CHAPTER THREE

EXPLORING AUSTRALASIAN TORPEDO BOAT DEFENCE, DISCARD AND ABANDONMENT: METHODS AND SOURCES

Introduction

This chapter addresses methodological and analytical approaches to the research design upon which this thesis is based. It discusses the range and availability of pertinent historical information, identifies repositories where primary source material is archived, and outlines the manner in which these data were accessed, reviewed, and applied within the research framework. Significantly, it also emphasizes the limitations posed by historical material, including the potential effect of bias on analysis and interpretation of the information these sources contain.

This study also derives evidence from the archaeological record. The commentary that follows outlines sources and methods utilised to investigate sites associated with Australasia's late-nineteenth and early-twentieth century torpedo boat defences, as well as the means by which their archaeological signatures were interpreted and compared. Because it is fundamentally an exploration of the material signatures of military disposal and abandonment within a maritime context, this thesis focusses on the existing construction and/or abandonment attributes of land-based torpedo boat support facilities, as well as the discard characteristics of torpedo vessels abandoned within terrestrial, intertidal, and submerged contexts. With the exception of limited excavation at one torpedo station site in South Australia, all archaeological investigations comprised non-disturbance documentation of visible *in situ* structures, features, and artefacts. Cultural material recovered during the torpedo station excavation was analysed, as were selected artefacts and hull elements associated with the late-1990s excavation and recovery of one of New Zealand's colonial

torpedo vessels. The latter assemblage comprises the only comprehensive museum collection of Australasian torpedo boat material culture from the colonial and early post-Federation/Dominion eras.

Used individually and in concert with one another, the historical and archaeological records illuminate several aspects of Australasia's early torpedo defences, including technological, economic, political, and cultural factors that influenced deployment and disposal decisions and activities central to this thesis. Although archaeological information comprises the empirical basis of the research design, natural and cultural site formation processes (as outlined by Schiffer 1996) often alter or eliminate certain types of material culture and influence what survives in the archaeological record, necessitating it be complemented by a documentary data set. Significantly, the archaeological and historical records also often exhibit distinct differences that, when explored together, ensure the topic in question is assessed and interpreted from multiple viewpoints in a comparative, comprehensive manner.

Historical Research

The starting point for this research project involved acquisition and assessment of primary and secondary historical sources, as the data contained within them ultimately informed and guided development and execution of the archaeological component of the research design. For example, the survey methodology (discussed later in this chapter) utilised historical information that included the number of sites potentially available for investigation, their respective locations, and post-depositional activities—such as reclamation and development—that may have affected the integrity of their archaeological deposits. Data derived from documentary sources also illuminated certain intangible aspects of early

Australasian torpedo defences not necessarily evident in the archaeological record, including the day-to-day actions and attitudes of individuals associated with the creation, operation, and discard of specific boats and stations. From a narrative standpoint, documentary evidence helped weave a story around which the analysis and interpretation of specific technical and spatial attributes of these vessels and their associated facilities could be shared in an informative, yet engaging manner.

Textual Documentary Sources

A variety of historical sources exist that address torpedo boats and their role in the seaborne defence of Australia and New Zealand between 1884 and 1924. Given the broad geographic scope of this research project, a wide assortment of published and unpublished secondary historical material was consulted at its outset to establish a chronological and contextual framework for individual torpedo boats and torpedo boat facilities, as well as the Australasian torpedo defence network in its entirety. Torpedo boat defences are addressed in several overview histories of Australasia's colonial navies and military infrastructure (see Adlam 1981; Gillett 1982; Jones 1986; Nicholls 1988; Cooke 2000; Oppenheim 2004), and have been the subject of articles and monographs that highlight individual elements of the larger system (White 1977; Gillett 1986; Moffat 1996; Pennock 1997b; Healey 1999; Adlam 2008). However, a review of these sources revealed a general lack of comprehensive data regarding specific attributes of torpedo station construction, operation, and subsequent abandonment, and torpedo boat discard events and practices. Indeed, some of these secondary sources make little or no mention of torpedo boat-related infrastructure or abandonment activities at all.

In instances where overview histories were unavailable, or incomplete and/or unreliable, they were supplemented with data derived from primary archival sources. The records that pertain to Australasia's early torpedo boat defences originated from a wide variety of official and unofficial channels, and include administrative correspondence, vessel orders and building contracts, inspection reports, supply inventories, account books, requisition orders, logbooks, private letters, and diaries. These documents are located at a variety of repositories throughout Australia and New Zealand, and were supplemented by material archived at the National Maritime Museum in Greenwich, United Kingdom. Australian sources include the National Archives, National Library, and Australian War Memorial in Canberra, state archives and libraries of New South Wales, Victoria, Queensland, Tasmania, and South Australia, and a vast array of museums and historical societies nationwide. New Zealand-based repositories include the National Archives and National Library in Wellington, the Hocken Library at the University of Otago, Christchurch City Library and Canterbury Museum in Christchurch, and the Thornycroft Torpedo Boat Museum in Lyttelton. Finally, this project has benefitted tremendously from the manuscript collections of private individuals, most notably that of Ms. Jan Perry of Adelaide, South Australia.

Archival material generated by official sources reflect the colonial—and later national—authoritarian structures that regulated and controlled Australia and New Zealand during the late-nineteenth and early-twentieth centuries, and reveal a range of military, political, and economic trends then in existence at the regional, state, national, or international level. However, because these records focus primarily on administrative, technical, or political aspects of Australasia's torpedo boat defences, they rarely reflect the personal perceptions of the individuals who wrote them. Consequently, the 'official' view of

the world characterised within these documents often falls short of accurately representing the attitudes of people directly associated with the day-to-day operation of torpedo boats and stations.

By contrast, local government sources, which document the official actions of local and regional entities and individuals, tend to more effectively represent these latter groups and occasionally offer insight into their respective ideologies, practices, and behaviour. However, the best archival representation of individual perspective exists within documents such as diaries and private correspondence. These items were often generated for limited (i.e., the writer or no more than one intended recipient) readership and therefore provide the most unexpurgated, unbiased accounts of specific historical events. They also frequently record day-to-day events, observations, and decision-making processes that may have been considered irrelevant from an authoritarian perspective and consequently not documented in official sources.

