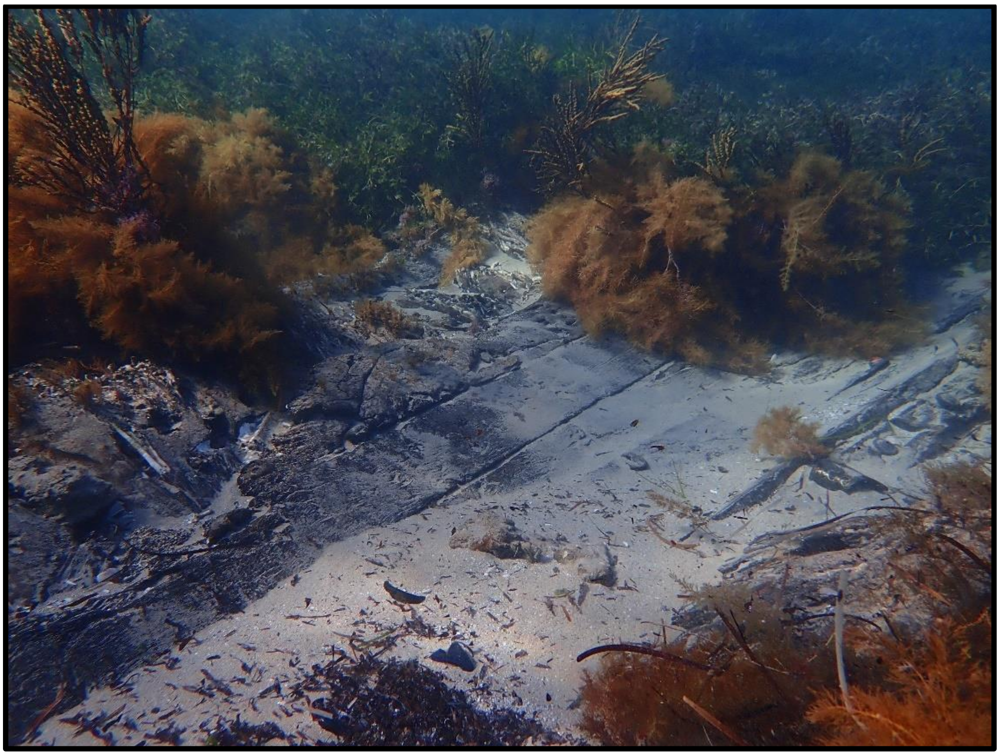
The *South Australian* Hypotheses

Impacts of vessel loss in South Australian colonial whaling



The Encounter Bay wreck, Encounter Bay, South Australia (Photograph by Irini Malliaros 25 June 2019)

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Declaration of Candidate

‘I certify that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text’

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Abstract

This thesis uses a case study from Encounter Bay, South Australia to examine the impacts of vessel loss in colonial South Australian whaling. A collaborative project to undertake study on South Australia's 'first-fleet' and other immigrant vessels began in 2018 with the search for the barque *South Australian.* One of the first sixteen vessels to bring free immigrants to Australia and one of South Australia's first whaling ships. *South Australian* is the oldest recorded shipwreck in South Australia, sinking in 1837, just one year after the formation of the colony. Originally built *Marquess of Salisbury* in England in 1819 as a Falmouth packet ship in service of the Royal Post Office, *South Australian* carried mail around the globe until it was purchased by The South Australian Company and sailed for Australia. In early 2018, the research team located the articulated remains of a wooden vessel in Encounter Bay, South Australia using a combination of historical records and local community knowledge. The Encounter Bay wreck is believed to be that of *South Australian*.

Encounter Bay and surrounding waters are the resting place of many other known shipwrecks. Most of these wrecks have been identified only through the historic record and their exact location is unknown. Positive identification of the Encounter Bay wreck is necessary to establish if the wreck site is indeed that of *South Australian* or one of the other vessels wrecked nearby. The location of the site and orientation of the remains provide an initial affiliation with historical documents pertaining to *South Australian*'s wrecking event. This initial affiliation allows for the undertaking of historical research into the wrecking event of *South Australian* and its impact to South Australia's early whaling activities. A vessel lost so early in a colony's history while involved with the first maritime economy of the area may have a large cultural impact.

This study set out to record the archaeological remains of the Encounter Bay wreck through underwater survey techniques, i.e. baseline-offset mapping, photography, 3D modelling, timber species identification, and metal analysis. With no previous archaeological data, recording of the Encounter Bay wreck allows for a study into the construction of the vessel as well as helps to identify the wreck. Analysis of historic documentation surrounding the wrecking event of a colonial whaling vessel evaluates the cultural impacts that the loss of an important vessel has on a fledgling whaling industry, if any. Identification of the remains and analysis of the cultural impact of *South Australian'*s loss are not mutually exclusive in this study. Even with a negative identification the research will provide information on a newly located wreck as well as evaluate the cultural importance of a vessel known to have operated in the region.

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List of Abbreviations

AM	Ante mortem
ANMM	Australian National Maritime Museum
DEW	Department for Environment and Water
EDS	Energy Dispersive X-Ray Spectroscopy
FUAD	Flinders University Archaeology Department
HMS	Her Majesty’s Ship
HSIM	Historic Shipwreck Identification Method
IJNA	International Journal of Nautical Archaeology
MMWH	Method of Multiple Working Hypotheses
PM	Postmortem
QAR	*Queen Anne’s Revenge*
SAILS	South Australian Immigrant and Labourer Shipwrecks
SAMM	South Australian Maritime Museum
SEM	Scanning Electron Microscope/Microscopy
SDD	Silicon Drift Detector
SWF	Silentworld Foundation

Chapter 1 – Introduction

Introduction

On 8 December 1837, while anchored outside of Rosetta Harbor in Encounter Bay South Australia, the barque *South Australian* was caught in a south-easterly gale that caused the ship to part its mooring line and strike the nearby reef stern first. The small crew and few passengers were able to escape with their lives and personal belongings but the cargo of whale oil and whalebone stored in the ships hold would require several weeks of salvaging to recover and the ships deepest hold remained largely inaccessible (Hunter 2018:1)[1]. The loss of *South Australian* ended a rich and varied history of a vessel that was one of the first ships to bring free immigrants and supplies to the young colony of South Australia as well as the colonies first known shipwreck. Although the crew salvaged as much of the rigging and hull as possible, the vessel was abandoned in the shallows inland of Black Reef and the exact resting place of the ship was eventually lost to time and memory.

In a bid to begin collaborative projects that would contribute to South Australian maritime archaeology, Silentworld Foundation (SWF), representatives of The Department for Environment and Water (DEW), South Australia Maritime Museum (SAMM), the Australian National Maritime Museum (ANMM) Flinders University Archaeology Department (FUAD) and Mark Staniforth (adjunct professor at Flinders University/MaP Fund) began discussions revolving around the first ships to bring immigrants to South Australia at the 2017 AIMA Conference in Adelaide, South Australia (Bullers 2018:1). In a meeting on 20 March 2018, representatives of the above institutions agreed to start a five-year program that would begin with locating South Australia's oldest known shipwreck, *South Australian*, and then progress into further historical and archaeological fieldwork on immigration and labour shipwrecks of South Australia (Bullers 2018:1). This collaboration has become the South Australian Immigrant and Labourer Shipwrecks Projects (SAILS). In April of 2018, a small team comprised of representatives from each institution was successful in locating a wreck (here-on referred to as the Encounter Bay wreck) in Rosetta Harbor, that is believed to be *South Australian*. The SAILS team began referring to the Encounter Bay wreck as *South Australian* due to correlation with historical documents, discovery location, and initial analysis. This document will refer to the vessel as the Encounter Bay wreck, however, some field documents (i.e. sample bags and maps) shown in this thesis refer to the shipwreck as *South Australian*.

This research supplements the next step in archaeological investigation stemming from the initial *South Australian* project in April 2018. By identifying the Encounter Bay wreck and using it as a case study to investigate the impact of a wrecking event on whaling activities in the Victor Harbor area in the early nineteenth century. This research will contribute to a lacking area of South Australian maritime archaeology; the ‘first-fleet’ vessels, their role in early South Australian economy post-colonisation, and their inevitable fates.

Historic Background of Victor Harbor

Encounter Bay in South Australia is located on the south coast of the Fleurieu Peninsula approximately 85 kilometres (50 miles) south of the capital city of Adelaide. Sheltered by a large granite bluff on the north and Granite Island to the south, this coastline boasts significant bio and geodiversity and has been historically significant to the indigenous peoples, early colonial maritime economy and present-day tourism. Named Encounter Bay by Matthew Flinders after his chance encounter with Nicolas Baudin on 8 April 1802 (Page 1987:11). Both men where charting the coastline for their respective countries (Britain and France) and collaborated in peace in the name of science even though their countries were at war. The area was later named Victor Harbor after Captain Crozier’s ship the HMS *Victor* in 1837. The township of Port Victor was surveyed and declared a port in 1865, which would later grow into the city of Victor Harbor.

Site of the mouth of the Murray, Inman and Hindmarsh Rivers and one of four ‘historic bays’ under the *Seas and Submerged Lands act 1973* located on the South Australian coast. Traditionally the land of the Ramindjeri clan of the Ngarrindjeri people where for thousands of years they hunted and gathered in the region they called ‘Wirramulla.’ The area was valued for its fertile lands which supported large animal populations and its sheltered waters that harboured a variety of marine life including the southern right whale. The Ramindjeri boasted a democratic political society interwoven with spiritual beliefs that was quite different from the inland tribes (Page 1987: 13). With the arrival of Europeans, the inevitable disposition of the Indigenous peoples of their land without compensation began.

European activity at Encounter Bay began when shore-based whaling stations were established in late 1836 at Rosetta Head by The South Australian Company (The Company) and a rival station at Police Point by Captain Blenkinsopp. Later a station would be established on Granite Island. These stations are accredited with being the most successful and longest lasting whaling stations in South Australia (Hosking 1973:2). Captain Blenkinsopp approached Samuel Stephens, the then director of The Company, in February 1837 about a joint venture in shore-based whaling, Stephens rejected his offer immediately and a bitter rivalry began between the two stations that would define the entire course of whaling history at Encounter Bay. The two stations finally merged in 1839 after Blenkinsopp’s untimely death, but personal disputes continued to limit the potential profit of the stations. In 1840 The South Australian Company completely abandoned the whaling enterprise and the Encounter Bay station was purchased by Captain Hart but saw a steady decline until all whaling in the area was abandoned in 1855.

The first true European settlers of Encounter Bay, Ridgway William Newland and his family and friends, arrived in July of 1839 to begin farming the fertile land. The town of Port Victor was laid out in 1863 when the horse-drawn tramway was extended to the harbour due to the poor anchorage for ships at Goolwa. The area became an important Port for coastal shipping of goods, mostly wheat. The name was later changed to Victor Harbor in 1921 when an apparent near shipwreck confused the location for Port Victoria. Today, Victor Harbor is a popular destination for Adelaide locals, especially in the summer months. It supports a thriving fishing economy.

Location

This information regarding the study area has been adapted from 'Historic Shipwreck *South Australian* (1819–1837) Conservation Management Plan' written by Rick Bullers of the Department for Environment and Water (2019).

The shipwreck site is in the inshore shallow waters of Rosetta Harbor, South Australia. It is located within a protected zone comprising a circular area with a radius of 30 metres with a centre point located at latitude 35° 34.641' S and longitude 138° 36.213' E (Figure 1.1.1). Located approximately 250 metres seaward of Franklin Parade in front of the Yilki Store in the community of Encounter Bay, and 700 metres north-west of Wright Island. It lies in approximately 3 metres of water, and approximately 25 metres from the edge of an extensive coastal reef flat. The edge of the inshore reef is oriented approximately northeast to southwest, and a sand channel within the reef leads shoreward (north-westerly) to the Yilki Store. The shipwreck itself is oriented on a bearing of approximately 280 (magnetic), with its centreline positioned oblique to the reef edge and the bow pointing out to sea.

The tides at Victor Harbor are generally varied between 0.3-1.3 metres above lowest astronomical tide during 2018 (Bureau of Meteorology 2018) and tidal currents are predicted to be low throughout Encounter Bay (Australian Water Environments 2013:23). Winds at Victor Harbor vary throughout the year with predominately south-easterly winds between November and February, with 20 percent of wind speeds above 40 kilometres per hour (km/hr), while between May and September the wind is predominantly in the north-western quadrant, with 20-30 percent of wind speeds above 40 km/hr. In March, April and October, the wind is relatively consistent from all points of the compass.

Figure 1.1. Map of Encounter Bay showing the location of the Encounter Bay wreck site (green) (Map by Timothy Zapor)

Research Question

This thesis investigates: How did the wrecking of *South Australian* impact colonial whaling in South Australia?

This question stems from an observation made by Cosmo Coroneos (1997) during research into the wreck of *Solway*. He observed that after the wrecking of *South Australian* and *Solway*, all vessels wrecked in the vicinity for 15 years after were smaller ships. He suggested that the wrecking of these two important ships may have had a profound impact on a young colony.

Aims

In order to answer the research question this study aims to achieve the following:

- Survey the wreck site;
- Provide a positive identification of the vessel;
- Assess the archaeological potential of the site;
- Build a life history of the vessel;
- Determine whether the archaeological data is consistent with historical records.

Significance

As discussed later in Chapter 2, studies of South Australian shipwrecks are frequently just historic accounts or preservation surveys; of the 'first fleet' of South Australia, only historic data has been compiled and many of the wreck sites have not been found (Table 1.1). Since the Encounter Bay wreck is believed to be *South Australian* which occurred early in the new colony's development and still within local waters, this research may be an essential entry point into studies of early South Australian maritime economy and the transitions required of these early vessels to meet the needs of such an isolated community.

Table 1.1. 'First sixteen' vessels of the South Australian Company and what is known of their fate (Bullers 2019:5)

	Vessel Name	Vessel Type/Tonnage	Known Fate
1.	*Duke of York*	Barque (190 tons)	Wrecked off Port Curtis, Queensland (1837), exact location unknown
2.	*Lady Mary Pelham*	Barque (206 tons)	Wrecked Port Fairy, Victoria (1849); VHR No. S405; location identified
3.	*John Pirie*	Schooner (106 tons)	Grounded at Victor Harbor, SA (1837), then re-floated. Wrecked, near Prime Seal Island, Furneaux Group, Tasmania (1848), exact location unknown
4.	*Rapid*	Brig/Snow	Wrecked near Fiji (1841); exact location unknown
5.	*Cygnet*	Barque (239 tons)	Fate unknown
6.	*Emma*	Brig (160 tons)	Fate unknown
7.	*Africaine*	Barque (316 tons)	Wrecked near Cape North, Nova Scotia, Canada (1843)

8.	*Tam O' Shanter*	Barque (383 tons)	Wrecked at Tam O' Shanter Bay, Tasmania (1837), exact location unknown
9.	*Buffalo*	Barque (850 tons)	Wrecked Mercury Bay, Whitianga, New Zealand (1840), location identified
10.	*Coromandel*	Ship (662 tons)	Scuttled Turakirae Head, Cook Strait, New Zealand (1933)
11.	*William Hutt*	Brig (260 tons)	Fate unknown
12.	*Isabella*	Ship	Fate unknown
13.	*John Renwick*	Ship (403 tons)	Fate unknown
14.	*Mary and Jane*	(196 tons)	Fate unknown
15.	*South Australian*	Barque (236 tons)	Wrecked Rosetta Harbor, Encounter Bay, SA (1837), location identified
16.	*Sarah and Elizabeth*	Barque (269 tons)	Fate unknown

Furthermore, undertaking study of the Encounter Bay wreck is significant because it not only has the potential to produce the first archaeological data about one of the 'first fleet' vessels, but also on the oldest known wreck in South Australia. Although the age of a shipwreck is not in and of itself a basis for archaeological significance, as pointed out by Cosmos Coroneos in a 1996 report on the nearby *Solway* wreck, "…the temporal context in which the vessel [*Solway*] was lost is of relevance to the early development of the colony of South Australia" (Coroneos 1996:24). The wrecks of *South Australian* and *Solway* were a crucial event and turning point in the understanding of what was needed in a developing and isolated colony and challenging geographic location (Coroneos 1996:25). This study has the potential to highlight important insights into early colonial maritime activity in an historically important geographic location and revive and grow the communities link with their early beginnings.

If the Encounter Bay wreck is that of *South Australian*, the study will contribute to knowledge on the construction of Falmouth packet ships, a type of Post Office packet ship constructed in England in the seventeenth and eighteenth centuries. While the Falmouth packet was a commonly used type of ship, little archaeological data has been collected regarding its construction. Only three Falmouth packet archaeological sites are known to exist including *South Australian*. Since *South Australian* was originally built as a Falmouth packet, this investigation may add to the information regarding this type of vessel.

Limitations

Archaeological data provides many insights into the nature of a shipwreck such as how the vessel was used, constructed, or how it wrecked; however, there are limits to what physical remains can reveal. Since the main objective of this research is to analyse the impact the loss of a vessel had on an entire industry, the answers will be found almost entirely in the historical record and not on the collected archaeological data. Furthermore, analysis of the impact will stem much from the personal opinion of the author and interpretation of the historical documentation. This means that much of the results and conclusions will be opinions but will hopefully contribute to the overall discourse of impact of vessel loss. Documentation analysed will largely be sourced from the original business records of The Company produced in the 1800s. While a small portion of these records have been digitised for easy reading, much of the records are original and depending on state of preservation, very hard to read, the collection of records is also quite extensive.

This study also represents the first archaeological data collected for the Encounter Bay wreck. Without a large pool of previously completed archaeological studies on the subject to pull from, analysis is limited to the data recovered in three small site inspections and one week of intensive fieldwork over 2018 and 2019. The survey activities in 2019 were restricted to what could be completed in a short window of time, mainly focusing on the exposed port bow. In-depth analysis of articulated wooden structures requires extensive documentation and excavation and until the entire site is recorded analysis will be limited. Survey of the wreck site was restricted to one week due to inclement weather patterns and was preliminary in nature so only exposed portions of the wreck were available for documentation.

Chapter Outline

The first chapter introduces the *South Australian* Shipwreck project and organisations involved. A historic background of Victor Harbor and a detailed description of the Encounter Bay wreck location are provided. The first chapter also includes the research question, aims, and significance of the research. This chapter ends with limitations of the project and an outline of this thesis.

Chapter Two is the literature review discussing previous archaeological studies as well as comparative archaeological sites. The theme of shipwreck identification is introduced and some of the different methodologies that have been used are presented. A selection of case studies involving the identification of shipwrecks are analysed exploring the methods, results, and conclusions of each study. The chapter finishes by discussing middle-range theory and the use of multiple working hypotheses to avoid bias.

Chapter Three details the methods used over the course of this thesis. Fieldwork involved survey of the wreck site in Encounter Bay, South Australia. Survey methods included baseline-offset mapping, photogrammetry and the collection of timber and metal samples. The chapter is divided into archaeological methods in the first half and historical research undertaken for the study in the second.

Chapter Four presents the results of the study. These results are again divided into two sections, archaeological and historical. The wreck site survey is presented first, followed by timber species identification and metal analysis. Historic research results are split into two sub-sections detailing the life story of the barque *South Australian* and The South Australian Company whaling ventures.

Chapter Five discusses the identification of the Encounter Bay wreck in relation to the archaeological results presented in Chapter Four. Discussion is broken into sections detailing timber species identification, metal analysis, and site interpretation. The chapter finishes by discussing the impacts that the loss of the vessel had on colonial whaling in South Australia with extensive use of the historical documents.

Chapter Six culminates with the conclusions of this thesis. The research question and aims are revisited in relation to the presented results. A positive identification of the Encounter Bay shipwreck is given. The chapter concludes with a presentation of possible future research avenues.

Chapter 2 – Literature Review

Introduction

Jeremy Green explains that the process of maritime archaeology involves the recovering of archaeological data through survey, excavation, recording, and documentation. Theoretical questions relating to the interpretation of this material begin with a more particularistic, object-oriented focus and move on to the deeper patterns of cultural systems (2010:1601). Historical particularism revolves around material culture studies using an artefact-oriented approach. While other approaches involve the development of hypotheses that study societal processes. An integrated method of research using both archaeological and historic records is arguably the best approach (Green 2010:1601–1602). The current study aims to walk that line between artefact-oriented studies and hypotheses driven studies of societal structure using Middle-Range Theory focused with multiple working hypotheses. The combination of historical sources as well as a seemingly well-preserved and untouched site provide a rare opportunity to positively identify a vessel in Victor Harbor and learn of the people that used it.

This literature review briefly discusses previous archaeological studies undertaken on shipwrecks in Australia and acknowledges a specific gap in data pertaining to South Australian colonisation era vessels. Furthermore, the methodologies involved in identifying shipwrecks is explored and discussed as relating to this specific study. Finally, Middle-Range Theory, Ruling Theory, and the Method of Multiple Working Hypotheses as a solution and framework is presented and analysed in relation to the research. This literature review supports the significance of the research as well as provides a solid foundation for the proposed framework.

Previous Archaeology

Australian maritime archaeology has had a penchant for historic shipwreck studies since its inception in the 1960s. With the finding of five early-European ships off the coast of Western Australia, the public interest in maritime archaeological sites skyrocketed. With the increasing interest and salvage of these shipwrecks, the Western Australian Museum realised the need for increased protection and management of underwater heritage resources. In response, they brought in Jeremy Green from the UK to spearhead an Australian Maritime shipwreck program (McCarthy 1998:33, 2006:2). From the more complex studies of well-known vessels that have wrecked in Australian waters such as *Batavia* (1628–1629), *Pandora* (1779–1791), *SS Xantho* (1848–1872), and *William Salthouse* (1824–1841), to countless smaller studies on historic wrecks across the country, it cannot be denied that Australian maritime archaeology considers shipwrecks a valuable underwater resource (Gesner 2000; Green 1975; McCarthy 1988; Staniforth and Vickery 1984; van Duivenvoorde 2015). What is lacking however is a focus on South Australian historic shipwrecks and specifically, early colonisation ships.

While South Australia has over 800 known shipwrecks, detailed cultural studies have been rare (Morris 2012:24). While studies on these wrecks are numerous, they have mostly revolved around the historic accounts of their voyages and wrecking, or limited surveys to establish preservation and protection measures (Arnott 1996; Chapman 1972; Clark 1990; Coroneos 1997; Coroneos and McKinnon 1997; Department of Environment and Planning: State Heritage Branch 1991, 1987; Kenderdine 1991; Loney 1993, 1973, 1971; McKinnon 1993; Moran 2000; Perkins 1988; Richards 2007; South Australian Department of Environment and Land Management 1994; Temme 1975). One plausible reason for the lack of detailed studies on South Australian shipwrecks is the high-energy zones or strong current flows some of these wrecks are often found in, however, these conditions may be found elsewhere as well (MacLeod 1998:81; Coroneos and McKinnon 1997).

A significant South Australian shipwreck is that of *Zanoni* (1865–1867). *Zanoni,* a composite barque featuring iron frames and wooden planking is the oldest and best-preserved ship of its kind in South Australia (Jeffery 1987, 1988; MacLeod 1998:81). Researchers engaged in multiple intensive studies including survey, excavation, and preservation (Jeffery 1988:3; MacLeod 1998:81). Excavation and survey of *Zanoni* was carried out over two seasons in 1986 and 1987 with iron corrosion studies taking place in 1997, these studies focused on analysing the cause of sinking and the establishment of preservation methods rather than on any theoretical or cultural aspects (Jeffery 1988; MacLeod 1998).

Previous Studies in Encounter Bay

Whaling activities of Encounter Bay are well documented; however, the archaeological remains of these sites have been all but obliterated to make way for residential expansion (Hosking 1973:3). The remains of the wrecks now are the only resources to reveal a more holistic or complete history of the wrecking events, archaeology, and early whaling industry of South Australia.

Solway

Solway is the most relevant (to this research) archaeological study of a South Australian shipwreck. Wrecked just two weeks after *South Australian* in the same harbour and same manner, *Solway* was the focus of a 1994 survey and test-excavation (Coroneos 1996). The study set out to analyse the remaining cargo on the wreck site and determine whether it could contribute to understandings of the lives of early South Australian settlers; patterns of trade on a frontier; provide a comparison of the quality of German or central/northern European manufactures with comparable British products; and distinguish between artefacts of German and British manufacture (Coroneos 1996:27). The research methods employed included baseline-offset triangulation mapping of visible features and artefact assemblages, and the excavation of several test trenches to recover artefacts. The results of the study in relation to the research questions were inconclusive due to poor trench placement and inclement weather affecting fieldwork (Coroneos 1996:39). This study was the first to hint at the notion of vessel loss contributing to changes in whaling practices in Encounter Bay—comparing tonnage of fifteen wrecks in the area after 1837—which led to the current study.

Comparative Archaeological Sites

South Australian is one of just three known archaeological sites of Falmouth packets, per Rick Bullers' (2019:28–30) Conservation Management Plan. The other sites are:

- *Hanover* (III), wrecked at Hanover Cove, Cornwall, England, in 1763; and
- *Lady Mary Pelham*, wrecked at Port Fairy, Victoria, in 1849.

Hanover (III)

Reportedly built in 1757, the vessel was a 100-foot brigantine commissioned as a Falmouth packet in 1758, operating on the Lisbon run (Parham et al. n.d.; Dresch and Evans 2017). *Hanover* (III) was the third of five Post Office packets of that name between 1712 and 1797. During a voyage bound for Lisbon with 87 passengers and a cargo of bullion, buffeted by winds on to a lee shore of the Bristol Channel, *Hanover* struck the mouth of what is now Hanover Cove. Of the 87 passengers, the only survivors were two men and a boy (Bullers 2019).

A salvage company found the shipwreck site in 1994. Identified when a bell inscribed with 'Hanover Pacquet 1757' was recovered, the find led to a large-scale salvage operation to 'save the site'. One season of salvage in 1997 returned over 50 cannons and produced an emergency designation as a protected wreck under the *Protection of Wrecks Act 1973*, halting any further salvage. Parham et al. (n.d.) conducted an archaeological assessment during salvage operations and concluded that *Hanover* (III) was not originally built as a packet but was a merchant ship commissioned after the capture of the previous *Hanover* (II) by France.

