishing trawler, the ***Dora K*** that was wrecked 500 m east of the mouth in 1975. He was also able to obtain photographs of the wreck from one of the local farmers in the area – a Mr. Jaco Louw – who had taken them at the time of the wreck (figure 49). The photos were consistent with the location of the anomaly. During the walking surveys on the eastern side of the mouth, other small bits of debris were found in the vicinity that were consistent with the remains of the ***Dora K*** (figure 50).

***

Although the project began as a search for the ***Meermin***, as reported in this dissertation it has also led to the development of a new survey and excavation methodology in this particular environmental zone. The next chapter will summarise the methodology and the finds and discuss possible ways forward for the ***Meermin*** project. Even though the quest for the wreck of the ***Meermin*** was not successful, the search itself drew more attention to the history of the vessel and the dramatic events it was involved in. The project therefore had a far-reaching impact beyond the research itself. The consequences of the project will also be briefly deliberated on in the next and final chapter.

Figure 49: Wreck of the fishing trawler Dora K. *(red arrows indicate rubbing strake on the vessel.)*

Figure 50: Remains from a fishing trawler, possibly the Dora K. *(scale in 10cm intervals).*

CHAPTER 5: THE FINAL OBJECTIVE – A STORY IN TWO PARTS

The primary focus of this thesis is the development of a new methodology to assist in the location inter tidal shipwrecks. It began with the desire to find a specific shipwreck, that of the slave ship ***Meermin***. In the beginning, I did not know that the end result would be the development of the methodology described in this thesis. It happened almost organically as outlined in the chapters above. This heuristic process delivered the methodology which proved to be successful since several shipwrecks were found buried under many metres of sand. The project, however, had a larger impact than simply the development of a methodology. This chapter will summarise the methodology and possible improvements, but will also look at the wider unexpected outcomes that arose as a result of the search for the ***Meermin***. The chapter will begin by describing the sequence of events that makes up the methodology devised. Possible improvements to the methodology will be discussed as there is room for improvement. This discussion will be followed by the description of an alternative sequence of events, some that were not planned and some planned, the public reaction to the project and some of the products produced during the project. The ***Meermin*** project will be placed in a wider context by examining the other artefacts of the project. This underlines the importance of the project by describing the impact archaeological research can have. The development of the methodology, although important for the ontogenesis of maritime archaeology in South Africa, becomes almost less significant against this background of public ownership.

5.1 A BRIEF SUMMATION

At first glance the methodology devised to locate shipwrecks in inter tidal zones is fairly straight forward – the process starts with archival research on the target shipwreck. This includes not only primary sources but also secondary sources. The sources could (as in the case of the ***Meermin***) comprise court records or wrecking accounts, which include eyewitness testimony. Published sources can include lists of shipwrecks in the search area, recorded legends or other research publications. Another element of the initial search is the oral history component – speaking to locals to ascertain what they may know of shipwrecks in a particular area. In the case of the ***Meermin*** this included the oral record of wreck remains that are exposed during certain tidal conditions. Following from this is the environmental research including the environmental history of the area. This aids to focus the search area.

The next step is the magnetic survey of the area and, in the case of the ***Meermin***, an airborne survey was proposed since it is the most efficient technique covering the largest survey area including the inter tidal zone that is impossible to cover in any other way. The targets gained by the airborne survey are next surveyed in detail with a handheld magnetometer after which a water probe is used to determine sand depth and exact location. Excavation in the inter tidal zone will always be difficult and will have to be adapted to local conditions. The judicious use of a backhoe or mechanical digger was found to be the most effective in uncovering a large enough area to allow for the identification of ship remains. Identification strategies will also vary with each situation. If one is fortunate one will find artefacts associated with a shipwreck but in the inter tidal situation it is more unlikely as many wrecks may have been stripped in historic times.

The ship's structure is probably what one will find in most cases and this is therefore the best tool to date and possibly identify the wreck as demonstrated during the ***Meermin*** project. Recording and sampling have been helpful in either identifying or eliminating candidates as particular shipwrecks. A flow chart (figure 51) was created to allow the reader to better visualise the methodology. Although simplified it gives an overview, at a glance, of the process needed to enact this methodology. It is hoped that the discussion above has shown that the development of this methodology was an involved and heuristic process.