Local, regional, and national viewpoints can also be extracted from critical examination and careful use of historic newspapers. In the wake of the Crimean War, newspapers were the primary means by which citizens of colonial Australia and New Zealand were kept apprised of diplomatic relations between Great Britain and other nations, and often trumpeted the need for a comprehensive naval and coastal defensive system in the wake of the first Russian Scare in the 1870s. Following the launch of New South Wales' first torpedo boat in 1879, and subsequent delivery and deployment of Thornycroft-built vessels to other Australasian port cities during the following decade, torpedo boat defences were often a topic of the colonies' newspaper reporting. Readers were treated to details ranging from the design and construction features of a particular torpedo craft or submarine mining station, to the respective qualifications and expertise of the servicemen and volunteers

responsible for their operation and upkeep. In some instances, archival news sources also advertised specifics of the sale and purchase of decommissioned torpedo defence matériel, including boats, equipment, machinery, weaponry, structures, and building hardware.

Historical and maritime archaeologists (see Brown 1985; Mrozowski 1988; Staniforth 2003a; Duncan 2006) have cited newspapers as a significant source of information about past people and events, as well as a basis for 'commentary and opinion about contemporaneous events in both colonial and metropolitan societies' (Staniforth 2003a: 55). While some researchers (Flatman 2003: 6; Pipkin 2003) have warned of inherent biases—such as politically-based agendas—within historic news sources, others (Duncan 2006: 45) observe that these biases 'may inform of contemporary historical attitudes within and without' specific areas of study and can be used to good advantage if they are recognised and acknowledged.

One specific problem encountered during a review of newspaper sources utilised for this research project was the extent and accuracy of information contained within them. On more than a few occasions, different news sources reporting on the same topic disclosed 'facts' that not only differed from one another, but also from information retained in archival data sets. Acknowledging these and other constraints, this thesis has utilised historic Australasian newspapers extensively to establish general context, as well as illuminate specific details about torpedo boat defences during the colonial and post-Federation/Dominion eras.

Archival Images

Other critical lines of evidence utilised to good effect in this thesis are archival images, including photographs, prints, paintings, maps, and architectural drawings. These visual representations reveal a wide array of information about Australasian torpedo boat

defences, including the construction and appearance of particular torpedo boats and stations, where they were deployed, when and how they were utilised, and who was responsible for their operation and upkeep. As Molyneaux (1997: 1-10) notes, the potential interpretive value of historic images can be quite significant, as they offer a visual reminder of past people responsible for the manufacture, use, and discard of archaeological objects. However, they are also prone to bias in the manner of written archival sources, and individual interpretations and constructs that result in their creation must similarly be identified and considered (Koltun 1979; Costall 1997; Molyneaux 1997).

At the outset of this research project, published histories were consulted to determine the extent and availability of pertinent visual sources, as well as details of their whereabouts and disposition. Subsequent visits to a variety of state and federal archives throughout Australia and New Zealand facilitated access to these images, and occasionally resulted in the discovery of others that were previously unpublished and/or unknown. Similarly, image collections retained at other repositories within Australasia and abroad, including museums, libraries, historical societies, and private collections, were evaluated for torpedo boat-themed material.

Remarkably, at least one historic photograph exists for each of the 14 torpedo craft incorporated into the colonial navies of Australia and New Zealand, and five of these vessels—Victoria's *Lonsdale*, *Nepean*, and *Countess of Hopetoun*, Queensland's *Mosquito*, and New Zealand's *Defender*—are known to have been photographed in post-Federation/Dominion discard contexts. Far less photographic evidence is available that depicts the facilities constructed to support the boats, and in certain instances individual torpedo boat stations—such as those at Brisbane and Hobart—do not appear to have ever been captured on film. Issues of availability aside, photographic records of these early

torpedo defences are an invaluable resource, as they provide literal snapshots of the boats and stations in varying states of use and disuse at multiple points along their 40-year span of operational service. In some cases, they represent the only reliable visual document of these assets, and therefore played a critical role in subsequent identification and interpretation of archaeological sites and material culture investigated during the fieldwork phase of this thesis project.

Australasian torpedo vessels and their associated infrastructure are also well represented by a variety of hand-drawn or printed images archived at various repositories throughout Australia, New Zealand, and the United Kingdom. These include maps and plans depicting the location and layout of all or part of a particular torpedo boat station, as well as detailed architectural schematics of individual structures. While enabling a more thorough understanding of how individual stations were arranged and constructed, as well as predictive utility in locating and identifying their respective archaeological remnants, specific problems associated with their use had to be considered. As Duncan (2006: 47) aptly notes, cartographic sources are often projected or inferred representations of 'official' (i.e., governmental) views of the world, and typically devoid of information that would make them a more accurate reflection of reality. The same issue applies to original builder's draughts produced by J.I. Thornycroft & Co., White of Cowes, and the Atlas Engineering Company. While perhaps the single most reliable historical source for details of torpedo boat hull design, internal arrangement, and outfitting, these documents often constitute idealised depictions of specific vessels and do not always reliably showcase 'as-built' characteristics and/or subsequent modifications.

Another source for printed visual depictions of torpedo boats and stations are magazines, journals, and illustrated newspapers published in the Antipodes during the later

Victorian era. Because the images contained within these publications were intended to illustrate one or more points within an associated news story, they typically forego detail and accuracy for highly stylized renderings of their respective topics. For example, the wood engraving print of a 'New Zealand spar torpedo boat' shown below (Figure 2) was published in the *Australasian Sketcher* on 27 August 1883 and contains a number of errors, the most notable of which include the presence of Whitehead torpedoes with dropping gear and a single smokestack. All New Zealand Thornycroft-built torpedo boats were outfitted with *two* smokestacks, but none were ever armed with anything more than spar torpedoes for the duration of their active duty careers. Despite their lack of detail, these illustrations are still useful in that they provide the only known contemporary depictions of particular aspects of early torpedo boats and defences. For example, an image in the *Illustrated Australian News* of 18 April 1885 features a rare interior view of an Australasian torpedo boat (the torpedo storage bay of the Victorian First Class vessel HMVS *Childers*), while both the *Illustrated Australian News* (1 April 1891) and *Australasian Sketcher* (4 May 1885) published prints of nighttime naval exercises in which the colonial warship HMVS *Cerberus* was engaged and 'attacked' by smaller, torpedo-carrying 'adversaries'.

