Excavation report of the VOC-ship Avondster (1659)

The
Anglo-Dutch
East-Indiaman
that was wrecked
twice in Ceylon

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Message of the Hon. Minister of Cultural Affairs and National Heritage of Sri Lanka, Mr. Mahinda Yapa Abeywardene:

It is with much pleasure that I add this message to the Final Report of the Underwater Archaeological Excavation and Research of the "Avondster" Excavation and Conservation Project of the Maritime Archaeology Unit which is a joint collaboration programme of the Central Cultural Fund, Dept. of Archaeology, the Amsterdam Historical Museum, the University of Amsterdam in the Netherlands and the Western Australian Maritime Museum.

The two main Sri Lankan institutions namely the Central Cultural Fund and the Dept. of Archaeology which are responsible for the operations of the Maritime Archaeology Unit, come under the purview of my ministry. As the minister in charge of the subjects of cultural affairs and national heritage, I wish to commend the valuable work carried-out by the "Avondster Excavation Project", being one of the major activities undertaken by the Unit during the past, with a view to training Sri Lankan diver-archaeologists, researchers, maritime artifacts conservators, and other scientific and technical personnel such as underwater photographers and draftsmen.

Sri Lanka, a nation that is rich in vast maritime and underwater resources, needs to carry-out further research into it and therefore she has to have the necessary trained human resources and basic infrastructure. I observe with much appreciation that the directorate of the "Avondster" projects has fulfilled this requirement to its maximum possible level, in spite of the great difficulties they had to come across during the Tsunami disaster in 2004, which led to a total destruction of the entire physical infrastructure of the Unit. This report proves that the Unit has got its full-life again due to the hard work and dedication of the team members of the Unit, both, national and international and the guidance given by the able directorate.

I wish to take this opportunity to extend my sincere gratitude to the government of the Kingdom of the Netherlands, its Embassy in Colombo, and the Amsterdam Historical Museum in the Netherlands for the generous support and cooperation extended towards this worthy venture for the preservation of heritage of Sri Lanka and the mankind and also to congratulate the team for the successful completion of the Final Report.

Mahinda Yapa Abeywardena

Minister of Cultural Affairs and National Heritage,
"Sethsiripaya", Battaramulla, Sri Lanka.
25th of July 2006.

Message of The Netherlands Ambassador of International Cultural Co-operation, Mr. Jan Hoekema

The past four centuries of the Dutch-Sri Lankan partnership resulted in distinctive influences on both the tangible and intangible heritage of the country. Our two countries have developed, and still maintain, a long-lasting and strong relationship. What remains today of the Dutch Period in Sri Lanka is a mutual heritage that evolved from interaction and exchange of elements between the Sri Lankan and Dutch cultures. The shared cultural heritage of Sri Lanka and the Netherlands is therefore an integral part of the current bi-lateral relations between the two countries.

The Dutch Ministries of Culture and Foreign Affairs have a joint fund for cultural projects. This Dutch Cultural Fund (HGIS-C) has supported many interesting mutual heritage projects all over the world and also in Sri Lanka. The world heritage site of Galle was the centre of many mutual heritage projects in Sri Lanka, including the Avondster project. Aim of this project was capacity building in order to set up a maritime heritage management sector in Sri Lanka through the excavation of the East India Man "Avondster". This excavation resulted in a substantial collection for the new maritime museum of Galle and in a well trained local staff in the field of maritime archaeology in Sri Lanka. It was a successful programme and I was lucky enough to witness this with my own eyes on my very first trip as Ambassador for International Cultural Relations in April 2003.

Just after the preservation and management of the Maritime Archaeological Unit and its collection were handed over to the Sri Lankan on 24 December 2004, disaster struck the town and therewith the project. The tsunami of Boxing Day 2004 flooded most of the collection and ruined the Maritime Archaeological Unit. Fortunately, there were no personal accidents amongst the the local staff. The bulk of the Avondster wreck also remained intact. It must be very demoralizing when a tidal wave destroys all the work that an enthusiastic team just finished. But soon after the tsunami a team of international experts travelled to Sri Lanka to survey the damage. And within a few months a new Unit was realized which made the real assets of the project visible, i.e. the local team and the network around them. These were built up so solidly that it was possible to rehabilitate the work quickly and efficiently, which made it possible to enjoy the results of a successful project.

And this is exactly where our Dutch Common Cultural Heritage Policy stands for. It is not only the restoration and conservation of cultural heritage, but it is the investment in people, in capacity and public awareness regarding the landmarks of a shared past that makes these projects worth investing in. This partnership is quite unique in the world and I am still as proud as when I discovered the intensity of it in Spring 2003.

Mr. Jan Hoekema

Ambassador of International Cultural Co-operation,
Director of the Cultural Cooperation, Education
and Research Department (DCO) of the Ministry of Foreign Affaires

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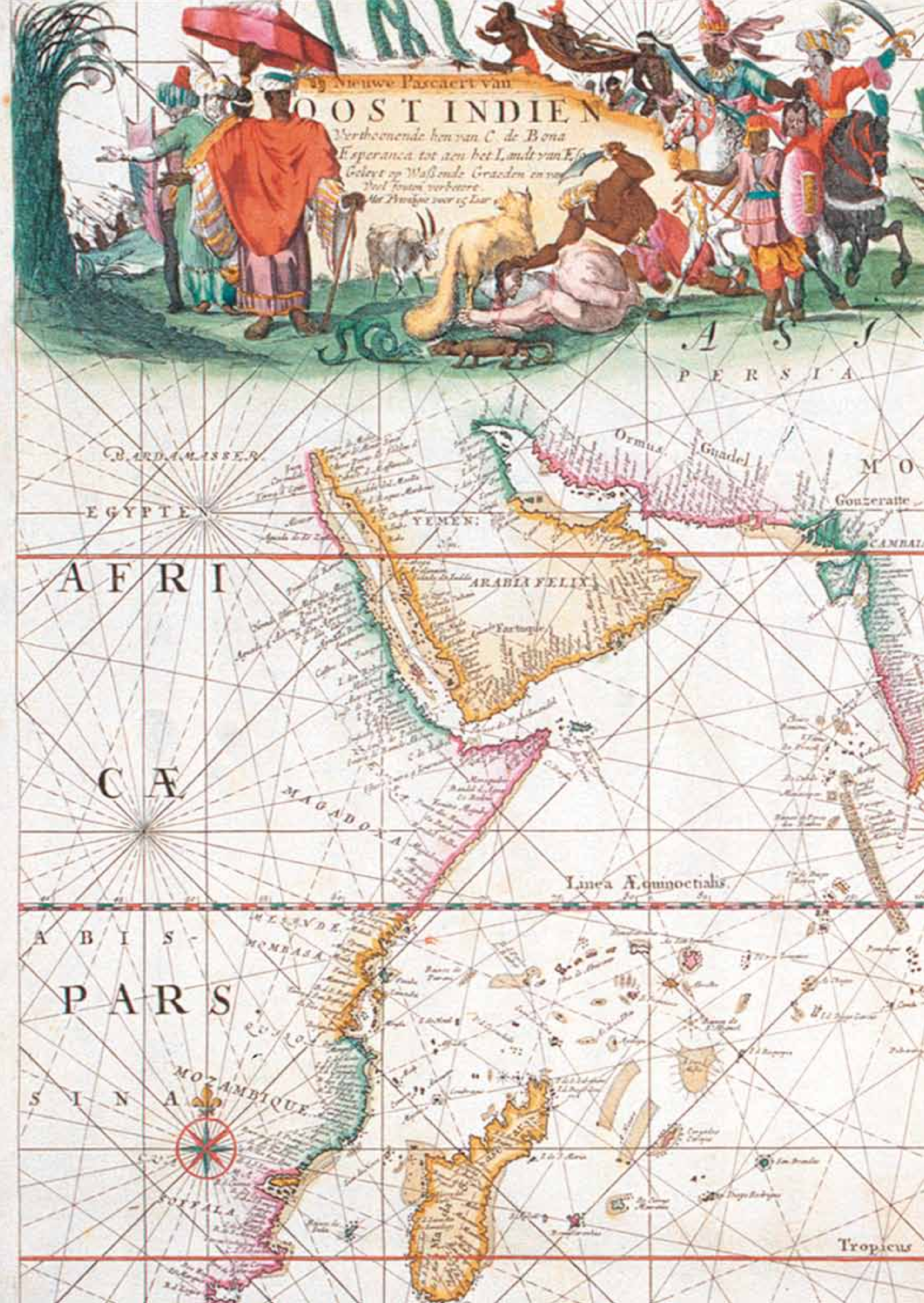
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Met Privilegie voor 15 Iaar
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LEAOTUNG
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BOR NEO
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Ladrones
HOLLANDIA
Capricorni


India
Sri Lanka
Galle

Introduction

Sri Lanka is strategically located between Arabia and East Asia, at a natural crossroads of navigational routes and has been a centre of trade and cultural exchange since ancient times. With Sri Lanka's significant seafaring history, and the archaeological riches of its land sites, there can be no doubt that study of the underwater sites will reveal a fascinating history.

Underwater surveys carried out in Galle Harbour since 1992 have revealed 26 archaeological sites dating from the 13th century, through the arrival of Europeans in the 16th century, to modern times. This history is also reflected in the material remains found on the harbour and artefacts excavated date from the 13th century to 21st century. Several stone anchors of Indo-Arabian pattern have been discovered, including one from the Arabian Peninsula weighing almost a tonne, and an anchor of Mediterranean pattern (Souter, 1998). A celadon bowl of the Southern Song dynasty (13th century) is one of the few relics of early trade with China; while the later 17th century blue-and-white Chinese tradeware is abundant (Prickett-Fernando, 1990). While Sri Lankan archaeology is rich in cultural treasures from much earlier periods, it is the combination of several United Dutch East India Company (Verenigde Oost-Indische Compagnie, or VOC) wrecks and the VOC's extensive historical archives that make Galle Harbour so interesting. This combination of archaeological and historical resources provides a unique opportunity to explore Sri Lanka's role in international trade, and to examine the political and cultural affects of this trade.

In 2001 a Maritime Archaeology Unit (MAU) was formed under the Mutual Heritage Centre and managed by the Central Cultural Fund, a Sri Lankan Government agency. The MAU's first major project was the excavation of the Avondster, one of five Dutch East Indiamen wrecked

References Figure 3

Site	Type
A	Large Iron wreck
B	Iron wreck
C	Iron wreck
D	Iron wreck
E	Wooden wreck
F	VOC-ship Hercules
G	Wooden wreck with ballast mound
H	Two iron cannons
I	Iron wreck
J	Large area of ceramic shards
K	Large iron wreck
L	Voc-ship Avondster
M	Iron anchor
N	Iron anchor
O	Iron wreck
P	Stone anchors site
Q	Wreckage
R	Iron anchor
D	Wreckage
T	Iron anchor
U	Iron anchor and wreckage
V	Wreckage
W	Iron wreck
X	Target possible wreck
Y	Iron wreck

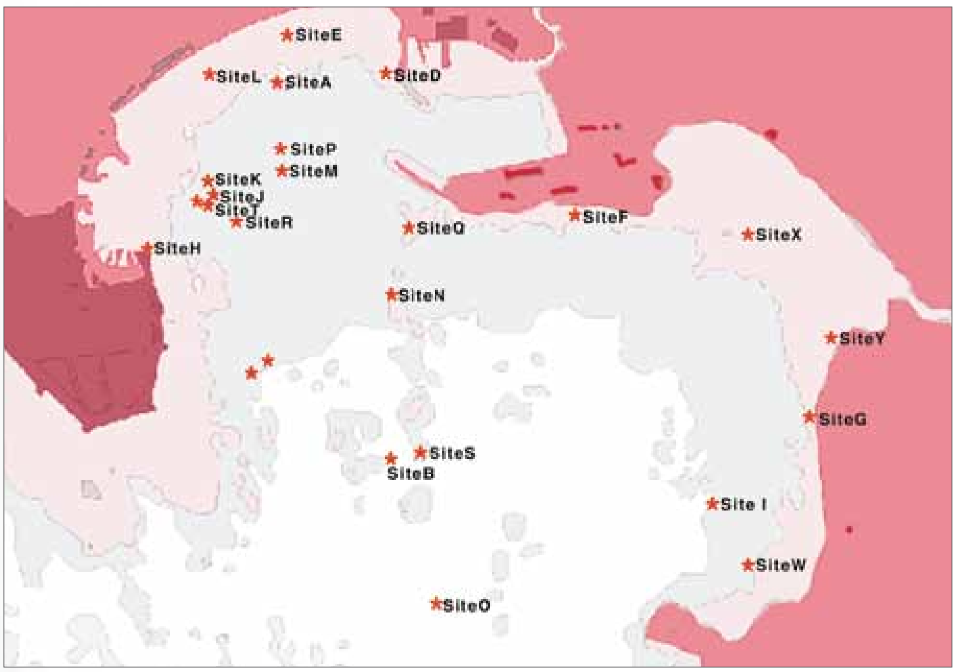

Figure 1 Nieuwe Paskaart van Oost Indien by J.vanKeulen (1680), Amsterdam Historical Museum
Figure 2 Map India and Sri Lanka
Figure 3. Archaeological sites in Galle Bay

in and around the Bay of Galle (Figure 3: site L). This project, sponsored by the Netherlands Cultural Fund, was carried out in cooperation with the Amsterdam Historical Museum; the University of Amsterdam; the Western Australian Museum; the James Cook University, Townsville; and the Mexican National Institute of Anthropology and History (INAH).

The Avondster Project had a number of aims in addition to the survey, excavation and conservation of the site and artefacts. One of the primary goals was to build the capacity of the MAU's Sri Lankan archaeologists and conservators, and associated infrastructure for the continuation of a permanent maritime archaeology program in Sri Lanka. Another important goal was the development of a maritime museum, to showcase Sri Lanka's broad maritime history, its sites and the people involved; with the initial displays based on the material recovered and research undertaken during the Avondster Project.

Capacity building in maritime archaeology essentially commenced in 1992 with the Galle Harbour Project, a training project for Sri Lankan maritime archaeologists and conservators. This program was initiated by the Post Graduate Institute for Archaeological Research (PGIAR), the Central Cultural Fund (CCF) and the Archaeological Department in Sri Lanka, assisted by the Western Australian Museum. After two years of preliminary training, survey and rescue, with the threat of damage from a proposed harbour development, excavations commenced in Galle Harbour. From 1997 the focus again centred on training. From 2001, with the acquisition of Dutch funding, an extensive program was developed: the Avondster Project, which, while based on the excavation of the Avondster shipwreck site, encompassed a broader agenda of providing a platform for maritime archaeology in Sri Lanka. The program was so successful that at the UNESCO Conference, the "Protection of Underwater Cultural Heritage in Asia-Pacific Waters", held in Hong Kong in November 2003, it was decided that a UNESCO regional training centre in underwater archaeological site conservation and management would be formed, based at the MAU in Galle.

The wreck of the Avondster was at risk and this was the main reason archaeological intervention was carried out, rather than the identity of the ship. The ship was located in 1993 and with subsequent monitoring it was clear that more and more of the wreck was being exposed (and eroded) through changes in the dynamics of the seabed. It was important to implement a rescue archaeology project to safeguard this significant heritage site. From 2001 to the end of 2004 important sections of the ship were excavated, in-situ protection implemented, collections conserved and preparations were made to open the National Maritime Museum in Galle at the end of 2005. As the Avondster Project drew to completion the staff of the MAU prepared a program, due to commence in January 2005, for the survey, management and presentation of additional maritime heritage.

However on 26 December 2004 only days after the first phase of the excavation of the Avondster was finalised, both the MAU premises and the National Maritime Museum in Galle were destroyed by The Tsunami. Most importantly all the staff of the MAU survived this disaster, but a substantial part of the historical collections and equipment was lost. It is both unsettling and ironic to realise that, despite concerted efforts to safeguard a collection against deterioration on the sea-bed, the artefacts now remaining on the wreck, exist with their contextual information intact, while the majority of the material excavated has been lost.

Despite the unfathomable humanitarian disaster that had taken place around them and the loss of their facilities, the spirit of the MAU group of young professionals was unbroken. They

Figure 4 - Divers of the Maritime Archaeology Unit Galle

remain determined that the future for this new discipline and thus their own future should not be washed away by the Tsunami. With the support of the Avondster Project's international network funds were brought together to rebuild the facilities of the MAU, allowing the MAU to continue operation, to safeguard maritime archaeology in Sri Lanka.

This report presents the first results of the excavation and historical-archaeological research of the VOC ship Avondster in the context of a broader field of research related to the role of Galle as an important port city in the Indian Ocean region. The report of this multi-faceted project is structured in two parts. In Part One (Chapters 1 - 6) you will find a general overview of the project and the history of the Avondster. In Part Two (Chapters 7 - 11) a number of authors elaborate on various subjects related to the project. This includes a history of Galle, the city in the context of VOC shipping within Asia, a detailed excavation report by the MAU team, an analysis of the ship's construction, a discussion of the in-situ protection applied to the wreck and a case study on the conservation of a wooden barrel excavated from the Avondster.

We hope that this publication expresses the excitement that we felt working together to accomplish the many ambitions of this project. The credit for this extraordinary achievement must go to a wide range of committed people from diverse backgrounds: firstly to the team of the MAU and to the other team members of the Project, all the people involved with the development of the MAU; training both on site and in the conservation laboratory. Credit also must go to the officials in the institutes that made this project possible, from the decision makers at the funding organisations to the civil servant who provided permits and permission. We must also thank, those who are supporting this endeavour by writing and speaking about it: the general public and the press. It is the enthusiasm and ongoing commitment of all these individuals that will make Maritime Archaeology in Sri Lanka sustainable into the future.

It is not possible to single out any institute or person, so many have made significant and critical contributions. A list of participants and supporting institutes is included in the Acknowledgements at the end of this publication.

Figure 1.1 : 'View at Galle' , Johannes Vingboons , The Atlas Blaeu - Van der Hem, p. 287, Österreichische Nationalbibliothek


DE OPENBAARE ZEE
DE STAD GALE
DE BAAY VAN GALE
DE BAAY BY OENEWATTE

1 Avondster: an East-Indiaman in Asia

The discovery and identification of the Avondster

In February 1993 an international team of maritime archaeologists and historians located a large wreck in the Bay of Galle, Sri Lanka. Close to the shore in shallow waters, this archaeological site was found in a surprisingly good state of preservation. An outline of ship's timbers an anchor at the bow and cannons spread over an area of approximately 40m by 10m made it easy to identify the site as the remains a large, probably European, vessel. Although most of the wreck was covered with sand, in the centre area a brick construction was visible, protruding from the seabed. As part of the Galle Harbour Project's maritime archaeological survey, all sites were allocated a unique identifier, this site was named Site L. The site was affectionately nicknamed 'chicken feet site' before the wreck was identified, due to the presence of slaughter waste that washed over the site from the adjacent storm water drains of Galle city.

The discovery of this wreck in the last week of the 1993 fieldwork season was a highlight of the survey that had started a year earlier. In two seasons 11 sites of archaeological importance were located. Spectacular finds included the site of the SS Rangoon (1865) and traces of the Dutch East-Indiaman Hercules (1661). This latter ship was identified using the extensive archives still available in both the Netherlands and Sri Lanka. The ability to link historical references with archaeological sites became an important facet of the research into the development of Galle and its role in the Asian trade and shipping network (Parthesius 2007). It also made the identification of the new wreck at Site L possible.

Initial observations, particularly of the ship's construction, strongly indicated that the wreck was European built. The presence of the exposed brick construction, made of small distinctive IJsselsteentjes, further indicated the vessel was probably Dutch.

Given this strong indication for a vessel of Dutch origin the starting point for identification was a list of the VOC ships that records show were wrecked in or near the Bay of Galle. The list consisted of three 17th century wrecks and two 18th century vessels. The 18th century vessels Barbesteijn and Geinswens were not likely candidates because they were of the largest vessel type, the so-called Retourschepen (homeward-bounders), and would therefore exceed the size of the vessel found on Site L. If this vessel was a VOC ship it was most likely one of the rate of jacht (yacht) that were the most popular vessel for intra-Asian shipping in the 17th century. In 1992 a wreck on the rocks near Closenburg was identified as the Hercules (1661). From accounts of the wrecking of the Dolfijn (1663) it is known that this ship wrecked outside the Bay of Galle, while journeying from Surat. So, from the shortlist of three 17th century yachts, the Avondster was the most likely candidate. In a letter from the Commander of the City of Galle, Van der Meijden to Governor Maetsuycker in Colombo the 'clumsy' wrecking of the Avondster was described:

> After our last [letter] to Your Hon of 23 June with the small flute Peguw via Cormandel, to our great displeasure, on 2 July in the night, in Gale baai, the old jacht Avondster, after her ropes had withstood the bad weather, in a light breeze slipped from her anchors and because of bad supervision perished. The first mate Bartel Schagh from Dantzig, who was first called by the watch, did not pay enough attention and went to bed again, while the boatswain's mate Coert Alberse and the steward Dirck Wilemsz

Figure 1.2: Map of "De Baay van Gale" and "De Baay by Oenewatte", Anonymous, Nationale Archives, The Netherlands, inventarisnr. VEL1056

> were not taking care in their watch duties, until in the end the skipper Arent Danielse Lem was called too, and neglected for a quarter of an hour to drop an anchor, because he thought that the jacht could be brought to deeper water with a kedge. But before the same was brought out the jacht ran aground and broke up immediately before the garden of Marcus Cassel and the small out flowing river at the side of the mountain.' (NA VOC 1230 [VOC, Letters and papers from Asia] [fol. 159 - 166 verso) [Translated from 17th century Dutch by Parthesius]

The above description raised various questions about the identification of Site L. According to Van der Meijden's account the vessel had broken up after it run aground while the hull of the wreck found on Site L appeared reasonably intact, at least to the first deck. The only apparent indication of the 'immediate breaking up' was a detached sternpost, located 12m south of the main wreck site, which may have belonged to the Avondster. The interpretation of the location described in the account was more difficult to reconcile. No references to indicate the location of Marcus Cassel's garden or any other garden could be found in the archives. So, the 'small out flowing river at the side of the mountain' became an important marker. In first instance the current view of the bay with the presence of a distinctive mountain with a river at the side in the NE of the bay made clarification difficult.

In the modern situation the beach at the NW of the bay has disappeared under a breakwater that protects the busy Marine Drive and the newer parts of Galle that have developed outside the fort. That this description was not immediately recognised was understandable – the location of the 'small out flowing river at the side of the mountain' was swallowed by the expanding city and is now the outlet for storm water drains and the 'mountain', something that would now be called a hill, is obscured by and covered with buildings. With these observations it became more likely that Site L was indeed the wreck of the Avondster, while bearing in mind the inconsistency between the description of a broken-up vessel and a site that shows a reasonably intact hull.

Based on the early surveys and an understanding of conditions on the site in July during the SW monsoon (the season the Avondster wrecked), the following speculative theory was developed for the formation of the Avondster wreck (Figure 1.4):

> The Avondster has been stranded (left): sand flows in through the open back of the ship, the ship submerges quickly in the soft sediment near the outlet of the river. (right) The superstructure of the ship breaks off in the swell, parts of the upper deck stay together

Figure 1.3 : view on the coastline with storm water drains and the hill covered with the new city; the Avondster site is in the foreground.

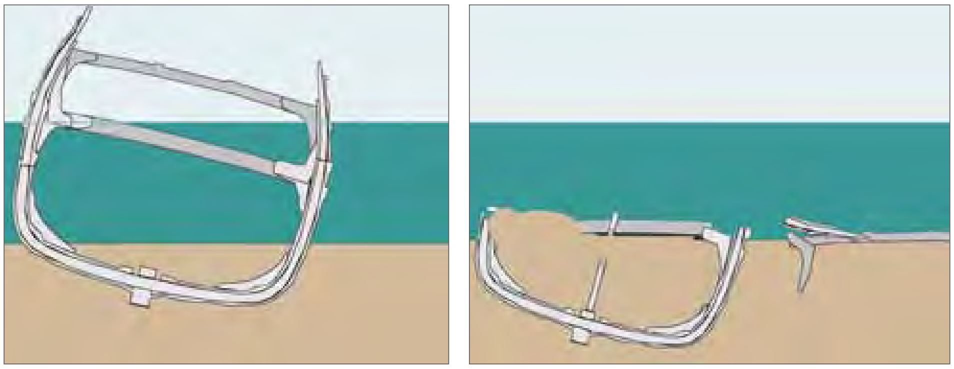

Figure 1.4 First speculative theory for the wreck formation of the Avondster site.

and are washed north of the hull. What are possibly deck beams (found in this area) are in the same orientation (Parthesius, 2003: pp.19-20):

Following this reconstruction of the wreck formation process it is possible that the loss of the sternpost and the later collapsing superstructure was the 'immediate break up' of the vessel stated in the account. It is even possible that Adriaan van der Meijden felt that his lack of or failed attempts to salvage goods from the wreck could be best explained by an account stating that the ship broke up immediately when grounded. Indeed it must have been a very difficult task to reach the stranded ship in the SW monsoon. However from the archaeological evidence we know that it is likely that locals have tried to salvage goods from the hold of the ship. In 1999 human remains were found underneath a deck in the stern section. Since no casualties were reported during the disaster and the skull was identified from a male of Asian descent, it is possible that this person died in an attempt to salvage goods. This would mean that the hold of the vessel was still intact after the wrecking and the hypothesis for the wreck forming process could be possible. This hypothesis was also subject to further investigations during the archaeological work on the wreck.

The history of the Avondster

The site was now positively identified as the wreck of the East-Indiaman Avondster, in the service of the Dutch East India Company (VOC) in the 1650's. From an account of the wrecking we also know that the vessel was considered old and worn out. Was it possible that the name Avondster (evening star) reflected the status of this vessel in the VOC fleet in Asia? That possibly the vessel was brought into service as an older ship and renamed accordingly by the VOC? There

View towards the east side of the bay with the distinctive 'mountain'; the river outlet is left of the mountain but not visible here.

were some archaeological observations that raised questions about the origin of the Avondster: although the presence of the brick galley was considered a clear identification of Dutch material culture, there was something 'odd' about the ship's construction, in particular the presence of lodging knees, a construction element that was not practiced in traditional Dutch shipbuilding. Was it possible that these knees were later additions? Was the Avondster built in an unknown Dutch style? Or did the vessel originate from a different shipbuilding tradition? The answer to these questions was again found in the archives. The ship came into the service of the VOC in 1653 after it was captured in Persian waters. The name Avondster first appeared in a letter from Batavia (the headquarters of the VOC on Java) reporting this prize to the VOC directors. Soon after the Avondster was sent to the Netherlands (NA VOC 1201; folio 821). The ship was previously called Blessing and was in the service of the English East India Company (EIC). Its English origin explained specific elements in the ships construction, while the presence of the Dutch galley reflects the standard maintenance practiced on return to the Netherlands.

Blessing, an English East-Indiaman

The vessel's exact age is unknown: first recorded as the John & Thomas, it was bought by the English East India Company in 1641 (Sainsbury, 1906a: p. 69). The vessel was then renamed the Blessing, and dispatched to Java. In the English records the vessel is listed as 250 or 260 tons, with a crew of about 65 for major voyages (Sainsbury, 1906b, p. 27). Reflecting the general fortunes of the East India Company, the Blessing made two relatively straightforward out-and-back voyages (to Bantam in 1642-43 and to Surat and Bantam in 1644-45) but was then deployed increasingly in regional trade, making only one more voyage to England in 1650. The deployment of a vessel in the Asian regional trade can be seen as a reflection of weak markets and intensifying trade competition, but the Blessing may also have been showing signs of ageing. In 1645-46 the English East India Company repaired the vessel after determining that its career could be economically extended for a further seven or eight years (Sainsbury, 1906b: p. 457). The Blessing survived for another 13 years and, at the time of its loss, was described by VOC officials as an 'old jacht'.

In 1652 the first Anglo-Dutch War broke out and although this conflict was ostensibly about local trade issues in Europe, it gave the VOC an excuse to attack its major competitor. The VOC promptly captured five English ships, the Duyf near Batavia and the ships Roebuck, Leonoret, Supply and Blessing in the waters around Persia—where the Dutch had lain in wait from February 1653 for unsuspecting English ships arriving from India. After a month the Supply arrived from Surat and the Blessing from Coromandel. The English at Gombroon were looking out for these ships so as to warn them, but they failed to spot them and a battle ensued (Foster 1915: p. 175). After its capture the Blessing was sent to Java where it was renamed Avondster.

The Avondster, a Dutch East-Indiaman

The Avondster was then sent to the Netherlands in 1654 where it stayed for a few months, probably receiving some refitting and modification. The galley of Dutch bricks which were found on the wreck site is evidence of refitting; there is also evidence that the VOC added extra layers of hull planking. Also found on the wreck site were 'lodging knees'—bracing timbers for the decks—which show the ship's English origin, as they were not used by Dutch shipbuilders (see chapter 9).

In 1655 the Avondster returned to Batavia. On a voyage the following year to Japan, the vessel carried luxury items that were gifts to the Japanese rulers. Amongst these presents were two large globes and an expert to explain geographical data to the Shogun. The departing VOC head official in Japan returned on the Avondster to Batavia (NA VOC 880; fol. 268-282 and fol. 278). No records have been found that suggest the ship was not seaworthy and indeed it was employed to carry valuable cargo and important people. In 1657 the vessel departed for the Netherlands but returned to Batavia due to severe leaking. The cargo was transferred to another ship and the Avondster never sailed to Europe again (Diary Batavia 1656-57: fol. 105). The Avondster was soon reassigned to escort duties at Craowan (Bay of Batavia) and then to command a blockade of Bantam (Diary Batavia 1656-57: fol. 139).

The Avondster continued active service in Asian waters, being dispatched to southern India, where Commissar Rijckloff van Goens was campaigning against the Portuguese. He decided that the Dutch were too weak to attack the Portuguese immediately. Defeat would have left Ceylon just partly captured, unprotected and he wanted first to assemble a larger fleet. He left several ships near Goa under the command of Adrian Roothaes. The guns of the Avondster and three other ships were transferred to bolster firepower and the fleet which stayed behind for the blockade of Goa comprised nine ships with 352 heavy guns and 1100 soldiers (NA VOC-1227; fol. 319ev). The Avondster was sent to Ceylon to inform the VOC authorities there about plans to attack the north coast, but could not reach her destination due to unfavourable weather and waited off Cape Comorin for the arrival of Van Goens and further instructions. Eventually a small fleet under the command of Van Goens reached Colombo in early 1658.

The Avondster transported soldiers from Colombo and Negombo to Tuticorin on the Coromandel coast. By the summer, Van Goens had captured all of the most important settlements on the northwest coast of Ceylon, his biggest problem being the large number of Portuguese prisoners. As several hundred were transported on the Avondster from Jaffnapatnam (now Jaffna at the northern tip of Sri Lanka) and from Tegenapatnam in southern India, to Bengal - along with money and valuable cargo from Pulicat, the ship was evidently still seaworthy (NA VOC 1231; fol. 155). The Avondster returned to Ceylon with a cargo including cloth, rice, oil and butter, opium and gunpowder. There was at this time a food shortage in Ceylon due to the disruption of agriculture and the number of foreign troops. In early 1659 the Avondster was sent to Ballasore on the Malabar Coast to fetch another cargo of rice, the vessel carried four elephants as a present for the local rulers—who deemed them inferior (NA VOC 1231; fol. 346, 362). Gathering the rice went slowly and the Avondster headed back towards Colombo only in the last week of April.

The Avondster was then destined to be one of nine ships carrying areca nuts from Sri Lanka to the Coromandel coast. Areca nuts were deemed by Van Goens to be the second most important commercial product of Ceylon (with cinnamon most important and elephants third). The Dutch had decreed that areca nuts should be carried only in Dutch ships and were enforcing their monopoly by blocking the harbours of Raja Sinha of Kandy. Troops had been despatched to Kalpitya and ships were sent to blockade Trincomalee. The last nuts of the harvest were slow to arrive and the Avondster, ordered to wait for this cargo, subsequently sank in Galle Harbour. For many years this 'small icon' of the VOC presence in Asia disappeared under a thick protecting layer of sediment only to be exposed again by historians and archaeologists 334 years later.

Figure 1.5 Bengale, Coromandel coast and Goa at the Malabar coast around 1620 (National Archives , The Netherlands)

10 Protecting the Avondster

by: Martijn Manders & Palitha Weerasinghe

Introduction

The in-situ protection of archaeological objects has become an important issue over the years. The reason for this is partly the amount of interesting archaeological sites and the frequency they are being discovered nowadays with the help of new innovative (prospecting) techniques. Other reasons for this are the high costs to excavate them and the growing notion that we should try to protect a representative part of our cultural heritage – our past- for future generations. This also counts for our underwater cultural heritage, consisting for a large part of shipwrecks. In the last decade, the international community has tried to regulate and formalise this protection. For example: article 1 of the ICOMOS-charter of 1996 as well as article 1 of the UNESCO-convention on the protection of Underwater Cultural Heritage of 2001 put emphasis on the fact that protection in-situ should be the first option (www.international.icomos.org). Through research, we have tried to prepare ourselves for this new approach towards underwater cultural heritage.

In the Netherlands, this research in in-situ preservation of our underwater archaeological sites dates from the end of the eighties. In 1988 the BZN 3 wreck, a ship of the Dutch East India Company (VOC) became the first wreck underwater to be both physically and legally protected: Now, in 2005, several sites have been protected underwater; on the seabed, in rivers and in lakes. The Dutch State (RACM) has been involved in two European (EU) projects, MoSS (Monitoring, Safeguarding and visualizing North European Shipwreck Sites (see: www.mossproject.com)) and BACPOLES (Bacterial decay of wood. (see: www.bacpoles.nl.), focussing on the degradation and the protection of archaeological and historical heritage in-situ. Information about what is threatening our heritage is collected in a systematic way, our protection methods are being evaluated and new solutions are being developed. Things learnt over the years have been applied in other projects. An example of this is the Dutch shipwreck Avondster in Sri Lanka that has to be protected against fast ongoing deterioration. The situation at the Avondster site, however, is slightly different from the above-mentioned wreck sites; it has been excavated for many years. Why should it be protected in-situ, then? How should it be done?

This article will describe how the Avondster wreck has been physically protected, explain the rationale behind this and describe the effects of this protection. Finally and importantly, recommendations will be given as to what should be done in the near and longer term to maintain this protection on the site.

Figure 10.1 The bow section was covered with a net that is usually used for water filtering and shrimp fishing (non woven, 100 % polypropylene and 40-60 % density).
Figure 10.2 Due to the weighting of the nets with sandbags, they were extremely heavy.

Site conditions

Immediately after its discovery in 1993, at a water depth of 2 to 4 metres, it became clear that the wreck site was eroding and becoming more exposed. This process continued throughout the following years. In 2003 the depth to sediment had increased to 3,5 to 5,5 metres. In 1993 as well as in 1996 the structure was on average only sticking out 50 cm of the seabed (Richards & Carpenter, 1996). In 2003, ten years after, this was surprisingly still the same, while depth on the site had increased (Tidal differences are only 0,5 metres. This cannot explain the increase of water depth. Also, during the years, more and more elements inside the wreck have become exposed, which also points to an increase of depth). In 1996 the anaerobic (buried) wood was on average in extremely good condition (Richards & Carpenter, 1996). This was also the case for most of the wood that was proud of the seabed. Attack by woodborers was not extensive and most of the aerobic wood was only deteriorated on the outer surface. Some wood samples even had a maximum water content (Umax) under 100%, which indicates a relatively undergraded structure (Richards & Carpenter, 1996: pp. 6, 12). Observations underwater in 2002 and 2003 indicated that the extent of deterioration of the exposed wood had increased significantly. Wood was soft and perforated with woodborer tunnels [Figure 10.3]. This does not mean that wood attack did not exist in 1993 and 1996. It was severe and probably just the same as we have seen in 2003. In addition, in 1993, during the discovery of the site, an anchor with wooden stock was found at the bow. The wood (Anisoptera sp.) still existed in its total length. In 1996, only three years later, half of the remaining wooden stock had deteriorated and disappeared (Richards & Carpenter, 1996, 4).

In the warm waters of the bay of Galle (up to 30 ˚C) biological activity is high. This means that under the right conditions, strong, solid wood may be completely deteriorated by woodborers, like the shipworm (Teredo navalis) within a few months. This results in weakening of the structure, parts literally fall off and hence vital archaeological information is lost.[1]

1. In the, for the Teredo navalis, less favourable conditions of the Wadden Sea in the Netherlands, it only takes one single year for oak wood to be totally degraded by Teredo navalis (Palma 2004, 23).

Figure 10.3 Exposed oak wood in the bow section, severely attacked by shipworm (Teredo navalis)

Figure 10.4 View from the stone barrier, protecting the road, towards Fort Galle and the ocean. This stone barrier is causing strong erosion on the wreck site that is lying just about 80 metres in front of it.

The building of a road with a rock wall on the beach line only 50m from the wreck, a few decades ago, is almost certainly the reason for the strong erosion [Figure 10.4]. The road has been built on the former beach, effectively severing the river outlet. Waves coming from the ocean are abruptly stopped against a rocky wall instead of breaking on a gradually sloping sandy coast and are then redirected out to sea again. This effect, called winnowing, creates a strong current around the wreck site, undermining the structure and removing the protective layer of fine silt and sand. Because of this stone barrier the river cannot deposit its fine sediment on the site anymore. It seems that in one decade the seabed around the wreck site has eroded dramatically. In 2003 new work was executed on the stone barrier close to the wreck. Some jetties were constructed in the water. Immediately the currents changed course and more sediment was removed from the site in places that were relatively stable prior to the new constructions. It is also possible that the seasonal excavations have had an influence on the stability of the wreck site itself. Excavating sediment and building structures on and near the wreck obviously creates different current patterns on a local scale, increasing erosion. Although previously noted on other sites, this phenomenon has not been extensively investigated.[2]

The deterioration rate was probably high in 1993, 1996 and 2003 and although depth increased, the visible structures still only stuck out a few decimetres (on average) above the seabed. This might well indicate that a lot of structure of the Avondster wreck has disappeared within 10 years.

2. This negative effect has been noted during investigations in the Wadden Sea in the Netherlands. One example is the wreck of BZN2 where trenches excavated during an assessment caused erosion in places that where relatively stable prior to human influences.

Preservation "in-situ"

As described previously, the Avondster wreck had been preserved for several centuries in a relatively stable environment Construction work near the site however, has made this environment increasingly more unstable and wood is deteriorating at a considerable speed. At the beginning of the Avondster Project, the decision was made to safeguard the valuable archaeological information of the wreck site by excavation, preserving the recovered artefacts "ex situ", but leaving the wreck itself in-situ.[3] Throughout the years its wooden structure has been damaged by wood eating organisms, erosion and also human activities such as fishing and diving. Not only the ship, but also the objects that belong to the inventory, cargo and the persons on board are deteriorating and being moved all over the wreck site by currents, swells and wave movement. This again causes losses of archaeological information[4]. The swell, current and breakers possibly also make the water oxygen rich from time to time. This, together with the large amount of organic waste found on the site and dumped in the water by the inhabitants of Galle, make the area extremely favourable for organisms attacking the archaeological wood and other organic material. In contrast, according to (Richards & Carpenter 1996, 2) excessive rainfall during monsoon season may decrease the salinity in Galle Harbour, especially near the storm water outlets opposite the wreck site, which could possibly decrease the rate of biological deterioration (Richards & Carpenter, 1996, 2).

The excavation of the Avondster wreck started in 2001 and if well executed, will go on for many years to come.[5] Therefore a suitable in-situ management plan was required prior to, during and after excavation so the loss of any archaeological information would be minimised. Without this protection it would be very difficult to conduct a systematic research program. Since erosion and biological attack was so severe, the deterioration of the wreck site would seriously compromise the archaeological excavation. Some areas would be constantly under threat through exposure with the continued deterioration and loss of archaeological remains. The major risk would be that this can lead to damage control by salvaging single objects from the seabed without knowing the contextual information.

A method of physical protection was designed that had to protect the wreck and associated artefacts against:

- Natural erosion and scouring caused by sea and weather;
- Objects being moved all over the site;
- Wood degrading organisms;
- Looting;
- Fishing activities;
- Chemical degradation e.g. the corrosion of metal objects (which are abundant).

3. The wreck itself will not be recovered because the ship would be extremely expensive to lift, to conserve and to exhibit in the appropriate environment. Information about the ship's structure will be gathered underwater. The finds are being conserved in a laboratory near the site, which was especially created for the Avondster Project.

4. Object that are mobile, means that it will be impossible to investigate them in their original setting; their original context.

5. It has always been the idea that the involvement of the Netherlands and Australia will be finally diminished. The people from the Maritime Archaeological Unit (MAU) of Sri Lanka that have been trained within the Avondster Project will then take over the excavation and conservation of the objects.

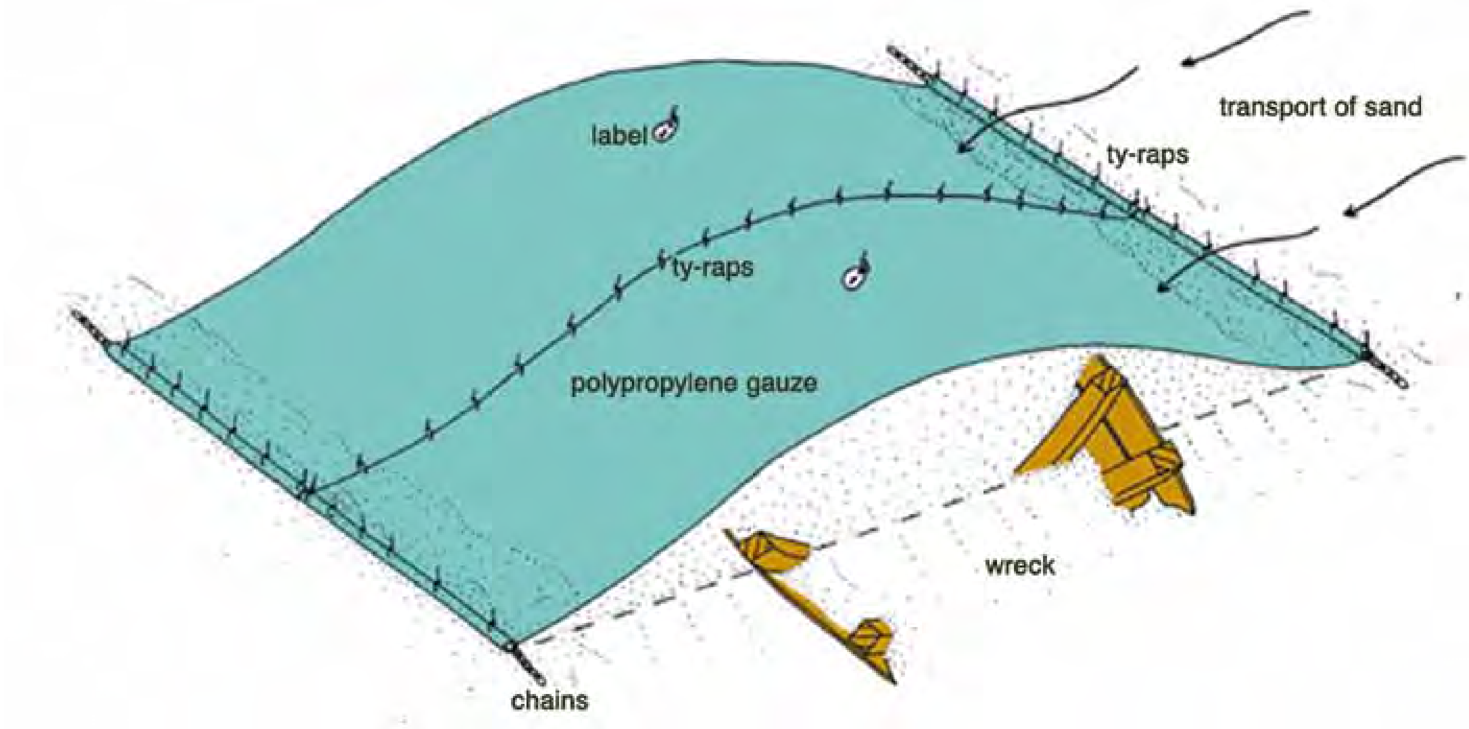

Figure 10.5 Principle of in-situ protection with polypropylene nets. This is how it is executed in the Netherlands (wrecks in the Wadden Sea). The in-situ protection on the Avondster is derived from this principle. Drawing M.Manders/M. Kosian

The method also had to be cheap, the materials easy to access in Sri Lanka, the protection easy to install and easy to remove in parts so the excavation in trenches could continue immediately afterwards.

It was decided to do a test protecting the site with polypropylene nets (Manders 2002 and 2003a) (Figure 10.5). This method has been used extensively in the Netherlands. There, shipwrecks that lie in a dynamic environment with high levels of sediment transport are covered with these nets. The sediment that is suspended in the water column during periods of high water movement can penetrate the net through the tiny holes. At the same time, the net will also break the current, so sand particles will settle under it. Within a short period of time the wreck site is buried. In many ways, the environmental conditions in the Wadden Sea (NL) and the North Sea (NL) are different from that in Galle Harbour. It is much colder (0 – 22 °C) and

Figure 10.6 Fine and coarse sand on the Avondster site.

with stronger tidal movements (in the Wadden Sea 3-4 metres) more sand is transported up and down the seabed and also more gradually. The tidal range in Galle is only 0.5 metres. Sand is merely moved by swell and a variable surge. On the other hand, the conditions in the Netherlands can also be compared with those at the Avondster wreck site; both locations are shallow, have a sandy seabed and both do have natural sand transport (Manders 2003a)[Figure 10.6].

This method was applied on the Avondster site in February 2003. An area of approximately 4 x 4 meters on the aft, port side of the wreck (the southwest of the site) was covered with black shading net (woven, 100% polypropylene and 60 % density) [Figures 10.7 A-B]. The net was weighed down with old chains. In this particular area the ships structure was slightly exposed, with a 40 to 50 cm deep scouring gulley on the outside of the wreck. Within two weeks a 15 cm layer of very fine silt or sand settled under the net, while outside of this test net, only coarse sand and shells were visible; sand and shells that could not have penetrated through the holes of the net (Weerasinha 2004). Most deposited silt and sand under the nets was found on the borders of the wreck structure. Sand had completely filled up the scouring gulley, just outside the wreck, under the portside. Only a thin layer of silt/sand of a few cm thick was deposited inside the wreck. After a further two weeks little further accretion occurred and the holes in

Figure 10.7 A-B First test executed on the Avondster site with shading net (woven, 100 % polypropylene and 60 % density). Old chains served as weights to keep the net down on the seabed.
Figure 10.8 A-E The nets were weighted down with sand bags that are rolled in the nets and closed off with Ty-raps (cable ties)
Figure 10.9 The nets were prefabricated on the shore and transported to the site by boat.

the net were blocked due to bio-fouling. Unfortunately, during the storms in May 2003 this test net was destroyed (Manders 2003b, pp.1-2). The results prior to that were promising however; sand settled on the wreck site in a short period of time and when accretion ceased due to bio-fouling, the net still served as protection against erosion of the sediment layer and abrasion of the wood.

If a sandy environment is stable and relatively immobile, which is the case under the net, only the top layer of about a few millimetres to a few centimetres is aerobic. The unprotected seabed around the site is however unstable and therefore, the thickness of the aerobic sediment layer is greater than under the net. Within a few days, the sand under the net had turned dark grey to black in colour, indicating a stable, less oxygenated environment.[6] Research by Richards and Carpenter in 1996 revealed that the undisturbed and uncovered sediment was essentially aerobic to a depth of approximately 20 cm (Richards & Carpenter 1996, p. 5).

Based on the success of the test executed in February 2003, attempts were made to cover the whole site using the same method in November that same year. It was decided, however, to use another kind of net (Manders 2003b, pp. 3-4). The new net had a more open and stronger structure (non-woven 100 % polypropylene and 40-50 % density)[7] [Figure 10.8 A-D]. As one of the main reasons for choosing this net was to capture more sand (and also slightly coarse grained), the holes needed to be larger. Also, due to the local swell and current the loosely woven test net frayed easily. In addition, it was very difficult to source large quantities of that particular net, which is imported from Israel, for a reasonable price[8]. The new non-woven polypropylene net is fabricated in Sri Lanka and is normally used for filtering water and for shrimp fishing.
In December 2003 the whole bow section was covered with five nets each measuring four meters wide and 25 meters long[9]. They were placed square on the wreck covering the hull and the area where parts of the broken off starboard side are

6. In 2003 we performed some tests outside the wreck with a handheld redox device to measure the redox potential of the sediment, which is a reflection of the dissolved oxygen content of the sediment. However, the apparatus did not work well and the results were however not satisfactory. In 1996 however, this research had been executed. The redox results indicated that the surface layer of the predisturbed sediment on the site, down to 20 cm, was very unstable and aerobic, while the deeper layers (at that time measured at a depth of 1 and 2 metres) were stable and anaerobic (Richards & Carpenter, 1996).

7. This net is manufactured in Sri Lanka by Malba Ropes Ltd and is normally used in the shrimp industry or for filtering.

8. A piece of black shading net of 4 x 1 metres costs RS 455,- (€ 3,81). In the Netherlands, scaffolding nets are used that cost € 50,- for 50 x 3,7 metres. This is a considerable difference in price (almost 4 times more).

9. The whole area from the excavation trench (trench 01) until the bow was covered except for the last metre of the bow. For the protection of the site to be effective, finally a strip of net should be placed over the bow, which extends a few metres outside the wreck.

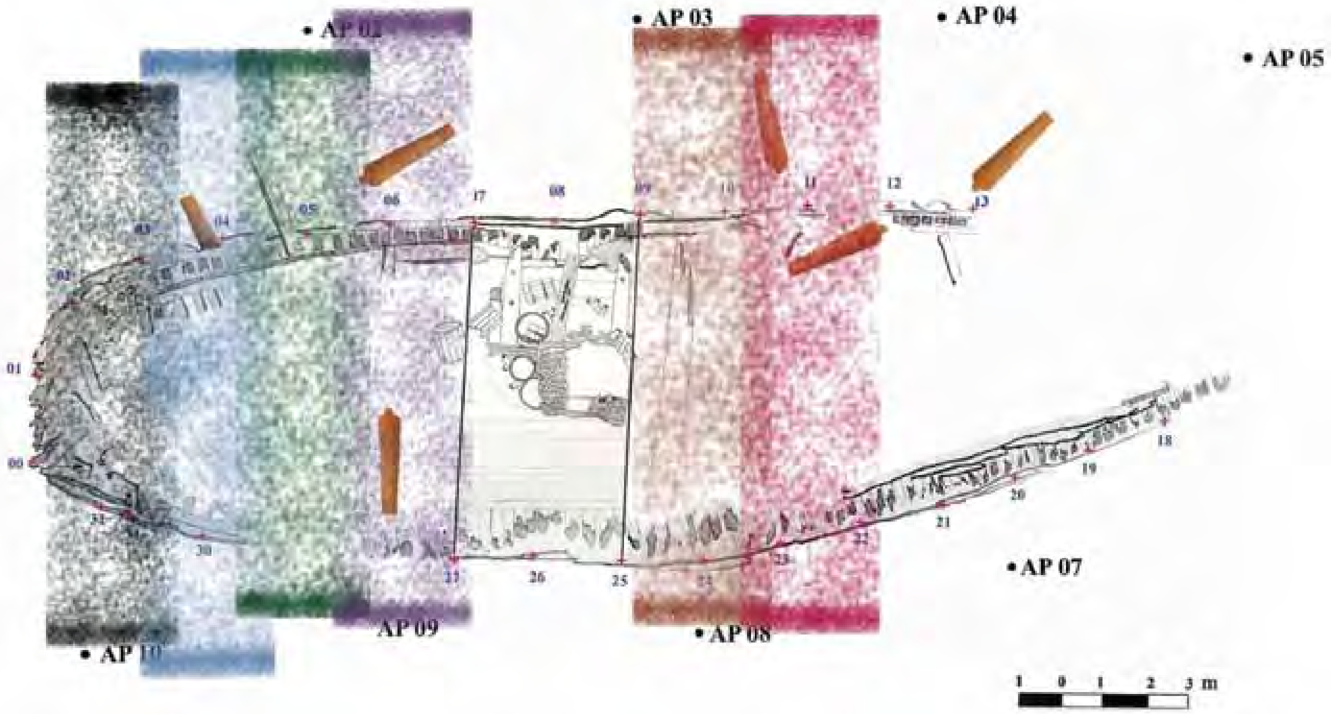

Figure 10.10 The site plan of the Avondster wreck with the projection on how the nets were laid down on the site. Drawing: R. Muthucumarana.

possibly still lying under the sand. The strips of netting were weighed down on both ends with sandbags. We chose sandbags instead of chains because it proved to be very difficult to find suitable iron chains for a low price. Old chains are re-used in Sri Lanka over and over again and are therefore, still valuable. In addition, it is not a good idea to introduce more iron to the site. Iron can increase the growth rate of marine biota thus increasing biological deterioration. The corrosion products can also impregnate organic materials increasing degradation rates in-situ and their presence can cause post conservation problems when artefacts are eventually recovered and treated.[10] The sandbags were half filled and rolled in the net. The different strips of net were overlapped and connected to each other with Ty-raps (cable ties), maximum 50 cm apart. Placing the nets on the site was difficult. The nets were prepared on the shore and were very heavy. It took four to six people to carry them to the boat and on each trip only four nets could be transported to the site [Figure 10.9]. In the water, it took two divers to place the nets on the wreck. With the nets still rolled up, they were laid down square in the middle of the wreck site and then rolled out to the port side and to the starboard side. The net projected an extra 4 metres past the port side and 8 metres or more to the starboard side because it was expected that more of the wreck and objects would be found there [Figure 10.10].

The results of the protection were even more promising than the test with the black net. After one week the whole bow area was covered again with sand. This means that in places there was sediment built up of more than 1 metre after just one week.

It is very important that, when a wreck is being protected with polypropylene nets, these nets are laid down loosely over the site. They can only filter the fine sediment out of the water if they can move up and down like grain stalks in the wind. The main disadvantage of this method however, is that if parts of the structure are protruding from the seabed, the nets tend to get caught, rip and then the protection is useless. There are ways to prevent this happening however; sharp edges can be covered with sandbags, textile or by sediment using a water dredge, prior to the installation of the nets. At the bow section of the Avondster wreck, one or two nets were damaged because of the above-mentioned reason. Further damage was prevented by using the water dredge to deposit sand on areas where the structure was protruding the seabed.

10. Communication with V. Richards, Western Australian Maritime Museum.

Due to the fast ongoing sedimentation on the half protected site, visibility decreased dramatically. This effect would be much less, even non-existent, if the site was completely covered with nets as per the original idea. For this 14 nets of 4 metres wide and 25 meters would be needed. The total material cost for the physical protection of the Avondster wreck (about 500 square metres) is approximately €2000. Complete coverage of the site has not been executed as yet. Large areas of the wrecksite still experience extensive erosion and degradation. Objects emerging from the seabed continue to be degraded, washed away and/or picked up by divers in the hope that they have prevented the artefact from being lost forever. But if this continues, the excavation will be devalued into an artefact related salvaging operation, illustrating what we already know, instead of an opportunity to learn more about our past from the unwritten source and to discover new things.

Of course it would have been better to physically protect the site immediately after its discovery in the early to mid 90's. Possibly a lot of information has been lost in the last decade but there is also still a lot left of the ships structure, cargo, inventory and personal belongings that is worth protecting. The galley and the stern section are protruding a few metres above the seabed [Figure 10,11]. It will be impossible to cover them with polypropylene nets at this moment as well. We propose the following: To lay the nets around the galley, while the brick stone structure should be well reinforced with sandbags. Maybe, after the whole site has been buried under a layer of sand, attempts can be made to cover the galley as well. At this time, the height differences are too large. The stern section is laying a few metres away from the rest of the ship's structure. Possibly the best thing to do is to raise the stern section from the seabed, investigate it, conserve it "ex-situ" and exhibit it afterwards in the new maritime museum in Galle fort.11

11. If this option is financially feasible. The conservation of such a large wreck part is very expensive and there are many difficulties to be expected.

Figure 10.11 The galley is sticking out a few metres from the seabed.

Monitoring and maintenance

After the protective nets have been installed on the site, this in-situ protection has to be maintained. Because of the shallowness of the site, it is obvious that monsoons might have an enormous effect on the environmental conditions at the Avondster. After each storm the nets should be inspected and repaired if necessary. This should also be done at the beginning and end of each diving season. In this way the stability of the wreck site under the protective nets can be ensured.

Due to constant biofouling the holes of the nets tend to block easily. When there is still sediment built-up on the site, it is important to keep these holes open, something that can be done by rubbing the nets from time to time.
It is also important to monitor the effects of the in-situ protection on the site. With this information, the protection can be improved and much can be learned for future projects.

For this project, a monitoring scheme was made for the test site, with visual observations four times in the first week after the protection, and then once after every two weeks (Weerasingha 2003, Chandaratne et al 2003, pp. 33-37). For the protection of the bow, the following strategy was executed; 4 inspections within 10 days after installation, then after one month another 4 times in 10 days and after two months 3 times within 4 days[12].

On the 26th of December 2004, a Tsunami hit Galle Harbour with incredible force. It was thought that it would have affected the conditions on the site. Eye witnesses state that just before the big wave entered the Galle Harbour the wreck itself became exposed (Jeffery & Muthucumarana 2005, p. 3). Surprisingly, monitoring in April, three months after The Tsunami, revealed that hardly any damage was done to the wreck site and its protection [Figure 12]. The covered bow site was still covered with a thick layer of sand. It shows us that even under extreme conditions the protection seems to be effective.

Conclusion

The Bay of Galle has tidal influences but most of the sediment is moved over the seabed by high swell and surge caused by the stone barrier near the site. This caused heavy erosion and abrasion of the Avondster site for many years, exposing it to further deterioration by natural, biological and human causes. In the last decennium, it is probable that a large part of the structure has disappeared. The protective treatments with polypropylene nets that were executed in 2003, have stopped (or at least slowed down) this deterioration. These nets work as follows: Sand that is transported over the wreck site falls through the holes of the net and settles because there is hardly any water movement under the net. It creates an anaerobic environment comparable to the conditions in which the wreck has been protected for a few centuries. At the bow where this protection was executed, it worked extremely well. It stopped abrasion and attack by woodborers; probably the most important cause of degradation at the Avondster site.

12. Making a few visual observations in a short period (after one month 4 times in 10 days), gave us the possibility to check if there were also changes from day to day bases that could threaten the site. We have not detected any. Now, monitoring after the Monsoon season and especially storms will be more sensible.

To protect the wreck site effectively prior to excavation, the whole structure has to be covered with sand again. With the proper equipment, like water dredges or airlifts, the protection is easy to remove. The wreck can be easily excavated in parts, while the rest of the site is still protected. Also, fishing nets will not get caught on the wreck parts. The favourable conditions under the net will keep the wreck site in good condition, as it was for almost 400 years before erosion of the seabed threatened the site. After the protective measures are in place it is important to monitor the site regularly. At a shallow site like the Avondster high swells and bad weather conditions, which are abundant during the monsoon season, pose a potential threat.

It is also important however, to keep in mind that the degradation will continue, albeit slower, whatever protective measures are undertaken. It is only possible to slow down or stop a few of the processes that are responsible for the deterioration of the different materials. For example, the protective measures we applied to the Avondster site will not stop deterioration caused by bacteria. This kind of deterioration however, is a slow ongoing process.[13] Luckily, bacterially degraded wood may lose strength but generally archaeological information is not lost.[14] Besides that, if the excavation of the Avondster continues, the contents of the wreck will be preserved ex-situ, effectively negating these negative influences. The wreck itself will then be well-protected in-situ for at least a couple of more decades.

13. See also www.bacpoles.nl and Björdahl (2000)

14. Huisman et al, in prep.

Figure 10.12 The nets and how they are lying on the wreck site now. It is clear that, even after a Tsunami, they are still holding sand on the site. The protection method works extremely well.

11 Conservation of an intact barrel 03/GHL/300, a case study.

by: Anusha Kasturi, Kamal de Soyza, Gamini Saman, Karina Acton, Patricia Meehan

Introduction

A wooden barrel with iron hoops and concreted interior was raised towards the end of the March 2003 fieldwork season. This intact barrel with contents is one of the most complicated and challenging artefacts the conservators of the MAU have faced. Efforts were made initially to preserve this unusual artefact intact. In late 2004, due to significant deterioration of the barrel structure, the artefact was separated into components. With these components now in treatment to stabilise the materials, the Tsunami of 2004 hit Galle and the barrel was lost. This case study details the efforts of the MAU conservators and project consultants to preserve this artefact before its tragic loss.

The New Find

During the fieldwork season of March 2003 an intact barrel was uncovered on the wreck of the Avondster. The top of the barrel had become exposed above the sediment line and wood previously covered was now unprotected (Figure 11.3). After consultation between archaeologists and conservators a decision was taken to raise the barrel.

The MAU's newly qualified diving conservator, Janaka Klarasawithana, was involved in the excavation of this item and provided advice to the archaeology team on how best to lift this item from the seabed. The barrel was bound with elastic pharmaceutical bandages to protect the structure as it was uncovered from the sediment. The barrel was then lifted, wrapped in wet fabric and transported to the MAU's conservation laboratories where it was immediately immersed in freshwater (Figure 11.2).

Condition

MAU conservators assessed the condition of the barrel with view to both immediate storage and long-term treatment options. Working together, archaeologists and conservators documented both the condition of the barrel & the technical features such as composition, construction and function; unfortunately the majority of these records were lost in the 2004 tsunami with only a few electronic records remaining, those backed-up by the Avondster Project.

The barrel had a traditional construction with pieces of flat wood forming the base and curved pieces, the staves, forming the walls of the barrel. The staves were held together by two remaining iron hoops, around the body of the barrel at the base and the centre. The iron was heavily corroded and covered with voluminous hard grey concretion. The upper half

Figure 11.1 The excavation of the barrel, a conservator prepares the barrel for lifting

Figure 11.2 The barrel immersed in freshwater

Figure 11.3 The barrel in-situ

and top of the original barrel had been lost. The interior of the barrel was filled with what appeared to be a thick hard grey concretion which covered the original contents. Evidence of the original contents of the barrel could be seen however, in the gaps between the pieces of the base and the staves. The solid contents were very heavy, with the barrel and its contents weighing approximately 50kg.

The wooden staves, although appearing intact, were badly deteriorated, showing loss of mechanical strength due to the loss of the wood's components such as hemicelluloses and cellulose. The surfaces of all wooden components (staves and the barrel base) were soft and could easily be damaged.

Storage & Treatment Support

Due to its fragile condition, a support was designed and built to ensure the barrel was physically stable and adequately cradled during conservation treatment, a process which necessarily involved lengthy immersion. Upright, the 50kg weight of the barrel was taken by the soft degraded wood of the base. Due to the poor condition of this wood; it was decided to invert the

Figure 11.4 Disc support for the barrel

Figure 11.5 Pulley system for handling the barrel

Figure 11.8 The barrel with the support system

barrel so that the weight would be supported by the solid 'concretion' and contents of the barrel instead of the fragile base

Two types of supports were required: 1) to support the weight of the barrel and allow safe lifting in and out of the storage and treatment solutions and 2) to support the fragile sides of the barrel.

Due to the weight and awkward size of the barrel a number of people were required to lift and handle it. Archaeologists and conservators worked together to design a container suitable for storage, lifting, handling and treatment of this object. A large disc was constructed from timber, timber batons were attached to the underside with stainless steel bolts (Figure 11.4). This disc was designed to support the barrel during treatment and to bear the weight when handled. A lifting system was designed by conservator Kamal de Soysa in which the disc was attached by nylon rope to a weighted pulley system attached to the roof structure (Figure 11.6). Using this system the barrel could be lifted from the storage-treatment tank in a controlled and safe way.

As it remained unclear how sound the barrel structure was, precautionary measures were taken to support the staves of the barrel by constructing a light frame around it. In-situ the barrel was supported by the sediment. To provide support out of the sediment, the elastic pharmaceutical bandages used for excavation were removed and reapplied to provide even coverage and light support to the barrel.

Plastic mesh sheeting (a plastic basket cut into sections) was placed around the barrel to provide additional support. The interior was selectively padded to ensure a good fit and to prevent abrasion of the barrel surface. The mesh sheets could be removed in sections to allow monitoring of the condition and surface cleaning without removing the barrel from the support. Polyester fabric and wadding was used as the padding material as it would not degrade in the aqueous storage & treatment solutions (Figure 11.7).

The inverted barrel was placed on the padded wooden disc, with the weight of the barrel supported by the 'concretion'. Additional padding was added where any wood remained at the concreted 'top' of the barrel.

Figure 11. 7 Protecting the barrel staves

Temporary storage of the barrel

The conservation of this intact barrel, comprising wood, iron metal and corrosion products, concretion and unidentified contents, was a challenge not taken lightly by the conservators of the MAU and the Avondster Project consultants. Conservation options were discussed and it was decided the most appropriate action initially was to place the barrel into a 'holding treatment' while stabilisation options were investigated, the contents identified and a long term treatment plan developed. The preference of the conservators was to conserve this artefact intact if possible. The next step therefore, was to ensure the barrel would be safe and stable in a storage solution.