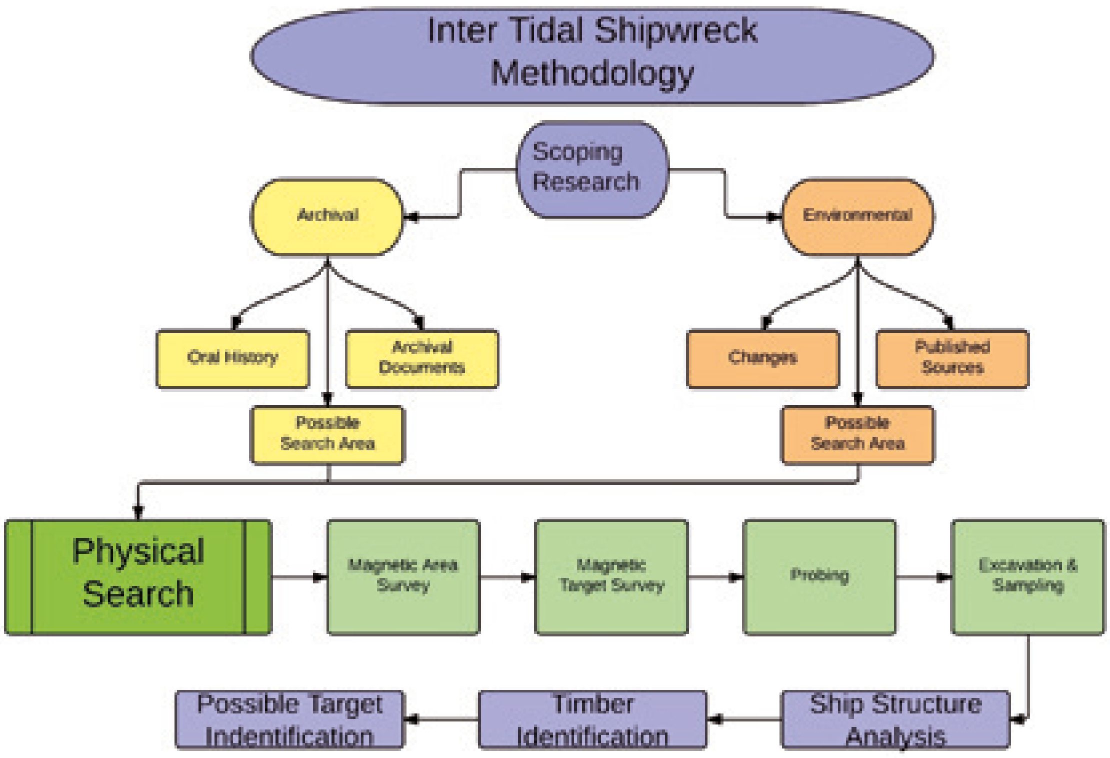

Figure 51: Flow chart illustrating the methodology developed during the search for the Meermin.

5.2 POSSIBLE IMPROVEMENTS

A successful methodology is a constant process of fine-tuning. In the case of the *Meermin* methodology, the improvements can be made in the application of more cost-effective technologies in order to increase efficiency, always keeping in mind that it has to be available in a South African context. Some of these technologies only became apparent after the search for the *Meermin* had been completed. In our current technologically driven world new solutions surface all the time. Some of these improvements are highlighted since methodology can never be static and is constantly evolving. In some sense, it is how new techniques are combined and utilised to produce positive results that form the basis of this thesis. In other words, it is not what technology you are using, but how you apply that technology in order to achieve a solution. In a way, the sequence of application is almost the methodology.

For example, the one area where a likely improvement is possible is in the airborne magnetic survey. Using an aircraft is expensive and necessitates special skills as the pilot needs to have appropriate experience. An aircraft is also subject to regulatory restrictions and needs special permission to fly in particular areas. In the Struisbaai area, for example, we had a South African Air Force base close by. The other difficulty with using an aircraft is the fuel cost. This was exacerbated in the ***Meermin*** project by the fact that the only company with an airborne gradiometer system was located in Gauteng, meaning that the aircraft had to fly down to the Western Cape. For example the airborne gradiometer ***Meermin*** survey cost R135 100 (Steenkamp 2009). So logistically, using an aircraft is complicated and expensive. This however is true of most aerial survey technologies, for example Lidar and aerial photography (see Agapiou & Lysandrou 2015, Doneus ***et al.*** 2013, Musson ***et al.*** 2013 and Schlitz 2004). Archaeologists of necessity try to find less expensive methods like using balloons and kites (for example Bryson ***et al.*** 2013; Myers and Myers 1980).