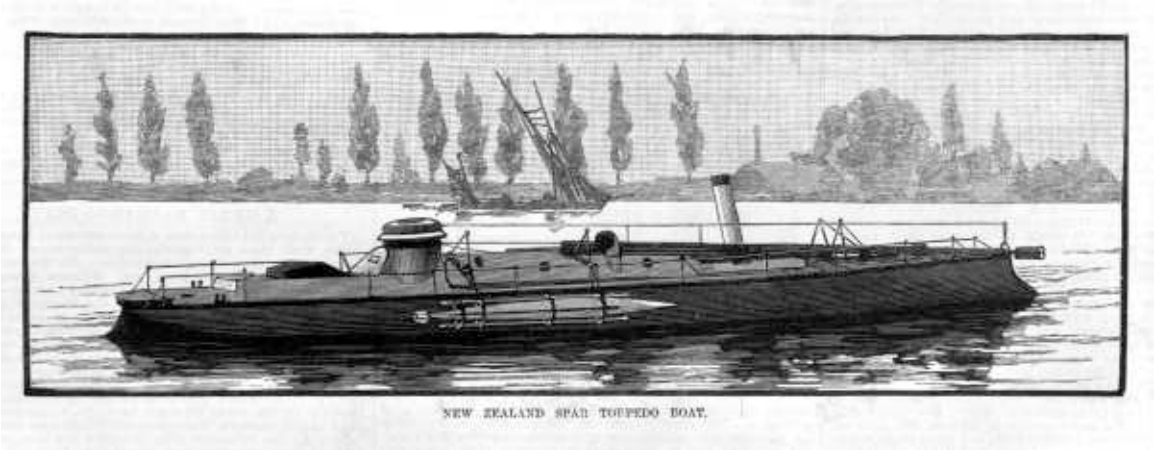

Figure 2. Error-laden print of a 'New Zealand Spar Torpedo Boat' appearing in the 27 August 1883 edition of the *Australasian Sketcher*. Image courtesy of the State Library of Victoria (Accession No. A/S27/08/83/164).

Finally, at least two historic paintings are known to exist that feature an Australasian torpedo boat as either a primary or secondary subject. The first painting, John Gibb's *Lyttelton Harbour, 1900*, shows the New Zealand torpedo boat *Defender* at anchor in Lyttelton's Inner Harbour immediately adjacent to the port's historic dry dock. The torpedo craft is but one of several sail- and steam-powered vessels depicted in the harbour, and as it is clearly a peripheral element of the painting, is not rendered in any appreciable detail. However, *Defender*'s presence in the composition is notable because it visually supports a later claim by some historians that the vessel was moved from its boatshed and slipway around the turn of the century and permanently moored thereafter in Lyttelton Harbour.

Defender is also featured in the second painting, but figures far more prominently in its overall composition. The work, entitled *Purau Beach* and painted by New Zealand artist Jesse Hollobon around 1930, shows the remnants of *Defender*'s discarded hull on the beach at Purau Bay, a small embayment almost exactly opposite Lyttelton on the south side of Lyttelton Harbour. The significance of *Purau Beach* to this research project is that it is the earliest known visual record of *Defender*'s abandonment site and post-discard condition. As such, it reveals the torpedo boat's hull had been broken into two separate sections by 1930, but that it also was otherwise relatively intact. Features such as the conning tower, stern casemate, and bow deck plates are all in their original positions, and aside from obvious flash rusting at various points throughout the vessel, the surviving sections are still well articulated and give the appearance of sturdiness. This contrasts significantly with later photographs of *Defender* from the 1940s and 50s, which show the hull in an advanced state of decay, collapse, and dispersal (see Chapter Six, page 295).

Oral Histories/Interviews

Oral histories have been utilised within the disciplines of historical and maritime archaeology to illuminate aspects of human activity and interaction that might not otherwise be revealed by either the archival or archaeological records (for examples of oral history in archaeological research, see Yentsch 1988; Paynter 2002; Young 2002; Souter 2003; Duncan 2006). As with other 'unofficial' documentary sources such as diaries and private correspondence, spoken narrative accounts are significant because they provide alternative or supplementary realities to contemporary textual material such as written histories and official documents. Indeed, oral histories may even refute the intentional misuse or misrepresentation of material culture, as when tangible evidence produced by a dominant social group—such as the ruling class—is utilised to 'substantiate the validity of…accepted or dominant written or popular histories' (Paynter 2002: S92-S93; Duncan 2006: 52). Alternatively, if used carefully, they can complement material culture, and even inform about a site in situations where archaeological data is compromised or absent altogether.

During the early stages of this research project, an individual with firsthand knowledge of the discarded hull of the torpedo boat *Defender* was brought to the attention of the author. At the encouragement of John Cleaver (Director of Lyttelton's Thornycroft Torpedo Boat Museum), the person in question made contact via e-mail and expressed a desire to discuss his personal recollections of the torpedo boat. Once it became evident that the individual's oral testimony would complement project data derived from archaeological and archival sources, a formal request was lodged seeking his consent for an oral history interview. An information package (Appendix A) designed and approved by the Flinders University Social and Behavioural Research Ethics Committee was sent to the interviewee to assist with the formalities of the interview process. The package contained Letters of

Introduction, a Consent Form for Interview, and a list of key questions and issues to be discussed during the interview session.

The interviewee was happy to provide consent (see Appendix A), at which time arrangements were made to conduct the interview approximately three months later at his home near Melbourne, Australia. Shortly thereafter, the information package was e-mailed to the interviewee to allow him time to thoroughly read and absorb its contents, as well as voice concerns and/or provide feedback to me ahead of the interview. The list of questions and issues referred to above enabled the interviewee to familiarise himself with the topics to be covered in the discussion, and also helped focus the interview's direction and facilitate ease and continuity of dialogue. The interview was recorded directly onto a laptop computer and saved as a digital (.band) sound file via Macintosh's 'Garage Band' music and sound recording software programme.

The recorded interview is 22 minutes, 46 seconds long, and was transcribed in its entirety (Appendix B). The original sound file generated during the interview was designated the 'master' copy and subsequently duplicated for archival purposes. The master and one duplicate were retained for the project's research data collection, copies of which are archived at the South Australian Maritime Museum and Archaeology Laboratory at Flinders University (in the South Australian cities of Port Adelaide and Adelaide, respectively). A second copy of the interview recording was provided to the interviewee. In addition, a draft version of the transcribed interview was sent to the interviewee for review and amendment. Ultimately, the interviewee received a copy of the finalised transcription, as well as his copy of the formal consent form and a covering letter thanking him for his participation. Significantly, upon being asked whether he objected to being identified in this thesis, the interviewee replied that he would be happy to provide written permission for use of his

name in this and other written material generated as a result of this research project (see Appendix A and H).