Cotswold Archaeology was commissioned in 2016 by Historic England to conduct a marine assessment, that included the wreck site of *Hanover* (III) and two other sites, to be considered for de-designation. The marine assessment included a desktop assessment, a foreshore/intertidal survey and a marine geophysical survey of the cove. Significant factors including discrepancies in site location, the removal of archaeological finds during salvage, the lack of archaeological materials found during the assessment, and doubts about the provenance of some artefacts made the need for continued listing questionable (Bullers 2019:28).

Lady Mary Pelham

Built in 1816 as a 206-ton brig in Rotherhithe, England the vessel served much of its early life as a packet out of Falmouth, ferrying Irish immigrants to New York (Olenkiewicz 2018a, 2018b). The South Australian Company purchased *Lady Mary Pelham* and used it as a whaling vessel in local waters. Outfitted to ferry immigrants to the new colony of South Australia, it made the voyage on 30

March 1836. It was the third vessel to arrive at Kangaroo Island. According to historical sources, the vessel underwent a major refit in Launceston in 1846 or 1847 which "was almost equal to a new vessel" (*The Argus*, 7 September 1849). After several years in the service of The South Australian Company, the Henty whaling family of Portland in western Victoria purchased the vessel, in their ownership it served as a whaler until 31 August 1849. Caught in a fierce gale while anchored off the port of modern-day Port Fairy, it parted its mooring chains and was deliberately beached by Captain Wing. No lives were lost and much of the cargo was salvaged, however, the vessel's back was broken resulting in a total loss of the ship (*The Argus*, 7 September 1849). A rough site plan from a site inspection in 1998 by Heritage Victoria shows substantial parts of the hull and its contents were still intact.

Methods of Vessel Identification

Matching a name to a shipwreck can be a vital part of the maritime archaeological process. With the positive identification of a site, studies into the lives of the people(s) that created and used the assemblage have a more solid foundation (Wilde-Ramsing and Ewen 2012:129). So how does a maritime archaeologist identify an unknown wreck? Matthew Harpster (2013) conducted a thorough study of shipwreck projects involving the identification of wrecks using submissions to *The International Journal of Nautical Archaeology* (IJNA) from 1972 to 2008. Harpster divided the studies into four study categories, Types A-D (Harpster 2013:592–593). Type A begins with the discovery of a name in historical sources followed by a search to locate the physical remains. Type B is simply the opposite, an archaeological site is located first and a name from historical records is sought after. Type C and Type D investigations are of a broader nature and show that shipwreck affiliation can be more than a name. Type C does not deal with a specific ship, instead dealing with an empire, nation-state, or culture that has a link to a historical narrative; while Type D studies have no links to historic narratives and may refer to structural or geographic definitions such as Southeast Asian or the double hulled vessel (Harpster 2013:592). These categories reveal that different methodologies may be used depending on the approach. These methodologies have one similarity; finds indicating a vessel's age are the most important in establishing a positive identification (Ahlström 1997:33).

Christian Ahlström (1997) discusses a methodology that falls under Type B. The process can be broken down into five steps: 1) An analysis of the material and artefactual finds from the wreck. 2) An assessment of the history at the central, provincial, and local levels during the period to which the wreck can be assigned. 3) Identifying associated sources. 4) Creation of hypotheses concerning the identity of the wreck from the material and written sources. 5) Testing hypotheses (Ahlström 1997:33). This methodology relies on using the historical record in conjunction with the archaeological record to identify periods throughout the life-history of the vessel. These periods are then used along with physical attributes of the site to reach a positive identification of the vessel. These periods are listed as: 1) Between the beginning of construction and the start of the vessel's last voyage. 2) The period covering the last voyage and the loss of the vessel. 3) The period after the sinking of the vessel (Ahlström 1997:44). Ahlström does not believe the name of the vessel is of much importance to the identification process, saying that it can cause confusion since many vessels carry the same name, yet goes on to state that it can be important when researching historical sources only if there are physical attributes associated (Ahlström 1997:45–46). One problem that can arise from identification methods is a tendency towards an 'all or nothing' label. The shipwreck either is or is not the suspected vessel and once an identification is made the research may be unintentionally limited (O'Shea 2004:1533).

To counter the 'all or nothing' affiliation, John O'Shea (2004) introduces a probability model, using mathematical formulae developed from Bayes' Theorem, to determine the likelihood that a shipwreck matches the name(s) found in historical sources. Simply stated, this formula calculates and updates probabilities. It allows a researcher to track how confidence in a hypothesis changes when new information is introduced (O'Shea 2004:1534). The collection of data revolves around five features of a shipwreck: maximum length, propulsion system, cargo, location, and gross tonnage. Each proposed name is given a probability in each of the five categories, relating to the archaeological remains, ranging from 0.01 (not probable) to 0.75 (very probable). The final probability reflects the correlation to each possible historic vessel. The format easily allows for the addition of new information. This method's strengths lie in the high level of adaptability in types of sites it can be applied to, especially useful for scattered wreck sites; the useful aspect of not relying on detailed historical information; the ability to highlight cases that require additional archaeological research; and because it is useful in linking historic vessels to sites as well as giving a quantifiable feeling of confidence in the overall conclusion (O'Shea 2004:1550–1551).

To add a degree of visibility to the methodology used to identify a historic shipwreck, David VanZandt (2009) used principles adapted by forensic scientists to identify deceased individuals and developed a method to identify historic era shipwrecks. The process begins by collecting ante mortem (AM) data (primary historical source evidence) and comparing it to the post mortem (PM) data (archaeological investigation), then evaluating each source for consistency to provide positive or negative identifications (VanZandt 2009:4). From this VanZandt developed 'The Historic Shipwreck Identification Method (HSIM)': a system to score the data comparison and final association, which he then applied to four different case studies.

Dating, vessel construction and rigging, cargo and cargo handling equipment, crew personal effects, location, and condition of the site are utilised to compare the AM and PM data for the four sites (VanZandt 2009:21). A score of 0–3 is given to each of the six categories. 0, indicates that data is unavailable or insufficient for an acceptable comparison; 1, that the historical and archaeological evidence agree enough to establish they belong to the proposed ship; 2, there is insufficient consistency in the evidence to state the remains are the suggested vessel; and finally, 3, when the AM and PM data are inconsistent (VanZandt 2009:24). The final shipwreck identification score, 1–3, is the highest total in any of the six categories. 1, is a positive identification, 2 means the evidence is unable to support a conclusion and 3 provides a negative association (VanZandt 2009:25–26). VanZandt (2009:96) claims that the HSIM provides a straightforward methodology to systematically identify a vessel and gives a clear understanding of the processes taken to reach the conclusion.

While these examples can all be traced to Harpster's 'Type B' studies, they (mostly) rely on the historical record to reach a positive affiliation. The target vessel of the current study falls into the 'Type A' category, having taken a vessel from historical sources and setting out to locate the physical remains. All historical evidence and initial archaeological findings indicate that the Encounter Bay wreck is indeed that of *South Australian.* Even so, it is important to be thorough when applying a positive identification, exploring the above methodologies of vessel identification will further solidify the initial affiliation. An important technique in avoiding false identifications is the use of middle-range theory through the formation of multiple working hypotheses to avoid ruling theory.

Middle-Range Theory

As archaeological thought, methodology and interpretation evolved in the 1900s, a paradigm shift from a scientifically focused 'artefact-based' discipline to an anthropological 'concept-based' discipline began. This movement, which began in America in the 1960s and was creatively deemed 'New Archaeology', sought to bring anthropological interpretation of past cultural systems to the forefront of archaeological thinking (Binford 1964). Up to this point, archaeologists had been focused on interpreting the physical archaeological record, reconstructing the past using the static data uncovered in the present; studying artefacts because they were interesting instead of using them as a means to study the peoples that created them. The major problem the movement faced is how to interpret past dynamic cultural behaviours of people(s) from the static archaeological record found in the present. In short, how does an archaeologist accurately give meaning to archaeological observations (Binford 2009:12)?

In order to make the relevant interpretations of the archaeological record in anthropological terms, a new theoretical framework and method of interpreting data was needed (Pierce 1989:8). The first person to suggest an answer to this problem was an anthropologist at the heart of the New Archaeology movement. Binford (1977) introduced some new concepts to the archaeological community that answered the call to build and improve theory in archaeology. One way is what he referred to as middle-range theory:

> If one accepts observations made on the archaeological record as contemporary facts along with the idea that such facts are static, then clearly basic problems for the archaeologist include (a) how we get from contemporary facts to statements about the past, and (b) how we convert the observationally static facts of the archaeological record to statements of dynamics

> ... We must develop ideas and theories regarding the formation processes of the archaeological record. Only through an accurate understanding of such processes can we reliably give meaning to the facts that appear, from the past, in the contemporary era (Binford 1977:6–7).

Although Binford was the first to introduce middle-range theory to archaeology, the concept dates back further. The sociological community saw the introduction of the concept of middle-range theory following the Second World War (Raab and Goodyear 1984:256). Several influential papers emerged in the mid-1900s, but one author in particular used middle-range theory at the core of his theoretical program (Merton 1949, 1967, and 1968). Robert K. Merton (1968:149–150) criticised behavioural sciences for engaging in empirical studies that were not 'directed' and relied too much on untestable general theory or were completely detached from theory altogether. To Merton (1968:38), middle-range theory is a way to guide empirical inquiry in order to bridge the gap between low-level theoretical, studies pertaining to observable data, and high-level theory that involves generalisations about entire social systems. When simplified like this, it is easy to see why this concept was so admirable to Binford and the emerging movement in archaeology aimed at theory building.

One problem faced archaeologists. The empirical data that the discipline deals with is not strictly behavioural as in sociology. The physical material culture of the archaeological record added an interesting variable and so adaptations were necessary. Binford applied these adaptations to the areas of interpretation of data (archaeological record) and interpretation of relevance of that data, stating that: 'Middle-range research is proposed as a means of developing secure and intellectually independent interpretive principles and of expanding our knowledge of phenomena of relevance to our interpretive task' (Binford 2009:20–21).

Stemming from the initial introduction of middle-range theory by Binford (1977; 1983), several other archaeologists incorporated this concept into their studies (Bettinger 1987; Thomas 1983, 2006; Torrence 1986; Willey and Sabloff 1980). These studies made small alterations to the concept and applied it to everything from site formation processes to behavioural archaeology but still roughly followed the ideas laid down by Binford. Of course, this movement met with opposition both inside the movement as well as outside. Outside criticism came from archaeologists that claimed the answer lied in using the physical characteristics of the archaeological record and not untestable behavioural reconstructions (Pierce 1989:1).

Raab and Goodyear (1984:255, 258, 265), while proponents of middle-range theory, criticised the use by archaeologists of the time as too 'narrow-minded' and methodological in nature, making it synonymous to the issue of site formation process; admitting that this stemmed from the logical problem of inferring cultural behaviour from material remains. They called instead for a more Mertonian use of middle-range theory, to formulate and test theories that can link empirical data to higher-order conceptual schemes (Raab and Goodyear 1984:258). Several studies of the time did however garner their approval for following a Mertonian use of middle-range theory. “Studies done by Binford (1980) and Wiessner (1982) can be thought of as middle-range theoretical approaches because they possess casual or potentially casual statements about *aspects* (exchange, social organisation, logistics systems, etc.) of hunter-gatherer cultural systems that can be explored empirically, using archaeological remains” (Raab and Goodyear 1984:263).

Whether applied to methodological problems or used as pure theory building, middle-range theory can be highly adaptable in its uses and therefore should be used for a wide range of archaeological research. What archaeologists needed was a scientific method of making inferences that allowed for the linkage of high-order general theory and the static empirical data of the archaeological record. One such method is that of Multiple Working Hypotheses. By creating simple working-hypotheses based on observations of the archaeological record, then using those to guide research that either confirms or negates propositions in the middle stratum, complex general theories about cultural systems can be validated (Raab and Goodyear 1984:257). This methodology also allows archaeologists to avoid pre-conceived biases based on initial findings, a process referred to as ‘Ruling Theory.’

Ruling Theory and Multiple Working Hypotheses

In his original paper in 1890, Thomas Chrowder Chamberlin discusses three phases of intellectual methods that science progressed through: Ruling Theory, Working Hypothesis, and his own Method of Multiple Working Hypotheses (MMWH); this paper was later published by *Science* in 1965 (Chamberlin 1965:754). Ruling Theory is the process of unconscious bias-laden thinking by a researcher involving the moulding of research design, data collection and interpretation to an ‘attractive’ explanation while simultaneously discarding or ignoring ‘unattractive’ evidence (Chamberlin 1965:755). Simply put, it is the tendency for a researcher to seek out evidence that supports a specific theory until that theory ‘becomes’ true. Chamberlin makes Ruling Theory analogous to the bond between a parent and child, where the researcher holds affection for the first satisfactory explanation to a phenomenon. As the explanation is explored further the researcher’s affection for it grows, and in time, the researcher begins to unconsciously favour and seek out evidence that supports this explanation or theory. Over a long enough period of time it appears that the theory fits the facts and that the facts fit the theory (Chamberlin 1965:755).

The case study of the Beaufort Inlet Wreck is a prime example of Ruling Theory in action, but not in the way it may appear. Upon discovery of what appeared to be a heavily armed, extremely large wooden shipwreck off the coast of North Carolina, it was suggested rather quickly that the wreck was the infamous pirate Blackbeard’s flagship *Queen Anne’s Revenge* (*QAR*) (Rodgers et al. 2005). With the announcement of such a significant study, institutes and organisations were lining up to join the research and government funding was readily offered. In a contentious article titled *‘Ruling Theories Linger’: Questioning the Identity of the Beaufort Inlet Shipwreck* the entire project was criticised for repeatedly confirming the wreck as *QAR* with little concrete evidence to support the claim (Rodgers et al. 2005). The authors claimed many archaeologists were compromising their objective observations in order to fit the pre-conceived notion that the wreck was *QAR*, a forefront factor of Ruling Theory (Rodgers et al. 2005:25). The longer time went on and the more it was promoted as *QAR* the more the researchers viewed the wreck as in fact being just that. Ruling theory left to run its course is a self-fulfilling hypothesis through repetition (Rodgers et al. 2005:26). On deeper inspection however, the authors of *Ruling Theories Linger* may have fallen victim to their own subject matter. In two response articles, it was argued that the evidence used by the original authors took much of the archaeological data out of context, or simply misquoted and under-researched the topic to push their case study for Ruling Theory (Miller et al. 2005; Moore 2005). 'In their attempts to prove the use of 'Ruling Theory' on the Beaufort Inlet shipwreck, the authors have unwittingly accomplished exactly what their article warned against— 'the creation of underdeveloped theories and conclusions based upon imperfect knowledge' (p.25)' (Moore 2005:338). In a follow up article, it is actually argued 'beyond reasonable doubt' that the wreck is in fact that of *QAR* since the 'right' artefacts have been found, the wreck is in the 'right' location and dates to the 'right' time; but even with so much contextual evidence there is still a possibility that it is an entirely different wreck (Wilde-Ramsing and Ewen 2012:339). Ruling Theory is not just something to be aware of while doing research but in all areas of academics. So how then does a researcher avoid Ruling Theory?

According to Chamberlin (1965:755), the process of Ruling Theory led to theorising in narrow lines and was condemned. In an effort to rectify, the method of the Working Hypothesis was developed. In this early scientific method, a guiding hypothesis is created to focus research and determine facts. The facts are not sought after to support the theory but instead are used for inductive reasoning and inquiry. The obvious drawback to this method being that a working hypothesis can easily devolve into a ruling theory (Chamberlin 1965:756). In order to prevent this from happening, Chamberlin (1965) proposed the MMWH. By examining all possible explanations of a phenomena and creating every tenable hypothesis on that subject the researcher avoids holding too much affection for any one explanation (Chamberlin 1965:756).

This method was later praised and adapted into that of "strong inference" by Platt (1965). Strong Inference keeps its roots in a more classic scientific method however and follows four steps: 1) devising alternative hypotheses; 2) devising a crucial experiment(s) to test each hypothesis in turn; 3) carrying out the experiment; and 4) recycling the procedure, making sub-hypotheses or sequential hypotheses to refine the possibilities that remain; and so on (Platt 1965:347). While similar, one major difference is that Chamberlin's MMWH allows for the outcome of more than one hypothesis being simultaneously true instead of systematically eliminating 'alternate' hypotheses (Elliot and Brook 2007:611). This leads to an unconscious thoroughness and open-mindedness when researching. The creation of comprehensive research designs before the commencement of laboratory or field work, and the use of multiple working hypotheses to create strong inferences, are methods used by archaeologists (and the general scientific community) for more than half a century. Their purpose is to guard against the creation of underdeveloped theories and conclusions based upon imperfect knowledge (Babits 1998b; Platt 1965; Plog 1974; Rodgers et al. 2005:25; Smith 1955).

Conclusion

Falmouth packet ships were vital to the Post Office economy of England in the seventeenth, eighteenth and nineteenth centuries. These sleek, fast vessels carried mail to all corners of the Empire and often times were used for war. Many times, these ships were sold and used for a variety of alternative purposes including emigration, supply ships, or whaling vessels. The investigation of the Encounter Bay wreck will contribute new information regarding the construction of and alternative uses for this common ship type.

Identification of shipwrecks can be divided into four categories. Type A and Type B relating to sites with supporting historical documentation; Type C, a broader cultural association; and Type D, a modern concept. Identification provides a larger context for analysis and both positive affiliations and negative identifications are important. Key factors of identification are origin, chronology, and function of an assemblage. This information is often found in historical documents and helps to link the results to the physical site through the archaeological evidence enabling the application of a name or affiliation to a shipwreck site.

Multiple working hypotheses are created to avoid giving precedence to the first viable outcome that is discovered during research. This process is called ‘Ruling Theory’ and can influence researchers to shape the outcomes in favour of a specific hypothesis. Creating all conceivable hypotheses ensures that a topic is researched in entirety and often will lead to several hypotheses being true simultaneously. The Encounter Bay wreck is believed to be that of *South Australian* because of the nature of the discovery and detailed historic documents surrounding the wrecking event. While it is probable that the wreck is *South Australian*, all possibilities should be explored to apply the strongest possible affiliation. This is likewise true with the historic research. Allowing for the possibility that the wrecking event had little-to-no cultural impact instead of assuming that the loss of a vessel had great impact will create a more complete understanding.

Chapter 3 – Methods

Introduction

The vessel *South Australian* has a well-documented historic background that details voyages taken, previous owners, and wrecking event information. The archaeological data for the Encounter Bay wreck in 2018 is scarce, being limited to three brief site inspections that include the initial discovery; however, the initial hull observations coupled with historic and ethnographic information, point toward this wreck being that of *South Australian*. These inspections were limited, due to inclement weather, to photography, baseline-offset mapping and observation. A collaborative project conducted by the DEW, ANMM, SWF and Flinders University carried out fieldwork for the current study over a seven-day period, 27 June to 03 July 2019. The fieldwork represents the start of a comprehensive research design that may lead to multiple seasons and eventual excavation of the wreck site. This chapter outlines the methodological approaches used during archaeological fieldwork and historic research.

Previous searches for and inspections of the Encounter Bay wreck

The Department of Environment and Water conducted a series of magnetometer searches to locate the wreck in the 1990s without success (Bullers 2018:6–10). After the initial discovery of the Encounter Bay wreck in 2018, archaeologists from the DEW, ANMM, SAMM, SWF, and Flinders University have conducted three site inspections of the Encounter Bay wreck: 20 April, 7 May, and 10–22 July 2018. The first inspection dive was undertaken during the initial fieldwork in April of 2018, resulting in a rudimentary ‘mud map’ of the exposed keel and bow using baseline-offset mapping by four divers, as well as a position from a surface vessel placed between temporary buoys marking the stern and bow of the site. The position was recorded using a standard Global Positioning System (GPS) using The World Geodetic System 1984 (WGS84) datum set to latitude-longitude coordinates (in decimal minutes) (Bullers 2019:23). The site was recorded using photographic and video footage.

Four divers completed the second site inspection on 7 May 2018 (two from ANMM and one each from DEW and SWF) with the purpose of conducting a baseline-offset survey of the bow section and to gather additional photographic and video footage (Bullers 2019).

The third inspection came opportunistically on 10 and 11 July 2018 with the intention to complete further baseline-offset mapping and begin photogrammetric recording. Due to poor weather, heavy surge and suspended sediment in the water column, baseline-offset mapping was impossible and photogrammetric recording had to be postponed. The inspection dives instead took the opportunity to conduct visual observations of changes in the formation of the site and collect more photographs and videos (Bullers 2019:23). Photographs and initial mapping done during these inspections will be presented in this thesis.

Multiple working hypotheses

While available historic and ethnographic data points towards this wreck being *South Australian*, it is not good practice to assume without confirmation. To approach this research in an unbiased manner and ensure proper archaeological and scientific methods have been applied, a research design using multiple working hypotheses was followed. Multiple working hypotheses as a methodology in maritime archaeology stems from foundations of archaeological methods presented by Plog (1998: 175-185), in Babits' and Van Tilberg's *Maritime Archaeology: A Reader of Substantive and Theoretical Contributions*. By identifying a problem, forming hypotheses, acquiring and analysing data, testing hypotheses and evaluating research the archaeologist avoids creating a bias towards one outcome or another.

For the current study, the use of multiple working hypotheses was applied to the fieldwork but also to analysis of data and historic research to understand the wreck in a cultural capacity. By formulating and testing hypotheses involving the impact the vessel had on whaling in colonial South Australia the research avoided objectifying the wreck as just an 'artefact' to be studied and instead used it to understand the people, time period and economy it was a part of. This methodology incorporated scientific and theoretical frameworks to create a comprehensive understanding of a significant vessel. Since very little archaeological data was available on the wreck prior to the start of this research, this methodology used an anthropological approach to initial archaeological research.

Multiple working hypotheses have been formed in two categories that apply to both the material remains as well as the cultural aspect. These categories are: Identification of the shipwreck and sinking event; and cultural significance to colonial South Australia. These initial hypotheses were created from available archaeological data and initial historical research into the time period and location and are subject to change throughout the course of research.

Identification of shipwreck and sinking event:

Hypothesis 0 – The site is not a shipwreck;

For the null hypothesis to be true, the fieldwork would need to prove that the archaeological site found in Encounter Bay is not a shipwreck.

Hypothesis 1 – The vessel is South Australian;

For this hypothesis to be true, the fieldwork will have to find evidence that the wreck matches the historic data available for *South Australian*. This evidence may include matching historical references, timber/metal analysis, shipbuilding technique, or artefacts.

Hypothesis 2 – The wreck is not South Australian.

For this hypothesis to be found true, the fieldwork will produce evidence of the same type mentioned above but matching a different historic vessel or not matching beyond a doubt with historic data for *South Australian*.

Cultural significance to colonial South Australia:

Hypothesis 0 – The sinking of the vessel had no impact on whaling practices in South Australia;

Hypothesis 1 – The sinking of the vessel caused a shift in approach to whaling by the South Australian Company;

For this hypothesis to be true, historic sources will be found indicating that changes in whaling practices in South Australia were a direct result of the loss of *South Australian*. These sources may include letters, diaries or orders from The Company discussing the loss of *South Australian.*

Hypothesis 2 – The South Australian Company was already in the process of changing approaches to whaling before the sinking event.

To prove this hypothesis true, historical sources will need to be found indicating that The Company had plans of changing whaling practices in Encounter Bay before the loss of *South Australian*. The same sources mentioned above will be sufficient.

Hypothesis 3 – The Company was already planning to make changes to whaling but the loss of the vessel prompted further changes.

This hypothesis requires the combination of evidence from both Hypotheses 1 and 2 in this category to be identified. If sufficient records are found that indicate changes to whaling practices were already happening before the loss, as well as changes relating directly to the loss, this hypothesis will be correct.

Archaeological Fieldwork

A small team of maritime archaeologists carried out diving and survey activities at the site in Encounter Bay, South Australia to collect data for the identification of the wreck and perform a detailed survey. Survey activities included underwater metal detector searches to establish the extent of the site. Collection of at-risk artefacts and installation of sediment monitoring stations. Baseline-offset mapping, photography and photogrammetry were used to record features of the site. Timber sampling was carried out on in situ remains using hand tools and metal sheathing and fasteners were collected to perform metal analysis. Although the aim of the fieldwork was a pre-disturbance survey, timber sampling was permitted by the DEW and included in the scope of work.

Determining Site Extent

The remains of the vessel sit in 4 metres of water just seaward of the tidal reef flats approximately 200 metres offshore. The wooden hull is resting in soft sand with the bow pointed roughly northeast. The observable site consists of increasingly exposed (significant change in exposed elements observed between 2018-2019 fieldwork) portions of the bow and midships covered in a fine layer of sand and drifting seagrass. The bow is fronted by a large area of built up sediment and thick seagrasses. These seagrasses extend all along the port side of the exposed hull. The entire aft of the wreck is covered by a receding mound of sand and seagrasses with timbers and other features protruding from the sides. To the starboard side of the wreck, a large open sandy patch devoid of natural features extends the entire length of the vessel reaching out perhaps 20 metres.

The hidden and buried boundaries of the site were determined by two divers swimming transect lines, carrying Minelab Excalibur II underwater metal detectors (Figure 3.1). Focusing on the port and starboard sides of the exposed vessel structure established how much of the wreck is buried in the surrounding sand and seagrass. Transects completed at one-metre intervals with divers swimming in opposite directions to avoid electronic interference made sure the entire area was covered. Transect lines were completed on both sides of the exposed wreck until no more anomalies were detected; roughly 10 metres on either side. Due to time constraints, all anomalies detected were not recorded, instead, an estimation of buried portions and extent of debris field was established.