A number of options were investigated for the storage and treatment of the barrel including the construction of a customised fibreglass container and the modification of existing tanks. The most simple and cost effective option however, was to purchase a 400L polyethylene water tank, of the type common throughout Sri Lanka. The size of the tank was also ideal as the small footprint required less room in an already over-crowded laboratory and the minimum amount of PEG (polyethylene glycol) solution could be used for the treatment (therefore, saving the cost of chemicals). The tank was modified by cutting off the top section which was then used as the lid for the container.

Initial desalination of the barrel then commenced. The barrel and support structures were placed into the new tank, filled with freshwater. As discussed in earlier in the chapter on conservation the breeding of mosquito larvae in aqueous treatment solutions is a serious public health issue in an area of Sri Lanka where dengue fever is endemic. For larger containers in particular, it was not always possible to ensure that the seal provided by the lid was sufficient to exclude the ubiquitous mosquito population. An ingenious solution was developed by MAU conservators. After consultation with zoologists of the Galle Maritime Museum, fish species were identified that would feed on mosquito larvae. A number of fish were then added to the desalination bath. The fish not only prevented the growth of mosquitoes, but also controlled other biological growths such as slime. This method of biological control proved effective throughout 2003 – 2004.

With the barrel in a safe storage solution the MAU conservators were able to clean the barrel of loose sediment and monitor its condition, while developing a long-term treatment plan.

Figure 11. (9 -10-11) Time line of deterioration: the base March 2003, March 2004 and November 2004

Structural Changes

By November 2003 some structural changes to the barrel had been observed (Figure 11.10). The wood at the base of the barrel appeared to be moving, with the centre moving slightly upwards from its original flat surface. These changes in condition were of serious concern to the MAU conservators and Avondster Project consultants.

As a result of these physical changes the need for a treatment plan that could be agreed upon became quite urgent. Although the identification of the contents was delayed by a number of months, a sample of the contents was analysed at a commercial laboratory in Colombo and the contents were identified as a natural plant resin. The report provided was also lost in the Tsunami. These results confirmed the hypothesis of the Project archaeologists who theorised that the resin was a type of harpuis, a yellow resin, a mixture of pine resin and linseed oil, commonly found in Dutch vessels and used in the preparation of caulking and for waterproofing of ropes and woodwork. These materials were soaked in the harpuis which penetrates into the structure and provides some protection against water damage.

The barrel was assessed in great detail and the causes of the damage identified. It became apparent that the interior of the barrel was not concretion as had been earlier thought, but in fact was filled entirely with resin. Where exposed, the surface of this resin had become, hard, brittle and grey in colour, closely resembling concretions formed under aerobic conditions. The upper surface of the barrel was covered with some concretion, but was predominantly resin. This resin, which appeared hard and solid at excavation, was in fact semisolid; fluid and since excavation the resin had been flowing very, very slowly.

In March 2004 an assessment of the barrel showed the following effects of this resin flow: the flow of the resin was stronger than the remains of the iron hoops and wooden staves, causing the staves to separate as the resin began to seep through the gaps the movement of the resin was affecting the stability of the wooden base, with the dowelled pieces separating and the wood beginning to fracture

This damage and movement of the resin was exacerbated by the following:

- the support for the barrel had been removed
- the bandages wrapped around the barrel had been pushed aside, resulting in uneven pressure and causing damage to the soft wood

As a result the following recommendations were made for immediate action:

- a treatment report should be made and kept up to date
- the condition of barrel should be photo-documented and all aspects of its condition recorded in detail
- the characteristics and properties of this type of resin should be researched
- physical protection should be re-established.

It was proposed that the existing bandages be removed and new bandages applied evenly over the height of the barrel, resulting in an even support around the walls. It was hoped that additional reinforcement of the barrel walls would reduce the outward flow of the resin. Despite these actions physical protection was not re-established and by November 2004 the continued flow of the resin had caused such serious structural changes to the barrel that it was no longer considered possible or safe for the barrel to remain as an intact entity (Figure 11.12 A-E). The decision to dismantle the barrel was not taken lightly.

The movement of the resin had deformed the barrel completely, with significant movement of the staves and the base. The corroded and concreted hoops had started to crack, the staves had begun to separate and an increased amount of resin was oozing through. The pieces of the base (on the top due to the previous inversion) had been forced upwards, on an angle, with a large surface of resin newly exposed. A large 'air' bubble formed within the resin had forced resin upwards, causing the lifting and angled movement of the base wood components. By the time the bubble had reached the surface only a thin shell of resin remained, which had subsequently shattered (Figure 11.12E). The interior of the bubble was irregular, but measured at over. Although the exact cause of the bubble formation is unknown, two theories have been suggested: either air had been trapped inside the barrel before the ship wrecked or the resin underwent deterioration that caused the production of gas.

In summary the resin had been under the influence of two forces: 1) the natural gravitational flow of the resin, downward and spreading outwards and 2) the movement of the trapped gas bubble – directly upwards – which forced the resin upwards too.

Proposed treatment of the barrel

Following discussions with the Project Director, the project consultants and the MAU conservation team, it was decided to dismantle the barrel, treat each material separately, and after conserved, reconstruct the barrel with aid of an internal support such as a customised acrylic structure.
This decision was taken due to the following reasons:
The barrel as a unity was deteriorating rapidly and if deformation continued it would be less and less possible to reconstruct in the future.
It would not be possible to treat the object intact while it was in such an unstable physical condition.

It is a composite object composed of wood, iron (in metal and in concreted corrosion products) and resin. The most successful method to conserve composite objects of these materials is to treat the components separately. PEG (used to consolidate wood) affects the iron and iron alters PEG and therefore its consolidation qualities, the effects of PEG on the resin were also unknown. Sodium hydroxide (used to inhibit iron corrosion and to desalinate iron) degrades wood and possibly could also react with the resin.

As the barrel was to be exhibited after treatment it was important to carry out full treatments of all materials, especially the wood and, if possible, the iron components.

Figure 11.12 (A -E) Time line of deterioration: the staves March 2003, March 2004 and November 2004; (E) shows the movement of resin caused by an air bubble

The method proposed to treat the barrel was the following:

1. Fully document the state of the barrel to record its condition and construction so that the condition of the components could be monitored during treatment, and to allow for accurate reconstruction following the stabilisation of the components.
2. If possible, cast a mould of the barrel to have more information on its technology and its state before dismantling.
3. Remove sediment
4. Separate, record and conserve iron concretions as well as any metallic iron from the walls of the barrel.
5. Free the wooden staves and base from the resin.
6. Clean the remains of resin from the wooden components. Remove iron corrosion products from the wood with 5% di-ammonium citrate.
7. Undertake PEG treatment of the staves and base.
8. If metallic iron was present, treat by placing in sodium hydroxide (2%) and possibly by means of electrolysis.
9. Store the resin for future study and possibly reshape for exhibition.

Once individual components had completed conservation treatment, the barrel could be reconstructed using the original staves and hoops mounted on a customised support, with the resin returned to the barrel within a rigid support.

Dismantling and treatment of the barrel

MAU conservators and project consultants dismantled the barrel in the November-December 2004 fieldwork season. The dismantling procedure was complicated and delicate, with many conservators involved.

Figure 11.13 The recording process

Figure 11.14 An example of the photo-documentation

Figure 11.15 Removing the staves

1. Recording.

The level of detail required was very high; recording was carried out in written, photographic, diagrammatic and overlay form. For recording purposes the barrel was divided into seven sections, with written descriptions prepared for each. Digital photographs of the different sections were taken and printed at A4 size and covered with a transparent plastic overlay. MAU conservators recorded details of manufacture as well as of deterioration on these overlays using permanent markers (Figure 11.14 & Figure 11.15).

The wooden staves were numbered and marked with Dymo tape fixed temporarily with pins. A diagram was made to locate the position of the staves within the barrel. The barrel was composed of 14 staves with four pieces of wood forming the base.

2. Removal of sediment and iron corrosion concretions.

The barrel's concretions were seen to be of two types. Firstly formed from sediment with a black colour (possibly due to being in an anaerobic environment) - these concretions were quite soft and easy to remove with a small chisel or a scalpel, and – secondly - iron corrosion concretions, some of which still retained a metal core, these were mostly black but had red to brown colouring in some areas – they were hard and some were more projected than others; most of them were of greater volume than the original metal hoops.

The remains of iron hoops were recorded with digital photographs and were individually numbered in order to be able to relocate them during the reconstruction phase of treatment. The concretions were removed mechanically, using scalpels, spatulas, and mostly chisels and hammers (Figure 11.16). The resin served as a good physical support for the wood while the deconcretion took place.

3. Detachment of the wooden staves.

The wooden staves were not homogeneous - some areas were more degraded (soft like sponge) than others (in some areas the wood was very solid and coherent). The upper part of the barrel was clearly more deteriorated due to its exposure (to aerobic conditions, surge, borer attack, etc.) showing loss, fractures, perforations, teredo galleries, etc. The wood of the base was more solid but the pieces had separated from each other and fractured due to the movement of the resin. The movement of the resin also caused fractures in some of the staves. After the removal of all the concretions the wooden pieces were separated from each other and from the resin (Figure 11.17). The first to be removed was the wood of the base of the barrel,

Figure 11.17 Deconcreting the barrel

Figure 11.18. A stave after separation from the barrel

which was located on the top of the artefact. In areas this wood had already separated from the resin – a result of the movement. In the adhered sections, the wood was removed by carefully introducing metal spatulas in between the wood and the resin or by chiselling the resin. The same method was used on the staves – using thin spatula blades and chiselling into the resin. In instances where the staves were not be easily separated from each other, they were detached together and a polyurethane foam padding was placed in the back to retain the curve and avoid breakage. After each stave was removed, it was recorded with digital photographs, cleaned (to remove remains of resin), and placed inside a container with tap water (Figure 11.18). The resin was retained and is to be returned to the barrel when reconstructed, and can be included in exhibition. During the whole process the barrel was kept wet by constantly spraying a fine mist of water over the surface.

Further treatment

The wood components were placed in freshwater for desalination, after which impregnation treatment in PEG solutions would commence. Wood with iron staining also required an additional pre-treatment to remove iron staining prior to PEG treatment. The concreted iron components were placed in sodium hydroxide (2%) for desalination.
The resin was air-dried and kept in dry storage. The details of the further treatment were included in a Procedures manual prepared for conservation work that was to be carried out from December 2004.

Post-script

A number of days after the dismantling treatment of the barrel was complete the 2004 Tsunami struck Galle Harbour. The components of the barrel were lost – the resin (Figure 11.19) was swept away, as were the concreted iron remains, the majority of the wooden components were also lost, a small number were found in the clean-up operation. It was a number of weeks before it was considered safe for staff to return to the damaged MAU premises and much of the surviving artefact material had dried in that time. The surviving barrel staves had dried and were severely deformed.

While this artefact and the hard-copy records of the treatment have been lost - there is much that still remains. The information gathered in the conservation process, is of great value – the analysis of the contents, the details of construction and photographic records and the lessons learnt for both the MAU conservators and the project consultants.

The following conservators were involved in some aspect of the conservation of the barrel:

T. Kamal K. de Soysa, Janaka Klarasawithana, K.A. Anusha Kasthuri, K.Y. Gamini Saman, Nerina de Silva, Vanessa Roth, Anna Shepherd, Patricia Meehan, Ian Godfrey, Jon Carpenter and Karina Acton.

Figure 11.19. The resin of the barrel (December 2004)


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12 Epilogue

How many times can a ship be wrecked? Building and Re-Building Maritime Archaeology in Sri Lanka.

Since the early 1990's, a team of Sri Lankan and International maritime archaeologists, historians, and museum curators have conducted research in the Bay of Galle. Underwater surveys have revealed an impressive number of heritage sites, dated from the 13th century up to modern times. Research into the extensive archives held in Sri Lanka and the Netherlands built a picture of Asia, and more particularly Galle, in the 17th century. Gradually a collection of artefacts grew, representing a cross-section of Sri Lanka's rich maritime past.

From the year 2000, these maritime archaeology activities were formalised with the creation of a Maritime Archaeological Unit (MAU) (including a conservation laboratory) under the Mutual Heritage Centre Sri Lanka. The centre is managed by the Central Cultural Fund in co-operation with the Amsterdam Historical Museum, the University of Amsterdam, the Western Australian Museum, and sponsored by the Netherlands Cultural Fund. The main objective was to extend the capacity in Sri Lanka for maritime heritage management and to build a collection for a new National Maritime Museum.

The Avondster Project was implemented to meet these objectives. A training program for maritime archaeologists and conservators was designed around excavations of the 17th century Dutch East Indiaman Avondster. In 1993 the wreck of the Avondster was discovered in Galle Harbour, investigations continued in 1996 and 1997 and the wreck was identified. Survey and test excavations in 1998 and 1999 revealed a site in an excellent state of preservation. A rich source of material finds and historical knowledge was anticipated. The wreck site situated close to the shore and in a water depth of about 4 m. From a diving safety perspective, it was deemed suitable for training, although visibility was often poor. The site was relatively easy to interpret underwater, enabling trainee maritime archaeologists to interpret the construction techniques used on a 17th century East Indiaman. The Avondster was also historically well-documented which, allowed the inclusion of historical-archaeological research in the training program.

The Avondster site was also selected because it was under threat. Due to changes on land caused by the building of a sea wall and the flow of run-off from storm drains, the Avondster had become increasingly exposed throughout the 1990s. The 1998 inspections of the site found progressively more of the shipwreck exposed. Once exposed, the wooden structure can quickly deteriorate and degradation was observed. For example, the prominent iron anchor found on the site had an intact wooden stock (in 1993) but this steadily degraded and by 1997 it had disintegrated completely. The proposal to develop a new harbour to the east of the Avondster site was also seen as an additional threat to its preservation. The development

Figure 12.1 Part of the Avondster Project team 2003

Figure 12.2 The remains of a 19th century steamer in Galle Bay.

would cause changes in the marine environment of the area such as changes to the silting and erosion patterns. Additionally, a new harbour would attract more traffic in the shallow bay, which in turn could impact the Avondster. Despite an official ban on diving in Galle Harbour, the site was also vulnerable to looting.

The opportunity to conduct a professional archaeological project on the Avondster using the highest possible standards was seen as an appropriate step to take in the protection of this site. It would also demonstrate how important archaeological information can be obtained, preserved and disseminated to the community. The Avondster Project involved the survey of the entirety of the exposed site, excavation of trenches in the bow, amidships and stern areas, and the recovery of about 3000 artefacts, including an iron cannon and a large iron anchor. In addition to the archaeological requirements, the development of conservation infrastructure, conservation training, and implementation of conservation techniques were deemed to be of equal importance. In co-operation with the Conservation Department of the Western Australian Museum, the Amsterdam Historical Museum and INAH in Mexico, a well-equipped conservation laboratory was built. Beginning in 1992, a small team of conservators have been trained in many of the techniques required to conserve maritime archaeological objects. Each year a permit was required from the Department of Archaeology to implement the project. The Sri Lankan government agencies have used guidelines from the yet-to-be-ratified 2001 UNESCO Convention on the Protection of Underwater Cultural Heritage in determining the conditions for the permit

The historical-archaeological research

From a scientific perspective, the 17th century European East Indiaman Avondster, which can be linked to extensive historical documentation, and is connected to an important stage in the development of Galle as an emporium in the Asian shipping network, is an eminent subject of historical-archaeological research. The Avondster was a cog in the complex wheel of the VOC/European/Asian trading network which was in operation from the late 16th century. The vessel served two European East-India companies, participated in various functional roles on all important trading routes and is therefore an important surviving component of this complex system.

The research and analysis of the ship remains and the artefacts recovered during this first stage of the excavation has only just begun. This study will include placing the Avondster in the wider context of the role and development of the VOC in Asia. A first general study on the development of Dutch shipping in Asia has been published as a direct result of the Avondster Project (Parthesius 2007). It is a future intention to develop a network of researchers and specialists to research other aspects of this broader theme, under the tentative title 'Silk Route by Sea'.

Such research is also a tool to build further the skills and capacity of the young heritage professionals in Sri Lanka. By working together in an academic framework new fields of research and publications can be stimulated, building upon the recognition of maritime heritage in Sri Lanka nationally and internationally. In this preliminary report, a discussion of the studies to date, an outline of work in progress and future aims is all that has been possible, but in the coming years it is hoped that the MAU and academic institutions within Sri Lanka will conduct research and publish their results to build the national knowledge base of this field.

Figure 12.3 Establishing the MAU in 2001

The capacity of the Sri Lankan maritime archaeology and conservation unit

Since the inception of the Avondster Project in 1998, the primary aim of the work carried out by the foreign consultants has been to train members of the MAU, the conservators and maritime archaeologists, to have the skills to be able to function autonomously. This aspect has been emphasised during all field seasons in the period 1998-2004. As part of this training, many foreign consultants with various skills have worked with the MAU team. Use of different consultants has broadened the MAU team's exposure to different experiences, thereby giving them the benefit of alternative approaches and many years of accumulated experience and knowledge. The training provided by specialist consultants to the Sri Lankan team, was integrated into a training program and a detailed system of assessment, designed by Karen Millar.

Currently, the MAU comprises five qualified archaeologists. Their qualifications relate to Sri Lankan terrestrial archaeology. Four of the five have post graduate degrees or are studying at this level. Between them they have 40+ years experience in terrestrial archaeology, site management and conservation. Two of the archaeologists became involved in the maritime archaeology work in Galle in 1992, two more in 2001 and the last in 2004. Three archaeologists have completed the NAS Part 1 training program but none of the archaeologists have any formal qualifications specifically in maritime archaeology. It is not uncommon for terrestrial archaeologists' to be employed as government maritime archaeologists, it is a situation that can be found in a number of countries.

From a conservation perspective, training pathways were focussed in three main directions: The competent application of suitable treatment procedures on the material types typically encountered on shipwreck sites, the implementation of appropriate procedures to facilitate efficient and effective artefact conservation and finally the development of the organizational skills and structures that would allow the conservators to simultaneously deal with a large collection of diverse material types rather than concentrating on the conservation of a small group of artefacts.

Looking exclusively from a maritime archaeological perspective the practical undertaking of the project was not totally satisfactory, for a number of reasons. The sea conditions were an important factor, causing problems with the excavation and recording methods, so in that respect the Avondster site was not as ideal for training purposes as initially expected. The ambition to carry out the project 'using the highest possible standards' was not set with the aim of reaching the highest technical level available in maritime archaeology but to set the highest standard that is sustainable within the Sri Lankan context. This means that often, deliberately, less advanced techniques and methods were used, if it was commonly agreed that these would be more sustainable once the international funding ceased, and therefore more appropriate for the MAU.

Important also for the sustainability of the program is an understanding of differences in work practises. During the programme these differences often lead to frustrations between the international consultants and the MAU team. Consultants often felt that work could be organised more efficiently following different work practises. For the project directors the key to this issue was the basic principle was that the MAU and the Sri Lankan institutes were responsible for the processes in order to ensure, the fit of the MAU within the Sri Lankan government systems and the sustainability of maritime archaeology and conservation into the future. Gradually experience in the field of intercultural cooperation has been gained which has resulted in a MAU structure that fits in with the Sri Lankan institutional system and is compatible for international communication and cooperation.

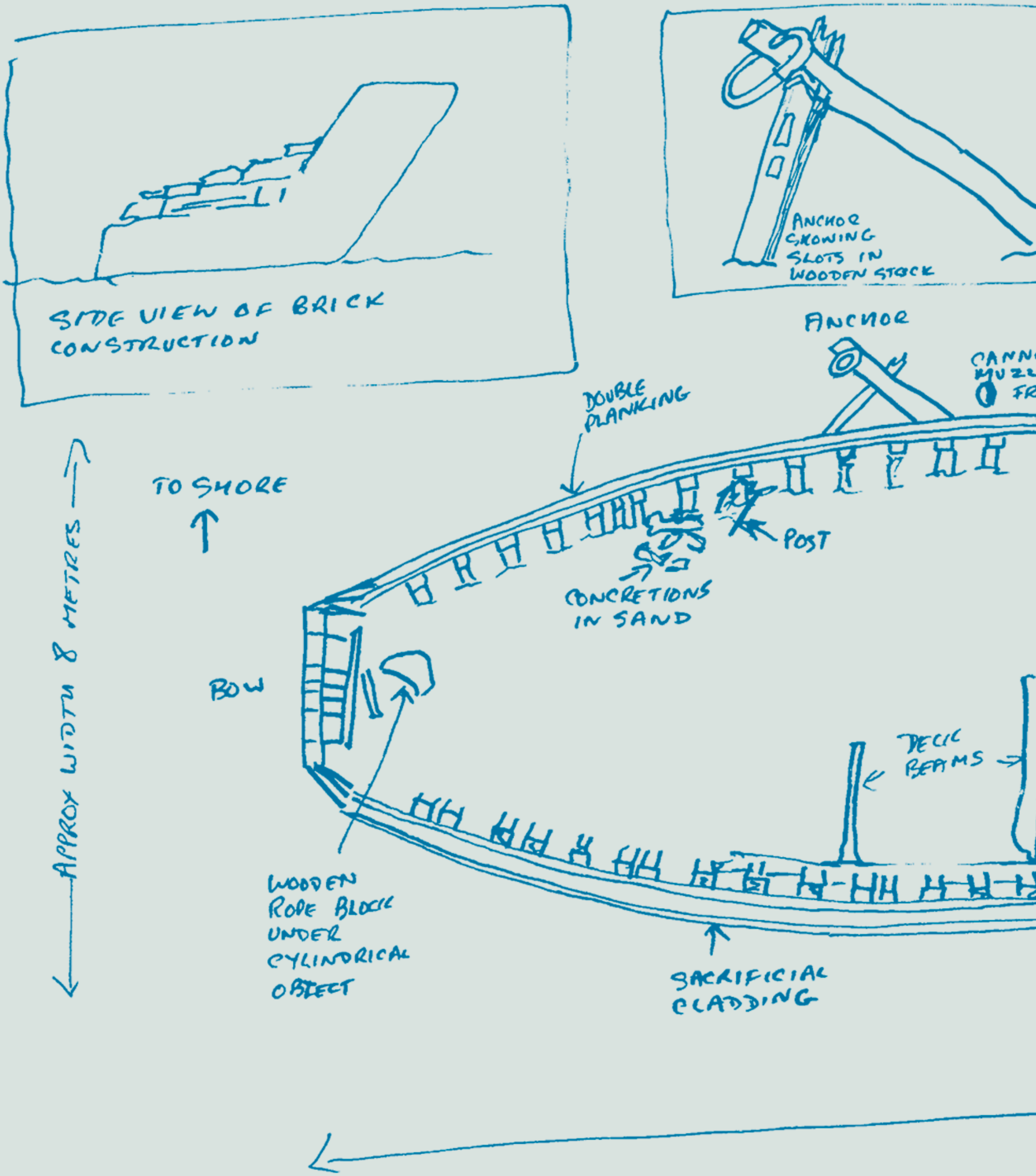
UNESCO has fully acknowledged the importance of developing capacity in the region and has facilitated two training sessions for maritime archaeology in the Asian region in 2006 and 2007 at the MAU in Galle. UNESCO has the following ambitious plan:

> 'Trainees from around the region who complete the programme of training at the regional field training school in underwater cultural heritage in Galle will be expected, upon their return to their national bases, to pass on their training to their own national team of marine archaeologists. To ensure this, the training received at the Galle Centre will be structured as a "training of trainers." In this way, the training will replicate itself at the national level and lead to the gradual formation of a corps of specialists in underwater archaeology in each participating Member States. Considering that the 2001 Convention and its general applications will be an essential part of their training curriculum, regional trainees are also expected to be effective in helping to sensitize national policy makers on the issues concerning the protection of the underwater cultural heritage. This should expedite the ratification of the Convention by Member States'. (http://www.unescobkk.org/index.php?id=818).

The importance of a broad international network became clear at the end of 2004. On 26 December 2004, only days after the excavation of the Avondster was finalized, the MAU premises and the National Maritime Museum in Galle were destroyed by The Tsunami. Luckily, all members of the team survived, but a substantial part of the historical collections and equipment were lost. At the request of the MAU team, almost immediately after the disaster an international network was activated to bring together the necessary equipment and funds. Nearly three months after the Tsunami destroyed the facilities the MAU team was in a position to resume their activities. On 24 March 2005 the new premises for the MAU was officially opened. With the support of the Cultural Emergency Response Fund, the Netherlands Cultural Fund and various international institutions, the basic infrastructure was restored and the recovered artefacts placed back into conservation. A team of experts in the field of maritime archaeology, conservation, museology and monument preservation assisted the MAU in assessing the damage caused by The Tsunami and helped with this first phase of rehabilitation.

Risk and decay of artefacts is inherent in almost any kind of historical-archaeological investigation and museum collection. It is ironic that the sea has taken a collection, once formed through a shipwreck, a second time, centuries later. The recovered collection was brought to safer grounds, but how safe will it be for the future? The fact that the wreck site appears undamaged by The Tsunami raises the question: just where is the safest place for archaeological material? However, at the end of the day it will be determination of the MAU, of these young Sri Lankan professionals, that will safeguard Sri Lanka's maritime heritage for future generations. With their enthusiasm to show the rich maritime history of Sri Lanka to the world, their maritime heritage might be protected from the biggest danger it faces; the treasure hunters who are still the greatest threat to heritage worldwide, greater than any natural disaster.

Figure 12.4 The Avondster Project team in 2001


SIDE VIEW OF BRICK CONSTRUCTION
ANCHOR SHOWING SLOTS IN WOODEN STOCK
ANCHOR
DOUBLE PLANKING
TO SHORE
POST
CONCRETIONS IN SAND
BOW
DECK BEAMS
WOODEN ROPE BLOCK UNDER CYLINDRICAL OBJECT
SACRIFICIAL CLADDING
APPROX WIDTH 8 METRES

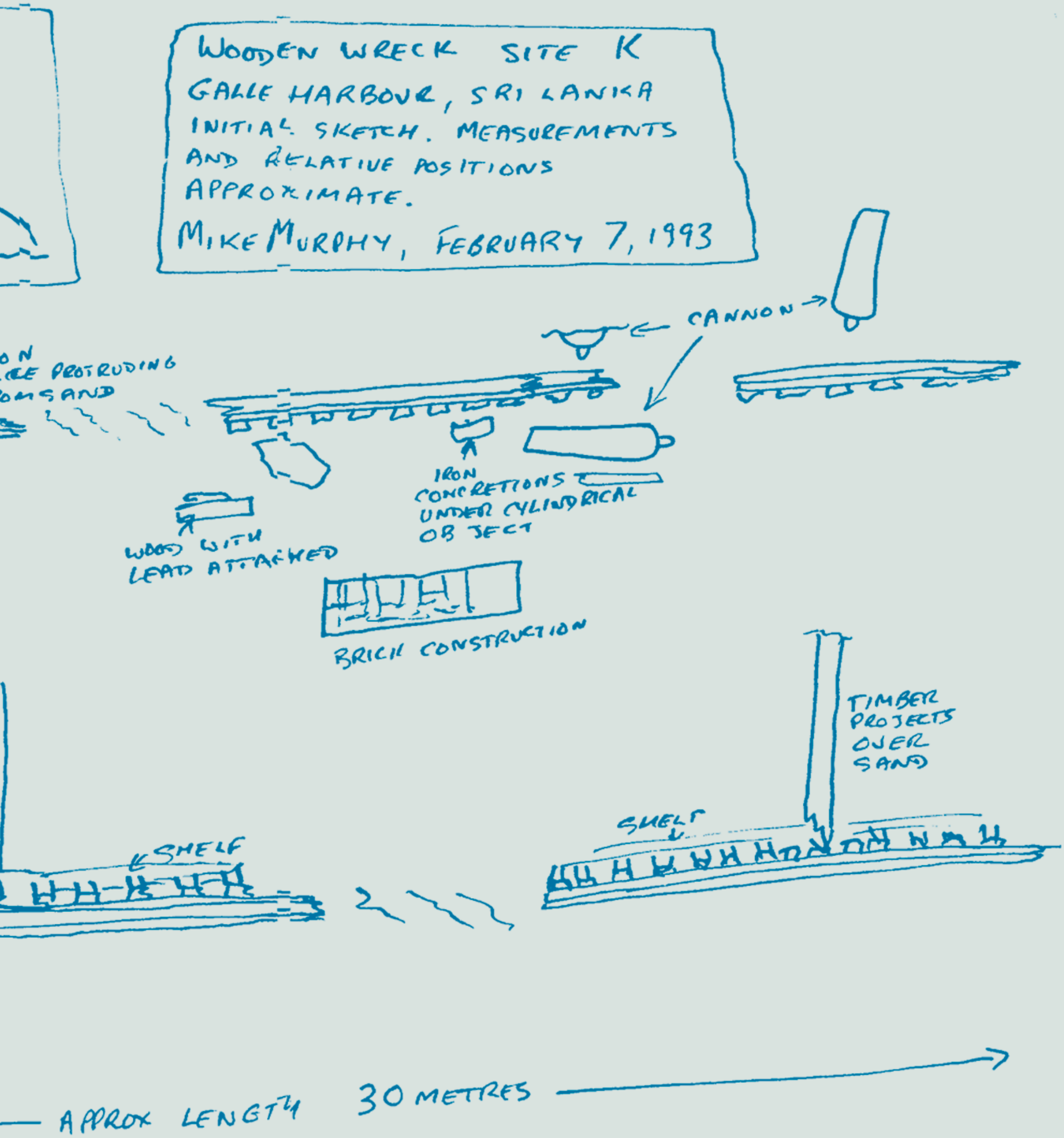


Figure 2.1 Sketch site K [sic] the Avondster site in 1993 drawing M. Murphy

2 The Avondster Project

Introduction a site under threat

After the location and identification of the wreck of the Avondster in 1993 the site was again surveyed in 1996 and in 1997. The focus of the latter surveys was undertake a comprehensive assessment of the site, and compare to the initial sketch and description of the site in 1993 (Figure 2.1)

The remains of the vessel lie parallel to the shore-line in a NE-SW orientation at a depth of approximately 3m-4m, covering an area about 40m long by 10m wide. The bow lies towards the SW and the stern in a NE direction. The wreck consists of an outline of timber frames and planking averaging about 500mm above the seabed. The vessel's timbers are exposed at the bow end, and at about mid-site the perimeter of the vessel becomes buried in sand. After a short distance the timbers are uncovered again for a few metres, then become completely buried until a relatively extensive section of the stern is reached. The stern protrudes approximately 2m-2.5m above the sediment. The centre section of the site is almost entirely covered with sand. In two places along the inner port side, a deck support timber protrudes from the central sand mound.

A large (5m by 1.5m) assemblage of bricks (IJsselsteen), cemented together, lay partly exposed in the centre of the site. Lead sheet protrudes from the sand nearby and was, following excavation, proven to be associated with the brick mass. On the shoreward side of the site, near the bow, a large wrought iron anchor shank and the remains of its wooden stock (which has totally disintegrated since it was first sighted in 1993), rises from the sand and terminates in a complete anchor ring, 3m beneath the water surface (Figure 2.2). There is only a light covering of sand around the matrix of concretions inside the bow region. Iron concretions extend from the starboard side of the bow region and continue to where the timbers become buried. Four concreted iron cannon were located, all positioned on the starboard side of the vessel. Very difficult to work effectively, this site in the 1997 survey was subject to low visibility, strong surge and undertow due to its close proximity (approx. 50m) to the shore (sand beach backed by a rock wall). Although prominent features such as the shank of the iron anchor, iron cannon and stern timbers are still visible, it appeared that some redistribution of sand had taken place since the last inspection in 1996 (Green et al. 1998:21-22)
This assessment led to some interesting observations and questions. In the first place it became clear that the site was not stable and that due to the high dynamic zone close to the shore, redistribution of sediment was a constant process. Parts of the wreck were regularly exposed and so subject to deterioration through natural processes but probably also through human disturbance. This is illustrated clearly by the observed deterioration of the anchor stock. Conservator Vicky Richards was able to compare the timber in 1993 and 1996. In 1993 the wood was, although penetrated by teredo, still well preserved and resilient. In 1996 the stock had lost half its length. Richards' conclusions were clear:
'The fact that the stock had survived at all would indicate that the site was extensively buried for many years, and it was only recently exposed for the marked deterioration to occur. The extent of damage that has occurred to the stock over the past three years suggests that it may disappear entirely in the near future' (Green et al. 1998:51).

Figure 2.2 Image of anchor on the Avondster site 1993

This wreck site, so well preserved for centuries, was now under threat. Not only by natural processes but also through probably human disturbance. Although there was no clear evidence of looting from this site, maritime archaeological artefacts from the Avondster period were for sale in local antique shops. The conditions on the site are difficult for archaeology due to swell and related bad visibility but it would not be difficult for a person to dive on the site and remove exposed or partly exposed artefacts. The site was also under threat from human activities in less direct ways: the close proximity to the storm water drains resulted in contamination of the site with modern materials, such as plastic bags, clothing fragments,

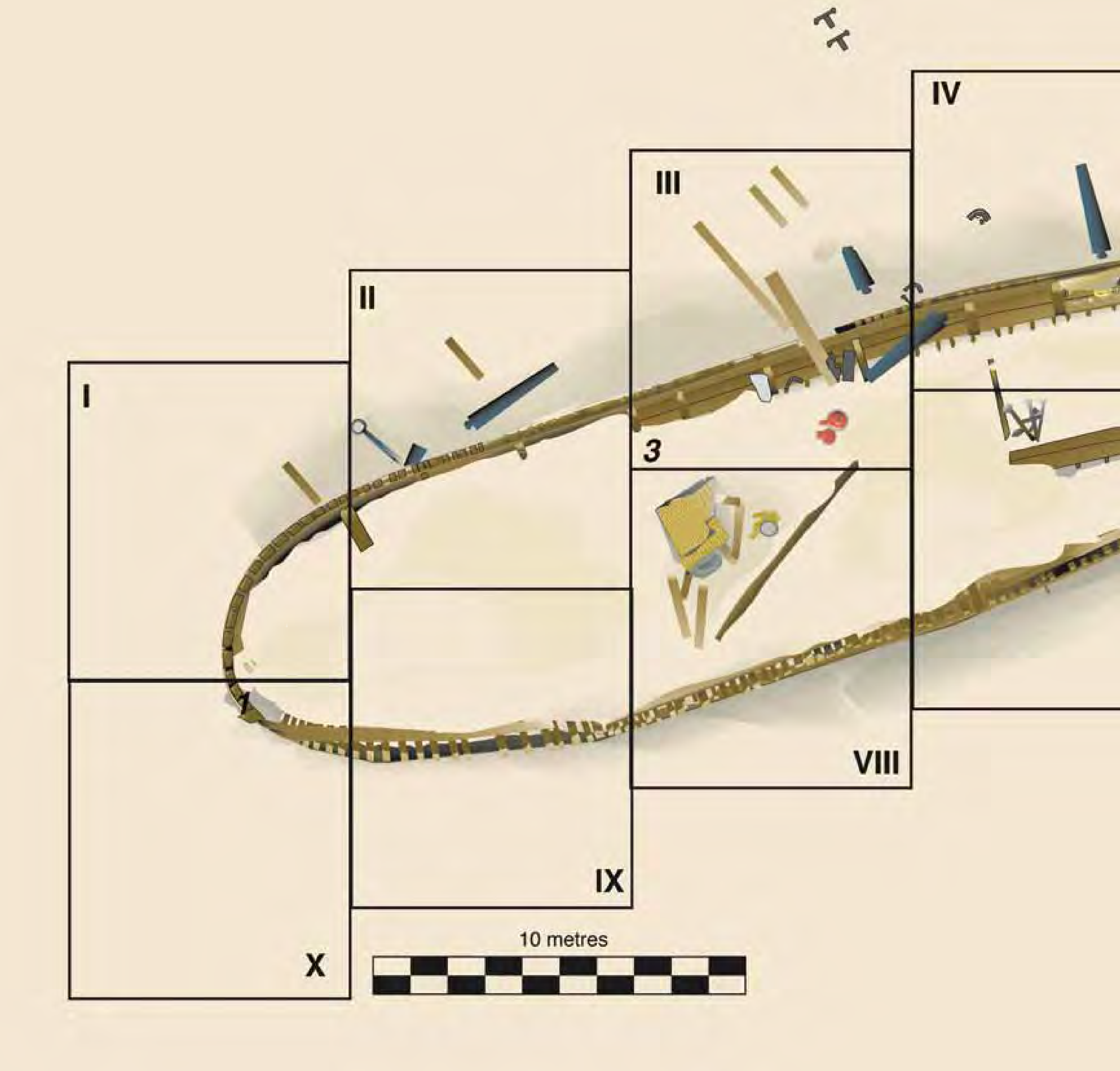


Figure 2.3 Site plan Avondster 1998, drawing R. Parthesius

paper, animal remains and other rubbish. This material becomes snagged on the wreck and pulls with the rhythm of the swell. It is believed that the remains of the anchor stock finally snapped due to this type of site contamination.

The threat to this site was clear but it was also important to understand the special circumstances that contributed to the survival of this wreck and its degree of preservation. The main reason was of course that the Avondster was submerged under a thick layer of sediment until recent years. It is interesting to note that the seabed level must have been at least two metres higher in order to cover the anchor stock. It has been suggested that the original river outlet created certain conditions that allowed the wreck survive hostile tropical conditions. While working on the site it was observed that following heavy rain, a noticeable layer of fresh water was present on the harbour surface. During the monsoon seasons, fresh water would flow directly into the harbour from the drains in close proximity to the site. The decreased concentration of dissolved salts due to the influx of fresh water was reflected in low salinity levels in the harbour. The presence of fresh water directly affects biological activity and the deterioration processes occurring underwater.

Description and Pre-disturbance survey

The conclusion that the Avondster was under direct threat lead to the start of a program of excavation and preservation. In 1998 and 1999 three fieldwork seasons were organised with the support of the Netherlands Department of Conservation. The initial aim was to set-up basic infrastructure for a full-scale maritime archaeological project. An important aspect of the project was to extend the basic training of the Sri Lankan team of archaeologists and conservators, that had commenced in 1992, to a level that they would allow them to participate in a future program.

In this period the Sri Lanka trainees worked alongside maritime archaeologists to produce the first site plan and received training in pre-disturbance techniques. In this period the Avondster site was very exposed and many artefacts were found rolling on the seabed. In order to limit future damage sandbags were used to cover the exposed parts of the site. As a result, the focus of excavation was forced to move towards a form of rescue archaeology. Based on this experience of working intensively on the site

with a combined Sri Lankan-International team, a proposal for the Avondster Project was formulated and accepted by the Department of Archaeology, Sri Lanka and funded by the Netherlands Cultural Fund. Although with the site under threat and rescue archaeology required, the Avondster Project had a wider scope and a clear goal to create a future for the research, conservation and public presentation of the rich maritime heritage of Sri Lanka. The granting of substantial funding by the Netherlands Cultural Fund for this program was based on the clear threat this heritage site was under and the unique opportunity to establish permanent infrastructure in Sri Lanka for future maritime heritage management. An ambitious program was formulated in the project proposal, approved by the Archaeological Department of Sri Lanka.

Project aims

In 2001 the Avondster Project commenced with a clear project design, which focused on:

- Capacity building (training and infrastructure) in the field of maritime archaeology and conservation of artefacts found underwater.
- The conservation and investigation of the Avondster site through excavation and/or on-site conservation.
- Integrated historical-archaeological research on Dutch shipwrecks in the Bay of Galle combining archaeological, historic and archival sources.
- The development of a research program to study the role of Galle as an emporium in the Indian Ocean region.
- Increasing public awareness through the establishment of a maritime archaeological museum.
- Formulation of a viable policy regarding the fight against looting to function as a role model for other regions.

Capacity Building

The best protection for this unique maritime heritage would be to build capacity and awareness in the field of maritime archaeology and conservation. The Avondster Project focused therefore not only on the archaeological excavation and conservation of the shipwreck itself but also on: Dutch-Sri Lankan cultural heritage in Galle; training Sri Lankan underwater archaeologists and conservators, comprehensive archival research; and building a museum to display the excavated finds. In 2001 the Maritime Archaeological Unit was established for this purpose. With an intensive training program, combining hands-on training with the actual excavation and protection of the Avondster site, the project aimed for sustainable capacity in these fields.

Infrastructure

In order to meet the project goals the establishment of basic infrastructure was necessary. Based on designs prepared by Jon Carpenter of Western Australian Museum, facilities were fitted out on a jetty of the old harbour in front of an

Figure 2. (4,5,6) Dive training in Galle Harbour

Figure 2.7 Diving at the Avondster site

Figure 2.8 Measuring at the Avondster site

Figure 2.9 Avondster artefacts in-situ 1998 ex-VOC warehouse (see figure 5.1). The layout included a dive station, artefact storage, wet and dry conservation laboratories and offices. With the growth of the collection, the type of treatments and changing needs in conservation equipment, the area required for treatment continued to grow. Outside the building a temporary construction of containers covered with a roof was prepared for conservation treatments and storage. For the conservation of a cannon and an anchor, a steel tank was designed and constructed. For maritime archaeology a full set of dive, survey and excavation equipment was acquired. A small beach next to the jetty was suitable for storing the boats. A hand library and computer equipment was set-up in an air-conditioned office for research and documentation.

Historical-Archaeological Research

The Avondster Project is an integrated historical-archaeological investigation. The combination of the archaeological assemblage of the Avondster, the wreck itself, contemporary archival information about the ship and the organisation it was part of, provided a dynamic set of research questions. The archival information poses questions to be answered by the archaeological process and the archaeological results, in turn, create questions to be clarified by historical research. Avenues of research included, but were not limited to: the various ship types in service; the material culture on board of a VOC ship; the technical development during the relevant period and the organisation of shipping. On a broader level the position of Galle in the network of shipping and trade in Asia during the 17th century was considered. Archaeological material could be linked directly to the Dutch records in the National Archives of Sri Lanka and the VOC archives in the Netherlands, which enabled multi-disciplinary research programs to be conducted.

Public Awareness

For a young and developing discipline like maritime archaeology public awareness is of major importance. Therefore the Avondster Project aimed for the presentation of the results in a maritime archaeological museum. This museology program was based on the excavation, research and conservation work centred around the Avondster. A team consisting of a maritime archaeologist/curator and a qualified curator were trained in the design of a permanent display in this field. The Avondster Project should contribute to presentation of this discipline through museum based programs. The decision to expand the National Maritime Museum, which originally focused mainly on marine biology and fishery, with a maritime historic-archaeological collection also served the purpose of public awareness of maritime archaeology, history and mutual heritage for present and future generations.

Figure 2. (10,11) MAU facilities seen from the land and the sea side

Figure 2.12 MAUlab: wet conservation section

Figure 2.13 Cleaning artefacts

Figure 2.14 Artefact exhibition in Dutch Reformed Church, Galle

Figure 2.15 Dutch Warehouse , Maritime Museum, Galle


10 cm

3 The excavation

Introduction

The survey and test excavation of the Avondster in 1998 and 1999 revealed a site in an excellent state of preservation. A rich source of material finds and historical knowledge was anticipated. The wreck site is situated about 80 m off the beach and in a water depth of about 4 m. From a diving safety perspective, it was deemed suitable for training, although visibility was often poor and the sea was often in a dynamic state. The site was relatively easy to interpret underwater, enabling the archaeologists and trainees to understand the construction techniques used on a 17th century East-Indiaman. The Avondster was also historically well-documented which allowed the Sri Lankan archaeologists to be introduced to maritime historical-archaeological research.

Survey and excavation seasons were planned on the Avondster in the calmer weather months of November/December and February/March from 2001 to 2004, the timing of the north-east monsoons in Sri Lanka. At the other times of the year the weather is dominated by the south-west monsoons, making it difficult or even impossible to work on the site. A swell constantly moves over the site creating a highly dynamic environment where visibility is often less than 50 cm and rarely more than 2 m. Large quantities of sand can be washed onto or scoured from the shipwreck in just a few days. Between 1993 and 1999 a large quantity of artefacts were found exposed on the seabed in context with the hull structure. These observations on how changeable the site was, were crucial in designing the survey and excavation approach and the logistics of implementing it over a 3 to 4 year period.

An extensive training program was developed by Karen Millar and Robert Parthesius and implemented in association with the excavation of the shipwreck site. A number of foreign specialists in maritime archaeology, conservation and photography took part in the field work and assisted in the training of the Sri Lankan team to a point where they were leading aspects of the fieldwork and were part of the team that produced many of the outcomes, as can be seen in the midship excavation report (Chapter 8).

The excavation work was implemented according to a 'Project Design' that was submitted to the Department of Archaeology in each of the years, 2001-2004 (see Parthesius 2003). In compliance with the Sri Lankan government policy for maritime archaeology the work on the Avondster had to be implemented in accordance with the UNESCO Convention on the Protection of the Underwater Cultural Heritage, 2001, which as at May 2007, had been ratified by 14 countries. As the endorsement of 20 countries is required before it is adopted as international law, this convention was therefore not in force. However, a number of countries are informally using certain aspects of the Convention to guide their maritime archaeology operations. This convention requires the development of a project design which includes, amongst other things, secure funding to implement all the activities required, details about the nature of the field work, conservation facilities, submission of a report, and having appropriate staff to implement the project (O'Keefe 2000).

Figure 3.1 (previous pages) Lion fish around the Avondster site

Figure 3.2 The brick galley

Part of the policy adopted by Sri Lanka and contained in the UNESCO Convention was that qualified maritime archaeologists were needed to supervise the implementation of the work (which meant foreign consultants in Sri Lanka's case, as they did not at the time have any 'qualified' local maritime archaeologists). The archaeological programme was implemented in cooperation with the Maritime Archaeology Unit (MAU) of the Central Cultural Fund (CCF) and the work was very much a team effort, with a number of people having responsibility for certain aspects. The Directors of the Avondster Project also saw 'the primary aim of the work carried out by the foreign consultants [was] to train members of the MAU as conservators and maritime archaeologists, so that they would have the skills to function autonomously. (Parthesius, 2005:235-236).

This chapter is a descriptive summary of the implementation of the field archaeology that were guided by the following Project and Research Designs.
It does not discuss analysis of the hull and the artefacts, nor does it include interpretation of the material in any theoretical framework, this information is covered in other chapters.

Project and Research Designs

One of the main topics investigated in the Avondster Project was the method of construction of this English ship. This included how it was modified by the Dutch to suit their requirements and its use in Asian waters. Other topics such as those outlined in the 2002/03 report included historical research into how the vessel was utilised in the VOC's Asian trade. This study raised questions about the VOC and her links with local internal trade and relations with local merchants. This research question addressed in the more general publication 'Dutch Ships in Tropical Waters' (Parthesius 2007).

In every stage the aim was to build on the experience of the previous period and gradually hand over the responsibility of the fieldwork to the MAU. This setup was reflected in the design of the excavation.

In the first stage the work in the bow section of the ship was focused on devising an effective recording system for the site, gaining experience with the site logistics and excavation techniques. In the second and third seasons the more complex midship section around the galley was excavated. Here the techniques designed were tested and fine tuned and, in some cases changed to suit the trench. During this part of the excavation the Sri Lankan team were primarily in control of the excavation and responsible for producing the midship excavation report.

In the final stage the excavation focused on handing over the responsibility to the MAU. At the same time additional special programs were conducted to provide specialist training and to maximise the possible output of information. These training sessions included the recording of the ship's construction, organised by Cristian Murray and further training on the use of Site Recorder (Site Surveyor) by Kevin Camidge. All steps had to be in pace with the capacity of the conservation team. Given the limited resources available, another important principle with the design of all the systems was the sustainability for the MAU into the future. This had consequences for the choice of equipment and thus on the processing of the information.

Description and Pre-disturbance survey

It was known that the wreck heeled on the starboard side towards the shore. The presence of the galley (Figure 3.2), supported by deck beams which run towards the remains of knees on the starboard site, indicated that the uppermost part of the wreck was most likely the remains of the main deck. (Figure 3.3) On the north side of the ship, between the bow section and middle of the ship, five were evident, all with the same orientation (330°), possibly the remains of deck beams. This may indicate that part of the orlop deck – the first deck that completely covers the vessel - (or the deck above it) became separated from the main ship whilst on the seabed. This suggestion is supported by the presence of objects and concretions washed shoreward. Plans for future investigations included a detailed survey of this area. A typical concretion in the form of three or four iron fittings for the rigging (possible a channel) can be seen 8 m north of the main structure. Another potentially important area that required detailed investigation was the area between the main ship structure and the separate stern section. Historical records indicate that the stern section broke away from the rest of the hull during the wrecking process. This was evidenced by the location of the sternpost, along with the under part of the stern section including a deck beam and a possible knee, resting southeast of the main structure.

Figure 3.3: A deck beam and frames on the starboard side of the vessel

1998-99 Site Plan

The 1998-99 survey, which was conducted over a short period of time, and recorded the major features of the site. A 'swim sketch' of the site was considered to be too inaccurate, to allow comparisons to be made with past pre-disturbance surveys. It was decided that a 'measured sketch' would be appropriate given the limited time and difficult site conditions. This sketch would give positions of objects and construction features. A relatively low level of accuracy, to 20 cm, was determined to be acceptable. The extent of the site had been determined by a least squares survey conducted in 1996 by Karen Millar. This data was used to complement the measurements taken on site and to increase the accuracy of the final plan. Ten survey tags were positioned at strategic points on site. Two baselines were established to allow two teams to work concurrently without affecting the others visibility. Three specific survey tags were used to position the baselines in relation to the site and each other. As a training exercise and to compare accuracy, each team used a different survey technique. One team (working the port side) took detailed frame head measurements (outside, inside and widths) by triangulation from two survey tags. The team working the starboard side used a system of baseline and offsets to cover a larger area. The baseline began at the stern and extended toward the bow, terminating at tag 1. Another baseline was used between tags in the bow to survey just the bow section. Each team transferred their data directly from their dive sheets to the computer sketch using Aldus Freehand 8.0, a computer based drawing program.

This work identified the relative positions of objects and construction details over the entire site as opposed to a highly accurate survey of only a small section. The resulting site-plan assisted in determining the general rate of degradation, in developing a project plan, and provided the starting point for the 2001 fieldwork.

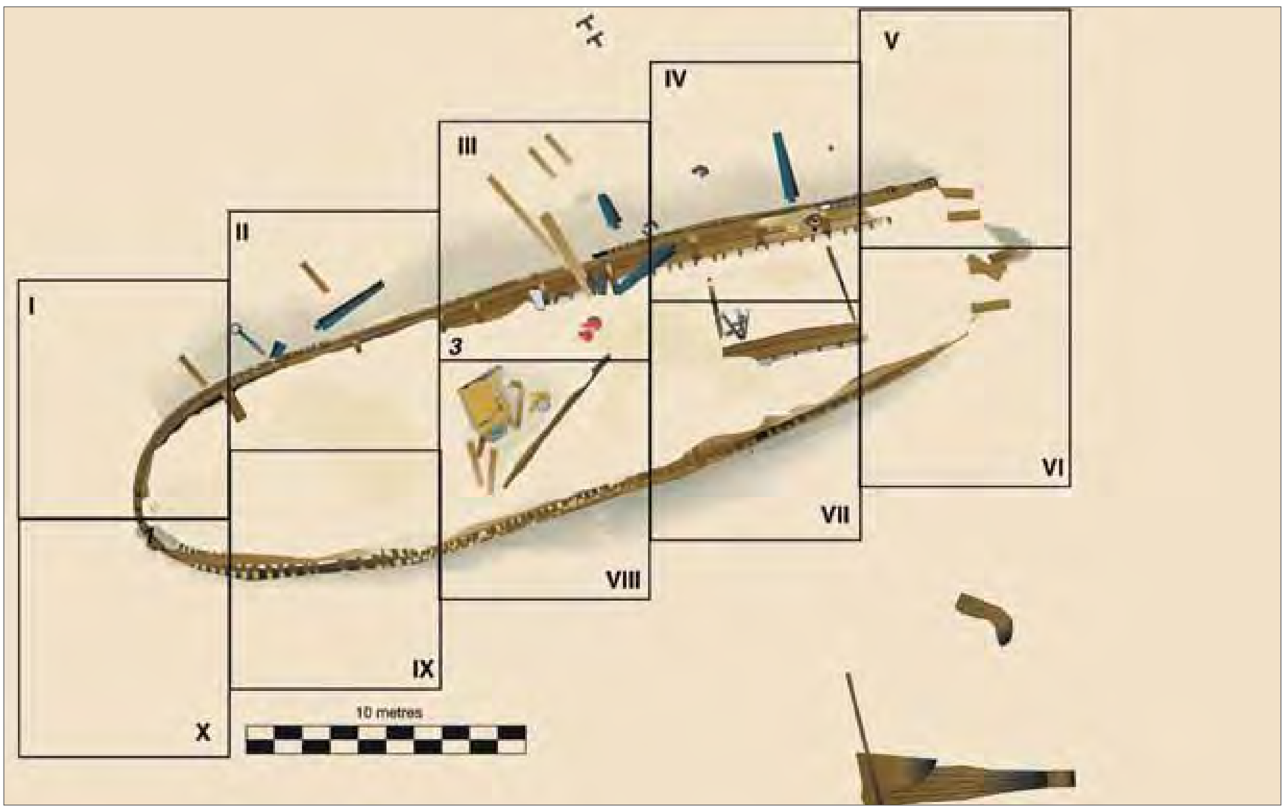


Figure 3.3. the 1998-99 Site Plan (drawing R. Parthesius)

Survey points, 2001

In 2001, an updated site plan was developed using the software program WEB IT. To obtain the measurements for the plan, 33 (numbered 0-32) stainless steel nails were fixed at two metre intervals directly onto the wooden remains of the ship, mainly on the hull and rudder, and starting from the bow. A ring at the head of each nail could be used to fix a measuring tape. Eighteen nails were fixed on the starboard side locating Survey Points 00 to 17. Survey points 18 to 32 were located on the port side. As most of the parts of the port side were under sand at that time, the nails were fixed on the port side hull and on the sternpost, which lay 18 m to the south east.

Measurements were taken from each point to every other point and a depth measurement was recorded, which then allowed a basic plan with accurate survey points to be prepared by Wendy Duivevoorde using the WEB IT Program. The galley was also included on this plan. At the end of the diving season the results of the survey were compiled into a 150cm x 100cm plan of the site. The plan provided an easy reference for the location of the survey points used for all measurements.

The WEB IT plan was initially drawn to a scale of 1:50 which was enlarged to 1:10 in the new site plan by the MAU team (Figure 3.5). Although physically the second plan is a large drawing (1.5m x 4m), it was deemed necessary to show some important features and to locate the many artefacts that were being found.

To draw the features of the shipwreck (hull planks, beams, cannons, concretions, etc.) a measuring tape was laid between two survey points and the features in the vicinity of the tape were measured by using the offset system. Two divers carried out the measuring and sketching between two survey points. The same pair then transferred the sketch details from the underwater sheets/field notes to the large plan each afternoon. This system reduced the chance of errors or omissions that no details were overlooked during the transfer process.

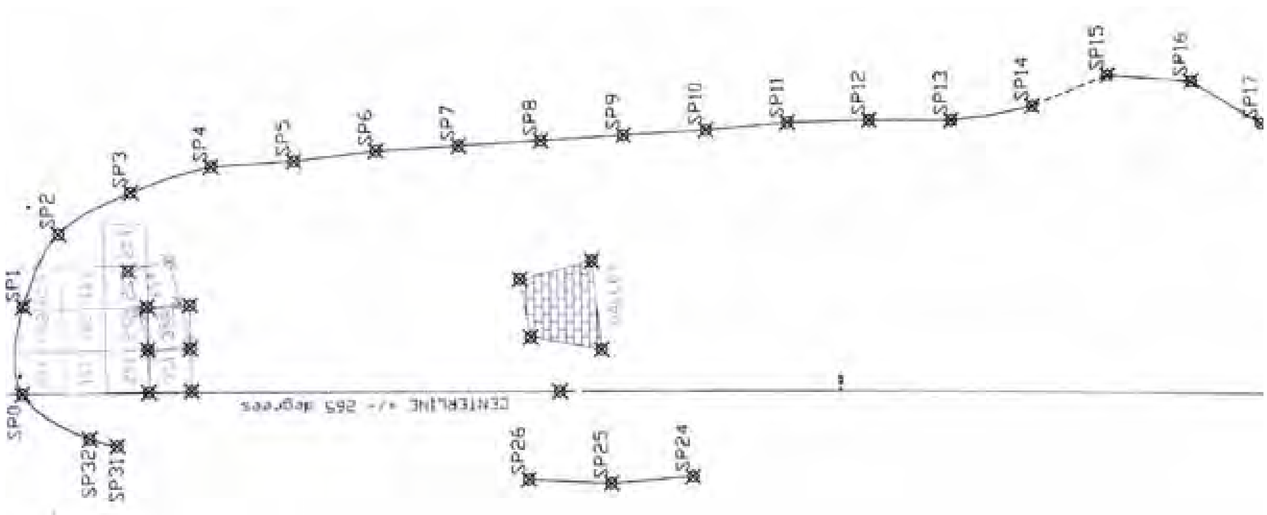


Figure 3.4: Sketch of Survey Points (SP) on the edge of hull and brick galley

Figure 3.5: The MAU Site Plan 2003

Excavation of the Avondster

In the following section, the further survey, excavation and recording work in the three excavation areas: bow, midship and stern are reported on. The general set-up, bottlenecks and outcomes are also explained. The MAU developed a comprehensive report on the midship excavation and it is presented in Chapter 8. Information of the finds can be found in the Avondster Artefact Catalogue. For every excavated section a brief description of the artefacts in their historical context is included.

Excavation of the bow section

It was decided that the bow was to be the first area to be excavated. This area was well defined and confined by the shape of the bow, which provided suitable conditions to trail excavation techniques as part of the training for the Sri Lankan team. The 2001 excavation season occurred over a 7 week period, the season included a preparatory logistal phase of logistics and a dive refresher course for the Sri Lankan team.

The chosen excavation and recording method was to use a baseline from the bow to the galley with 2 x 1 m excavation grids at set positions along this baseline. This system was familiar of the Sri Lankan team of experienced land-based archaeologists. The grids were related to the fixed site survey points by trilateration. Three-dimensional measurements of the bow timbers and artefacts were achieved, aided by the WEB IT and later Site Recorder computer programs. A water dredge was used to remove marine sediments and sand and expose the ship's timbers and artefacts.

Directly underneath a protective layer of sandbags that had been placed in the bow in 1999, a coil of rope was located between thin standing layers of planking. In addition, a collection of pulley-blocks, wheels, deadeyes, more rope and cannonballs were found. The rope appeared to be well preserved but in fact was quite vulnerable to damage. The swell and consequent surge of seawater on the rope quickly caused the ends to unravel and fray. The wood of the blocks was badly degraded, soft and vulnerable to surge damage also. The sheave appeared less degraded, a consequence of its likely manufacture from a more durable wood species. The rope and wooden objects were located in sediments only 0.5 m deep. The blocks recovered in the 2001 excavation appeared to be more deteriorated than those recovered from the same part of the ship in the late 1990's. This indicates a detrimental change in the burial conditions since the initial excavation. It was noted that the wooden items located at the greatest depth of the excavation (0.5 m) appeared to be in better overall condition. The rope and/or wooden objects were possibly stored in a wooden barrel. A concreted barrel hoop lay on the ship timbers with wood fragments remaining possibly the barrel base. Only a very small quantity of rope was recovered in order to give conservators the opportunity to establish storage and treatment facilities for this material.

The quantity and fragile nature of the rope caused the early termination of excavation in this area, but it proved a success in that a section of the bow was recorded and the Sri Lankan team had gained considerable experience in implementing all the requirements of a competent underwater archaeological excavation in difficult conditions.

A total of 307 registered artefacts, ranging from coiled rope, pulley blocks, concretions, musket balls, timber fragments, coal, bone, glass, ceramics and clay smoking pipes were recorded and recovered from the bow area (see the Avondster Artefact Catalogue). Artefacts relating to rigging and ship maintenance were expected since this was where the riggers had their workshops and related equipment was stored. During the site survey of 1998-1999, exposed ringbolts and rope provided evidence of this function.

During the excavation of this area in 2001-2002 more items related to the activities of the boatswain and the sail maker were found including the larger quantity of rope, much of it neatly coiled below decks, its normal place for storage. The rope is of varying diameter; some is 'sheathed' (bound with a smaller rope for protection; the binding could be replaced when necessary).

Further survey and midship excavation, 2002

During the second fieldwork season in 2002-03 it became clear that the previously installed survey points on the hull of the Avondster would not survive the extreme conditions found on the site. Martijn Manders of then the NISA (Netherlands Institute for Ship Archaeology) was asked to design a new system that would be more durable. In November 2002, 10 aluminium poles (AP) were driven into the seabed around the perimeter of the wreck. From these permanent survey points, all sections of the ship can be measured. During the excavation additional (temporary) points were located to record excavation deeper in the hull. The grid frame system previously employed in excavating

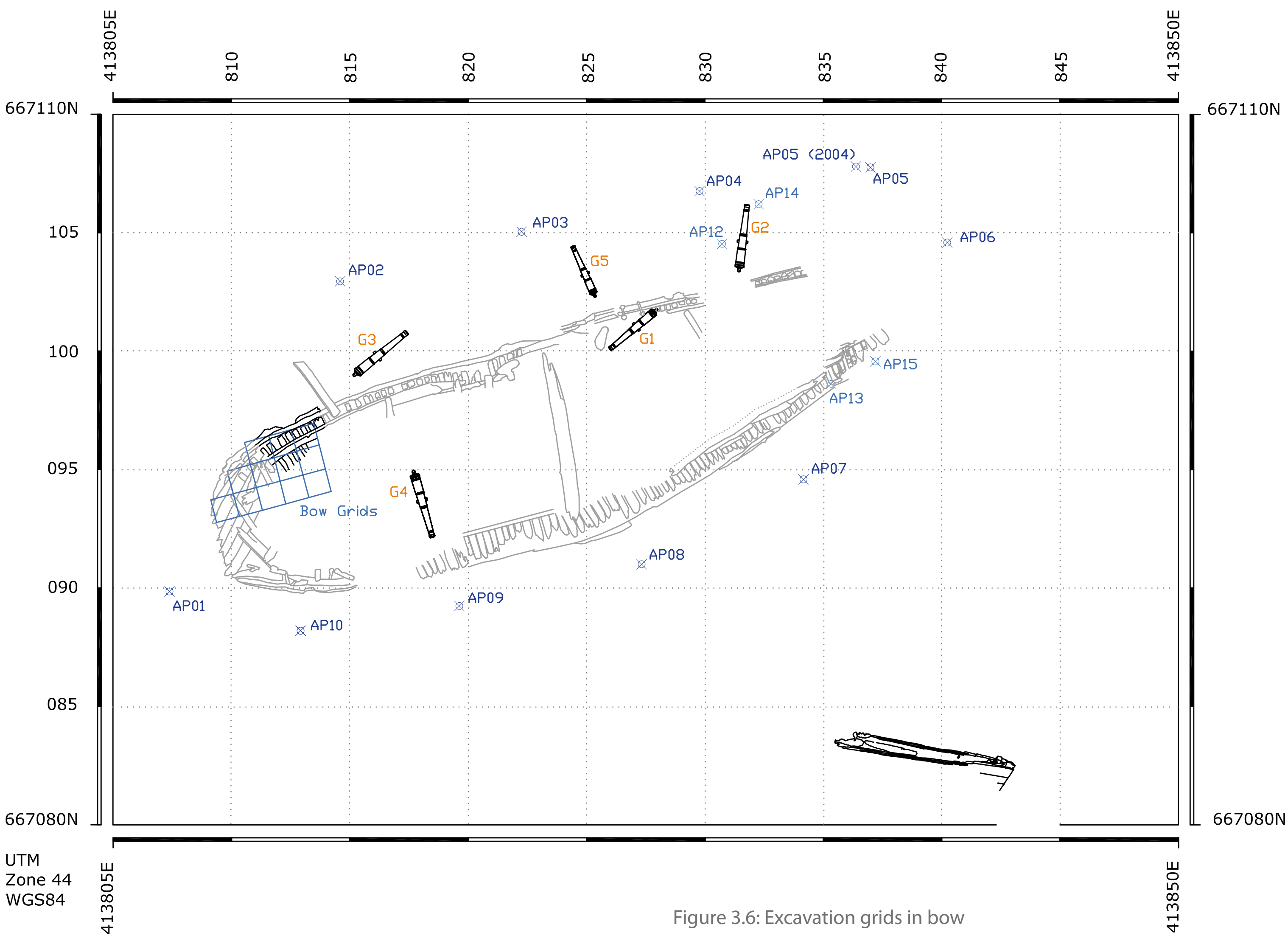


Figure 3.6: Excavation grids in bow

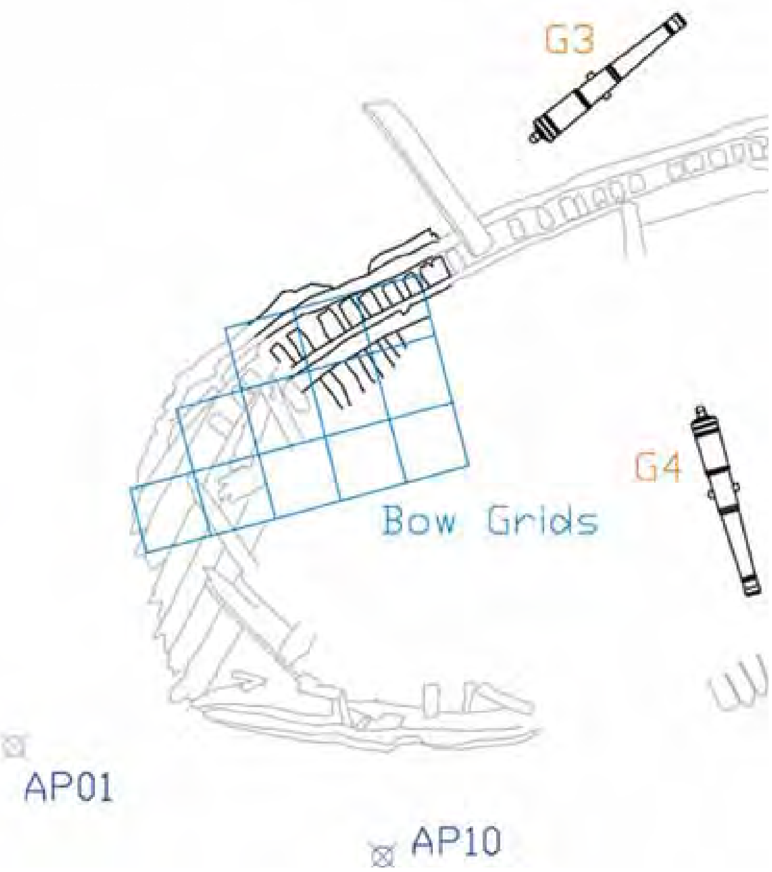


Figure 3.7: Bow timbers in vicinity of excavation grids

Figure 3.8: Detail of the bow excavation plan

Figure 3.9: Working underwater using the water dredge

the bow section was reconsidered during this period. It was decided that the outlines and features of the wreck could be measured using the new pole survey points and the excavation area would be defined by a trench, with its location also defined by triangulation with the poles. Finds would then be connected to the ship. This way of working was much quicker than working within small frames and provided the accuracy required.