The interviewee, Clive Goodenough, was born in Christchurch, New Zealand in 1940, and spent his childhood and early adult years there before immigrating to Australia. While growing up in the Christchurch area, he visited *Defender*'s abandonment site with family and friends on multiple occasions, spent a considerable amount of time playing on the surviving hull, and was even photographed sitting in the conning tower during one sojourn in the early 1950s (Figure 3). A copy of this photograph subsequently passed into the possession of the Lyttelton Museum, and was eventually included in an exhibition hosted by the Thornycroft Torpedo Boat Museum. In 2008, Goodenough informed John Cleaver that he was the 'anonymous child' referred to in a caption associated with the exhibited photograph. Recognising the information potential that could be derived from a personal recollection of *Defender*'s discarded remnants, Cleaver facilitated an introduction between Goodenough and the author shortly thereafter.

In the interview that resulted from this introduction, Goodenough described his childhood experiences with *Defender*'s remnants during the early and middle 1950s. It was during these visits that he had an opportunity to explore and observe elements of the vessel's surviving interior and exterior hull, as well as associated material culture within its immediate environs. *Defender* was removed from its secondary deposition site and intentionally dismantled and buried at the behest of the local town council during the late 1950s. Because subsequent recovery of *Defender*'s surviving hull elements in the 1990s was not conducted in accordance with accepted archaeological methods and standards, the site's archaeological context was severely compromised, if not destroyed entirely. Goodenough's observations are therefore significant because they occurred before *Defender*'s surviving hull was moved,

crushed by heavy machinery and buried, and therefore offer the potential to at least partially reconstruct the deposition site's lost contextual data and enhance understanding of any discard footprint it may have retained.

Figure 3. 10-year-old Clive Goodenough sitting in the disarticulated conning tower of the abandoned New Zealand torpedo boat *Defender*, ca. 1950. Image courtesy of the Thornycroft Torpedo Boat Museum (Accession No. TTBM/ILL/22).

Of course, personal recollections have potential limitations in much the same way as archival documents and images. For example, the accuracy of an interviewee's memories may be altered by the passage of time, and influenced by his or her personal attitudes, opinions or biases. In an effort to circumvent (or at least limit) these potential pitfalls, interview questions posed to Mr. Goodenough were kept as simple and straightforward as possible. Inquiries that specifically addressed *Defender*'s condition and appearance overlapped

topic and theme as a means to cross check facts within each answer. Other questions intentionally elicited Mr. Goodenough's opinion of the torpedo boat's abandoned remnants (and his recollections of the Lyttelton community's feelings about the site) as a means of identifying potential bias within the interview as a whole.

Archaeological Research

This thesis extracts meaning from the spatial arrangement, construction, and disposal attributes of Australasian torpedo boat support facilities, as well as the location and discard features of specific torpedo boat abandonment sites. Because the total number of such sites in Australia and New Zealand is relatively small, random sampling was not employed as a means for selection, nor were sites divided into arbitrary study regions. On the contrary, efforts were made from the outset to locate, identify, and record as many of these sites as possible, and to examine them both individually and as components of a larger defensive system. This holistic approach was applied with the intention of extrapolating the maximum amount of useful archaeological data with which to develop and explore the research ideas proposed in this thesis.

Existing Site Data

Prior to this project, sites associated with Australasia's early torpedo boat defences were the focus of very limited archaeological investigation. However, the potential utility of the information derived from previous studies—including, but not limited to, site location and condition, material culture collections, and survey results—dictated that efforts be made to acquire a baseline collection of all existing data. This was accomplished by accessing archaeological site files archived at state and federal government repositories in Australia and

New Zealand, including Heritage Victoria, South Australia's Department of Environment and Natural Resources, Queensland's Department of Environment and Resource Management, and New Zealand's Department of Conservation and Historic Places Trust. Ultimately, the New Zealand search produced site files for one abandoned torpedo boat (*Defender*) and all four of the country's former submarine mining stations, while similar efforts in Australia revealed data sets pertaining to two torpedo boat discard sites (the Victorian boats *Lonsdale* and *Countess of Hopetoun*) and one torpedo station (South Australia's North Arm Torpedo Station). Although limited in number, published and unpublished reports, monographs, and articles produced as a result of associated investigations were collected and reviewed for information that could aid specific objectives associated with this research project.

Of the sites referred to above, only three—*Defender*, its former boat shed at Magazine Bay in Lyttelton, and *Lonsdale*—were the subject of any form of sub-surface investigation prior to the commencement of this project. The effort to 'excavate' *Defender* was driven by a community heritage initiative in the late 1990s to see its surviving hull components recovered and exhibited at Lyttelton's Thornycroft Torpedo Boat Museum. While the rationale for the initiative was sound, an archaeologist was not tasked with overseeing the excavation and recovery efforts. Consequently, these activities were not conducted according to archaeological standards, resulting in the loss of important contextual data. A very different outcome resulted from the investigation of the boat shed at Magazine Bay, which was directed by a New Zealand-based consulting archaeologist who also showcased the project's findings in an unpublished technical report (Watson 2004). Consulting archaeologists also successfully located, excavated, and documented sections of *Lonsdale* in the late 1990s (Schwartz 1997; Hewitt and Tucker 2009).

Portions of one other site, the submarine mining facility at Torpedo Bay near Auckland, New Zealand, were excavated archaeologically in 2009 in the wake of a survey of the same installation conducted by the author one year earlier (see Chapter Five). These investigations were carried out at the behest of the Royal New Zealand Navy (RNZN), following its decision to retrofit the site's standing structures and transform them into the nucleus of the RNZN's Heritage Centre and Naval Museum. Two unpublished reports (Plowman 2008, 2009) have been compiled as a result of this project, with a third currently in production. Of the four sites not excavated, two were the focus of survey-level investigation by either professional or avocational archaeologists during the last two decades, while the remainder underwent cursory inspection by the government agencies responsible for managing them. Details specific to these and all other previously documented sites will be explored further in Chapter Five.

Museum Collections

In conjunction with research trips to archives, site file repositories and archaeological sites, museums known to house hull components and artefacts associated with the torpedo boats *Defender*, *Mosquito*, *Lonsdale* and *Childers* were visited. As mentioned previously, *Defender*'s assemblage, including its reconstructed bow and stern sections, is curated and exhibited at the Thornycroft Torpedo Boat Museum in Lyttelton, New Zealand. Objects recovered from the remaining craft are housed at the Queensland Museum, Queenscliff Maritime Museum and Museum of HMAS Cerberus, respectively. All items—whether on display or in storage—were examined and documented in an effort to draw specific inferences about each boat, including its quality of upkeep while in active service, operational

modifications to the hull and other adaptive strategies, and its overall condition when discarded.