Another possible solution is the use of drone technology. Drones give more control than either balloons or kites and are less expensive than aircraft. Versteeg ***et al.*** (2007) investigated the feasibility of such a system and compared it to using a full-size aircraft. In their case, they were looking at remote-operated helicopters versus full-sized helicopters. They found that there was a significant reduction in cost when using a drone system without negating quality or even quantity of output. Also, the other area where the drone system is significantly better is in risk alleviation as there is no pilot at risk as is the case with a full-sized aircraft. An aircraft is also subject to more regulations and safety procedures. These operational constraints do not apply to drones.

In 2007 when Versteeg *et al.* did their study, drones were cutting edge and experimental. Even as late as 2013 Stoll was experimenting with a magnetometer drone system with similar positive results to Versteeg *et al.* This has since changed as one can nowadays purchase a complete drone system with on board magnetic sensors. The Canadian company GEM Systems manufacture an Overhauser magnetometer specifically for drones (www.gemsys.ca/UAVs-pathway-to-the-future accessed 5/6/2017). They even provide drones on request. It is still an expensive proposition for a South African research institution. There is however a local engineering company, Remote Exploration Services (www.res.co.za, accessed 5/6/2017) that constructed their own drone to carry the GEM systems magnetometer and have developed in-house controller software to direct the drone's flight path. Logistically this means that two people with an off-road vehicle can visit a site and deploy the drone from the beach, a far easier process than employing an aircraft. Remote Exploration Services were, however, reluctant to let the project use their system and cited difficulties with drone regulations in South Africa as their main reason. Possibly when we secure more funding and offer to pay for the service they will be more amenable to us using the system.

As described above, a water probe was adapted to determine sand depth and exact location of the target shipwrecks. Although it worked quite well it was physically demanding as we had to carry a 5 HP pump, a 4 m steel probe with a diameter of 35 mm and the hoses to the site. This procedure can be improved by downscaling the pump and by using a thinner probe. The small two stroke pump (figure 52) with a smaller diameter probe can for example be deployed. By using the smaller pump one also reduces the size of the hoses needed with a concomitant loss in weight of equipment to be carried to the site. There is no reason to think that a thinner probe will not be as effective as the larger one as the basic principle of jetting a stream of water down the pipe stays the same. The probe was also tested underwater and it works admirably. In fact, it is easier to use than on land due to the fact that it has more buoyancy than underwater.

Figure 52: Small two stroke pump

What is more difficult underwater is the use of a handheld magnetometer. The targets obtained by the aircraft are as visible on the water as on land but this is not the case for the handheld instrument underwater as the instruments do not always record the data generated internally. The project was fortunate to get a handheld system on loan from the US National Park Service Submerged Resources Unit in 2012. This system, the Quantro proton tone magnetometer, works by sending a tone to the diver which changes in intensity as a high magnetic field is approached. Unfortunately the system does not record data which means the diver has to record signal strengths manually. Regrettably the system did not work in South Africa possibly due to the lower magnetic field. Besides this, the Quantro system highlights the main problem with underwater handheld instruments, and that is the lack of an ability to record data. This is mainly because it is very difficult to record position data underwater. It is, however, not impossible. Other systems like the J.W. Fisher DiverMag 1 does not record data and has a sensitivity of only 1 Nanotesla (http://www.jwfishers.com/products/dm1.html accessed 25/07/2017). The only system found that records the magnetic reading as well as its position underwater is made by Shark Marine in Canada (http://www.sharkmarine.com/ accessed 24/07/2017). The Shark Marine system utilises an underwater tablet with a floating GPS and Doppler positioning system. The Doppler uses four downward pointing sonar beams that track the diver's position underwater. It uses a Marine Magnetics Explorer magnetometer sensor that has a 0.02 Nanotesla sensitivity, making it one of the more sensitive units available (http://www.marinemagnetics.com/products/marine-magnetometers/explorer/ accessed 25/07/2017). Although this looks like the ultimate system the major problem is the price. At US$ 88 000 it is out of the range for any South African heritage institution.