Figure 3.1. Timothy Zapor conducting metal detection survey on starboard side of exposed structure to establish site boundaries (Photograph by Timothy Zapor, June 25, 2019)

Mapping of Site

Archaeological recording of the wreck site was started during the initial discovery in 2018. A crude baseline-offset map of the exposed bow portion was created using the keelson as a guide for the baseline. Divers focused on the starboard side, recording in situ copper bolts and timbers using 30-metre tapes and mylar attached to slates. Distances (offsets) to features were recorded by one diver holding a measuring tape at a 90-degree angle to the established baseline (Bowens 2009:120–121; Burke and Smith 2004:96–97). A more detailed site map was created using baseline-offset measurements during the following site inspections in July of 2018. When the fieldwork in June of 2019 began, portions of the bow and stern that had been exposed the year before had already been mapped in detail; however, it was immediately noticeable just how much more exposed the port bow had become.

A roughly sketched mud map was created using the previously drawn site map to discern newly exposed areas and changes since the site visits in 2018. With the blowout of the site exposing much more wooden structure in the bow area prior to the 2019 fieldwork, the team decided to focus on detailed plan mapping of important structures at the port bow. A new baseline, following the keelson from the bow back to the receding mound of sediment at midships, was established by hammering two iron stakes into the sediment and tying a 100-metre tape securely to each stake. The baseline was left in place for the duration of the fieldwork and the iron stakes remained on site permanently for future mapping. To ensure consistency, all map production during the 2019 fieldwork was done by James Hunter of the ANMM. An initial detailed sketch of the port bow was done using pencil and mylar. This sketch was then used to plan important points that needed precise measurements from the baseline. Working in teams of two divers, the wooden structures of the port bow and midships were measured and plotted using the baseline (Figure 3.2). The detailed mapping of the port bow and midships was then tied into the original plan map.

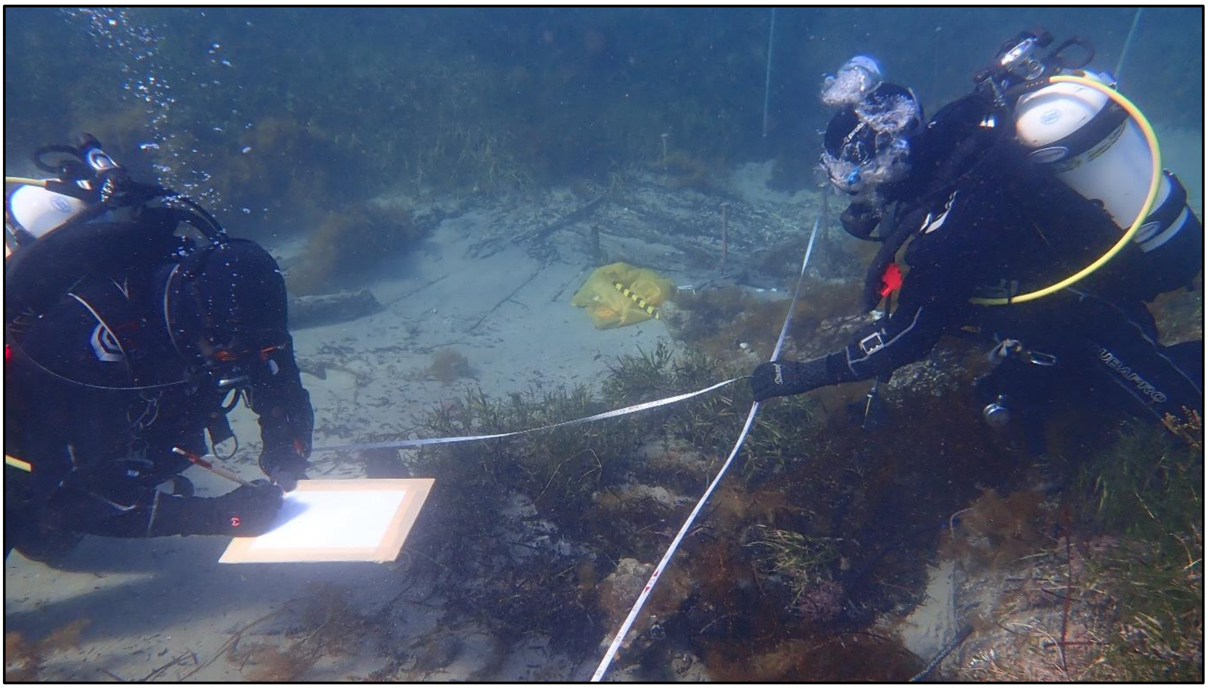


Figure 3.2. James Hunter and Kieran Hosty completing baseline-offset recording of bow features (Photograph by Irini Malliaros, June 25, 2019)

Photographic Recording and 3D Modelling

Photographic documentation was a key component of the 2019 fieldwork. Using multiple small-site survey techniques, over 5000 photographs and videos were taken to allow for 3D modelling and to aid in identification of the wreck (Bowens 2009:76–82; Green 2016:165–167). Photographs and videos were captured using a GoPro Hero 3 with attached lights and red filter, a GoPro Hero 6 with attached red filter and an Olympus digital camera (Figure 3.3). General overview photographs were taken of exposed wooden structures, artefacts, and general site conditions. Close-up detail photographs were taken of prominent features, artefacts and structures using a photo scale. Photogrammetric data for portions of the port bow, mast step and exposed artefacts were captured with a camera set to take an image every 2 seconds to ensure proper overlap of pictures. During days with exceptional visibility underwater, images were taken from higher up in the water column to create a photomosaic of the entire wreck site. Two divers taking consecutive overlapping photos swam transects both horizontally and laterally over the site to ensure complete coverage. 3D images were created using Agisoft PhotoScan Professional.

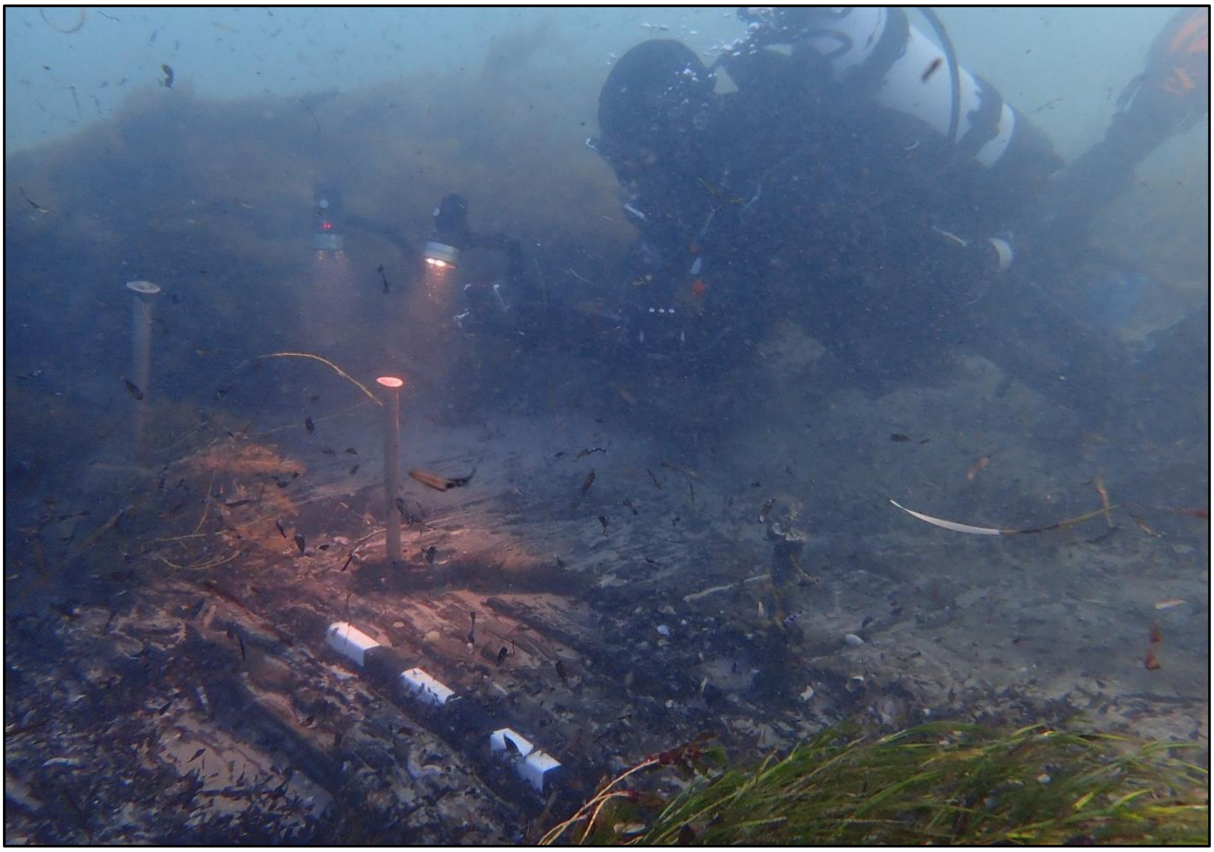


Figure 3.3. James Hunter capturing images for photogrammetry (Photograph by Irini Malliaros June 22, 2019)

Timber Sampling

Timber sampling is an important tool to aid in the identification of vessels. The data may indicate timber species utilised and help provide archaeologists with possible construction locations. Timber samples were collected from in situ locations of known vessel elements (i.e. keelson). Collection of samples was done using hand tools, hammer and chisel and hacksaw, to remove matchbox sized pieces of wood (Figure 3.4). Eight samples were collected from eight different structural elements. The structural elements sampled were: Knee, keelson, floor, frame, ceiling, inner hull planking, outer hull planking, and treenail. Sample locations were determined by visual inspection of the timber elements to avoid areas of heavy biological deterioration by tube worms and gribble. Multiple samples were taken in instances where structural elements contained high amounts of biological deterioration. Following best practices recommended by Ian Macleod, timber sample locations were initially sealed with an epoxy based aqua putty (Dr. Ian Macleod pers. comm. 2019) (Figure 3.5). It was quickly determined that this practice was in fact more damaging to the fragile timber elements than the protection it provided and was discontinued after several samples. Samples were stored in Ziploc bags labelled with all relevant provenience details, including site, feature, collector and date. Baseline-offset measurements were taken for each sample location as well as photographic records.

Figure 3.4. Timothy Zapor collecting timber sample from a frame (Photograph by Irini Malliaros, June 24, 2019)

Figure 3.5. Aqua putty (white) inserted into timber sample locations (Photograph by Timothy Zapor, June 24, 2019)

Jugo Ilic of Know Your Wood laboratory conducted species identification on eight timber samples (Table 3.1) (Appendix 1). Wood identification is the process of analysing timber to identify what type of tree it has come from; the most common way of doing this is through microscopic observation (Abe

2016:240). In order to identify a species, identification requires the observation of the microstructure from three directions: transverse, radial, and tangential (Mizuno et al. 2010:2842). One method of microscopic observation involves slicing small portions of the timber from each needed direction and observing them under an electron microscope, however this method requires a large sample (Mizuno et al. 2010:2842). Often, anatomical observation is not enough to distinguish down to the species level and other methods utilising molecular DNA or chemical analyses may be needed (Abe 2016:240).

Table 3.1. Timber samples collected from South Australian

Sample Number	Feature	Notes
001	Treenail	Cross-sectional dimension: 30mm in diameter
002	Keelson	
003	Outer hull planking	Port stern
004	Inner hull planking	Port stern
005	Floor timber	Port bow
006	Knee	Port bow
007	Frame timber	Port bow
008	Ceiling planking	Bow

Metal Analysis

Metal samples were taken from copper sheathing, loose keel bolts, and sheathing fasteners collected directly from the wreck site. Sheathing and fasteners were collected in sample bags with provenance data clearly marked for transport to the analysis lab. Three copper keel bolts were removed from the site and samples were cut from them using a hacksaw, one sample per bolt (Figure 3.6). These samples were placed in sample bags marked with provenance data for transport to lab. After photographic documentation, the keel bolts were returned to the site. Samples were given to Wendy van Duivenvoorde who performed chemical analysis and produced a report (van Duivenvoorde 2019) (Appendix 2). Three keel bolt samples and three sheathing fragment samples were analysed (Table 3.2). In addition to the six samples taken directly from the wreck site, two keel bolts linked to *South Australian* from the SA Heritage Collection in Netley were sampled and analysed for comparison.

Figure 3.6. Timothy Zapor and Kieran Hosty extracting metal samples from a copper bolt (Photograph by Irini Malliaros, June 23, 2019)

Table 3.2. Metal samples analysed from the Encounter Bay wreck and SA Heritage Collection in Netley

Sample number	**Label on sample bag**
SA0404	Keel pin, *South Australian* Shipwreck
SA0405	Keel pin, *South Australian* Shipwreck
SA Bolt 001	Bolt from *South Australian* ship's hull
SA Bolt 002	Bolt from *South Australian* ship's hull
SA Bolt 003	Bolt from *South Australian* ship's hull
SA Sheathing 001	Sheathing from *South Australian* ship's hull
SA Sheathing 002	Sheathing from *South Australian* ship's hull
SA Sheathing 003	Sheathing from *South Australian* ship's hull

Scanning Electron Microscopy (SEM) is a non-destructive process capable of identifying the elements present in a sample. Knowing the composition of metal elements on a shipwreck may provide data on the manufacturing time period as well as manufacturing technique. A scanning electron microscope (SEM) is comprised of three major sections: the electron column, the specimen chamber, and the computer/electronic controls (Ul-Hamid 2018:4). Electrons beamed from an electron gun are focused into a small diameter probe by electromagnetic lenses located in the electron column. This beam is then swept across the sample where the electrons in the beam penetrate a few microns into the surface (Ul-Hamid 2018:4). 'This penetration allows the electrons to interact with the samples atoms and generate a variety of signals such as secondary and backscattered electrons and characteristic x-rays that are collected and processed to obtain images and chemistry of the specimen surface' (Ul-Hamid 2018:4). The following comes directly from the *Report on the Results of the Semi-Quantitative Chemical Analysis of the* South Australian *Shipwreck Metal Samples* produced by van Duivenvoorde (2019:2–6) (Appendix 2).

The metal samples were analysed at Adelaide Microscopy, South Australia, using a FEI Quanta 450 FEG Environmental Scanning Electron Microscope (ESEM) (Figure 3.7). The FEI Quanta 450 is a High-Resolution Field Emission Scanning Electron Microscope and is used to image and analyse surface topography, collect backscattered electron images and characterise and determine a sample's elemental composition through x-ray detection with a silicon drift detector (SDD) and energy dispersive x-ray spectroscopy (EDS) detector.

Sample preparation for the sheathing and the bolts that were collected from the shipwreck site included embedding a small fragment of each sample in phenolic hot mounting resin for general use (brand: Struers MultiFast). The resin was added and set in a Struers CitoPress-10 hot mounting machine (Figure 3.8). The mounted samples were then polished using a Struers TegraPol-11 diamond polisher to get clean, uncorroded surfaces for analyses (Figure 3.9 and Figure 3.10). This process eliminates inaccurate results caused by surface corrosion, which copper alloys are strongly affected by (Feretti 2014:1756–1757).

The two so-called keel bolts labelled SA404 and SA405, that are registered as from *South Australian* in the SA Heritage Collection Storage, were drilled to extract a few mg of material from their heads—for each sample a brand-new titanium drill bit (1/16”) was used to get an un-corroded metal sample to avoid any possible cross contamination. Sample preparation included adding the drilled material from each fastener on 12mm aluminium stub with carbon tape tabs (Figure 3.11 and Figure 3.12)

The FEI Qanta 450 with SDD EDS detector allows for a semi-quantitative analytical method of elemental composition by spot or area testing. As this method of analysis is a localized testing method, it is not necessarily representative for the composition of an entire sample. If possible, preferably three areas per sample are tested to ensure they are characteristic. The bolts were however analysed in their entirety as such fasteners, when embedded in epoxy, display the full cross-sectional surface of their shafts (in this case these sections measure a few by a few mm) (see Figure 3.10). The areas chosen for elemental determination are those that display solid metal and are free of any surface corrosion (Figure 3.13 to Figure 3.15).

The Following SEM settings were used during data acquisition: High-Vacuum, Kilovotage: kV 20, Element Normalized, SEC table: default, standardless. The time per sample analysis was automated as the Quanta 450 is the fastest SEM EDS collector in Australia.

Figure 3.7. FEI Quanta 450 FEG Environmental Scanning Electron Microscope, Adelaide Microscopy, University of Adelaide (Photograph by Wendy van Duivenvoorde)

Figure 3.8. Struers CitoPress-10 hot mounting press (Photography by Wendy van Duivenvoorde)

Figure 3.9. Struers TegraPol-11 polisher (Photography by Wendy van Duivenvoorde)

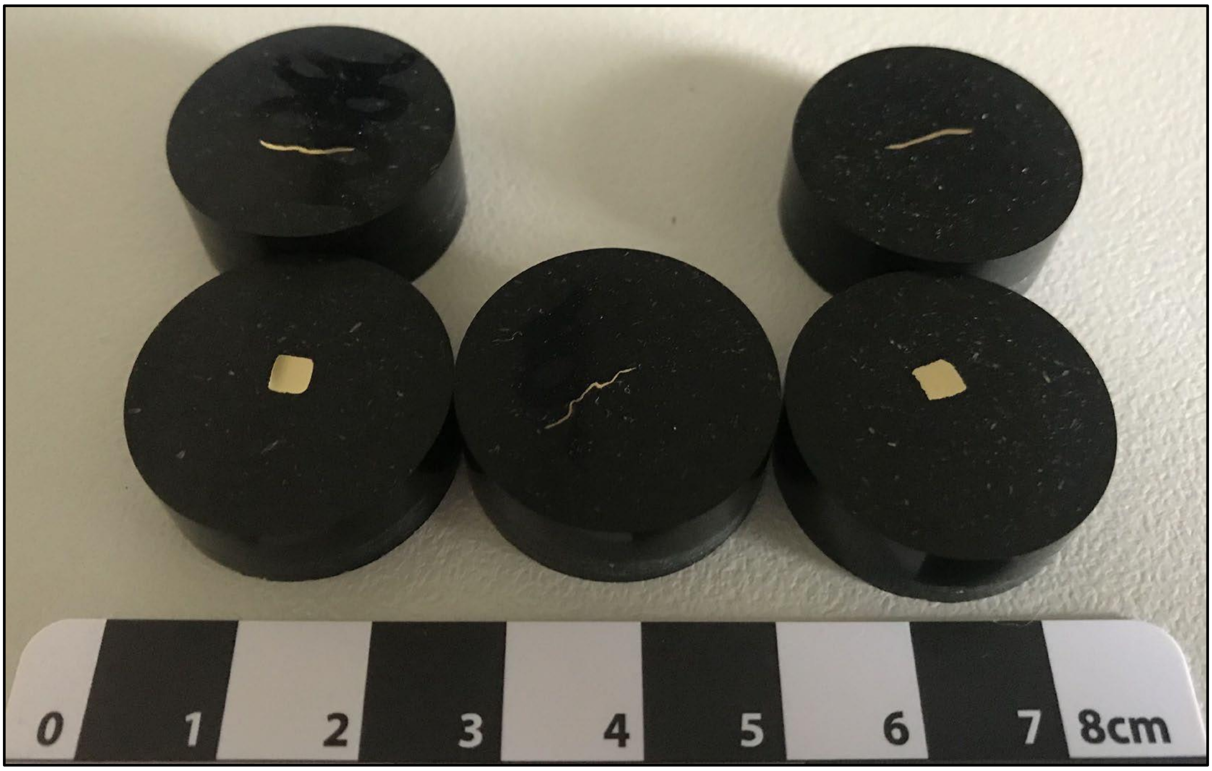


Figure 3.10. Examples of samples embedded in black-coloured resin, the top two samples and bottom centre are all metal sheathing whereas the bottom samples on left and right are cross sections of fasteners (<u>not</u> South Australian shipwreck) (Photography by Wendy van Duivenvoorde)

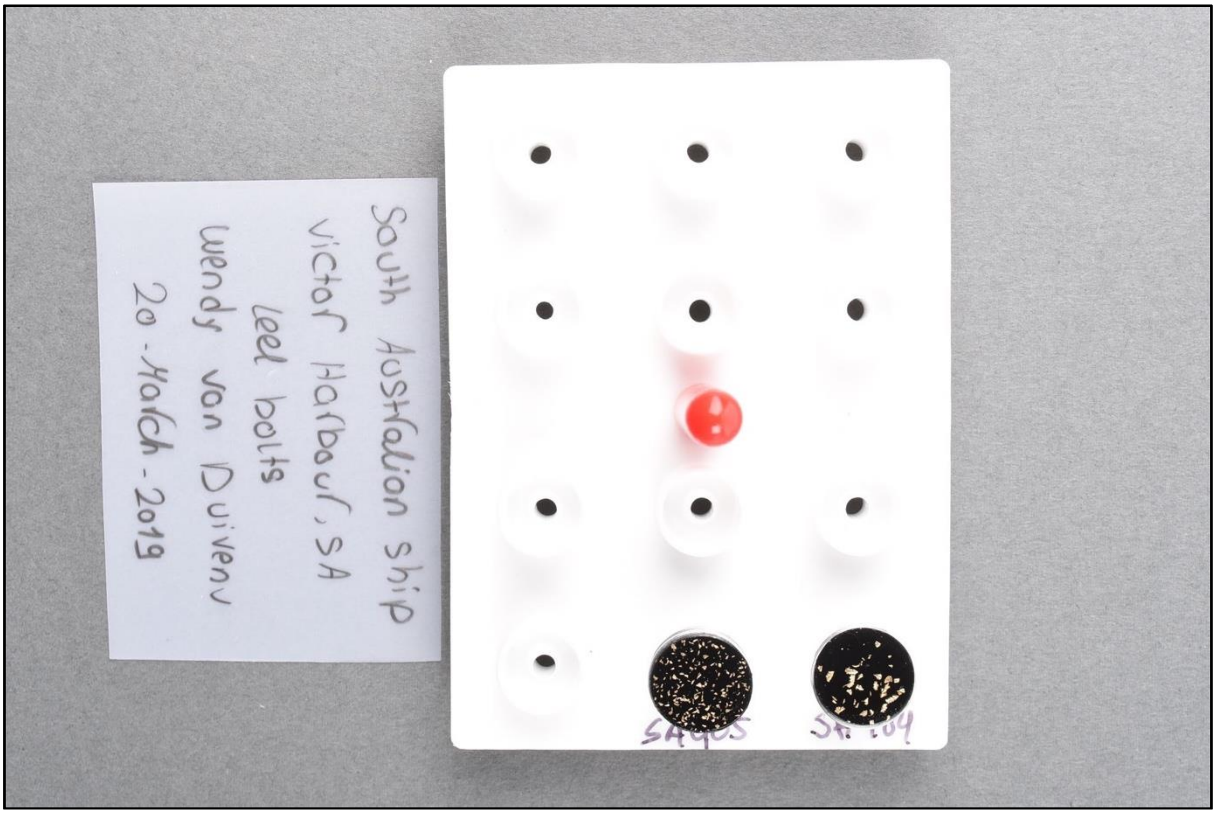
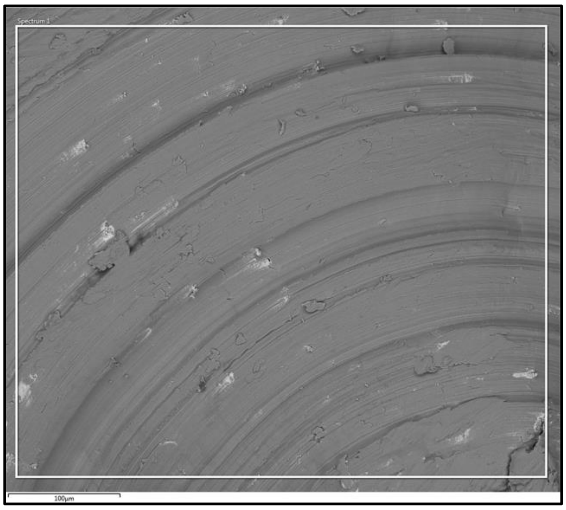


Figure 3.11. Example of drill shavings mounted on aluminium stubs with carbon tape tabs (South Australian shipwreck) (Photography by Omaima Eldeeb)

a



b

Figure 3.12. Drill shavings of bolt (a) and magnified drill shaving showing spectrum analysed (b, Spectrum 1) (South Australian shipwreck, keel pin 0404). White-coloured inclusions are lead (Micrographs by Wendy van Duivenvoorde)