In at least one instance, inspection of archaeological objects retained in a museum collection verified their identity and origin. A section of steel hull donated to the Queensland Museum in the 1970s was reportedly recovered from *Mosquito*, but questions persisted as to its exact origins. This artefact was discovered during a search of Queensland-based museums for torpedo boat-related material culture, and during a subsequent visit to Brisbane the author arranged with Queensland Museum staff to access and inspect it. Examination of the object confirmed its identity as a section of *Mosquito*'s armoured casemate; however, specific features exhibited by the hull section revealed that it originated from the stern end of the casemate, and not from its forward end, as was previously believed. Similarly, another artefact recovered from *Mosquito* was identified as a section of the vessel's teak rub-rail. This item was collected around the same time as the casemate section and subsequently inventoried in the Museum's collections for over 30 years as an unidentified 'relic of HMQS *Mosquito*'.

Site Surveys

The primary objectives of the archaeological component of this thesis project have been to reveal, examine and interpret patterns represented by:

1) Construction attributes and abandonment features of torpedo boat stations built in Australia and New Zealand during the latter half of the nineteenth century; and

2) Discard signatures specific to Australasian torpedo boats decommissioned and abandoned during the first two decades of the twentieth century.

In order to extract as much information potential as possible from the total assemblage, a survey strategy was devised in which visible elements of known torpedo boat defence and

discard sites were systematically surveyed and their recorded data analysed. In instances where a particular site's location was unknown or unconfirmed, efforts were made to survey for and identify evidence of its existence.

A total of six sites were recorded during the fieldwork phase of this project, including remnants of three torpedo stations and one torpedo boat discard locale in New Zealand, one torpedo station in South Australia, and an abandoned torpedo boat in Queensland. Seventeen remaining sites associated with the torpedo boat defensive system were not documented for a number of reasons, the most common of which stemmed from issues of inaccessibility. For example, two sites in Victoria—one a former submarine mining station with extant historic structures, and the other the abandoned hull of *Countess of Hopetoun*—are located within the security perimeter of the Australian defence installation at Swan Island. The sensitive nature of this facility precluded Australia's Department of Defence from granting access to either site, despite requests from both Heritage Victoria (petitioning on the author's behalf) and the author for the opportunity to visit and investigate them. In other instances, the whereabouts of specific sites either could not be deduced through archival sources, or are generally known but almost certainly buried and/or detrimentally impacted by relatively recent land-reclamation and development activities associated with urbanisation and expansion of Australasia's larger metropolitan areas, particularly Sydney, Melbourne, Brisbane, and Auckland.

Time and budgetary constraints dictated that most archaeological fieldwork was limited to digital photographic recording of visible features and artefacts, acquisition of site location data via handheld Global Positioning System (GPS), and creation of scaled site plans through the utilisation of baseline-offset and/or tape-and-compass survey methods. In the vast majority of cases, surveying equipment such as dumpy levels and/or total stations

were not employed because they were simply not available (due primarily to scheduling and equipment-use conflicts with priority projects hosted by the Flinders University Department of Archaeology, including field schools and field methods topics). However, these devices were always included in the recording regime whenever they could be obtained.

The primary function of the photographic record was to capture a site's overall appearance, condition, and spatial arrangement at the time it was surveyed, as well as specific attributes of its material composition (i.e., methods of construction at a torpedo station, or the extent of surviving hull structure at a torpedo boat abandonment locale). A range pole or photographic scale and north arrow were included in most photographs; however, in instances where these items were not accessible or available, common objects such as a metric ruler or pencil were substituted. As each photograph was taken, a register of its particulars—including frame number, the date, orientation of the image relative to magnetic north, the image subject, and comments—was compiled and later transcribed as a Microsoft Word document.

Because the vast majority of sites visited as part of this study were located on relatively level ground with few or no obstacles, the baseline-offset method was frequently the preferred survey option. A 100-metre fibreglass reel tape was established as the baseline, from which a series of 90-degree offsets were measured with a smaller—usually 50-metre—reel tape to specific site features and artefacts. The accuracy of plotted positions on the landscape was checked and, if necessary, refined by mapping the locations of fixed positions (such as buildings or official survey markers) and comparing these data against recorded site information. Larger features were also checked against topographic maps and aerial photographs to confirm their spatial arrangement on the landscape. GPS coordinates were recorded for features and artefacts, and later used in conjunction with ortho-rectified maps

to plot their positions relative to one another. These data were also utilised to graphically depict the geographic location of each site investigated during this study.

In instances where the size of a site exceeded 100 metres in length or width, or followed an irregular pattern, other techniques were utilised to obtain desired data. For example, the relative complexity and size of the submarine mining facility at Torpedo Bay in Auckland was too great to be accurately documented via baseline-offset survey in the time allotted; consequently, elements of the site were recorded with a Sokkia Powerset 4000 total station acquired on temporary loan from the New Zealand Department of Conservation. The device was set up on the seaward end of Torpedo Bay jetty (which is located on the footprint of the historic jetty once associated with the submarine mining station) and used to map extant remnants of the boat shed and slipway used to house Auckland's torpedo vessel *Waitemata*. In an effort to reduce error, three permanent survey markers were originally considered as geographic reference (datum) points; however, only two were identified that offered a clear line-of-sight between the total station and prism. Ultimately, two datum points proved sufficient to produce an accurate, geo-rectified plan of the boat shed and slipway structures.

Sub-Surface Investigations

In late 2009, an opportunity arose to excavate the former North Arm Torpedo Station, located on government-owned property near Port Adelaide in South Australia. The site is situated within a parcel of land bordered on two sides by rivers; this waterfront aspect has long made the property desirable to real estate developers, and the current owner, the South Australian Ministry for Economic Development, is exploring options for its future improvement and development (Aaron Brumby, pers. comm., 30 April 2010). Aware that

such activities could have potential adverse effects on the torpedo station site, Defence SA (the organisation responsible for administering the land on the Ministry's behalf) was approached and permission requested to conduct limited archaeological excavation. Ultimately, access to the site was granted following arbitration with representatives from Defence SA and their subsequent approval of a proposed scope of work (Appendix C and D).

Several structures were built at the North Arm Torpedo Station during its period of active service between 1884 and 1922, the majority of which featured a wooden frame clad in corrugated metal sheeting. One of the rare exceptions to this ubiquitous architectural practice was a stone and/or 'sand brick' magazine erected at the site sometime after 1890 as a replacement to the original torpedo store and magazine, which—not surprisingly—was of wood frame/corrugated metal construction. Little archival information exists that provides specific details about this building; indeed, the few historical accounts that make mention of the second magazine contradict one another on several points, including its dimensions and the methods and materials used to create it (see Chapter Five). Archaeological investigation of this structure would therefore potentially provide answers to these lingering historical questions. More importantly, for the purposes of this thesis project, excavation had the potential to reveal site-specific data about the North Arm Torpedo Station's construction, spatial arrangement, and abandonment features. These data could then be compared with information derived from other Australasian torpedo station sites addressed in this study.