On the beach other non-invasive technologies are available such as Ground Penetrating Radar (GPR) instead of a water probe. This can potentially give sand depth as well as indicating other non-magnetic material types such as timber. Although GPR has been used by archaeologists since the 1970s (Gaffney & Gater 2006), it is not without its challenges. It is a complicated solution that requires expertise not just in the field, but especially in the processing of data. This is because the data collected is often in the form of huge datasets that are a function of the collection methodology. A brief discussion of how GPR works follows, although not in-depth as it was not a method extensively used during the development of the ***Meermin*** project.

GPR works by the transmission of high-frequency radar pulses sent from a surface antenna into the ground (Conyers 2007). These pulses are reflected back differentially by the deposit it is sent into. The time differences between the reflected pulses are measured and that enables the operator to create profiles of the subsurface environment. With the correct calibration and application of data processing software, it is possible to create a three-dimensional interpretation of the sub surface tested. This then also gives accurate depths without any disturbance to the deposit. In June 2015, a GPR system was tested with the help of Mr. Coen Nienaber from the University of Pretoria. This initial test was to see whether GPR would be a viable alternative to handheld magnetometry on buried shipwreck sites.

It was decided to test the system (a US Radar instrument: www.usradar.com, accessed 12/07/2017) on ***Meermin*** site 4 as this is the site likely to be explored further when funding becomes available again. A grid was set up over the main large anomaly and the radar cart was run over the site with a lane spacing of 50 cm. Although there were problems with the data that relate to the instrument used, methodology and the weather conditions on the day, all of which caused a large part of the data to become corrupted, the test still produced astounding results. Figure 53 represents an overlay of the part of the GPR data that was useable on the magnetic data. One can very clearly see the beginnings of an outline of a shipwreck. This proves the potential value of GPR in that it allows us to detect the presence of materials not detected by magnetometry. We plan to implement a survey and ground truthing programme on Site 4 in the near future.

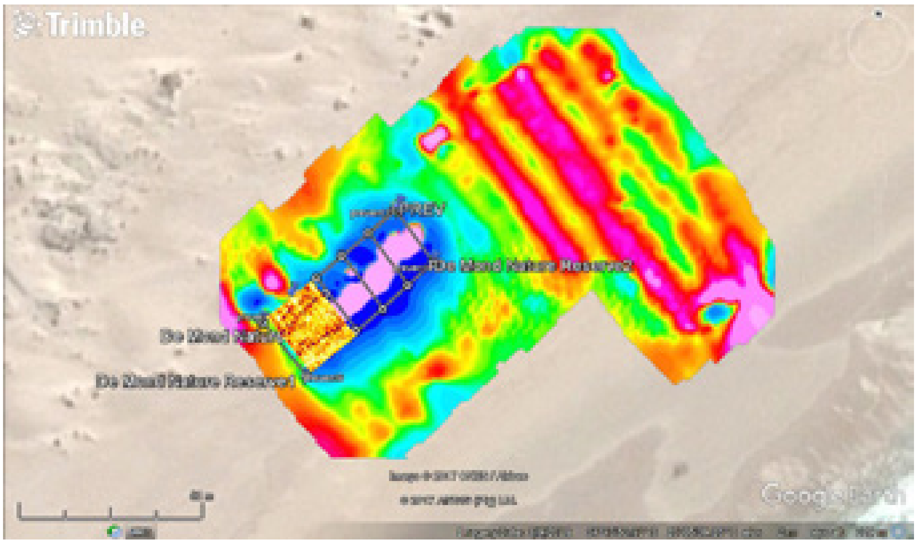

Figure 53: Ground Penetrating Radar data overlain on the magnetic signature. Note the shiplike form.

Recording the sites found during ground truthing was limited by the time and equipment available therefore photography played an important part in recording as it was quicker to do than the more traditional site drawings. What features were recorded and how the sites were photographed became more important than originally realised. A recent advancement in the use of photography is the creation of 3D digital models using the software Agisoft Photoscan. This software has of late been extensively used in archaeology (see for example Barsanti ***et al.*** 2013, Bennet 2015, Van Damme 2015). The software prefers photos that were taken from different directions and would then stitch together the photos to create an accurate 3D model. The one site at which photographs were taken from multiple angles was ***Meermin*** Site 5, which was recorded from 360 degrees around the site. When processed with Agisoft it was possible to create a 3D model of the site that one is able to use to determine measurements (figure 54). Unfortunately, the same process was not followed at the other sites discovered during the ***Meermin*** project mainly because we were unaware of the future possibilities in the development of 3D software and were not experienced in photogrammetry. The photos that were taken at most of the sites were details of features and overall site photographs. A future strategy now that we do have access to the Agisoft software would be, as a standard operating procedure, to take photos in a 360 degree arc of sites excavated.