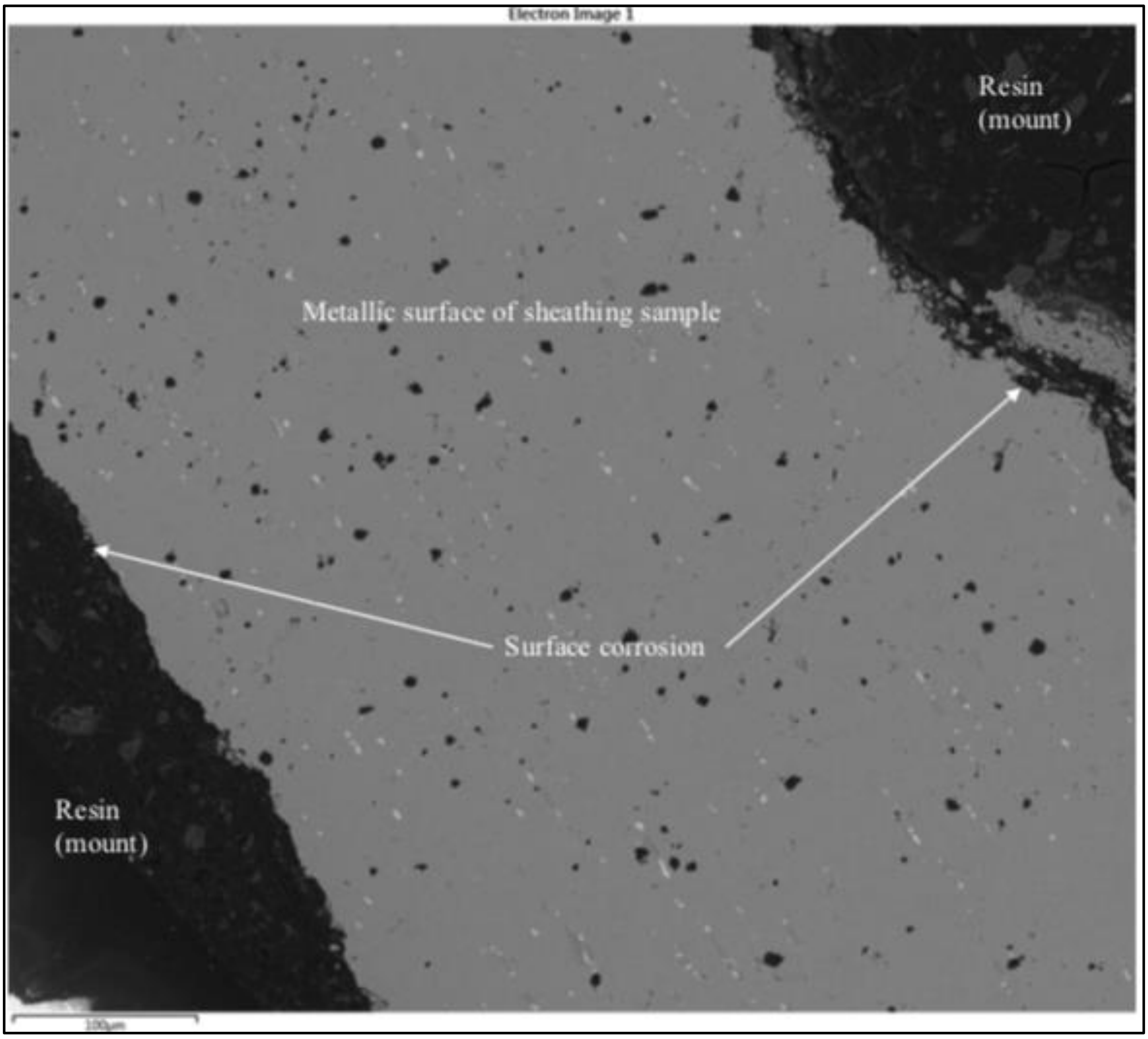


Figure 3.13. Cross-section of sheathing fragment (sample no. 003), showing surface corrosion on edges and metallic surface of the sample. White-coloured inclusions are lead; black coloured inclusions are carbon. Micrograph of mounted sample (Micrograph by Wendy van Duivenvoorde)

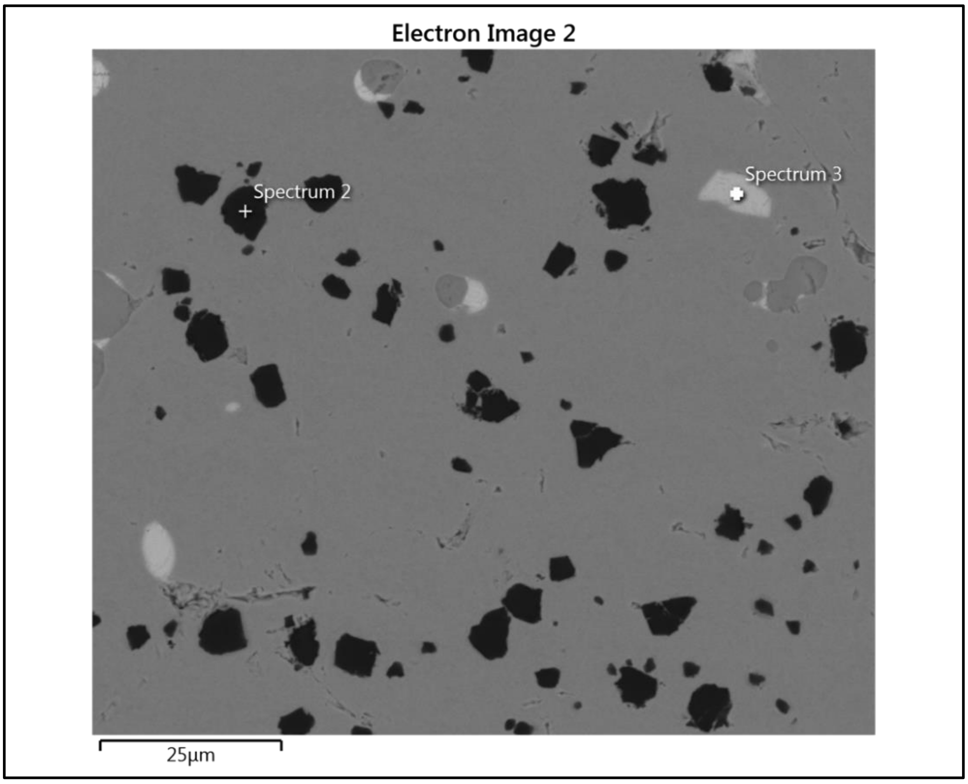


Figure 3.14. Micrograph of mounted sample showing spot analyses on carbon (Spectrum 2) and lead (Spectrum 3) inclusions. (South Australian shipwreck, bolt sample 001) (Micrograph by Wendy van Duivenvoorde)

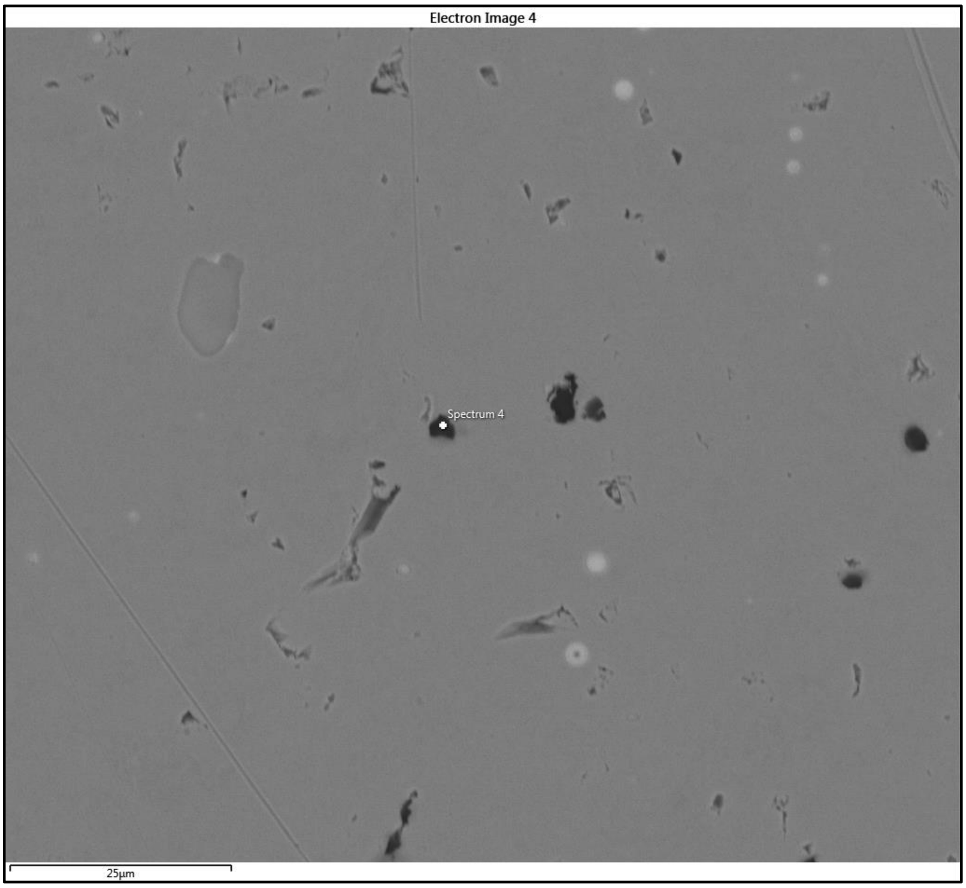


Figure 3.15. Micrograph of mounted sample showing spot analysis on carbon inclusion (Spectrum 4). (South Australian shipwreck, sheathing sample 001) (Micrograph by Wendy van Duivenvoorde)

Sediment Monitoring Stations

Sediment monitoring stations were installed in accordance with the research design developed for the collaborative project. These stations consisted of six, metre-and-a-half galvanised steel poles marked at 10-centimetre intervals from 0 to 100 centimetres. Marks were scored into the pole using a hacksaw and labelled with black sharpie. The poles were then pounded into the sediment surrounding the exposed wreck up to the '0' mark using a hammer (Figure 3.16). Six stations, three on each side of the exposed timber structure, will provide an overall understanding of sediment movement across the site. These stations were marked on the site mud map, documented with photographs of the sediment at the time of installation, and recorded with video footage using a Gopro Hero 6 Black. These monitoring stations will be used to gain a better understanding of the conservation needs and environmental changes occurring.

Figure 3.16. Kevin Jones and Timothy Zapor installing a sediment monitoring station (Photograph by Irini Malliaros, June 24, 2019)

Historical and Archival Research

Archival records were sought in order to locate the bulk of needed information pertaining to the cultural significance of the Encounter Bay shipwreck. The majority of The South Australian Company's original business records are housed at the State Library of South Australia, North Terrace and Kintore Ave, Adelaide, South Australia, 5000. This collection, stored across 23 metres of shelving, provided access to physical documentation from The Company relating to the use and loss of *South Australian* and other aspects of whaling activities during the time period. Resources such as personal letters from officers, daily journals, annual reports to the directors, logbooks from different vessels, and various other types of administrative records were examined. Two historical theses that make extensive use of the archival resources belonging to The South Australian Company, *Aspects of the History of the South Australian Company* (Diamond 1955) and *Whaling in South Australia* (Hosking 1973) provided insights into important documents containing pertinent data related to this research. Trove, the Australian National Library database, provided online access to newspapers from the nineteenth century during the use and loss of the vessel in Australian waters. Relevant articles were found using keywords such as *South Australian*, shipwreck, Encounter Bay, The South Australian Company and whaling, or combinations thereof. *The South Australian Gazette and Colonial Register* (SAGCR) provided the most relevant articles to the time period.

Lloyds Shipping Register as well as *British Packet Sailings: Falmouth* (Olenkiewicz 2018a, 2018b) provided information relating to use of the vessel during its early lifetime. Consulting secondary sources such as *Bay Whaling* (Nash 2003) and other informative titles relating to practices of the time period provided comparative information that aided in the analysis of archival records.

Close working relationships with the public in Victor Harbor provided vital information before and during the multiple field sessions. An active community of beachgoers frequently find shipwreck debris washed up on the beach. Residents are in contact with the DEW and help to collect and preserve debris found along the waterfront of Encounter Bay.

Conclusion

Without any previous archaeological data for the shipwreck at Encounter Bay, the fieldwork focused on collecting as much valuable data relating to vessel identification as possible. Scale drawings, photography and photogrammetry, and sampling of timber and metal were utilised to provide this information during the fieldwork of 2018 and 2019 on the physical remains. Extensive historical and archival research, such as photographs, newspapers, original business records, and secondary sources provided a cross-reference for the collected fieldwork data to help in the identification of the vessel. The following chapter will present the results of fieldwork and historical research.

Chapter 4 – Results

Introduction

This chapter presents the data collected from archaeological fieldwork as well as historical records and documents. The archaeological fieldwork data is organised into three sections. The first detailing the 2019 archaeological survey work with information from the 2018 inspections included for seasonal comparison of site exposure. Secondly, the timber species identification is discussed. The third section examines the semi-quantitative chemical analysis of the metal elements recovered during the recent fieldwork. Outcomes of the historical research have been divided into two sections that deal with the life-story and wrecking event of the barque *South Australian*, and the final section that presents The South Australian Company's whaling practices.

Wreck Site Survey

Based on site inspections between April 2018 and July 2019, extensive portions of articulated elements remain intact. The entire port-side lower hull/cargo hold from bow to midships is exposed, revealing articulated hull components including the keel and keelson, frames, cant frames, hull planking, sacrificial planking, ceiling planking, remnants of the foremast step and portions of the stem. The keel remains mostly buried with the keelson predominantly exposed towards the bow and marked with a line of large cupreous-keel bolts that can be seen running from stern to stem. Large portions of the lower hull still feature in situ copper or copper-alloy sheathing, predominantly visible on the starboard side. Where the sheathing has been weathered and removed, sheathing tacks and fasteners are clearly visible in the timbers. Loose keel bolts and fasteners of varying sizes can be found out-of-context scattered around the site. Some of these, along with portions of sheathing, were collected for sampling and then re-buried on the site to prevent their loss.

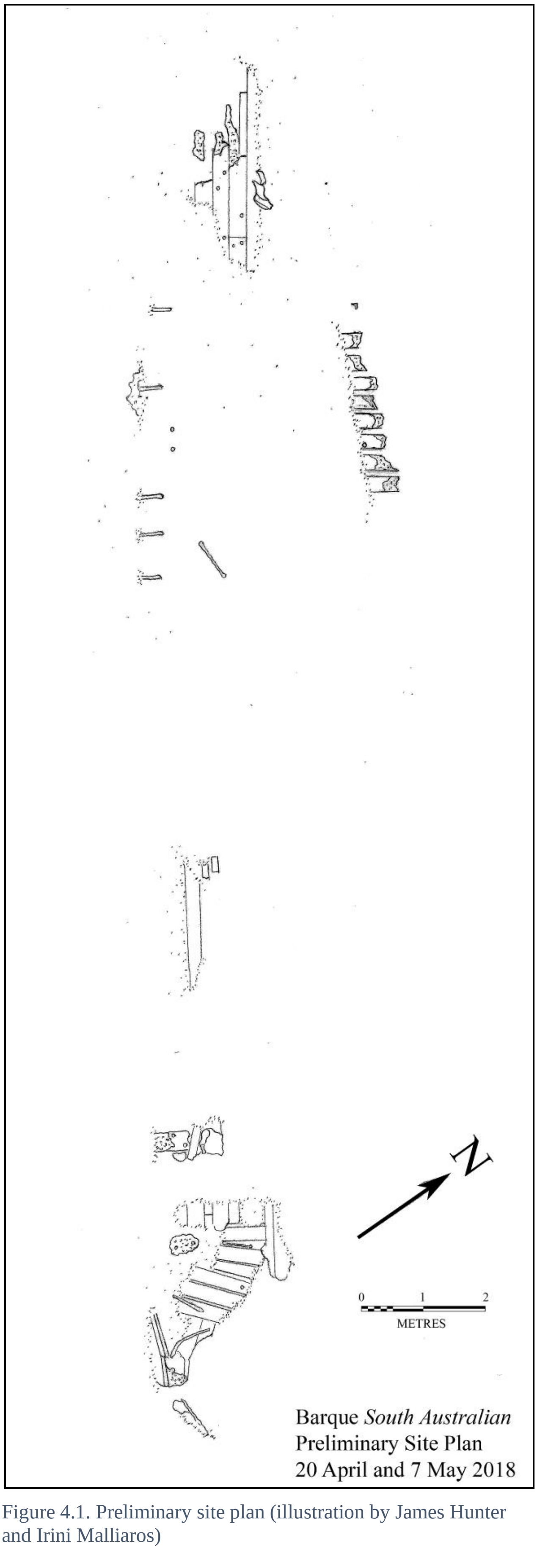


Figure 4.1. Preliminary site plan (illustration by James Hunter and Irini Malliaros)

Past midships toward the stern, a large mound of sand and seagrass still covers a large portion of the articulated remains. This mound may conceal archaeological deposits such as a ballast mound or remnant cargo—referring to *South Australian*'s logbook which indicates the lower cargo hold was completely submerged after wrecking and inaccessible (Bullers 2019:24). Structural components such as frames and inner and outer (sacrificial) hull planking were observed protruding from either side of this mound. It is important to note that the size and coverage of the sand mound, as well as overall sediment coverage across the site, reduced significantly between the 2018 inspections and the 2019 fieldwork; as much as 300-400 mm of sediment loss.

This sediment loss can be observed by comparing the site plan drawn during initial inspections and the mud map sketched during the 2019 fieldwork. Over the three inspections in 2018 an overall site plan and a detailed plan of the port bow using baseline-offset measures of exposed structural elements were created (Figure 4.1 and Figure 4.2Figure 4.2). The main features detailed in this plan are the angled cant frames (designated F1 to F6 in Figure 4.2), along with ceiling planks aft of the cant frames and outer planking visible forward of F1 (Bullers 2019:24).

The mud map sketched during the first days of the 2019 fieldwork shows the extensive articulated structural elements around midships and either side of the receding sand mound (Figure 4.3). The mud map was sketched overlaying the preliminary site plan from 2018 with detailed measurements collected mostly in the port bow and midships areas.

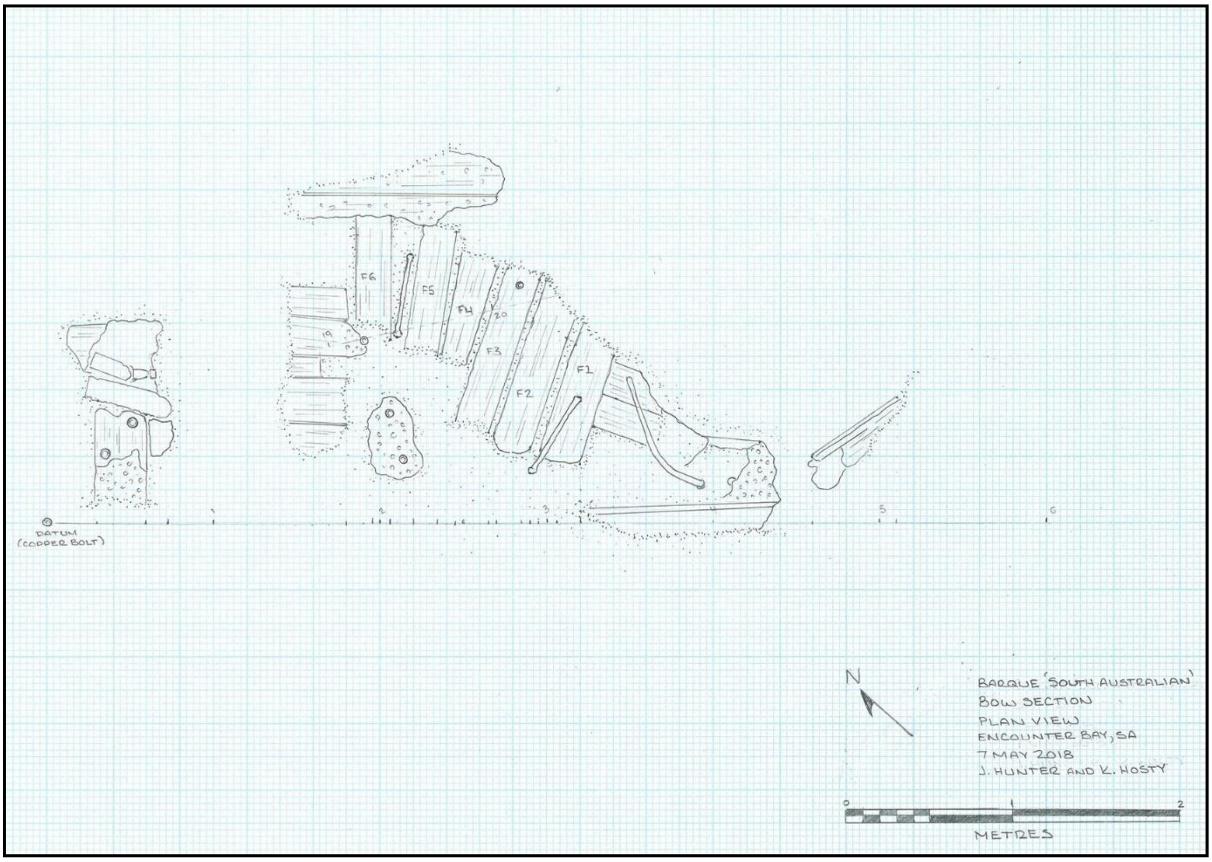


Figure 4.2. Baseline-offset plan of the port bow (illustration by James Hunter and Kieran Hosty)

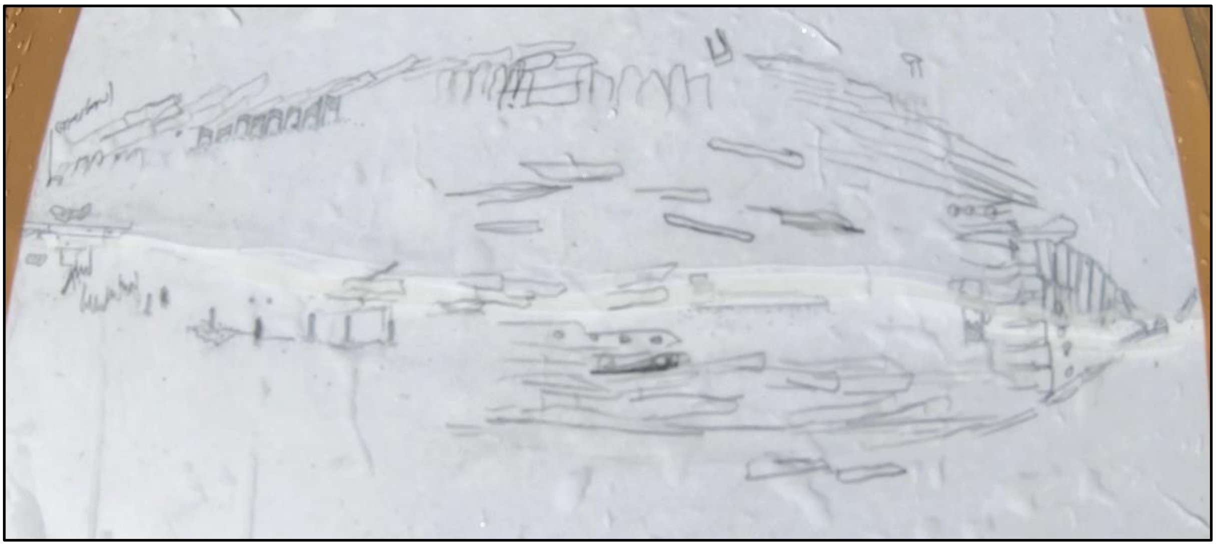


Figure 4.3. Mud map of exposed structural elements during 2019 fieldwork (illustration by Irini Malliaros)

Large portions of newly uncovered structural remains can be seen predominantly in the midships region. These newly uncovered timbers are yet untouched by biological components such as shipworm and gribble. The vessel appears to have collapsed to the port side after wrecking, evidenced by a large concretion field extending along the entire side of the port hull planking. Lack of elements immediately to the starboard side of the remains, which is adjacent to a large patch of open sand, supports this hypothesis. An updated site plan of the newly uncovered elements is still in post-production and was not completed in time for this report. Due to time and weather constraints, further baseline-offset measurements are needed to complete a detailed site-plan.

Metal detection surveys of the port and starboard side indicate that no significant remains are buried farther than 1 m extending on either side of visible elements. The concretion field along the port hull extends approximately 3 m out and is covered with thick seagrasses. This concretion field includes two metal scuppers as well as large amounts of unidentified components. Magnetometer surveys during the initial discovery in 2018 revealed large anomalies to the north of the wreck-site, the orientation and list of the lower hull may suggest that this is part of the standing rigging (Bullers 2019:27).

Photogrammetry is largely still in post-production from the 2019 fieldwork and will require more field time to create a complete site model. Two screen captures taken from two interim P3DR models of the site generated by James Hunter of the Australian National Maritime Museum and SAILS Project show the bow section and the midships section to the point where the hull disappears beneath the sand mound respectively (Figure 4.4 and Figure 4.5). Structural elements can be seen articulated and in excellent condition including floor, ceiling, and frames with the shape of the starboard bow outlined clearly. A third screen capture taken from a model clearly illustrates the foremast step (Figure 4.6).