The structure that originally served as the magazine was converted into a lecture room and general-purpose activity area referred to in subsequent years as the 'main hall' or 'main building'. Although the original function of this building mirrored that of the second magazine, it was constructed from different materials and methods at a different phase in the

torpedo station's existence. Excavation of the main hall created an opportunity to compare and contrast its construction attributes with that of the second magazine, and search for evidence of adaptive strategies in the design and manufacture of each building. Most importantly, it provided an opportunity to reveal evidence of specific discard and abandonment behaviours in the wake of the station's deactivation.

As early as 1884, a portion of the main building also served as living quarters for personnel assigned to operate and maintain the torpedo station. Over time, it became known as the 'caretaker's cottage' and was home to the facility's second overseer, Chief Petty Officer Henry Perry, between 1895 and 1922. In a situation unique to submarine mining bases established in Australasia during the colonial era, Perry's wife and six children lived with him in the caretaker's cottage for the majority of the time he was assigned there. The prospect that the site's material culture might reflect the Perry family's presence at the torpedo station was an intriguing one, given their noticeable absence in the historical record. Artefacts and features indicative of 'domestic' activities (such as toys, fine tableware, and elements of women's clothing) would, in theory at least, stand in stark contrast to the site's predominantly defence-related function and character. Although peripheral to the primary focus of this thesis, any exploration of material culture left behind by the Perry family promised to shed light on the lives of civilians existing within a colonial military context, including evidence of adaptive strategies and reuse, discard, abandonment, and reclamation behaviours.

It should be pointed out that the boat shed and slipway constructed at the North Arm Torpedo Station were not surveyed or otherwise archaeologically investigated during the 2010 project. Although integral to a comprehensive study of torpedo boat defensive infrastructure, remnants of these facilities were projected to lie buried beneath metres of

infill, as well as a modern car park and access road. In addition, this area has been subject to extensive trenching associated with utility line placement and other development activities, which in turn has very likely detrimentally affected the contextual integrity of archaeological features and artefacts (Wimmer 2008: 39, 53).

The North Arm Torpedo Station was the subject of earlier archaeological surveys in 2000 and 2004 (see Treloar and Treloar 2001; Wimmer 2005, 2008). The site maps that resulted from these investigations were beneficial because they feature the locations and identities of all archaeological structures, features, and artefacts visible at the time the surveys were undertaken. This information assisted with the excavation strategy and isolated sub-surface activities to specific areas within the site most likely to answer pertinent research questions. Such focussed investigative activities had the beneficial side effect of maximising the efficient use of time and labor available to the project.

Remote Sensing

A review of data gleaned from prior surveys of the North Arm Torpedo Station, as well as assessment of primary and secondary historical sources and other archival material, enabled the locales of the caretaker's cottage and second magazine to be hypothesized with a fair degree of accuracy. In order to further refine—and potentially confirm—the existing predictive model for each structure's location, the author sought the assistance of Dave Ross, a remote sensing specialist whose area of expertise is Ground Penetrating Radar (GPR). Ross conducted a comprehensive GPR survey of the projected locales of the caretaker's cottage and second magazine, with the goal of isolating specific structural features (such as the intersection of two or more walls) and utilising these data for subsequent placement of excavation squares or trenches.

The GPR unit comprised a Geophysical Survey Systems, Inc. (GSSI) TerraSIRch SIR-3000 with a 400 Megahertz antenna. Amplitude 'slice maps' of survey transects were generated via a digital programme called GPR Process; visual representations of these maps were in turn created with the SSG-Surfer 3D contouring and surface plotting software package. Yet another software system, GSSI's RADAN, was used to view and process two-dimensional profile images of each survey transect. The results of the GPR survey are discussed in Chapter Five.

The initial GPR survey area (Survey Tract 1) was established within the projected location of the second magazine and measured 20 metres (east-west) by seven metres (north-south). A total of 14 lanes—spaced at 0.5-metre intervals—were superimposed within the survey area on the east-west axis. The same spacing was utilised for lanes established on the north-south axis, resulting in 40 radar profiles. A star picket was placed at the northwest corner of the survey area and served as a temporary datum. Prior to commencement of the survey, the area to be investigated was cleared of dense vegetation, rubbish, or other material that could potentially interfere with the GPR's ability to detect sub-surface features. To ensure the GPR operator remained within the survey's parameters and maintained consistent lane spacing and direction, survey boundaries were marked with 100-metre fibreglass reel tapes and each 0.5-metre interval denoted with spray painted lines. In an effort to maintain consistency in the radar profile data, the GPR operator executed each survey transect in a uniform direction (i.e., west-to-east for each 20-metre lane, and north-to-south for each seven-metre lane).

Another survey zone (Survey Tract 2) measuring seven metres (north-south) by four metres (east-west) was established 30 metres east of the first in an attempt to verify the postulated location of the caretaker's cottage. Predictive modelling influenced its placement,

as did the discovery of an isolated surface accumulation of historic artefacts during pre-survey efforts to clear the area of vegetation and debris. As with the investigation of Survey Tract 1, transects were spaced at 0.5-metre intervals, physically highlighted on the landscape, and investigated in a uniform direction (west-to-east for four-metre lanes, and north-to-south for seven-metre lanes). A total of 14 radar profiles were obtained from transects on the north-south axis, and eight from those oriented east-to-west.

In addition to its role in the placement of excavation trenches, the GPR was used to prospect for and—if successful in locating them—delineate other sub-surface features associated with the North Arm Torpedo Station. Survey Tract 3 was established within a portion of dirt road that transits the site in an effort to delineate the width of underlying remnants of the torpedo station's tramway bed and search for buried components—such as railway sleepers and steel rails—that may have been associated with it. It measured 24 metres (east-west) by three metres (north-south) and comprised 12 west-to-east transects spaced at 0.25-metre intervals. The final GPR survey unit (Survey Tract 4) was placed immediately north of the dirt road, almost directly across from Survey Tract 2, in an attempt to locate and delineate features, (including remnants of a fireplace/hearth) associated with the northern half of the main building and caretaker's cottage. The smallest of the survey tracts, it measured 4.5 metres (north-south) by three metres (east-west), and featured transects spaced at 0.5-metre intervals. As with Survey Tract 1, placement of this unit was determined in part by a visible concentration of cultural material, including fragments of historic brick and mortar.