Figure 54: 3D Model created from photographs of Site 5.

5.3 ADDITIONAL IMPACTS OF THE PROJECT

In any project, there are planned and expected outcomes, but also unexpected results. When working with external funding one has obligations to the funder that include public exposure. In the case of the ***Meermin*** project, we released a statement to the press early on. Because we were at the beginning of the project we tried to keep this to a minimum by only sending a short press release to the South African Press Association. We did not, as is usual, have a press conference. The reaction to the project took us by surprise and very soon we had articles appearing not only in the South African press (see for example Roelf 2004 and News 24, 2004) but also internationally most notably in the New York Times (LaFraniere 2005) and a leading Dutch newspaper the Volkskrant (Bos 2006). The author was even contacted by the BBC (Duncan 02/09/2005 Correspondence) and National Geographic (Lange 01/06/2006 Correspondence). Both channels, however, were only interested in the project once we found the wreck and not in the process of finding it. The author also received a request from a nonfiction author to write a popularised account of the ***Meermin*** story (Salisbury 24/08/2005 Correspondence). There were several issues with this request, however, as the writer wanted to use research compiled by the project but write the story as the sole author.

Even in the popular scientific press, the project had an impact. As related above, the project was given a free educational copy of the Geosoft software. The Geosoft Corporation has an in-house publication, Earth Explorer that regularly features users of their product. The ***Meermin*** project was the front-page feature in the 2009 edition of the magazine (Chandler 2009) and was featured again as part of an online workshop in 2017 or webinar called "The link between Tsunamis, Corvettes, Lost Ships and Bombs" (www.geosoft.com/videos accessed 20/07/2017). The ***Meermin*** project was used to show how the software could help with archaeological exploration.

What the press reaction revealed was that the story of the revolt on board the ***Meermin*** had the ability to appeal to the public imagination. That the story would have a national impact could be anticipated given the socio-political situation at the time. In post-apartheid South Africa, there is an expectation that the members of the museum and heritage community should be principal actors in bringing about a new democratic society based on a critical examination of the past (Galla 1999). Museums have had to move away from depicting and focusing research on the tangible heritage of European origin. In fact, this was one of the important reasons for choosing the ***Meermin*** as a focus of research. The wider impact of the project culminated in a request from a Dutch film company, Off the Fence, to make a documentary of the ***Meermin*** story. They were alerted to the project and the story by the aforementioned New York Times article.

5.4 *MEERMIN* DOCUMENTARY

The documentary, "Slave Ship Mutiny", was made for the PBS network as part of their "Secrets of the Dead" series (www.pbs.org, accessed 20/07/2017) in cooperation with Arte France and WNET.ORG. It follows three people in their separate quests to uncover the story of the ***Meermin***. The first was the author, as the archaeologist searching for the wreck and analysing the structure to help identify wreckage found. The second actor is the historian, in this case, Nigel Worden from the history department at the University of Cape Town, combing the archives to trace the fate of the slaves. The third person represented a slave descendant, Lucy Campbell, a local activist who was trying to make sense of her roots. Although the formula was somewhat contrived and possibly too emotionally charged (Worden 2014) the documentary had a huge international impact, being shown not only on the channels mentioned above but also later being picked up by the History Channel. The Australian version was accompanied by an educational programme (www.historychannel.com.au/teachers-guide/slaveship-mutiny/ accessed 21/07/2017). The airing of the documentary on a widely accessible channel such as the History Channel brought the story of the ***Meermin*** to a much wider audience. A Google search with the keywords "history channel ***Meermin***" delivers more than 3000 results. Although not all hits are for the documentary, it does give a rough indication of the impact.

During the production of the documentary, the author had very little control over the script and how the story was told. This seems to be in line with what Sperry (2008) notes to be the trend for documentaries relating to maritime archaeology. The limited influence of the author and therefore scientific control could be why the documentary had an overly dramatic approach and minor historical inaccuracies (Sleigh & Westra 2012). One cannot dispute, however, that it had a significant largely positive public impact. This is important as maritime archaeology was portrayed as a positive and scientific endeavour attempting to uncover a difficult past. This helps in dispensing with the image of maritime archaeology as an elevated form of treasure hunting (Sharfman ***et al.*** 2017) in that the archaeologist was not looking for treasure, but rather attempting to illuminate an important historical event by careful study and systematic survey practices.