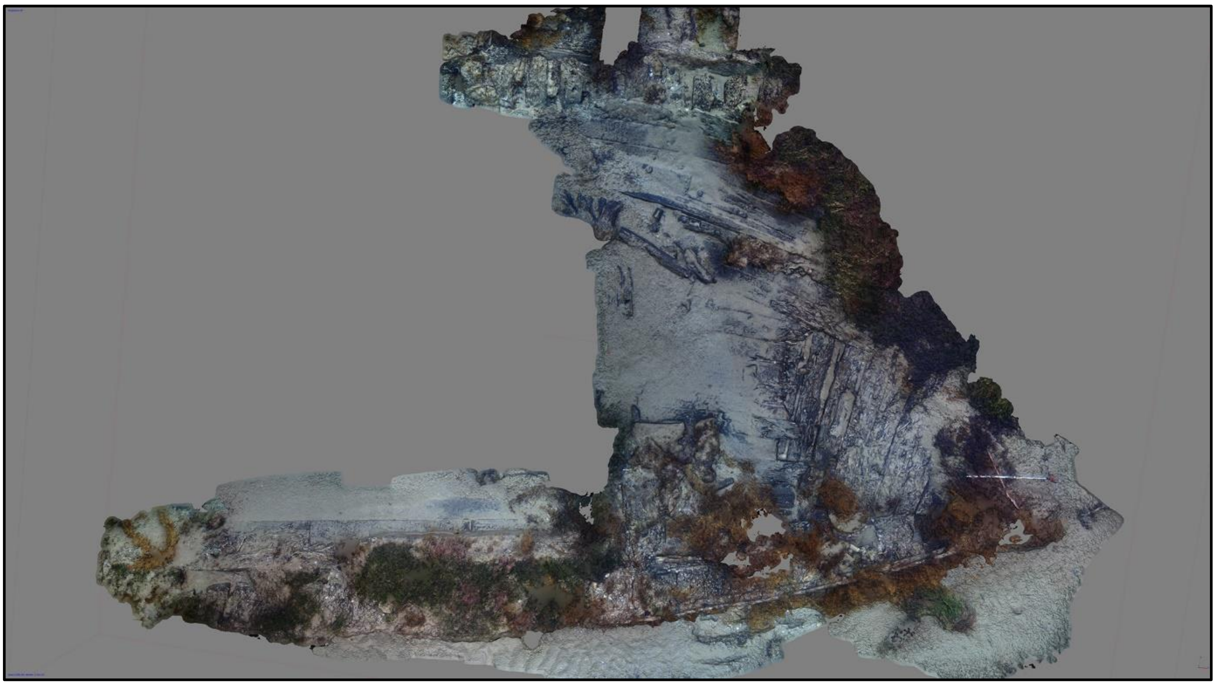


Figure 4.4. Screen capture of interim 3D model showing the bow section (3D model by James Hunter, photos by James Hunter and Irini Malliaros)

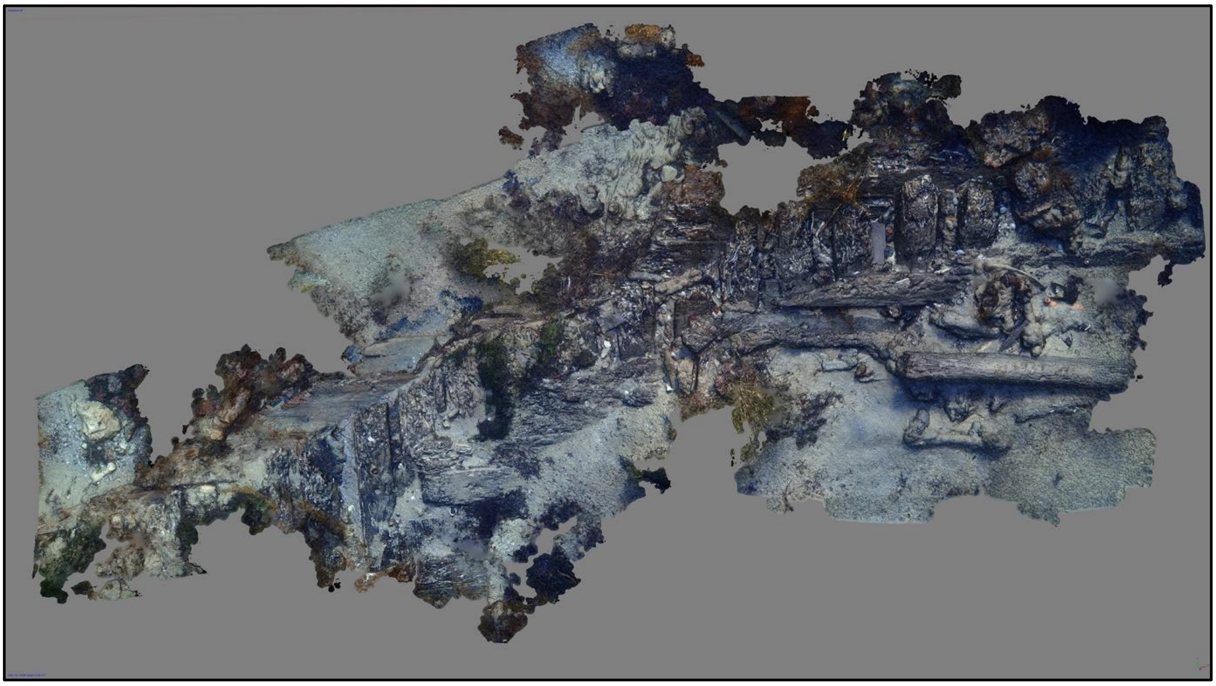


Figure 4.5. Screen capture of interim 3D model showing the midships section (3D model by James Hunter, photos by James Hunter and Irini Malliaros)

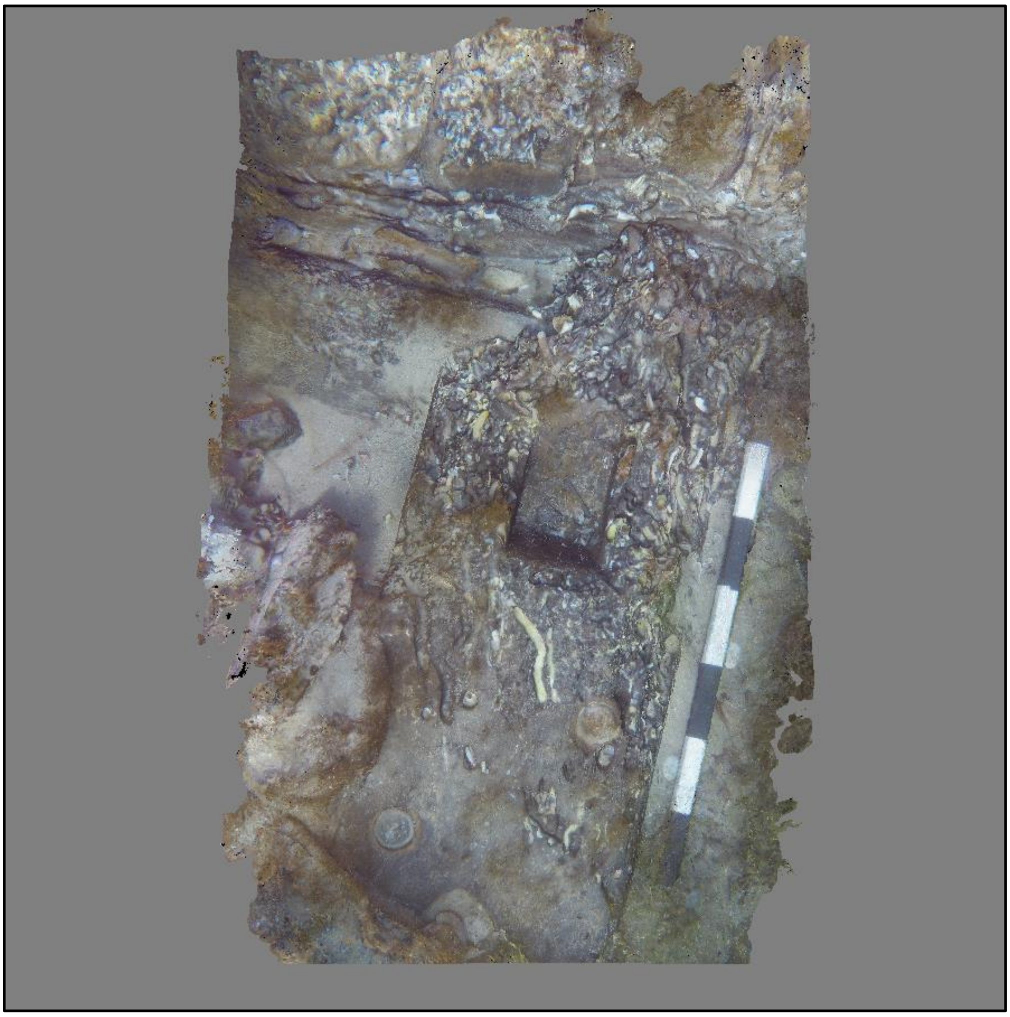


Figure 4.6. Screen capture of interim 3D model of the foremast step section (3D model by Timothy Zapor, photos by James Hunter and Irini Malliaros)

Timber Species Identification

Shipbuilding throughout history has utilised many species of wood including both hardwoods and softwoods. Predominant wood species in each category respectively are: beech, elm, oak; and cedar, cypress, fir, and pine. Properties sought after in ships timbers can include straight grain, durable, strong, and hard (Steffy 1994:256–259). Eight timber samples sent to Jugo Ilic of Know Your Wood laboratory, for species identification are from four different species or species groups: *Tectona grandis* (teak), *Quercus robur* (white oak group), *Pinus cembra* (Siberian pine), and *Ulmus procera* (elm) (Appendix 1). The properties, uses, and distribution of the different species are outlined in Table 4.1.

Table 4.1. The Encounter Bay wreck wood species identification, properties, distribution and uses

Scientific Name	*Tectona grandis*	*Quercus ?*[1]*robur*	*Pinus cembra*	*Ulmus ?*[2]*procera*
Common Name	Teak	English White Oak	Siberian Pine	English Elm
Properties	Straight grained, moderately hard, heavy, low stiffness, excellent decay resistance	Straight grained, excellent decay resistance, hard, heavy	?	Interlocked grain, hard
Geographic Range	Indonesia, India, and Central America	Most of Europe, to Asia Minor, and North Africa	High elevations in Northern Europe	Western Europe
Use	Ship building, indoor/outdoor furniture, joinery, flooring	Cabinetry, furniture, flooring, ship building, barrels	?	Boxes, baskets, ship building, furniture, hockey sticks, veneer, archery bows, paper
South Australian element	Treenail	Keelson, floor, knee, frame, ceiling	Outer hull planking	Inner hull planking

?[1] Indicates one of several species belonging to the white oak group from the northern hemisphere

?[2] Indicates that the wood structure does not permit further differentiation among species

Scanning Electron Microscopy with SDD EDS detector

Semi-quantitative analysis of metal samples using a SEM with SDD EDS detector was undertaken on three bolts and three sheathing fragments. The results of spectral analysis show that the sheathing recovered from the site recently is composed of almost pure copper with small inclusions of carbon (Figure 4.7). All the sheathing samples had similar spectral signatures (Appendix 2). The keel bolts recovered from the site in 2019 show similar compositional results, containing almost pure copper with inclusions of carbon and lead (Figure 4.8). All three bolts had similar spectral signatures as well (Appendix 2). Analysis of the so-called keel bolts that are held at Netley returned different spectral signatures. Spectral analysis revealed that the bolts contain copper and zinc with traces of iron, lead, and tin (Figure 4.9). Both bolts were comprised of similar elements (Appendix 2).

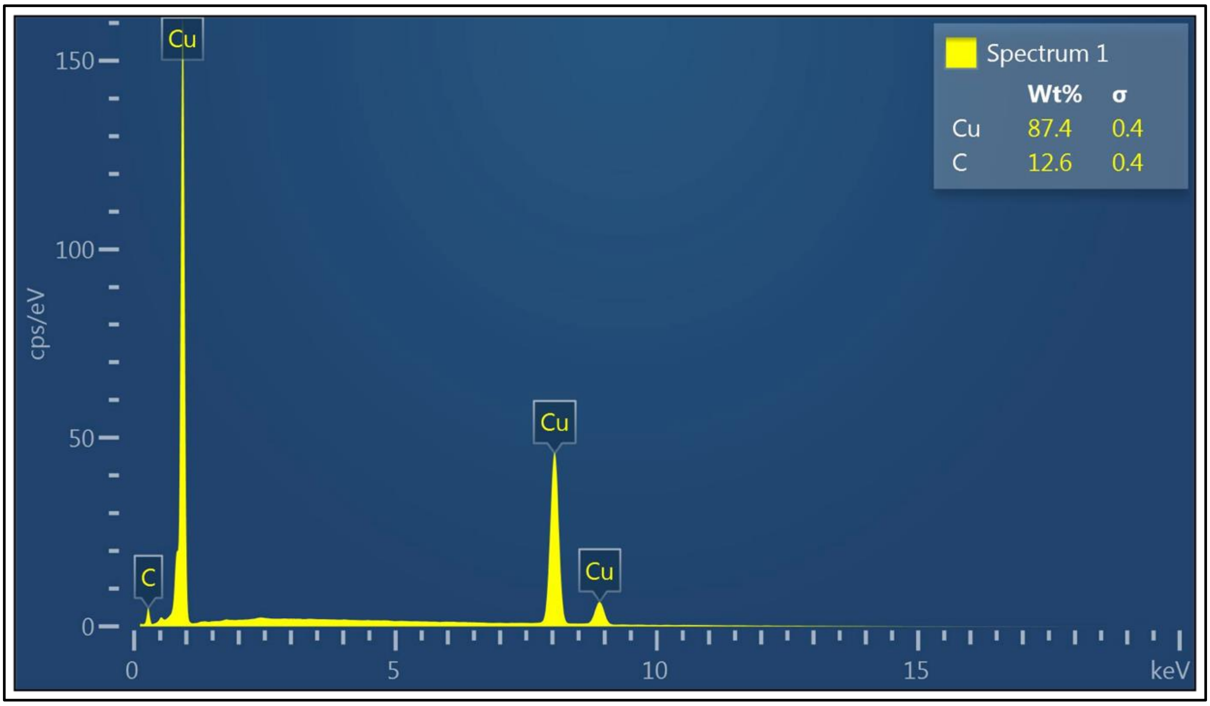


Figure 4.7. SEM spectrum results from SAS sheathing sample 001 (Illustration by Wendy van Duivenvoorde)

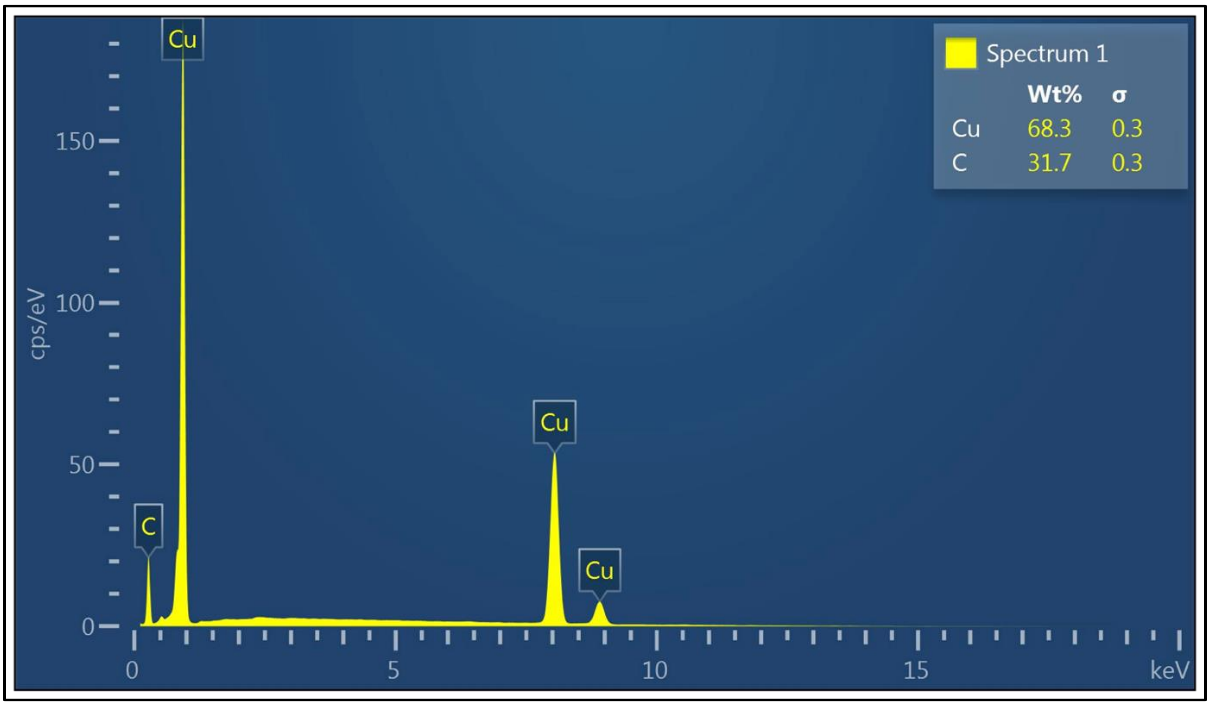


Figure 4.8. SEM spectrum analysis from SAS bolt sample 002 (Illustration by Wendy van Duivenvoorde)

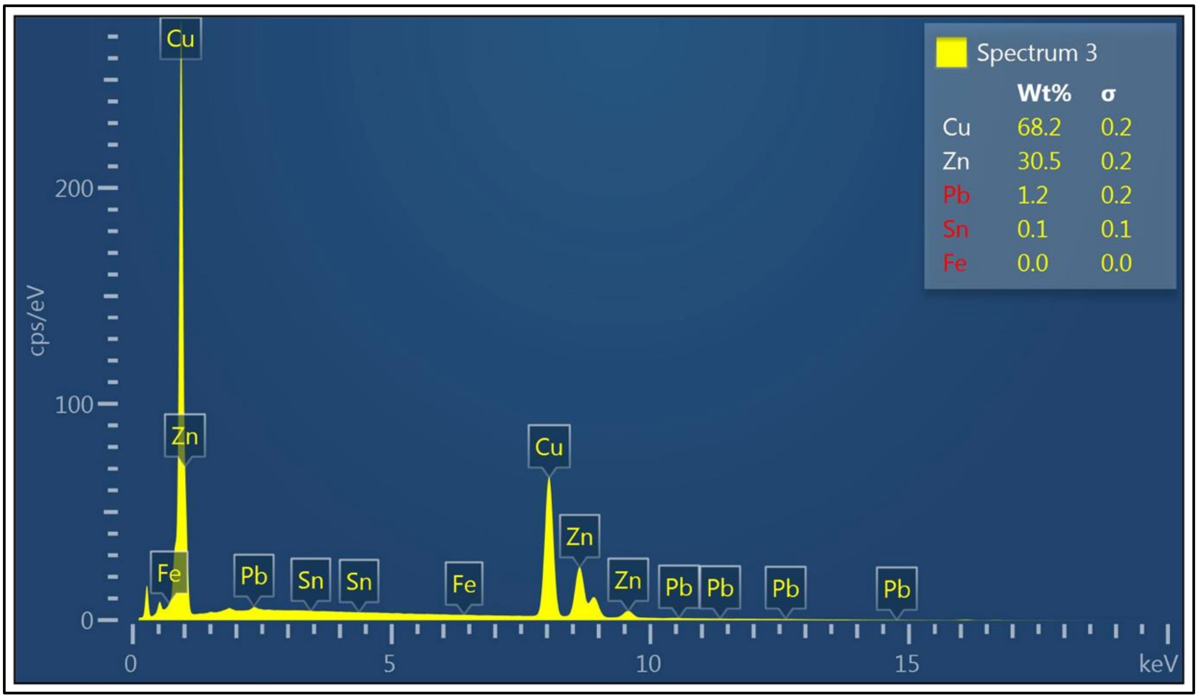


Figure 4.9. SEM spectrum analysis from SA 404 (Illustration by Wendy van Duivenvoorde)

The semi-quantitative results of SEM analysis show the estimated breakdown of identified elements by percentage for each sample and spectrum. The aforementioned preparation method for the samples eliminates surface corrosion thus allowing for 100% identification of composition. The sheathing samples recovered from the wreck site contain an estimated 82% to 89% copper (Cu) with 10% to 17% carbon (C) inclusions (Table 4.2). Keel bolts recovered from the site show higher carbon content with an elemental makeup of 31% C and 68% Cu with two of the samples containing 0.36% lead (Pb) (Table 4.3).

As aforementioned, elemental composition of the keel bolts that are housed at Netley varied from that of the recently recovered bolts and sheathing. The two bolts are comprised of 63–68% Cu, 31–34% zinc (Zn) and 1–3% Pb, with trace amounts of iron (Fe) and tin (Sn) (Table 4.4). The trace elements were measured manually but their almost nihil presence indicates that they were not added in the manufacture of this alloy (van Duivenvoorde 2019:10). This composition matches that of a post-1830's Muntz metal alloy and suggests that the two keel pins held at Netley are from a different vessel and not *South Australian*.

Table 4.2. Elemental composition of ship's hull sheathing, the Encounter Bay shipwreck

	Wt%				Atomic %		
Description	C	Cu	Total		C	Cu	Total
Sample Sheathing 001: spectrum 1	12.63	87.37	100		43.34	56.66	100
Sample Sheathing 001: spectrum 2	12.39	87.61	100		42.79	57.21	100
Sample Sheathing 001: spectrum 3	12.10	87.90	100		42.14	57.86	100
Sample Sheathing 002: spectrum 1	12.14	87.86	100		42.23	57.77	100
Sample Sheathing 002: spectrum 2	10.32	89.68	100		37.84	62.16	100
Sample Sheathing 002: spectrum 3	10.94	89.06	100		39.38	60.62	100
Sample Sheathing 003: spectrum 1	17.35	82.65	100		52.62	47.38	100
Sample Sheathing 003: spectrum 2	12.51	87.49	100		43.07	56.93	100
Sample Sheathing 003: spectrum 3	10.76	89.24	100		38.95	61.05	100

Table 4.3. Elemental composition of ship’s hull fasteners (bolts), the Encounter Bay shipwreck

	Wt%					Atomic %			
Description	C	Cu	Pb	Total		C	Cu	Pb	Total
Sample Bolt 001: spectrum 1	31.00	68.63	0.36	100		70.46	29.49	0.05	100
Sample Bolt 002: spectrum 1	31.75	68.25	–	100		71.10	28.90	–	100
Sample Bolt 003: spectrum 1	31.00	68.63	0.36	100		70.46	29.49	0.05	100

Table 4.4. Elemental composition of two keel pins from the South Australian Shipwreck Heritage collection

	Wt%							Atomic %					
Description	Fe	Cu	Zn	Sn	Pb	Total		Fe	Cu	Zn	Sn	Pb	Total
Sample SA404: spectrum 1	0.06	62.69	34.07	0.00	3.18	100		0.07	64.73	34.20	0.00	1.01	100
Sample SA404: spectrum 2	0.03	64.67	33.51	0.07	1.72	100		0.03	66.10	33.30	0.04	0.54	100
Sample SA404: spectrum 3	0.04	65.63	33.49	0.11	0.72	100		0.05	66.62	33.05	0.06	0.23	100
Sample SA405: spectrum 1	0.00	67.76	31.43	0.04	0.77	100		0.00	68.75	30.99	0.02	0.24	100
Sample SA405: spectrum 2	0.04	67.31	32.04	0.00	0.61	100		0.04	68.21	31.56	0.00	0.19	100
Sample SA405: spectrum 3	0.01	68.15	30.53	0.10	1.21	100		0.01	69.36	30.20	0.06	0.38	100
Spot analysis													
Sample SA404: spectrum 4	0.04	6.69	4.26	0.06	88.94	100		0.12	17.53	10.85	0.09	71.42	100

Historical Research

In relation to the guiding question of this research, which explores the impact to early south Australian whaling that the wrecking of *South Australian* had, this historical study sought to create an image of The Company's whaling practices before, during, and after the wrecking event. To achieve this, Company approaches to whaling in South Australia were investigated. Areas focused on included: types of vessels purchased initially and what for; ships purchased later and why; shipbuilding practices in relation to whaling; types and techniques of whaling planned; and how did plans change in reaction to actual events such as vessel loss? A timeline of important events from 1835 (the creation of The Company) to 1841 (the end of The Company's involvement in whaling) has been created to give visual context to the list of events discussed in this section (Figure 4.10 and Figure 4.11). A life-story of the barque *South Australian* is presented in this section as well.

Life-story of the barque *South Australian*

The barque *South Australian* has a diverse history that began in Little Falmouth (Flushing), United Kingdom in the year 1817 when shipbuilder Richard Symons laid the keel. Two years later the vessel was completed as the Falmouth packet *Marquess of Salisbury* and employed by the Royal Packet Service for mail, passenger, and freight transport in the near-shore and inland waters of Europe (Figure 4.12). Packet ships were medium-sized vessels used extensively in European coastal mail services during the seventeenth to nineteenth centuries that had a variety of different rig configurations including brigs, barques and sloops. The original dimensions of *Marquess of Salisbury* listed a displacement of 236 tons, an overall length of 87 feet (26.5 metres), and a beam and draught measuring 25 feet (7.6 metres) and 6 feet (1.8 metres), respectively (Winfield 2014:282) (Table 4.5). The original rigging configuration is unknown but most likely a brig since this was the most common rigging for Falmouth packets (Hunter 2018). The original captain of the vessel was Lieutenant Thomas Baldock who also had the ship commissioned and may have had a hand in its building (Winfield 2014:282).

In 1823 the Royal Navy took over the operation of the mail service and in 1824 *Marquess of Salisbury* was purchased, refitted as a 10-gun Cherokee class brig-sloop and renamed HM Brig *Swallow* (Winfield 2014:282). Brig-sloops were a two-masted warship manufactured by Britain in the Napoleonic period in two classes, the 18-gun Cruizer class and the 10-gun Cherokee class (Winfield 2014:229). The smaller size of the vessel was more economical than the larger frigates in terms of manpower and could be armed with 32 (Cruizer) or 18 (Cherokee) pound carronades giving them the highest ratio of firepower to tonnage of any ships in the Royal Navy (Winfield 2014:229). Although HM Brig *Swallow* was classified as a 10-gun Cherokee class brig-sloop, records indicate the vessel only carried four 12-pound carronades (Winfield 2014:282).