Several north-to-south GPR transects were run across the projected width of the torpedo station site in an attempt to identify and define the northern and southern edges of the earthen embankment upon which the facility's buildings were constructed. Additionally,

radar imagery compiled during this phase of the survey was expected to reveal the whereabouts and extent of sub-surface disturbance associated with brine main installation through the northern half of the site during the 1930s. The earthen embankment is the only torpedo station feature easily identifiable in radar profiles; consequently, the GPR operator was directed to search for the embankment's northern edge and transit to its opposite end within arbitrary corridors of minimal or no vegetation and/or rubbish. As embankment features were encountered and projected on the GPR's monitor, an assistant marked their location(s) on the landscape with survey flags or high-visibility spray paint. These positions were later plotted with a surveyor's automatic level and integrated within the overall site plan (see Chapter Five, Figure 9).

In an effort to locate and identify ferrous (iron) material culture associated with the North Arm Torpedo Station's infrastructure, including tramway rails and building hardware, a systematic metal detector survey was conducted in conjunction with the GPR investigation. Dave Ross supplied a Minelab 850 metal detector for this task. Initially, the metal detector was deployed to prospect for metallic contacts in the same survey tracts covered by the GPR; however, the search area was ultimately expanded to include the historic boundaries of the torpedo station's nucleus (comprising the earthen embankment and all structures built upon it).

Metal detector survey transects were spaced at 0.5-metre intervals—this enabled the operator to sweep and overlap the spaces between individual lanes, thereby providing full coverage within each survey tract. As metallic contacts were encountered, an assistant to the metal detector operator marked their locations on the landscape with survey flags. These anomalies were later investigated by visual inspection or, if buried, via probing. As the vast majority of contacts were either located on the ground surface or deposited in shallow (i.e.,

10-centimetre deep or less) contexts, they were visually examined and identified. Metal objects thought to be associated with the torpedo station were plotted with a surveyor's automatic level and integrated within the overall site plan, while material culture that post-dated the station's occupation (such soda cans and modern wire nails) were noted, but not mapped.

Excavation Strategy and Methodology

Utilising a combination of data collected from the GPR survey and Wimmer's 2004 investigations, the projected whereabouts of the former caretaker's cottage and second magazine were each initially investigated with a single linear trench oriented with its longest dimension on the north-to-south axis. Both excavation units were arrayed on a superimposed grid according to the projected locations of the structures they were intended to reveal. Consequently, their declination—at 350 degrees magnetic—was slightly west of true north (see Figure 9). Trench 1, excavated in the projected location of the second magazine, measured five metres by one metre, while the other unit (Trench 2) was extended an extra metre to the south to include all visible elements of a surface concentration of historic brick, mortar and concrete rubble.

As excavation progressed, an extension was added to the north end of Trench 2 in an effort to better define construction features located within its northern half. Towards the end of the project, a third trench (Trench 3) was excavated west of Trench 1 in order to refine the orientation and extent of the earthen embankment, and search for additional evidence of the second magazine structure. Initially, Trench 3 measured five metres by one metre, but was later expanded to expose a portion of the tramway bed and suspected wall and/or foundation components associated with the magazine. A lateral extension measuring

one metre (east-west) by two metres (north-south) was excavated along Trench 3's western wall, and a one-metre square extension was placed within the dirt road bordering its northern terminus.

Initially, all trench excavations proceeded in arbitrary 10-centimetre levels, each of which was identified with a numerical designation (i.e., Level 1 in Trench 1 was labelled '1.001', in which the number before the decimal denotes the trench number and those that follow it the specific level). However, as elements of the torpedo station's original ground surface and structural features were uncovered and identified, excavation strategy shifted to focus on the site's stratigraphy and subsequently progressed according to changes in sediment colour, texture and composition. Information specific to each arbitrary level or stratigraphic layer, including its sediment characteristics, associated material culture, and relationship to other depositional layers, was recorded on a context form.

Attributes specific to each trench were captured visually by way of scaled plan view and elevation drawings. Composite plans were generated for each trench floor as different contextual units within it were encountered and identified, and complete stratigraphic profiles were produced for each trench wall at the conclusion of the excavation project. These illustrations were supplemented by digital photography, which was used to document specific *in situ* artefacts and features, as well as the overall appearance of exposed trench floors and walls. Information pertaining to each scaled drawing and site photograph was compiled on *pro forma* registers and incorporated within the site's data archive, copies of which are curated at both the South Australian Maritime Museum and the Flinders University Archaeology Laboratory.

The spatial arrangement and elevation(s) of each trench and its respective stratigraphic levels, features, and artefacts were recorded with a surveyor's automatic (or

'dumpy') level. Data derived from dumpy level readings was logged on *pro forma* registers and later used to generate a comprehensive site plan that reflected the extent of the 2010 investigations. The location and elevation of at least two modern survey benchmarks were also recorded; these were used as reference points to tie the rest of the site's features into the modern landscape and subsequently plot them on digitally rectified maps and aerial photographs.

Flinders University Department of Screen and Media student Ian Bethune filmed the 2010 North Arm Torpedo Station excavation and used a percentage of the resulting footage to produce a short documentary film entitled *An Archaeological Excavation: The Port Adelaide Torpedo Station*. The 6-minute, 37-second film chronicles the two-week investigation by weaving together a narrative of the site's history and archaeological significance with imagery of excavation activities. Bethune's two-and-a-half hours of raw footage depicts project participants engaging in a variety of tasks, including excavation, site survey, and recording, remote sensing, photography, and activities associated with field analysis and identification of artefacts. Significantly, it also includes impromptu interviews with third- and fourth-generation descendants of the torpedo station's former caretaker, Henry Perry. While the oral histories related in these interviews did not contain information directly relevant to the excavation project—and were therefore not utilised for this research—they are nonetheless valuable within the wider contexts of Port Adelaide and South Australian heritage. Of particular interest and importance are the personal insights these stories reveal about the Perry family's experience at the North Arm facility between 1895 and 1922.

Artefact Recovery and Analysis

Artefacts encountered *in situ* during the North Arm Torpedo Station excavation were mapped and photographed before being recovered. To facilitate recovery of small finds that may have been overlooked during the excavation process, sediment removed from all arbitrary levels and/or stratigraphic contexts was sieved through 10-millimetre mesh shaker screens. Artefacts captured during the sieving process were subsequently placed within clear polypropylene Ziploc bags. Each bag was labelled with pertinent site and contextual information, including a Flinders University Department of Archaeology site prefix (in this case, the acronym 'NATS' representing **N**orth **A**rm **T**orpedo **S**tation), date of recovery, associated trench and context number(s), and the name of each individual directly involved in the artefact's recovery (i.e., those excavating and sieving sediment in which the artefact was discovered).