Excavation of the midship trench

Beginning in March 2002, excavation was implemented in a 4 m wide (athwart-ships) midship trench. This excavation continued through to April 2004, in conjunction with a number of other activities. An aluminium pole placed in a horizontal manner just forward of the galley was used as a control in measuring the depths of the layers, artefacts and ship's structure during the excavation of the midship trench.

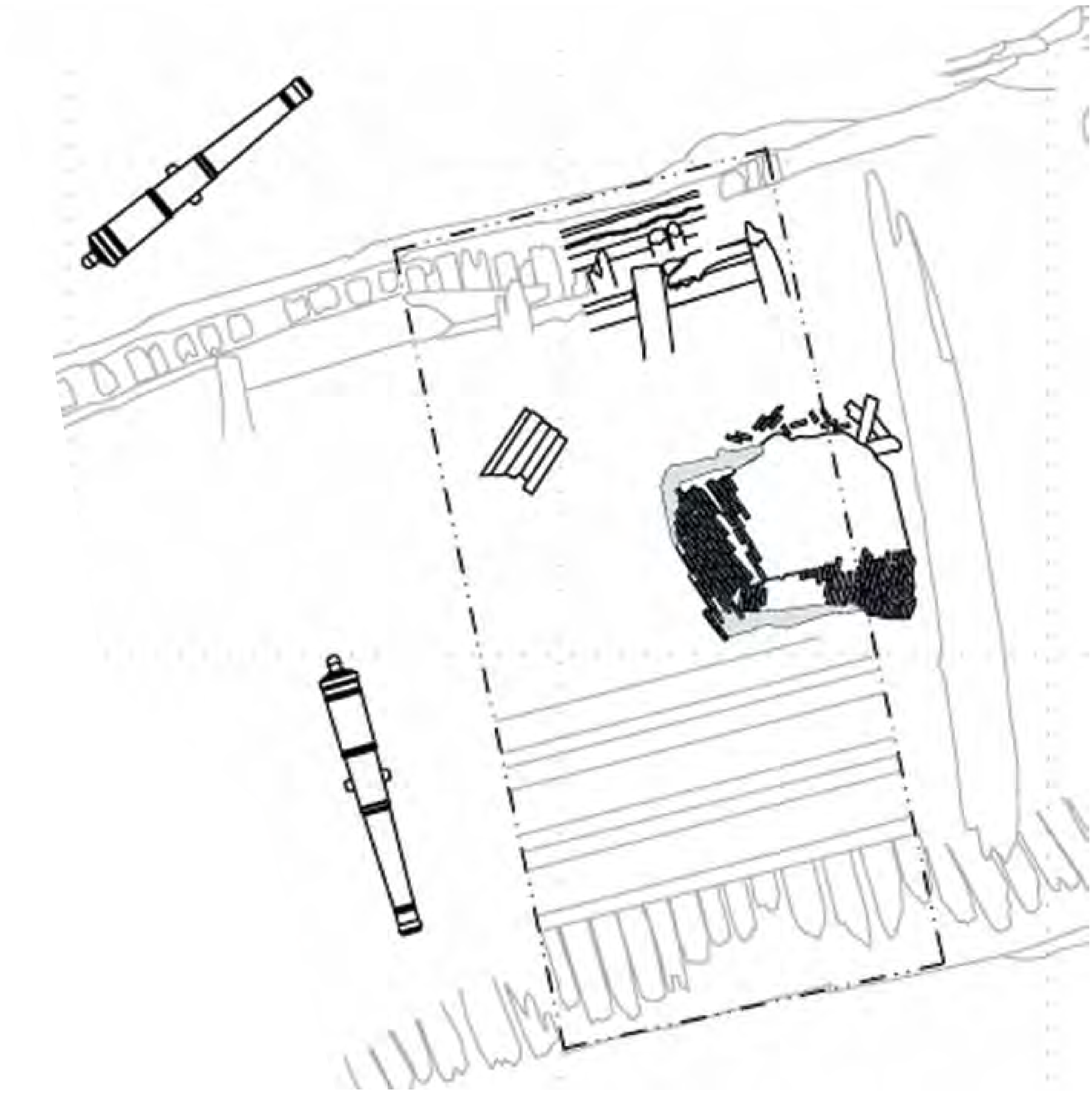
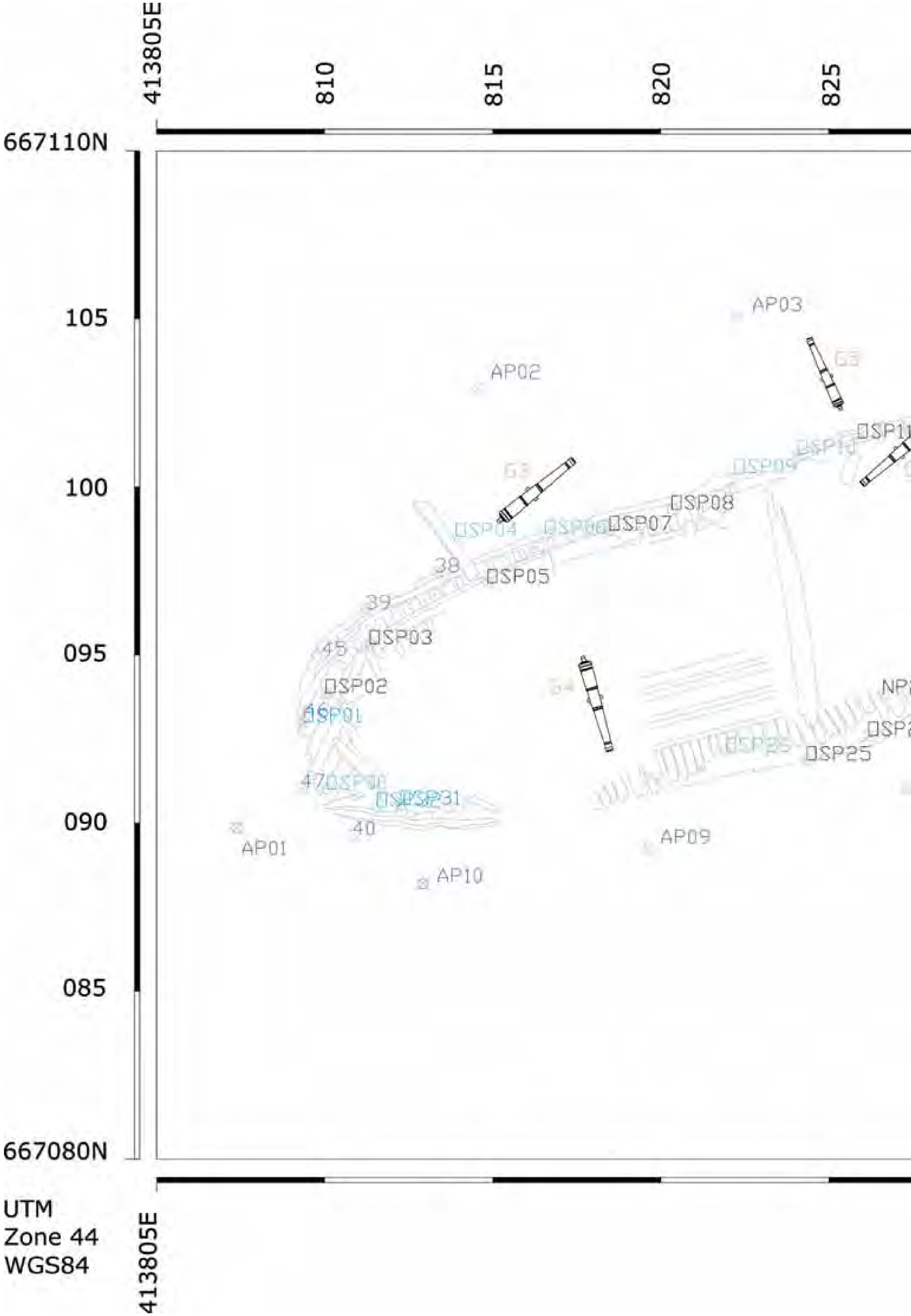


Figure 3.10: Site plan showing midship trench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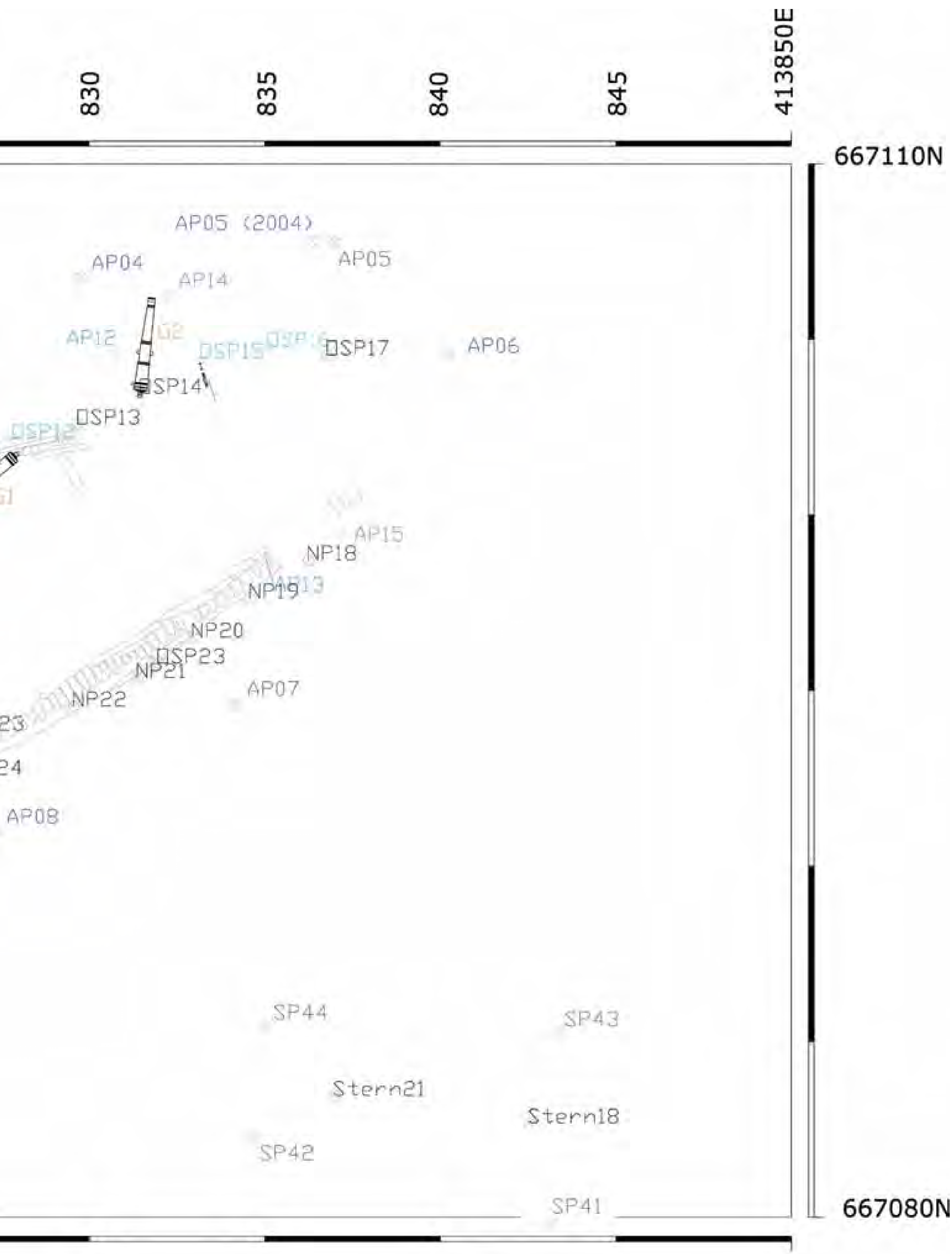


Figure 3.11: Aluminium Poles (AP) fixed around site. Stern Poles (SP) around the stern post which were established there in 2004.

It was decided to conduct the midship trench excavation layer by layer, six in total, with the depths and descriptions of each layer shown below in Table 1.

Layer	Layer depth (thickness)	Nature of Sediments	Description of cultural material
No. 1	Variable to 25 cm	Very mobile fine soft sediments and modern objects	Modern
No. 2	20 cm	Slightly older, less disturbed including coarser sand and crab shells	Modern material similar to layer 1
No. 3	55 cm	Dark grey fine compacted sediments, generally undisturbed	Possibly containing canal (river) deposits. Decayed wooden objects, contemporary with site. Exposure of ship's structural timbers, lead under brick Galley
No. 4	45 cm	Grey compacted sediments similar to layer above, undisturbed	Ship's construction timbers, deck beam under galley, dunnage, galley related artefacts
No. 5	30 cm	As above	Decking, ceiling planking, dunnage
No. 6	20 cm	As above	Bottom of ship's structure, futtock riders, intact barrel

Table 3.1 Excavation layers in the midship trench

At the stern side of the trench near survey point 9, the depth of the excavation was reduced due to the difficulty of preventing the sides of the trench from collapsing. Apart from the sterile top layer of sand, the excavated area was very complex to work because of the confused nature of artefact material located, i.e. fragile sections of timber barrels, collapsed structural timbers and tightly packed scrap timber (dunnage) used in stowing the ship's cargo. Progress was also slowed by the difficult conditions caused by very low visibility and swell movement.

To reach the bottom of the trench to take a cross section, the remaining sand of layer 6 was removed completely. When this was done in the narrow strip at the western border of the trench a barrel was revealed. The excellent condition of this barrel suggested that the original contents might be preserved. It was left in-situ for future excavation.
As in the bow excavation, on the completion of the midship excavation, the trench was reburied. A layer of green shade cloth was placed over the excavation area to delineate the boundaries for future work on the site. A quantity of dunnage that had been removed from the trench was reburied and the excavated spoil was redirected over the trench using the water dredge. A number of sandbags were then placed back over the area to prevent scouring.

A selection of finds from the midship

A total of 1351 artefacts were recovered during the midship excavation. All of the artefacts are included in the Avondster Artefact Catalogue.

The midship section was generally used for crew accommodation and food preparation and this was confirmed on the Avondster site by the brick galley located in this area. In 1998-99 various objects related to food production; stoneware vessels, pewter implements and a grinder were found including a large broken martaban. During the 2002-2004 excavation, more artefacts related to the crew were recovered around and underneath the galley. An iron cooking pot and also a vast collection of Asian earthenware cooking pots were found in this area.

Finding both European and Asian stoneware storage jars provides an interesting indication for a mixed Asian-European material culture. Ceramic storage jars are often found on ships of this period. They were used as containers for sugar, salt, tea, salted fish, candied fruit, butter, oil, wine, spirits, opium and even holy water and mud from the Ganges. More prosaically, they were used to store drinking water. There are two identifiable types of stoneware storage jars among the Avondster sherds: storage jars from Asia (martabans) and beardman jugs from Europe. The term 'martaban' has been used generally for strong storage jars. However, the term can be misleading, as it has also been associated specifically with jars made in the vicinity of Martaban, a port in Burma. In the VOC archives there are numerous references to this port. The first mention is as follows:

> In this city large earthenware pots are made, which are called martavanas in Indian; they are transported in large numbers through the whole of India; the reason that so many are transported is that in India they are used in houses and ships instead of jars: because there are none of such from Portugal; these come in their place to preserve oil, water and wine and such things, and it stays very well in them and it is a great comfort to the traveling man; because they also appear in Portugal; as they are used on ships from India, for water and oil etc. (Kern 1910. p. 69)

These martabans jars are still being made in Asia, of unglazed high-fired earthenware. Stoneware jars from Thai kilns were also transported overland (or transported by ship) to Martaban for export. Characteristic jars (more accurately called jugs as they all have a narrow neck) commonly known as Beardman Jug originate from the Rhine area in Germany. The body is of white, buff or grey clay with a rich content of silica acid, which vitrifies at a high temperature. For this reason a lead glaze could not be applied. Instead common salt was thrown into the kiln during firing and the soda formed during this process combined with the silica and alumina in the body leaving a thin, colourless glassy film on the surface. Colour was added by thin washes of slip stained brown by iron (usually), blue by cobalt, or purple by manganese. Most remains of the Beardman Jugs on board the Avondster were found around the galley and would have been used for storing special liquids such as oils or alcohol. They were a common part of a Dutch ship's inventory, as can be seen by the numbers found on VOC shipwrecks such as the Batavia (1629), Vergulde Draak (1656) and Witte Leeuw (1613) (for a full report see the Avondster Artefact Catalogue).

The midship area also comprised the hold of the Avondster, where the remains of the cargo were found. Areca nuts were an important part of the merchandise, which the Avondster was loading for India, according to the historical records. These nuts come from the areca palm, the most graceful and delicate of Sri Lankan palms. Chopped areca nuts, often incorrectly called betel nuts, are mixed with betel leaf and lime for chewing. The resultant mixture is a mild stimulant, popular in many Asian countries. (NA VOC 1231, fol. 535). Chank shells found on the wreck site were of the species Turbinella pyrum (previously known as xancus and called chianco in Dutch). These shells are used in Hindu and Buddhist rituals, and can be bored for use as musical instruments in religious ceremonies. Left-handed specimens are particularly rare and valuable but the three dozen found were right-handed. The Avondster carried chank shells as part of its cargo during 1658. Chank shells are found in Sri Lankan waters, but have not been recorded around Galle. It is probable that the shells came from the ship, considering chank shells had formed part of the Avondster's cargo nine months before sinking (NA VOC , 1231 fol.177-179).

Many wooden barrels (and the iron concretions left by barrel hoops) were found near the galley. Most were broken, but some remained intact and were kept in situ. One barrel was excavated and analysis indicates it contained a pine resin: pines are not found in Sri Lanka but pine resin was mixed with sulphur and fibres such as animal hair for caulking joints and also used between layers of planking for protection against marine organisms. Planks caulked with hair or a sticky mix containing hair may be seen in this area. Some timbers show traces of matting or sackcloth. Many of the barrels were surrounded with wooden branches and off-cuts, believed to be dunnage for packing the spaces between barrels to prevent movement. There was also firewood found near the galley identified by their impractical shapes and the traces of burning. Coal was also found on the site. This would have come from Europe, as the Dutch had found no satisfactory sources in Asia and it was usually in short supply (Parthesius 2007 pp 94-103).

Excavation of the stern section

The excavation of a stern trench was carried out in November/December 2004 after an assessment the previous year of the most appropriate area. A bulkhead and part of an upper deck on the starboard side, and what looked like a keelson on the port side, had been observed and the trench was laid out to include these features. In November 2004 it was found that up to 1 m of sand had moved onto the site, making the exact definition of the trench in relation to the permanent survey points difficult. A 2-m-wide trench athwartships was established which ran approximately from the starboard side hull survey points 14 and 15 to 18 and 19 on the port side.

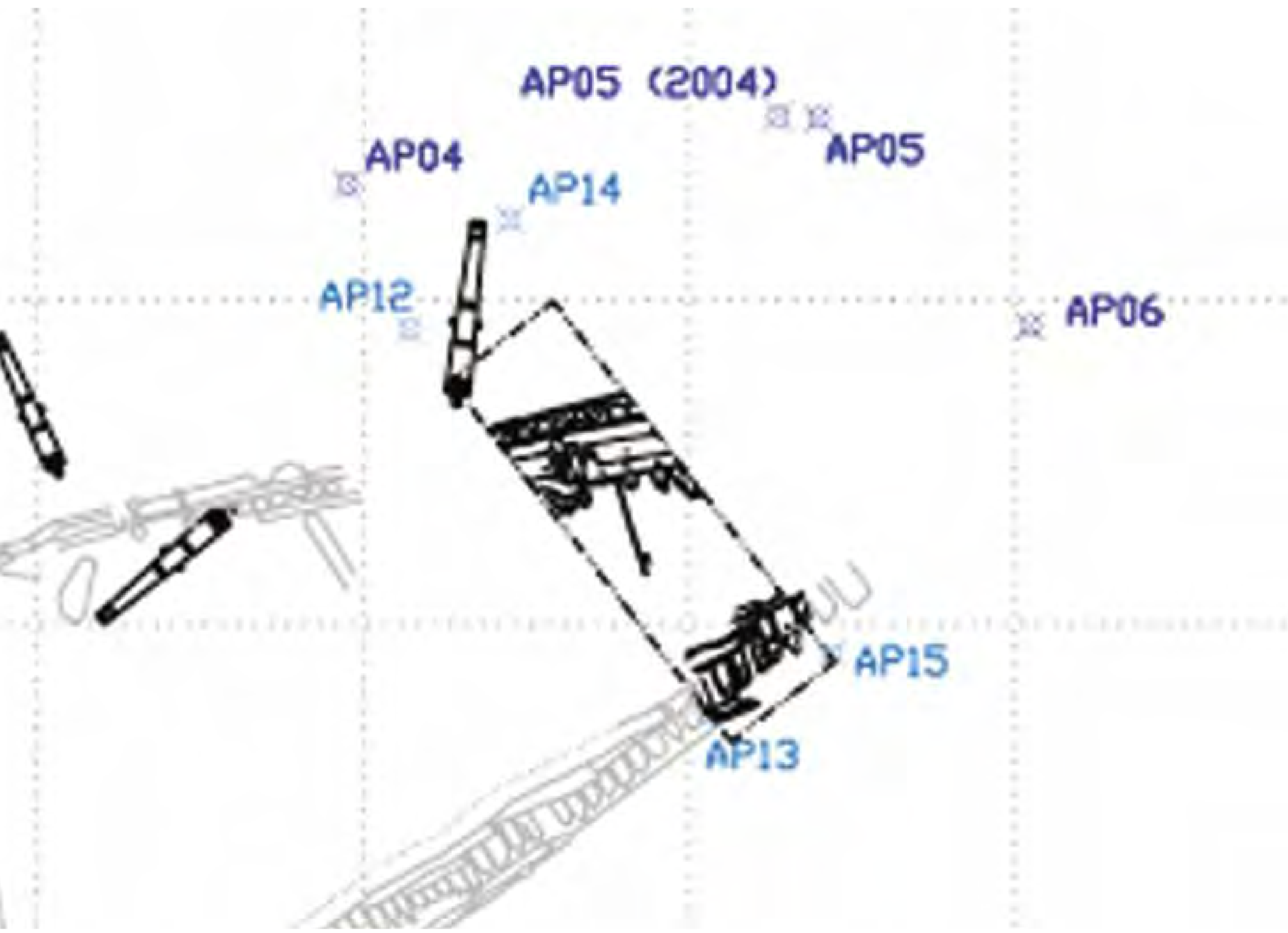


Figure 3.12: Site plan showing location of stern trench

The trench was delineated with two horizontal aluminium poles, one being used as the datum for measuring depths from using Site Surveyor/Recorder software. . Layers of 'sterile' sediments (sediment that had moved onto the site from November 2003 to November 2004 and therefore were considered sterile of Avondster structure and associated artefacts) were removed over the whole trench, until structure was encountered on the starboard side.

The excavation continued from the starboard side of the vessel where degraded frames, outside and ceiling planking of the hull were uncovered and as it moved into the vessel, deck planking and deck beams were uncovered and recorded in three dimensions. Artefacts such as rope, medicine jars (Figure 3.13), an intact brown earthenware pot (Figure 3.14), a beardman jug, pulley sheave and musket balls were located on the deck planking and concentrated up against the starboard ceiling planking (indicative of the vessel listing over on its starboard side). Further aft, along the edge of this deck/ceiling planking, a rectangular wooden container was encountered with leather straps that secured the box and its contents (Figures 3.15 & 3.16).

The initial plan was to excavate the trench from starboard to the port side, but poor visibility and the risk of working in more undisturbed layers under such conditions required the excavation to occasionally move to a more artefact sterile area, (ie. the port side) and work back into the centre of the trench. As the middle of the trench gradually exposed a much thinner timber, thought to be a bulkhead, was encountered running athwart-ships from under the deck. More rope and musket balls were found in this location. At this time the trench could not be completely uncovered and recorded due to the delays caused by frequent low visibility (and occasional nil visibility).

The November/December 2004 season, the last season, was also plagued with poor visibility and continual swells but much of what was planned was achieved. The excavation was recorded using the Offset and the Site Recorder software, enabling distribution plans and elevations to be drawn (Figures 3.19 & 3.21).

Some finds in the context of stern section

The stern section of a VOC yacht functioned as the officers' quarters and the constables' workshop. Artefacts such as navigation instruments, personal belongings, trade related items and objects related to the maintenance of guns and weapons were expected to be found there. During the 1998-99 survey, lead shot, a barber's plate and other artefacts related to the ship's surgeon (ointment jars and lice combs) were found in this area and additional surgeon's items were excavated in 2004.

The contents of one ointment jar were identified as mercury quicksilver or mercury. Mercury was used in different concoctions for genital diseases but also, for instance, to remove surplus flesh from ulcerations. The healing qualities of mercury are very doubtful. It was applied in several forms, depending on the surgeon, including pills, ointments and mercury fumes. It was believed that relieving a person of his fluids

Figure 3.13: Medicine jars in-situ on the Avondster site

Figure 3.14: Brown earthenware pot from stern excavation

Figure 3.15: A section of the wooden box in-situ on the Avondster site

Figure 3.16: Wooden box with utensils, possibly constable's equipment

Figure 3.17: Ross Anderson excavating in average visibility adjacent to the starboard hull (showing frames, outer and inner planking)

through sweating and administering laxatives for instance, was beneficial and mercury was such a laxative. A person treated with mercury would start to produce an enormous amount of saliva, sometimes a couple of litres per day. This was seen as a favourable omen, whereas in fact this is one of the first signs of mercury poisoning (Leuftink 1991:109). A fragment of antler was also recovered from the stern trench. The Hollandia Compendium (Gawronski et. al. 1992) lists 'marrow of deer horn' (Rasurae C. Cervi) as part of an extensive list of medicines for ships leaving Holland for the East Indies, but it does not suggest how the 'deer horn' would have been used.

Another interesting artefact was a cupping device. This pewter cup was used by pressing the mouth of the heated cup against the skin, creating a vacuum which caused blood or other bodily fluids to rise to the surface. A similar device was found on the Hollandia (1743), and they are still commonly used in some parts of Asia (Gawronski et. al. 1992). Also found in the stern during an earlier season was the remains of a human skull. This is still being analysed to assess its association with the Avondster, since archival documents indicate that there were no casualties during the wrecking.

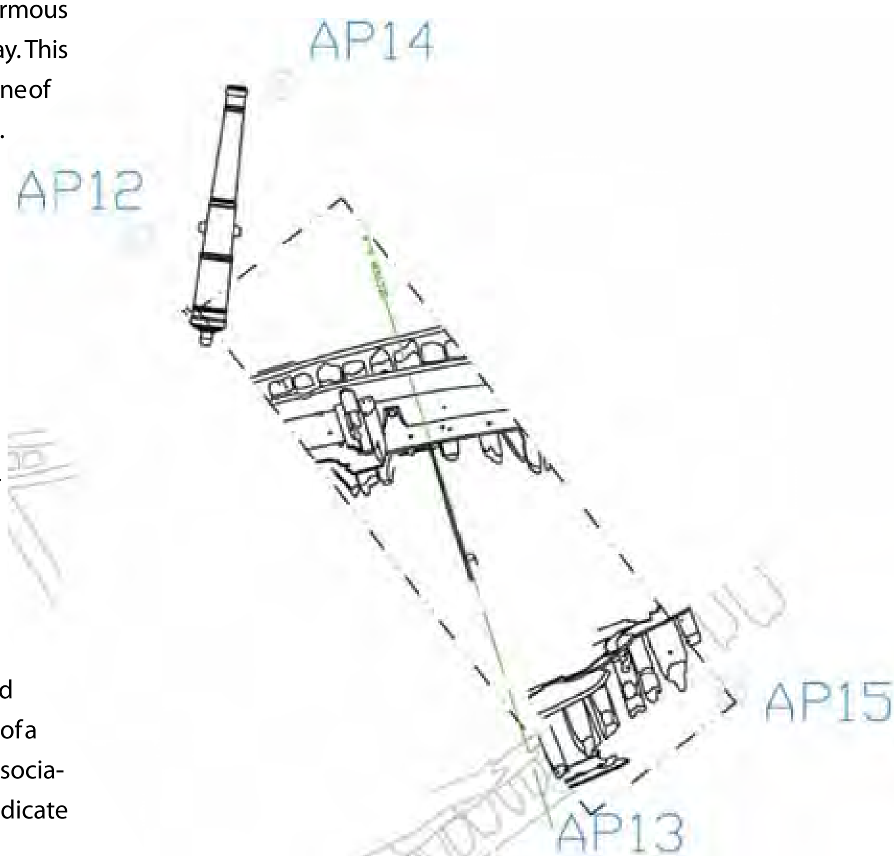


Figure 3.18: The stern trench showing the ship's structure

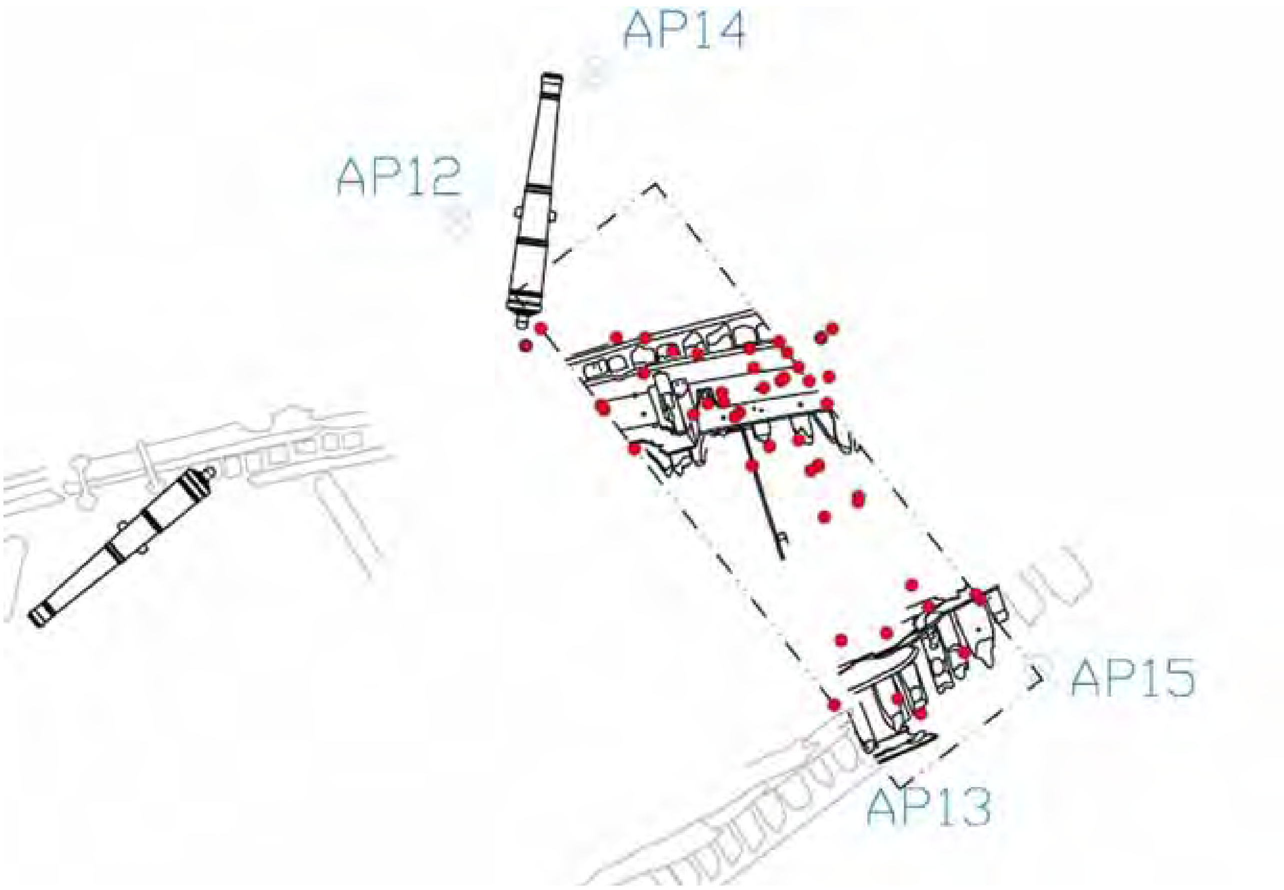


Figure 3.19: Stern trench plan showing distribution of artefacts

The more comfortable circumstances for the officers in this part of the ship were reflected in luxury items like a candlesnuffer, candlestick and some porcelain that were clearly personal belongings and not official trade items. Around 1659, when the Avondster sank, most of the trade in ceramics and porcelain was concentrated between Japan and Formosa to Batavia and from there to Holland, with another flourishing trade between VOC posts in Asia. Galle was one of the most important VOC trade posts, but its role in the ceramics trade was mainly trans-shipment. Chinese porcelain arrived there via Formosa or Batavia and was shipped mostly to Surat in India and to Mocha and Gamron in the Middle East. Only occasionally was porcelain ordered for consumption in Galle:

Figure 3.20: 99-GHL-027 Antler.

> 'On April 23rd (1645) the Governor of Ceylon had the rest of the cargo not in demand on the Malabar Coast, including some 1400 pieces of porcelain, taken from the VOC-ship Arent for the use of the garrison at Gale.' (Volkert 1954. p. 97).

Such luxury items would not have been restricted to the officers as wealthy local people would also have used Chinese porcelain. Their preferences were different from those in Holland and can be seen in sherds from Galle Harbour and antiques in the local shops. The few pieces of porcelain from the Avondster site appear to be personal belongings as they are individual pieces and no evidence of 'sets' such as dinner services was not found. Most sherds belong to small teacups and simple bowls. Only a few fragments of plates have been found. An ornate copper alloy spoon with a barley-twist handle and a decorative 'horse hoof' shaped at the tip was found (Figure 3.22). It is identical to one (GT3019) found on the Vergulde Draeck (1656) (GT3019), described in WA Museum interpretation as 'the most ornate spoon recovered from the Dutch wrecks (in Australia)' The distinctive 'horse hoof' at the end may be a symbol of a soldier or cavalry regiment, or could have been put to practical use for mixing and grinding small amounts of paste on the manuport (rock grinding base) or similar. Other theories for the distinctive

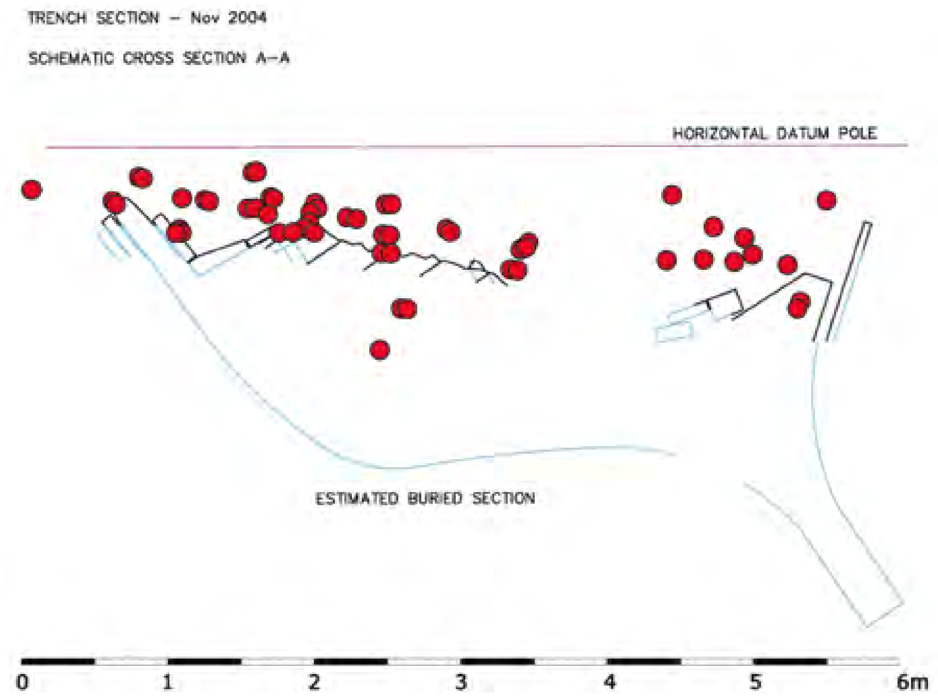


Fig 3.21: Elevation of stern trench showing distribution of artefacts

shape of the handle end were that it could be used as a tongue depressor or to help inhale medicinal powders through the nostrils (see the Avondster Artifacts Catalogue).

The excavation in the lower section of the stern uncovered possible remains of the constable's workshop. The remains of the early mentioned wooden workbox with leather straps suggest that it may have belonged to the constable, who was responsible for all firearms and ammunition on board. Visible in the concretion are a priming pin, used to probe and clean the touch-hole of a firearm and to pierce cartridges, the handles of some tongs or scissors, the wooden handle of another tool, a musket ball, and some copper wire. Leather straps and buckles of different sizes were found in the same area, and may have belonged to a cartridge belt or similar item. A fragile, soft and eroded wooden cylinder, approximately 150 mm long and with


Figure 3.22 Spoon in-situ on the wreck

a 12mm diameter, was found associated with (fitted into) a flat piece of timber hollowed along its length on one side to the same dimensions as the rod. The artefact has fine grooves along its length that may have been natural or worked. A similar object is described as a cartridge mandrel in the Hollandia Compendium that states its purpose: 'Cylindrical palm-wood rods on which the cartridges for the handguns are rolled. The lower end of the cartridge mandrel is hollowed out to take the ball when making live cartridges. A brass cylinder is used with the mandrel which is pushed over to make the cartridge' (Gawronski et. al. 1992, p. 186).

A stone manuport and grinding stone were found associated together with the leather belt caught around and under it. The manuport is a slab of of heavy, grey coloured fine-grained rock believed to be basalt. The base is 26cm square and approximately 6-7cm thick. There were circular grinding wear marks on the flat side of this slab. The associated grinding stone was one half of a split river-worn boulder or cobble, perfectly flat on its split base. It seems likely to have been used for medicinal purposes such as grinding pastes, ointments, preparations, herbs etc. Mortars and pestles are known to have been part of the equipment list for apothecaries on VOC ships though such an item has not been located on the Avondster. It seems most likely from its association (with the drug jars and antler) that this artefact was used for preparing medicines.

The cannons represent the military function of the ship. One cannon was raised and is currently in conservation. During conservation treatment of the cannon, a cannon ball and the remains of the wadding and powder bag were found inside the bore. A collection of cannon balls and a grenade was also found in the bow. In the stern section a reasonable quantity of shot was found. Lead shot could have been used for a handheld firearm like a pistol, carbine or musket. It could also be packed in a bag or wooden canister and fired from a cannon. Two canisters of shot have been found on the Avondster, as well as quantities of loose shot. Shot bound with copper wire has also been found, both loose and in the canisters. These were very effective in cutting rigging and wounding people. The excavation of a set of nested cup-weights demonstrates the trade and commercial functions of the ship. The container is similar to one found on the Batavia (1629) (Figure 3.23 & 3.24).

Figure 3.24 nested weights Batavia (1629)

Figure 3.23: Two photo's of nested cup-weights Avondster

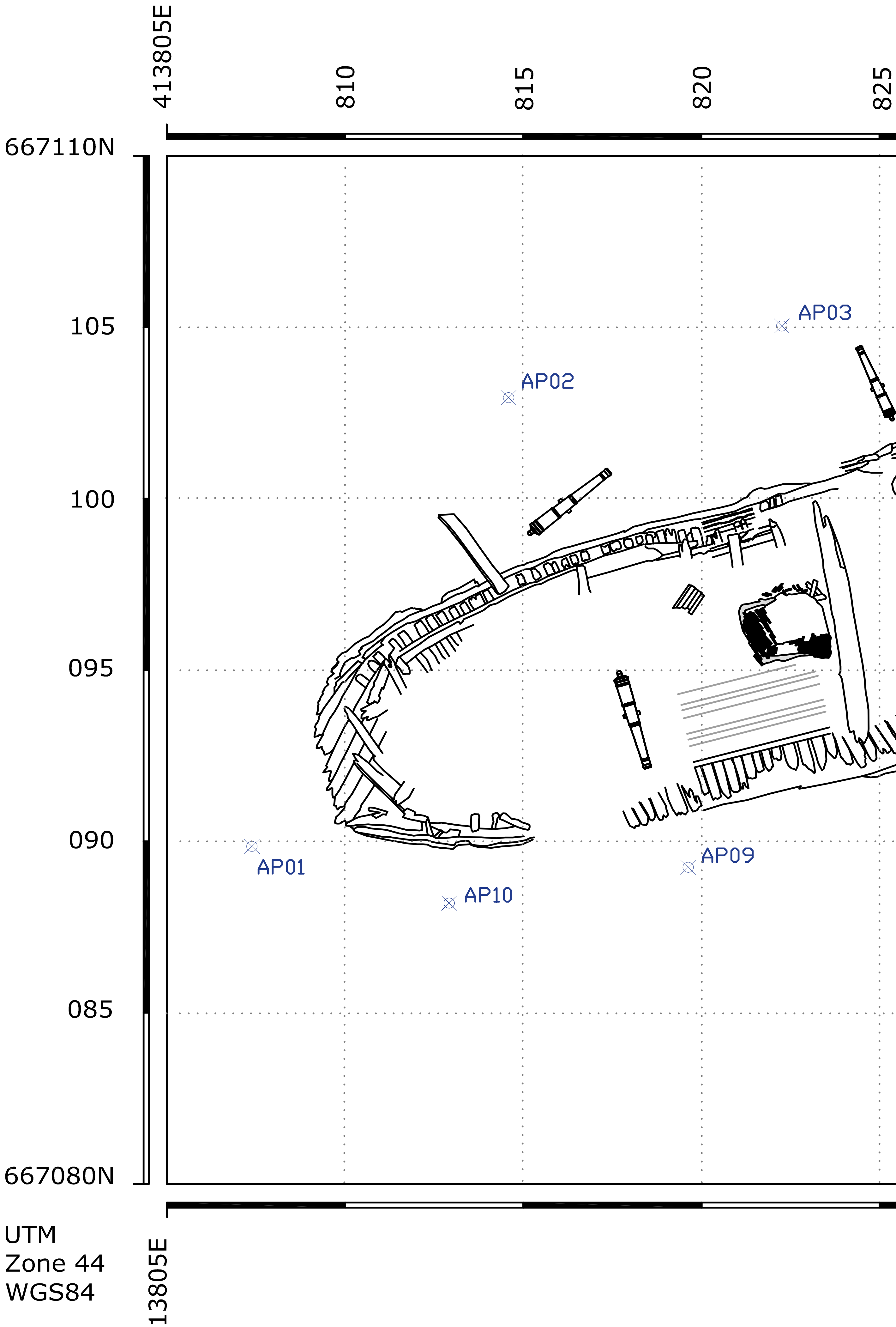
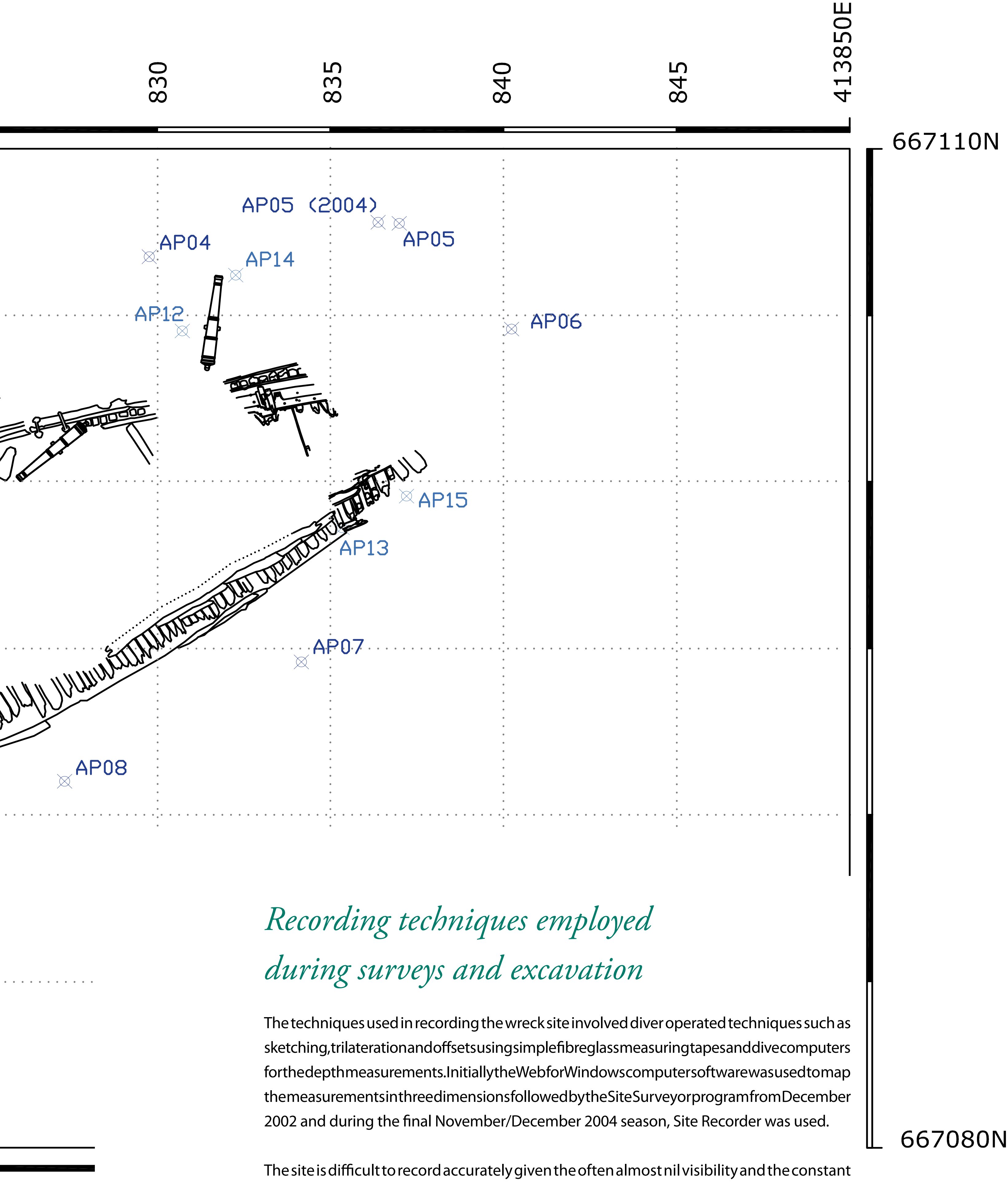


Figure 3.25 Final site plan 2005



Recording techniques employed during surveys and excavation

The techniques used in recording the wreck site involved diver operated techniques such as sketching, trilateration and offsets using simple fibreglass measuring tapes and dive computers for the depth measurements. Initially the Web for Windows computer software was used to map the measurements in three dimensions followed by the Site Surveyor program from December 2002 and during the final November/December 2004 season, Site Recorder was used.

The site is difficult to record accurately given the often almost nil visibility and the constant swell. Photographic techniques, such as photomosaics and photogrammetry were not practical given these conditions. When the measuring tapes were being used, constant monitoring had to be employed to ensure that they were straight and not being greatly impacted by the swell or that they were not caught-up on some feature. Measurements had to be repeated to ensure accuracy.

Site Surveyor is a software program specifically designed for underwater archaeological surveying. Any feature of the ship, such as structures or artefacts, can be mapped or recorded. Measurements acquired from numerous techniques can be used such as: measurements from measuring tapes (using trilateration, triangulation, ties or offsets) in association with a recorded depth (from a dive computer), or measurements taken with acoustic measuring systems. The measurements are entered into the program which interprets the data to determine the best fit for each point. Ideally measurements should be taken from at least four control points to ensure the highest level of accuracy. In 2004 Site Surveyor was extended to Site Recorder, a program which includes drawing base maps, artefact catalogues, dive logs and other functions all within the one program (www.3hconsulting.com)

Final site plan developed by Site Recorder

During the final season, U.K. maritime archaeologist Kevin Camidge joined the team. His task was to consolidate and check previous survey data (primarily the data used in the Site Surveyor computer program) against new survey data as it was acquired during the 2004 season, and to develop a site plan using Site Recorder. GPS coordinates were taken of two AP and used to place the wreck site into the worldwide UTM grid and this was incorporated into the final site plan developed in Site Recorder. A number of site plans were compiled by Kevin Camidge from the many measurements taken by the MAU and foreign team and have been shown in this report. A final site plan can be seen in Figure 3.25 together with a hypothetical overlay of the ship and the remaining ship's timbers

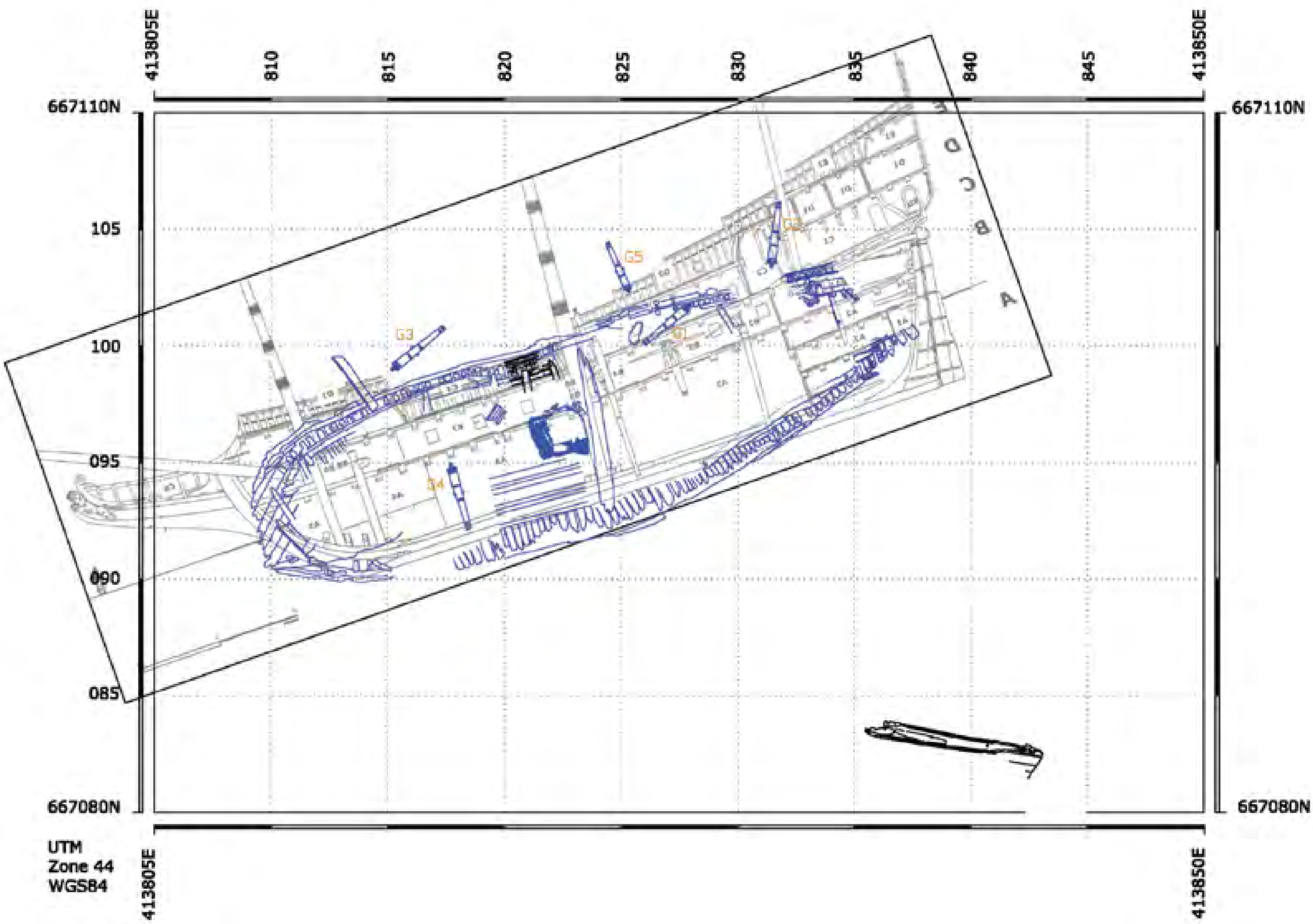


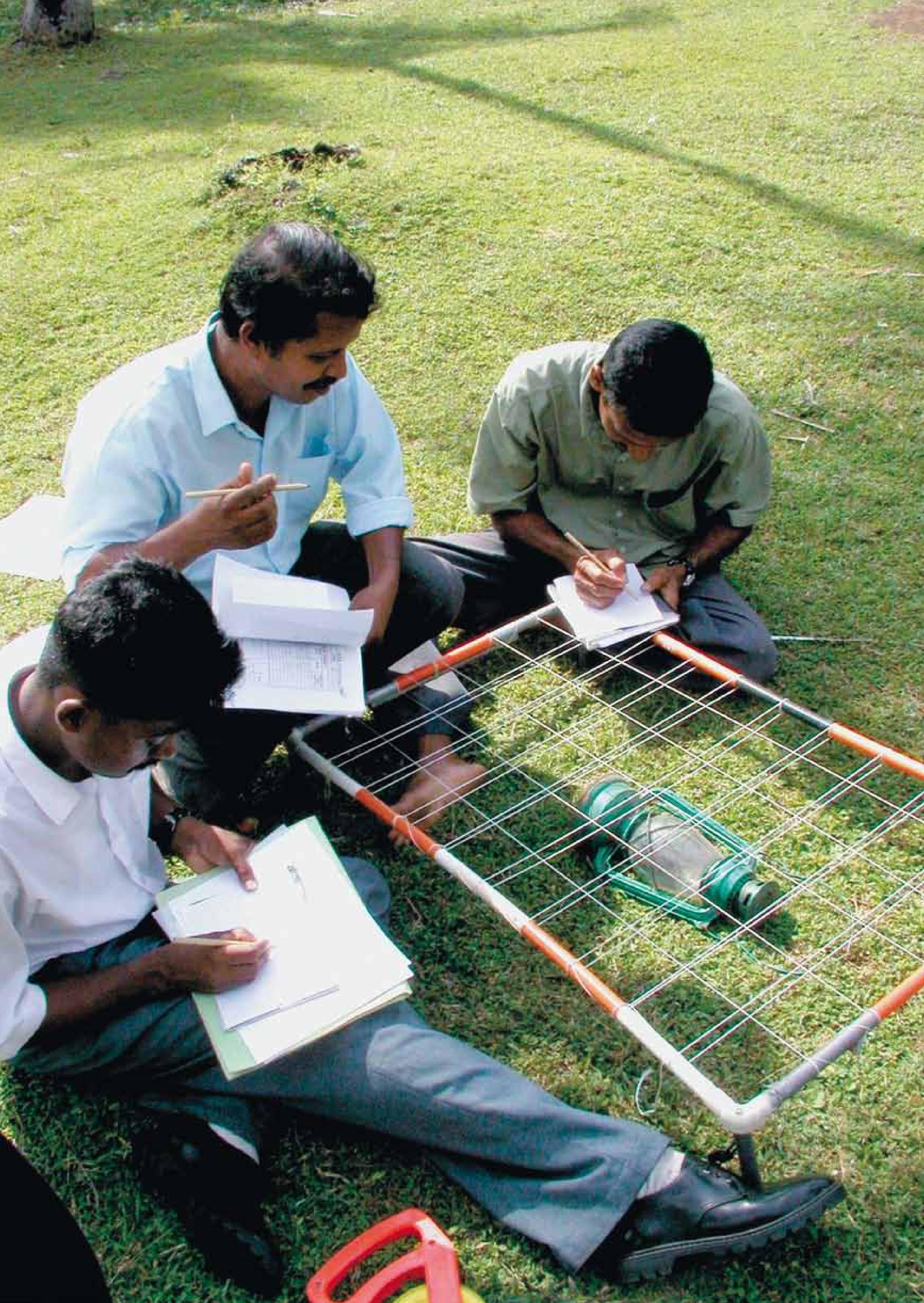
Fig. 3.26 Final Site Plan overlaying a hypothetical section of the ship

Conclusions and discussion

The hypothesis formulated at the time of the first survey (see chapter 1) has not been supported by information revealed by subsequent surveys of excavation. The wreck leans much more on one side than was previously suspected. It seems likely that the account of the Avondster breaking up after it run aground must be referring to the breaking of the sternpost, causing the jacht to sink immediately and the disintegration of the superstructure caused by the forceful swell on the shore there during the SW monsoon.

The shipwreck site is greatly impacted by a regular small swell which picks up the coral sediments and greatly reduces visibility. It is also located adjacent to a large storm-water drain which, when it rains, greatly contributes to a reduction in visibility. The continual movement underwater and poor visibility make this site difficult, but not impossible, to work. Significant progress was made in the practical training of the Sri Lankan team in both archaeological and conservation systems and work practices. The team assumed responsibility (under supervision till the end 2004 from a chief archaeologist: in March 2002 Michael Nash, Cultural Heritage Branch, Tasmania, then Martijn Manders, NISA, Netherlands, from November 2002 till November 2003; later Bill Jeffery, James Cook University, Australia, from November 2003 to December 2004) for the organisation of the practical excavation tasks and were stimulated to record the results of their work, some of which be seen in Chapter 8. As a number of other archaeologists, photographers and skilled personnel from within Sri Lanka and abroad contributed to the many aspects of this work, this report therefore needs to be seen as the culmination of the work of many individuals and organisations (see list of participants).

The excavation and site work produced much information on the construction and shape of the ship and the material culture (about 3,000 artefacts). These are discussed in separate Avondster Artefact Catalogue. Many artefacts encountered amongst the exposed timber structure and recovered were later identified to be from a more recent time-period. A number of more recent pieces of material culture, such as plastic toy cars (Volkswagen), chicken feet, plastic bags, garment manufacturing fragments, fibreglass remains of today's fishing fleet were also often encountered. This complexity of material culture from today back to the 17th century puts a new meaning on what some archaeologists call a shipwreck: a 'time-capsule.' In the very bottom of the ship, intact sections of construction timbers and artefacts were found in amongst undisturbed contemporary sediments. As less then 30% of the Avondster site has been excavated the site has the potential to answer further questions and reveal more information about this important phase in the Sri Lankan and Dutch history. The analysis carried out on the artefacts recovered to date provides directions for further work. The use of different theoretical frameworks to extend research into other areas, such as the impact of Dutch trading activities on the Sri Lankan ways of life. The country now has an experienced group of Sri Lankan archaeologists and conservators (the MAU) that can develop this and other lines of inquiry.



4 Maritime Archaeological Conservation in Sri Lanka

Introduction

As in many countries, archaeological investigations in Sri Lanka have traditionally focused on terrestrial sites, with Sri Lanka's rich history and culture typified by the myriad of highly significant historic and archaeological sites in the 'cultural triangle' region associated with Kandy, Sygiria, Anaradhapura and Polonnaruwa. Conservation practices in Sri Lanka focused therefore on the treatment and stabilization of artefacts and monuments excavated from these and other significant terrestrial sites.

Thus, despite Sri Lanka's fascinating pre- and post-colonial maritime history, maritime archaeological investigations have been extremely limited in both their number and scope. As a consequence there was neither maritime archaeological nor maritime archaeological conservation expertise available in the region until the early 1990s. At that time, this situation was discussed during meetings between Australian and Sri Lankan institutions. In 1992 representatives from the following Sri Lankan bodies: the Postgraduate Institute for Archaeology, the Central Cultural Fund and the Maritime Heritage Trust met with representatives from the Western Australian Museum and the Indian Ocean Centre for Peace Studies (University of Western Australia). An agreement was made to set up the joint Sri Lanka-Australia Maritime Archaeological Research Program. This 1992 commitment initiated the nation's fledgling Maritime Archaeology program, a program that steadily evolved until it accelerated and developed more systematically during the Avondster Project.

Training Programs

From the program's inception dual sub-programs operated concurrently, with experienced maritime archaeology and maritime archaeological conservation consultants working with their Sri Lankan counterparts to build upon background knowledge and experience in their respective fields. One of the primary aims was to provide the knowledge base that would allow a Sri Lankan team to take charge of maritime archaeological operations and conservation. The broader aims of this first foray into maritime archaeological activities and training were wide-ranging and in addition to the provision of training opportunities, involved the investigation and assessment of possible maritime archaeological sites in Galle Harbour. Initial training reflected the modus operandi of staff from the Western Australian Museum; that is, maritime archaeologists and conservators working together to gain maximum information from shipwreck sites and excavated artefacts. By developing the skill base of Sri Lankan conservators and also by providing diving training it was hoped that eventually, diving conservators would be able to accompany maritime archaeologists into the water to monitor shipwreck environments, advise archaeologists on the condition of artefacts in-situ, assist with recovery of artefacts from shipwreck sites and finally to stabilize and conserve recovered artefacts in the laboratory.

Figure 4.1 Lifting of the anchor March 2002

Figure 4.2 Training NAS course 2003

The program commenced in 1992 in Galle with a series of lectures and workshops given by staff of the Department of Materials Conservation of the Western Australian Museum to a group of 10 Sri Lankan conservators, with varying levels of experience, led by Mr Senarath Lithypatharana, Head of the Conservation Facility at Anaradhapura. Lectures focused on theoretical aspects of materials degradation in marine environments and treatments used to stabilise artefacts recovered from these environments. Illustrated presentations, lectures and tutorials on conservation covered all material types that were commonly encountered on shipwreck sites with practical sessions based on artefacts recovered previously from Galle Harbour by the Sri Lankan Sub Aqua Club (predominantly ceramics). Initially some problems were encountered due to language and translation difficulties, difficulties that obviously hindered a more complete understanding of the content of lecture and tutorial presentations.

From 1992, training was provided during each fieldwork season, with the content largely dependent on the skills and backgrounds of visiting consultants. During several expedition seasons the conservators, supported by a program of lectures, gained knowledge and hands on experience with a variety of salt affected, waterlogged and corroded materials. Early training programs focused on passing on knowledge about material types, deterioration mechanisms in marine environments, standard treatments and in-situ monitoring of shipwreck environments and artefacts. While training opportunities were provided during each of the work seasons from 1992 to 2000, there was no overall training program to which consultants adhered. This ad hoc approach to training, while not ideal, still contributed to a progressive improvement to the skill levels and awareness of the subtleties of maritime archaeological conservation for the Sri Lankan participants.

As conservators are in high demand in Sri Lanka, continuity of training was also an issue. The same group of conservators was rarely available to undertake training during successive visits by the conservation consultants. As a result, few Sri Lankan conservators were exposed to all training programs or did they all gain the benefit of being able to take part in programs that would have reinforced earlier learning.

The advent of the Avondster Project, combined with continuing improvements in the available infrastructure (facilities, equipment and treatment chemicals) also saw a change in the approach to training taken with the Sri Lankan team. While the preceding years had seen a more formal, but somewhat ad hoc approach to training, excavations associated with the Avondster Project meant that a more systematic approach had to be adopted with respect to artefact treatments, in conjunction with more practical, experience-based training that utilized the increasing number and diversity of excavated artefacts. In effect, visiting consultants worked alongside their Sri Lankan counterparts, with demonstration-based rather than formal learning being the norm. The pool of international conservation consultants was also widened to include representatives from various institutions and countries including the Netherlands, Mexico and Australia.