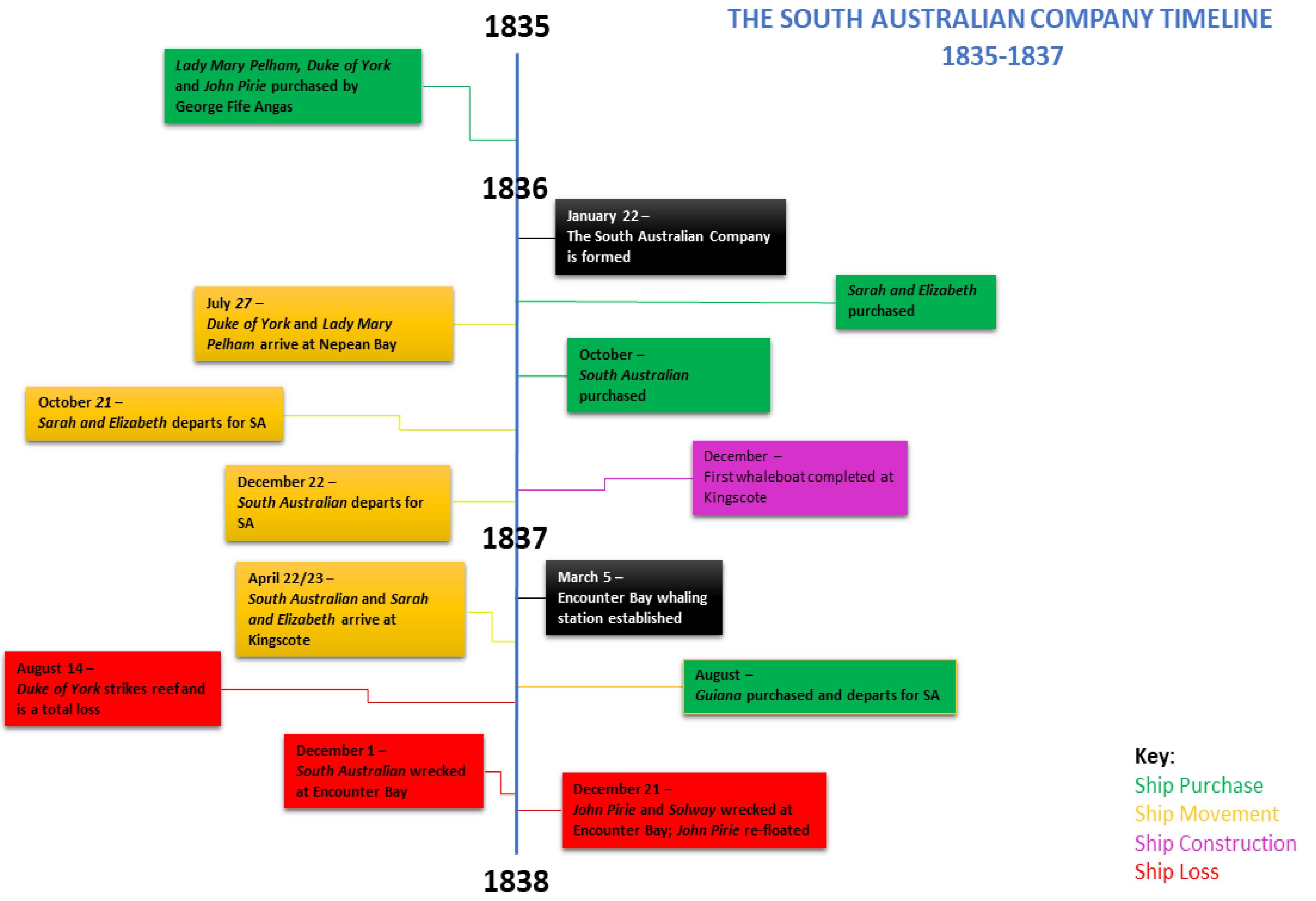


Figure 4.10. The South Australian Company Timeline 1835 to 1837 highlighting important whaling events

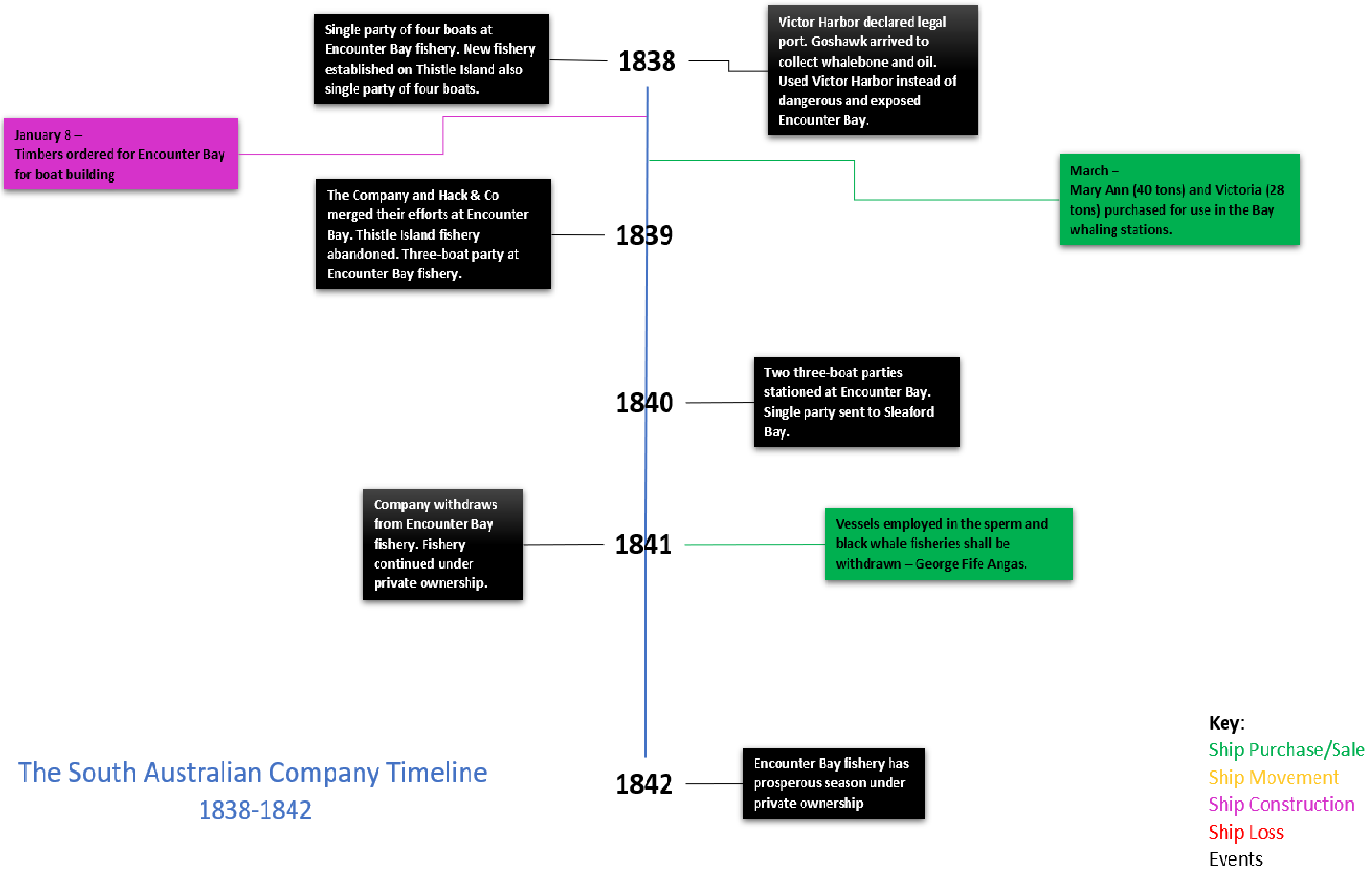


Figure 4.11. The South Australian Company Timeline 1838 to 1842 highlighting important whaling events

Figure 4.12. Watercolour of H.M. Packet *Marquess of Salisbury*, Thomas Baldock Esq.'Commander 1822' by N. Cammillierie (Source: Bruce Castle Museum, UK)

Table 4.5. Recorded statistics of *South Australian* (Bullers 2019:3)

Statistic	**Value**	**Source**
Length overall	87' (26.5 m)	Hunter (2018)
Length of keel	68' 7" (20.75 m)	Winfield (2014); Harrison (2018)
Breadth	25' (7.6 m)	Hunter (2018)
Breadth	25' 1" (7.6 m)	Winfield (2014); Harrison (2018)
Depth	6' (1.8 m)	Hunter (2018)
Burthen	236 tons BM	*Lloyds Register* (1824); Harrison (2018)
No. Decks	2	*Lloyds Register* (1824)
Complement	2-9P and 21 men (peace establishment)	*Lloyds Register* (1824)
Complement	28	Winfield (2014)
Guns	*Nominal*: 10-gun *Armament*: 4 British 12-pound carronade (broadside weight: 24 Imp. lb [10.9 kg])	Winfield (2014); Harrison (2018)

The smaller size of the vessel left little room for water and provisions however and coupled with the shorter range of the carronades these vessels were better used for coastal enterprise rather than long sea voyages; although the Royal Navy did employ them to carry mail to their overseas colonies. HMS *Swallow* continued service as an overseas mail runner, mostly to the American colonies and the

Caribbean, out of Falmouth under the charge of Lieutenant Commander Thomas Baldock, RN until 1831 when he was replaced by Lieutenant Smyth Griffith, RN (Olenkiewicz 2018a, 2018b; Winfield 2014:282). In September 1836 *Swallow* was purchased by the South Australian Company, registered in London and renamed *South Australian*.

The South Australian Company refitted the vessel as a barque with the intent of ferrying emigrants and cargo to Australia to begin a new colony of free peoples in partnership with England for mutual economic gain. On 22 December 1836 the ship set sail from Plymouth under the command of Alexander Allan, Jr with a cargo of 60 (mostly) British and German emigrants and breeding stock of two Devon bulls, two Devon heifers, twenty pigs, and twenty Cashmere goats. Of the emigrants on board, many were skilled labourers and included 'five fishermen, four shipwrights, a butcher and salter, a smith and farrier…two German vine-dressers [and] a flax grower' (State Library of South Australia 2017). Other persons of interest aboard *South Australian* included David McLaren (second colonial manager of South Australia), John and Samuel Germein, and ship surgeon Dr. William H. Leigh. En route to South Australia, the vessel made port in the South Atlantic island archipelago of Tristan de Cunha and the Cape of Good Hope, South Africa before arriving at Kingscote, Kangaroo Island on 22 April 1837 (State Library of South Australia Archives [SLSAA], South Australian Company, BRG 42/78/30, Log book of the proceedings on board the *South Australian*, 1 November 1836 - 25 October 1837).

After arrival in South Australia the vessel was employed for economic purposes as a whaling vessel for the South Australian Company. The vessel made three voyages from the company's headquarters in Nepean Bay to the whaling station at Rosetta Harbor, Encounter Bay to run provisions, cargo, personnel and the occasional passenger (Hunter 2018). In May of 1837, *South Australian* made a voyage to Encounter bay carrying whaling equipment for the Encounter Bay station. The vessel was then refitted as an offshore whale processing platform or 'cutting-in' vessel and made one last round trip voyage to Kangaroo Island in November 1837 where command of the ship was changed to Captain JBT MacFarlane (Bullers 2017:4). Upon its return to Rosetta Harbor, *South Australian* was loaded with the station's takings from the whaling season (200 barrels of whale oil and 10 tons of whale bone) and prepared to transfer the cargo to the ship *Solway* that was scheduled to arrive in Rosetta Harbor shortly. On 8 December 1837, while awaiting the delayed *Solway*, the vessel was caught in a strong south-easterly gale which caused the ship to slip its mooring cable and wash inland striking Black Reef stern-first. Even though the captain had ordered the lower yards and topmasts lowered to the deck before breaking loose, the heavy action of the sea washed the vessel over the reef (Durrant 2014a, 2014b).

The hull was significantly damaged in the wrecking and the vessel settled in the shallows inshore with water quickly filling up the hold. Luckily no lives were lost and the crew was able to recover their personal belongings. Over the next few weeks the ship was salvaged for any useable parts and cargo, however the deepest part of the hold was underwater and remained largely inaccessible; the items within were not recovered (State Library of South Australia Archives [SLSAA] Business Record Group {BRG} 42/78). *Solway* finally arrived in Rosetta Harbor around 18 December and was subsequently lost in a near identical south-easterly gale that pushed the ship onto Black Reef on 21 December 1837 causing a total loss of the vessel. Salvage efforts transitioned to *Solway* and no further salvage of *South Australian* is recorded.

The South Australian Company Whaling Ventures

It is well documented that The Company had great interest in whaling from the very beginning, as can be seen in their prospectus, which lists whaling among their first goals (The South Australian Company 1835). It was such a priority that the man behind the creation of The Company, George Fife Angas, purchased two vessels and fully equipped them for the pursuit of sperm whale in the South Seas Fishery even before The Company was formed (SLSAA BRG 42/1). These vessels, *The Duke of York* (190 tons) and *The Lady Mary Pelham* (207 tons), both Falmouth packet ships, were purchased by Angas from the Royal Packet Service, London and Liverpool respectively, in the latter half of 1835 (SLSAA BRG 42/17:13, First report of the directors of the South Australian Company, 1836). A third vessel, *John Pirie* (106 tons) was also purchased by Angas for more general mercantile use but also with off-shore whaling in mind (SLSAA BRG 42/17:13). These three vessels were purchased and outfitted under the assumption that if The Company was formed, they would be transferred at cost for the specific purposes of whaling. On January 22nd, 1836, The Company was formed and purchased the three vessels from Angas for a total of £3,175 (SLSAA BRG 42/1:24).

Shortly after the creation in 1836, a fourth vessel, the third purchased specifically for the sperm whaling enterprise, was acquired. *Sarah and Elizabeth* (269 tons) had been unsuccessful in the northern whale fisheries and so was refitted for the South Seas Fisheries and instructed to head to South Australia and take any whales they could along the way (SLSAA BRG 42/17:22–23, The first supplement to the first report, 7 April 1837). The fourth whaling vessel was purchased in October of 1836. *South Australian* (236 tons), a Falmouth Packet owned by the Royal Navy, was acquired and refitted to be of use in bay whaling as a coasting vessel (SLSAA BRG 42/1:100). This vessel was different than the previously purchased ships in that it was not sent with a full crew and supplies for whaling. The directors believed a crew would be found upon arrival in South Australia and so the ship was loaded instead with a skeleton crew of five officers, three apprentices, and eight Greenland whalers along with livestock and immigrants and sent to Kingscote on December 22nd, 1836 from Plymouth (SLSAA BRG 42/28). Arriving at Kingscote April 22nd, 1837, The Company was unable to find a crew for *South Australian*. Unable to be utilised for its intended purpose, *South Australian* was sent to Encounter Bay to be used as a ‘cutting-in’ vessel, helping in the processing of whales, which led to the ships eventual loss some months later (SLSAA BRG 42/28:74–75, D. McLaren to E.

Wheeler, 16 May 1837). Finally, a fifth whaling vessel, *Guiana* (tons), was purchased by The Company in August of 1836 and departed quickly for the new colony (SLSAA BRG 42/16:18).

At this point it is important to note that The Company had two whaling ventures planned; pelagic whaling, in what was known as the South Seas Fishery, and bay or off-shore whaling which was to be established upon arrival in the many coastal bays of the region (Figure 4.13). The target of the deep-sea fisheries was sperm whales, while the bay whaling targeted the black or 'right' whales. The focus during the initial purchase and outfit of ships was provisions for pelagic whaling, which was planned to be ready for the 1837 season and provide immediate income for The Company. Bay whaling would be a secondary focus once the colony was underway and ideal locations chosen (SLSAA BRG 42/17:21, First annual report). The establishment of the fishery at Encounter Bay was the result of a rivalry between a Captain Blenkinsopp and the then colonial manager for The Company, Samuel Stephens. Blenkinsopp proposed a joint effort in bay whaling at Encounter Bay which was refused outright by Stephens. That very night, Stephens sent a small party to Encounter Bay under the cover of darkness and claimed the bluff location in the name of the Company (SLSAA BRG 42/28, S. Stephens to G.F. Angas, 27 December 1836).

Figure 4.13. Depiction of pelagic sperm whaling. *Barque Terror commencing after sperm whales* (1840s) (Source: ANMM Object #00038532)

The proceedings and intricacies of The Company's bay whaling ventures were not documented as extensively as the sperm whaling industry. A vivid picture of bay whaling practices in Encounter Bay is described by a G.B.W. in the *South Australian Register* (Barrow 1947:5–8) (Appendix 3)

Two other locations, Thistle Island and Sleaford Bay, had brief usage as bay whaling stations for The Company but due to poor production did not last more than one season. The first season of bay whaling in 1837 saw the wreckage of three Company vessels at Encounter Bay; *South Australian, Solway,* and *John Pirie* (which was re-floated). These vessels were not being used to hunt and capture the black whales but were instead anchored there to collect the seasons takings for transport back to England—with the exception of *South Australian,* which was being used as a processing platform for the whales as mentioned above—the company had both the vessels and cargo insured (SLSAA BRG 42/16:11–16). The following season saw the disuse of Rosetta Harbor as an anchorage, instead using the anchorage under Granite Island. In one documented instance, a captain anchoring to collect the seasons takings of oil and bone refused to use Rosetta Harbor due to the unsafe anchorage. This led to increases in costs as smaller vessels were chartered to transport the oil and bone from the whaling station out to the vessels at Victor Harbor (SLSAA BRG 42/28, D. McLaren to E. Wheeler, 21 August 1838; G. Martin to G.F. Angas, 13 October 1838).

Through annual reports to the directors and other documents it is known that the Encounter Bay fishery was using one-to-three teams comprised of three-to-four whaleboats during each of the seasons from 1837 to the abandonment of the industry by 1841 (see Figure 4.10 and Figure 4.11) (SLSAA BRG 42/17). These whaleboats were small wooden vessels that were mainly built on site (Figure 4.14). From a letter to the directors from a Mr. C. S. Hare, the first whaleboat was completed at Kingscote in December 1836 (SLSAA BRG 42/17). Further evidence of shipbuilding can be seen in a list of goods ordered by The Company:

> 6 January 1838 – Encounter Bay, timbers ordered for boat building. 3 March 1838 – order made by Hart, Captain of the barque Hope – Order placed at Kingscote for timber and goods for Kingscote and port Adelaide. 100 loads of best Condie New Zealand vine logs of from 12 in to 18 in square averaging 24 feet long. 50 loads of best Condie New Zealand vine plank 2, 3 and 4 inches thick. New Zealand timber for boat knees and boats timbers, six spars each 46 feet long, calloper 9 m in the middle suitable for masts for cutters, six spars of 33 feet long same calloper, 30 or 40 spars suitable for boat masts not less than 35 feet long (SLSAA BRG 42/91).

While the whaleboats and other small coastal vessels were presumably built at several locations (Kingscote, Encounter Bay, and Port Adelaide) in South Australia, two small vessels were specifically purchased for use in bay whaling as well; *Mary Ann* (40 tons) and *Victoria* (28 tons) were purchased in March 1838 (SLSAA BRG 42/28, D. McLaren to G.B.T. McFarlane, 20 February 1838; BRG 42/9, D. McLaren to E. Wheeler, 4 April 1838). These vessels are the only documented ships purchased in South Australia by The Company for whaling. The five large vessels purchased specifically for the pursuit of sperm whale all came from England and no evidence of large shipbuilding or local purchase has been found.

Figure 4.14. Depiction of a whaleboat. *The Chase* – Duke, William (1848) (Source: https://trove.nla.gov.au/work/235239567 accessed: 13 October 2019)

Movement of the five large vessels through the sperm fisheries from 1836 to 1841 is a complicated subject that can be followed in the provided sources and therefore will not be discussed in depth here. These ships were often out on the open ocean for years at a time. Important to note is that these vessels, again with the exception of *South Australian*, were used consistently to hunt sperm whales in the deep sea from 1836 until 1841 when all of them were sold and the sperm whale industry was abandoned by The Company. Several of the vessels were used for cargo transportation or laid up in various locations for repairs for significant periods of time and few had successful whaling seasons save for *Guianna* (SLSAA BRG 42/17). Overall the pelagic whale industry was not a profitable one for The Company. As aforementioned, the loss of *Duke of York* on an unknown reef in 1837 was the only loss that happened during a pelagic whaling cruise and both the ship and part of the cargo had been insured.

Conclusion

The wreck site survey combined with the timber species identification and metal analysis offer details about the construction and origins of the Encounter Bay wreck. This data cross-referenced with the documentary research yielded data that aids in the identification of the vessel. The historical research also allows for a thorough and detailed investigation into the impact of the loss of *South Australian.* The next chapter will discuss in detail the results of archaeological data collection and historical research.

Chapter 5 – Discussion

Introduction

Using the Encounter Bay shipwreck as a case study, different methods of vessel identification where investigated to provide an accurate affiliation for the wreck. This affiliation may be more than just a name, as a name is just one type of identification. The construction style, culture or location are other types of associations that are important in identifying a wreck. The abundance of historical records relating to the time period and area provide excellent comparison for the collected archaeological data and help make a positive identification. The historical records also provide a platform for the exploration of causality surrounding the loss of an influential vessel in a fledgling whaling colony. Since comparable archaeological studies in the region and area of study are scarce, this research provides insights into how a cultural study, that relies on historical information with limited archaeological data, can be utilised.

Identification of the Encounter Bay Shipwreck

Harpster's Type A affiliation is one that refers to a specific ship from the past. The name of a vessel is found in historical sources and then a site is searched for that fits that vessel's perceived characteristics to make a positive affiliation (Harpster 2013:592–593). As described in the introduction, the search for *South Australian* fits squarely into this category of vessel identification methodology. *South Australian* was chosen due to its significance to South Australia, ease of access to wrecking location, and wealth of historical documentation. The approach to the identification of Type A sites is straightforward compared to affiliations that deal with the discovery of unknown physical remains first and name affiliation second. Since characteristic data such as wrecking location, construction type and material, and cargo pertaining to the vessel is already known, affiliation through simple archaeological survey methods is plausible. Site-plan mapping of *in situ* remains is ideal to compare relationships between structural elements and that of the known building style. Since the origin and construction style of *South Australian* is known, timber species identification and metal analysis provide invaluable data that reinforces the historical affiliation of the vessel.

Timber Species Identification

Nine vessels are known to have sunk in the Encounter Bay and Victor Harbor region with several near the location of the Encounter Bay wreck (Coroneos 1997) (Table 5.1). The three vessels that are estimated closest to that of the Encounter Bay wreck, *Alpha* (1847), *Jane and Emma* (1852), and *Ferret* (1900) are Australian-built sailing vessels and therefore likely to contain wood species native to Australia or New Zealand (Bullers 2019:11). Due to this fact, knowing the origin location for the timbers found in the wreck greatly aided in a positive identification. If the timbers sampled had been of Australian or New Zealand origin, the process of identification would have had to consider a larger variety of evidence.

Table 5.1. Chronological List of Shipwrecks in the Encounter Bay Area (Bullers 2019:11)

Vessel Name (Year of Loss)	Vessel Type	Location	
South Australian (1837)	Barque	35° 34.641’S; 138° 36.213’E	Rosetta Harbor
Solway (1837)	Ship	35° 35.048’S; 138° 36.119’E	Rosetta Harbor
Alpha (1847)	Schooner	Unknown: near Rosetta Head	Rosetta Harbor
Jane and Emma (1852)	Cutter	Unknown: near Rosetta Head	Rosetta Harbor
Lady of the Lake (1877)	Timber Barge	Unknown: near Victor Harbor	Encounter Bay
Ferret (1900)	Cutter	Unknown: off Wright Island	Rosetta Harbor
Triton (1908)	Launch	Unknown: off Granite Island	Encounter Bay
Mary (1938)	Iron Barge	Unknown: off Granite Island	Encounter Bay
Galini (1981)	Fishing Vessel	Unknown: near Victor Harbor	Encounter Bay

The original designs i.e. ship lines or construction drawings, of *South Australian*, or *Marquess of Salisbury*, as the vessel was originally named, were not found. Therefore, original building materials or details are unknown; however, it is understood that the ship was originally constructed in Little Falmouth (Flushing), England (Winfield 2014:282). It is likely that a post office packet built in Falmouth in the early 1800s would be constructed from timber found, or imported, in Europe. Of the four species identified from samples taken off the shipwreck in Encounter Bay, three of these species are woods found abundantly in Europe and are known to have been used in shipbuilding, and specifically British shipbuilding during the time period (Steffy 1994:256–259).

Most elements sampled on the Encounter Bay wreck returned a wood identification of European Oak (*Quercus robur*). This wood is found on numerous wrecks and was historically important in European commerce and warfare (Steffy 1994:256). English Elm (*Ulmus procera*), found as the inner hull planking, is a favoured wood found in English warships, generally used for keels; however, HMS *Dartmouth* (1655) and *Yarmouth* (launched 1695) had both planks and keel fashioned from elm and may have been used if a lack of other suitable materials were unavailable, or less readily available as in previous times (Steffy 1994:257). Siberian Pine (*Pinus cembra*) is an interesting identification. Although pine was frequently used as sheathing or ‘sacrificial’ planking in British ships, the use of the rarely seen, high-elevation variety of pine found mostly in Alpine Europe may indicate a misidentification (James Hunter and Rick Bullers pers. comm. 2019). It is likely that the pine would be a more common variety found in ships, such as Maritime Pine (*Pinus pinaster*) which is found along the Mediterranean coast from Italy to Portugal and along the Atlantic coasts of Portugal and France (Steffy 1994:258).

The outlier in the otherwise European-based timber identifications, is the presence of a Teak (*Tectona grandis*) treenail. Found in forests across Indonesia, India and Central America, Teak is a common wood found in shipbuilding due to its hard nature and excellent decay resistance. This outlier however, may further solidify the identification of the Encounter Bay shipwreck as *South Australian.* In its early career as HMS *Swallow*, the vessel made frequent trips to the Americas and the Caribbean (Olenkiewicz 2018a, 2018b). It is also documented that the vessel was caught in a storm while in the Caribbean, nearly dismasted, and put into Cuba for repairs (*The London Standard* 20 December 1834). The presence of a teak treenail could be indicative of these, or other, repairs while travelling outside of European waters. The plank the teak treenail was embedded in, as well as other treenails found on the vessel will need to be sampled to reinforce this hypothesis. To further support the conclusions of the timber species identification, metal analysis of fasteners and copper sheathing found on site was carried out.

Metal Analysis

Wooden ship hulls are exposed to elements such as wind and water but also detrimental biological organisms like 'ship worm' (*Teredo navalis*) and the 'gribble' (*Limnoria terebranshas*); ocean dwelling molluscs and crustacea that feast on wood. Throughout history, shipwrights have tried various methods to protect the wooden hulls of ships from these dangers. Methods have included sacrificial planking, antifouling compounds, filling nails, and metal sheathing (lead, copper and mixed metal) (Bingeman et al. 2000:218–220). Use of copper sheathing as a general practice appears after 1761 when the Royal Navy covered *Alarm*'s hull, however, there are reports of copper sheathing on Chinese junks in the early seventeenth century (Bingeman et al. 2000:220; Kemp 1976:777; McCarthy 2005:102). Copper sheathing was initially used as a protective measure, but it was quickly realised that the coppering provided a strategic advantage as well. It was found that the coppered ships achieved greater speeds and manoeuvrability as well as faster refits (McCarthy 2005:107; Rodgers 1993:296). This was confirmed by several captains after fighting the French Navy at the Battle of the Saints (1782) (Bingeman et al. 2000:221–222)

Pure copper was used in ship hull sheathing up until 1832 when George Fredrick Muntz developed yellow metal, a 60 percent copper and 40 percent zinc alloy, also known as Muntz metal (Flick 1975:74). There are several reasons the brass mixture was superior to pure copper sheathing; expense and durability being the biggest. It was quickly discovered that pure copper sheathing reacted catastrophically with iron fasteners. Iron fastenings were preferred over copper due to hardness and inexpensive production costs. With the introduction of copper sheathing it was discovered that the corrosion caused between the iron fasteners and copper sheathing would eventually cause the bolts to become ‘iron sick’ or slack in the timbers (McCarthy 2017:109). Fasteners of pure copper were found to be too soft for hammering and different types of composite fasteners were experimented with throughout the nineteenth century (McCarthy 2005:102–107). The problem was partially resolved in 1783 when William Forbes and others began experimenting with new methods of manufacturing copper and copper-alloy fasteners that resulted in hardened copper bolts (McCarthy 2005:105–107). Even so, the use of copper fasteners was only worthwhile in situations where galvanic action was a concern such as below the waterline and iron was still preferred in most situations.