A field laboratory was established on site to process artefacts as they were recovered. It was initiated in an effort to assess and identify cultural material during the excavation project, and thereby facilitate interpretation of the site in conjunction with the field investigation. Additionally, the field lab was intended to serve as a time- and space-saving initiative. By filtering non-essential, non-diagnostic objects (such as modern rubbish) from the artefact assemblage, it ultimately reduced the amount of time needed to process each item, as well as the amount of storage space and materials required for long-term curation.

Bags containing recovered artefacts were transferred to the field lab station, where each was assigned a catalogue number corresponding to a master inventory of recovered cultural material (known alternatively as the 'Bag List'). Catalogue numbers were assigned sequentially in the order they arrived at the field lab. Artefacts within each bag were then removed and rough-sorted according to their identifying characteristics. With the exception

of modern rubbish, which was immediately disposed of, all recovered material was sorted according to artefact type, counted, weighed, and photographed with a metric scale. In cases where large quantities of one artefact type were recovered (i.e., shell, brick rubble, and other forms of fragmented masonry), these items too were counted, weighed and photographed. Representative samples of the best preserved or most complete specimens were collected for further analysis and the remainder discarded within the excavation backfill pile. Objects with potential diagnostic attributes, such as decorated and undecorated ceramics and bottle glass with embossed lettering, were segregated from other artefacts and set aside for field cleaning and analysis.

The overall condition of an artefact determined whether it underwent cleaning in the field. Fragile items were set aside for later stabilisation and cleaning under controlled conditions, while dirt and foreign material was manually removed from the remainder of the artefact assemblage using soft-bristled dry brushes. Preliminary analysis involved rough sorting of artefacts into six general material types: ceramics, glass, metal, flora, fauna, and other (rubber, plastics, etc.). Attributes specific to each object (such as its material composition, dimensions, weight, and distinguishing features) were then noted on a standardized artefact record form. Items of particular significance or interest were photographed on site with a Nikon F5 SLR digital camera and drawn to scale. Photographs and their associated information were incorporated within the site's existing photographic log, while each completed sketch was added to its respective artefact record. All artefacts that underwent field analysis were re-bagged and, along with all other recovered material culture, were transported to the laboratory for further analysis and identification.

Once in the laboratory, the artefact assemblage in its entirety underwent additional cleaning and was further subdivided into the following groups: military, domestic, structural,

and unknown. Artefacts falling within the 'military' and 'structural' categories—such as fasteners, building hardware, and masonry—were given particular attention, as they were considered most likely to confirm the locales of specific structures, as well as provide information relevant to their dismantling and/or abandonment following the torpedo station's deactivation. In total, 1,481 artefacts with a combined weight of 13,200 grams were recovered during the 2012 investigations. Following analysis, the entire artefact assemblage was boxed and transported to the South Australian Maritime Museum in Port Adelaide, where it will be curated as an element of the Port Adelaide Community Archaeology (PACA) Collections. Soil samples collected from specific features at the torpedo station site were retained for future flotation, and are also curated within the PACA Collections.

All data relevant to the assemblage were later coded, integrated within a Microsoft Excel spreadsheet, and statistically analysed (see Appendix F). Information contained within the spreadsheet was in turn developed into a KEMu database developed specifically for the North Arm Torpedo Station's 2010 material culture assemblage. This database, along with the artefact assemblage, is maintained by the South Australian Maritime Museum as part of the Port Adelaide Community Archaeology Collections. A copy of the Excel spreadsheet is also on file at the Flinders University Archaeology Laboratory.

Elemental Analysis

In an effort to learn more about methods and materials used to construct the torpedo boat *Defender*, and determine the extent of corrosion that affected its hull following abandonment, the author requested a small hull sample for analytical testing during a research trip to the Thornycroft Torpedo Boat Museum in November 2008. In response, Museum staff supplied a complete section of lower midships hull plate recovered from

Defender's abandonment site during the 1990s, with the understanding that a copy of all analytical results would be submitted to the Museum for inclusion in its data archive. The sample was photographed by the author and subsequently shipped to the Clemson Conservation Center (CCC) in Charleston, South Carolina. CCC is the laboratory responsible for the archaeological investigation and conservation of the American Civil War submarine *H.L. Hunley* and is internationally renowned for its analytical equipment and capabilities.

Nestor González-Pereyra, a CCC chemical engineer and conservator, conducted elemental analysis and characterisation of *Defender*'s hull sample via Scanning Electron Microscope-Energy Dispersive Spectroscopy (SEM-EDS). SEM-EDS provides a qualitative and quantitative analysis of the elements that comprise a given object, and in this particular case was utilised to determine the elemental composition of the hull plate section. Because the steel comprising the hull plate was galvanised when *Defender* was constructed, the sample was cut into smaller portions in order to obtain cross-sections of the plate and determine the composition of its metal fabric. Chemical microanalysis of the sample was then undertaken with a Hitachi 3700N SEM equipped with an Oxford INCAx-act EDS probe. Results of the SEM-EDS analytical battery are included in Appendix H and discussed in Chapter Six.

During excavation of the North Arm Torpedo Station site in May 2010, small fragments of an unidentified coarse-textured, yellow-coloured material were recovered from the projected location of the second 'sand brick' magazine. In addition to its visible physical attributes, the substance emitted an odour strongly suggestive of elemental sulphur. Because the presence of sulphur—a primary constituent in the manufacture of gunpowder—would be a potential indicator of the sand brick magazine's locale at the torpedo station site, the

decision was made to analyse the largest and most intact sample of the unidentified material and determine its elemental composition.

Dr. Wendy van Duivenvoorde and Mr. Mark Polzer analysed the sample at the Western Australian Maritime Museum's archaeological conservation facility in Fremantle, Western Australia. The device utilised to perform the analysis was a Bruker Tracer III-V hand-held X-Ray Fluorescence (XRF) spectrometer. XRF spectrometers are X-ray instruments used for routine, relatively non-destructive chemical analyses of rocks, minerals, sediments and fluids. The technique works on wavelength-dispersive spectroscopic principles and is typically used for bulk analyses of large amounts of geological materials. The relative ease and low cost of sample preparation, and the stability and ease of use of hand-held XRF spectrometers make them one of the most widely used devices for analysis of major and trace elements in rocks, minerals, and sediment. Results of the XRF analysis appear in Appendix G and are discussed in Chapter Five.