The increased numbers of artefacts recovered from the Avondster also meant that artefact management procedures needed to be re-examined. During the Avondster Project consultants worked with the Sri Lankan team to broaden their skills into areas other than purely the assessment of deterioration of artefacts and associated treatments. Specifically consultants provided assistance in the following areas:

- preventive conservation and storage issues
- chemical handling and solution preparation

- artefact management and prioritisation of treatments
- treatment systems for handling large numbers of finds
- laboratory procedures including documentation of artefacts and treatments
- consultations with archaeologists to improve communication and teamwork
- ensure that the most appropriate treatments outcomes resulted from conservation processes
- development and maintenance of a professional library
- accessing information, in particular on-line sources
- assessment and interpretation of conservation literature

To support conservation staff in their efforts to adapt to more stringent laboratory practices and procedures, consultants produced many documents to assist in the adoption of appropriate collection and conservation management procedures. Documents covered issues such as pre-treatment communication with archaeologists, laboratory organisation, conservation procedures (including artefact processing) and treatment proposals, treatment records and documentation (including standardized treatment forms for group and individual treatments, labels for treatment containers), guidelines for treatments (including desalination, iron removal and impregnation) and storage recommendations for completed artefacts. Many of these individual documents have been incorporated into a treatment manual Procedures for the Treatment of Marine Archaeological Materials (Godfrey and Carpenter, eds, 2005) that describes specific treatment recommendations for artefacts excavated from the Avondster.

Development of Conservation Infrastructure

During the early stages of training no conservation facilities existed in the Galle area and programs were conducted at the consultants' business base – the hotel Nooit Gedacht. At the close of each work season (usually one per year) artefacts were transferred to the conservation laboratory in Anaradhapura and/or relocated to the Archaeology Department building within the Galle Fort. The Anaradhapura laboratory was an appropriate storage facility with a good environment and with the equipment and facilities needed to ensure continuity of conservation treatments. It was however, too distant from Galle. Storage in the Galle Fort on the other hand, while convenient, was only appropriate for short-term usage as the environment was unsuitable and the facilities were inadequate for continued conservation treatments.

In 1996 concept plans were prepared for a purpose-designed conservation laboratory to be based in an existing building located in Galle. The plans, formalized in the document, 'A Maritime Archaeological Conservation Laboratory in Galle, Sri Lanka' (Carpenter, 1996), was prepared in response to the likely use of a building situated in Galle Harbour, for the conservation facility. This building, situated on a jetty, while very convenient for archaeological investigations of the harbour, posed some difficulties with respect to artefact conservation due to the ingress of salt laden air.

The laboratory plan provided information on how the building could be modified to take into account the projected uses, essential requirements such as security for the collections, details concerning conservation procedures and equipment, chemicals (including approximate quantities) and safety requirements, staffing and professional development, advice regarding public awareness and access, recommendations regarding monitoring of the storage spaces and stages in the progressive development of the laboratory.

This building was renovated, and a facility for the newly formed MAU opened in 2001. The MAU opened with four main work areas: an air conditioned office and instrument room, a dry lab for conservation treatments and temporary artefact storage, a wet lab for conservation treatments and artefact registration and a maritime archaeological store and workshop. Fitting out and the effective use of the areas in the building evolved over the years.

The laboratory's first large storage tank was built on the platform at the seaward end of the jetty, the only accessible space that also allowed for relatively easy handling of large objects. In 2002 a bunded, steel storage tank was acquired and located on land adjacent to the laboratory.

Although the humid, salty, corrosive air had been identified as a potential problem for treated artefacts, its impact on laboratory equipment was a more immediate problem. Corrosion and subsequent breakdown of vital electronic equipment such as the chloridometer, was one of the driving forces behind the installation of air-conditioning in the office area. This space then provided an appropriate environment for computers, cameras and other valuable electronic laboratory equipment. Access to internet and to email via the office computers was a considerable boost to the team. Reference materials were easier to access and conservators had good access to international consultants during the intervening periods between expedition seasons.

Up until 2001, the Western Australian Museum had provided the bulk of the consultants who had supported the operations of the maritime archaeology and conservation programs. With the commencement of the Avondster Project, fieldwork seasons were extended to twice yearly, increasing the contacts between archaeology and conservation consultants and their Sri Lankan colleagues. This doubling of the contact between the consultants and the local team resulted in an inevitable scaling up of operations and the need to re-assess operational matters, in particular collection and laboratory management issues.

A general scaling up of operations also led to extra pressures on the existing infrastructure and to the increase of health risks of the conservation and maritime archaeology staff. Increased numbers of artefacts placed increased pressure on conservation procedures, treatment and storage spaces, larger quantities of chemicals meant that compliant storage facilities had to be established, greater demands were placed on the supply of low salt, fresh water and larger quantities of aqueous treatment solutions provided increased breeding opportunities for mosquitoes. Some staff members were severely affected by dengue fever, most likely due to the large numbers of mosquitoes present in the laboratories. Most of these issues were able to be overcome in the short term, with the conversion of a sea container into a segregated chemical store, the purchase of lockable metal cupboards to replace the inappropriate wooden ones for the storage of treated artefacts and more stringent sealing of aqueous containers and the implementation of better pest management practices to restrict mosquito breeding in the laboratory.

Figures 4.3 a-f   The Avondster conservation lab with desalination baths, dry and wet sections and chemicals for treatments.

A reduction in the number of conservators available to work on the maritime archaeological collection and delays in the delivery of chemicals and equipment also affected operational efficiency. In 2001, six conservators were engaged to work on the maritime archaeological collection, the number dropped to the equivalent of a full time conservator in early 2004, with only one full-time conservator and 2 part-time conservators available to work on a collection that was increasing with each excavation season. This cut in staff and the loss of trained and experienced conservators led to obvious delays in the implementation of treatment regimes.

Despite the problems outlined above, the operations of the MAU conservation team continued to steadily improve over the period of the project, together with gradual improvements in every aspect of the associated infrastructure.

Conservation Practices

Prior to the Avondster Project conservators were able to operate in much the same way as they had when working previously with terrestrial finds, that is, work on one object until its treatment was finished and then move onto the next object. It is essential however, that a different mindset and approach is adopted when working with artefacts from marine environments, something that had not been emphasized previously to the Sri Lankan team. The types of treatments involved, particularly those involving desalination, iron removal and impregnation with consolidates means that artefacts may be in treatment solutions for periods ranging from months to years. It is important therefore for treatments to be initiated for all excavated artefacts, for these treatments to be monitored closely, for solution changes to be made when necessary and treatments terminated when monitoring indicates this to be the case.

In many cases, following an assessment of their respective conditions, artefacts could be grouped together and treated as one batch. Concurrently, treatments could be initiated for other groups or individual artefacts. These types of operations meant that the work of the laboratory had to be well coordinated, that all conservators had to work as part of a team, that chemicals needed for treatments were available when needed and that infrastructure and equipment were available and functioning. Unfortunately many of these criteria needed to ensure that conservation operations proceeded smoothly were not always followed up. Problems occurred in the delivery of chemicals, in the corrosion and malfunction of laboratory electronic equipment in a humid environment and with a reduction in the numbers of conservators available to work on the collection.

Conservation Processes – an introduction

Following established procedures, artefacts are received into the laboratory, registered and incorporated into the Conservation Register, assigned to conservators for treatment and appropriately stored, initially, either in sea-water or fresh-water. Artefacts are treated either individually or in groups of similar objects. After assessment of their condition artefacts are documented and proposals are written for their conservation. Taken into consideration are the materials and chemicals required, chemical disposal and requirements for packing and storage. Containers, treatment solutions and supports for fragile artefacts are then prepared and active treatment is commenced.

Conservation treatment of maritime archaeological artefacts typically consists of desalination, with additional actions such as deconcretion and consolidation commonly carried out on inorganic and organic material. A treatment report is updated throughout the process, recording details of the condition of the objects before and after treatment, a short description of their technology and full details of the treatments carried out.

Conservation of inorganic materials: Ceramic, Stone & Glass

Ceramic and stone being porous materials, contain residual salts absorbed from the marine environment. Post-excavation deterioration of such artefacts is mainly due to salt damage, caused by the crystallization, often repeated, of soluble salts. In the case of glass objects, soluble salts as well as the continued presence of moisture, contributes to their deterioration. Treatments aim at desalinating these artefacts before drying.

While most shards of ceramic and glass and fragments of stone were organized into groups and desalinated by immersion in baths of fresh water, some artefacts were treated individually. The concentration of chloride ions in the rinse solution was monitored, with desalination considered complete when levels had stabilised at 10 parts per million (ppm) or lower.

Case Studies

Beardman jug (02/GHL/161)

A complete Beardman jug with its original cork stopper intact was found close to the galley area, together with a similar jug (02/GHL/160). The stoneware jug had one mask on the neck, a slightly irregular shape, an uneven brown glaze and was of medium height (155mm). The cork appeared to be in sound condition except for some soft areas.

The cork was removed and the contents, a clear liquid with a slight smell, were recovered with a sample retained for future analysis. Desalination of the jug and cork was carried out separately in fresh water.

Storage vezel (98/GHL/11)

About 37 shards of a large storage jar, including the base and rim, were excavated in 1998. Evidence of the clay-coil technique of manufacture was visible on the inner surface. The upper portion and outer surfaces had a blackish-brown glaze. The exterior and interior surfaces were covered with iron stains and deposits. The body of this ware also contained a high proportion of iron inclusions.

One of the guiding principles of artefact conservation is to stabilise artefacts using processes that involve minimum intervention. Restoration techniques may be carried out for many reasons, one being to assist in interpretation of an artefact. As this item was selected for display in the new National Maritime Museum

Figure 4.4 (a-e:) Removal of cork and decanting of contents from beardman jug (02/GHL/161)

it was decided that, in addition to desalination, this vessel would be reconstructed, with the concretions removed and the iron staining reduced.
Marine encrustations were removed mechanically, using wooden sticks and dental picks. The shards were desalinated in baths of fresh water, while the chloride levels were monitored. The shards were removed and air-dried in 2002 when no chlorides were detected in the desalination baths.

Tests were conducted to determine the best method of removing the iron stains. Several shards were immersed in a solution of sodium dithionite (2%) /ammonium citrate (2%) in tap water for approximately two weeks. They were then removed, brushed with soft brushes, rinsed with distilled water and left to air-dry. It was estimated that 75% of the stains were removed in this manner. The black shiny glaze became visible, the colour of the ceramic body changed from a reddish-brown to an ash brown colour and the exposed edges of the shards were an ochre colour. One shard was therefore cleaned further, using wooden sticks and soft brushes to remove the iron deposits, followed by swabbing with ethanol. Mechanical removal of the stain in this way was successful on the glazed surface, which was clearly visible. On the edges of the shards, the ochre colour was removed and an ash-brown coloured ceramic body was revealed.

Another test was conducted using a separate shard that was sectioned into four areas, three of the sections were treated with different solutions viz. ethanol, ethylenediaminetetra-acetic acid (EDTA, 5%) in deionised water and triammonium citrate (5%) in deionised water while the fourth was left untreated for comparison. Cotton wool swabs and soft brushes were used to assist in the removal of the stains. Whilst iron deposits were removed, there was little change in the appearance of the glazed surface.

Of all the tests, the best results were obtained with the sodium dithionite/ammonium citrate treatment. It was considered too harsh however, causing unacceptable colour changes to the ceramic body. It was decided to continue cleaning with ethanol and mechanical methods only as this method was the least interventionist but still reduced the surface iron staining. Although the vessel was due to be reassembled after stain removal, this was not possible due to the loss of the majority of the shreds in the Tsunami of 2004.

Figure 4.5 Desalination of ceramic artefacts

Conservation of Inorganic Materials

Metal Artefacts

Chloride ions, in the presence of water, are one of the major corrosive and destructive elements of the burial environment, especially where metal artefacts are concerned. The main aim of the treatment of metals is to remove the chloride ions and thereby prevent further corrosion reactions from taking place. This is usually achieved by storing the objects in appropriate chemical solutions, which arrest further corrosion whilst diffusion of the chloride ions takes place. With some chemical treatments, the reduction and dissolution of corrosion products on the surface of the object accelerates its desalination.

Desalination treatment involves monitoring the chloride ion concentration of the treatment solution using either instrumental (e.g. chloride meter) or wet chemical techniques. Desalination relies on chloride ions diffusing out of the artefact into the wash solution. The chloride levels are monitored over time and desalination is considered complete when the chloride ions remain at a consistently low level. The final level varies from material to material.

Lead and Pewter artefacts

Lead artefacts recovered from the Avondster site included musket balls, sheets, pipes, sounding weights and lead sheet – commonly used for minor repairs to a wooden hull. These artefacts were covered with a thin layer of concretion, composed of a mixture of marine seabed debris and lead corrosion products held together with calcareous (calcium carbonate) cement (North and MacLeod, 1987).

Spoons, mugs and other objects associated with life on-board ship are more likely to be made of pewter, an alloy containing lead and tin. The pewter finds of the Avondster were well preserved, probably due to the formation of an adherent and protective layer of surface corrosion.

To allow detailed study of the metal surface of a selection of artefacts, de-concretion treatments were carried out. After de-concreting, it is essential to protect the exposed metal surface with a coating as lead and its alloys are very susceptible to corrosion caused by organic acid vapours. These vapours are present in the atmosphere as by-products of the deterioration of organic materials. Wood and paper are common sources of these acids and storage near these materials is avoided.
Other lead items were rinsed, cleaned and air-dried before being placed into monitored storage.

Case Studies

Pewter spoons

The protective layer of corrosion and concretion on the spoons were removed by a combination of mechanical and chemical methods. Initial cleaning was carried out with a scalpel and dental picks, taking care not to damage the very soft metal. The artefacts were further treated with alkaline dithionite, a chemical that desalinates as well as removes the remaining concretion and corrosion products. Artefacts were placed in a solution of sodium hydroxide (2%) / sodium dithionite (2%) in tap water. As sodium dithionite oxidises in contact with air, the container must be airtight for the solution to remain effective; a well-sealed lid or layer of paraffin on the solution surface is usually sufficient. After two weeks, the reduced black corrosive products that had formed on the object were removed by brushing the surface with a detergent and fine abrasive powder. Finally, the cleaned and dried metal surface was protected with a coating of 'Becketts Archival Ferrous Polish' (microcrystalline wax in white

Figure 4.6 Mechanical cleaning of pewter spoon (03/GHL/234)

Figure 4.7 Pewter spoon, showing the maker's mark. (03/GHL/234)

spirits). After polishing and applying a wax layer the metal surface was left with a slight shine. The labelled artefacts were stored in well-sealed polypropylene plastic containers that helped to protect the conserved items from organic acid vapours present in the existing storage environment.

After treatment of the spoons, a maker's mark could be examined in detail on the inner surface of the bowl close to the point of attachment with the handle.

Copper alloy objects

Objects recovered from the Avondster, included various forms of lighting equipment such as an oil lamp, candle stand and holder, candle snuffer, as well as sheeting fragments, bolts and wire.

Copper alloys are toxic to marine organisms, inhibiting their growth and reducing the formation of marine concretions. Where concretions do form under aerobic conditions, they can incorporate calcium carbonate, calcareous deposits from molluscs, worm-casts and sand.

Two main methods were used for the desalination of copper alloy artefacts, either sodium dithionite/sodium hydroxide solution or sodium sesquicarbonate solution. Using the former solution, all concretion and surface corrosion can be rapidly removed, leaving the treated metal with a slight grey colour. The second method is much slower, taking place over a number of months, but the artefact retains all concretion and surface corrosion layers. The process requires little maintenance, the chemicals are safer and with this method the

Figure 4.8 Pewter spoon after treatment (03/GHL/234)

treated artefact develops a green colour. The choice of treatment method was determined by the nature of the individual artefact and the desired treatment outcome.

Typically, small decorative items with minimal loss due to corrosion or concretion layers were treated with the dithionite method, principally due to the speed of the process and the level of surface detail that can be revealed.

Iron artefacts

As iron corrodes in seawater nutrients are released that provide food sources for surface-colonising marine organisms. Concretion, composed predominantly of calcium carbonate, is formed due to the build up of skeletal materials from these organisms (North and MacLeod, 1987). Typically, iron artefacts were de-concreted using hand-tools followed by desalination in a sodium hydroxide (2%) solution. Iron artefacts recovered from the site ranged from numerous iron concretions to large finds such as an anchor and a cannon.

Case Studies

Cannon balls

About fifteen cannon balls of varying diameters were excavated in 2001, de-concreted and then desalinated as a group in sodium hydroxide solution (2%). A casting seam, which is a raised line formed as a result of casting the ball in a two-part mould, was noted on a number of the cannon balls. Desalination in sodium hydroxide solution is a slow process that typically takes a number of years. Of all treatments currently used for small, salt-laden iron artefacts, this was deemed the most appropriate for the artefacts, facilities and staff currently available at the MAU.

Anchor (02/GHL/187) and Cannon ((02/GHL/175)

As it is difficult to remove chlorides from large iron artefacts by soaking alone, one of the most efficient methods to extract chloride ions from iron is electrolysis.

In this process the artefact is placed in a conductive solution (usually 2% sodium hydroxide) and connected to an anode (sacrificial metal). A small external voltage is then applied to change some of the corrosion products to more porous states that allow chloride ions to diffuse more easily from the metal.

The cannon (02/GHL/175) and anchor (02/GHL/187) were laying adjacent to one another on the site, both covered in a thick layer of marine concretion, which had fused, joining the two items on the seabed. The anchor and cannon were separated and raised from the Avondster site in March 2002 and stored in temporary concrete tanks. In November 2002 the concretions were mechanically removed using hammers and chisels. Care was taken to keep both artefacts wet during this procedure by hosing them and covering with wet hessian sacks. Premature drying of the artefacts increases the corrosion rate and could cause loss of the corrosion layers and any information such as surface markings contained within them.

Figure 4.9 (a-d) Candle snuffer (03/GHL/244), Under water and stages of treatment(

The bore of the cannon had become completely plugged with concretion during its underwater burial. The bore was drilled out to reveal a cannon ball and the remains of wadding and powder. These items were removed and treated separately.

A steel tank with separate compartments was specially built for the treatment of the anchor and cannon. The anchor and cannon were both placed in sodium hydroxide solution (2%) and in March 2003 the electrolytic phase of the treatment commenced. Mild steel anodes for the cannon and anchor were manufactured in Galle. The anodes were designed to give even electrical coverage to all parts of the cannon and anchor so that the chemical reactions occurring during electrolysis were balanced.

When establishing electrolysis treatment, good electrical contact between the artefact and the power supply is essential. As the outer corrosion layers are not very conductive, holes were drilled into both the cannon and the anchor until the metallic core was reached. Threads were cut into the holes and stainless steel cathode rods were threaded and screwed into place. The cathode rods were connected to transformers located inside the air-conditioned area of the MAU.

A corrugated iron roof was erected over the treatment tank to prevent water ingress that would have diluted the treatment solution and altered the pH and chloride levels. A shade cloth curtain was placed around the sides of the tank to prevent leaves and other debris from contaminating the solution, and signs attached to alert passers-by to the presence and dangers of the alkaline solution.

The initial applied voltage was 1V, increased to 2V after 2 days. The low voltage level ensures that hydrogen evolution is kept to a minimum, as strong bubbling can worsen any cracks present in the artefacts. Samples of the electrolyte (2% sodium hydroxide) taken immediately before electrolysis and after 8 days showed a sharp rise in chloride levels, indicating the increased efficiency of chloride extraction with electrolysis treatment.

Initial estimates indicated that these treatments would be complete three years after their initiation (march 2006). Treatment was progressing well until the Tsunami struck the MAU. When staff were able to return the MAU they found the anchor and cannon still within their treatment tank, but the electrolysis equipment was lost and the electrolyte solution of sodium hydroxide was replaced with seawater. In March 2005, three months later, the container was moved to the new MAU facilities and the anchor and cannon were returned to a 2% sodium hydroxide solution. Desalination of these items still continues in a sodium hydroxide solution.

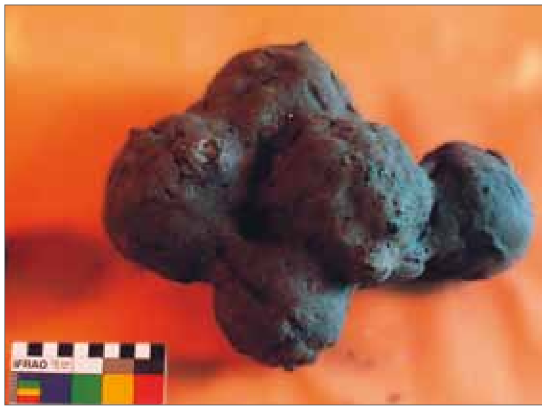


Figure 4.10 Deconcreting the anchor

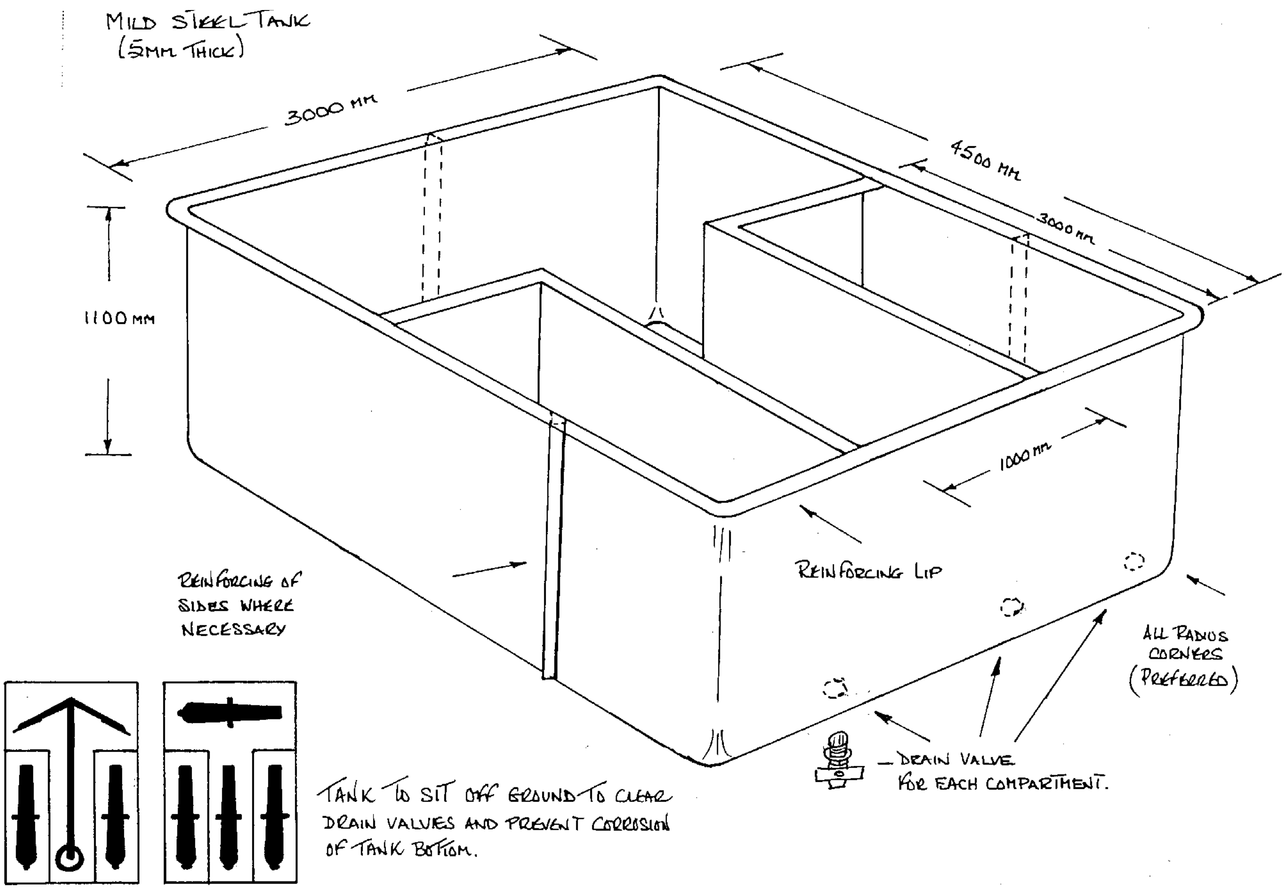
Figure 4.11 Cannon balls before decroncreting

Figure 4.12 Cannon balls after decroncreting

Figure 4.13 Deconcreting the cannon (02/GHL/175)

Figure 4.14 Removing the cannon ball and wadding from the cannon (02/GHL/175)

Figure 4.16 Placing the cannon on cradle and internal anodes for the electrolysis treatment of the cannon (02/GHL/175)



Fifure 4.15 Design of steel tank for treatment of the cannon and anchor

Conservation of organic materials:

Wood, Rope, Leather, Other Plant Material

Organic material survived on the Avondster site due to the natural process of bio-degradation by marine organisms and microbes being slowed by the anaerobic burial environment. Waterlogging does however degrade organic material to varying degrees. Distortion and disintegration in the form of shrinkage, cracking, splitting and crumbling of the fabric of the artefact is still likely to occur, especially in the drying stage of the treatment. Conservation treatments attempt to minimise this damage by progressively introducing consolidates into the porous artefacts. This is necessary because as organic materials degrade, the original components break down and are leached into the surroundings. Water takes the place of these components and temporarily supports their shape and structure. Without the incorporation of consolidates which displace this water and provide support for the original structures, these artefacts would suffer great damage when they are dried.

Case Study

Rope

Many pieces of rope were recovered, including a coil of cable laid rope (02/GHL/165), thought to be about 62m long. The rope was cleaned of soil and marine deposits by careful brushing and smaller sections of rope were then supported, by sewing them into a mesh "sausage" to prevent them from becoming entangled and to prevent loss of fibres during treatment. All rope was treated by immersion in an aqueous solution containing polyethylene glycol 400 (10% PEG 400) and ethulose (1%) with boric acid (1.4%) and borax (0.6%) present as a biocide. The duration of treatment, generally one to two months, depended on the size and condition of the rope. Although vacuum freeze-drying is the preferred drying method for treated rope, the best method available at the MAU was slow air-drying in a perforated plastic container. Other drying options typically used include slow drying at reduced temperatures in either a freezer or refrigerator.

Figure 4.16 Rope undergoing treatment with 'PEG 400'

Conservation of composite artefacts

Conservation of composite artefacts, such as those composed of metallic and organic components, is the most problematic aspect of maritime archaeological conservation. Chemicals that are used to stabilise one material can be damaging to another. For example, sodium hydroxide used in the desalination of iron is strongly alkaline and damages leather and wood while polyethylene glycol used for the consolidation of wood and leather is slightly acidic and accelerates the corrosion of objects containing iron and copper alloys. Alternative treatments, usually incorporating corrosion inhibitors must be used or, if possible, the different material components are separated and then treated individually. If separation of the components of an artefact is to be attempted, the conservator must carefully consider the implications; are the components functionally related? Can the item be separated without damage? Can the components be reassembled after treatment? Will the risks involved outweigh the advantages of separate treatments for the components?

Case Studies

Cannon ball and Ceramic fragment (03/GHL/134)

In a marine environment, iron corrosion products will often form concretions that fuse different objects together and thereby complicate the treatment process. One such example found on the Avondster site consisted of a ceramic fragment concreted to a cannon ball, registered as 03/GHL/134. After discussion between the archaeologists and conservators, it was decided that these items were not functionally related and, as the best conservation result would be achieved by treating each component separately, that the components of the concretion would be separated.

The ceramic and iron were separated using hand tools. The corrosion was mechanically removed from the cannon ball before it was placed in 2% sodium hydroxide to desalinate. After separation a large amount of iron corrosion products remained on the surface of the ceramic. Some of this was mechanically removed with hand-tools and scalpels before a solution of 5% diammonium citrate in freshwater was used (by immersion and in poultice form) to remove the last of the corrosion products and to reduce the staining. The fragment was then placed into a freshwater desalination bath.

Toolbox (04/GHL/357)

One of the most interesting artefacts excavated from the stern section of the Avondster was the remains of a wooden toolbox. A considerable part of the wood constituting the box, from the bottom and three of the sides, was preserved. The tools contained in it also remained in situ, concreted together. The ends of some tools were visible, revealing

Figure 4.17 (a-b) Cannon ball attached to a ceramic piece before and after mechanical separation (03/GHL/134)

copper alloys and a wooden handle. Copper wire of different calibres could also be seen on the top and on the sides of the concretion.

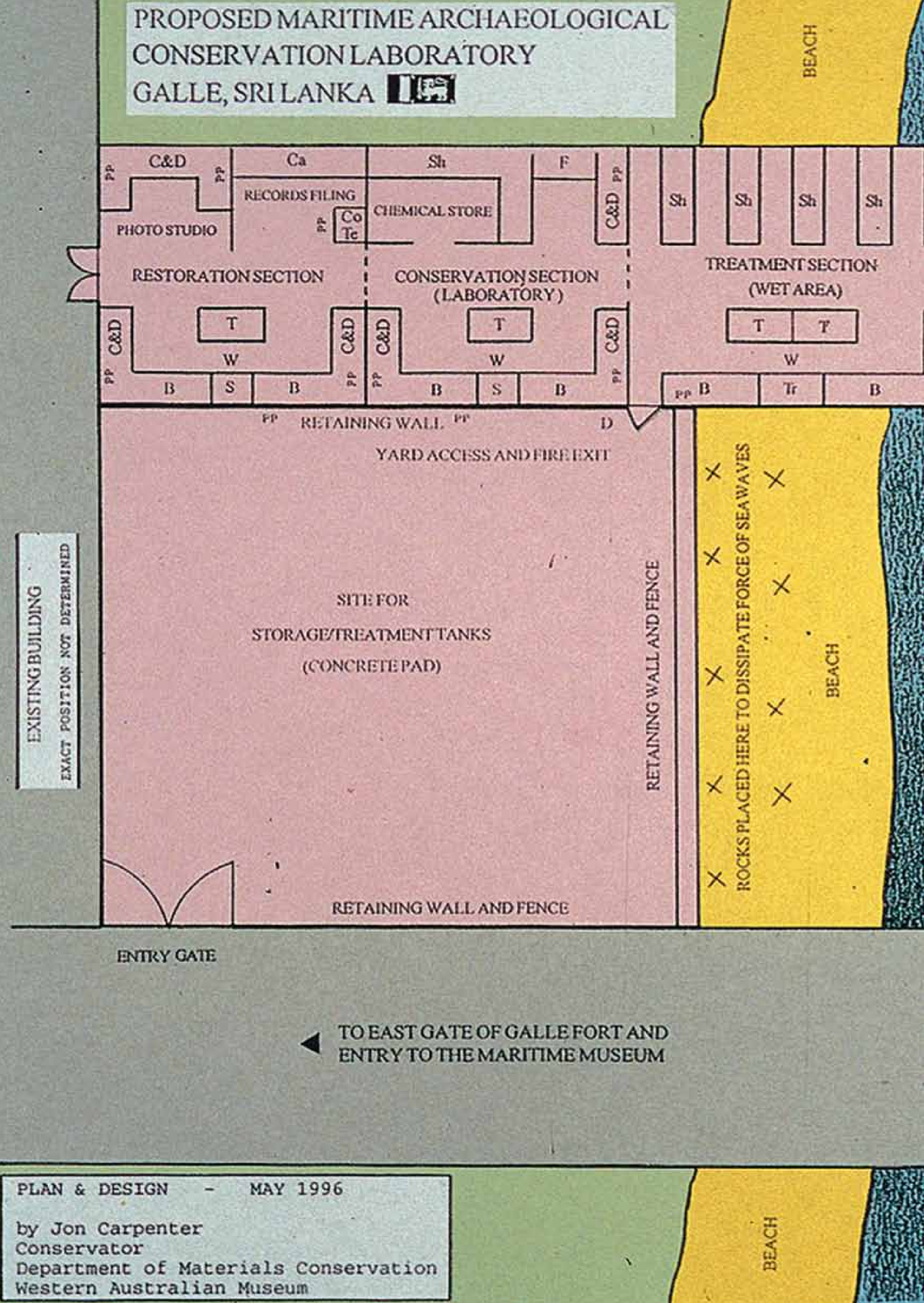
Adhered to the wooden surface of the bottom of the box were remains of two planks of wood belonging to the deck on which the toolbox had rested in-situ. In between the two planks were the remains of the material used for caulking. Three straps of leather from another artefact were also attached to the bottom of the toolbox.

Due to its significant research value and the complexity of its components and therefore its likely treatment, a detailed assessment was carried out. Artefacts of this type clearly exemplify the situation that is sometimes described as 'the excavation continuing in the laboratory'. In this case much can be learnt by careful documentation of all components in this artefact assemblage. The types of objects in and around the box, their spatial arrangements, their condition and the impact of contact on preferential preservation are just some of the information that may be revealed with detailed assessment, with further information potentially gained if a decision is made to separate the components of this type of artefact assemblage. After the initial assessment was made, the box was placed in tap water inside a container and placed inside the refrigerator in order to keep the most vulnerable material (wood) in the most stable possible conditions until active treatment processes commenced.
It is very sad that only days after this object was excavated it was lost from the collection when the Tsunami struck Galle Harbour.

Conclusion

Towards the end of 2004, with training essentially completed, assessments made of excavated artefacts and treatment procedures defined, the conservation consultants looked to the future with confidence, feeling that the Sri Lankan conservation team had sufficient training and background to take full responsibility for managing the MAU conservation laboratory and for the on-going conservation of artefacts in their care. It was also considered important for the Sri Lankan team to accept this challenge. By doing so, it was felt that they would also gain the self-confidence needed to move forward and become fully self-reliant.

Figure 4.18 The Toolbox of the Mastergunner (04/GHL/357)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(CONCRETE PAD)
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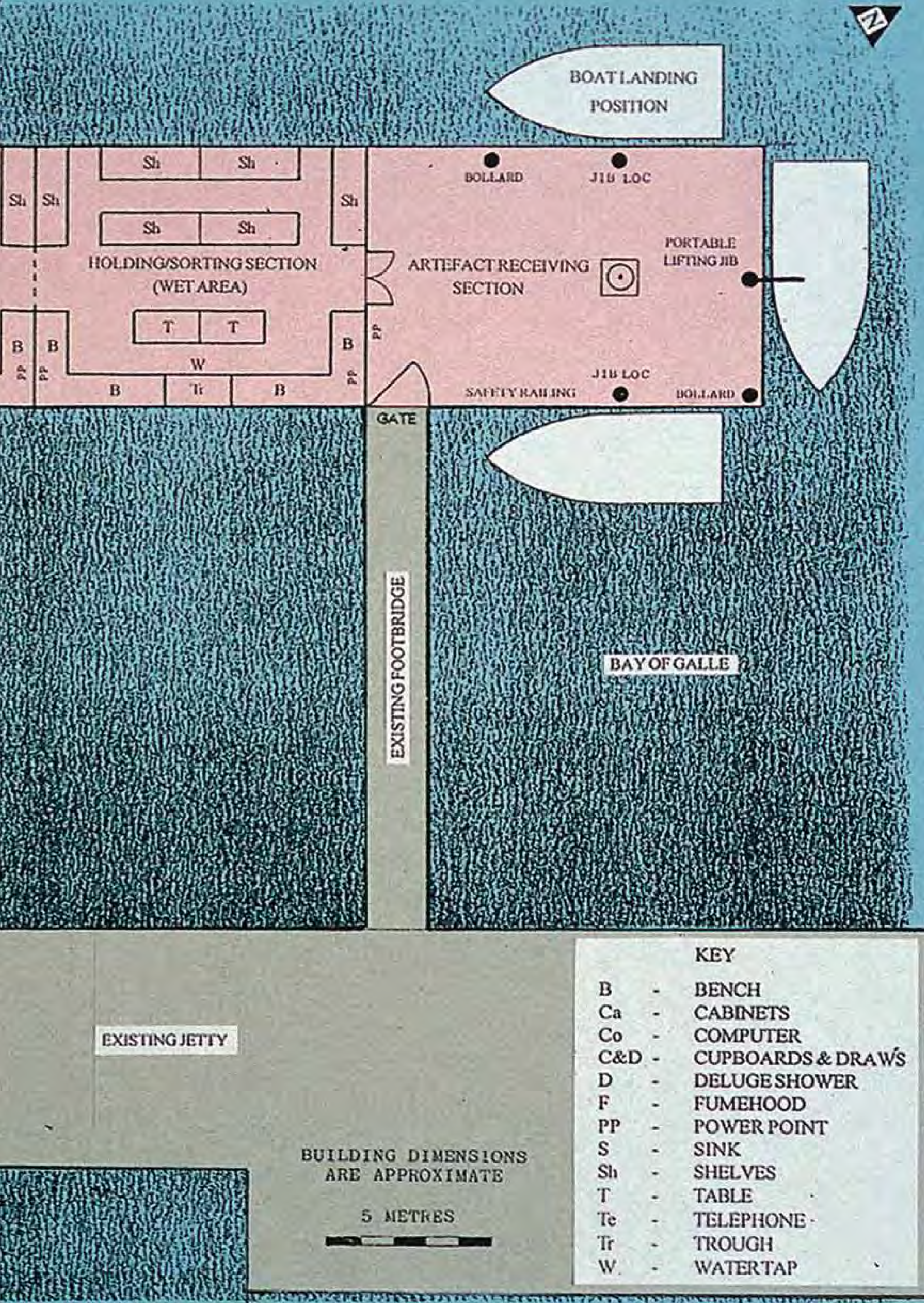
TO EAST GATE OF GALLE FORT AND
ENTRY TO THE MARITIME MUSEUM
PLAN & DESIGN - MAY 1996
by Jon Carpenter
Conservator
Department of Materials Conservation
Western Australian Museum



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BOLLARD
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BAY OF GALLE
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BUILDING DIMENSIONS ARE APPROXIMATE
5 METRES
KEY
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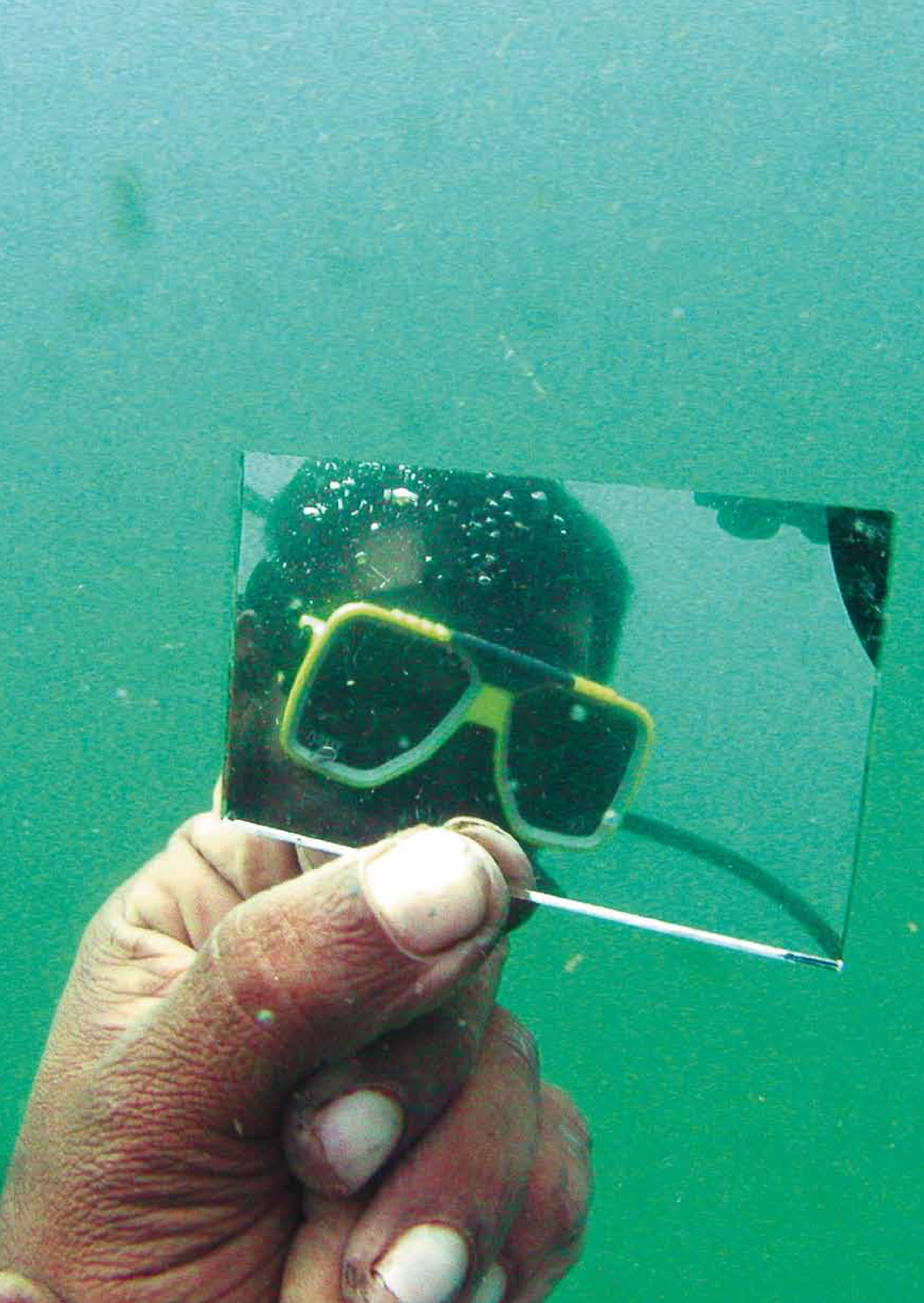
Ca - CABINETS
Co - COMPUTER
C&D - CUPBOARDS & DRAWS
D - DELUGE SHOWER
F - FUMEHOOD
PP - POWER POINT
S - SINK
Sh - SHELVES
T - TABLE
Te - TELEPHONE
Tr - TROUGH
W - WATERTAP



5 Capacity Building in Maritime Archaeology

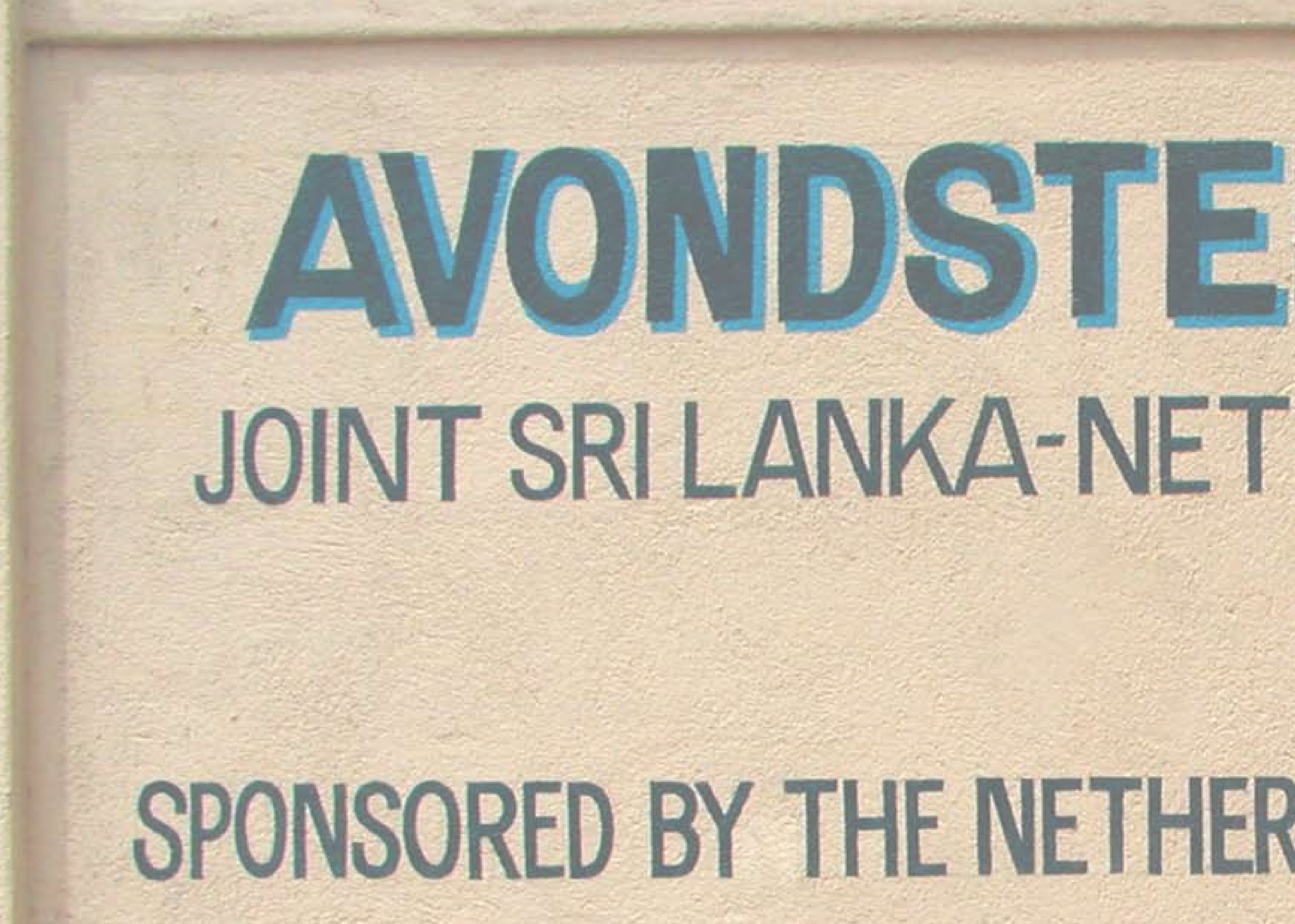
Introduction

In 1990 the Sri Lankan Archaeological Department adopted a resolution acknowledging the importance of maritime archaeology in the rich and extensive history of Sri Lanka. Up to that time, there had been only one occasion when an underwater site was explored. A wreck, which had been carrying a cargo of silver coins, was discovered by Arthur C. Clarke and studied by Peter Throckmorton in the early 1960s. Although this could have catalysed the protection underwater heritage, it remained an isolated incident. Even today, it remains an example of the threat treasure-seekers pose to genuine archaeological investigation. An unfortunate spin-off was that it served as a model for local scuba divers who began business in (unregulated) underwater tourism from the 1970's (when Sri Lanka began to be marketed as a "sea, sun and sand" tourist destination).

After 1990, and under the impetus of Cdr Somasiri Devendra, who was working towards the recognition of professional maritime archaeology in Sri Lanka, a more responsible and scientific approach was adopted. The Department of Archaeology, the Central Cultural Fund and the Post Graduate Institute of Archaeology sought the assistance of the Maritime Archaeological Department of the Western Australian Maritime Museum to train a core group of archaeological students in Galle. An additional undertaking for the training team was to compile a database of shipwrecks in the bay. This programme began in 1992 and continued on a seasonal basis for three years.
Some members of the current Sri Lankan Maritime Archaeology Unit (MAU) became involved in maritime archaeology fieldwork in 1992. Initially, training focussed on hands-on work carried out by Sri Lankan archaeologists under guidance from consultants, this training was supplemented with additional theory sessions.

The funding during those early years was sporadic and uncertain which resulted in field-work being conducted only intermittently. Since the training occured during the fieldwork seasons, it too could not be systematic and continuous. With the granting of funding for the Avondster Project in 2001 for a 3 year period, it was possible to design a logical sequence of training modules over the project time frame.

Figure 5.1 Plan of MAU lab Galle made by Jon Carpenter in 1997
Figure 5.2 MAU diver in 'self refections'



Training programme

Training of the Sri Lankan members of the Avondster team was a major focus, not only for the Director's of the Avondster Project but also for the foreign consultants who participated in the project. The reasoning behind this was simple. In order to function autonomously in the future, after the Avondster project, Sri Lankan practitioners needed the skills required to implement effective and professional maritime archaeology. They also needed the skills required from their government regulatory authorities and the international community. Sri Lanka was the first country to use the conditions contained in the UNESCO Convention on the Protection of the Underwater Cultural Heritage 2001 (yet to be ratified) when implementing maritime archaeology projects, namely the Avondster Project and this included the need for 'qualified maritime archaeologists' and a 'competent authority'. Sri Lankan personnel were trained and qualified archaeologists and conservators apart from the hands-on, practical training (including diving training), which began in 1992, they had not received any formal, accredited maritime archaeology and conservation training.

This began through the training and assessment program designed and implemented by Karen Millar. This enabled the employing institutions of each of the MAU team to become aware of the component parts of the training they had received and the level they achieved. It also allowed each participant to identify areas they were proficient in and areas requiring further attention, ie. through an evaluation system which was tailored specifically for this group and which included the training they had received since 1992. Also considered during the 2001-2004 period was the

need to develop links with academic institutions in Sri Lanka and to look at other forms of training that could provide some formal accreditation in maritime archaeology. This later aspect was picked up by Tatiana Villegas Zamor who conducted the first Nautical Archaeology Society (NAS) training course from February-March 2003 and again in November 2004. Briefly, the NAS program has been designed to introduce the theoretical, ethical and practical skills and to develop, through four phases the implementation of, and reporting on non-disturbance surveys of underwater archaeological sites. Whilst not a tertiary qualification in maritime archaeology, the NAS program and its world-wide recognisable accreditation, in association with the program designed by Karen Millar, enhanced the theoretical and practical skills of the Sri Lankan MAU team. It also gave the MAU the potential to enlarge the maritime archaeology skill base in Sri Lanka by themselves becoming NAS tutors and training interested members of their community.

However, the ideal situation for the MAU was to become embedded in the academic world of Sri Lanka and to link the unit with specialists from a range of relevant institutions. It was considered that this would benefit the MAU by enhancing its publication profile and also give the team access to academic specialists when required. The academic focus was enhanced by encouraging the team to undertake research on aspects of their work and to publish it, making contact with scholars from the Post Graduate Institute of Archaeological Research (PGIAR) and other institutions on specific subjects, and by inviting specialists from Sri Lankan institutions to participate in the project. An example of this was the ceramics research project, which was a co-production of the PGIAR, the Central Cultural Fund (CCF) and Dutch consultants (see Avondster Artefact Catalogue).

Figure 5.3 The MAU entrance wall

In 2003, the Avondster Project gained the endorsement of UNESCO and the inclusion of the project on the Agenda for the Mozambique and Hong Kong UNESCO regional meetings to study the application of the Convention for the Protection of Underwater Cultural Heritage 2001. The Avondster project was used as an example of what can be achieved in developing countries. The Avondster project complies with the requirements for international cooperation and information sharing in the development of public awareness and training. In many ways the Avondster project was viewed as a major example to the international community. Based on these and others observations, the Hong Kong meeting supported a feasibility study to establish a training centre in Galle for the Asia/Pacific region.

On agreement between UNESCO, the International Committee for Underwater Cultural Heritage (ICUCH), ICOMOS, CCF, the University of Amsterdam and the Amsterdam Historic Museum, an international exchange program was initiated. Five international underwater archaeologists and conservators were funded to go to Galle to participate in the excavation and share experiences with the Sri Lankan team. The participants came from Argentina, Colombia, Portugal, Mexico and Uruguay. They participated actively in the underwater excavation, in situ preservation, conservation and research work and also took part in some of the discussions at the ICUCH meeting. The experience proved to be very positive for all involved and could serve as an example to be repeated in other parts of the world.

The Annual General Meeting of ICUCH was held in Galle in December 2003. One of the reasons Sri Lanka was selected as the venue for the Annual General Meeting to take place was the official naming of the MAU as an UNESCO Regional Training Centre. The meeting was held at "Nooit Gedacht", the headquarters for the Avondster Project. Attendance by delegations from Canada, the Cayman Islands, Colombia, South Africa, Portugal, Australia and the Netherlands ensured a high profile for the Avondster project. A report titled "Report of the UNESCO training season, Avondster Project, Galle, November, 2003" was compiled and it details the concepts of the first ICUCH/UNESCO training program in maritime archaeology.

The development of the UNESCO Regional Training Centre in Maritime Archaeology in Galle was seen by the Directors of the Avondster project as a significant step in the capacity building of the MAU. Through linkages to Universities for formal accreditation of the training program, it would provide the MAU with the means to gain the appropriate accreditation and for them to be seen as the 'competent authority' under the UNESCO Convention and to grow professionally. It would also see foreign specialists continue to be involved with the MAU and the enhancement of the present infrastructure and possibly enlargement of the staff. At that time the MAU (archaeology staff) consisted of five qualified archaeologists. Their qualifications related to Sri Lankan terrestrial archaeology. Four of the five had post graduate degrees or were studying at this level. Between them they had 40 years experience in terrestrial archaeology, site management and conservation. Two of the archaeologists became involved in the maritime archaeology work in Galle in 1992, two others in 2001 and the last in 2004. In addition to personnel, the MAU had been provided with a building and facilities for the

Figure 5.4 (a-d) NAS training 2003

conservation, analysis and management of the recovered artefacts; storage and maintenance of field equipment and office work.
In December, 2004 through the Tsunami that swept into Galle, much of the infrastructure and Avondster artefacts were washed out to sea or destroyed, but with no loss of life of any of the MAU staff. The Netherlands, Norway, Australia and other parts of the international community were quick to respond in providing funds and resources to re-build the facilities in another, more Tsunami resistant location. The MAU staff was also quick to respond and bounce back from the Tsunami, producing a three year strategic plan and developing and an annual newsletter outlining their achievements, set-backs and future aims. These initiatives inside and outside the country, kept the concept of a UNESCO Regional Training Centre in Galle alive and through lengthy discussion papers and negotiations between the UNESCO Bangkok office, the CCF, PGIAR and ICUCH, the first training program commenced in March/April 2006 under the supervision of Cdr. Somasiri Devendra.

In collaboration with maritime archaeologist, Bill Jeffery (James Cook University, Australia) and conservator Jon Carpenter (Western Australian Museum) both team members of the Avondster project, a program was developed and implemented to train the MAU staff as trainers of future trainees from the Asia/Pacific region. The program was based on the requirements of the UNESCO Convention on the Protection of Underwater Cultural Heritage 2001 for implementing maritime archaeology projects and took into account the considerable practical skills that the MAU had acquired since 1992. It covered a number of theoretical and other practical aspects during a lecture series given by the trainers, Sri Lankan academics and practitioners. Funded by the UNESCO Beijing office and including a Chinese practitioner as its sole international representative, twelf Sri Lankan staff from the MAU, the Department of Archaeology and the Museums Department completed a training program which involved a comprehensive assessment process. UNESCO will in some way acknowledge the training gained by each of the participants and it is planned that the PGIAR, through an affiliated University will provide the accreditation for this subject, possibly as part of a Post Graduate course. Future field schools at the Galle Regional Training Centre are planned and funding has been sourced but the outbreak or increase in fighting in Sri Lanka may delay their implementation for some time.

Conclusion

The Sri Lankan MAU is on the threshold of achieving its recognition under the UNESCO Convention on the Protection of Underwater Cultural Heritage 2001 as being the 'competent authority' through formal academic accreditation of its staff. It is also on the threshold of an exciting stage in collaboration with UNESCO and a number of foreign specialists as the Regional Training Centre for the Asia/Pacific region. It has the potential for the MAU to develop many interesting projects in and around Sri Lanka and for the MAU staff to develop and extend their professional expertise by assisting colleagues and those that they train from various countries in the region.

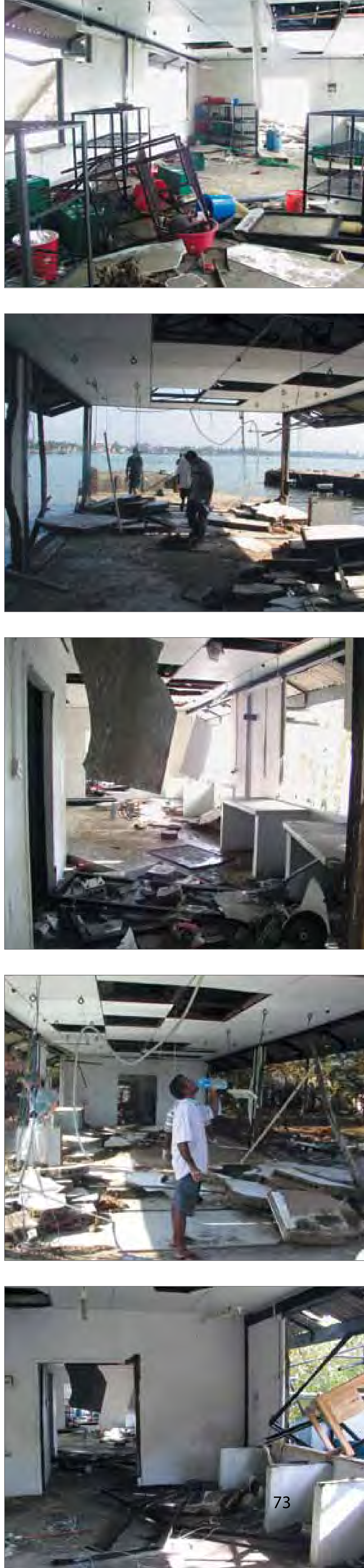


Figure 5.5 (a-e) The MAU lab destroyed by the tsunami 2004

6 The Post-Tsunami rebuilding of the Maritime Archaeological Unit

Impact of the 2004 tsunami:

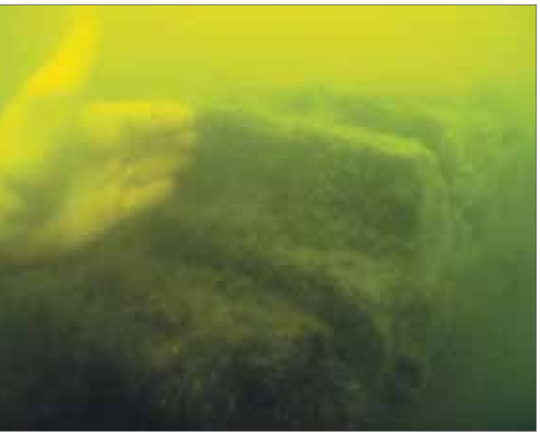
The Tsunami of 26 December 2004 devastated the Galle seaside area, including the MAU facilities that fronted the harbour itself. The impact of the Tsunami on the facilities, artefacts in the collection, equipment and treatment chemicals was extreme. Additional to the physical impact of the Tsunami was the effect that such a dramatic event had on the morale and psyche of MAU team members. The only consolation from this tragic event was that there was no loss of life among members of the MAU team.

The building was extensively damaged with concrete walls and windows broken and partitions destroyed. The surrounding grounds were severely eroded and much debris was deposited in the vicinity of the building. Of the two sea containers adjacent to the site, the one containing the chemical storage area was severely damaged but remained on site, while the other was washed out to sea, ending up a couple of kilometres away from the MAU building. Fittings, equipment, treatment containers and cupboards were all lost from the building. The external treatment tanks that contained the Avondster cannon and anchor remained on site but the treatment solution was replaced by seawater.

Much of the collection was lost to the Tsunami, either being washed out to sea, smashed into unrecognizable pieces or deposited under mud and sediment on the shore. Some of the collection was recovered as a result of being retained in damaged metal cupboards or being found close to the MAU building. Other parts of the collection were found too late, with some artefacts, wooden artefacts in particular, having suffered irreparable damage due to uncontrolled drying that occurred prior to their repatriation to the MAU laboratories. These shrunken, warped objects were retained and documented as part of the post-Tsunami operation. In all, approximately 70% of the collection was lost (see Avondster Artefact Catalogue).

The effects of the Tsunami on MAU staff and the consultant team were less tangible but equally devastating. To see years of work washed away and to have to face the prospect of starting anew with a somewhat uncertain future was particularly daunting for many.

Figure 6.1 View from the shore the Avondster site marked with white floats.
Figure 6.2 The 'old' MAU lab destroyed by the tsunami.



Rebuilding the MAU

The international community, and the Netherlands Government in particular, responded immediately with both compassion and financial support. This allowed assessments to be made of the situation, equipment to be purchased and building works to be undertaken, all of which provided valuable support to the MAU team.

A small team of consultants visited Galle a few months after the Tsunami and assisted in relocating the MAU facilities to a building inside the safety of the Galle Fort. The entire recovered collection was assessed, documented and a post-tsunami database established that allowed the full extent of the collection loss to be determined. Recovered artefacts were placed in stable, appropriate storage solutions to minimize further deterioration and proposals were drawn up to guide treatments for those artefacts requiring continuing conservation. The Avondster cannon and anchor were moved to new facilities adjacent to the new MAU premises in the fort and treatment reinstated. Setting up of this treatment facility was an important step, symbolizing a new start for the MAU. Plans were also drawn up to guide the full redevelopment of the MAU facilities and operations and recovered chemicals assessed, documented and placed into appropriate storage premises.

Damage Assessment of the Avondster site

The first assessment of the Avondster was carried out on 14th March 2005 by Geoff Kimpton, Robert Parthesius, Rasika Muthucumarana, Bill Jeffery and K.D. Palitha Weerasinghe. Geoff Kimpton, formerly from the Western Australian Maritime Museum his an experienced commercial diver, on the first dive he used a float attached to him so the boat crew/safety diver could keep track of his progress. A number of stories had been told of Galle Harbour containing numerous vehicles, with possibly some of the 500 people still missing witin them. Nets and boats had also been washed into the bay and it was thought that some of this material and human remains may be countered on the shipwreck. Entanglement in nets was also considered a possible problem. The Police had been consulted regarding the correct procedures to follow in the event of discovering human remains.

The Avondster site is about 80 metres from the beach, at a depth of 4-5 metres. Many of the adjacent buildings on land had been totally or partially destroyed, and it was envisaged the shipwreck site would be similary impacted.
The first surprise was that the five mooring buoys placed around the site in November 2004 were still in position.

Figure 6.3 Preparing the first dive on the Avondster site after the Tsunami

Figure 6.4 Boat on it's way to the Avondster site after the Tsunami

Figures 6.5 The first dive on the Avondster site after the Tsunami

Figures 6.6 The first dive on the Avondster site after the Tsunami

Figure 6.7 Measurements at the first dive on the Avondster site after the Tsunami

Underwater, there were similar surprises. The survey poles were in place, still with the guide ropes between them and the stern trench that was being excavated in November/December 2004 was still delineated with the horizontal grid poles, including the measuring tape that had been fixed to them.

The majority of the shipwreck was covered with marine sediments (a mixture of a fine silt and coarser sediments), but a small section of the bow timbers, the galley bricks, a cannon and the section of the stern post that had the highest relief off the seabed (1-2 metres) looked untouched. A number of people who experienced the Tsunami in Galle reported that they had seen an exposed shipwreck possibly the Avondster and another nearby shipwreck site when the tide went out before the Tsunami hit. Others reported a large whirlpool as part of its impact.

Some small sections of fibreglass (possibly from fishing boats) were found near the stern post and within the stern trench but very little other debris was encountered. The limiting factor in this inspection was that the effective visibility was about 30 cm on the seabed and 50 cm at the top of the stern post.

A further inspection was carried out on the 18th March when underwater visibility had improved to about 80 cm. Some of the cloth/mesh that had been laid over many parts of the timber structure was found to be exposed in addition to some timber.

Conclusions

A possible scenario for the current state of the Avondster shipwreck site is that it was exposed by the Tsunami leading to some damage, including some movement of artefacts then covered back with marine sediment. Another possibility is that the site suffered no damage, as is suggested by the visible remains and the position of survey posts, ropes, tapes and tags. In November 2004 the majority of the site was covered with sediment including the stern section which was about 1 metre more than in to November 2003. Some of this sediment was removed during excavation of the stern trench and at the time of the Tsunami it was relatively clean. In 2006 the levels are the same as those in November 2004, pre-excavation. It is a possibility that the ship's structure and artefacts uncovered in the stern trench have been impacted by the Tsunami.