Metal analysis of ship sheathing is performed for a similar reason, and in conjunction with, timber species analysis. Knowing the composition of the metal can allow archaeologists to discern a general time period that the sheathing was created; pre- or post- 1832 for example. While timber species analysis gives a likely location of construction. As aforementioned, it is likely that the vessel was constructed in Europe; metal analysis has shown a composition of almost pure copper for the sheathing samples, indicating that the sheathing was made before Muntz metal-type alloys were used. Combining these two data sets points to a vessel built in Europe before 1832. This information reaffirms the historical record and further indicates the likelihood that the wreck is that of *South Australian*, which was built in England in 1819. Furthermore, analysis of copper sheathing recovered from British shipwrecks in Australasian waters that have been dated to the same period as The Encounter Bay wreck has shown nearly identical compositional results (Wendy van Duivenvoorde pers. comm. 2019).

Site Interpretation

Since this project represents the first archaeological data collected for the Encounter Bay wreck, initial analysis of the articulated wooden structure is quite rudimentary and limited to the exposed elements. A more complete and detailed survey of the remaining wooden structure is needed to fully compare the building style with historical sources. Initial analysis of the exposed port bow and midships region of the wreck reveals solid cant frames oriented in a way that suggests a vessel with fine lines (Bullers 2019:23, 27). As a Post-Office packet, *South Australian* would have most likely been built for speed. The lack of any wooden elements above the hull (i.e. masts, rigging, etc.) may also be a good indication that the wreck is that of *South Australian,* as the logbook mentions that much of the vessel was salvaged after the wrecking event; however, the lower cargo hold was underwater and largely inaccessible during salvage attempts. The portion of the wreck still covered by the mound of seagrass and sand would likely be covering the lower cargo hold.

The orientation of the wreck site is also worth noting. The remains lie in a general east-west orientation at an approximate 45° angle to the shore, with the bow of the vessel pointed outwards (east). This orientation can be seen in contemporary historical sources of the wrecking event of *South Australian;* particularly in a lithograph attributed to Robert Pearson depicting the vessel shortly after the wrecking (Bullers 2019:27) (Figure 5.1). This lithograph also shows the wrecked vessel listing to the port side. The remains are canted to the port side as can be observed in the exposed keel-bolts that are at a visible angle (Figure 5.2). The upper sections of the copper-alloy keel bolts rise above the sediment as much as 700 mm in some areas (Bullers 2019:27). Much of the wooden structure that remains is along the port side and has recently been uncovered, judging by the pristine nature of some of the timbers. If the vessel had been leaning to port after wrecking, much of that side would have probably been buried and protected from the currents while the exposed starboard side would have been more susceptible to breaking down and being removed from the site. The archaeological record reflects this scenario.

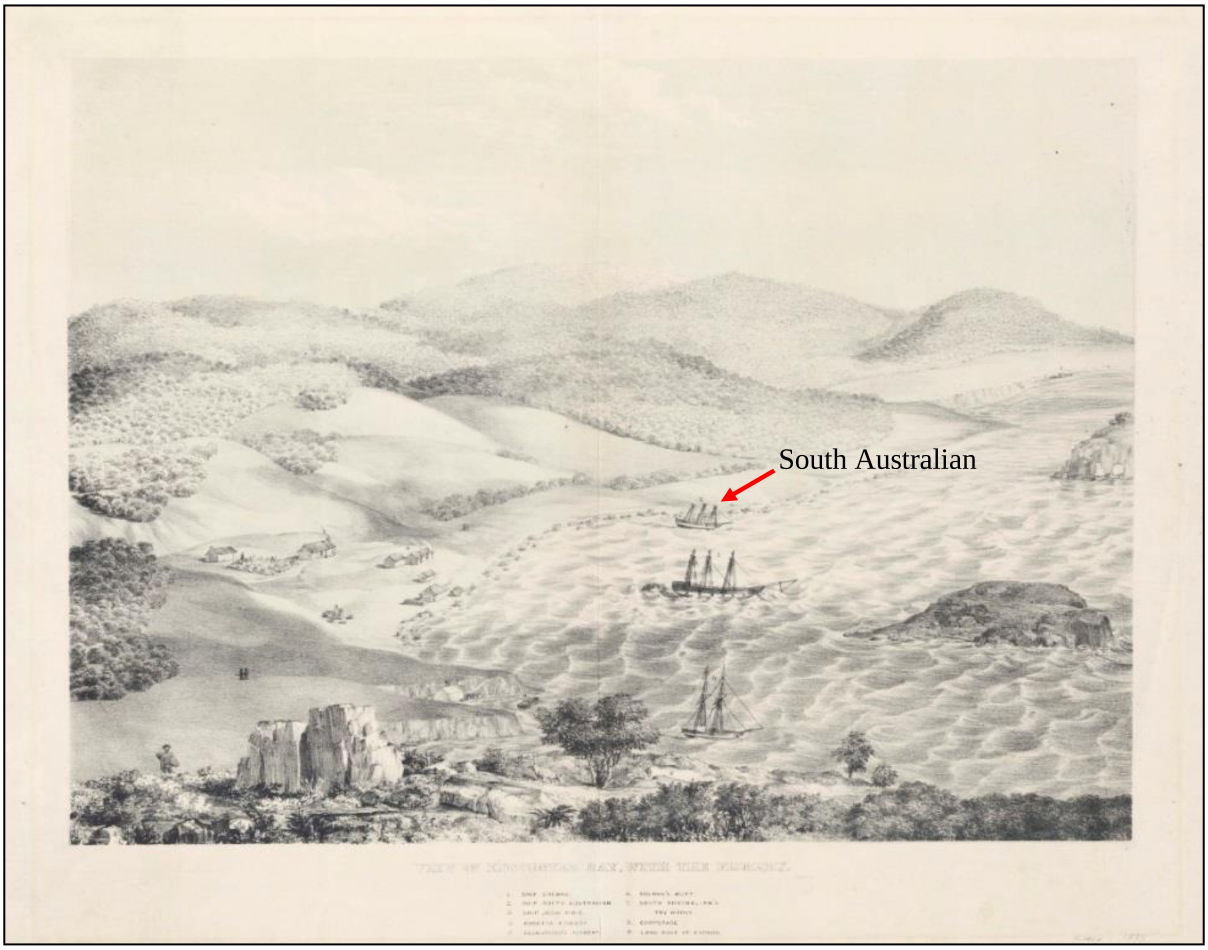


Figure 5.1. 'Views of Encounter Bay, with Fisheries'. Lithograph attributed to Robert Pearson, showing the wrecks of South Australian and Solway, prepared c. January 1838 (Source; NLA ID 2125556)

Figure 5.2. Keel-bolts protruding out of sand with an obvious angle to port side (Photograph by Timothy Zapor)

Artefact analysis is also a useful tool to affiliate a wreck with a certain time period or culture. Since the fieldwork done so far on the Encounter Bay wreck has been limited to a (mostly) pre-disturbance survey, many artefacts still remain on site. During the final days in the field, certain 'at-risk' artefacts were recovered. These artefacts were chosen for recovery due to diagnostic characteristics and their exposure on the site. Artefacts recovered included glass bottles, ceramic fragments and a gun flint. These artefacts are currently undergoing conservation at the South Australian Maritime Museum.

Artefacts that were observed on site included stoneware, glass and ceramic fragments, intact glass bottles, a copper wash basin, a cow tooth, gun flints, and lead scuppers (Figure 5.3 and Figure 5.4). While these artefacts have yet to be fully recorded, a surface analysis can aid with their placing the wreck within a certain time frame and confirm its cultural affiliation. The presence of a cow tooth and gun flints, for example, are of special importance. The cow tooth may be indicative of the livestock that was known to be carried by *South Australian* on the voyage to South Australia, while the gun flints point to another documented historical event. During its time as a 'cutting-in' vessel at Rosetta Harbor, *South Australian* was being used by the director of the company as a command vessel. While anchored in the bay, an altercation between the director and a rival whaler took place involving shots being fired from the deck of *South Australian* (Diamond 1955:222). This story may confirm the presence of firearms aboard the vessel prior to the sinking event and explain why gun flints were found at the wreck site.

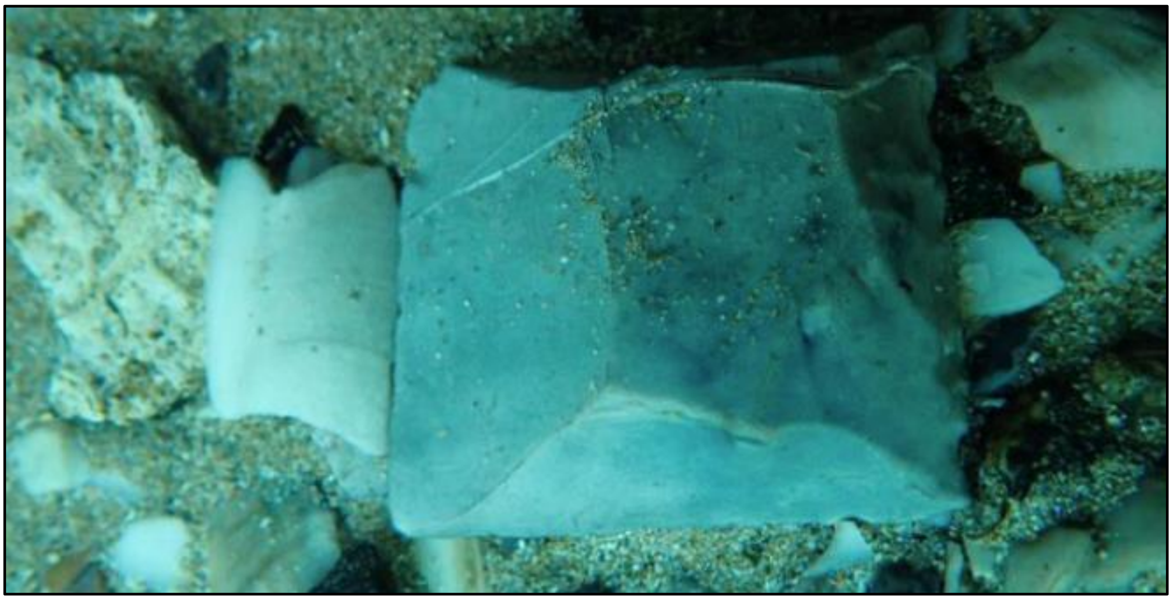


Figure 5.3. One of two large gun flints, measuring 4–5 cm square, uncovered in the May or July inspections (Photograph by Irini Malliaros)

Figure 5.4. A cow tooth found adjacent to starboard hull planking during the 2019 fieldwork (Photograph by Timothy Zapor)

Impacts of Vessel Loss

Analysing the impact that the wrecking of *South Australian* had on The Company's whaling industry requires an in-depth look at the overall practices and plans that The Company had in place in South Australia. These practices are laid out in detail in Chapter 4 – Results. As aforementioned, two different whaling ventures were planned; pelagic whaling, and shore-based whaling. Pelagic whaling was the primary focus and was intended to provide large amounts of income to The Company while establishing the new colony of South Australia. The shore-based whaling industry was to be established upon arrival and would utilise small wooden vessels, called whaleboats, produced on site.

These small vessels hunted southern right whales from whaling stations like the one at Encounter Bay. This practice was the most widespread and popular form of colonial whaling as it was relatively cheap to set up and operate (Nash 2003:15).

Five vessels in total were purchased with the specific purpose of being used as pelagic whaling vessels; *Duke of York, Lady Mary Pelham, Sarah and Elizabeth, South Australian,* and *Guiana*. These vessels were fully equipped for voyages of months or years chasing sperm whale throughout the Pacific Ocean. There is some discrepancy in the historical record about the intended use of *South Australian.* Some records mention that the vessel was purchased for use in the south seas fishery, which is the name given to the regions of the Pacific where sperm whale was hunted; while some records mention it was purchased as a bay whaling or coasting vessel. Bay whaling is an intermediary between pelagic whaling and the shore-based approach. Essentially a large sailing vessel that coasts up and down the shallow waters of the South Australian mainland hunting the southern right whales that frequent the bays and shallow waters. As mentioned previously, neither of these roles were carried out by *South Australian* due to lack of crew and the vessel ended up sinking in Encounter Bay while aiding the Encounter Bay whaling station.

Since the wrecking happened while being used for shore-based whaling, it can be stated that the event did not have an impact on the pelagic whaling industry; however, this may not be entirely true. A crew might have been found at a later date and the vessel swapped between the two industries. Earlier that year, The Company had lost *Duke of York* and it would later be found out *Sarah and Elizabeth* was so riddled with rot that it would wind up in dry-dock for the better part of a year, costing The Company large amounts of money (SLSAA BRG 42/17). Without the early loss of *South Australian*, the vessel may have been available for use in the pelagic whaling industry. With an additional vessel and greater success, the decision to abandon pelagic whaling by 1842 may have been altered. This hypothesis is purely conjecture and without a different outcome can never be proven one way or another.

What can be seen in the historic record is the immediate effects upon shore-based whaling caused by the loss of two valuable ships. In the historical sources, the loss of *Duke of York*, *South Australian*, and *Solway* were met with an almost dismissive response by management; These losses were the result of misfortune in an unknown land, the vessels and cargo were insured and they made plenty of money for The Company by chartering immigrants to the new colony, so we shall continue on without pause or change of course (SLSAA BRG 42/16:11–15). What does seem to happen however, is increasingly bad business decisions with direct negative effects due to the outcomes of the losses, especially of *South Australian.*

The most obvious change is the eventual establishment of an official port at Victor Harbor. Prior to the port being created, The Company had been using Rosetta Harbor as an anchorage to supply the whaling station at Encounter bay; to devastating effect. Clearly not a properly sheltered harbour due to lack of protection from southerly and easterly winds, captains refused to anchor at Rosetta Harbor, instead choosing nearby Victor Harbor. This forced the company to charter smaller vessels in order to move supplies and the seasons taking from the station at Encounter Bay to Victor Harbor. Not only was the company chartering these smaller vessels, but larger tonnage vessels to take the place of the lost *South Australian* and *Solway*. Instead of purchasing new vessels, some of these vessels were chartered for months or years on end; one such vessel was *Goshawk* (SLSAA BRG 42/28, Agreement with Captain Robert Laing, of the *Goshawk*, 24 July 1838). This cost The Company large amounts of money that drastically offset the takings from the Encounter Bay Station. Two small vessels were purchased specifically for use in shore-based whaling after the wrecking event. The records make no mention of how these ships were used, but it can be assumed they were utilised for tasks such as cargo and supply transport in the bays and coastal waters that *South Australian* and *Solway* had previously been used in.

Another change to the logistics of bay whaling is the apparent abandonment of the use of 'cutting in' vessels. A 'cutting in' vessel provided a mobile platform in the shallows near the station where the freshly caught whales could be flensed into manageable pieces to be taken to the tryworks on land (Nash 2003:22–23). After the wrecking event, no mention of any use of 'cutting in' vessels is made in the records. This may be a direct result of realising that Rosetta Harbor was not a safe anchorage or The Company may have used smaller vessels in this role, such as the two newly purchased ships, and the information simply did not make it into the record.

When looking at these direct outcomes, it can be seen that the loss of *South Australian* did not cause a change in the actual practice of whaling; that is to say, the physical manner in which the animals were hunted remained the same. The changes that did occur were more logistical in nature. Changes to the processing of whales in the form of 'cutting in' vessels and changes in cargo and supply transport to stock the station and carry the seasons takings away back to England. The establishment of the official port at Victor Harbor was also undoubtedly influenced by the wrecking event as well, if not a direct cause.

This research began with a hypothesis that the loss of *South Australian* and *Solway* caused a shift in the size of vessels used in Encounter Bay as shown in the archaeological record. While this is clearly true—the purchase of smaller ships to be used in bay whaling and the use of Victor Harbor instead of Rosetta—it may have been an accidental effect. *South Australian* was never meant to be used in the capacity it was being used in at the time of wrecking. If original plans had not fallen through, a vessel of that tonnage would never have been in the waters of Encounter Bay in the first place. But what of *Solway's* presence in Encounter Bay? The answer to that is again, the ship was never meant to be used in that capacity. Initial plans called for the construction of 'small coasting vessels' to be constructed at a dockyard at The Company's headquarters at Kingscote, Kangaroo Island immediately upon arrival (The South Australian Company 1835). These smaller vessels would carry cargo and supplies up and down the coast while the larger vessels would handle transport across the ocean to England. Due to poor management and unfortunate events, the dockyard at Kingscote was never built and other than the whaleboats, The Company never constructed any vessels. While the inevitable outcome of losing two ships at Encounter Bay was the use of smaller tonnage vessels, the actual plans for shore-based whaling were not influenced as ships of that size would not have been used if not for certain unavoidable events.

Conclusion

Recording the remains of the Encounter Bay wreck as part of the first archaeological investigation into the loss of *South Australian* has contributed to a positive affiliation for the wreck. Extensive historical sources and ethnographic data documenting the location and wrecking of *South Australian* led researches to discover articulated wooden remains that appeared contemporaneous with historic accounts. Timber species identification, metal analysis of fasteners and copper sheathing, site mapping, and analysis of artefacts provide evidence to the building style, possible construction location, and culture surrounding the Encounter Bay Wreck. Using this information validates the historical data and shows that the Encounter Bay wreck is almost certainly that of *South Australian.* This conclusion supports Hypothesis 1 of identification of shipwreck and sinking event. Further recording of the Encounter Bay wreck will provide valuable archaeological data as one of just three known Falmouth Packet archaeological sites in the world.

The positive affiliation with *South Australian* and not the other wrecks known to be in and around Encounter Bay is made based on timber species identification, metal analysis, and site interpretation. As aforementioned, the other wrecks in Encounter Bay are either Australian built vessels or built and wrecked at the end of the nineteenth or beginning of the twentieth century (see Table 5.1). For the Encounter Bay wreck to be any of the Australian built vessels, timber species analysis would have identified Australian wood species as local shipbuilders preferred to use local timbers (Bullers 2006; Clayton 2012). Metal analysis provides a likely date of construction for the Encounter Bay wreck of before 1832 because of the chemical composition of the copper sheathing. Nearby wrecks in Encounter Bay indicate a likely construction date after 1832, which means if they were copper sheathed Muntz Metal type alloys would likely be present. The two keel bolts from the South Australian Heritage Collection at Netley returned an analysis that is comparative to a Muntz Metal type alloy. These bolts may belong to one of the other wrecks that have not been located in the area.

Using *South Australian* as a case-study for the impacts of vessel loss in South Australia's colonial whaling industry has shown that extensive historical documentation is needed for this type of cultural analysis. Creating hypotheses based on the archaeological record can be substantiated using historical sources if enough data is available. The loss of *South Australian* caused changes in logistics to shore-based whaling activities and contributed to the overall abandonment of all whaling ventures by The Company but did not create changes in the process of whale hunting. These results validate Hypothesis 1 of cultural significance to colonial South Australia; however, the changes were much subtler than originally hypothesised.

Chapter 6 – Conclusion

Introduction

The main research question of this thesis is to analyse the impact that the sinking of an important vessel had on colonial whaling activities in the Victor Harbor region using a case study from Encounter Bay, South Australia. Located in 2018, the Encounter Bay wreck is an articulated wooden vessel believed to be that of *South Australian*; one of the first vessels to carry free immigrants to Australia and be employed as a whaling vessel in the fledgling colony of South Australia. Fieldwork involved recording much of the exposed remains underwater in Encounter bay; recovering timber samples for species identification; collecting metal sheathing and fastener samples for semi-quantitative metal analysis (using SEM); and beginning photogrammetric recording of the site. In conjunction with the SAILS Project, this thesis represents the first archaeological investigation into the remains and provides a foundation for the identification of the vessel. Historical research into *South Australian* and analysis of its loss consisted of the study of the original business records from The South Australian Company held at The State Library of South Australia. In Addition, this study assesses how well an archaeological question can be answered using purely archival research.

Recording and Identification of the Encounter Bay wreck

Since this study began with the name of a specific ship found in historic sources which then led to the discovery of articulated wooden remains, the debate surrounding the identification of those remains is fairly straightforward. When designing the search pattern for the 2018 fieldwork, available historical and local knowledge was combined to create grids that were numbered due to their likelihood of containing the remains of *South Australian*. Subsequently, the Encounter Bay wreck was discovered in square one of the predictive model (Bullers 2018:11) (Figure 6.1). Although all historic evidence supports the conclusion that the Encounter Bay wreck is that of *South Australian*, scientific evidence is still required. This thesis contributes archaeological evidence towards that end. Survey of the articulated remains, samples of the wooden structure, and analysis of the copper sheathing and fasteners reveal aspects of the ship's construction including methods, building locality and date.

Timber species identification and the composition of the copper sheathing obtained through SEM EDS analysis provide the most conclusive evidence towards an identification of the remains. The eight timber samples taken from known elements on the wreck site revealed four species of wood: Teak, white oak, Siberian pine, and elm. Three of these species are found abundantly in Europe and are known to have been used in British shipbuilding of the period when *South Australian* was constructed (Steffy 2003:226). The outlier, teak, may be indicative of repairs while traveling to places such as the Americas. *South Australian* has historical documentation of repairs made while in Havana, Cuba when it was nearly dismasted.

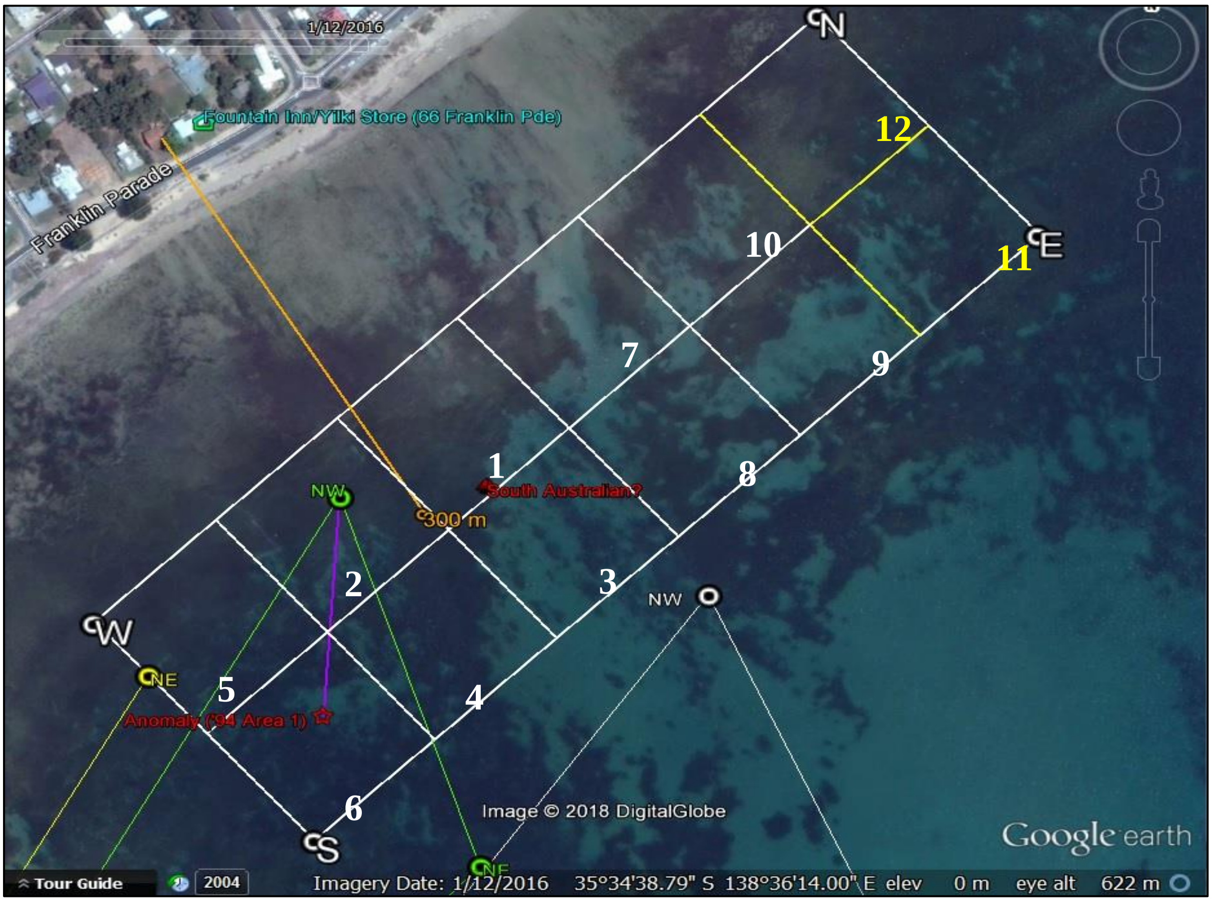


Figure 6.1. Predictive model with ten search squares numbered in order of priority. Each square is 100 x 100 m (Map by Rick Bullers)

As aforementioned, use of copper sheathing was first standardised after 1761 when the Royal Navy coppered the entire bottom of *Alarm* (Bingeman et al. 2000: 222). Up until 1832, copper used in the sheathing of ships was almost pure copper, the inclusions of impurities such as carbon and lead helped to make the copper slightly more durable. The original patent for Muntz metal, No. 6,325 obtained on October 22, 1832 and expiring in October 1846 for a 60:40 copper zinc alloy changed the composition of ship sheathing to make it less expensive and more durable (Flick 1975:76). The SEM EDS analysis of three keel bolts and three fragments of copper sheathing reveal a composition of almost pure copper with carbon and lead inclusions. The lack of minor elements such as zinc and lead in the spectral analysis indicates latest date of production for the Encounter Bay wreck is 1832.