5.5 EXHIBITIONS

This image was carried forward in a travelling exhibition constructed by the author as part of the requirements of the funding received. The eight-panel exhibition attempted to not only highlight the search for the ***Meermin*** but also put the story into historical context. The archaeological process was also explained so that the viewer not only understands the history but also appreciates how the scientist works at exposing the past. Added to the exhibition was an education package consisting of copies of the display panels and questionnaires and activities to be completed by the students. The exhibition opened at the Iziko Maritime Centre in 2011 and moved to the Bredasdorp Museum in 2012 and then on to the Diaz Museum in Mossel Bay in 2013. The exhibition was critically examined by Heather Wares (2013) in her history master's thesis – "Maritime archaeology and its publics in Post-Apartheid South Africa".

Wares did a comparative study between the traditional Shipwreck Museum in Bredasdorp, the ***Meermin*** Exhibition, and the Nautical Archaeology Society programmes run by SAHRA. The basic premise was to contrast the old notion of the wonder of an object salvaged (object for the object's sake) as premised in the Bredasdorp Museum, with the constructing of new publics by locating resonance with its subject in an exhibition or emphasising the importance of context rather than object as in the case of the ***Meermin***. Her detailed analysis of the exhibition concludes that the exhibition created a new public through a transformation agenda in an attempt to move away from the colonial history model as expressed in the Bredasdorp Museum permanent displays. Her main criticism of the exhibition is that the information on the ***Meermin*** project is still controlled and disseminated by experts as the public is expected to follow the information supplied. In her opinion, this limits freedom of choice as the visitor is guided by the different panels to come to specific conclusions about the ***Meermin*** story and the archaeology involved in the search for the wreck.

An interesting and totally unexpected and unsolicited development was the inclusion of the ***Meermin*** story in the Michaelis School of Fine Art at UCT's first-year module "Images in Conflict" (FIN1009S). The inclusion of the ***Meermin*** was inspired by another temporary exhibition that was the result of a cooperative venture between Brown University and Iziko Museums in 2013. This exhibition, 'Ships of Bondage and the Fight for Freedom' juxtaposed the ***Meermin*** story with that of the US slave ship Sally, and the well-known 1839 slave uprising on the Portuguese slave ship Amistad (https://www.brown.edu/initiatives/slavery-and-justice/ships-bondage-exhibit-cape-town-south-africa Accessed 21/07/2017). The ***Sally*** (which was owned by the Brown Brothers, the early benefactors of what would become Brown University) experienced a failed insurrection in 1765. The aim of the exhibition was to 'tell a global history of the slave trade and its contemporary legacies while also providing a comparative study between bondage in the Atlantic world and South Africa'. The course reader included the exhibition text and students watched the documentary 'Slave Ship Mutiny' as part of the background information for the course. What was somewhat surreal was that the author was made aware of this course by his daughter who happened to be a first year Fine Art student in the class. She, in turn, had the peculiar experience of watching her father appear in a documentary in class.

5.6 ACADEMIA

The first notable academic artefact of the project was an honours thesis by Andrew Alexander (2003). Alexander was part of the ***Meermin*** research team and was tasked with finding and transcribing archival records pertaining to the ***Meermin*** episode. He used this information to discuss the revolt on board the ***Meermin*** and to analyse the ranking structure and responsibilities on board Dutch East India Company ships. He also looked at the emotional state and reactions of the crew and Malagasies on board the ship during the revolt and subsequent wrecking. Although Alexander perhaps read too much into the documents, as one cannot know the emotional state or the thinking of the people on board the ship with certainty, he still gives a succinct analysis of the events during the mutiny. The work in his honours project further inspired Alexander to use some of the material for a masters thesis (2005) wherein he examined the VOC slave trade to Madagascar in more detail by comparing three slaving voyages – those of the vessels the ***Neptunus*** (1760–61), the ***Meermin*** (1765–66) and ***De Zon*** (1775–76). Although not directly a product of the ***Meermin*** project we can at least claim that it was inspired by the project.