Figure 6.8 The new MAU premises in Galle Fort
Figure 6.9 The new MAU premises in Galle Fort
Figure 6.10 The new MAU cleaned and painted
Figure 6.11 First meeting just before the official opening of the new MAU l
Figure 6.12 The official opening of the new MAU premises

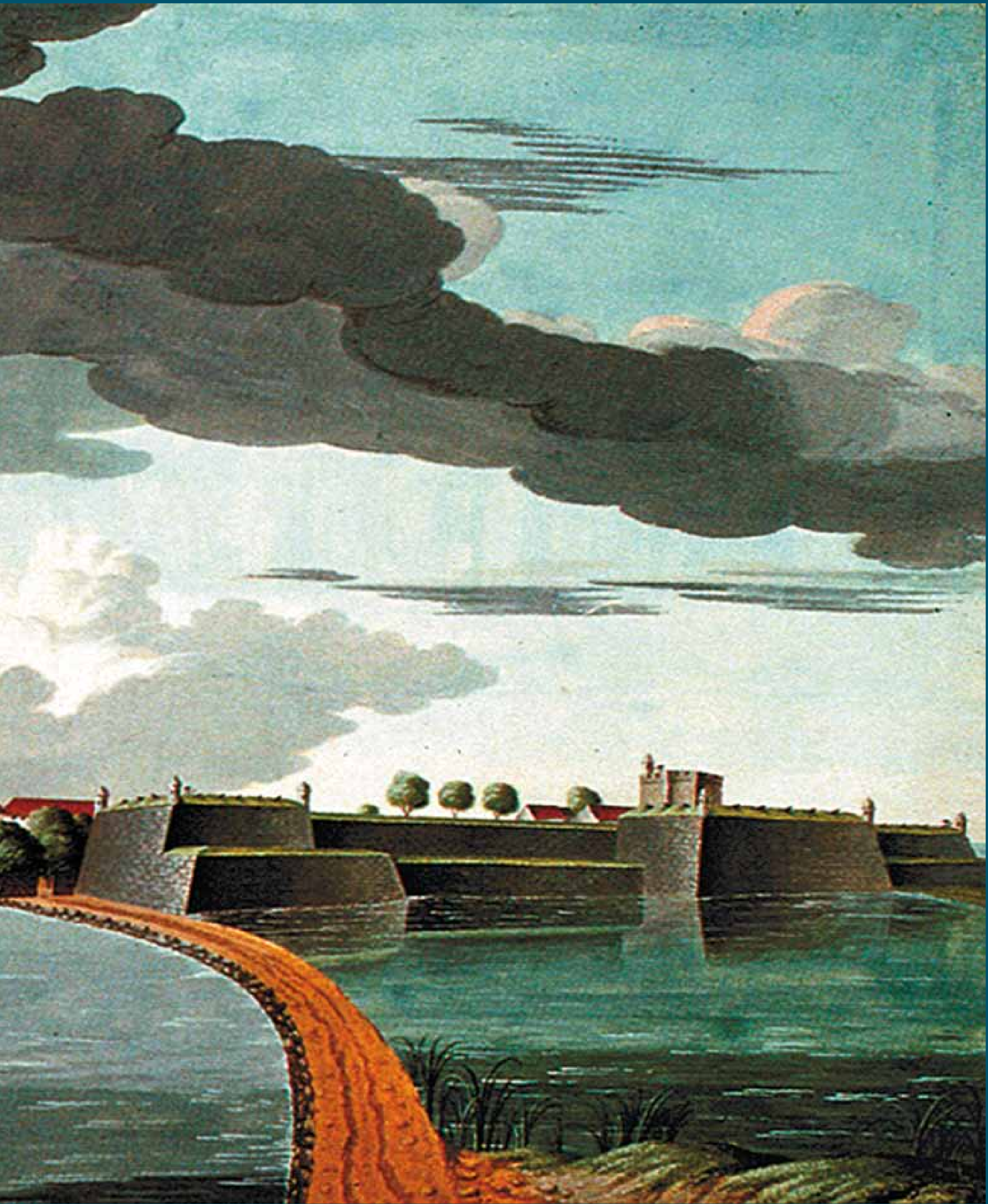


Figure 7.1 'View at Galle', around 1710, C. Steijger, Rijksmuseum Amsterdam

7 Galle, an important centre in the VOC shipping network

By Wessel Pil, Menno Leenstra & Robert Parthesius

Introduction

The choice of Galle as the initial focus for maritime archaeology in Sri Lanka was with good reason. The port city of Galle, in the south-west of the island, had a splendid natural harbour in the days of sail. The port was in use in pre-Christian times, but gained in importance after the 12th century. By the 14th century it was arguably the most important port in the country, retaining this pre-eminence until 1873 when an artificial harbour was built at Colombo. The great Chinese admiral Zheng He commemorated his visit by leaving a trilingual inscription in 1411; the three languages were Chinese, Tamil, and Persian (incised in Arabic script), implying a cosmopolitan trading community. The Portuguese arrived in 1505 and later built a small fort. It was only after Galle was captured by the Dutch in 1640 however, that the city rose to its greatest prosperity (for local traders as well as from the Dutch viewpoint). The Dutch rebuilt the town and strengthened the fortifications. The English took over in 1796 but made few changes to the infrastructure, since British commercial and imperial interests led to Colombo steadily gaining in importance at Galle's expense. Hence it is the remaining Dutch architecture of the 17th and 18th centuries which adds to the unique character and charm of the city. Among VOC's Asian ports, Galle was second only in importance as a trading centre to Batavia (now Jakarta).

Dutch trade and logistical centre

Fleets of ships came to Galle each year for trade, supplies, and repairs. Although the inner harbour was considered safe during most of the year, the entrance to the harbour was not. Reefs and submerged rocky pinnacles were a danger. To enter the bay safely, skippers needed the services of a local pilot. Galle also had a small shipyard and skilled craftsmen who could carry out necessary ship repairs. Important trade items included textiles, pepper and yarn from South India, cinnamon, cardamom, pearls, gems and elephants from Sri Lanka. Some of the local products were exported only to destinations a short distance away (e.g. elephants from Sri Lanka to India), while others travelled further afield. Textiles were important in trade to other parts of Asia, while most of the cinnamon was exported to Europe (Fig. 5). The VOC was active in handling all of these goods, using an appropriate variety of ship types for each purpose. These are represented in the wrecks found in Galle Harbour. The wreck of the Avondster (1659) therefore reflects part of the organisation of trade and shipping in this important period of European expansion in Asia.

Figure 7.2 Entrance of Bay of Galle, 2004

When the Dutch first went to Asia, all of their ships initially made the long and dangerous voyage from Europe and back, but this was soon replaced by a 'hub-and-spoke' system. The Dutch captured Jakarta (Java) in 1619, renamed it Batavia and made it the hub of their Asian trade. Small ships were dispatched to trading ports all over Asia and the cargo they brought to the central storehouse was conveyed to Europe by large 'return-ships' (retourschepen), specifically designed for the lengthy voyage and usually of 500 to 1100 tons. During the VOC's first 50 years, it developed different ship types depending on the type of cargo, the distance to be travelled, the ports involved and the sea conditions expected. A class of 'jachts' was designed for Asia (Parthesius, 1993). Two of the ships specially built for the Asian trade were wrecked in Galle: the Hercules in 1661 as it departed with a cargo for Batavia and the Dolfijn two years later on arrival from Surat. The Avondster, in contrast, was a modified English ship and had made several trips between Europe and Asia before being 'retired' to the Asian routes. Two return-ships, the Barbesteijn (1735) and the Geinwens (1775), were also wrecked in the bay of Galle (Parthesius 1997).

Smaller ships were required to transport goods from production fields to the trading hubs including those using the Dutch-built network of canals in Sri Lanka. The range of vessels included local dhoni and sloops. The use of the dhonis as pilot vessels can be seen in an 18th century print of Galle Bay (Fig. 6). This print also shows the use of Dutch ship types that must have been built locally or shipped to Asia because of their small size (VOC, 1169 folio 123 and 159). It is known that in the 1660s, boats were built in Galle, ranging in size from 36 to 68 tons. (SLNA 1/5973 folio 24 and 288, NA VOC 887).

One of the aims of the Avondster-project was also the study of the role of Galle in the total shipping and trade network of the VOC. As part of the programme 'Dutch Ships in Tropical Waters' at the University of Amsterdam, Parthesius organised study groups with master students to investigate also the early development of Galle as logistical centre in more detail. The following section is the result of these study groups. Wessel Pil who also joined the Avondster team in 2004 wrote his master's thesis on this subject (Pil 2006)

Figure 7.3 View at modern Galle, 1999

The early development of Galle as a Dutch port city 1640-1670

22 May 1661 four ships lay in the bay of Galle ready to set sail for Batavia. The ships, the Elburg, Tholen, Angelier and Hercules, had been waiting for some days for an offshore wind to help them on their way. Early on the morning of 22 May conditions seemed to be right. The city's most senior Company official, commander Isbrand Godsken, had to give the signal for the ships to depart. At the time two other Company officials who held a higher position than Godsken, namely Rijckloff van Goens and Adriaen van der Meijden, were in the city. At six o'clock in the morning Godsken went round the city to inform them both of the imminent departure of the ships. Superintendent Van Goens approved the decision and Godsken then went on his way to the house of Van der Meijden, the governor of Ceylon (present-day Sri Lanka). He was still in bed and Godsken could not speak to him. To avoid losing time Godsken decided, in consultation with admiral Roothaes, to let the ships set sail. On arrival at the beach it was made clear to the ships that they could raise the anchors and that a pilot would be sent to escort them safely out of the dangerous bay of Galle.

The flute Elburg and the yacht Tholen were the first to be escorted out of the bay. Pilot Bastiaen Andriesz guided the two ships between the rock masses and reached the open sea without a problem. The yachts Angelier and Hercules were then prepared for departure. Completely unexpectedly, a strong wind blew up during these preparations. At that moment the Angelier was still at anchor and this saved the ship from disaster. The Hercules fared differently. According to an eyewitness on the Angelier, the rope from the first anchor broke. The ropes on the two reserve anchors had evidently not been secured properly, so there was nothing to hold the Hercules. She smashed onto the rocks. The entire cargo destined for Batavia was lost. This included 1700 packets of cinnamon and sacks of rice (NA, VOC 1239, f. 1137-1139; NA, VOC 1232, f. 167-170; NA, VOC 1243, f. 1179-1181).

The loss of the Hercules was a huge blow for the Verenigde Oost-Indische Compagnie (VOC-Dutch East India Company). An investigation was instigated to ascertain the exact cause of the disaster. All the main actors blamed the disaster on someone else. The skipper of the Hercules was ultimately held responsible for the damage and had to pay the costs. The loss of the Hercules was not the only shipping disaster the VOC had had to deal with in a short time in Galle. In 1659 the Avondster had perished and four years later the Dolfijn suffered the same fate. The Avondster was anchored in the bay when, out of the blue, the rope from the anchor broke. The skipper and crew noticed this too late and the Avondster drifted on to a rock and broke in two. The Dolfijn was lost in 1663 for other reasons. Her long voyage before reaching Galle had been fraught with technical problems. The ship was leaking and the crew were constantly struggling to keep the Dolfijn afloat. When she was nearing Galle these efforts proved to be inadequate and the ship sank, taking a large cargo of gold with her to the seabed.

If the loss of a ship was a serious drain on the resources of the VOC as a whole, the impact in Galle would, at the very least, have been just as great. In a period of twenty years the city had grown into the most important logistical crossroads of the VOC after Batavia, where the Company's head office in Asia was located. From there the VOC administered the regions in the East. In Batavia's shadow, Galle was to develop into an important trading post and location for the Company. Every year many ships called at the city. Thus Galle mainly had shipping to thank for its existence. The loss of a ship in the bay of Galle would, therefore, have made a very deep impression on the city and its inhabitants. This article will discuss the context in which these shipping disasters occurred. It will endeavour to answer the question of what Galle looked like in the period 1640 – 1670, paying attention to the city itself and the social developments.

Figure 7.4 VOC coats of arms at the Dutch Warehouse in Galle

A short history: the context

Since the founding of the VOC in 1602 the Dutch had tried to make contact with Ceylon. This would be advantageous to the Company in two ways. First and foremost Ceylon was of great commercial interest: it was the only place in the world where cinnamon grew. This product fetched a lot of money on the European market. Ceylon was also of strategic importance. The island would be an ideal base for the VOC to extend its power in this part of Asia. The Company also wanted to build up a trading network in this region. In their struggle for Ceylon they clashed with the Portuguese, the most important European power in this region since the sixteenth century. At the end of the 1630s / early 1640s, the VOC succeeded in taking a number of harbour ports in Ceylon. One of these was Galle, which came into Dutch hands in March 1640. Several places were taken in a short time on the west and east coasts of the island. After a short period of calm (owing to a truce agreed in Europe with the Portuguese) the Dutch began an offensive in the mid 1650s. One after the other they seized Colombo, Mannar and Jaffnapatnam (Jaffna today), thereby expelling the Portuguese from the island for good in 1658. Besides the King of Candy, whose authority was mainly in the inland areas, the VOC was the only remaining territorial power on Ceylon (Arasaratnam 1976, pp. 14-23).

In the early years after the VOC established itself on Ceylon, Galle was the administrative and trading centre. The VOC followed the example of the highest authority in Asia in how it administered its territories. This authority was located in Batavia and comprised the Council of India, under the direction of the Governor General. The Council of India was responsible for the general administration of the VOC in the East. Regional governments were set up, which took over some of the tasks of Batavia, so that the Company could be optimally managed. Ceylon was one such government. The governor, assisted by the Council of Ceylon, was the head of the island. Until 1658 this administration was located in Galle. In these early years the city was thus the centre of the island in every way for the Dutch. In 1658 the governor and the Council of Ceylon moved to Colombo, which had been taken from the Portuguese two years earlier. At about the same time the island was divided into three districts. These were the divisions of Galle, Colombo and Jaffnapatnam. Galle was chosen to be the centre of the division under the direction of a commander. Galle's first commander was Isbrand Godsken, mentioned earlier. The commander was assisted by a Council – the Political Council of Galle. They were responsible for governing the city and the surrounding area.

In the area around Galle the Company maintained the existing administrative structures as far as possible. This was the same policy that the Portuguese had followed. It was undesirable and impossible to appoint Company employees everywhere. It would increase personnel costs further and, moreover, the staff was not available. So local chiefs often kept their positions. The Galle division was divided into two districts: the dissavany of Matara and the Galle Corle. A Company official with the title of captain was in charge of the Galle Corle. The head of the dissavany of Matara was the dissava. He came from the local population and was the contact person with the Company. These two districts were further divided into smaller areas known as corales. People from the local population were in charge of these and each village also had its own chief. The Company thus administered the area around Galle from above without interfering too much in the various levels of administration. The local population was employed in agriculture (in particular the cultivation of rice) and harvesting cinnamon (Hovy 1991, pp. LXXXVII-XCIII; Arasaratnam 1996, pp. 1-7).

Thus outside the cities and towns the Company did not really interfere with existing structures. In Galle itself, however, a Dutch colonial city was built. Here the VOC wanted to keep a tight rein on matters and develop the city as a centre of trade and shipping. It was not surprising that the Dutch chose Galle as the logistical centre. Merchants from all over Asia had been visiting the city for centuries. In the Dutch period Moorish (Muslim) and so-called 'Gentijfs' merchants found their way to Galle (the latter were Hindustanis). Both came from the Indian coast. Galle lay at the southern tip of Ceylon and was a crossroads in the routes between the west and the east of Asia. The bay of the city afforded protection to the ships against the various winds, thereby guaranteeing a safe place to anchor. The bay was, however, full of rocks and cliffs which meant that skippers needed assistance on arrival to pilot their ship safely into the bay. The natural setting of the city also offered the VOC the chance to build a permanent settlement. Three-quarters of Galle faced the sea but was inaccessible owing to the rocks. Only the north side of the city faced land. There a high defence wall provided protection from land attacks. Galle was, therefore, well defended and hence an ideal place for a branch of the VOC.

During the first 30 years of the Dutch period Galle developed vigorously. It became a fortress town with many Dutch characteristics. Unlike Batavia, for example, where the VOC built a completely new city on the remains of the old, the contours of the city already existed in Galle when the Dutch arrived. An important factor was that the city was built on a rock. This also gave the city its name: Galle comes from the Sinhalese word 'Gala' meaning rock. During the Portuguese period the city had acquired a particular form. The Dutch were to adapt, extend and refine these contours. It is a good idea to keep this in mind as certain decisions were made because of the demands of the situation at the time. Let us first look at the defence of the city.

The defence of the city

In the Portuguese period Galle was already protected by extensive defences. With the help of two Portuguese contemporaries, maps and other cartographic material we have managed to build up a reasonable picture of the defences. When the Company besieged the city in March 1640 they approached from the land. They encountered a wall which ran from the bay to the side on the sea. We can deduce from the writings of Fernaõ de Queyroz that there was a watch tower at both ends of the wall. Between the watch towers were three bastions. From the watch tower on the side of the bay, a wall built of stone and clay ran in the direction of the first bastion, which was called Sant-Iago. According to Queyroz this bastion was not that big and its walls were weak. After the Sant-Iago, the wall was thicker before reaching the Conceycao bastion, which was the middle point of the defences. The Conceycao bastion was bigger than the Sant-Iago, but had a weak 'camiza', an additional defence wall that had to cope with the initial attack in a fight. Then there was another stretch of defence wall as far as the Santo Antonio bastion. Work on the Santo Antonio had only recently been completed and hence, according to Queyroz, this bastion was in very good order. From Sant-Iago a small wall ran round the bay to the fourth bastion. Situated on a rock, this bastion was called Santa Cruz, but it did not play a big role in the defence of the city as it had no cannon. There were cannon on the other bastions (Queyroz 1930, pp. 828, 839). The writings of the Portuguese captain João Ribeiro who resided on Ceylon at the time of the fighting over Galle also give this picture of the defences (1947, p. 35).

Illustrative material, including a map of Galle dating from 1627 (Figure 7.5), provides more information. Constantine de Sa, who represented the Portuguese authorities on Ceylon from 1618-1620 and 1623-1630, commissioned this map. It shows the three bastions on the north side of the city and a fort, marked on the map as 'sitio de fortalesa', which protected the bay

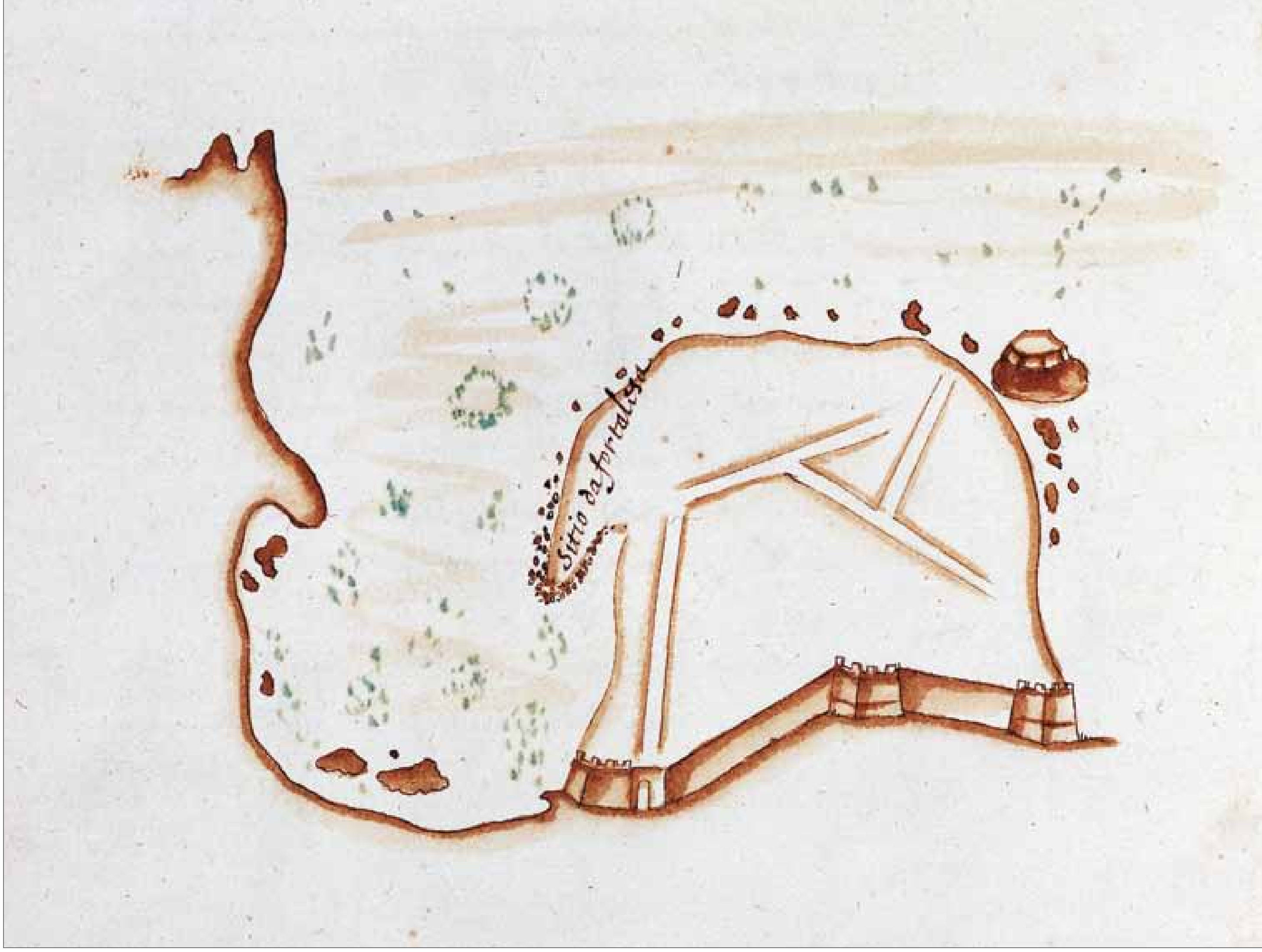


Figure 7.5 Beschryving ende Caarten van den Eylande Ceylon met afzonderlijke plans van Ceylon, 1606., Manuscript, Groot 0.32 - 0.405 El.,. 6 - 10 N.Br., Anonymous; Nationaal Archief -inventarisnr. vel0928(17). Map of Galle as published in: Constantine de Sa's maps and plans of Ceylon (1624-1628). E. Reimers ed. (Colombo 1929). The drawing dates from 1627 and is in the National Archives of the Netherlands (Sheet 928). This is a copy of the drawing. The measurements of Galle are clearly incorrect. The bay and the land opposite are also not drawn to scale. The fort, marked on the map as 'sitio da fortelesa', was on the left in the city. Although four streets can be seen, it is not possible to work out the street pattern. The three bulwarks are on the north side of the city. The bay and the sea around Galle are full of rocks..

from hostile ships. It is highly probable that this refers to the Santa Cruz bastion. Another map, by Pedro Barreto de Resende, also shows this bastion as well as the defence wall on the north side (Figure 7.6). This map was made in 1635 and depicts the buildings inside the city walls. It is the only map of Galle from the Portuguese period showing so much detail and is hence of great value. More information about how the buildings in the city are depicted on this map is given below.

During the fighting over Galle in 1640 the Portuguese defence walls came under fire. After the VOC had taken the city, the walls had clearly suffered some damage. This had to be repaired in the following years. The local population were asked to help with this work. In 1641 work on strengthening the bastions with earth and extending the defence walls was carried out on a daily basis (Colenbrander 1900a, pp. 241, 336). This operation was not entirely without problems. In September 1642 constant rain caused 'some of the walls of the fort of Galle' to collapse. The rain also damaged a number of buildings in the city. A delivery of chalk, which was not available in the city, was requested to repair this damage. Furthermore, the garrison was in need of an ammunition store and the city governors requested permission to start building one (Colenbrander 1900b, p. 258; NA, VOC 1144, f. 50).

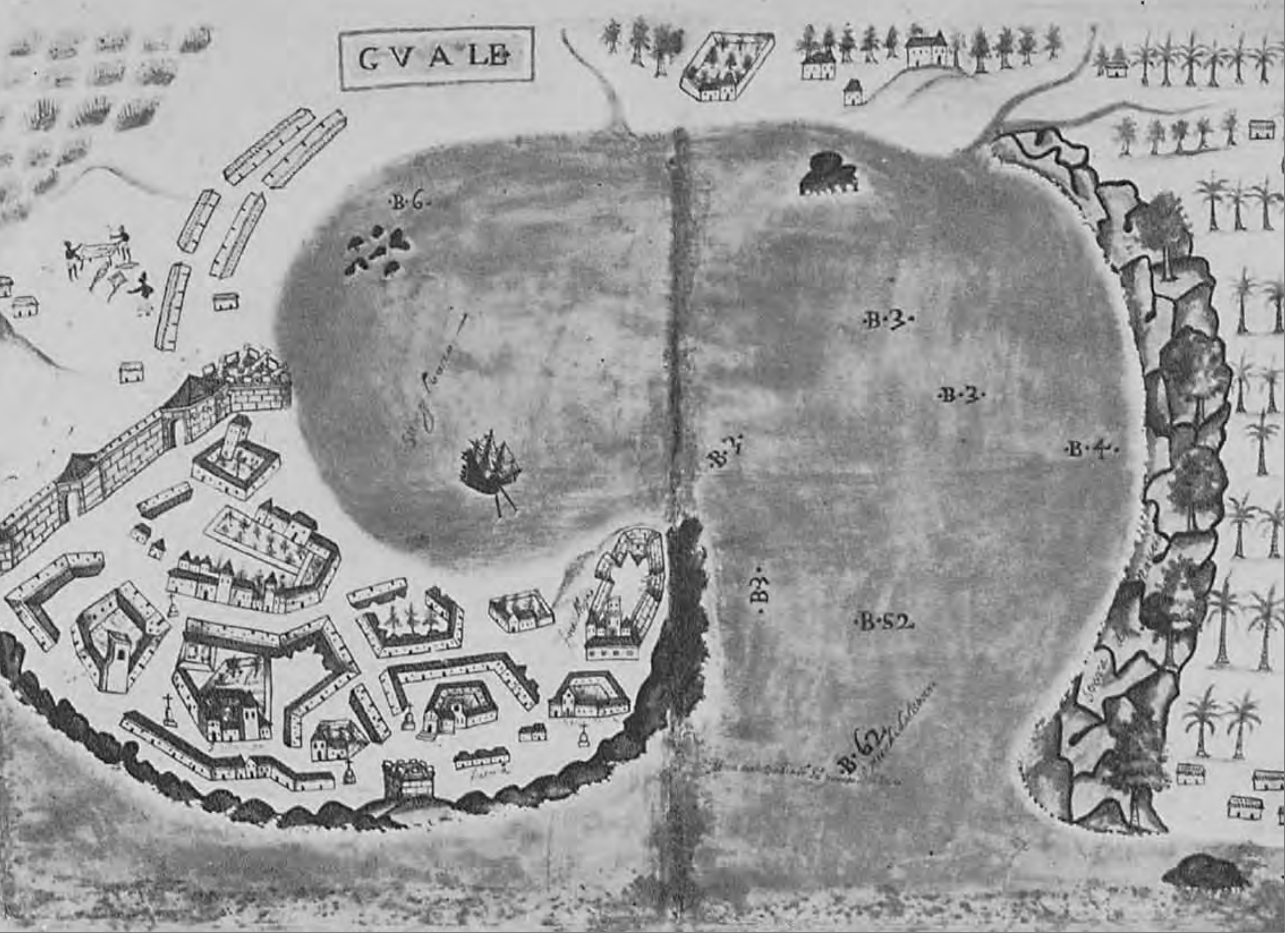


Figure 7.6 Map of Galle by Pedro Barreto de Resende, probably made in 1635 and published in 1646. The map has been reasonably drawn to scale. The city is elongated and curves around the bay. A number of points are shown in the bay, probably rock masses that have been marked for skippers. The city is protected on the north side by a defence wall, which has three fortified points, probably bastions. Two entrances in the wall can be seen. On the southeast side of the city is the 'fortaleza'. It is feasible that this is the Santa Cruz bastion. The street pattern and buildings are clearly depicted. The map gives the impression that the city was completely full of buildings. Three churches are named: the 'St. Domingo', the 'St. Pedro' and the 'St. Francisco'. 'Misericordia' is written below the 'fortaleza', the poor house. Above that is the workplace, described as 'feitoria'. From: Cortesão and Teixeira da Mota, Portugaliae monumenta cartographica, 589G

After these difficult early years the city gradually took shape. Dutch names replaced the Portuguese names for the bastions. The Santa Cruz became the Swarte Fort (Black Fort), the Sant-Iago the Hooftwacht (Main Guard), the Conceycao the Middelpunt (Middle Point) and the Santo Antonio the Zeepunt (Sea Point). These four bastions formed the heart of Galle's defence works. Two other works improved the defence of the bay further: the Waterpas and the Ackersloot. The Waterpas was further on from the Swarte Fort and therefore stuck out a little. According to the German Johan Jacob Saar it was built in 1653 (1930, p. 66). Saar was stationed on Ceylon and other places for the VOC in the 1640s and 1650s. He described what Galle looked like in this period in his accounts of his travels. The Ackersloot bastion lay to the south of the Swarte Fort. This bastion was named after the birthplace of Willem Jacobsz Coster, who had led the conquest of Galle in 1640 (Brohier 1978, pp. 45-46). Meanwhile there were now two ammunition cellars in the city and ideas were afoot to build a smithy and an arsenal (NA VOC 1185, f. 375).

At the end of the 1650s it became clear that the VOC had secured a permanent place for itself on Ceylon and the Company carefully considered how Galle should be defended in the future. In this connection an interesting scheme dating from 1659 deserves careful consideration. It depicts the existing defence works and explains the plan to fortify the city further (figure 7.6). Van Goens and Van der Meijden signed the map on 10 May 1659 in Colombo. They requested the Governor-General and the Council of India to implement the plan. The surveyor Adriaen de Leeuw had drawn the plan, which was titled 'Project to fortify the City of Galle'. De Leeuw was the surveyor of Ceylon at that time. In addition to Galle he designed a defence plan for Colombo (Zandvliet 1998, pp. 144-146).

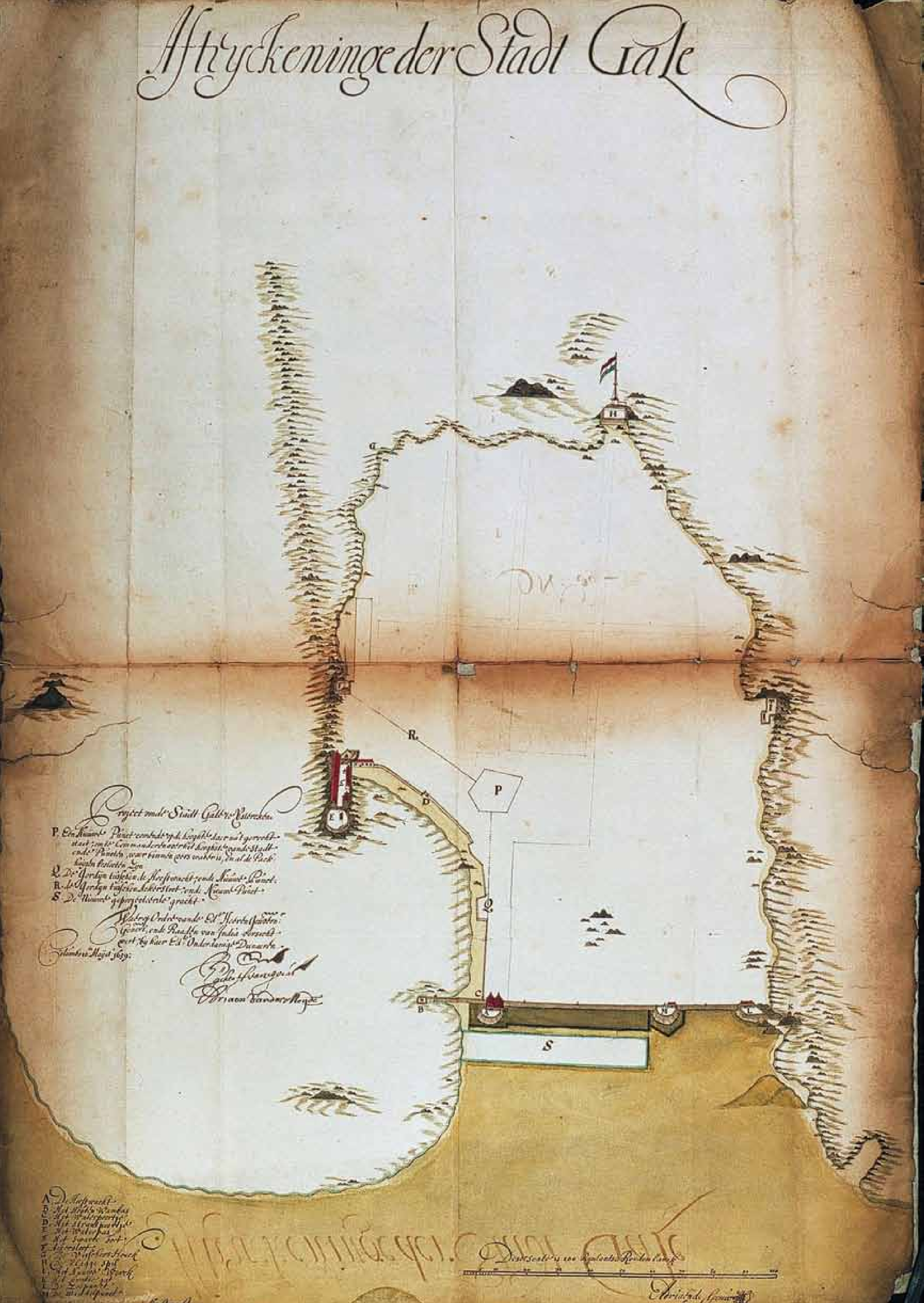
Several places can be recognized on the map. These are the Waterpas, the Swarte Fort, the Ackersloot, the Hooftwacht, the Middelpunt and the Zeepunt defence works. The southeast of the city is marked as Visschers Hoeck (literally Fishermans' corner). On the south side of the city was the Flag Pole. This was erected as a landmark so that skippers could recognize Galle. A mast with the Dutch flag would attract attention. A new bastion, the so-called 'Nieuwe Werck' (New Work) was built on the west side. The main provision of De Leeuw's plan was the construction of yet another new bastion, the 'Nieuwe Punt' (New Point), to be located between the Swarte Fort and the Hooftwacht. This was the highest part of the city, so the bastion would be a look-out point over Galle. In addition defence walls had to be built between this bastion and the Swarte Fort and the Hooftwacht. Lastly, a deep canal was to be built to fortify the north side of the city.

De Leeuw's plans were never realized. The reasons are unclear. Perhaps the Governor-General and the Council of India thought that the cost of the project was too high or saw more scope in other building plans. Nevertheless, the construction of the defence works did begin after 1659, in particular the three bastions on the north side of Galle. The Council of Batavia was not altogether happy with the course of events, as a letter to the Council of Ceylon indicates: 'but whether doubling the thickness of the walls and enlarging the canal of Galle is necessary, we have our doubts. In our opinion, we should wait until the other work can be completed first. Too much shouldn't be tackled at the same time, as that would cause too many problems for the coolies and the villages[1] (NA, VOC 883, f. 644). Thus Batavia questioned the extensions that were being done and whether it was a good idea to use the local population for this work. The coolies would then not be able to work on the land, which could have a detrimental effect on the quality of the harvest. For these reasons work was temporarily halted at the end of 1660. Two years later, however, construction was progressing as planned. Commander Roothaes, who succeeded Godsken, was of the opinion that the fortification of Galle would even be totally completed within seven or eight months (NA, VOC 1249, f. 1461).

Roothaes' prediction proved to be somewhat optimistic. Construction was still in progress in 1663. The quality of the bastions, however, had been tested. The Galle journal tells us that trial shots were fired at the Middelpunt from the Zeepunt to see what the effects of the cannon balls would be on the wall. The conclusion was that the cannon balls 'returned with the same speed and flew over the heads of the onlookers. Little damage could be found on the walls of the bastions with the exception of one or two grazes'[2] (SLNA, 1/2712, f. 203). From this somewhat dramatic account it is clear that the walls of the bastion had stood up to the cannon fire

1. 'Maer of het verdubbelen van the muijren ende verwijden van the gragt van den Stadt Gale, soo nodigh wercksal weesen [...] weten wij niet, maer souden een oordel en dat daer met, nog wel eenigen tijt sal connen worden gewagt tot dat andere nodigen wercken geabsolveert sullen wesen om niet al te veel seffens over hoop te haelen, ende the coulijs and the dorpen, niet te veel te beswaeren.'

2. 'bijna met gelijke snelheijt terug [kwamen] en veele over 't hooft der omstanders [vlogen] sonder dat aen d'steenen anders konde vernomen werden als een star met kleyne affgebreyselde schilfers'



Afteyckeninge der Stadt Gale
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S

excellently. When Van Goens, who had by then had succeeded Van der Meijden as governor, and De Leeuw came to inspect the work in September 1663, the building work on the Zeepunt and Middelpunt was completed. It was only on the Hooftwacht that some work still needed to be done (SLNA, 1/2712, f. 342, 346). In 1667 the fortification was at last completely finished. With much celebration the bastions went into use in August that year. The new names of the three bastions on the land side were revealed during these festivities. The Middelpunt was named 'the Sun, the bastion on the bay the Moon, and the one on the sea side the Star'[3] (SLNA, 1/5973, f. 236). This quotation has resulted in the names of the Sun and the Moon being swapped in historical sources. Many writings follow this order, which is incorrect (Wagenaar 1994, p. 68). The correct names of the bastions are from east to west: the Maen (Moon), the Son (Sun) and the Ster (Star).

With the completion of the work on the defences of the city, Galle was for the time being an unassailable stronghold. The fortification followed the European model, giving Galle the appearance of a fortified city in the Republic. The only difference was that the city was surrounded by sea for the greater part. Governor Van Goens was exceedingly pleased with the result. He even thought 'that repairs would not be necessary in the coming centuries. As we assume that we will never leave Ceylon (being one of the Company's most valuable possessions), we have executed this plan'[4] (NA, VOC 1268, f. 1065). According to Van Goens the plan was thus evidence that the Dutch intended to stay on Ceylon forever.

3 'de Son, the punt aande bhaij the maen, the punt aan the zeecant the Ster'

4 'dat in eenige eeuwen om geen reparatie behoeft gedaght te werden, want the wijl wij vaststellen dat wij Ceijlon (als een waerdigh andapperent als den waerdighste juweel van the Compagnies Kroon) noijt moet dencken te Vlaaten [verlaten] soo bouwen wij ook ja soodanige concept'

Figure 7.7 Project to strengthen the fortifications of Galle, signed by Van Goens and Van der Meijden on 10 May 1659. The map was made by the surveyor Adriaen de Leeuw and is now in the National Archives of the Netherlands (Sheet 1053).

Legend:

A.	De Hooftwacht (The Main Guard)
B.	Het Houten Wambas (The Wooden Wambas)
C.	Het waterpoortje (The water gate)
D.	Het strandpoortje (The strand gate)
E.	Het Waterpas (The Waterpas)
E.	Het Swarte Fort (The Black Fort)
F.	Ackersloot
G.	De Vischers Hoeck (The Fishermen's Corner)
H.	De Vlagge Spil (The Flag Pole)
I.	Het Nieuwe Werck (The New Work)
J.	Het Crabbe gat (The Crab place)
N.	De Zeepunct (The Sea Point)
O.	De Middelpunct (The Middle Point)
…	De poort staende onder de Hooftwacht (The entrance near the Main Guard)
P.	Een Nieuwe Punct comende op de hooghte daer nu 't geregtstaet; om te commanderen over het hooghste van de Stadt: ende Puncten, waer binnen vers water is, en al de Packhuijsen besloten zijn. (A New Point that will be located where the court of justice is at the moment. This place is suitable because it is the highest point in the city. There is fresh water available and all the warehouses are located here.)
Q.	De Gordijn tuschen de Hooftwacht; ende Nieuwe Punct. (The wall between the Main Guard and the New Point.)
R.	De Gordijn tuschen Ackersloot; ende Nieuwe Punct. (The wall between the Ackersloot and the New Point.)
S.	De Nieuwe geprojecteerde gracht. (The proposed new defence canal.)

In the city

It is now known what Galle's defences looked like in the early years of the VOC period. In addition to being a fortified town, above all Galle was logistically an important crossroads. Every year many ships entered the harbour to load and unload their cargo. Between 1640 and 1660 twenty VOC ships on average moored in the harbour each year. The majority of these were yachts of all different sizes. The others were flutes, frigates, galiots, returning ships and warships. Galle was a central place in the logistical network of the VOC. In addition to VOC ships ten Asian merchant ships visited the harbour on average every year, mainly from the Indian coast. Lastly there were small seagoing vessels - fishing boats and transport ships used for transport along the coast. All this shipping provided a lot of employment. Consequently many Company employees settled in the city where they lived and worked. Building quickly got under way and as well as housing, certain social services were provided. Within thirty years Galle was a small city with a dynamic society.

What did the Dutch find when they conquered the city in 1640? A number of Portuguese sources tell us that there were some churches, a workplace, a hospital and a poor house in Galle (Queyroz 1930; Ribeiro 1947). In the northwest corner of the city, for example, was the church of St. Francisco. Resende's map (figure 7.2) gives us a better picture of the buildings in the city. A number of the buildings just mentioned are marked on this map. It is also interesting that the first attempts at a street pattern are apparent. The houses are depicted on the map in an orderly fashion. At that time 262 Portuguese families lived outside the garrison in Galle. There were also six hundred craftsmen active in the city (Ribiero 1947, p. 35). It is not evident from these sources how many slaves there were and how many Sinhalese were living in the city. We do know that they outnumbered the Portuguese. The problem, however, is that the sources focus on the Portuguese and tell us little about the local population and the slaves.

More is known about the buildings and the inhabitants of Galle in the time of the VOC. Thanks to a large amount of archive material we have been able to reconstruct a picture of the city at that time. An extremely interesting source in this connection is the schepenkennisrol, which originates from the National Archives of Sri Lanka in Colombo (SLNA, 1/6309). This source includes the period 1655 to 1675 and provides information on the ownership of real estate in Galle. The source continues after 1675 but is difficult to read owing to the deterioration of the ink. During the period 1655-1675 an exact note was made in a document of when a house or garden changed owners. The document stated the parties involved in the transaction, the real estate in question, the amount the purchaser was indebted to the vendor and the date when the transaction took place. What is particularly interesting is that a precise description was given of the location and surroundings of the real estate. In this way we can build up a picture of the streets that existed in Galle and where the houses and gardens must have been situated. As the description of the location of the real property was coupled with a description of the immediate surroundings, we can learn more about the city in addition to the houses and gardens that existed. The documents refer, for example, to various public buildings. This source also tells us about the composition of Galle's population. The name and position of the parties involved are given for every transaction. In this way it is clear who was active in the city. In total there are about 450 transactions.

A placard dating from 1646 shows that a street pattern already existed. This stipulated that the population must clean the street once a week. It was necessary because 'most of the

Galle 1655-1670	
A	Bazaar
B	Weeshuijssteeghie
C	Lijnbaenstraet
D	Visschers Hoeck
E	Kerckstraat
F	Moorse Kramerstraet
G	Zeestraet / Zeeburghstraet
H	Middelstraet
K	Kerckdwarstraet
1	Ster
2	Son
3	Maen
4	Waterpas
5	Swarte Fort (Black Fort)
6	Ackersloot
7	Vlaggespil (Flag Point)
8	Kerk St. Francisco (St Francisco Church)
9	Kerkhof St. Francisco (St. Francisco Churchyard)
10	Weeshuis (Orphanage)
11	Stadsherberg (Inn)
12	Timmerwerf (Carpenter's yard)
13	Kerk (Church)
14	Pakhuis (Warehouse)
15	Ziekenhuis (Hospital)

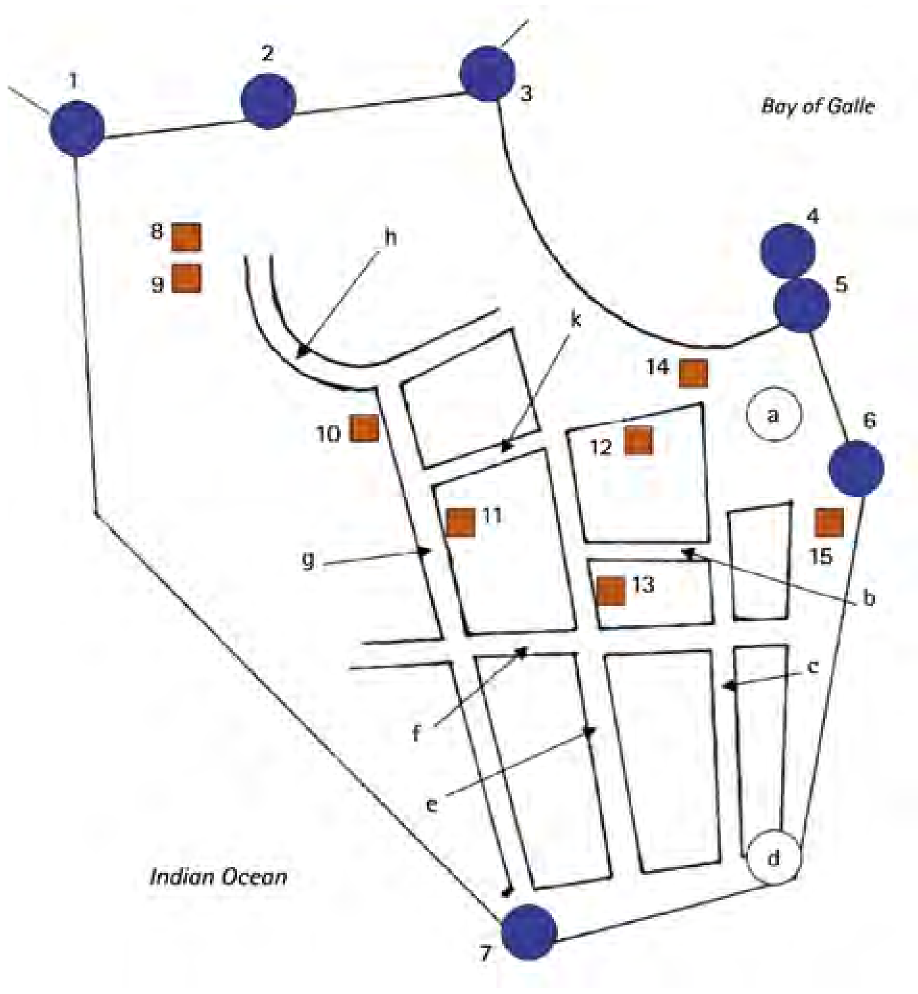


Figure 7.8 Reconstruction of Galle around 1670.

houses of the city are situated on straight streets nowadays'[5] and it was better for the city if the streets were clean (Hovy 1991, p. 10). The schepenkennisrol very probably resulted from an ordinance dating from 1648. This stated that all transactions regarding real estate had to be registered from then on (Hovy 1991, p. 15). In the early years, however, the governor of Ceylon gave away many houses. After the Portuguese left, a lot of houses were unoccupied. Uninhabited houses fell into disrepair and to prevent loss of capital the Company gave the houses to its employees. A deed stating that the property had been a gift was proof that the new owner had acquired the house 'honestly'.

We know from the schepenkennisrol which streets existed at this time. Figure 7.4 shows which streets these were. The documents mention Lijnbaenstraet (literally Rope Yard Street, known today as Leyn Baan Street), Kerckstraat (currently Church Street), Zeestraet (present-day Lighthouse Street) and Middelstraet (modern Middle Street) the most. There were therefore many buildings in these streets from early on. With the exception of Middelstraet, they ran from north to south. We know this because the documents state that the houses

5. 'jegenwoordich 't meerendeel der huysinge deser steede in reghte straten sijn gebracht'

are on the west or the east side of the street in question. Middelstraet partly ran from east to west but at a certain point curved northwards in the direction of the Son bastion, previously known as the Middelpunt. This is probably the origin of the street name. Now and again Middelpuntstraet (Middle Point Street) was even mentioned, which does seem to confirm this assumption (SLNA, 1/6309, f. 213, 216). Zeestraet is also referred to as Zeeburghstraet (Sea Fortress Street) or Clipstraet (Reef Street), probably because the street ran in the direction of the Flag Pole or reef which the area was named after. Van Kittensteijn referred to this point a few times as the 'work of Zeeburgh' (NA, VOC 1185, f. 478, 484). Other streets mentioned in this source are the Weeshuissteeghie (Orphanage Lane), Kerckdwarsstraet (Church Cross Street), Moorse Kramerstraet (Moorish Pedlar Street) and Nieuwe Lijnbaenstraet (literally New Rope Yard Street). The Visschers Hoeck also appears in the documents; hence this part of Galle was also inhabited.

A central point in the city was the market square, known as the bazaar. This was in the northwest corner of Galle, to the southeast of the Swarte Fort. One of the first times the bazaar was mentioned dates from September 1646. In that year a decision was made to open a meat hall on the bazaar where livestock would be slaughtered and sold (Hovy 1991, p. 10). In contrast, the separate fish market was located outside the city walls of Galle until 1650. We know this because Van Kittensteijn wrote to the Council of India on 23 March 1650: 'On a day to day basis we are trying to bring the market where fish is sold into the city. This would liven up the city. Then the sale of products outside the city would not be allowed.'[6] (NA, VOC 1177, f. 379). An additional advantage was that the Company would then have more control over the trade in fish. In any case, at the end of 1650 there was an adequate supply of products on the bazaar. Van Kittensteijn informed the Council of India that: 'Everything is for sale in large quantities at a low price on the bazaar'[7] (NA, VOC 1185, f. 365). This was in contrast to the early years in Galle when food was in exceedingly short supply, as everything had to be brought to the besieged city by ship. To ensure that business on the bazaar would run smoothly, in 1643 the Company created the function of bazaar keeper. This person was responsible for fostering and maintaining good relations between the Sinhalese and Company employees on the market. A soldier with a good reputation was to be appointed to this position (Anthonisz 1902, pp. 396, 443). The schepenkennisrol mentions a bazaar keeper twice: in 1656 Michiel Pouwels and two years later Lubbert Willemsz (SLNA 1/6309, f. 12 and 61).

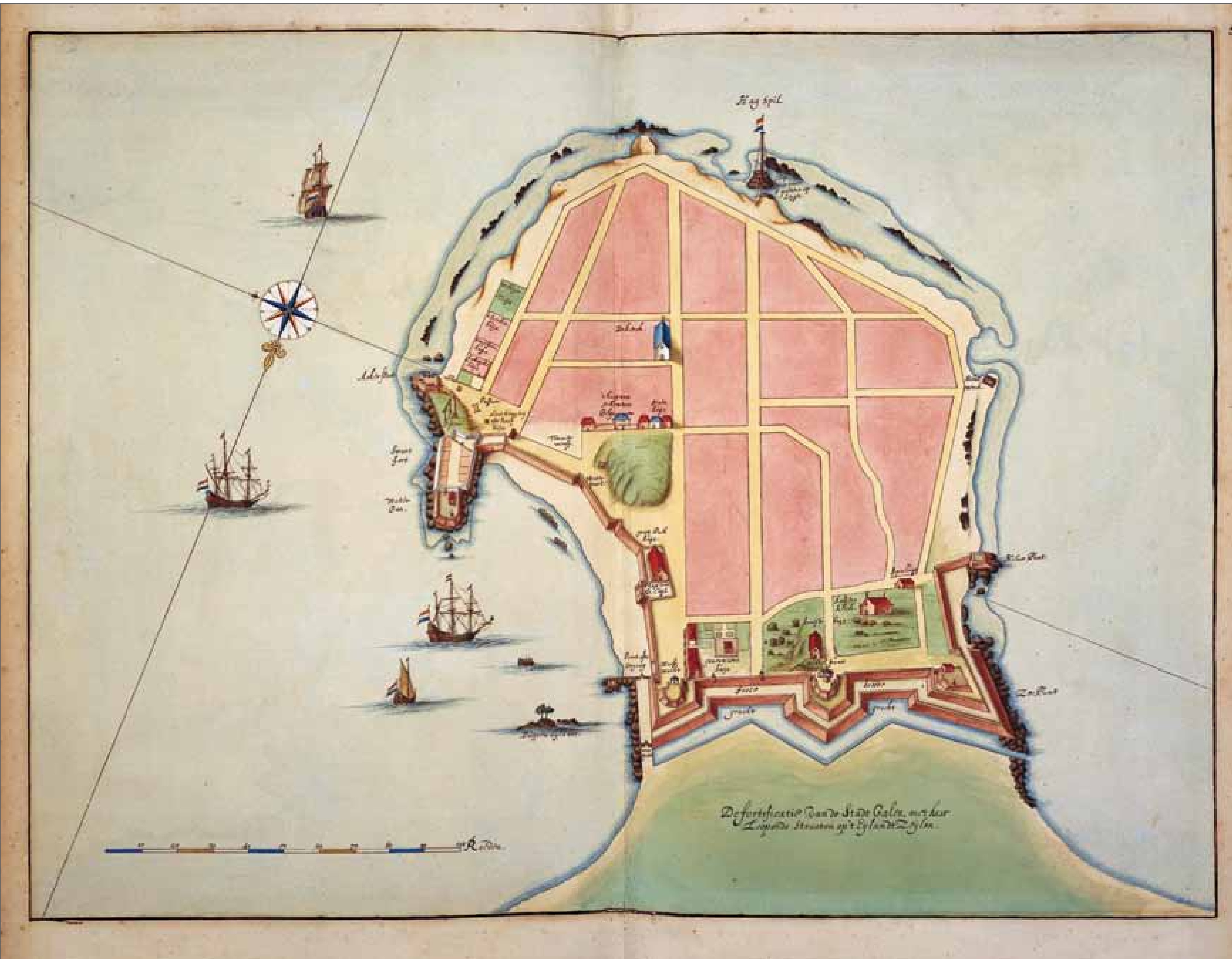
Several Company officials owned a house around the edge of the bazaar. The hospital of the VOC was situated on the southeast side of the square. In 1646 it was decided that 'the white house' was suitable for use as a hospital after some minor repairs (NA, VOC 1159, f. 545). The German Saar also located the hospital on this spot. According to him, the building had served as the mint in the Portuguese period (Honoré Naber 1930, p. 66). The hospital mainly treated soldiers. Seafaring personnel who came to Galle could also be treated here if they were ill. Thus the schepenkennisrol also mentions the medical staff that were required. The senior surgeon was in charge and was assisted by other surgeons and junior surgeons. The position of 'sieckevaer' is mentioned once; he worked on a ship or was the head of a number of nurses in a hospital.

6. 'Wij sijn dagelicx besich alle winkels visch passerende basaar die tot noch toe buijten d'stad haer plaets gehad hebben binnen the fortresse te trecken naer welc effect het d'stad seer levend maken [...] expresse te laten verbieden genige theminstedingen buyten the stad sullen mogen Vcocht [verkocht] werden.'

7. 'Op the basaer is alles ten overvloede tot een geringe prijs te crijgen.'

A map of Galle dating from around 1663 tells us more about the buildings in the city. The map has the title, 'The fortification of the city of Galle, with the streets there on the island of Ceylon' (figure 7.5). The author of the map is unknown. Several landmarks, such as the bastions and the defence walls, can be clearly seen on this map. It is also noticeable that the street pattern now has a definitive form. A comment should be made, however, about the southeast corner in this respect. It is highly questionable whether this part of Galle was already being developed. The schepenkennisrol and other sources would indicate otherwise. The bazaar (marked here as the 'passaer') is certainly recognizable. To the south of this is an elongated block of buildings with several descriptions. From south to north: 'de Suijer Tuijn'

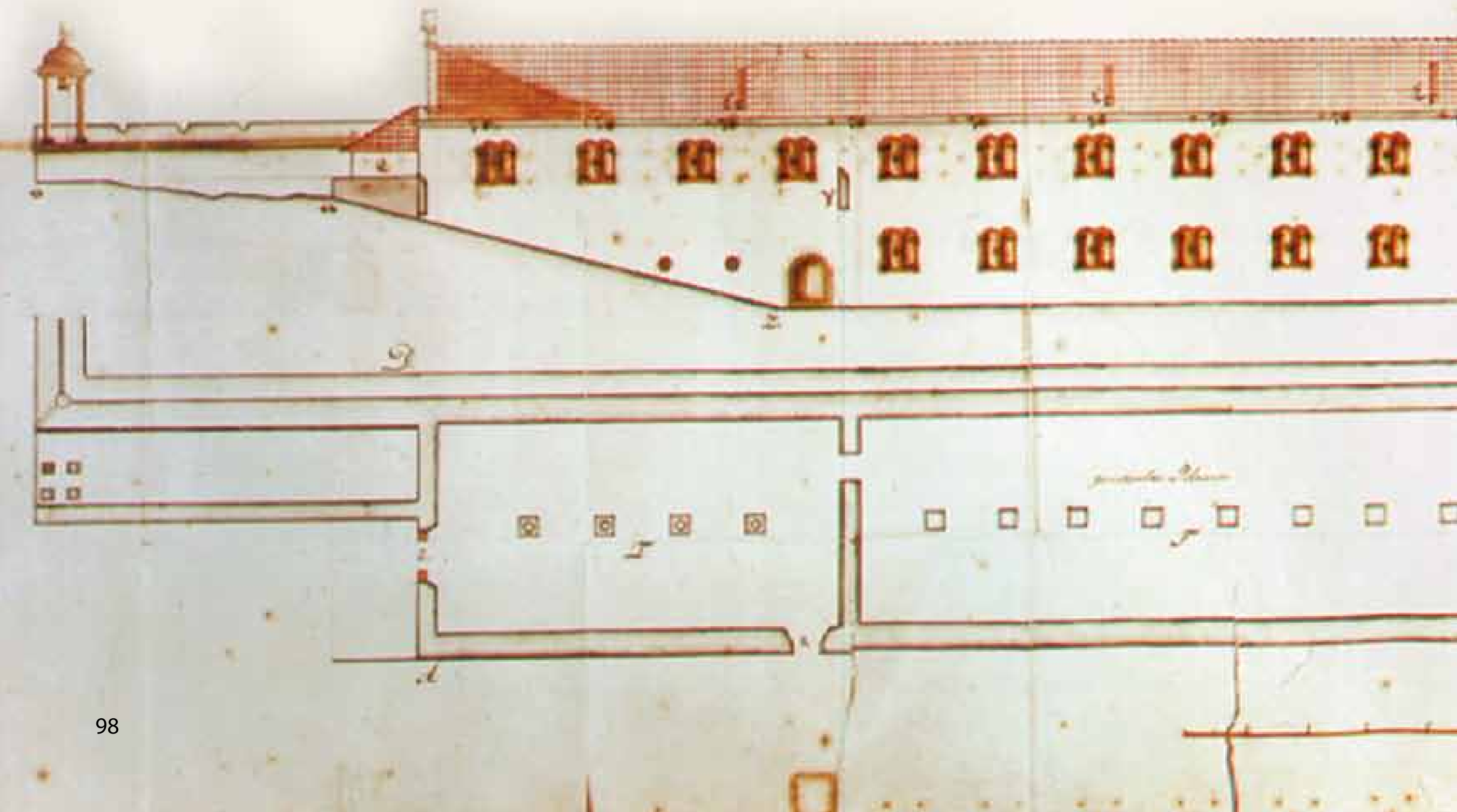
Figure 7.9 Map of Galle from around 1663. The map gives an exceptionally clear picture of how the city looked at this time. The work on the fortifications appears to be almost finished. On the north side of Galle the Main Guard, Middle Point and Sea Point provide protection against attacks by land. A wall runs from the Main Guard to the Sea Point in the direction of the Black Fort. The wall and this fort provide protection against an attack from the sea. Other defence works, such as the Akersloot, the Flag Pole and the bastion on the northwest side of Galle are also depicted.
Furthermore, the map gives a good impression of what had already been built in the city. The street pattern appears to have taken on a definitive form. Whether this was actually the case is dubious, given that the land in the south and southwest was still unused. Moreover, the map shows the hill in the city, mentioned in several sources, as well as a number of buildings and landmarks. The church, timber yard, bazaar, hospital and various houses can all be recognized. From: F.C. Wieder, Monumenta cartographica: reproductions of unique and rare maps, plans and views in the actual size of the originals accompanied by cartographical monographs V (The Hague 1933) no. 110.



(the Sury Garden), 't Siecken huijs (the Hospital), 't meesters huijs (the Master's House) and fabrijcks huijs (the Factory House)'. It was known that the hospital was located here. The mention of 'de Suijer Tuijn' here is interesting as palm trees grew in the garden. Palm wine was produced from these which was economically advantageous. The other places are new. On the north side of the bazaar two gallows can be recognized. 'Justiti' (justice) is written next to them. At that time there was also a 'lont klopperij ofte Rasphuys' on the bazaar. So sentences were passed in this corner of the city. The guilty were hung on the gallows or had to work in the house of detention making cord or rasping wood.

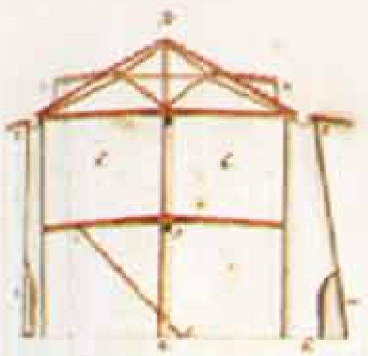
Galle also had a timber yard. This was on the west side of the bazaar, behind one of the houses. This was a good location, given how close to the bay it was, which had many advantages when ships need repairing. Many Company employees worked in the timber yard. The schepenkennisrol mentions several of them. In addition to working on minor repairs to ships they would mainly have been involved with the construction of the city. A master carpenter was in charge of these men. For a long time this was Reyer Gillisz. He originated from Enkhuizen, a maritime city in the north of Holland, and arrived in Asia in 1636 as a junior carpenter. Gillisz worked his way up to senior carpenter and in 1643 renewed his contract with the VOC for three years (Anthonisz 1902, p. 407). In 1650 he was elected a governor of the orphanage in Galle and was still registered as a master carpenter then (NA, VOC 1185, f. 492). Six years later he bought a house in Lijnbaenstraet. At that time he was still the 'master carpenter of the Company's yard and carpenters'. We know that Gillisz died before 29 April 1658, as the orphanage governors of Galle then sold his house in Lijnbaenstraet for the benefit of his children who had been orphaned (SLNA 1/6309, f. 5, 57). Gillisz had therefore served the Company for more than twenty years and during that period had managed the timber yard and its staff.

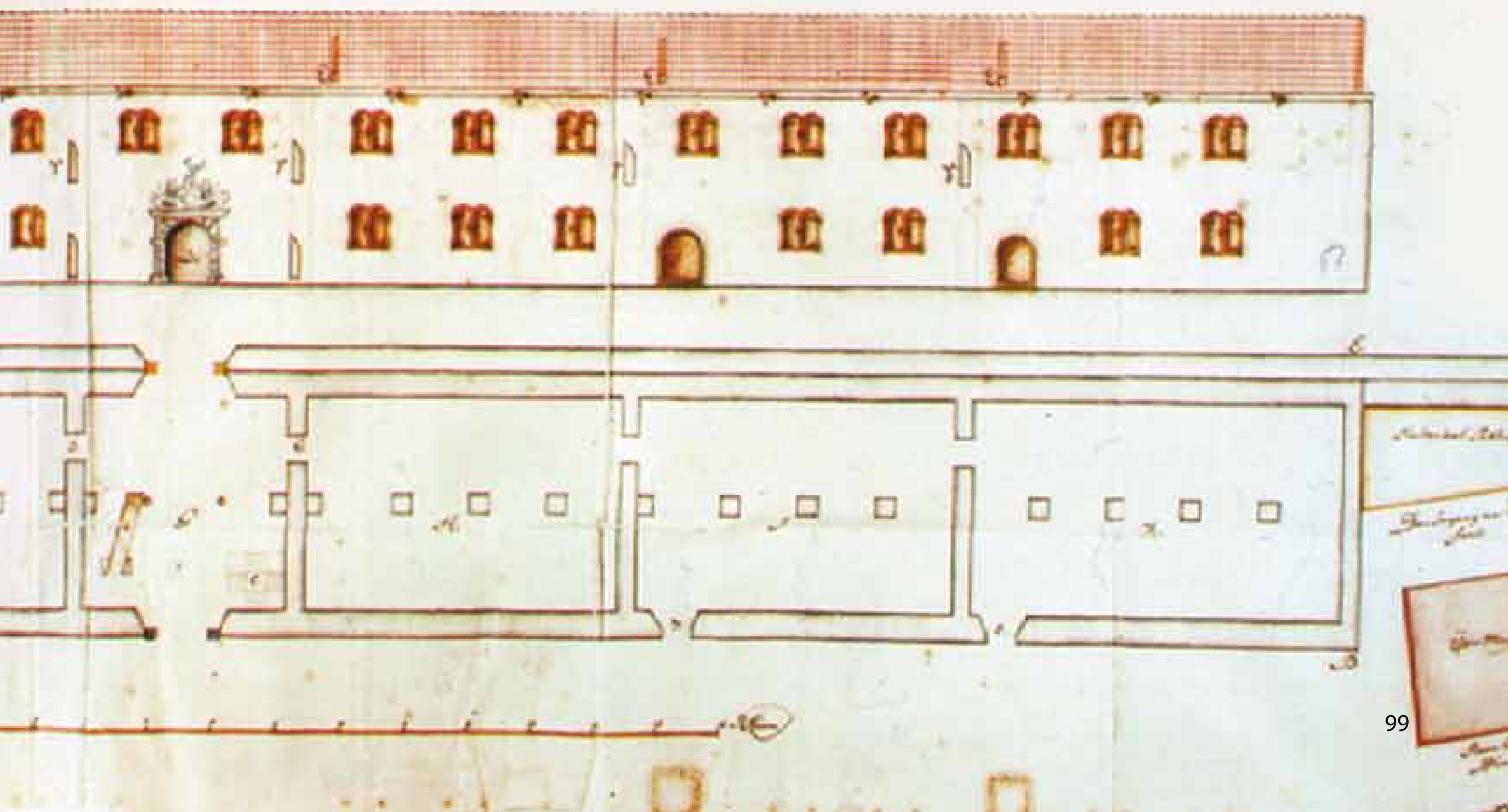
Figure 7.9 The Dutch Warehouse in Galle around 1717, The Netherlands National Archives (aanwinsten eerste afdeling inv. 599)



Besides the workmen in the timber yard there were other craftsmen working in the city. Without doubt one of the most striking of these was Claes Blom, who came from Hamburg. He was a master smith and from July 1657 the schepenkennisrol mentions him regularly. As master smith, Blom was the boss of the smithy and the arsenal. It is not known where these were located. In April 1675 Blom is mentioned in a document from which we can conclude that he had been in Galle for at least eighteen years. (SLNA 1/6309, f. 32, 41, 138, 188, 244, 268, 306, 311, 313, 324). Blom was thus responsible for a number of businesses and had many people under him. His many years in the city and the positions he held made him one of the most prominent figures in Galle. In the smithy he was assisted by a smith and a foreman. The farrier and the blacksmith would also have been found in the workplace. The blacksmith spent his time producing large, heavy items of iron. It is likely that the coppersmith, who produced and repaired copper-work, had close connections with Blom's workplace. Blom's staff would also have included a craftsman who made and repaired a particular type of gun and a craftsman who made the wooden components of handguns. Altogether Blom ran a fairly large enterprise. The fact that all these jobs existed shows that the city was extremely industrious.

The existence of several warehouses was of critical importance to the city. The cinnamon that was brought to the city as well as the food supply for the population had to be stored somewhere. In the early years the old Portuguese church, the St. Francisco, served this purpose. In 1646 this church was still used as a place to sleep for the Company slaves. When the church was in danger of collapsing that year, all the slaves were transferred to the Swarte Fort. At that time crew members on shore leave were also staying in the fort (NA, VOC 1159, f. 543). A year later the St. Francisco was permanently vacated after extremely heavy rainfall. The cinnamon and rice then stored in the building were moved to a warehouse. This storage place was on the beach in the bay of Galle, between the Swarte Fort and the Maen bastion. Next to the church was a Portuguese cemetery, according to the schepenkennisrol (SLNA, 1/6309, f. 213). Between 1656 and 1664 there was also a warehouse in Kercksdwarsstraet. This was on the north side of the street, one plot from the corner with Zeestraet (SLNA, 1/6309, f. 8, 69, 134, 156, 165). What the warehouse was used for is not known.





In 1667 plans were made to build a big new warehouse in the city. It was to be built at right angles to the Swarte Fort. This part of the city sloped slightly upwards; in figure 7. 5 this is represented by a mountain. The warehouse was directly on the beach so that goods could be easily transported to and from the ships. It had to be built of stone with large wooden beams to hold the construction together. Building commenced in 1667 under the direction of Hans Christoffel. This Christoffel is also mentioned in the schepenkennisrol. It refers to him as the 'overseer of the E. Comp's works' (SLNA, 1/6309, f. 151). In 1669 the first part of the warehouse was finished (SLNA, 1/5973, f. 57, 317, 331, 335-336, 344; NA, VOC 1268, f. 1065; NA, VOC 1269, f. 368). This section would ultimately serve as the basis of the large warehouse that was completed in the eighteenth century.

Galle was a centre for trade and shipping. This is very clear from the jobs mentioned in the schepenkennisrol. Seafaring personnel are well represented: skippers and steersmen, as well as seamen of a lower rank like a sailor, gunner, artilleryman, quartermaster, steward and a sail maker are mentioned. They bought a house in Galle as an investment or as somewhere to settle. The pilot of Galle had an important task, namely to guide ships into the bay of Galle that wanted to moor there. After a ship had signalled that it wanted to enter the bay, by hoisting the Dutch flag and firing three cannon shots, the pilot went to meet the ship. In the early 1660s this was the task of Bastiaen Andriesz. We came across him earlier when the Hercules went down. Andriesz came to an unfortunate end in September 1663 when he drowned in a small local vessel (a dhoni) (SLNA, 1/6309, f. 102, 124, 133; SLNA 1/2712, f. 339).

The city had two other positions related to trade: the sabandaar and the captain of the Mahabadde. These two offices had already existed before the arrival of the VOC. The sabandaar (literally 'harbour master') was responsible for collecting the harbour dues and served as an intermediary between foreign merchants and the local authorities. The Company maintained this office on Ceylon but the sabandaar also remained elsewhere in Asia where the VOC had sovereign rights, as in Malakka and Batavia (Stapel 1943, p. 167). For a long time Joan da Costa was the sabandaar of Galle. We come across him in this position for the first time in 1650. Ten years later he was presented, with the approval of the Council of India, with a gold chain for his loyal service (Ottow 1995, p. 195). The captain of the Mahabadde supervised the trade in cinnamon, the product of Ceylon. This person was in charge of the chialas, a caste that was compelled to peel the cinnamon. This was already the case before the arrival of the Company. The captain of the Mahabadde was assisted by the vidanes (village chiefs). They had to make sure that the cinnamon peelers went into the woods to harvest the cinnamon in good time. The chialas had to meet the quotas imposed by the VOC (Reimers 1927, pp. 31-32). This was of paramount importance, given that cinnamon fetched vast sums of money on the European market.

The urban society

In the early years after the conquest of Galle the emphasis was on defending and holding the city. The population of the city was therefore predominantly made up of soldiers. In 1644 there were in total 887 Company employees in Galle. Of these 824 were registered as soldiers, 190 of whom were ill. The other people were seamen, craftsmen, merchants and medical staff (NA, VOC 1147, f. 662). The military presence remained high after this. A number of them are mentioned in the schepenkennisrol, including positions such as soldier, corporal, lieutenant, ensign, sergeant and captain. Gradually it became clear that the Company had a secure hold on Galle, which meant

that after a number of years the city itself could develop. The city government took shape and people settled in Galle voluntarily. Many of these citizens were ex-Company employees who went to live in Galle after they left the Company. People who had not been employed by the Company, such as the local population and merchants, also found their way to Galle. Life in the city developed at a rapid pace and the composition of the population became extremely diverse.
In 1660 the structure of the city government was settled. A letter from Van Goens to the Council of India provides some insight into this composition. He stated that Godsken had been appointed commander of Galle and a Political Council would assist him. Together they administered the division of Galle, that is to say the city and the surrounding land. 'The merchants Ooms, Jan de Voogel and [...] dissava Ferdinandus Alvares' were members of the council. Six 'of the most prominent ministers including a military person and the captain of the citizenry'[8] were also members. A description of the function of the captain of the citizenry has never been found but he was probably responsible for the civic militia and represented the citizens of Galle on the Council of the city. Van Goens does not say what the tasks of the other members were. According to him, there were a number of other offices in Galle focusing primarily on trade. Someone was responsible for the general administration and there was also a fiscal, a shopkeeper, a cashier, a receiver and a dispensator (NA, VOC 1233, f. 189-190). Some of these probably sat on the Council. The fiscal, cashier and receiver performed important tasks. The fiscal was responsible for the maintenance of order as a whole in the city and the surrounding area and for tracking down commercial irregularities. He was a sort of chief officer of justice. The cashier managed the Company's cash. The receiver was responsible for supervising and recording the incoming and outgoing goods. The schepenkennisrol tells us that there was also a bookkeeper in Galle. He kept a record of the financial results of the business, probably including the extensive personnel administration. Lastly the shopkeeper and the cashier were responsible for the sale and issuing of various goods, including food.

The schepenkennisrol also mentions a number of other positions. Some of these can be classed as support staff, such as a clerk, a messenger and a bookbinder. There were secretaries, including a personal secretary for Van der Meijden, the governor. A shutter is mentioned once. This person was probably responsible for opening and closing the town gate. We know from Wieder's map that there was in any case an entrance to the city near to the Son bastion. Furthermore, there was the office of usher, who was a bailiff in the service of the court. This source also mentions an inspector of weights and measures. In view of all these positions we can conclude that many offices existed at an early stage in Galle and that the city was developing robustly.

From the moment the VOC had Galle in its possession, plans were made to found a colony in the city. In 1646 fourteen or fifteen citizens lived there. Four years later the number had grown to 68. The governor of Ceylon at that time, Joan Maetsuijcker, was of the opinion that a colony of citizens in Galle would be advantageous to the Company. By giving the citizens a limited measure of freedom to trade independently of the VOC, they were able to build up a living. The advantage of this to the Company was that they did not have to spend as much money on paying soldiers; the citizens could help defend the city in an emergency. Their presence would also be a positive impetus to the city. Van Kittensteijn and Van Goens, who were governors after Maetsuijcker, saw many advantages in the policy of colonization. Van Goens even wanted entire families to come over from the Republic. They too would be given the opportunity to manage a piece of land and develop agriculture. This would make the island self-sufficient and strengthen the hold on the interior. In the end the families did not come to Ceylon and there

8 'daer onder een militaire, ende den capitein van the burgerije'

was little enthusiasm for the plans for agriculture – it was hard work and did not produce results for some years. The textile trade, however, did develop with the coast of India.

Nevertheless a number of ex-Company employees did settle in Galle. The schepenkennisrol mentions them regularly. Many of them had been in the service of the Company for a long time and had no inclination to return to Europe. They were very content with their situation and stayed on the island, often because they were married to local women. In this case they were even forbidden to repatriate to the Republic. One person, the captain of the citizenry, represented their interests in the city government. For some time Jochem Jochemsz held this position. We know that he had lived in the city since 1656 and was captain of the citizenry from 1659 (SLNA, 1/6309, f. 3). Jochemsz was extremely active in Galle – he owned several properties and was a governor of the orphanage. At the end of 1661 Jochemsz was reported as missing. How he went missing was never discovered nor what happened to him. Three years later the custodians sold one of his properties and we can conclude that Jochemsz had died (SLNA, 1/6309, f. 119, 134, 165). In 1662 Van Goens expressed how deeply the loss of Jochemsz had affected him. According to the governor the citizens of Galle had clearly felt the demise of Jochemsz (Ottow 1995, p. 244).

The continuing development of the city was reflected in the religious and social life that was evolving in Galle. We know that there was a church in Kerckstraet from 1653. Here the Protestant faith was preached. The day-to-day care of the church was in the hands of the sexton, an occupation mentioned in the schepenkennisrol. In 1666 the church in Kerckstraet was still in use. That year Van Goens asked if he could start building a new church because the old one, according to him, was no longer up to standard. He thought that it would not cost too much and if that unexpectedly was the case then there were 'some devotees of the church who would be prepared to contribute something'[9] (NA, VOC 1259, f. 2680-2681).

Several religious officials were active in the city. The most important of these was without doubt the minister. His primary task was to preach the Protestant religion to Company employees. He was also expected to teach the local population of Ceylon the basic principles of Protestant teaching. The Portuguese had converted the local population to Catholicism. The VOC was not pleased with this but in the first twenty or thirty years did not forbid Catholic services. They were afraid that a ban would increase the unrest in the countryside, which could have detrimental effects on the economy. The Company founded schools in Galle and the surrounding villages where the local population were given lessons in Protestantism and taught to read and write. In this way the local population became familiar with the Protestant faith. The minister visited these schools to see whether the teaching was up to standard.

Philippus Baldeaus was one of the preachers the schepenkennisrol mentions. He was working in the city in 1657 but is mainly known for his historical writings about Coromandel, Malabar and Ceylon (Baldeaus 1672). Many historians have used his work as the basis for their story of the history of Ceylon. Baldeaus and other ministers were assisted in their work by various other people, such as the sick visitor and the schoolmaster. The former was a comforter of the sick who assisted the minister. He visited the sick, read to them from the bible and sang psalms. In addition, the sick visitor was responsible for the schoolmasters in the Company's area. In 1650 there were sixteen schools in Galle and the surrounding area, of which two were in the city itself. The local population learned to read and write here, with an emphasis on the

9 'eenige lieffhebbers oock wel gesint tot the kerck ijets te contribueren'

Protestant faith. A schoolmaster is mentioned once in the schepenkennisrol, namely Francisco d'Araouge who worked in Bentota (Goonewardena 1958, pp. 147, 148; SLNA, 1/6309, f. 100). There was also an orphan chamber and an orphanage in Galle. The orphan chamber was founded at the request of the Council of India. This was as early as 1646. We can conclude from this that orphans already needed caring for (NA, VOC 1159, f. 545). The mention of several orphanage governors in the schepenkennisrol shows that the Company took care of the orphans. Where the orphan chamber was situated exactly is not known. More can be ascertained about the location of the orphanage. The documents show that there was a Weeshuissteeghie. This would imply that the orphanage was located there but no evidence of this has been found, however. It was possibly the site of an old Portuguese orphanage and that is the origin of the street name. Another possibility is that the orphanage was indeed located here but moved no later than 1666. From that date the schepenkennisrol does mention the orphanage and it was located in Zeestraet. Several documents state that the orphanage was on the west side of Zeestraet, one plot from the corner of Zeestraet and Middelstraet (SLNA, 1/6309, f. 201, 262, 303, 307).

Lastly it is interesting to note in connection with Galles' buildings that there were several inns in the city. Here the people could relax and enjoy a drink. Exactly how many there were is not known but there was definitely an inn in Zeestraet between 1657 and 1664. This was on the east side, one plot from the corner of Zeestraet and the Kerckdwarsstraet (SLNA, 1/6309, f. 37, 156). We also know that Van Goens wanted to restrict the number of inns because they were the cause of several problems in the city. The occupation of innkeeper was particularly popular with citizens who settled in the city. In 1663 Van Goens pointed out that a decision had been made to tax the innkeepers a fixed sum of six 'rijksdaalders' per month but little had come of it. Now something had to be done about this (Reimers 1932, p. 75). Who the owner of the inn in Zeestraet was is not known. Cornelis de Ledoucx and others are mentioned in the schepenkennisrol as innkeepers. De Ledoucx originated from Bruges and left for India in 1651 as a sailor. In 1652 Van Kittensteijn appointed him as an assistant (NA, VOC 1202, f. 202). De Ledoucx first appears in the documents in 1658 as a citizen. In subsequent years he is mentioned several times and in 1665, when he bought a house in Middelstraet with the name 'de drie capers' (the three privateers), he held the position of city innkeeper. At the end of 1667 we know from the schepenkennisrol that he was still the a city innkeeper, as he then bought a piece of ground outside the city (SLNA 1/6309, f. 59, 169, 189, 235).

Until now we have only looked at Galle through the eyes of the VOC. On the one hand this is logical as the city was in the hands of the Dutch. The Company moulded the city in a way that was most advantageous to itself. The impression could possibly arise that the society of Galle only comprised Company employees. This was certainly not the case. The local population and merchants from Ceylon and the surrounding area were also active in the city but there is less evidence of their presence in the historical sources. We have to rely mainly on VOC material for the history of Galle in this period. The local population and merchants as well as the group of women are not mentioned very often. However, the schepenkennisrol does provide some information. It mentions them regularly but gives no indication of their numbers. The fact that we have actually been able to establish their presence, however, must be seen as a step in the right direction.

Regarding the local population, the sources mention, for example, a head of an area or village. The chief of the Dolasdas corale, an area to the east of Galle, is mentioned. This was Antonio Rabel who was on good terms with the Company.
He owned two houses in Middelstraet. In thanks for his loyal services to the VOC, Rabel received a gold chain in 1660 (SLNA 1/6309, f. 91, 103; Ottow 1995, p. 195). The schepenkennisrol also

mentions a number of village chiefs (the vidanes) and persons in charge of a group of cinnamon peelers. Once or twice the documents mention someone who is described as 'Sinhalese'.

The 'Gentijfs' and Moorish merchants were more noticeably present in the city. They were mentioned earlier because they had found their way to the city centuries ago. Some of them had been in Galle for many years and owned a few properties. One of the most striking was the 'Gentijfs' Candelappe. The schepenkennisrol mentions him several times. He was certainly active in Galle between 1653 and 1664. In that period he bought and sold several houses and traded in arrack (a distilled spirit) and other commodities. He bought two houses in the Moorse Kramerstraet in 1653 and 1657. He also owned two houses in Lijnbaenstraet (SLNA 1/6309, f. 12, 19, 24, 76). It appears unlikely that Candelappe lived in these four houses at the same time and the assumption is that he bought them as an investment or traded in houses.

The Moors, Islamic merchants, had also found their way to Ceylon. They supplied products like clothing and rice and traded in arrack. In 1650 Maetsuijcker wrote about the Moors that 'for various reasons not much good could be expected for the noble company' from them[10] and that the VOC should therefore get involved in these markets (Reimers 1927, pp. 36-37). He does not give the reasons for this lack of confidence. Van Goens also distrusted this group. In 1663 he said that a close eye should be kept on the Moors. They were to be excluded as far as possible from Colombo and Negombo. The arrival of Moorish residents would, according to Van Goens, be damaging to the colony of citizens. He referred to the situation in and around Galle where they were present in large numbers and caused problems. Some of the trade was in their hands and they spread the wrong religion. They had already been banned from trading in the areas around the city and it was now necessary to make sure that this was enforced. Moorish merchants who wanted to sell their wares in Ceylon were therefore charged various tolls. The trade they were involved in was only permitted via the harbour of Galle (Reimers 1932, pp. 61, 65, 69)

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A number of Moors were active in Galle. They had names like Aude Lebbe, Onre Neijnde, Neijna Marcka and Cheeudal Caddij. Given the name of the street we can assume that the Moorish population predominantly settled in Moorse Kramerstraet. No evidence of this, however, has been found. Firstly, they owned houses in other parts of the city. Secondly, European Company officials also owned houses in Moorse Kramerstraet (SLNA 1/6309, f. 143, 232, 253, 257, 275). In which case the name of the street may be explained by the fact that the Moors possibly lived in the street before the arrival of the VOC. Another reason could be that they did indeed live in this part of the city but the schepenkennisrol does not mention this. It is therefore difficult to say anything about the place where this group stayed in the city. It is in any case certain that they were active in Galle.

Lastly, some comments about the women who lived in Galle. As is often the case this group do not feature prominently in the history of the city. The sources of the VOC only mention them sporadically as they were not employed by the Company and did not hold any positions in the city. Not many European women lived in Galle. Only the top Company officials were allowed to bring their wives with them from Europe. Most Company employees therefore married a woman from the local population. From 1640 the Dutch were permitted to marry Portuguese and Sinhalese women. The reason for this was to make their stay on the island easier (Anthonisz 1902, p. 370). The King of Candy protested in March 1644 about marriages between the Dutch

10 'om verscheyde reedenen niet veel goets voor d'E Compe: [de edele Company] te verwachten sy'

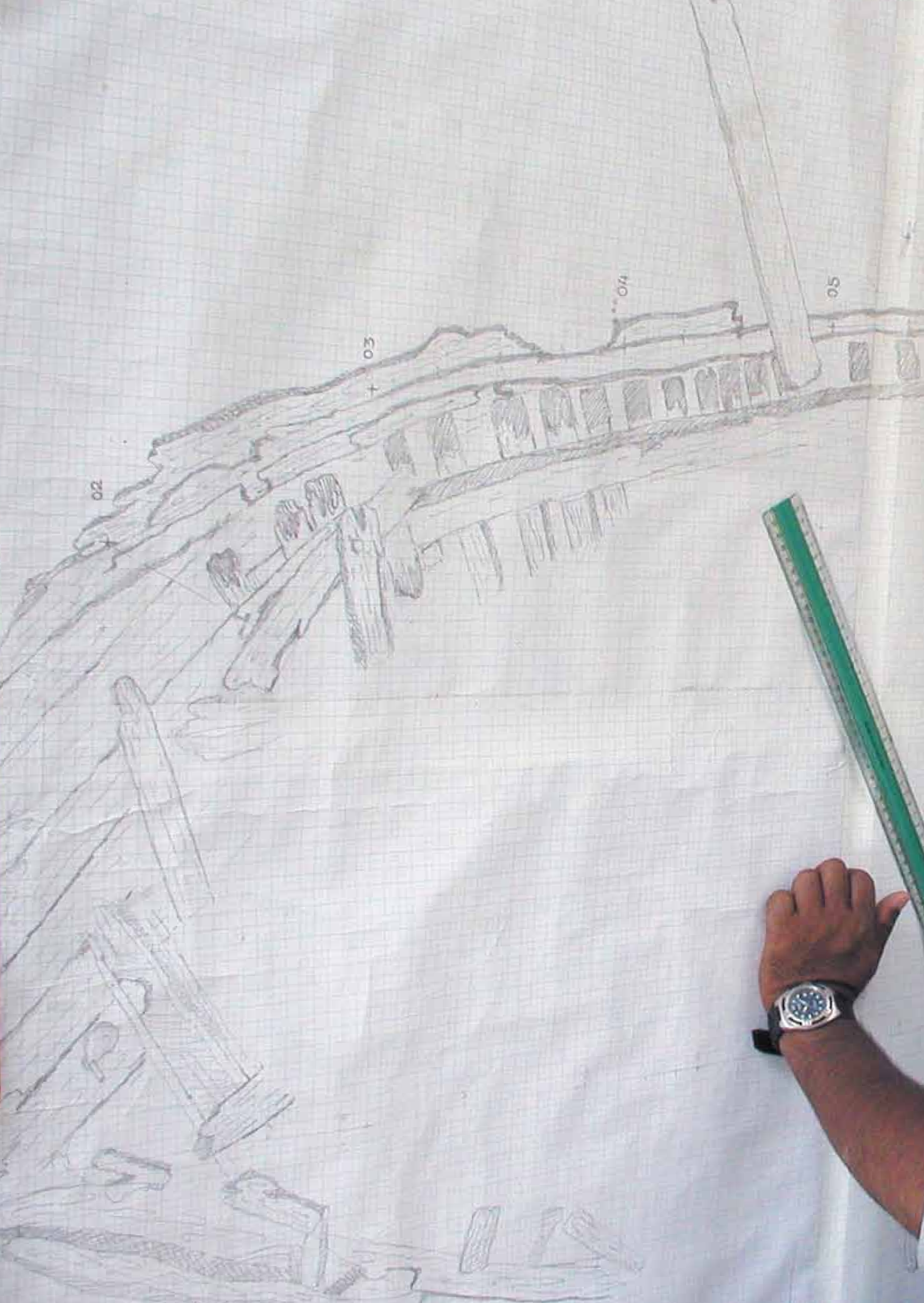
and Sinhalese women. The Council of India, however, was of the opinion that Company employees should be allowed to marry these women if they stayed on Ceylon for the rest of their lives (Colenbrander 1902, p. 308; NA, VOC 869, f. 402). Ultimately there were many mixed marriages. Van Kittensteijn, Maetsuijcker and in particular Van Goens approved of Company employees starting a family. It fitted in very well with their ideas of founding a colony on Ceylon. This followed the example of the Portuguese who had often settled as landowners. The presence of a large number of families meant that the position of the VOC in Galle and elsewhere would be strengthened. The existence of an orphanage shows, moreover, that families were already living in the city soon after the arrival of the Dutch. When both parents died the children were taken care of in the orphanage of Galle. A problem that the city government regularly encountered was that there were not enough women living in the city. In March 1659 Van Goens therefore asked the Council of India whether they could send some women to the island. The governor added the request 'no old hags or filthy whores'[11] (NA, VOC 1231, f. 348). Evidently women sent earlier had not met with approval. The schepenkennisrol mentions a few women, often in the capacity of vendor. Why they sold their houses was not mentioned. Possibly they were leaving Galle for good after the death of their husband or were again marrying a Company employee who already owned a house in Galle. In these cases there was no longer any reason to keep the house.

Conclusion

In 1662 the surgeon Wouter Schouten came to Galle. He made the following notes in his travel report about his visit: 'During our time there, and in the years that followed, we substantially fortified this city, located on an extremely beautiful bay. Galle already had large walls, ramparts, canals, bulwarks and gates built by the Portuguese. There were splendid houses and buildings, clean wells, beautiful gardens and churches in the city. The Dutch could live here quietly for many, many years. The Bay of Galle is spacious and can afford shelter to a large number of ships but some hidden rocks in the middle of the channel of the approach route make the bay dangerous. The ship the Hercules, which broke into a thousand pieces on such a rock, experienced this' (Breet 2003, p. 287).

This quotation summarizes the development of Galle in a couple of sentences and brings us back to the Hercules. In the period 1640 to 1670 Galle had grown into a Dutch colonial fortified city. Every year ships visited the city to load and unload goods. The fortifications guaranteed the safety of Galle and visiting ships anchored in the bay. Building developments inside the walls of the city had progressed further in this period. The street pattern, houses, a church, warehouses, inns and other facilities were built in this period. At the same time the society also developed. Not only people engaged in trade, defence or the city government had found their way to the city, but also citizens, for example, who wanted to settle in Galle permanently. People from the local population and merchants from India and elsewhere were also active in the city. Unfortunately the historical sources say little about their presence. That is the problem: the VOC sources give a one-sided view of the city. In a short time Galle became a Dutch city in the East.

11 'geen oude vellen ofte vuijle hoeren'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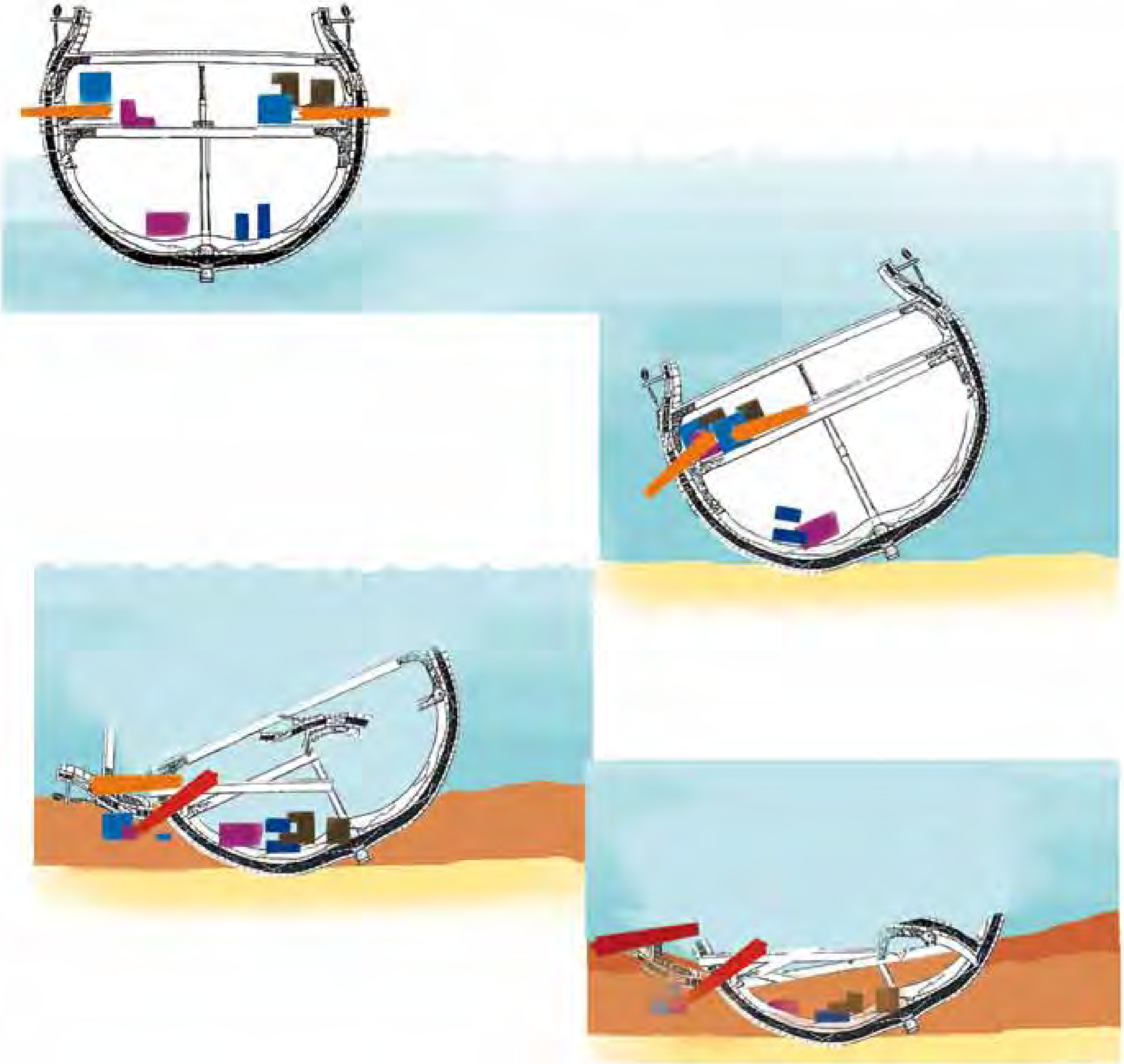
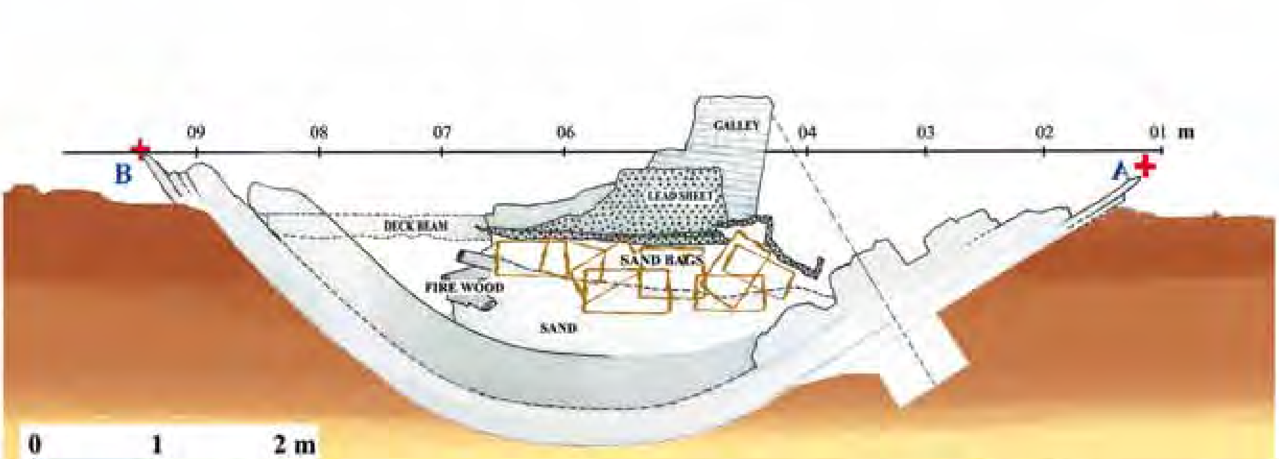
Forming process of the Avondster





Cross section of the Avondster

8 Report on the excavation of the midship section

By Rasika Muthucumarana, Wijamunige Chandaratne, K.D. Palitha Weerasinghe, Abesin Mallawa Arachachchige Dayananda

Introduction

The excavation of the midship area began in November 2002 and continued until the end of April 2004 with an experienced diving team who could work full time. Given the highly dynamic nature of the site, the excavation method needed to be planned carefully. The trench was defined in such a way that it included all the important features which allowed us to then excavate layer by layer. It was decided to mark the site based on Survey Points and to excavate only that area. The water dredge was used for excavating and digging. Since the site is in shallow water, a water dredge and not an airlift was used. There were two Robin water pumps each of 3HP, which were used from a rubber dingy. The pumps were actually not powerful enough to do the job well and they had to be repaired very often. Therefore at the end of the year 2003 a new 5.6HP Robin water pump was purchased. This made excavating much easier.

It had been assumed that the hull and wooden planking on the starboard side and the port side were intact and that these could be used as the two sides of the trench without much difficulty. But the edges of the trench, on the bow side and stern side were naturally demarcated by sand which, when the digging went deep, would collapse and sand would flow into the excavation pit. Therefore they had to be demarcated using two nylon ropes. To lessen sand slippage, digging was carried out a little way away from the margin with sand bags and alternative techniques used to prevent the movement of the sand.

To remove the new layers of sand and crab shells, which formed every day, quick dredging was used. For fine excavation work 'hand-blowing' was used where sand is carefully stirred up by hand a little distance away from the dredger. In that way the small and fragile artefacts in earlier layers and sediment could be saved. Since the sand that is removed will fall on another part of the site, any artefact that is deposited with the sand, without being noticed, will not be lost.

To help in the accuracy of the site mapping 10 aluminium poles (AP) were placed around the perimeter of the site in November 2002. This has been reported on in chapter 3 (see Figure 3.11).

Figure 8.1 Mid-ship trench location

Figure 8.2 Avondster wreck site formation process

Aims of the Excavation

Apart from the general aims of the excavation of the Avondster formulated in the project proposal the excavation of the midship section had the following aims:

- To better understand the composition of the site and the wreck forming process;
- To gather information on the ship's construction by excavation of the assumed location of the master-frame;
- To gather archaeological evidence for the area where food preparation and cooking took place;
- To gather archaeological evidence on the cargo of a ship employed for regional and local trade;
- To fine tune the excavation techniques for this site.

Pre-excavation conditions

To make it easy to locate the site and as mooring points for the dive boats, buoys were placed around the wreck, attached to concrete blocks by chains and buried using the dredge. Based on the experience gained in the bow section it was decided to work in a trench four metres wide running across the ship from the permanent survey points 07 and 09 on starboard to 25 and 27 on the port side. It was understood that if the excavation trench went too deep, its narrow width might create problems. Two nylon lines from SP 07 to 27 and from SP 09 to 25 were laid to define the trench area. After marking the excavation site the seabed surface was recorded by drawings and by photography and video filming. Also Site Surveyor measurements were taken of the site and the main objects. A primary surface plan of the original state of the site was first prepared and transferred into a 1:10 master plan.

The hull region between the survey points 00 to 17 on the starboard side was exposed and clearly visible during November 2002. Similarly the region between survey point 18 to 27 and 30 to 32 on the port side were also clearly exposed. Therefore it was not difficult to mark the boundaries of the excavation trench and to start the trenching.

First layer

Towards the end of November 2001, the excavation of trench 07-09 began with the removal of the top layer of sand and other waste material, which had been deposited there. The port and starboard sides of the hull became clearly exposed making it easy to identify, measure and draw. The top-most layer consisted of sediment and modern objects that are

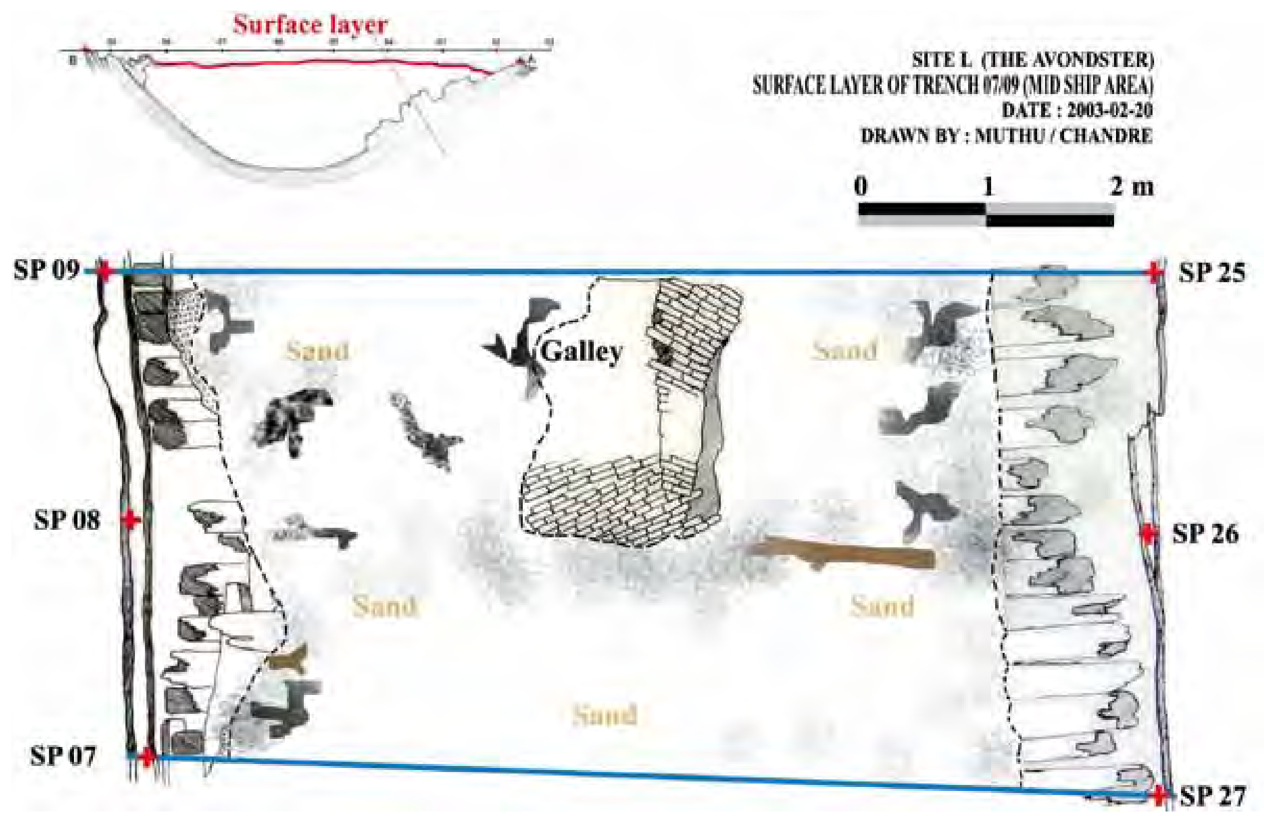


Figure 8.3 Seabed of mid-ship trench before excavation

Figures 4.3: Port side of the hull, marking extent of mid-ship trench

continually deposited and removed by the waves and currents. Excavation began after this layer was removed. The layer below the seabed, (which will be referred to as the first layer), consisted of crabs, waste matter and concretion, which were removed to a depth of about 25 cm. No finds belonging to the wreck were found in this layer.

Second Layer

The excavation work continued after a non-excavation period of some months during which a new layer of sand had formed over the site. Excavating from the port side commenced with removal of this layer. The decision was made to remove the sand layer by layer until we had reached the maximum expected depth of the trench. Knowing that

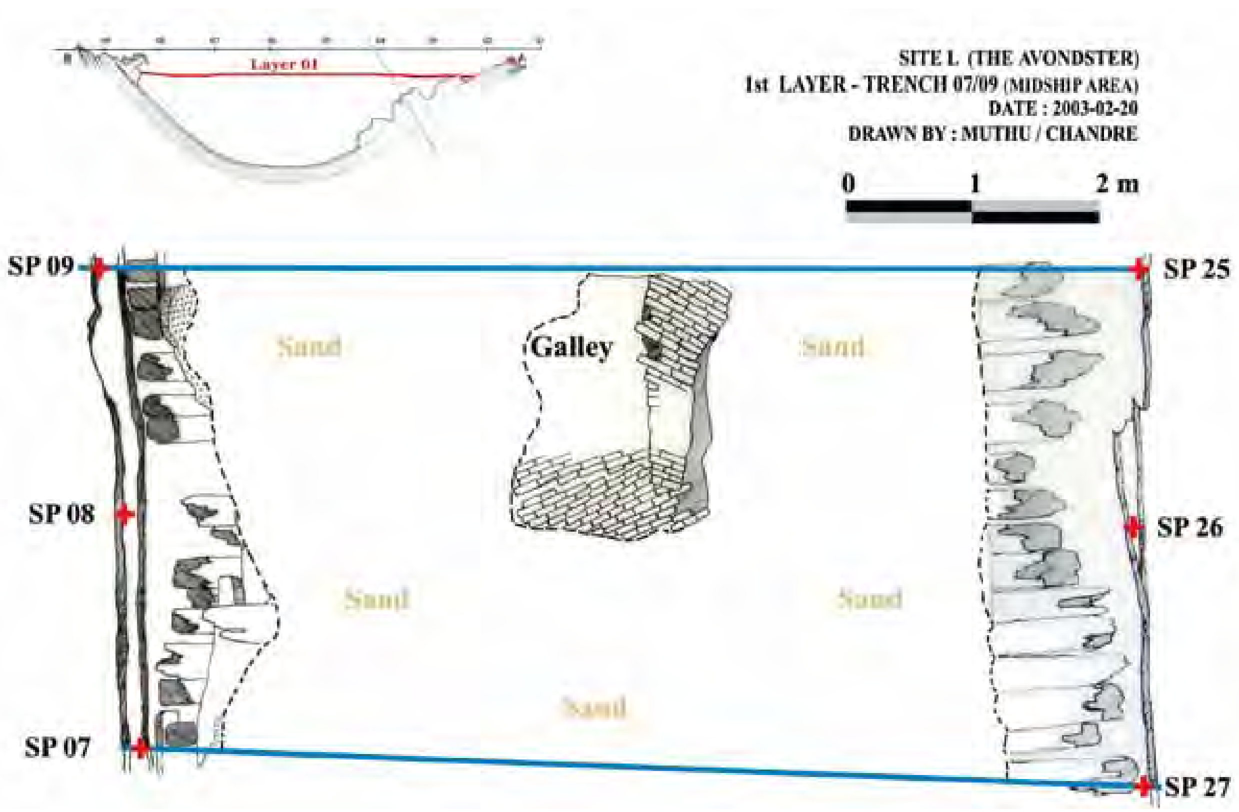


Figure 8.4 First layer of the Trench 07/09

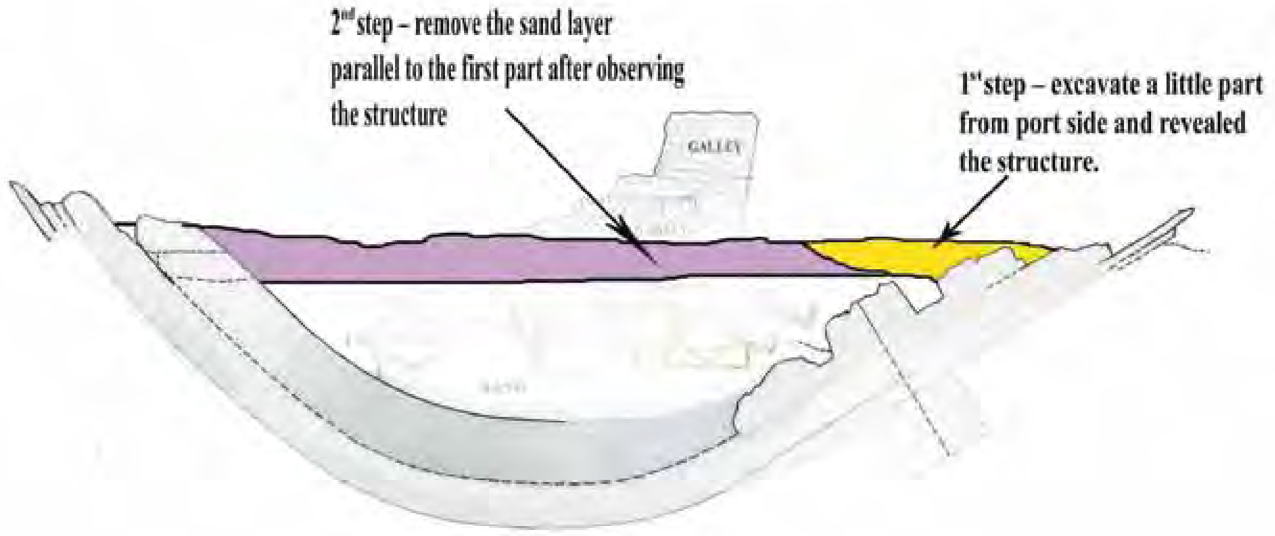


Figure 8.5 Trench cross section, showing how the excavation followed the structure

the ship had inclined towards the starboard side during the wrecking process, the starboard side was expected to lie deeper in the seabed than the port side.

The ship's position was confirmed by identifying the port side hull parts. Because the depth was expected to be greater at the starboard side, it was decided that the excavation trench would follow the hull from the shallower port side to the starboard side.

A 20 cm thick layer of sand was removed to reveal a layer of slightly older, less disturbed material, predominantly gravelly sand and half-decayed crab shells. This second layer was not soft like the first layer, which was newly laid, and contained slightly heavier sand particles. It was not easy to remove this material, which was re-deposited on the site by the waves to form the new upper layer.

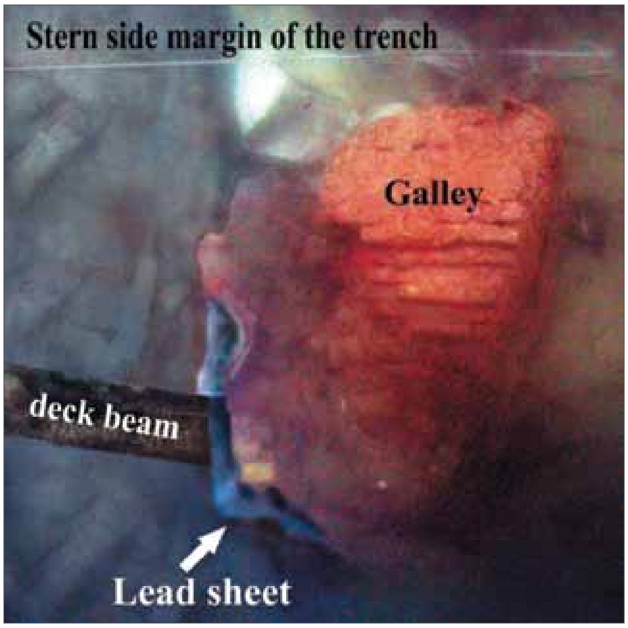


Figure 8.6 Top view of the galley

A thick wooden plank or longitudinal timber (approximately 20 cm thick and 50 cm wide) was exposed, lying on the port side frames, and appeared to be fixed to these frames. It was lying parallel to the length of the ship and appeared to be a thicker ceiling plank. Near SP 09 a structure made of lead sheeting was revealed but could not be identified. The most likely possibility is that it is a part of a lead drain from the galley. Apart from the brick parts of the galley nothing of importance was discovered. Moving towards the starboard side the construction continued to increase in depth as expected. It became easy to excavate following the ship's structure from the port side.

Third Layer

A layer of sand, very different in composition and about 55 cm in depth was removed during this phase. It was dark grey in colour and made up of small particles, which were very well compressed when compared with the other layers. A hypothesis is that this could be the sediment deposited by the canal (river), which had its outlet in this area at the time the ship sank. A few decayed parts of crabs and decayed wooden pieces were also found in this layer.

We were able to fully expose the wooden longitudinal timber found on the port side. The width of the longitudinal timber was 60 cm. Since the longitudinal timber extended into the unexcavated area, its total length could not be determined.

As the excavation continued, the stability of the galley structure became a concern. Underneath the brick galley construction was a lead sheet. Under that were mostly sand and decayed wooden parts. One side of the galley rested on

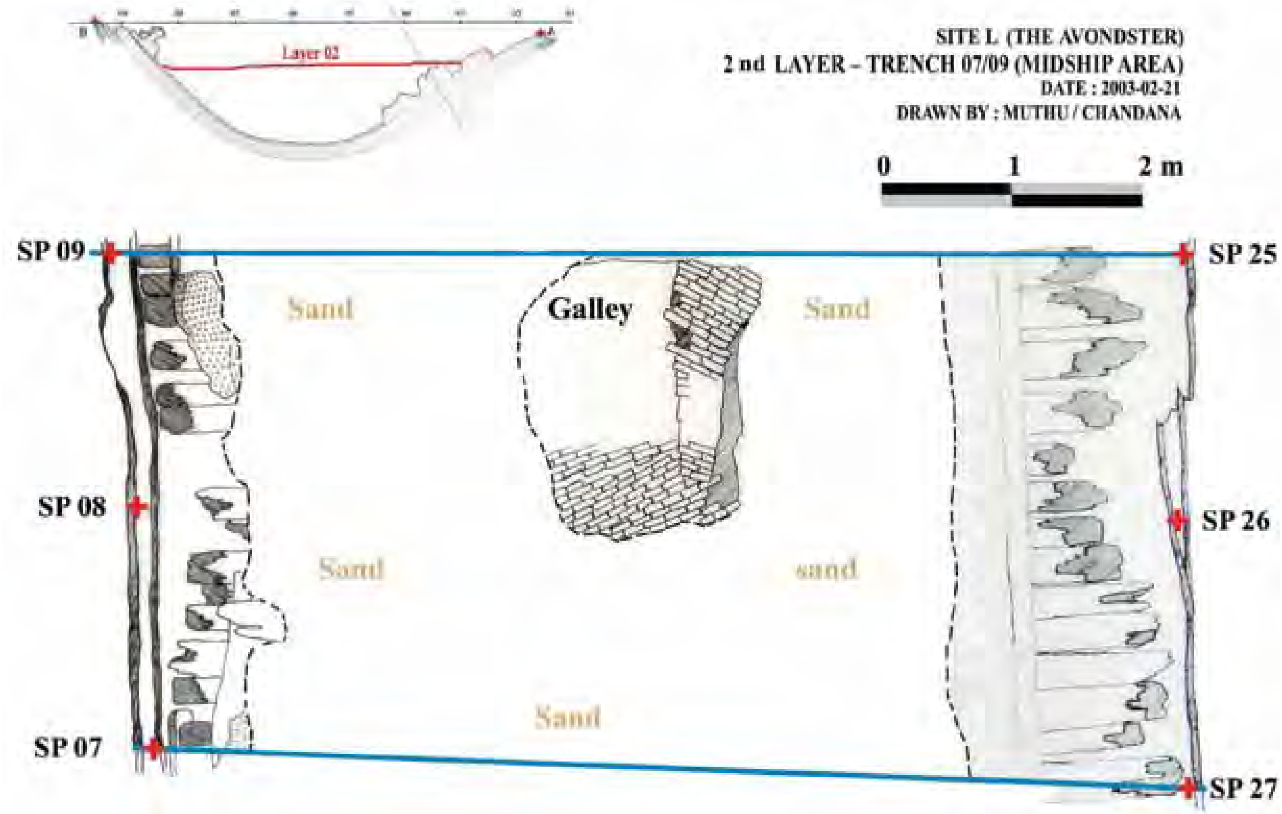


Figure 8.7 2nd layer of the trench 07/09

Figure 8.8: The galley supported with sand bags

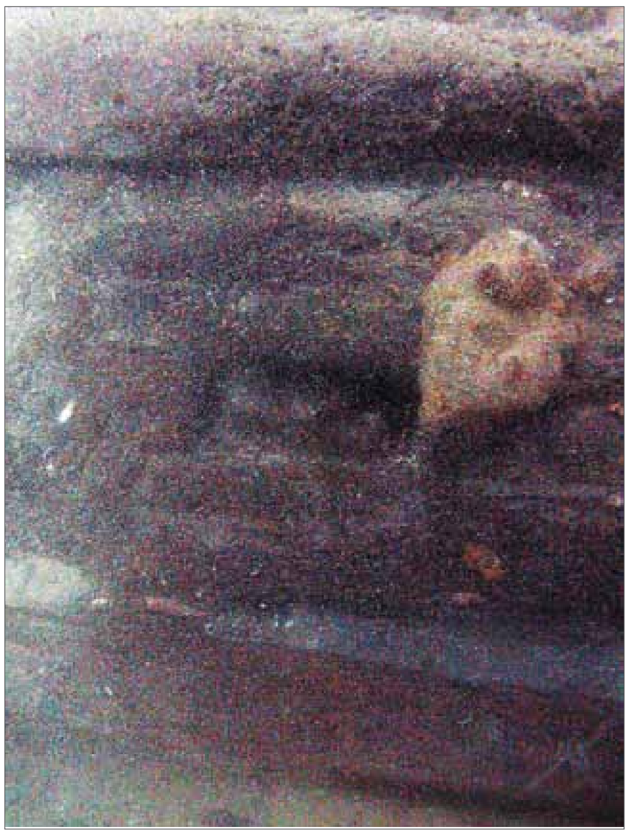


Figure 8.9 The unusual marks on possible keelson

a deck beam, which extended from the starboard side to port side. This created the possibility of loose bricks dislodging or the galley collapsing when the sand was disturbed in the nearby excavating trench. To prevent these scenarios, the galley was supported with sandbags and excavation activity was kept some distance away.

A second longitudinal timber was found about 20 cm away from the first longitudinal timber, also 60 cm in width but only 30 cm thick. This longitudinal timber had an unusual shape and some unknown marks. This could possibly be the keelson. A number of huge round stones were found, lying in-between and on top of the two longitudinal timbers on the port side. These are probably ballast stones.

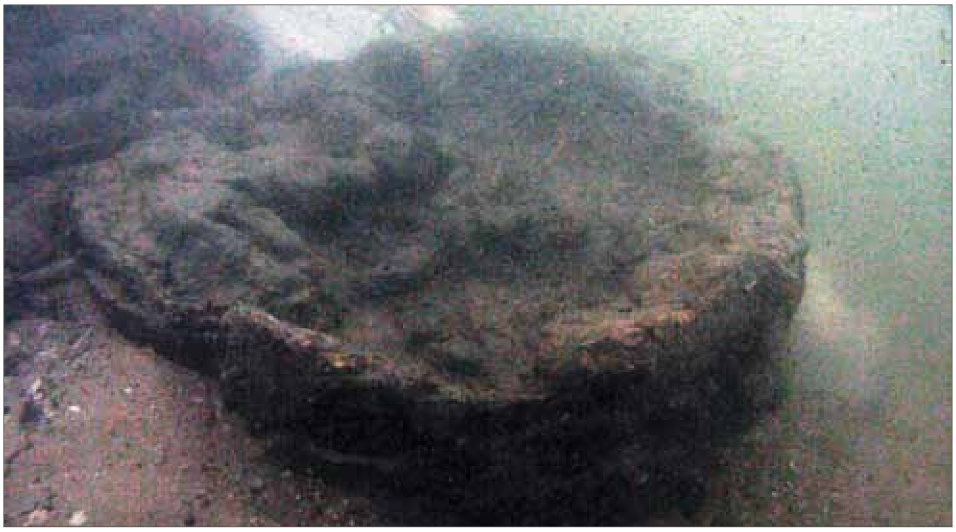


Figure 8.10 Barrel No. 1

Figure 8.11 Lead sheet / gutter at the base of the galley

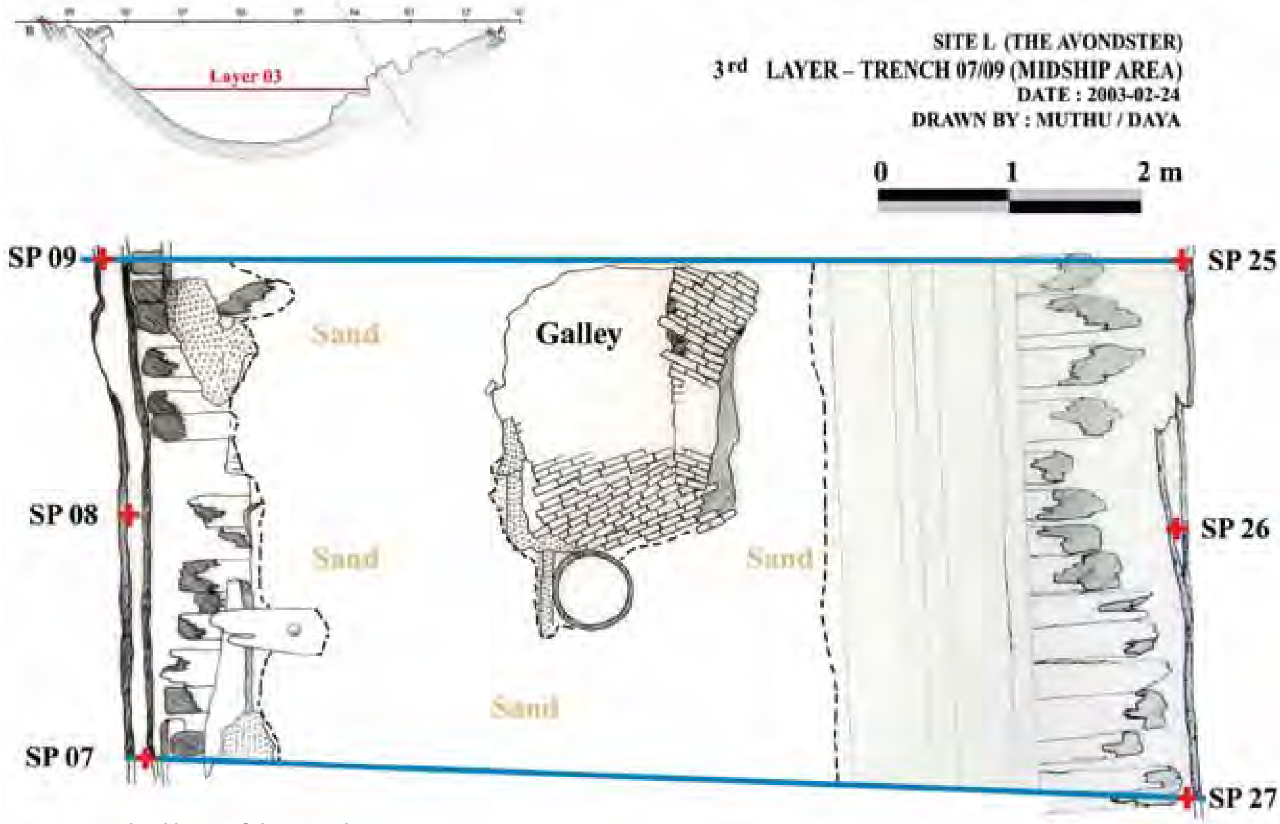


Figure 8.12 Third layer of the Trench 07/09

Among the objects found in this layer were the remains of a barrel and a length of lead sheet. The barrel remnant is 60 cm in diameter, however the height is unknown since the staves have broken or rotted away. Only what could be the lid or the base was found. Unidentified solid material was attached to the barrel remains, which could have been its contents.

The lead gutter, (about 15 cm in width and 70 cm in length), was found at the north west end of the galley. It is made from lead sheeting bent hollow in order to serve as a gutter. It is nailed to a wooden pole for support. The object looks very much like a part of a drain, however it is not certain if it had this function. After exposing these artefacts, they were covered with sand bags. Once they had been measured and drawn in-situ they were raised.

Fourth Layer

Many interesting facts about the construction of the ship were found whilst excavating this layer. As usual the excavation began at the port side. Parallel to the two thick longitudinal timbers found previously, a third longitudinal timber (65 cm wide and 25 cm thick) was found. Because of the structure of the longitudinal timber and its position in the ship we thought it might be the keelson. This assumption was yet to be supported by further evidence.

The grey sand in this layer resembled that found in the third layer, which also might have originated as river sediment. As we dug deeper (through a layer 45 cm deep) the sediment became hard and supported itself like a wall without falling. It was clearly the undisturbed layer.

A special feature of this layer was the number of wooden logs found here. These could have been used as dunnage, which kept the barrels in the midship area from moving or they might have been fire-wood for use in the galley. To come to a conclusion we needed to examine their shape and also find out what species of wood they are. Each piece was numbered underwater and recorded in-situ. They were then brought ashore where samples were taken for further analysis. After that the wooden logs were reburied near the site.

Also in this layer, the deck beam, on which the fallen galley rests, was found. This beam (measuring 213 x 30 x 15 cm) extends from the starboard to the port side underneath the galley. It goes through the ceiling and is attached to a large knee on the starboard side. Taking into account the location of the beam and the knee it was thought that this was the first deck and the place that the deck beam is attached is probably the position where the lower deck and upper gun deck separated.

Figure 8.13 Five numbered wooden logs

Approximately 30 cm from the first barrel another, more deteriorated barrel was found on the starboard side. It was filled with sand. The barrels were protected with wrappings of cloth and brought ashore.

A number of elements relating to the structure of the ship were found on the starboard side. Two vertical timbers, which extended from the bottom and rose up near Survey Points 07 and 09,

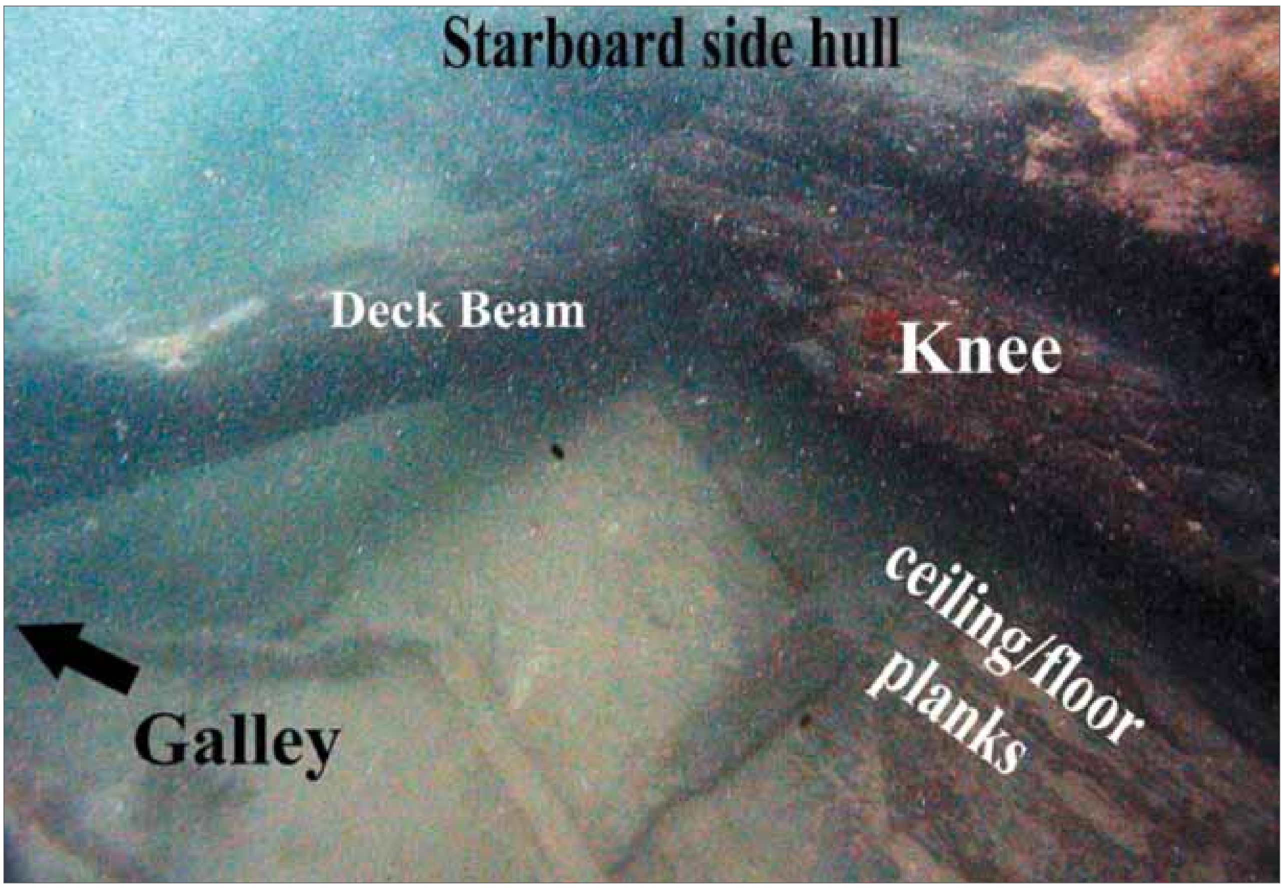


Figure 8.14 Starboard side of the trench 07/09

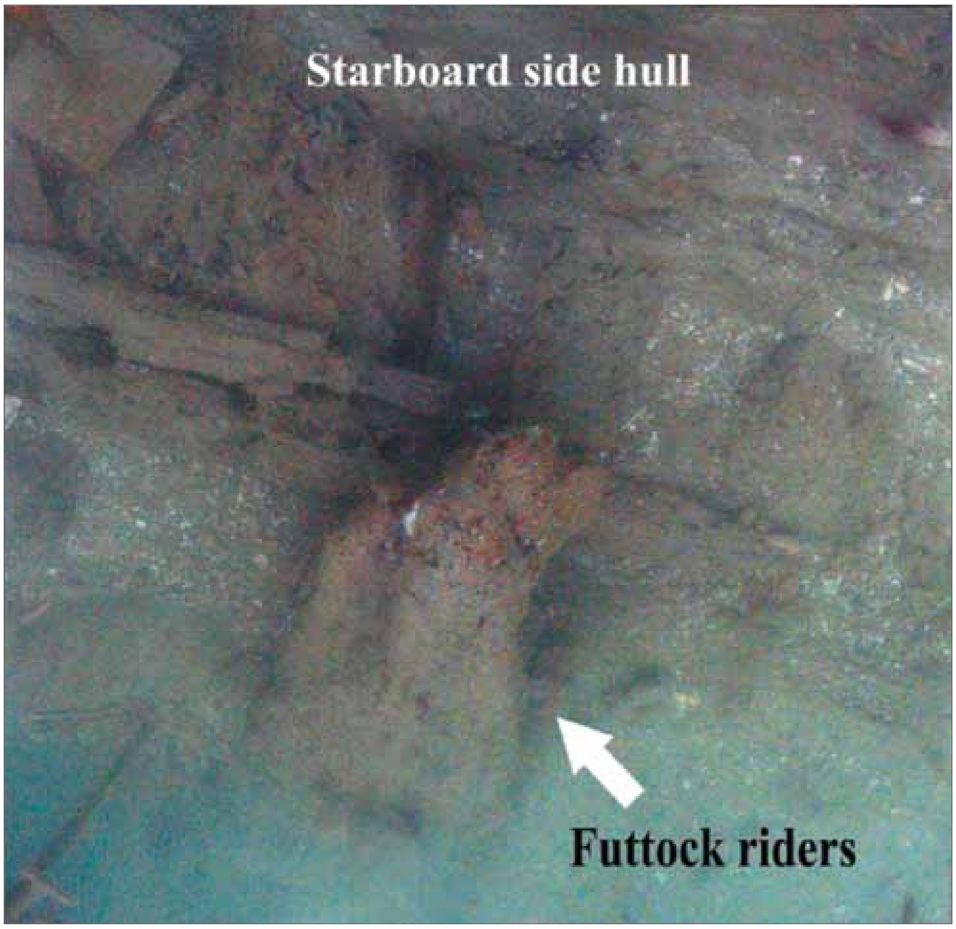


Figure 8.15 One vertical timber on the starboard side

were found. From their shape, their location and the marks on them they are assumed to be futtock riders. Beneath the position where the deck beam is fixed to the hull, a number of wooden planks, which make up the lower deck, were found. These planks had withstood the test of time and were well preserved. Caulking material could still be seen where the planks joined each other.