5.7 MODELS AND REPLICAS

The ***Meermin*** project had its start in the attempt by the VOC Foundation's committee for the tercentenary of the founding of the VOC as stated above. A scale model was planned, but due to lack finances not realised. Later on the author attempted to continue this as an aid to help with the familiarising and identification of the construction of the ***Meermin***. The author attempted to re-allocate some of the Lotto funding for the building of a construction model and even went as far as finding a model builder and purchasing special timber. The Lotteries Board, however, did not agree and the model was left unfinished (figure 55). Later in 2010 the VOC Foundation contracted the same model builder (Brian Donnely) to complete the model and lent it to Iziko for an exhibition in the Slave Lodge (figure 56).

Figure 55: Ship model of the Meermin in progress

Figure 56: Completed ship model of the Meermin on display.

The Slavery exhibition at the Slave Lodge has a small section where a quarter scale section of the lower part of the ***Meermin*** was reconstructed. It is here that the model is located, replacing another model of a Dutch East India Company ship. The museum had originally displayed the model of the VOC Ship (***Drommedaris***) because firstly it did not have a model of ***Meermin*** and secondly it wanted to represent a Dutch ship typical of the kind that was used for the slave trade. The placing of the ***Drommedaris*** did not sit well with the VOC Foundation (Sleigh pers. comm.) and motivated them to get the funding to complete the ***Meermin*** model. Perhaps this was due to the fact that the ***Drommedaris*** was not actually a slave vessel, or because it was one of the ships that came with Van Riebeeck when he arrived to colonise the Cape. The latter may have been seen by the VOC Foundation to undermine Van Riebeeck's status as icon as depicted in the 1952 tercentenary celebrations (Rassool & Witz 1993). If this was the case, it is ironic that they replaced it with a model of the ***Meermin***, a symbol of struggle against VOC domination.

The ***Meermin*** Project and its appearance in the press inspired another ship enthusiast, the founder of the now defunct Whisper Boat Building Academy, Peter Jacops, to approach the author with plans to build a full-scale replica of the ***Meermin***. Mr Jacops is an internationally qualified marine surveyor and started the Whisper Academy to train underprivileged young deaf people to build boats. His idea was that the story of the ***Meermin*** would resonate with the community and potential funders. The idea was to do something similar to what had been done in the Netherlands with the building of the Batavia replica (see http://www.bataviawerf.nl/ accessed 23/07/2017). A committee of interested parties was formed consisting of businessmen, the author as museum representative, local politicians and tourism industry representatives. The City of Cape Town was approached and the committee presented the proposal to them. Although the City expressed some interest it seemed as if the project was somewhat too esoteric for them and they lacked funding. The committee forged on till 2009 when the project fizzled out because of lack of interest (e-mail correspondence from 2006 to 2009).

5.8 REFLECTING ON THE *MEERMIN* PROJECT

As archaeologists, we find sites and investigate them in order to interpret the past in a way that helps us better to understand the times we live in. We develop methodologies to enable us to carry out these goals hoping to produce either theses or peer reviewed publications. We often do not realise the impact this research has on the public even though, as archaeologists, we often carry out our work with public funding and therefore have a public responsibility. The ***Meermin*** project is a good example of this. The author set out to find a shipwreck and developed a methodology for doing this. It ended up being a good deal more complicated than originally envisaged even though the subject of the ***Meermin*** as a slave ship hinted at the possibilities the project could engender.

Even though we did not find the ***Meermin***, I believe that the project was a success. The methodology works as a way to locate the remains of ships buried beneath the sands of the inter tidal zone. With some of the improvements suggested above, the implementation of the methodology does not need to be overly expensive. The *Meermin* story is, however, more than that of a shipwreck. We have told the story in many ways – exhibitions, documentaries and models, all without actually finding the wreck and, I would like to contend, because of the archaeological search for the wreck. It is this search and the publicity surrounding it that inspired other people to take up the story in the various ways detailed above.

Further, I assert that it was important for maritime archaeology in South Africa to focus on the methodology of finding inter tidal shipwrecks. In the past all the wrecks worked on by archaeologists in this country (only a handful) were either found accidentally like the ***Brunswick*** (Boshoff & Kruishaar) or were located by treasure hunters like the ***Oosterland*** (Werz 1992). It is vital for the small maritime archaeological community in this country to show that we are capable of developing and applying our own scientifically based methodologies. It is crucial that a reliable base of skills and methodologies be established so that the South African maritime archaeological community can expand on the archaeological record and grow the discipline's knowledge base and thus facilitate higher levels of theoretical development.