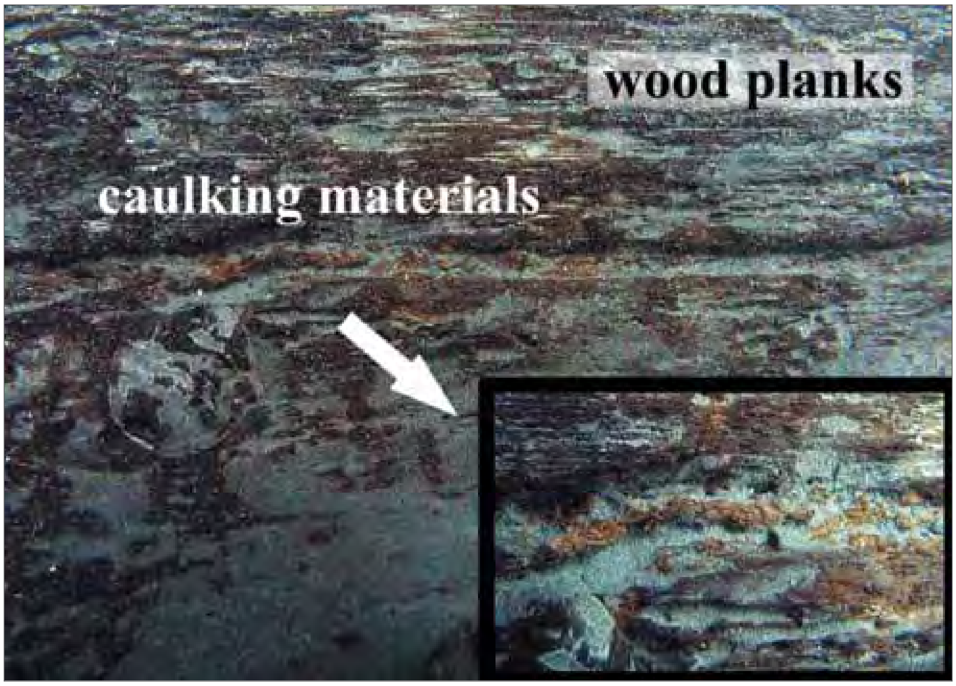


Figure 8.16: Ceiling planks with calking materials

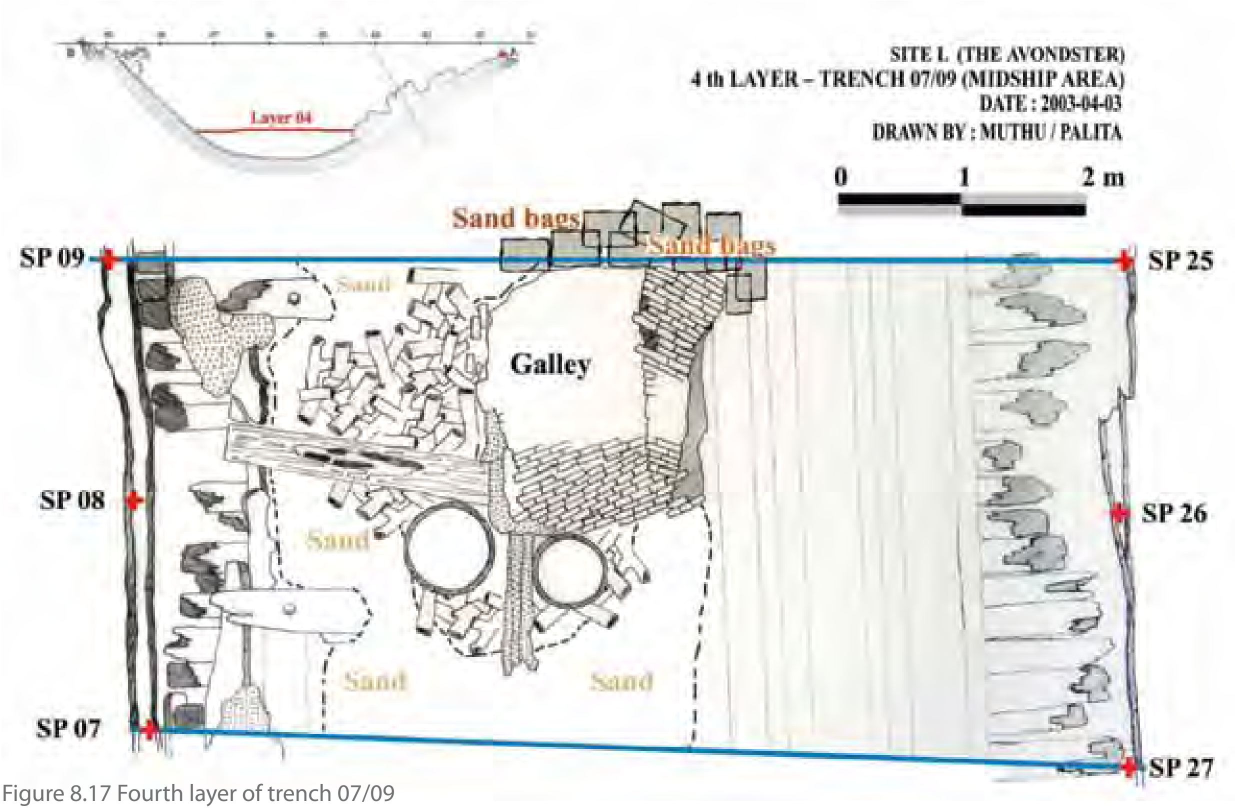


Figure 8.17 Fourth layer of trench 07/09

An aluminium pole was positioned across the trench, between Survey Points 07 and 27 to take cross section measurements of the trench. The pole was levelled and measurements were taken according to the three-dimensional rectangular recording system. An additional pole was required to support the horizontal pole at the centre, in order to maintain a level position. After taking the cross section measurements, this was removed to continue with the excavation work.

Figure 8.18 Barrel No. 3

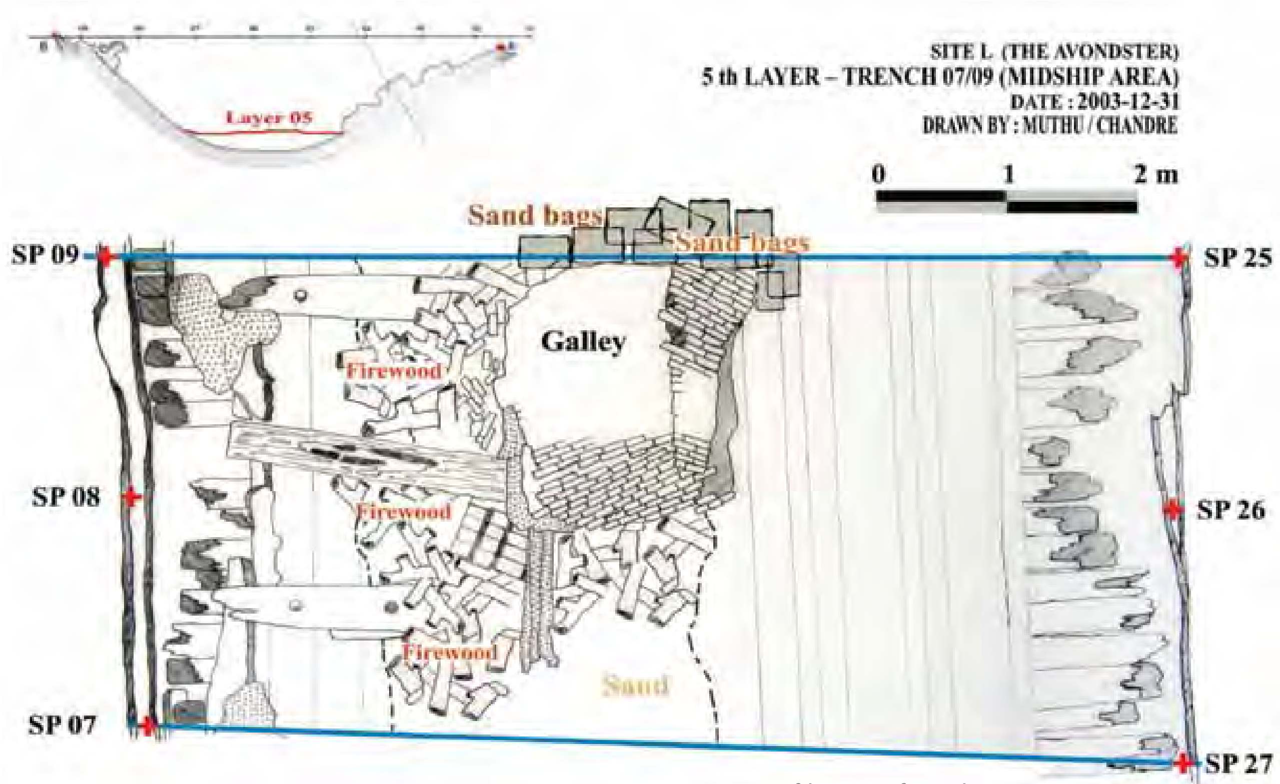


Figure 8.19 Fifth Layer of trench 07/09

Fifth Layer

The excavation of this layer was interrupted for a number of months due to monsoon conditions. Numerous pieces of fire-wood were found in this area, which were numbered and sampled. After recording they were re-buried outside the hull and covered with sand bags. Many more pieces of fire-wood were evident beneath the firewood layer that was removed.

During the non-diving period, the trench was once again completely filled with sand, which had to be removed. Since excavation work from the port side to the galley had been completed during the previous season, it was not necessary to remove the sand in that section. The trench was cleared to the previous stage, from the galley to the starboard side. When work was interrupted intermittently due to rough seas, new sand layers settled in the trench, which had to be removed each time before work could resume.

Another important task undertaken during this period was to stabilise the sand movement on the site by covering parts of the ship with plastic mesh. By November 2003 an area from the bow to Trench 07-09 was covered. Although this helped the future protection of the ship, it made our excavation work more difficult. The covering prevents the site being seen in its entirety along with identifiable parts of the structure. An additional disadvantage has been the effect on the visibility. Turbulent underwater conditions disturb the mud particles, which have deposited on the net, reducing visibility tremendously.

The dunnage, which was found between the galley and the starboard side in the previous layer, was seen to extend even further, into this layer. They were numbered, sampled and then removed from the trench and stored under the mesh at Survey Point 30. The second barrel, found near the galley, was damaged further during the off-season. This occurred due to its large size and structural weakness. Since there was no longer enough room to keep large artefacts inside the laboratory, we covered this second barrel (the first barrel was raised from layer 4) with a net and kept it on the galley. When this barrel was relocated, another barrel became visible underneath it. This one (barrel no. 3) was positioned on its side, filled with sand and was decaying, but it was nevertheless fully intact. It was wrapped in a net and protected with sand bags.

The wooden planks found on the inside of the hull at the starboard side were seen to extend further towards the bottom. Because of this, it was suggested that they might be the floor planks of the lower-most deck. They were about

20-40 cm in width and the caulking materials could be seen where they joined. The assumption was that the two beams, which extend to the bottom near the Survey Points 07 and 09, were both futtock riders.

Sixth layer

A sand layer of approximately 20 cm was removed for the sixth layer and it was the last one before reaching the full extent of the hull. Excavation had been completed up to the galley where the danger of destabilisation prevented the removal of all the supporting material. After taking samples the dunnage was re-buried. It became evident that the two futtock riders had gone underneath the galley and their ends could not be seen.

To reach the bottom of the trench to take a cross section, the remaining sand was removed completely, in at least one section of the trench. When this was done in the narrow strip at the Western border of the trench another barrel (no.4) was revealed. The excellent condition of this barrel suggested that the original contents might even be preserved. It was left in-situ for future excavation.
Reduction in visibility was so significant at this time that the area that had be cleared for the cross section became too dark to properly examine the bottom wooden planks of the ship.

Further recorded finds, located towards the west side of the galley, included two rims of a broken barrel and a few wooden pieces. The excavation of Trench 07-09 was concluded by refilling the area with sand since the wooden parts, which were then in an aerobic situation, would deteriorate fast if left uncovered.

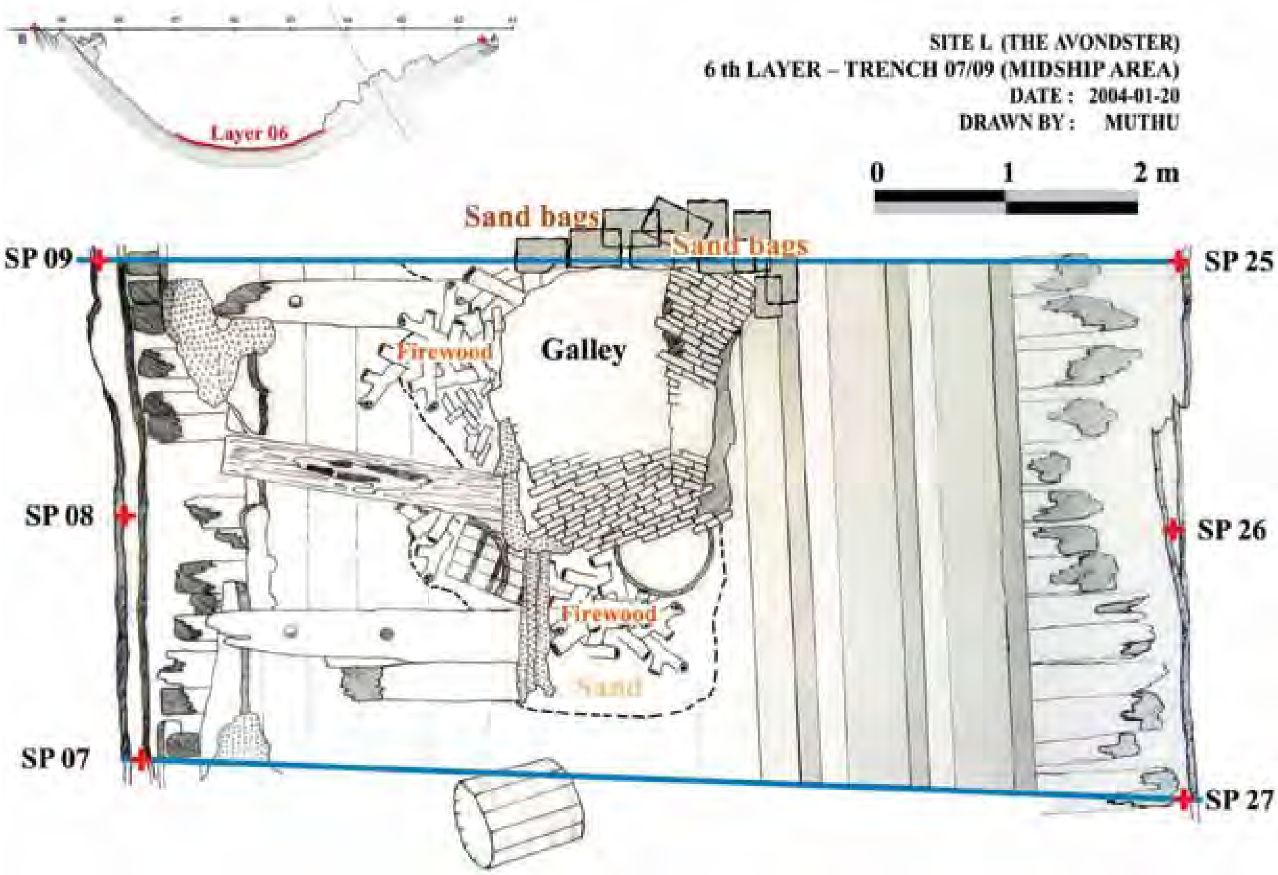


Figure 8.22 Sixth Layer of trench 07/09

Figure 8.21 Barrel no. 04 near the Western border

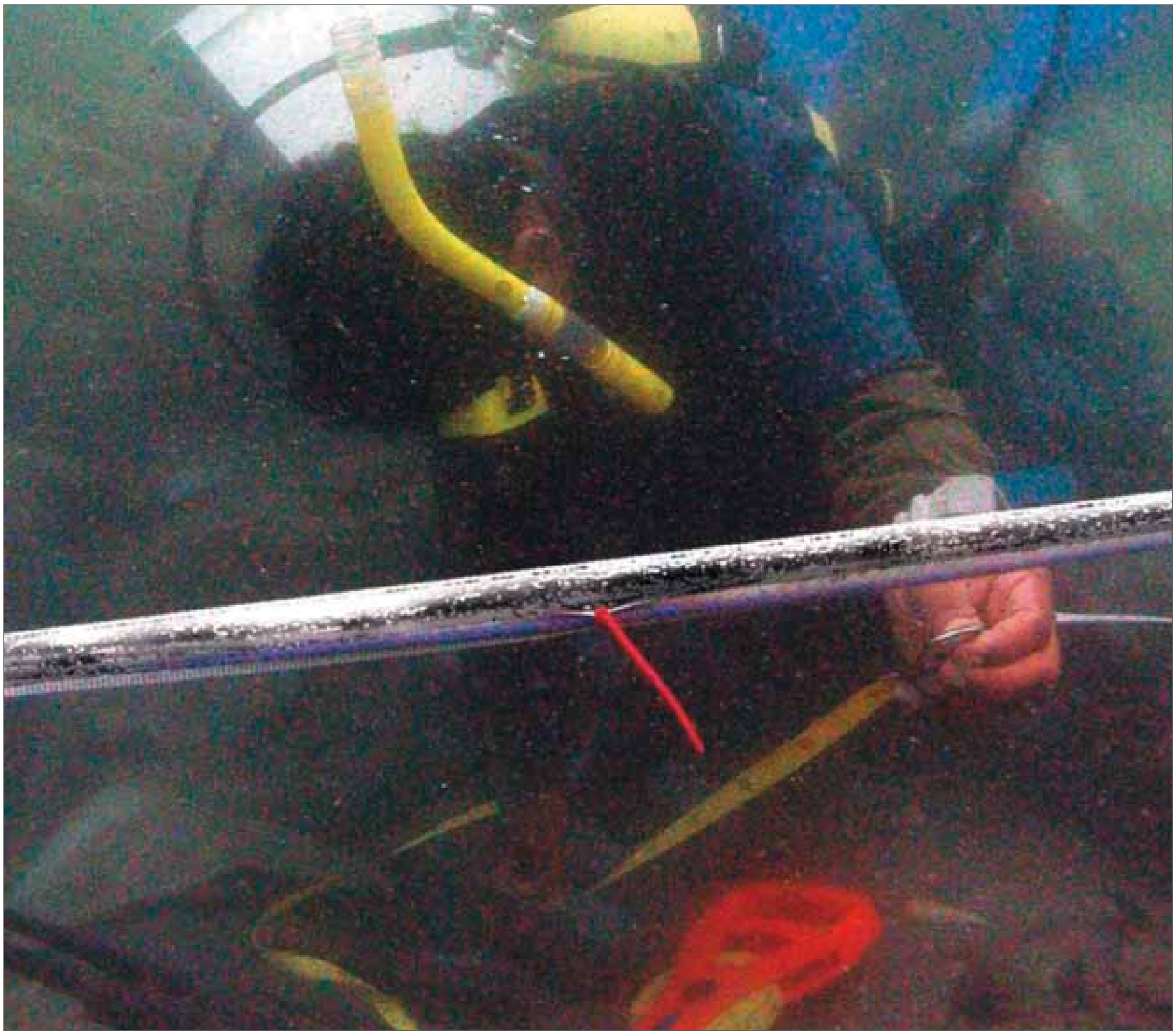


Figure 8.20 Taking measurements from levelled aluminium pole

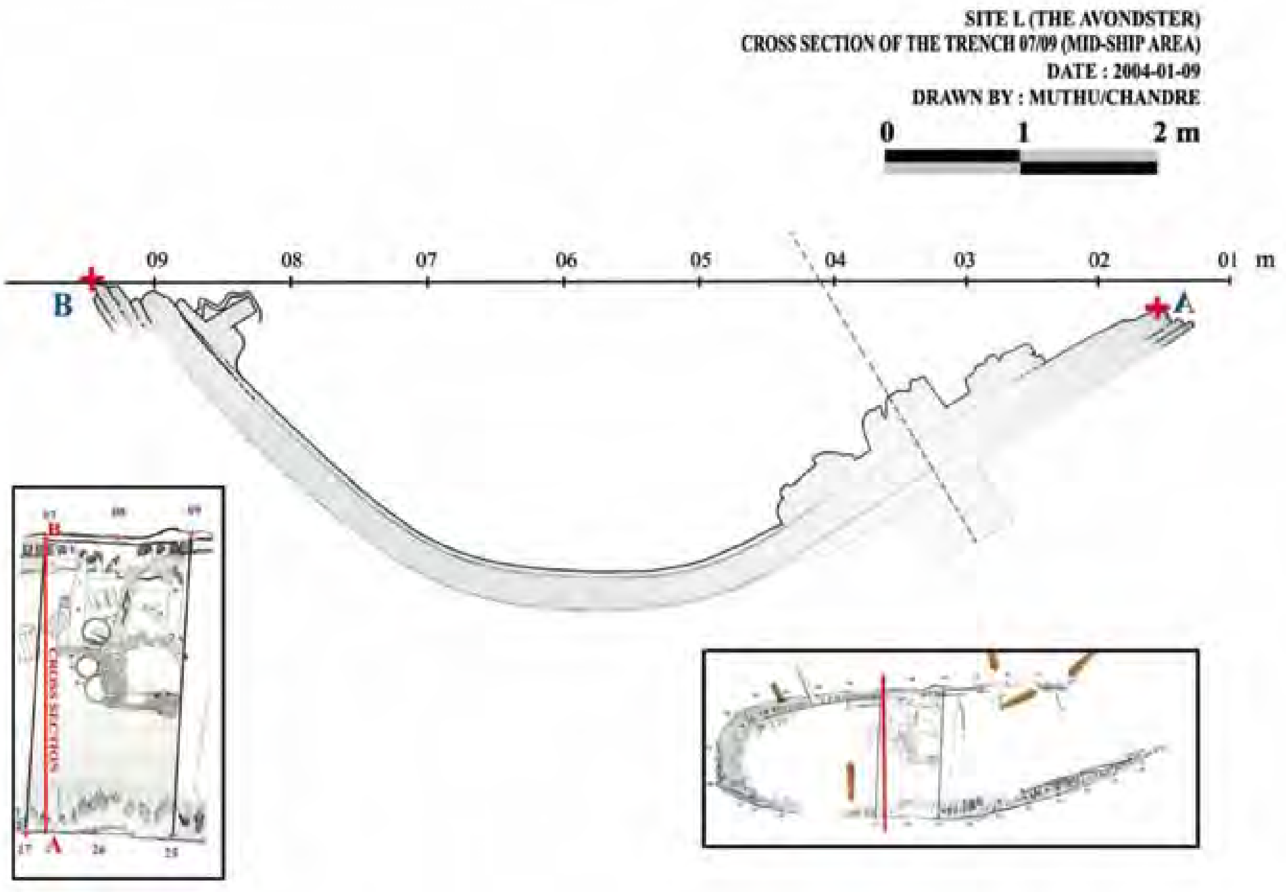


Figure 8.23 Cross section of trench 07/09

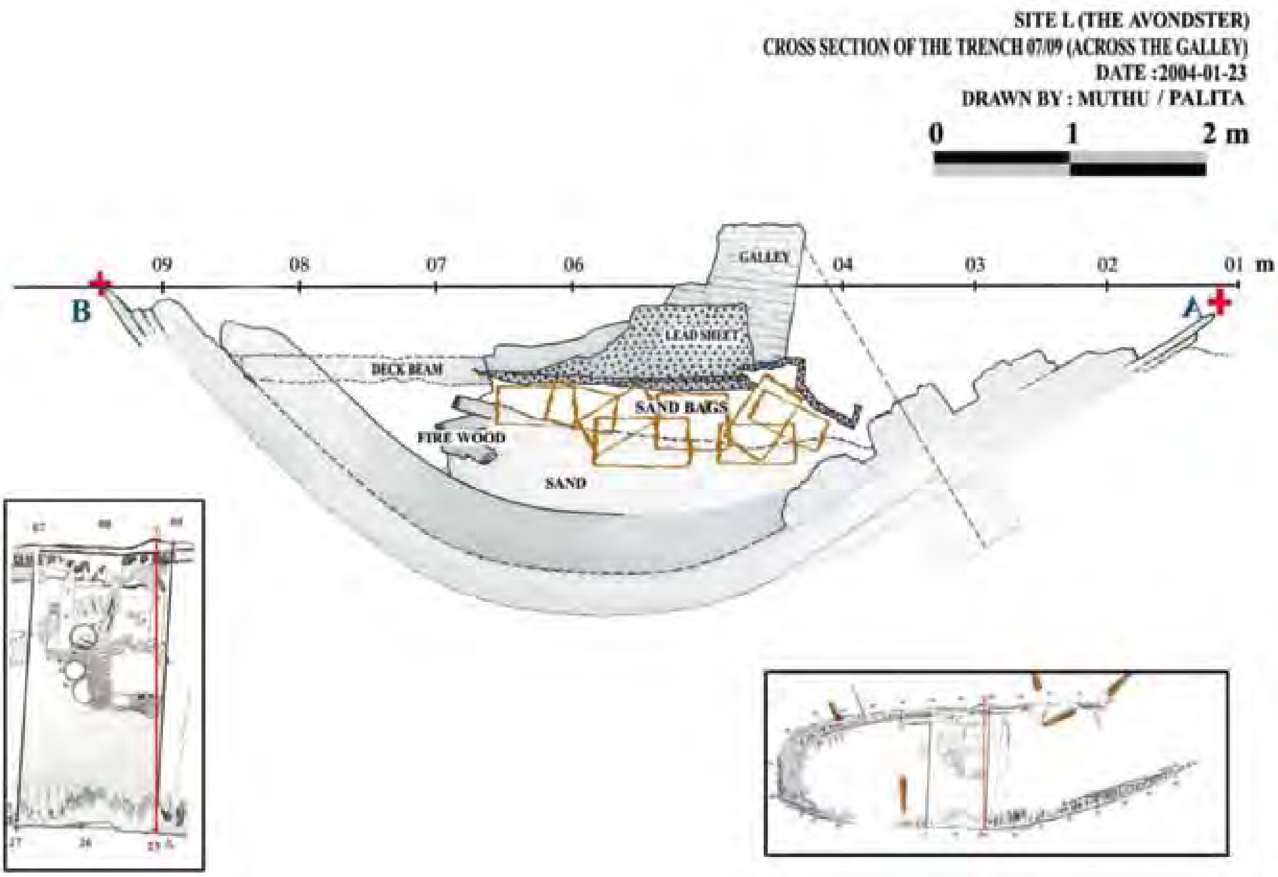


Figure 8.24 Cross section of the Trench 07/09 (across the galley)

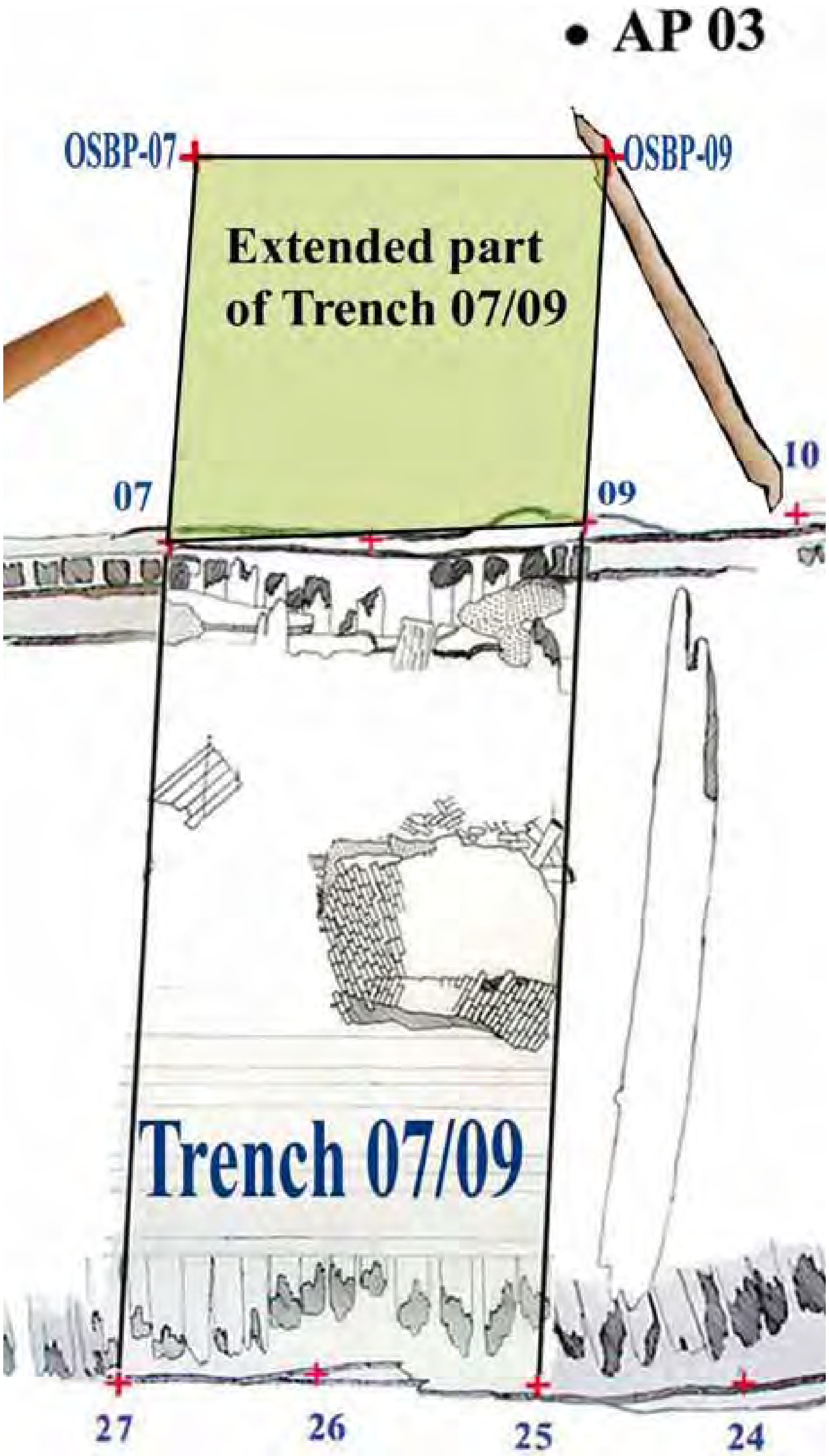


Figure 8.25 Plan view of extended part of Trench 07/09

Extended part of Trench 07/09

During this period the trench was extended further towards the starboard side. Since the ship has inclined towards the starboard side, and taking into consideration the direction of the waves, it wasetre thought that there might be artefacts and remains outside the hull on the starboard side. This trench was therefore used to search for artefacts and to examine the outside parts of the hull. The trench was extended 3.80 m from the hull of the starboard side

Figure 8.26 Surface of the extended part

and named "the extended part of trench 07/09". After taking a surface look at this section measurements were taken for the reports.

On the 5th and 6th November 2003 initial preparations were made for this task. The lines stretched between Survey Points 25 and 09 were extended further outside the starboard side. The plan was to extend it about 4 metres, but nothing could be found to mark this distance. It was then decided to connect the line to a wooden beam, 3.80 metres away, with a copper nail. The other line (from SP 27 to 07), which stretched 3.90 metres outside the starboard side, was fixed to the seabed with a wooden peg.

The excavation work on the extended trench started on the 23rd November 2003. The wooden peg was replaced with an aluminium pole and called 'OSBP-07' (Outside the starboard side Point). The copper nail fixed on the wooden beam was named 'OSBP-09'. The boundaries of the trench were marked with a nylon line between these two points. The surface of this area and all its contents were recorded as were the depths of all essential points. It was found that the surface lay about 15 cm below the level of the hull.

Figure 8.27 Rope attached to the outside of the hull

Before the excavation started, hundreds of crab remains and lots of concretions had to be removed from the surface of the trench. The excavation started on the 23rd February 2004 when a layer 40 cm in thickness was removed. This layer was formed of gravelly new sand and half decayed crab shells. A lot of pottery pieces were found in this layer as well as a little weight. After removing this layer the old grey slush sediments could be seen. Part of a wooden nail and a piece of a rope (diametre 5 cm) attached to the surface of the outside hull with slush was also found.

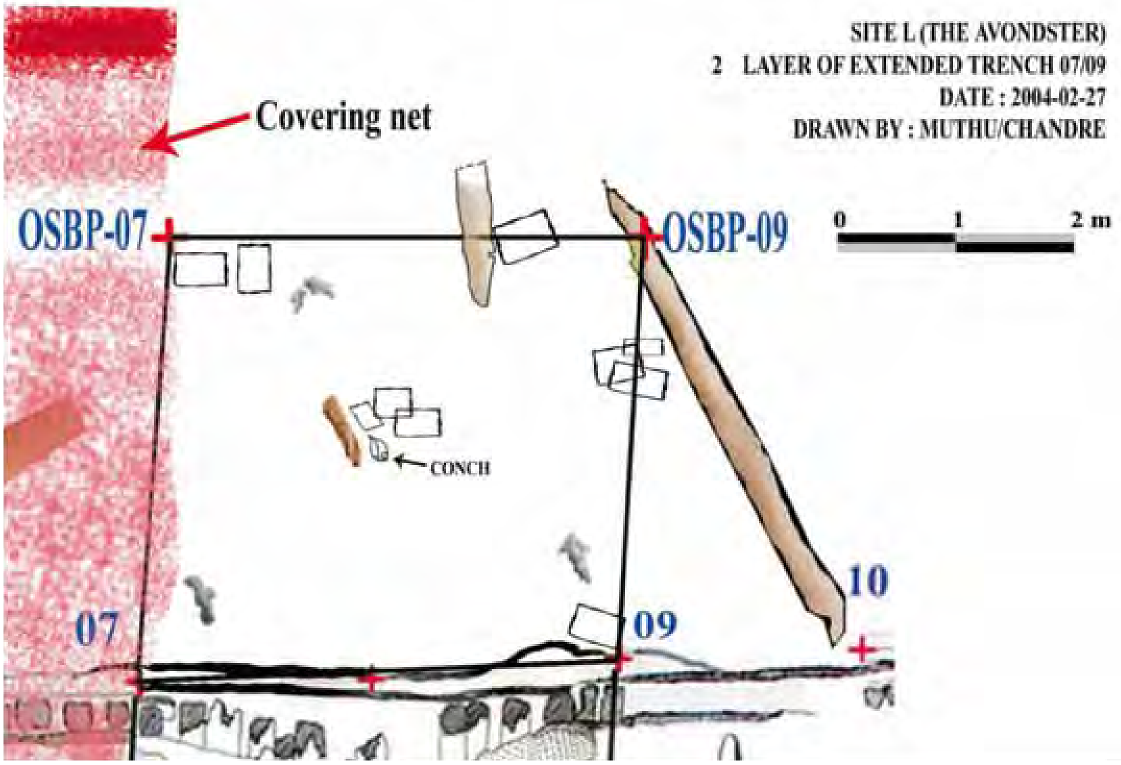


Figure 8.28 Second layer of extended trench

Second layer of extended trench 07/09

The excavation of the second layer took place from 27th February 2004. Fewer artefacts than expected were obtained from this trench, but a lot of pottery parts were found. A special find was a half decayed conch from the middle of the trench. Small parts of clay pipes and glass bottles were found all over the trench. There was a big wooden beam near the southern border of the trench and to the east large concretions could be seen. A layer of sand 55cm thick was removed from this second layer of the extended trench.

Third layer of extended trench 07/09

Excavation started on the 2nd March 2004. This was the last layer to be excavated on this trench. No important artefacts or remains were obtained, just a few pottery parts. The layer was dug out another 20 cm deep, but it became clear that no further information of interest would be obtained by continuing, so excavation was stopped. A cross section of the trench was taken with a levelled aluminium pole and the cross-level, in order to get the shape and the angle of the hull from the outside. The trench was refilled by using the water dredge.

Conclusion

The aims of the midship excavation were:

- To better understand of the composition of the site and the wreck forming process;
- To gather information on the ship's construction by excavation of the assumed location of the master-frame.

From these aims the following conclusions can be drawn:

The inclination of the ship could be determined to be 30 degrees to starboard. That means that more of the starboard side has been preserved then previously thought. It was considered that during the wreck forming process parts of the ship and artefacts would have been spread outside the ship's hull on the starboard side. The excavation of the extended trench 07/09 does not support that assumption.

A cross section of the hull of the ship was taken and important features like the keelson probably exposed. Although it cannot be confirmed where the master frame was located since the mast step has not yet been found, it will provide essential data for further analysis.

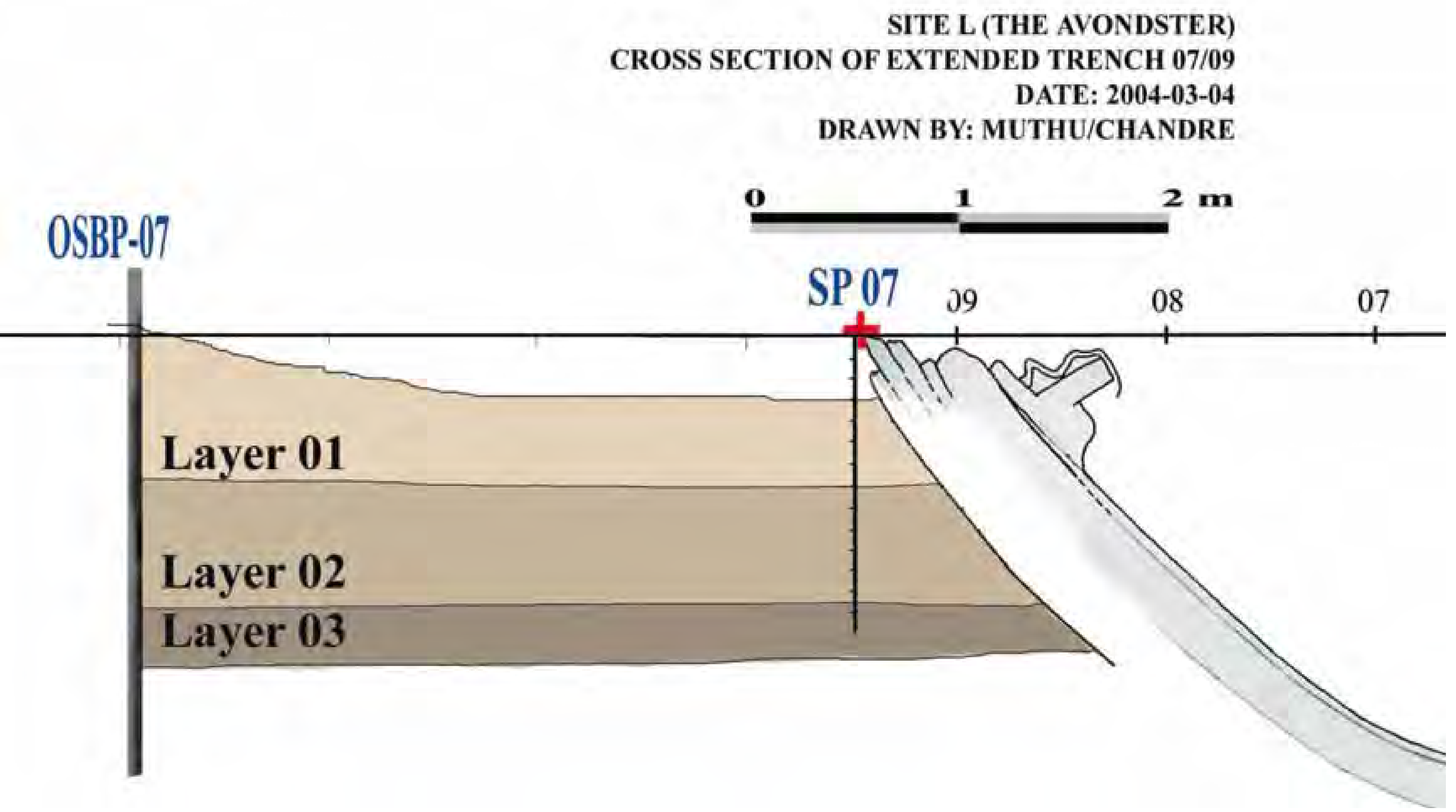


Figure 8.29 Cross section of the extended trench

Figure 8.30 The outside surface of the hull from the extended trench

The further excavation aims were:

- To gather archaeological evidence for the function of the area historically known as the sector onboard where food preparation and cooking took place;
- And to gather archaeological evidence on the cargo of a ship employed for regional and local trade,.

An interesting collection of finds were retrieved reflecting the activities around the galley and ranging from fire-wood for the galley, possible supplies in the barrels, a cooking pot and a grinder for food preparation and plates and spoons for the meals. From the cargo were the remains of coconuts and a conch shell.

With regard to our aim to 'fine tune the excavation techniques for this site', the following conclusions can be drawn. The excavated trench provided extensive experience on the excavation and recording techniques of a highly dynamic site exposed to swell in shallow waters. By adopting the method of working in a four-metre wide trench with permanent survey points and a profiler, a reasonable level of accuracy was achieved. It is recommended that for the next trench the various ship's construction features and other key objects should be labelled to create a better reference framework for recording by sketches, photographs and video. It will also make the description of the ship's construction easier.

Yf I wold have a shipp by this plott to be made the which shold exsed in …
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a shipp that should bear 350 the tonnes what should then the scale of the …
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of the scale of Cubike proportion with 26 the scale and breadth of the first …
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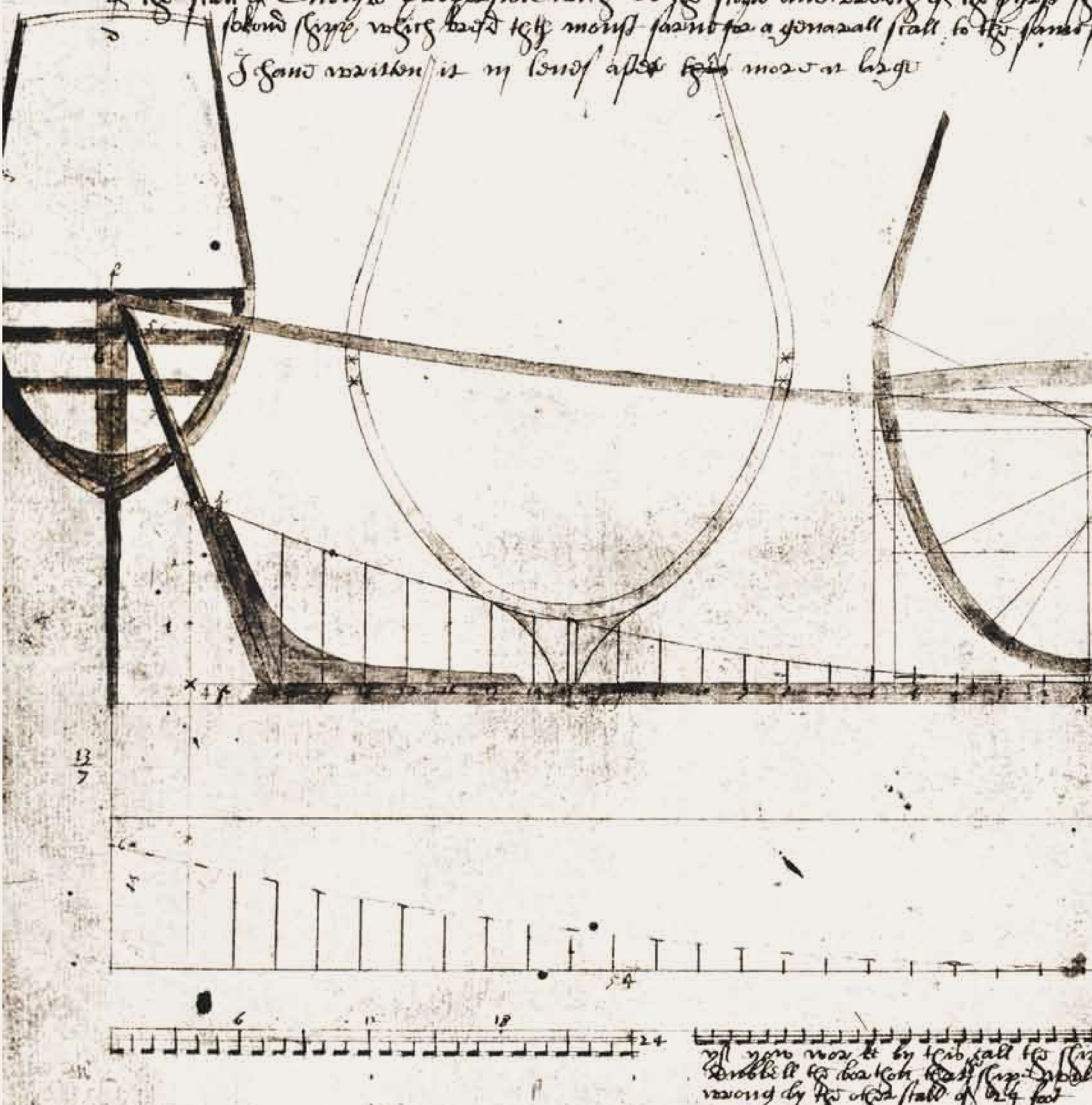

yf you work by this scale the …
… the … wrong by the other scale of 24 foot

the Content of a shipp that hath ben here to fore made by the sayde rules in what
1/4 or 1/2 or 3/4 or double the breadth the draught as for example here I have made a shipp
the same goode [illegible] tonnes & not being over charged with the same / which I would have
breadth so / to him that hath the worde of the [illegible] I saye multiplye the draught
by the [illegible] the draught for want of that knowledge enter the first Colome
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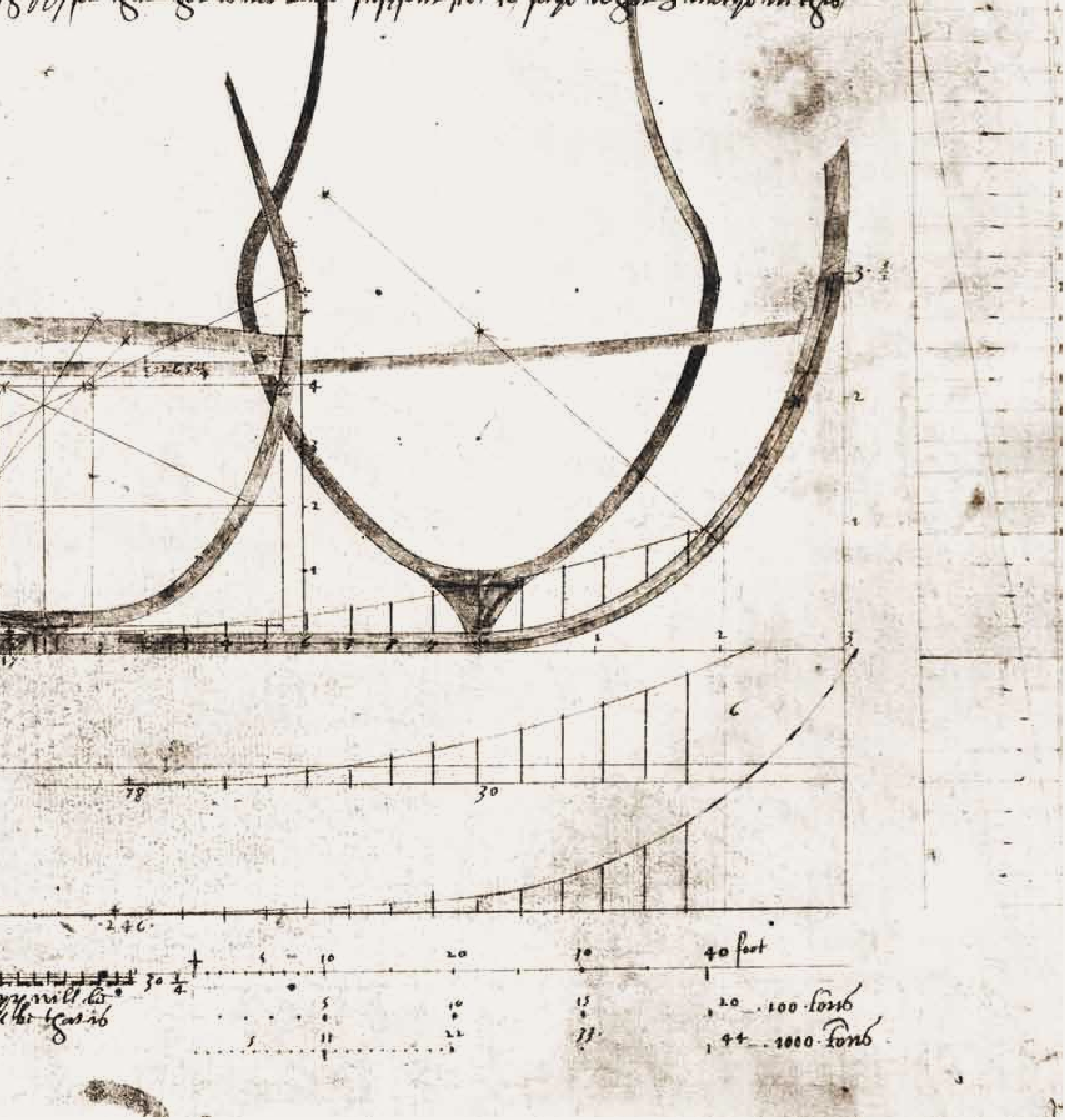
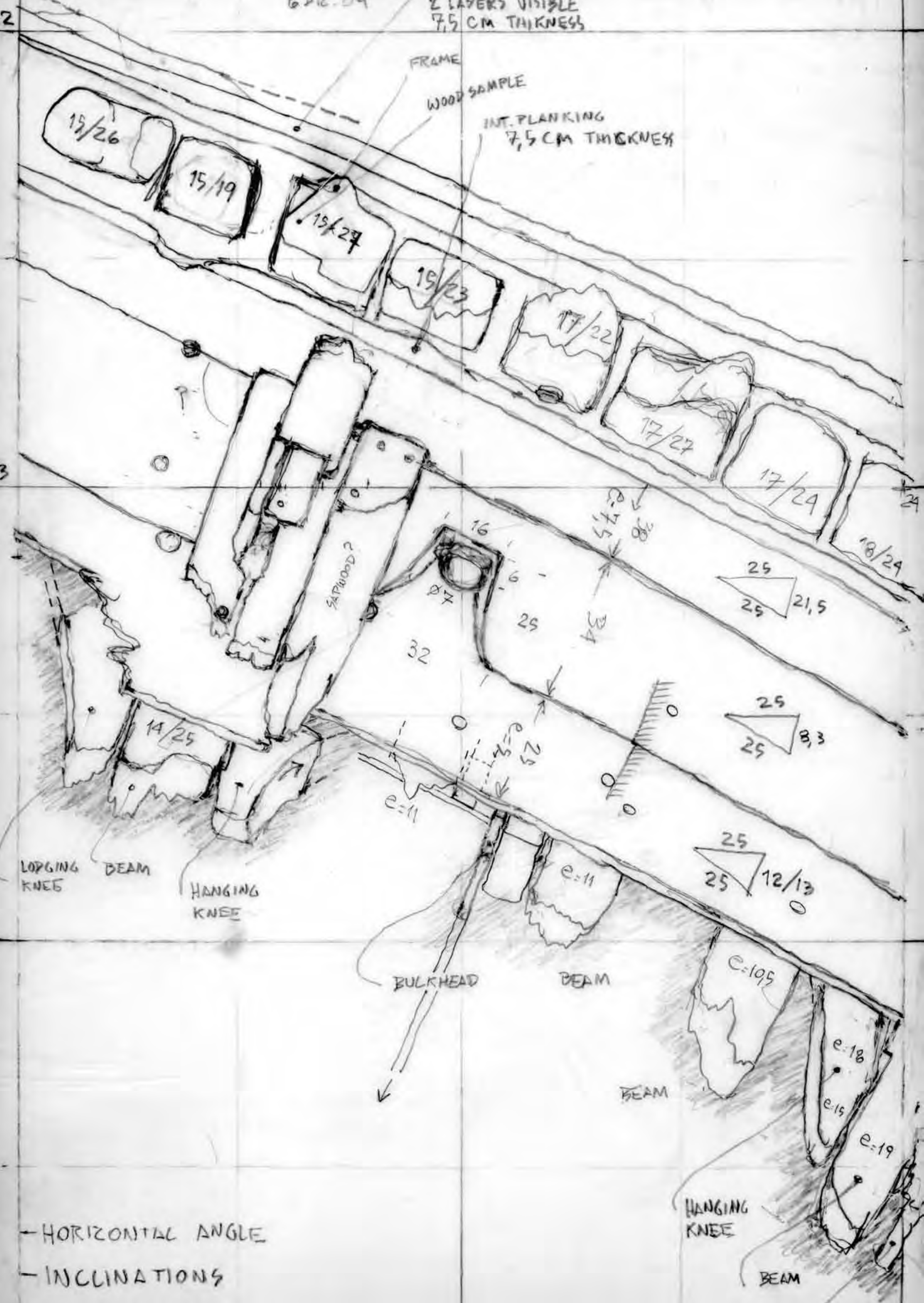
shipp / for that here is not [illegible] sufficient [illegible] to saye what I meane in this




2 LAYERS VISIBLE
7,5 CM THIKNESS
FRAME
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15/26
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LODGING KNEE
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BULKHEAD
BEAM
BEAM
HANGING KNEE
BEAM
- HORIZONTAL ANGLE
- INCLINATIONS

9 The interpretation of the Anglo-Dutch East-Indiaman Avondster ship's construction

by: Cristian Murray with contributions by Martijn Manders

Introduction

As mentioned earlier, the Avondster was originally an English merchant ship captured by the VOC in 1653 during the First Anglo-Dutch War. Formerly named the John and Thomas, it was bought by the English East India Company in 1641 and renamed Blessing. Under the East India Company service it made at least three voyages to the Indies and many regional trade journeys. After being captured by the Dutch, the vessel was renamed Avondster and taken to the Netherlands, where it was probably refitted to accomplish the VOC requirements. In 1655 the ship sailed to Batavia and remained operating on regional trade routes until its loss in the Galle Bay in 1659 (Parthesius et al. 2005).

The VOC officials who reported the wreckage referred to it as an 'old yacht'. Other records state that in the last years of its career the ship suffered severe leaking and was no longer able to make the long voyage between Europe and Asia. Since the vessel stayed in Asian waters for many years without returning to the Netherlands, it is quite probable that it underwent different repairs and routine maintenance with the use of local techniques and/or materials (Parthesius et al. 2005). Evidence of the use of local resources has already been found with the existing wooden stock of one of the Avondster anchors being made from Calophyllum, a species native to Asia (Richards 1998).

The Avondster was thus a merchantman with an extended and active career. Six years serving the VOC, 12 years in the service of the English East India Company and an undetermined period prior to the acquisition by the second, gives an estimated total life of about 20 years. It can therefore be considered a relatively old vessel - and probably not in its best condition - when it sank. Anyway, despite the ship was probably already showing evidence of its age when it was captured by the VOC, it was certainly considered seaworthy enough to take part in the demanding European-Asian intercontinental trade. This is demonstrated by the fact that the Avondster was the only English vessel among eighteen captured in Asia by the VOC up to 1660 that was used for a return voyage.

From these precedents what would be expected to be found in the Avondster wreck site are the remains of an aged merchant ship which was built according English traditions, probably refitted or adapted to Dutch East India Company requirements, and possibly repaired using Asian local

Figure 9.1 The principal elements of ship design are shown in a drawing of the type found in Matthew Baker's Fragments of Ancient English Shipwrightry from c. 1630. The hull form was controlled by the body projections (Pepysian Library, Magdalene College, Cambridge University).
Figure 9.2 Underwater drawing of the starboard side at Trench 02; a movable drawing grid was used to record the structure remains (drawing C. Murray).

resources. From a technological perspective, this vessel is a remarkable case of the integration of shipbuilding traditions. For instance, we know that in the mid seventeenth century northern European merchant seagoing vessels were built using diverse conceptual approaches (Maarleveld 1992, Adams 2003). Some traditions made use of transversal timbers – the frames – to give the shape and support to the hull, while others assigned that function to the external planking. Evidence of the different methods used in England and the Netherlands could be found in the remains of the Avondster.

In consequence it will be interesting to focus the research on the ship's construction on the following aspects:

- The Avondster building sequence and the possible conceptual approach followed by its builders.
- Possible adaptations in the ship's hull made both by the English and the Dutch.
- The way in which Asian local materials - and maybe also local techniques - would have been used when the ship required maintenance or repairs.

The present article should be seen as an interim report which makes suggestions for future investigations and new areas of research. The descriptions and comments below refer only to the construction of the hull structure. The rigging is not considered here. They are the result of the surveys and subsequent research conducted during the fieldwork seasons of February-March 2003, November-December 2003 and November-December 2004. Previous research on the ship construction was made after the fieldwork carried out in 2002 and 2003 and is already published (Parthesius et al. 2003, Parthesius et al. 2005).

Methodology

The site was only partially excavated - around 7 % of the estimated buried structure (see excavation report). Since most of the wreck is still buried under sand, the recording and study of the ship remains were made, firstly, on the parts of the structure that were visible above the seabed and, secondly, on the sections of the hull exposed by the excavation (Trenches 01 and 02). Even though several diagnostic structural components were recorded, much of the hull remains covered by sediment and their study will only be possible after further excavation. Therefore the following descriptions and interpretations are of a preliminary character and could be revised if new excavations take place.

The methodology was focused on identifying the ship's different structural elements, recording their main features (such as shape, dimensions and wood type) and examining the way they are assembled. Special attention was paid to those elements which were of common practice in British or Dutch ship construction of the seventeenth century as well as to the evidence of repairs and modifications. Unfortunately not enough time could be devoted analysing the fastening methods in detail.
No component of the structure was disassembled to provide access to unexposed pieces. Disassembling wood timbers such as the ceiling or the external planking would be necessary to examine the actual building technique and sequence, but at this stage of the project it was decided not to use such intrusive techniques. Samples were taken from a number of timbers in order to identify wood species.

Two basic survey methods were applied underwater to draw the hull remains. The 'offset' method was mainly used for the structure parts with a long and narrow shape. After fixing labelled survey points to the wooden structure with copper nails, a measuring tape attached to a rigid pole was fitted connecting two points. The survey points, which were lying approximately 2 m apart from each other, were mapped in the site plan with trilateration from datum points previously fitted outside the wreck. The pole was used as a baseline from which right-angled horizontal measurements were taken. Since the measurements taken with the offset method were relatively short, the system was accurate enough to draw a 1:10 scale plan of the structures. The resulting two-dimensional drawing was complemented with depths of relevant points. In the midship area a cross section was measured and drawn with the help of an aluminium pole fixed transversely over the wreck.

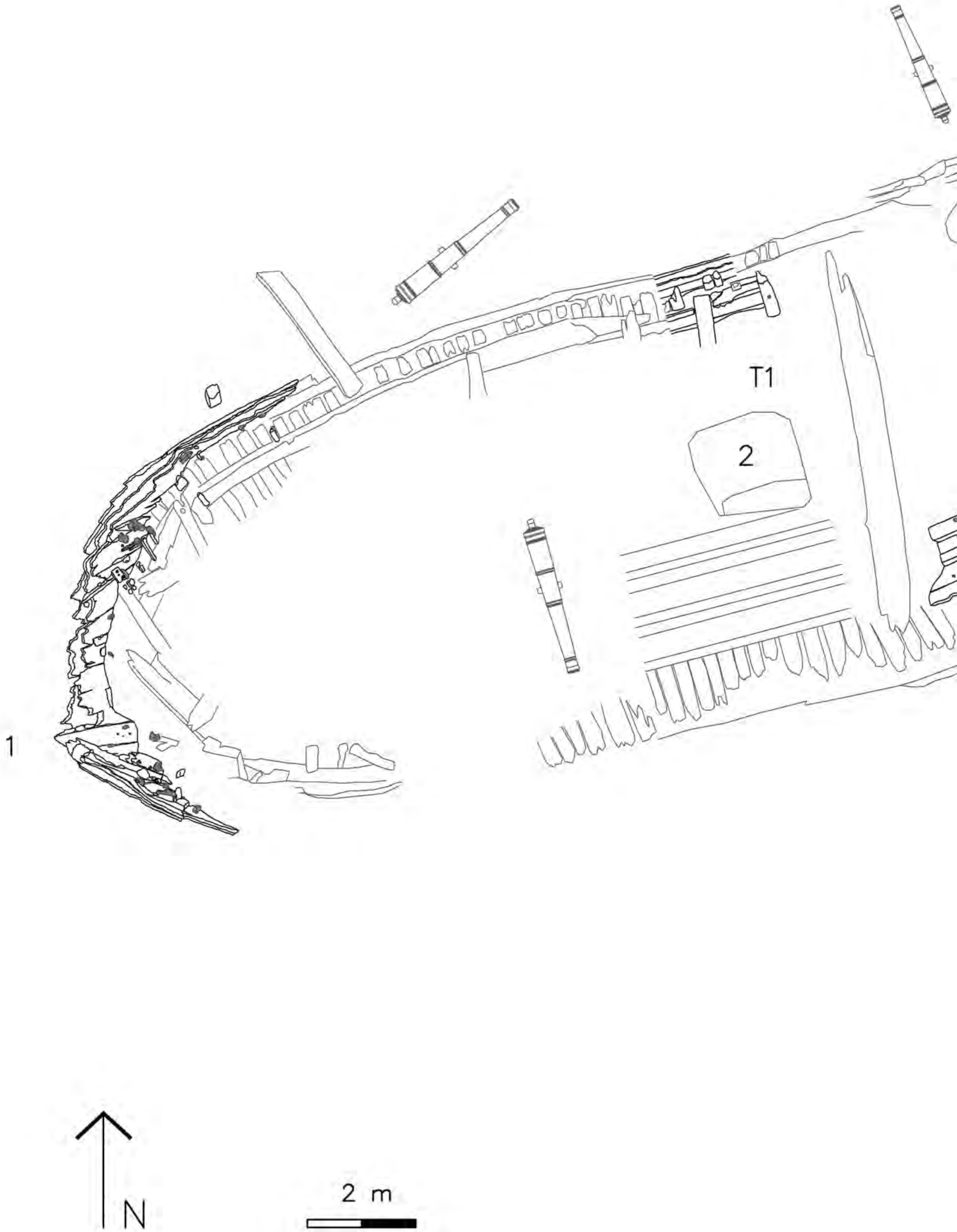
A mobile 'drawing grid' was also used, particularly where the structure to be surveyed had numerous small details and the datum offset method was not practical (Figure 9.2). A plastic 1 by 1 m grid with 10 by 10 cm string squares and double stringing was utilized. Depths were measured from the top of the grid. The grid was positioned within the site using trilateration from the previously established survey points. Additionally, underwater photography was used to complement the drawings.
The resultant drawings were then digitalized and imported to an 'Autocad' file. Finally they were assembled in the site plan, where all the survey points were previously positioned using the 'Site Surveyor' software.

Although the survey methods used were considered appropriate for the required purpose, some improvements could be made. Environmental factors like low visibility (1.5 m in average) and high-energy swell had a great influence on drawing and measuring. In particular the strong movement caused by the swell was a considerable disturbing factor for both the divers and the equipment. The plastic drawing grid, for instance, was too light and could not be kept in a stable position. The use of a heavier metal frame would have been better.

Since one of the main goals of the project was to train the local team of archaeologists in underwater techniques, many of the survey tasks were executed by them with the supervision of an experienced archaeologist. Studying ship remains underwater is an important task within a maritime archaeological project since it provides the necessary information to investigate the construction of the vessel and its use over time. It becomes a challenging task as well when the environmental conditions are so difficult, as is usually the case on the site of the Avondster. Every site has its own characteristics and conditions, demanding custom-made solutions. Developing skills, methods and techniques suitable for the site conditions therefore became a high priority, as well as helping the Sri Lankan team to find their own solutions for the difficulties in the fieldwork that they would encounter.

Areas recorded in the 2003 and 2004 fieldworks

During the fieldwork carried out in February-March and November-December 2003 and November-December 2004 different areas of the site were recorded to enable the study of the ship's structure. Some of these areas were excavated while others were not (Figure 9.3).



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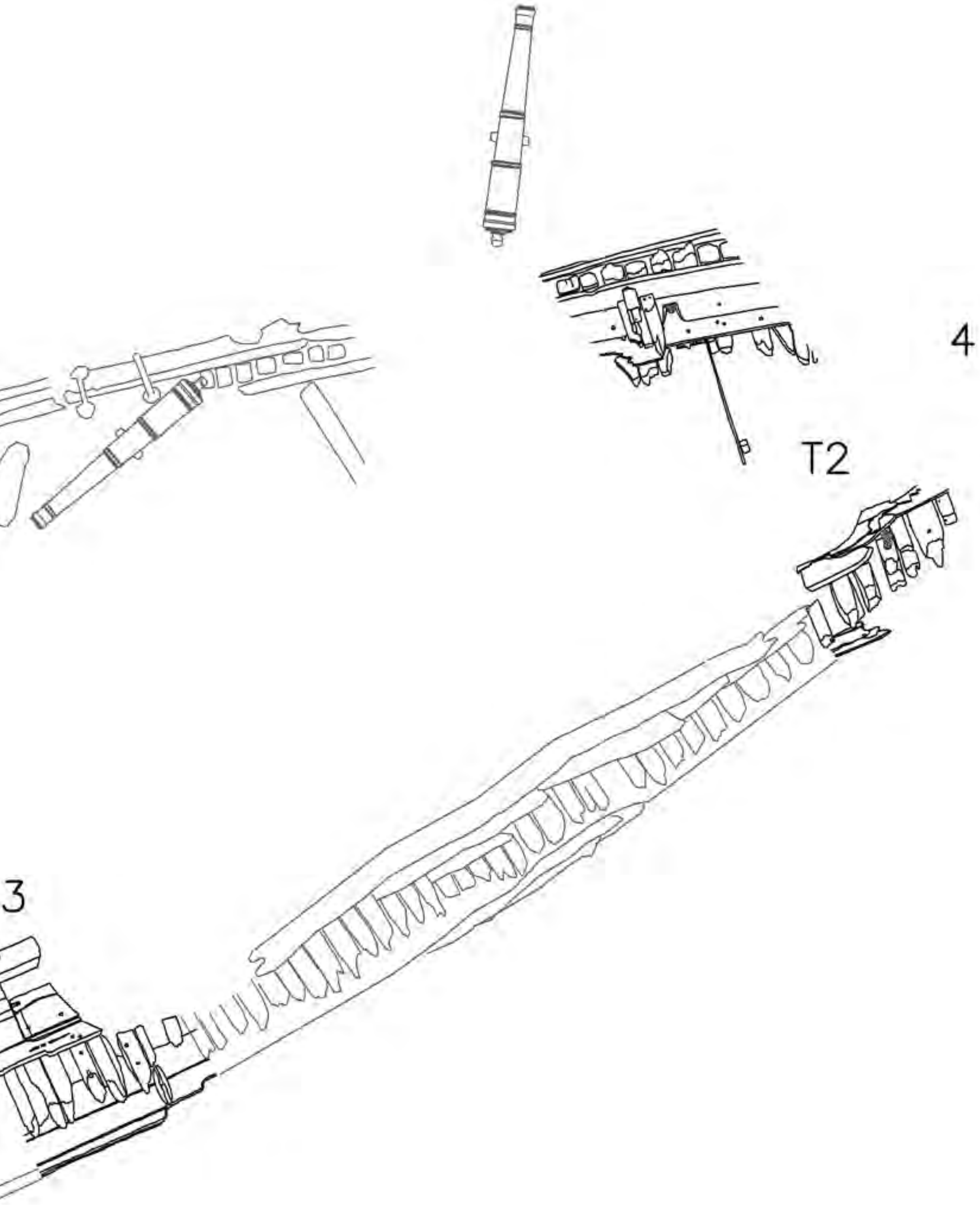


Figure 9.3 Plan of the exposed hull remains; the grey lines illustrate the areas recorded in previous fieldwork.

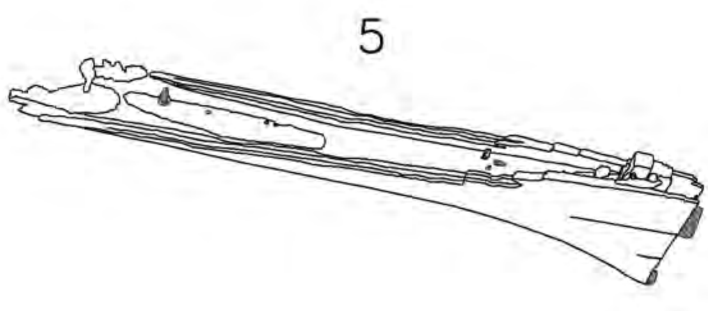
references:

1. Bow,
2. Galley,
3. Keelson,
4. Stern,
5. Sternpost section,

T1. Trench 01,

T2. Trench 02

(drawing by K. Camidge and C. Murray, based on recordings of the 2003-2004 field seasons and previous site plan by R. Muthucumarana).



An area of the hull around the middle of the ship was investigated after a 2 m wide trench excavation (Trench 01) was completed. It is located around a brick structure identified as the ship galley and close to where the midship (or maximum breadth) section should be. The excavation exposed parts of the starboard and port sides, while the central and deepest part of the structure remained covered. A section of the port side close to the centreline was also uncovered, showing interesting features that helped us to understand the construction of the midship area. An area across the stern section of the vessel was also excavated (Trench 02). Two meter long sections of both sides of the hull structure were uncovered, while the space between them remained covered by sand. From the presence and position of the different structural components, the port side section uncovered was identified as being the ship's bottom close to the centre-line, although no traces of the keelson were observed there.

Unfortunately the trenches could not be extended to uncover a whole cross-section of the structure. An exposed cross-section of a well preserved wrecksite like this is essential in the examination of the most relevant structural components and to enable the recording of the hull's lines.

Although no excavation was conducted in the bow area during these field seasons, it was decided to record the visible remains of the structure since it was more exposed than in previous years. The exposed remains consist of a narrow and curved structure about 12 m long, most of which belongs to the starboard side.

Finally, a detached fragment of the stern, which is located towards the south east of the main structure, was also recorded during the 2004 fieldwork. This section of the wrecksite had not been recorded in detail during previous fieldwork seasons.

Ship design

The only dimensions of the Blessing-Avondster known from historical sources are related to its tonnage. In the English records it is listed as a ship of 250 or 260 tons, with a crew of about 65 for major voyages (Sainsbury, 1906: III, 27). No building contracts, ship plans or depictions have been found so far, so the original design of the ship remains unknown. However, on the basis of the archaeological remains and contemporary documents such as manuscripts and treatises on shipbuilding, an attempt can be made to reconstruct its principal dimensions and shape.

As a seagoing merchant ship, a number of qualities concerning the cargo capacity and the sailing capabilities might reasonably be expected for the Avondster. With a degree of certainty the English East India Company and later the VOC assessed those qualities on the basis of their own requirements, and obviously approved them. The characteristics of a rather larger vessel with a seaworthy hull and a slightly fuller body would have been preferred. It is interesting to note that the Avondster is described in several English and Dutch contemporary documents as a slow ship.

As a vessel built in England, its dimensions and shape would have been dictated by the English building procedures of the time. A number of English contemporary manuscripts explaining the design process have survived. Among the most detailed documents are Mathew Baker's Fragments of Ancient English Shipwrightry, probably dating from the 1570's, the anonymous A Treatise on Shipbuilding from c. 1620-25 and Anthony Deane's Doctrine of Naval Architecture, 1670. In most of the sources the ship's principal dimensions, such as the keel length, breadth and depth in hold, were governed by rules of proportion. Such rules were based mainly upon an accumulation of empirical knowledge, since mathematical and physical knowledge during the seventeenth century was limited (Roberts 1998).

However it must be noted that the theoretical methods of design mentioned above may have been used only by the larger, more progressive shipyards. In the smaller yards and for smaller seagoing vessels less sophisticated procedures - like the use of moulds and battens to acquire shapes - could be expected (Steffy 1994). In consequence the present reconstruction is just a theoretical exercise, the purpose of which is to verify whether the results are consistent with the ship remains or not.

Taking 1640 as the approximate date of the construction of the Avondster, the Treatise on Shipbuilding (Salisbury & Anderson 1958) seems likely to be one of the most appropriate sources. In this work the author recommends a Keel Length:Breadth ratio of 25:9 and a Breadth:Depth ratio of 7:3, so knowing one of these dimensions the others can be calculated. Using the tonnage rule of the time (L x B x D / 100), the keel length for a 250-260 ton ship would have been around 23 m (77'). However, the keel dimensions in the archaeological record seem to be somewhat larger. Though it remains buried, from the extension of the exposed structures we are able to estimate its approximate length to be about 28 m (92'). This potential discrepancy between the historical sources and the archaeological remains can not presently be explained. They could be related with possible modifications made by the Dutch, such as an enlargement of the hull (a verlanger or verlenger), or simply with the use of a different tonnage rule.

The principal dimensions based on the estimated keel length and the proportions of the Treatise on Shipbuilding are given in Table 1. The values for breadth and depth match reasonably well with the archaeological evidence. These figures represent a tonnage of 437 by the aforementioned rule, which corresponds to a medium sized merchantman for the period.

Dimension	feet	meters
Keel length	92'	28.04"
Breadth	33'2"	10.11
Depth in hold	14'4"	4.37

Table 9.1 Possible principle dimensions of the Avondster based on the Treatise on Shipbuilding from c. 1620-25 (Salisbury & Anderson 1958).

The midship section was, in the English shipbuilding of that period, a major factor in controlling the hull form. Most of the manuscripts explain the procedure to delineate it. Figure 9.4 shows the reconstructed midship section of the Avondster based on the proportions and geometry explained in the referred treatise. The radius of the principal arcs that mould the midship section – the floor, breadth and reconciling sweeps – are a given proportion of the main breadth (Salisbury & Anderson 1958). This reconstruction could not be compared so far with the archaeological remains since only small sections of the frames have been exposed during the excavation.

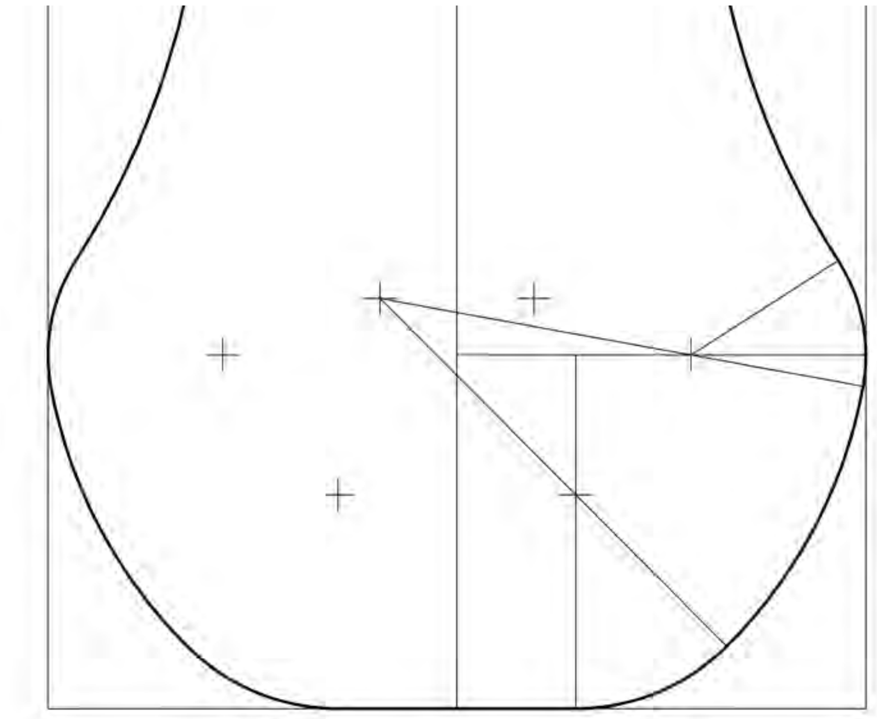


Figure 9.4 Reconstructed midship section of the Avondster based on the Treatise on Shipbuilding from c. 1620-25 (drawing C. Murray).

Hull remains

Extent and integrity

The remains of the ship's hull consist of an integral structure around 30 m long and 8.60 m wide and a section of the stern, which is detached and lies, at the nearest point, 12 m from the former (see Figure 9.3). The said structures cover an area of about 220 m^2. The presence of disconnected structures or components buried under the sand can not be discarded.

The bow is easily identifiable in the main structure and is orientated west-south west. Although only a short section of the keelson was uncovered, the location of the vessel's centreline can be traced from the configuration of the structural components near it.

The wreck is lying on the seabed on its starboard side (Figure 9.5A-B). Measurements taken in the stern area after excavation gave a list of 34 degrees, which seems to be consistent throughout the length of the surviving hull structure. The disposition of the cannons along the starboard side, some of them outside of the ship, is consistent with the mentioned list. This also indicates that the wreck lay in that position for a long period, even before it broke up. From observations made during previous fieldwork, it is quite probable that collapsed parts of the upper structure are still buried under the sand outside the starboard side (Manders et. al. 2003, Parthesius et al. 2003). However, an excavation trench outside the wreck following the line of the midship trench (Trench 01) did not reveal any significant structural part (see chapter 8 on Trench 01).

The remains of the main structure do not project above the sediment level more than 40 cm. Due to the pronounced list, the starboard side is buried to a significant extent and is therefore much better preserved than the port side. The starboard side has survived as high as the main deck, well above the turn of the bilge. The port side has survived not beyond 2.5 m from the centreline.

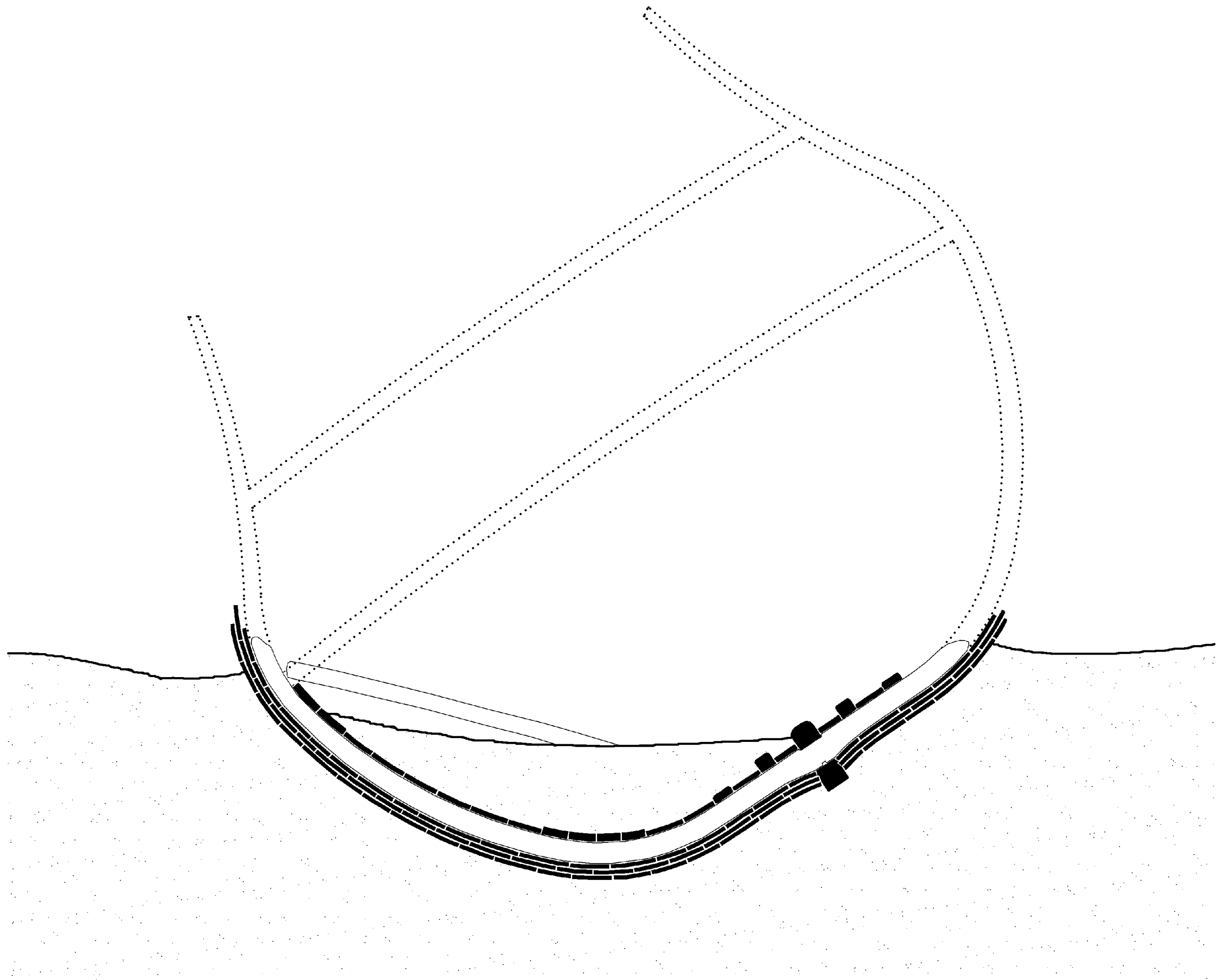
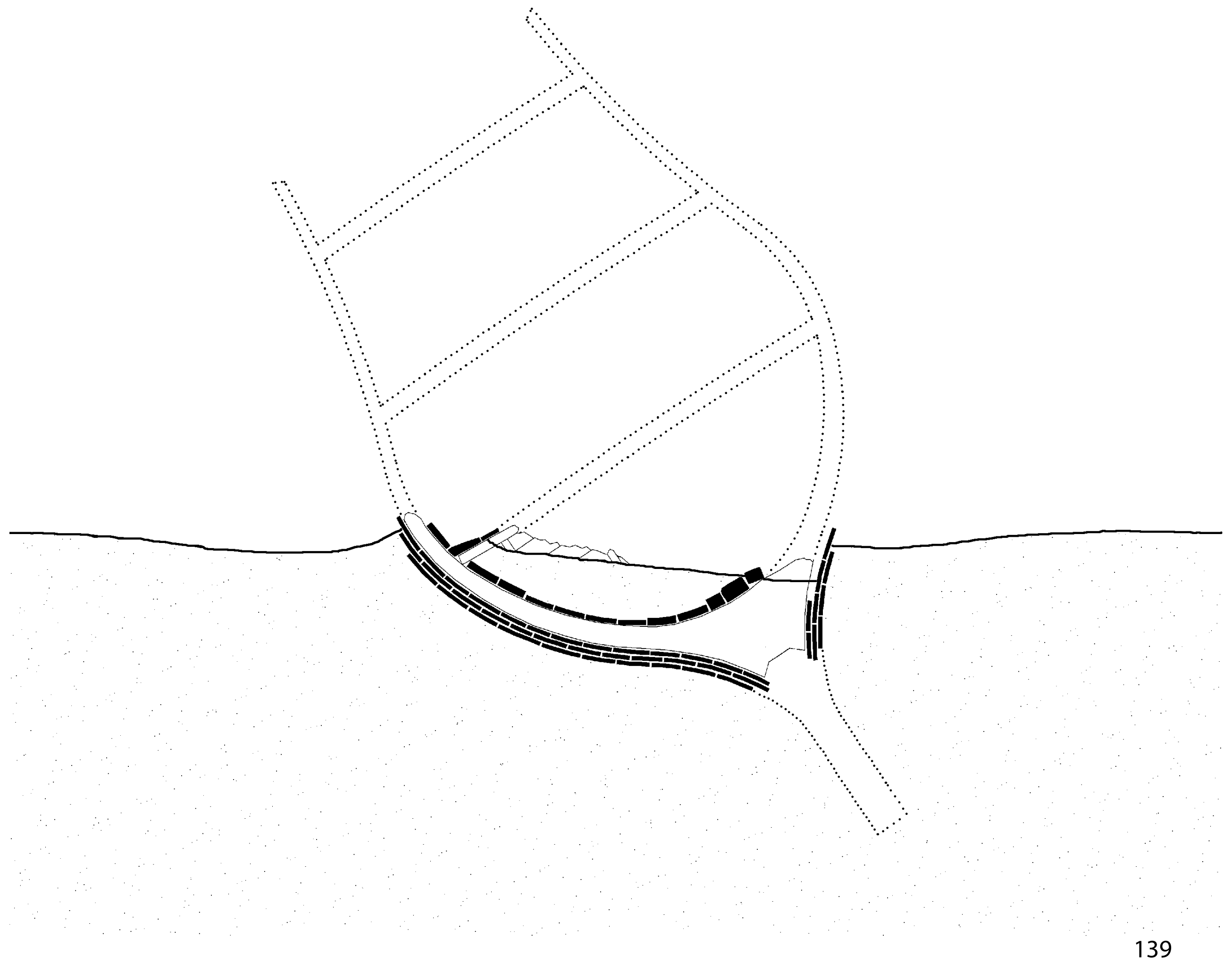


Figure 9.5 (A-B) Schematic cross sections of the surviving structure based on the recorded exposed remains and the reconstructed section of Figure 9.4 (looking abaft): A. Midship, B. Stern. The missing parts are drawn with dotted lines (the stern keel section lays separated from the main structure); the buried remains are hypothetical (drawing C. Murray).

1 m



The separated fragment of the stern, essentially a 7.5 m length of structure containing part of the sternpost, the keel and associated planking, lies on its starboard side with a list of 38 degrees. Together with the galley it is the most exposed part of the shipwreck, with a maximum elevation of 1.4 m above the surrounding sediment level. A significant scouring around the structure has been observed.

The separation of the stern structure is probably a consequence of the wrecking process as it is known from archival sources that the ship broke up after grounding (Parthesius et al. 2005). Since the excavation did not reach the lower levels of the aftermost section of the hull, it is not possible to identify the exact place where the stern structure was originally connected with the hull. However, it seems that not much of the length of the ship is missing between the main structure and the stern section.

The whole surviving structure represents approximately 30% of the original hull. By comparison with the average rate of preservation reported from other contemporary shipwrecks in tropical waters (like the Batavia, Vergulde Draeck and Sea Venture, among many others), this proportion is significantly higher. This situation offers the opportunity to conduct a rewarding analysis of the hull structure.

Framing

The eroded ends of several frames are visible in most of the exposed hull's outer limits (Figure 9.4). The exceptions are limited to the bow area, where only small remains of frames protrude from the sediment, and the sternpost section, which shows no traces of frames. The excavated areas are, naturally, the places where frames were more exposed and thus accessible for recording and analysis. The areas excavated in the last two field seasons are, as was previously mentioned, the midship trench (Trench 01) and the stern trench (Trench 02).

The ends of fifteen frame elements were recorded at the port side, within the excavated areas. Their proximity to the centreline suggests that they correspond to floors and first futtocks. The positive identification of each single frame was not possible since the keelson and ceiling, which are placed on top, were not disassembled. Eleven frame elements were recorded after excavation of the starboard side. They were preliminarily identified as second and third futtocks due to their distance from the projected centreline and their relative position to the remains of the main deck. This could be verified if further excavation and dismantling of the ceiling takes place. Samples taken from some of the futtocks were identified as being of white oak (Table 9.2).

References Table 9.2

(*) 1 sample from each element (identification Godfrey 2005)

B. bow area

M. midship area

S. stern area

BL. bottom level

WL. waterline level

nr. not recorded

avg. average

c. circa

Element	Location	Sided dim. (or thickness) in cm	Moulded dim. (or width) in cm	Wood sample (*)
Frames - possibly floors & first futtocks	M-S / BL	10 to 33 (most bet. 18 & 22)	nr.	
Frames-possiblysecond&thirdfuttocks	M-S / WL	14 to 27 (avg. 24)	17	Whiteoak(Quercussp.)
'Room & Space'	M-S / BL-WL	54 to 60 (avg. 57)	Room avg: 43 Space avg: 14	
Planking - inner	M-S / BL-WL	5	nr.	Elm (Ulmus sp.)
Planking - middle	M / WL S / BL	8 5	nr.	Elm (Ulmus sp.)
Planking - sheathing	M / WL S / BL	8 5	nr.	Pine (probably of the red deal type)
Planking - total	M / WL S / BL	21 15		
Ceiling - stringer	M / BL	10	c. 25	
Ceiling - common plank	M / BL	6	c. 35	
Ceiling - limber strake	M / BL	18	21	
Ceiling - limber board	M / BL	7	31	
Keelson	M / BL	31	27	
Rider	M / WL	c. 25	nr.	
Stempost	B / BL	c. 25	c. 35	
Sternpost	S / BL	c. 25	c. 36 (atrecordedlevel)	Whiteoak(Quercussp.)
Deadwood knee?	S / BL	c. 24	c. 20 (atrecordedlevel)	Whiteoak(Quercussp.)
Main deck - beam	S / WL	16 to 25	11 to 19	Whiteoak(Quercussp.)
Main deck - planking	S / WL	5	c. 25	Whiteoak(Quercussp.)
Main deck - waterway	S / WL	c. 6 / 9	c. 40	
Main deck - spirketting	S / WL	7.5	c. 38	

Table 9.2 Dimensions and wood types of the recorded structure elements.

A certain pattern in the framing structure was detected, at least 22 of the 26 recorded single frames are arranged in pairs (Figure 9.6). this disposition suggests a double-frame construction system, in which the frames comprise of two rows of overlapping futtocks. Double frames were used in shipbuilding of the period, mainly in the bigger yards for the construction of warships and Indiamen (Goodwin 1987, Morris et al. 1995). According to Anthony Deane's Doctrine of Naval Architecture (1670) the frames of an average size ship consisted of a central floor timber, three overlapping futtocks and a top timber on each side of the keel (Lavery 1981).

Double frames are commonly associated with the 'frame-first' shipbuilding method, in which the complete structure of frames was pre-erected on the keel before the planking began. In contrast, in the 'shell-first' method the building sequence was reversed, since the external planking was first assembled and the frames were fitted afterwards. In this system the framework did not need to follow a specific pattern, being simply placed to fit the internal shape of the shell in the most convenient way. This means that the length and sided dimensions of individual frame elements were much more flexible and they were scarcely attached to each other. Additionally, a number of transitional methods were also applied in the seventeenth century, as was demonstrated by several studies of both English and non-English ships (Martin 1978, Maarleveld 1992, Adams 2003). In these methods the construction sequence consisted in an alternating assembly of frames and planking sections. For instance, the proposed model for the Sea Venture, an English merchantman wrecked on a Bermuda reef in 1609, suggests that the assembly of the lowest strakes of the bottom planking happened after placing some control floors across the keel, but before putting the futtocks in place. This stepwise procedure of advancing the construction provided the shipwrights with the required control to fair the frame timbers to the appropriate shape (Adams 2003).

In most of the frames recorded at the Avondster site the two rows of futtocks have a gap of around 2 cm on average. Additionally, no traces of horizontal fastenings were observed in the exposed frames, but their presence in the covered sections is not discarded. Only two joints connecting adjacent frame elements were observed, being both butt joints. Because of their location close to the centreline they presumably correspond to the joint between the floors and second futtocks. No treenails or bolts were used to interconnect both timbers.

This evidence - the absence of fastened joints between adjoining timbers - suggests that the frame elements were assembled piece by piece, i.e. not pre-erected before the planking. In such cases the strength of the framing system would depend largely on the fastening between frames and the inner and outer planking. To confirm whether the Avondster was originally built from built-up frames or another type of building sequence is a subject that needs more in situ research before this research question can be resolved.

The 'room and space', i.e. the distance from a moulded edge of one frame to the corresponding point on an adjoining frame, is relatively regular (see Table 9.2 for dimensions). The average 'space', the unoccupied distance between frames, is around 1/3 of the standard 'room', the part occupied by the double frame. Nevertheless the recorded frames are a small proportion of the whole framing and consequently these measurements have to be considered to be fragmentary evidence. The 'room and space' is a key indication of the robustness of the structure. From the values available, it can be assumed that the Avondster's hull was relatively heavily built. This is consistent with the records from 1643 where it is reported as being a very strong vessel (Sainsbury, 1906: II, 361A).

The sided dimensions of frames close to the centreline vary, ranging from 10 to 33 cm (Table 9.2). The sided dimensions are larger at the waterline level than near the keel, a pattern that cannot be explained from the available data. At the stern-portside area moulded dimensions could not be measured as the excavation did not reach the external planking below them, but the significant depth of these timbers is evidence of their closeness to the centreline. Additionally, further excavation is necessary to identify whether they are full frames - lying across the keel - or half frames, with their heels resting against the deadwood. The use of half frames at the stern was common practice in English shipbuilding, where the narrow angle between both arms of a floor made it impractical to build them from a single piece of timber (Lavery 1984).

No evidence of cant frames - frames that are not perpendicular to the centreline - was recorded, although only a small portion of the frames at the vessel ends were uncovered by the excavation. However it is believed that cant frames were not extensively adopted on British ships until the beginning of the eighteenth century (Goodwin 1987).

The fastening systems were expeditiously recorded and were not fully investigated at this time. Several holes of treenails are visible on the inner faces of some of the frames, while one frame has two large iron bolts protruding from its upper face. Additionally, it is likely that not all the existing treenails have been identified and they are therefore missing on the site plan.

The almost complete absence of frames in the exposed area of the bow is somewhat curious, contrasting with the extensive survival of the external planking. Such situation could be associated with the relative strength of the external planking.

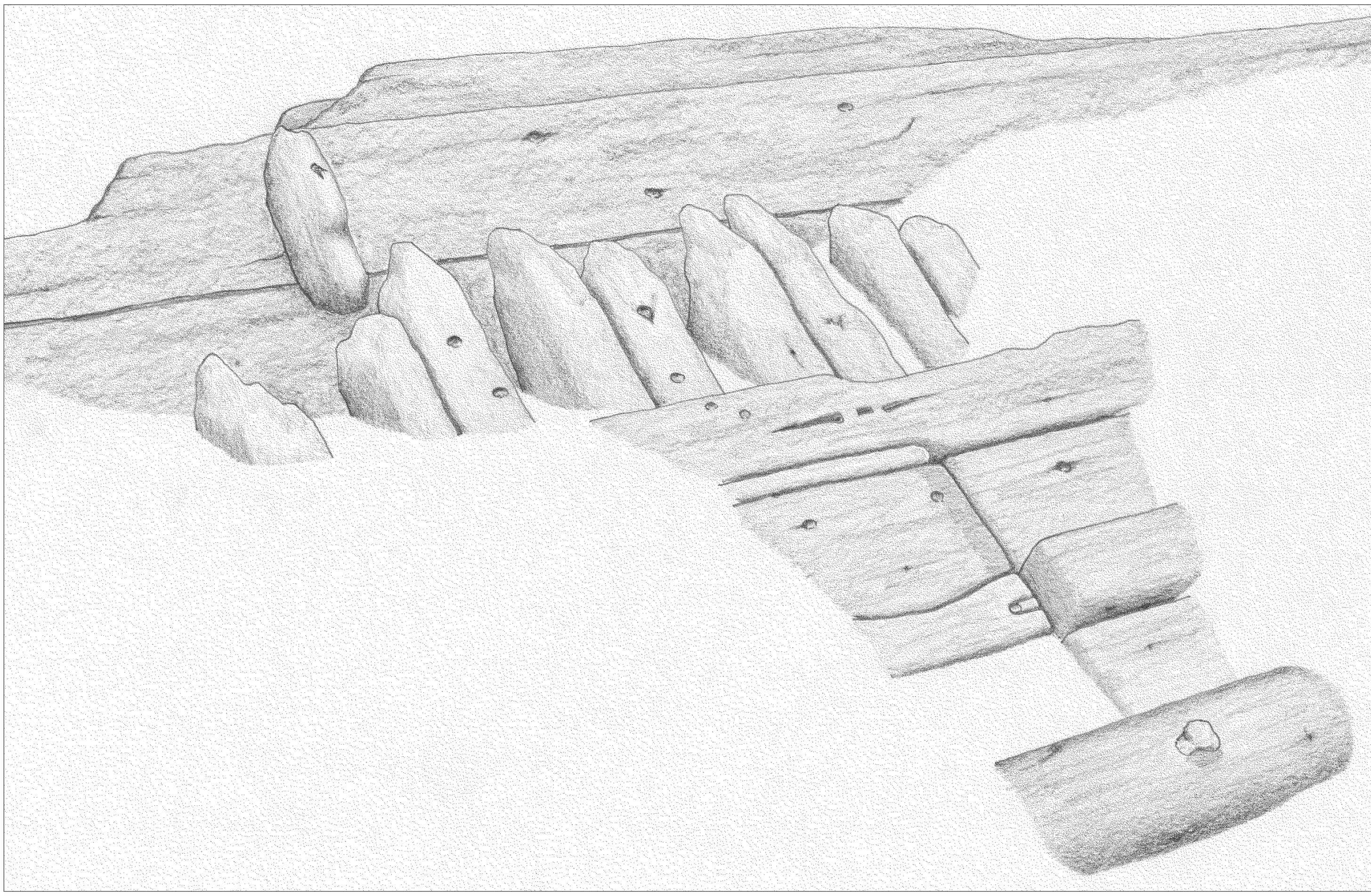


Figure 9.6 Sketch of the portside bottom remains excavated amidships. The timber with an iron concretion at the low right corner of the illustration is the keelson (drawing C. Murray)

External Planking

The external planking is visible in most parts of the site, both on the starboard and the port sides. It is 'carvel-built', that is, built with planks laid flush onto the frames and fastened to them. Interestingly, the planking comprises two layers of planking plus a third layer of sheathing (Figure 9.7). It has a total thickness of as much as 21 cm, which is even thicker than the frames!

The thickness of each layer varies according to the surveyed section and the condition of the wood (see Table 2). In the sternpost area the total thickness is about $^3/_4$ of the thickness amidships. The difference between the areas could be associated with the need to reduce the planking thickness where the lower sternpost section is reached, and also with the possible presence of a wale in the surveyed midship area, where the measurements were taken near the waterline. A thinner layer of planking, which is easier to bend, could also be used where the hull's curvature is more pronounced.

A multiple-layer planking system was previously recorded on the wrecks of large Dutch merchantmen of the time: the Mauritius (built 1602; L'Hour et al. 1989), the Batavia (wrecked 1629; Green & Parthesius 1989; Parthesius 1991), both in service for the VOC, and the Scheurrak SO1 (dated c. 1585; Maarleveld 1994; Manders 2003). The same planking system was also found on the B&W2 wreck (built before 1609; Lemée 2006) which is probably of Dutch origin and was in the service of the Danish East India Company. These four vessels had in common a double layer of solid oak planking not less than 14 cm thick. Additionally, the Mauritius, Batavia and B&W2 had also an external pine sheathing of approximately 3 cm thick. Maarleveld (1994) suggests that the double planking solution adopted in the aforementioned ships is an adaptation of the Dutch-flush shipbuilding tradition (a kind of shell-first method) for the construction of larger vessels in a transitional period of Dutch shipbuilding at the end of the sixteenth century.

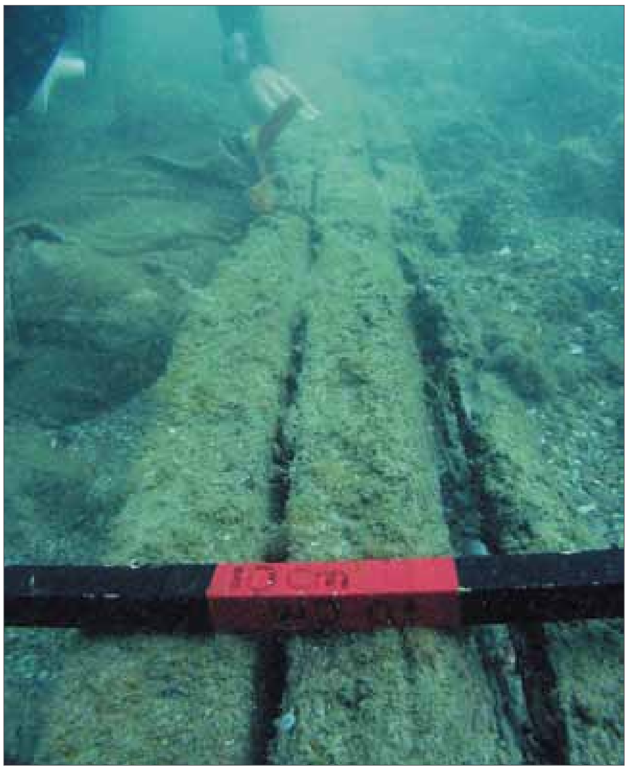


Figure 9.7 The three layers of the Avondster external planking; from left to right: sheathing, middle layer and inner layer.

The two inner layers of the Avondster planking are made of elm (identified from samples taken from the sternpost area) while in the previously mentioned Dutch ships oak was used. Oak was usually the preferred wood for the external planking both in England and the Netherlands, while elm was frequently used in English shipbuilding for long structural timbers like the keel. Elm planking was also found in other English wrecks like the man-of-war HMS Dartmouth (built 1655, sank 1690; Martin 1978), but no historical or archaeological records of elm planking have been found for Dutch vessels.

The outermost layer of planking, the protective sheathing (or doubling), is pinewood and has a remarkable thickness of 5 to 8 cm. Usually the sheathing consisted of thin boards of a soft sacrificial wood which protected the inner, more durable planking from wood-borer organisms. Pinewood was considered more resistant to shipworm than oak and it was also cheaper. Since this layer absorbed most of the physical and biological damage, it would have been necessary to regularly replace it.

In the bow area two layers of sheathing were observed. The wood appears to be a tropical species, which would be evidence of repairs using local resources. The stempost also seems to be sheathed (boxed). These are initial observations and and requires further research .

The fastening method also requires more investigation. As no excavation was carried out on the outside of the structure and no part has been dismantled, the system that was used to fasten the planking to the frames and the different layers between them could not be recorded.

In some areas of the wreck the external surface of the sheathing shows a concreted shell created by the corrosion products of closely spaced multiple iron nails. After removal of a small portion of this sheathing, rectangular holes of 5 by 6 mm in a diagonal pattern were exposed (Figure 9.8). This additional protection from wood borers was also found in other Dutch wrecks like the Batavia (1629) and the Buitenzorg (1759). In a written reference from 1634 it was required that the protection by external nailing become standard practice in VOC ships sent from the Netherlands (Coolhaas 1960). A similar method was also used in England where it was known as 'filling nails' (Bingeman et al. 2000).

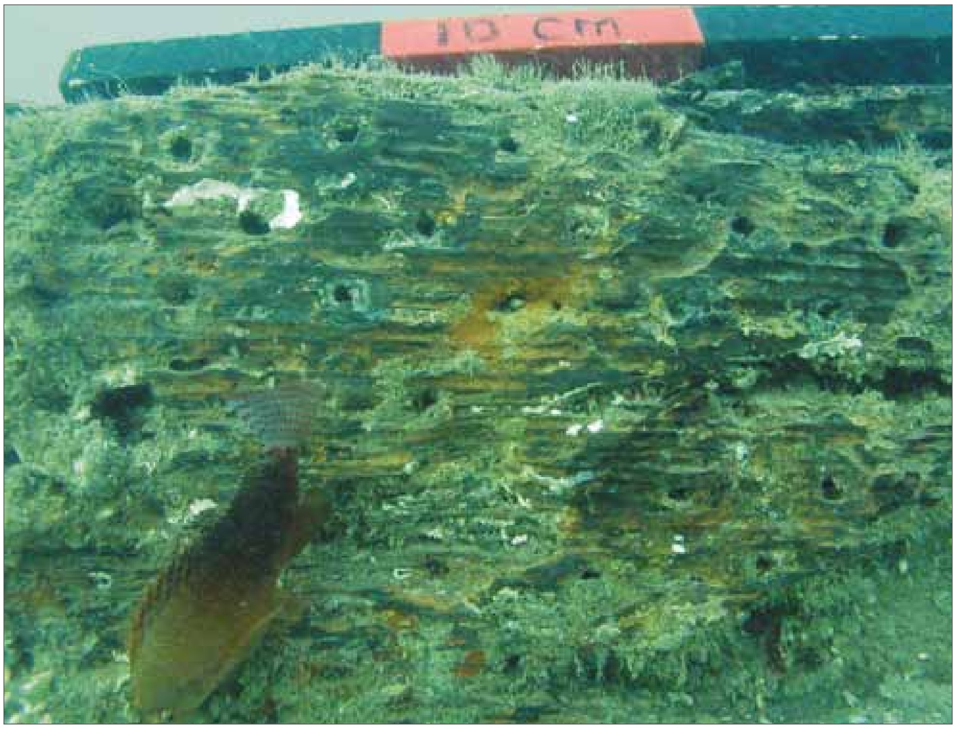


Figure 9.8 Holes left by the iron nails, now corroded away, driven in the external surface of the pine sheathing for extra protection against wood borers.

Internal hull components

Several structural timbers were recorded and identified in the interior of the hull. Most of them are placed in the longitudinal, fore-and-aft, axis.

A set of longitudinal timbers of different sizes placed atop the frames at the midship area are part of the ceiling, the internal planking of the hold (see Figure 9.6). The outermost element towards the portside, which is 110 cm from the centreline, seems to be a stringer, a thick plank that provided additional longitudinal strength (see Table 2). The inboard edge of this timber has a rebate where a narrow piece of pine is fitted, probably a repair made at some point in the ship's life. Adjacent to the centreline lays a common ceiling plank. Next to it the limber strake, the lowest permanent ceiling plank, is placed. The thickness of the timber indicates it also has a structural function

The next and last plank towards the centreline is the limber board, which could be removed to clean the limber hole (see Table 9.2). Curiously, the last three elements (the common ceiling plank, limber strake and limber board) all terminate at the same point. Both the ceiling plank and the limber strake continue in adjacent pieces, while the corresponding limber board is missing. The last structural element uncovered with the excavation at the midship area was a small section of the keelson, its dimensions being 31 cm sided and 27 moulded. It has rounded upper edges and a large iron bolt head protruding from its upper surface. The identification of the keelson provides valuable information about the position of the whole structure.

In the interim report of the February-March 2003 fieldwork written by the MAU team a similar structure of ceiling planks and keelson is described, which was uncovered after excavating at the west side of Trench 01. Here the keelson presents a small cut-out recess on the top, presumably to hold a stanchion, and several ballast stones were found close to it. Even though the main-mast step was expected to be found within this area, no evidence of it was found (Manders et. al. 2003). On the starboard side evidence was found of the caulking of the ceiling planks. Here pieces of tarred rope were found to have been driven into the seam between the planks.

Three fore-and-aft planks partially covered by thin boards can be seen in the stern area lying atop the frames. They seem to be part of the ceiling - maybe the limber strake and the limber board. The thin boards placed over these planks possibly have a protective role for both the structure and the cargo.

The head of what could be a rider was uncovered amidships, on the starboard side. This is a large timber fitted transversely atop the ceiling and was used as a structural reinforcement, like an internal frame. Traces of an iron bolt used to fasten it to the ship side can be seen. It is commonly asserted that merchant ships did not have riders since they reduce capacity. Whether this timber was part of the original construction or was introduced later as a structural reinforcement – maybe to strengthen an old ship, is unresolved and requires further investigation

Additionally, two small lead plates with nail-holes around their edges were found close to the rider. They could have been used as patches to prevent water leaking. Together with some repairs in ceiling planks, they are evidence of maintenance during the ship's life.

Stem and stern posts

A short segment of a timber that seems to be the stempost was recorded in the bow area. Its dimensions are approximately 25 cm sided and 35 cm moulded. Since this area was not excavated only the remains exposed above the sediment, which are a small proportion of the bow structure, could be measured and drawn.

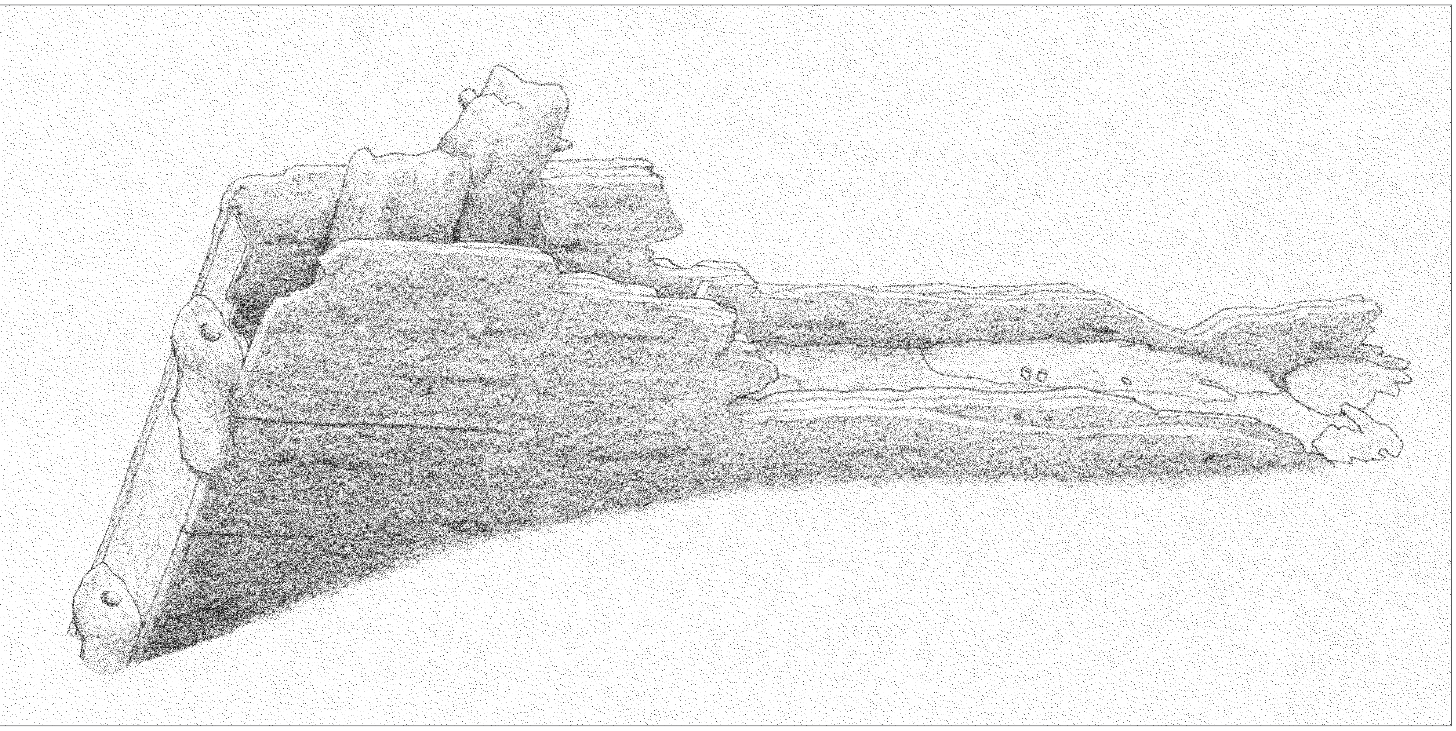


Figure 9.9. Sketch of the lower stern hull section that lies on the seabed detached from the main structure. The sternpost has broken up just above the upper surviving rudder gudgeon (drawing C. Murray).

The assumed stempost has a slight upward curvature and is flanked on both sides by the strakes of the external planking. From the angle that the strakes join this piece, the surveyed segment would belong to the lower section of the stempost. No traces of associated timbers like the apron (the inner false post) were observed within the exposed structures. Remains of a caulking or protective material were observed in this area inside the joints of some timbers. It seems to be composed of a matting of animal hair and tar. A similar product was found in the wrecks of the B&W2 (before 1609), Sea Venture (1609), HMS Dartmouth (1690) and the VOC ship Batavia (1629). Its applied on the hull together with sacrificial wood sheathing in the seventeenth century British Navy, as well as on VOC ships, is known from historical records (Bingeman et al. 2000). lower segment of the sternpost is one of the main structural components of the hull section which is detached from the main structure (Figure 9.9). This hull section is a homogeneous structure which presumably retains its original shape. Most of the internal structure could not be recorded since it is covered by the external planking.

The aft side of the sternpost is sheathed with a metal plate, identified as lead, 5 mm thick. Between this plate and the wooden surface of the sternpost a very thin copper sheet is placed. This sheathing has a width of 25 cm, which is probably equal to the sided dimension of the sternpost. The rake of the sternpost could not be measured since the keel was not exposed. A sample of the sternpost was identified as white oak.

Two iron concretions protrude from the aft side of the sternpost, which are presumed to be the remains of the rudder gudgeons (Figure 9.10). The distance between the top sides of both gudgeons is 108 cm. The braces of these fittings are not visible, seeming to be covered by the planking. Interestingly, the sides of the sternpost are also covered by the external planking, although it seems to be only by the pine sheathing. No traces of the rudder were observed in this area.

Two vertical timbers project out from the top of the stern structure afore the sternpost. The one abaft is probably the inner post, a timber attached to the forward surface of the sternpost to increase its strength. The forward timber could be the upper part of the deadwood knee. A number of iron bolts can be seen protruding afore this timber, between the lower strakes of planking (Figure 9.11).

No remains of the athwartships elements of the stern structure, i.e. frames and transoms, were found in this area. The keel is presumed to be buried under the sand, further excavation is required to confirm this.

Deck structures

Several structures from the decks were found and recorded on the starboard side of the hull. The port side has no deck remains, since its surviving level is much lower than that of the starboard side.

Figure 9.10. The surviving upper rudder gudgeon, heavily concreted, still attached to the sternpost .

Figure 9.11. Iron bolts protruding from the wooden remains of the stern hull section, between the planking strakes.

A section of a deck, presumably the main (or lower) deck, is still in its original position at the stern area, where it was uncovered after excavation in Trench 02. Five beams can be observed under the deck planking, which are broken close to 1 m from the ship's side (Figure 11). The beams are, on average, 46 cm apart and their sided dimensions from 16 to 25 cm and their moulded 11 to 19 cm. The first and last beams have both hanging and lodging knees while the three beams in the middle seem to have no knees. However, since the space under the deck planking was not excavated the supporting structure can only be inferred from the exposed timbers. Hanging knees were common in the English, as well as the Dutch shipbuilding traditions while lodging knees are a characteristic of English construction.

The outermost strake of the deck planking is placed onto the deck beams. Some treenails in line with the deck beams can be seen. Both the planking and the beams have been identified as white oak. Adjacent to it and along the hull side a waterway is placed. Waterways have the function of keeping any water away from the sides and directing it towards the scuppers, which drain the water off the deck. The upper surface of the waterway has a slight slope towards the interior of the vessel and its inboard edge has a recess where a scupper is located. Only the rim of the scupper's round intake is visible, which seems to be made of lead. The internal diameter of the intake is 7 cm. The presence of a scupper proves that this deck was above the water level. On the basis of the shape of the reconstructed cross section and the list of the hull, this deck is believed to be the main (or lower) deck, the deck just above the water level. Curiously, a solid round object, which seems to be a piece of iron shot, is firmly lodged into the scupper's intake.
A similar lead pipe was found amidships running through the side of the ship. It has a square section of 9 cm each side and has a rim around its intake. It could be a different type of scupper or a pipe to drain the water from the pump.

The spirketting is placed against the frames internal face. This plank is the lowest strake of the internal planking above the deck. An assembly of five small wooden pieces placed athwartships is located in the angle formed by the waterway and the spirketting. It is placed just afore the scupper and in the same line of the deck beam below. The purpose of this set of timbers is unknown but could be associated with the structure of a bulkhead.

A bulkhead was observed under the deck in the stern area. It runs athwartships and is built with horizontal boards supported by square section stanchions. The presence of a wooden lining covering the underside of the deck is somewhat curious. It could be related to the function of the cabin or storeroom below.

A deck clamp was partially uncovered in the starboard side amidships (Trench 01). It probably corresponds to the same deck level located at the stern area. Although collapsed, a deck beam still lies in its original place (Figure 9.12). It has a sided dimension significantly larger than the beams at the stern area previously mentioned. Such a significant scantling was probably there to support the weight of the galley (a brick structure identified as Dutch origin by its use of a special type of yellow bricks, IJsselsteenjes), The galley is now resting 2 m from the ship side and still over the beam. This deck beam was braced from both sides by lodging knees, which held it in the horizontal plane. Remains of the aft knee can still be seen in its place while the fore knee, which was loose, was recovered during previous fieldwork for analysis. Some evidence of standing knees was also observed on the starboard side. They might have been placed there at a later stage to reinforce the hull or to enable cannons to be carried on board.

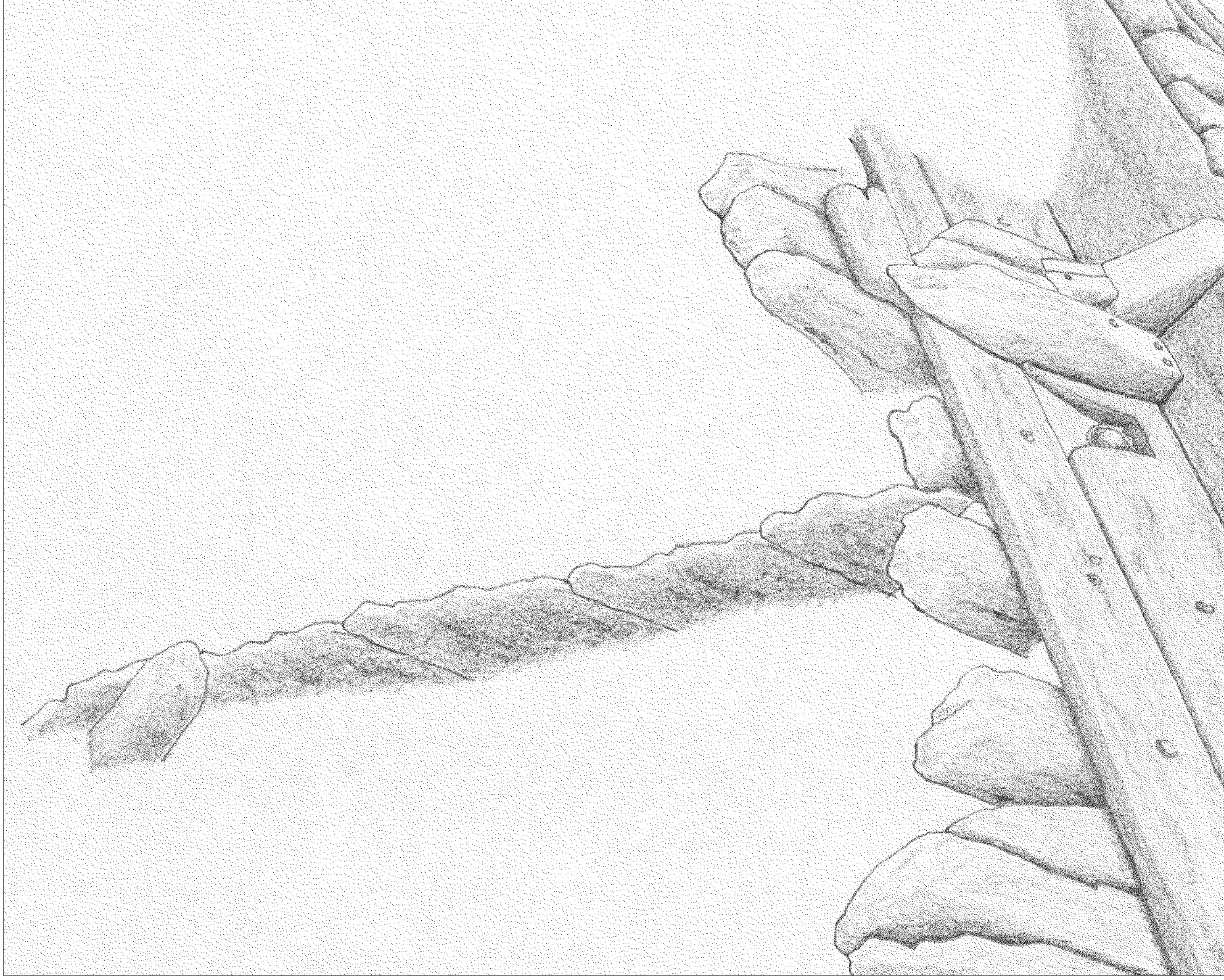


Figure 9.12 Sketch of the deck and bulkhead remains excavated at the stern. Note the recess in the waterway for the scupper (drawing C. Murray).

Figure 9.13 Midship starboard side section.

Construction and Adaptation

A relevant aspect of the ship-construction study is the building sequence. The succession in which the structural components were assembled provides essential information to help us to understand the conceptual approach that shipbuilders followed in the construction of their vessels (cf. Maarleveld 1992, Adams 2003, Lemée 2006). The particular concerns the way in which the intellectual creation - the design - was articulated with the manufacture process and is strongly connected with the social context in which they take place.

In its most developed version, the construction process of the frame-first method was divided into two phases. The design phase, where the hull lines were pre-established and represented in a draught or a model, and the construction phase, later carried out according to that design (Figure 9.13). This system was only followed at the large shipyards since it required learned shipwrights to deal with the relatively complex design projections. Conversely, in the shell-first method the design and construction developed simultaneously. The hull shape was defined by the shipwrights while they progressed with the construction, although they certainly had in mind the overall form before starting (Maarleveld 1992, Adams 2003).

Some transitional methods developed in the sixteenth and seventeenth centuries in Europe can be located around the two conceptual boundaries mentioned before. In the 'frame-based' method illustrated by Adams (2003) the shape of the hull was directed by the frames, but the construction alternated between sections of frames and planking. This was a more organic approach to ship construction than the one adopted by the frame-first method. The 'bottom-based' method developed in the Netherlands, in which the bottom planking was assembled prior to any frame, was led by a different approach (Figure 9.14). The hull shape was defined at the same time as the construction proceeded (Witsen 1671, Maarleveld 1992). Frame-based, bottom-based and other transitional methods were different answers related to special social and economic environments.

The construction sequence used to build the Avondster cannot be confirmed on the basis of the archaeological and historical information available at the moment. Although the visible double-frame pattern supports the hypothesis of a frame-first system, some evidence is not consistent with the pre-erected framing. This evidence shows non-interconnected frame elements and a considerable variation in the frame scantlings, particularly the sided dimensions. A transitional method such as the 'frame-based' described by Adams (2003:191) could have possibly been applied by its shipbuilders. This author suggests that in England '... much, if not most carvel building in the sixteenth and seventeenth centuries was not 'skeleton' construction in the sense of a complete framing system of 'ribs' erected prior to the application of a plank 'skin'. In reality, the two advanced side by side...' Only new archaeological data from the wrecksite could reveal what building sequence was followed. Dismantling the ceiling should be necessary to understand how the framing was actually built. Important clues could also be found through the examination of the fastening of the planking-frames-ceiling assemblage. Additionally, looking for traces of provisional fastenings in the external planking (like temporary clamps) could be helpful, since their presence is indicative of a 'bottom-based' construction sequence.

Some constructional features found in the Avondster are characteristically English. Many deck beams are braced to the ship's side by hanging knees as well as lodging knees. Hanging knees were common practice, both in Dutch and English shipbuilding. But lodging knees were only used by the Dutch in specific areas, like the beams around the large hatches, while the English shipwrights used them to support the ends of the beams together with hanging knees. The presence of these structural elements is evidence of English shipbuilding.

In contrast, other features were found to be of Dutch origin. The waterway from the deck assembly recorded at the stern area is one example. The English built thicker and narrower waterways, with a pronounced chamfer or rounded edge to keep the water away from the sides. The waterway found at the site is a wide plank of c. 40 cm with a slight slope in its upper face, a typology that can also be seen in the Swedish warship Vasa (built in 1628 by a Dutch shipwright). The presence of this element indicates that the Dutch made modifications to the interior of the hull, may be as part of repairs or as a more important refitting to change the layout of the deck.

The double-layer planking and the thick sheathing are an interesting technological attribute of the Avondster. We know that this ship was originally built in England, where the planking was usually erected in a single layer and no precedents of carvel double-planking are known. Was the double-layer therefore an alteration made by the Dutch?

Figure 9.14 Drawing by Sieuwert van der Meulen from his series Navigiorum aedificatio from around 1700, showing the Dutch flush-planked shipbuilding (Groot & Vorstman 1980).

The construction of the external planking in such a strong manner - in total 21 cm thick in some parts - suggests that this element had a primary role in the structural integrity of the ship, beyond its natural water-tightness function. It seems that it was considered not just a skin sustained by an internal structure, but rather a strong self-supported shell. This could be preliminarily considered an indication of Dutch shipbuilding tradition. As it was previously said, the double planking was a technological solution adopted by the Dutch shipwrights to build large merchant vessels in the late sixteenth and early seventeenth centuries. This method could be an adaptation of the common (one layer) flush-planking system for the construction of larger ships, keeping to the concept of a strong shell with internal reinforcements. Archaeological data from the Scheurrak SO1 and Batavia shipwrecks indicating that they were originally constructed with a double layer of planking support this assumption (Maarleveld 1994).

However, if the Blessing's planking was in a good enough condition when the ship was captured by the Dutch, there was no reason to replace it. They could have added a second layer of planking and sheathed the underwater hull with softwood to make it fit to operate in tropical waters. Several historical references indicate that the hulls of VOC ships were reinforced and protected to deal with the specific conditions encountered in sailing between Europe and Asia, as well as within Asia (Parthesius 2007). Beside this, the extra layer could have been the solution found by the Dutch shipwrights to strengthen a weakened and leaking hull. In this way, in accordance with the Dutch conceptual approach to shipbuilding, where the external shell was a critical component of the structure, the shipbuilders would have chosen to reinforce the external planking rather than the framing or internal structure. Archaeological data from the B&W2 wreck revealed that an extra layer of oak planks was constructed in a later rebuilding stage of the ship. This also seems to have been the case for the Mauritius (Lemée 2006).

The wood used for the planking can be a clue to its origin. The historical records indicate that the Dutch only used oak to plank their East-India ships. The other examined Dutch wrecks with double planking - the Mauritius, Batavia and Scheurrak SO1 - are all oak-planked. As a consequence, the use of elm for the Avondster planking reveals that it was not fitted in the Netherlands. Although the double planking was not characteristic of English shipbuilding, the presence of elm indicates that it was fitted in England prior to the ship's capture by the Dutch. However, it is doubtful that the vessel was originally built with double planking, a technological solution which is more commonly assigned to the Dutch shipbuilding tradition of the period. A more realistic explanation could be that the second layer was added by the English East India Company after the acquisition of the vessel. This could have been done for different reasons: for extra protection for a long stay in tropical waters, to improve the stability or to increase the buoyancy – the last might be necessary if the ship was refitted to carry heavier guns and new gunports were opened in the lower deck. It is known that major repairs were carried out in 1646, when the English East India Company estimated that the ship could continue in service for seven or eight more years (Sainsbury, 1906: III, 145A). In any case, the addition of an extra layer of planking could explain the several complaints expressed in the English and Dutch written sources about the slow sailing of the ship.

These hypotheses can be confronted in the wreck site by the analysis of the fastenings, both between the planking and frames and between each planking layer. Investigation of the keel might also provide some clues. A double layer of planking as part of the original construction would have a double rabbet in the keel, both rabbets probably being of the same depth. But if the second layer was a later adaptation it may possibly have a less deep rabbet or even no rabbet at all.

The use of pine sheathing as a protection against the teredo worm in tropical waters was common practice for VOC ships. The application of a thin layer of pinewood, of about 3 cm, in the submerged part of the hull is confirmed from both the historical and archaeological records. But the large thickness of the Avondster sheathing is somewhat peculiar. In addition to its protective function, such heaviness of the sheathing could have been an attempt to reduce the weakness of the ship structure in the last years of its life. Considering the structural role that Dutch shipbuilders assigned to the external planking - 'a strong and watertight composite shell' (Maarleveld 1994) - this idea seems to be reasonable. A thorough examination of the fastening system used to connect the sheathing with the rest of the structure can shed light on this question. The use of a thick sheathing could be explained - once again - by the need of a broader hull to increase stability. However in this case the extra thickness would have been applied only at waterline level and not necessary in the bottom, where it was also observed. It is also possible that the increased sheathing could have provided additional protection from the impact of cannon fire during times of war. In any case, since the sacrificial sheathing was frequently replaced it is quite probable that it was fitted by the Dutch some time before the ship sank.

The maintenance of European ships operating for extended periods in Asian waters was one of the main issues for the VOC. Evidence of repairs made in Asia have already been found with the wooden stock of one of the anchors being made from an Asian species and the possible use of tropical wood as sheathing in the bow. Other evidence of repairs like the few lead patches and wooden repairs of the ceiling support the historical records which mention serious leaking. However, they have not been properly examined yet and their origin is uncertain. Although more evidence of repairs is expected in the hull structure, the systematic integration of local materials and building techniques remains a subject to be investigated.

Conclusions

Although the study of the partially excavated hull of the Avondster has provided a considerable amount of information on its construction characteristics, it has also led to many new questions. In fact most of the conclusions derived from the present analyses are of a preliminary nature and could be verified if the excavation is resumed in the future. Additionally, it is worth remarking that the study of the construction of the Avondster has significantly contributed to the development, in cooperation with the Sri Lankan MAU team, of the skills and techniques required to record, analyze and interpret wooden ship remains in highly dynamic environments.

The principal dimensions of the ship seem to be consistent with the rules of proportions derived from contemporary English shipbuilding treatises. However, the tonnage calculated using the standard formula of the period is somewhat larger than the one expressed in the English documents. This could mean that a different method was originally used to determine the tonnage, or that the ship was in fact larger, maybe as the result of a modification made by the Dutch.

Some attributes of the framing system like non-connected frame elements and flexible sided dimensions indicate that it was not pre-erected before the planking begun. Additionally, the heavy-built planking could be interpreted as evidence of shell-first construction. However, the observed double-frame pattern suggests that the hull's shape was directed by the frames. Therefore the building sequence was probably carried out with a frame-based method in which the bottom planking could have been assembled after placing some control floors across the keel, but before putting the futtocks in place.

Since the planking is made of elm it is most likely of English origin. However, the double-planking is an odd system for the English shipbuilding tradition. The extra layer could have been added at a later stage, possibly when the vessel was purchased by the English East India Company to operate in tropical waters. It could have been the solution to increasing the buoyancy and to raise the gunports higher above the waterline. The pine sheathing was probably added by the Dutch, since it was standard procedure for VOC ships. Its remarkable thickness could have been to improve the ship's stability or simply for extra protection.

The Avondster, with its much better preserved hull remains than other VOC shipwrecks, could reveal the overall concept of its building sequence and the extended history of adaptations that it seems to have undergone. The significant amount of evidence enclosed in this site provides the opportunity to better understand the traditions involved in the construction and maintenance of an East Indiamen in the mid seventeenth century.

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