The *Meermin* is the vehicle chosen for this and in doing so we created a symbol of the struggle for freedom in this country by reviving the story and conceiving new memories to decolonise the past. This we can see in the juxtaposition of two events related to the *Meermin*. One a beauty contest and the other a surprise revelation of a signature in an archival document related to the *Meermin* episode. In 1989, at the height of apartheid, the Bredasdorp Museum organised a beauty contest entitling it the 'Miss *Meermin*' contest (Wessels pers. comm). Local beauties (all white) competed in quasi 19th century costume (figure 57) in an effort to boost visitors to the Bredasdorp Museum and the environment. In the documentary 'Slave Ship Mutiny' Nigel Worden, the historian, shows Lucy Campbell, the slave descendant, the signature of one of the *Meermin* rebellion leaders, Massavana. She is overcome by emotion and cannot stop her tears.

For me, these instances exemplify two completely different forms of ownership of the *Meermin* story. On the one hand, you have a frivolous event that commemorates the wreck only because it happened to take place on that coastline and, I suspect, because of the name of the ship, *Meermin* – Mermaid – a traditionally beautiful mythical creature. They do not focus on the revolt or on what happened to the people involved. On the other hand the mere appearance of a physical manifestation in the form of Massavana's signature brought forth tears in Lucy Campbell. Campbell cannot prove descent from the *Meermin* slaves, but the mere fact that her forefathers were slaves is enough for her to identify closely with the slaves from the doomed ship.

Who has the better claim to the ***Meermin*** story? I think the answer would be to see what would happen if another 'Miss ***Meermin***' beauty pageant is held today in the New South Africa. It is likely that the reaction would be different and possibly more widespread.

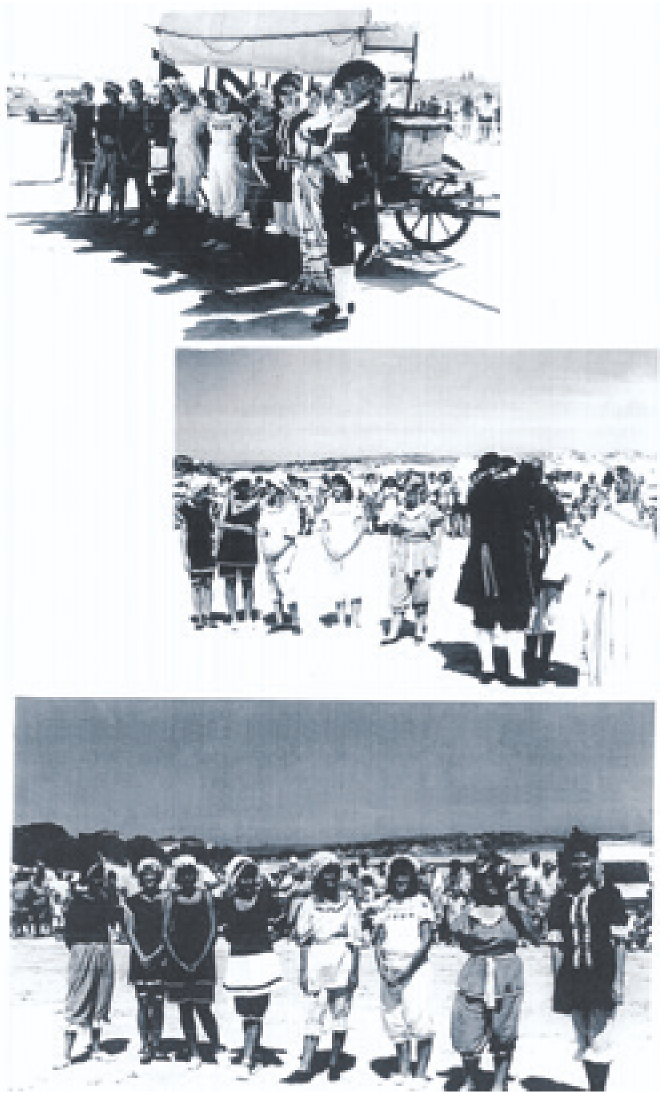

Figure 57: The Miss Meermin competition. (courtesy of H Wessels)

It is therefore a blessing and a curse for the archaeologist to use a strong story like that of the ***Meermin***. A blessing in that it captures the imagination of people and makes for more understanding and legitimacy for archaeology. A curse in that the archaeology becomes almost ancillary to the story – a true handmaiden of history.

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