Initial analysis of the building style from baseline offset mapping of exposed remains has revealed the presence of solid cant frames oriented in a way that suggests a vessel with fine lines (Bullers 2019:23, 27). As a Post Office packet, *South Australian* would have likely been built for speed. While further documentation of the articulated remains is necessary, initial findings from exposed portions of the port bow support the evidence of a vessel built for speed. Artefacts that remain exposed on the wreck site can lead to comparisons in the historical record; the presence of a cow tooth and gun flints for instance. On the initial voyage from England, *South Australian* carried livestock in addition to passengers. A conflict between two men aboard *South Australian* while the vessel was anchored in Rosetta Harbor resulted in the firing of pistols from the deck of the ship. These two historic sources may account for the presence of artefacts observed on the wreck site and aid in the identification.

There are other vessels that are known to have wrecked in Encounter Bay or nearby Victor Harbor that have not yet been located (Coroneos 1997). Some of these vessels are known to be Australian made or built later than the date provided by SEM analysis. The only other European made vessel known to have sunk in Encounter Bay is *Solway*, which has been previously located and studied (Coroneos 1996). The European construction location suggested by the timber species, a metal analysis date prior to 1832, construction similarities to that of Falmouth packets, and artefacts that are found in historical documents relating to *South Australian* indicate that the Encounter Bay wreck is most likely *South Australian*.

Impact of Vessel Loss

Research into the impacts of vessel loss is mutually exclusive to the time, place, and circumstances surrounding that specific vessel. This is to say that few overarching truths can be applied to all instances of a vessel sinking other than there is invariably an impact to someone or something. Furthermore, the analysis of impact is directly tied to how much historical and archaeological data exists. The more well documented the wrecking event and the circumstances surrounding it are (i.e. culture, vessel history, region, etc.), the more concrete the analysis will be. The historical record surrounding *South Australian* is luckily quite extensive and therefore more facts exist to be analysed. Even so, much of the analysis is conjecture and the archaeological record reveals little.

South Australian was obtained by The Company with the intent of operating within their whaling industry in the new colony of South Australia. The Company was involved with two different whaling industries at the time of purchase; Pelagic whaling in pursuit of the great sperm whales in the deep sea, and off-shore whaling in pursuit of the Southern Wright Whales that frequented the bays and shallow waters of Australia. Records indicate that *South Australian* was likely intended to be used in support of the off-shore whaling industry at Encounter Bay as a coastal sailing and Bay whaling vessel. After the voyage to South Australia carrying immigrants, supplies, and livestock, the vessel was assigned to the Encounter Bay whaling station due to the lack of a suitable whaling crew. It was used as a cutting-in vessel until its untimely demise in December of 1837.

Direct effects of the wrecking event include the abandonment of cutting-in vessels, the disuse of Rosetta Harbor, and the chartering and purchase of many smaller vessels to replace the lost ship(s); since *Solway* was lost in the exact place and manner at almost the same time. These changes are all reflected in the historical record through letters and reports between members of The Company. Indirect effects of the sinking are harder to analyse but possibly represent the greater impact to whaling. The creation of Victor Harbor as the official port in the area came shortly after the *South Australian*'s loss, however was likely not a direct effect. Rosetta Harbor was an unsafe anchorage and was only being used by The Company due to lack of experience and convenience, therefore Victor Harbor would likely have been chosen as a port regardless of the loss.

The greatest argument of impact can be made for the complete and total abandonment of all whaling activities by The Company by 1842. Seeing as *South Australian* was the second (of three) ships to be lost in the whaling industry there is no evidence that it alone caused the abandonment. The Company treated all three losses the same in the historical records; since the ships and cargo were insured there was hardly any impact at all. However, the loss of *South Australian* and *Solway* seem to have caused more direct changes to whaling than the loss of the only pelagic whaling vessel, *Duke of York* (lost 1837). These changes are reflected in how much money the company had to pour into the Encounter Bay whaling station. The abandonment of the whaling industry was the culmination of numerous bad decisions by managers as well as some unfortunate luck which cost The Company more money than it made. While the impact made by the loss of *South Australian* is evident, it did not come with catastrophic outcomes as initially hypothesised.

Future Research

The wreck site of *South Australian* provides excellent opportunities for future research. The accessibility and significance of the remains is ideal for further survey and possible excavation. Survey work completed so far has been minimal and restricted to what is exposed. Even so, the exposed portions, which are rapidly expanding, have not been fully mapped due to weather and time limitations. The wreck site is currently the subject of ongoing discourse in the Victor Harbor community after a public presentation by the SAILS team. The archaeological remains and current rate of exposure provide a unique situation. Much of the remains are highly degraded by ship worm and gribble while the newly exposed sections are nearly pristine. With the apparent blow-out of the site, conservation of the exposed timbers is of utmost importance. A decision must be made whether to rebury the remains immediately or move on to excavation.

Full excavation of the remains could be justified due to the limited archaeological data pertaining to Falmouth packet sites and the seemingly pristine nature of the articulated structure. As mentioned earlier, this site represents just one of three known Falmouth packet archaeological sites in the entire world, with little-to-no archaeological investigation having been done on the other two. The other argument for full excavation and conservation can be made due to the significance the vessel has to Victor Harbor and South Australia. This route would require massive amounts of funding and space to be made available for community-based conservation. A second excavation option is that of a small test excavation to reveal the portions of the wreck still covered by sand. This would possibly only provide further insight into cargo being carried at the time of sinking and the likelihood to provide new information in regard to the vessel's significance to South Australia or as a Falmouth packet site is small.

Of the two Falmouth packet sites known besides *South Australian*, the wreck of *Lady Mary Pelham* stands to provide the greatest contribution. Constructed just two years prior and used in almost the same way as *South Australian*. Timber samples and comparison of building styles could lead to greater understanding of how these vessels were constructed. Mapping of the sites will provide a foundation for future case studies of Falmouth packet ships.

During 2019 the community members in Victor Harbor came forward with pieces of wreck they had collected along the beaches. After a particularly violent storm, forty-two pieces of shipwreck were found washed ashore in Encounter Bay by Rick Bullers and Timothy Zapor. These timbers, which include two near-pristine deadeyes, were collected and taken to Netley where they were photographed and conserved. Further documentation and timber species identification may be beneficial to determine which wreck these timbers may have broken off from. Adding to this, further exploration and survey of Encounter Bay and Victor Harbor is necessary to locate and study the remaining wrecks that have not been located. The conservation status of these wrecks may be of concern with the blow-out of the *South Australian* wreck site.

Conclusion

Analysis pertaining to the impacts of vessel loss is possible through the historic record if enough documentation exists. This analysis may be highly opinionated on a reader-to-reader basis and should be discussed openly with supporting facts to reach a solid conclusion. Furthermore, this type of analysis does not necessarily require comparative archaeological evidence. The survey of the remains of *South Australian* did not provide anything that added or detracted to the debate surrounding the impact of the loss of the vessel. The archaeological record did however support the historical documentation surrounding the wrecking event and vice versa. The extensive historical documentation provided invaluable data that allowed for the identification of the remains. This is consistent with what Harpster (2013) terms a Type A identification, where a specific name is found in the documentation and the remains are located and identified using the historical record. Type A affiliations comprise a small amount of the overall shipwreck studies, which are mostly Type B, where remains are found and then a name is sought after. Type B affiliations require much more complex identification techniques but are also reliant on how much historical information is available.

This thesis successfully undertook initial archaeological investigation of the Encounter Bay wreck. It has led to an identification of the vessel. Furthermore, it assessed the impact this vessel had on colonial whaling industries of early South Australia using the historical record. Additionally, the investigation provides new data on Falmouth packet ship design and construction with the potential to contribute much more.

References

Abe, H. 2016 Wood Identification Research and Its Importance. *Mokuzai Gakkaishi*, 62(6):240–249.

Ahlström, C. 1997 *Looking for leads: shipwrecks of the past revealed by contemporary documents and the archaeological record*. Helsinki: Finnish Academy of Science and Letters.

Arnott, T. and South Australia. State Heritage Branch 1996 *Investigator Strait: maritime heritage trail*. Adelaide: State Heritage Branch.

Australian Water Environments 2013 Victor Harbor Coastal Management Study. Unpublished report to Victor Harbor Council.

Babits, L. E. 1998 The Berth 52 Vessel (09CH691): interim report (1982). In L. E. Babits and H. Van Tilburg (eds), *Maritime archaeology: a reader of substantive and theoretical contributions* pp.187–202. New York.

Borrow, K.T. & Pioneers' Association of South Australia 1947 *Whaling at Encounter Bay*, Adelaide: Pioneers' Association of S.A.

Bettinger, R. 1987 Archaeological approaches to hunter-gatherers. *Annual Review of Anthropology* 16:121–142.

Binford, L.R. 1964 A consideration of archaeological research design. *American Antiquity*. 29(4):425–441.

Binford, L.R. 1977 *For theory building in archaeology: essays on faunal remains, aquatic resources, spatial analysis, and systemic modelling*. New York: Academic Press.

Binford, L.R. 1980 Willow smoke and dogs' tails: hunter-gatherer settlement systems and archaeological site formation. *American Antiquity* 45:4-20.

Binford, L.R. 1983. *Working at archaeology*. New York: Academic Press, Inc.

Binford, L.R. 2009 *Debating archaeology: updated edition*. Walnut Creek: Routledge.

Bingeman, J.M. J.P. Bethell, P. Goodwin and A.T. Mack 2000 Copper and other Sheathing in the Royal Navy. *The International Journal of Nautical Archaeology* 29(2):218–229.

Bowens, A. (ed.) 2009 *Underwater archaeology: The NAS guide to principles and practice*. 2nd ed. London: Wiley-Blackwell.

Bureau of Meteorology 2018 Climate Statistics for Australian Locations: Victor Harbor (Encounter Bay): Site Number 023804. Retrieved 23 May 2018 from <http://www.bom.gov.au/climate/averages/tables/cw_023804.shtml>

Burke, H. and C. Smith 2004 *The Archaeologist's Field Handbook*. NSW: Allen and Unwin.

Bullers, R. 2006 Quality Assured: Shipbuilding in Colonial South Australia and Tasmania. Flinders University Maritime Archaeology Monographs Series No. 8. Department of Archaeology, Flinders University, Adelaide.

Bullers, R. 2018 South Australian project plan. Unpublished report for the Department for Environment and Water, Government of South Australia. Adelaide.

Bullers, R. 2019 Historic shipwreck *South Australian* (1819-1837): conservation management plan. Unpublished report for Department for Environment and Water, Government of South Australia. Adelaide

Chamberlin, T.C. 1965 The Method of Multiple Working Hypotheses: with this method the dangers of parental affection for a favorite theory can be circumvented. *Science* 148(3671):754–759.

Chapman, G. 1972 *Kangaroo Island shipwrecks: an account of the ships and cutters wrecked around Kangaroo Island.* Canberra: Roebuck Society Publication, Volume 6.

Clark, P. 1990 *Shipwreck sites in the south-east of South Australia 1838–1915.* Adelaide: Australian Institute for Maritime Archaeology Special Publication, Volume 5.

Clayton, K. 2012 Australian Timbers: Their Significance in Early Australian Shipbuilding. *Bulletin of the Australasian Institute for Maritime Archaeology* 36:55–76.
Coroneos, C. 1996 The Solway (1837): Results of the 1994 test excavation. *The Bulletin of the Australian Institute for Maritime Archaeology* 20(1):21–40.
Coroneos, C. 1997 *Shipwrecks of Encounter Bay and Backstairs Passage*. Fremantle: Australian Institute for Maritime Archaeology Special Publication, Volume 8.
Coroneos, C. and R. McKinnon 1997 *Shipwrecks of Investigator Strait and Lower Yorke Peninsula* Fremantle: Australian Institute for Maritime Archaeology Special Publication, Volume 9.
Department of Environment and Planning: State Heritage Branch. 1991, Wardang Island, *Maritime heritage trail*. Adelaide.
Department of Environment and Planning: State Heritage Branch. 1987, *Conserving our historic shipwrecks*. Adelaide.
Diamond, A.I. 1955 Aspects of the history of the South Australian Company - the first decade. Unpublished MA thesis, The University of Adelaide, Adelaide.
Durrant, C. 2014a Encounter Bay 1836-1837. Retrieved 12 May 2018 from <http://www.durrant.id.au/early_colonists/encounter_bay_1837.pdf>.
Durrant, C. 2014b Letter to Charles Mann, 24 February 1838. Letter from JTB MacFarlane regarding the loss of the South Australian, transcribed by Chris Durrant. Retrieved 12 May 2018 from <http://www.durrant.id.au/early_colonists/macfarlane.pdf>.
Elliott, L.P. and B.W. Brook 2007 Revisiting Chamberlin: multiple working hypotheses for the 21st Century. *BioScience* 57(7):608–614.
Ferretti, M. 2014 The Investigation of Ancient Metal Artefacts by Portable X-ray Fluorescence Devices. *Journal of Analytical Atomic Spectrometry* 29:1753–1766.
Flick, C. 1975 Muntz metal and ships' bottoms: the industrial career of G.F. Muntz. *The Transactions of the Birmingham and Warwickshire Archaeological Society* 87:70–88.
Gesner, P. 2000 HMS 'Pandora' Project – a report on stage 1: Five seasons of excavation. *Memoirs of the Queensland Museum, Culture* 2(1):1–52.
Green, J.N. 1975 The VOC ship Batavia wrecked in 1629 on the Houtman Abrolhos, Western Australia. *International Journal of Nautical Archaeology* 4(1):43–63.
Green, J.N. 2010 Maritime archaeology. In *Encyclopedia of archaeology*, pp.1599–1605. San Diego Calif.: Elsevier Inc.
Green, J.N. 2016 *Maritime archaeology: a technical handbook*. 2nd ed. San Diego, Calif.: Elsevier Academic.
Harpster, M. 2013 Shipwreck identity, methodology, and nautical archaeology. *Journal of Archaeological Method and Theory* 20:588–622
Harrison, S. 2018 British Merchant Sloop *Marquis of Salisbury* (1819) and British Sloop *Swallow* (1824) (10). In: *Three Decks: Warships in the Age of Sail*, retrieved 15 December 2019 from <https://threedecks.org/index.php?display_type=home>.
Hosking, W.J. 1973 *Whaling in South Australia, 1837-1872*. Unpublished BA(Hons) thesis, School of Social Science, Flinders University, Adelaide.
Hunter, J. 2018 Barque *South Australian*. In: *SA History Hub*, History Trust of South Australia. Retrieved 12 May 2018 from <http://sahistoryhub.com.au/things/barque-south-australian>
Jeffery, W. F. 1987 A cultural resource management programme of shipwrecks in South Australia. *Bulletin Australian Institute for Maritime Archaeology* 11(1):39–45.
Jeffery, W. F. 1988 An evaluation of the Zanoni (1865-1867). *The Bulletin of the Australian Institute for Maritime Archaeology* 12(1):1–8.
Kemp, P.K. (Ed.) 1976 *The Oxford Companion to Ships and the Sea.* Oxford.

Kenderdine, S. & South Australia. State Heritage Branch 1991 *Artefacts from shipwrecks in the south-east, 1851-1951: a catalogue of collections of artefacts from vessels wrecked in the south-east of South Australia between 1851 and 1951*. Adelaide: State Heritage Branch, Dept. of Environment and Planning.

Loney, J. K. 1971 *Wrecks on South Australia's south-east coast: shipwrecks and strandings from Port Macdonnell to the Murray River*. Apollo Bay, Vic.: J.K. Loney.

Loney, J. K. 1973 *Wrecks on the south coast of South Australia*. Dimboola, Vic.: J.K. Loney.

Loney, J. K. 1993 *Wrecks on the South Australian coast: including Kangaroo Island* 1st ed., Yarram, Vic.: Lonestone Press.

Lloyds Register 1824 *The Register of Shipping for the Year 1824*. Lloyd's Register of Ships Online. Retrieved 15 Decmeber 2019 from <http://www.lrfoundation.org.uk/public_education/reference-library/register-of-ships-online >.

MacLeod, I. D. 1988 In-situ corrosion studies on iron and composite wrecks in South Australian waters: implications for site managers and cultural tourism. *The Bulletin of the Australian Institute for Maritime Archaeology* 22:81–90.

McCarthy, M. 1988 SS. Xantho: The pre-disturbance, assessment, excavation and management of an iron steam shipwreck off the coast of Western Australia. *International Journal of Nautical Archaeology* 17(4):339–347.

McCarthy, M. 1998 Australian maritime archaeology: changes, their antecedents and the path ahead, *Australian Archaeology* 47(1):33–38.

McCarthy, M. 2005 *Ships' Fastenings : From Sewn Boat to Steamship*. College Station: Texas A&M University Press.

McCarthy, M. 2006 Maritime archaeology in Australasia: reviews and overviews. In Mark Staniforth and Michael Nash (eds), *Maritime archaeology: Australian approaches*, pp.1–11. Springer, New York.

McKinnon, R. and South Australia. State Heritage Branch 1993 *Shipwreck sites of Kangaroo Island*. Adelaide: State Heritage Branch, Dept. of Environment and Land Management.

Merton, R.K. 1949 *Social Theory and Social Structure*. New York: Free Press.

Merton, R.K. 1967 *On Theoretical Sociology*. New York: Free Press.

Merton, R.K. 1968 *Social Theory and Social Structure* (3rd ed.). New York: Free Press.

Miller, W.J., J.E. Callahan, J.R. Craig, and K.M. Whatley 2005 'Ruling theories linger': questioning the identity of the Beaufort Inlet shipwreck: a discussion. *Nautical Archaeology* 34(2):339–341.

Mizuno, S., R. Torizu, and J. Sugiyama 2010 Wood identification of a wooden mask using synchrotron X-ray microtomography. *Journal of Archaeological Science*, 37(11):2842–2845.

Moore, D.D. 2005 Technical comments relating to 'Ruling Theory' and the identification of the Beaufort Inlet Wreck. *Nautical Archaeology* 34(2):335–339.

Moran, V. and Heritage South Australia 2000 *Southern Ocean shipwreck trail*. Adelaide: Heritage South Australia.

Morris, C. 2012 Information for the future: an analysis of shipwreck artefact records in South Australia. Unpublished MA thesis, Department of Archaeology, School of Social Sciences, Flinders University, Adelaide.

Nash, M. 2003 *The bay whalers: Tasmania's shore-based whaling industry*. Woden, A.C.T.: Navarine Publishing.

Olenkiewicz, J.S. 2018a. *British packet sailings: Falmouth – North America: 1755 - 1826*. Retrieved 18 June 2018 from <https://www.rfrajola.com/Mercuty/Falmouth%20Packets%20NA.pdf,>

Olenkiewicz, J.S. 2018b. *British Packet Sailings: Falmouth – Brazil 1808 – 1850*. Retrieved 18 June 2018 from <https://www.rfrajola.com/Mercuty/BrazilPackets.pdf,>
O'Shea, J.M. 2004 The Identification of Shipwreck Sites: A Bayesian Approach. *Journal of Archaeological Sciences* 31:1533–1552.
Page, M.F., A. Roberts, and Victor Harbor. Council 1987 *Victor Harbor: from pioneer port to seaside resort*. Victor Harbor, S. Aust.: District Council of Victor Harbor.
Perkins, J. & Society for Underwater Historical Research 1988 *The shipwrecks of Port Elliot 1853-1864*. Adelaide: Society for Underwater Historical Research.
Pierce, C. 1989 A Critique of Middle-Range Theory in Archaeology. Unpublished paper. Department of Anthropology, University of Washington.
Platt, J.R. 1965 Strong inference: certain systematic methods of scientific thinking may produce much more rapid progress than others. *Science* 146(3642):347–353.
Plog, F. T. 1974 Archaeological Methods. In L. E. Babits and H. Van Tilburg (eds), *Maritime archaeology: a reader of substantive and theoretical contributions,* pp.175–85. New York.
Plog, F.T. 1998 Archaeological methods. In L. Babits and H. Van Tilburg (eds), *Maritime archaeology: a reader of substantive and theoretical contributions*. New York: Plenum Press, 175–185.
Raab, L.M., and A.C. Goodyear 1984 Middle-range theory in archaeology: a critical review of origins and applications. *American Antiquity* 49(2):255–268.
Richards, N. 2007 The history and archaeology of the Garden Island ships' graveyard, north arm of the Port Adelaide River, Port Adelaide, South Australia. Unpublished BA(Hons) thesis, Department of Archaeology, School of Social Science, Flinders University, Adelaide.
Rodgers, N.A.M. 1993 *The Insatiable Earl*. London.
Rodgers, B.A., N. Richards, and W.R. Lusardi 2005 'Ruling theories linger': questioning the identity of the Beaufort Inlet shipwreck. *The International Journal of Nautical Archaeology* 34(1):24–37.
Smith, M. A. 1955 The Limitations of Inference in Archaeology. In L. E. Babits and H. Van Tilburg (eds), *Maritime archaeology: a reader of substantive and theoretical contributions*, pp. 167–74. New York.
South Australian Department of Environment and Land Management 1994 *Kangaroo Island maritime heritage trail*. Adelaide.
South Australian Company, The 1835 *Prospectus of the South Australian Company*. London: The Company.
Staniforth, M. and Libby Vickery 1984 The test excavation of the William Salthouse wreck site: an interim report. Special publication No. 3. *The Australian Institute for maritime Archaeology*, Melbourne.
State Library of South Australia 2017 The *South Australian* 1837–1838. Retrieved August 9 2019 from <https://bound-for-south australia.collections.slsa.sa.gov.au/1837SouthAustralian.htm>.
Steffy, R. 1994 *Wooden Ship Building and the Interpretation of Shipwrecks*. College Station: Texas A&M University Press.
Temme, A.R. 1976 *South Australian shipwrecks, 1800-1899*. Adelaide: Society for Underwater Historical Research.
Thomas, D.H. & R. Kautz 1983. *The archaeology of Monitor Valley*. New York: American Museum of Natural History.
Thomas, D.H. & R.L. Kelly 2006 *Archaeology* 4th ed. Belmont, Calif: Thomson/Wadsworth.
Torrence, R 1986 *Production and Exchange of Stone Tools*. Cambridge: Cambridge University Press.

Ul-Hamid, A. 2018 *A Beginners' Guide to Scanning Electron Microscopy* 1st ed. Cham: Springer Internation Publishing.

van Duivenvoorde W. 2015 *Dutch East India Company Shipbuilding The Archaeological Study of Batavia and Other Seventeenth-Century VOC Ships* First ed. Ed Rachal Foundation Nautical Archaeology Series.

van Duivenvoorde, W. 2019 Report on the results of the semi-quantitative chemical analysis of the *South Australian* shipwreck metal samples. Unpublished report prepared for Flinders University.

VanZandt, D. 2009 A Systematic Method for the Identification of Historic Era Shipwrecks. Unpublished MA thesis, Department of Archaeology, School of social Sciences, Flinders University, Adelaide.

Wiessner, P. 1982 Beyond willow smoke and dogs' tails: a comment on binford's analysis of hunter-gatherer settlement systems. *American Antiquity* 47:171–178.

Wilde-Ramsing, M. & U. Ewen 2012 Beyond reasonable doubt: a case for Queen Anne's Revenge. *Historical Archaeology* 46(2):110–133.

Willey, G.R., & J.A. Sabloff *1993 A history of American archaeology* 3rd ed. New York: W.H. Freeman.

Winfield, R. 2014 *British warships in the age of sail, 1817–1863: design, construction, careers and fates*. Yorkshire, UK: Seaforth Publishing.

State Library of South Australia Archives (SLSAA)

BRG 42/1 South Australian Company, Minutes of meetings of directors, 9 October 1835 – 20 December 1836.

BRG 42/9 South Australian Company, Letters received from the colonial manager, 1837–1841, 1843–1936

BRG 42/16 South Australian Company, Second annual report, 28 June 1838.

BRG 42/17 South Australian Company, Annual reports, nos. 1–111 (gaps), 1836–1947.

BRG 42/28 South Australian Company, Letters sent to London, 1836–1840, and general letters, 1836–1845.

BRG 42/78 South Australian Company, Log book of the proceedings on board the *South Australian*, 1 November 1836 – 25 October 1837.

BRG 42/91 South Australian Company, South Australian Company list of goods ordered, 10 May 1837 – 22 February 1838.

Newspapers:

South Australian Register April 1837.

The Argus 7 September 1849.

The London Standard 20 December 1834.

Appendix 1 – Timber Species Identification

KNOW YOUR WOOD
19 Benambra Street, South Oakleigh, Victoria 3167, AUSTRALIA Phone: 03 95127523
Mobile: 0499 300 208
Email:knowyourwood1@gmail.com
Provider of wood identification services

8 September, 2019

WOOD IDENTIFICATION RESULTS

Mrs Ireni Milliaros Silentworld
Foundation 289 Mona Vale
Road St. Ives NSW 2075

Dear Renee,
Re: **Wood identification of eight wood samples form recently discovered wreck of the British built post office packet *South Australian*. Your request 9-July-2019.**

Following microscopic examination, in my opinion the structure of the wood specimens is consistent with[1]:

Sample	**Scientific name**	**Commercial or Trade name + Remarks**
No annotation, 30mm diameter 	*Tectona grandis*	TEAK
Keelson (2) 	*Quercus ?[1]robur*	WHITE OAK GROUP

Out planking stern 	*Pinus cembra*	SIBERIAN PINE
Inner planking stern 	*Ulmus ?*[2]*procera*	ELM
Floor 	*Quercus ?*[1]*robur*	WHITE OAK GROUP
Knee 	*Quercus ?*[1]*robur*	WHITE OAK GROUP
Frame (1) 	*Quercus ?*[1]*robur*	WHITE OAK GROUP
Ceiling 	*Quercus ?*[1]*robur*	WHITE OAK GROUP

[1] One of several species belonging to the white oak group from the northern hemisphere.
[2] Wood structure does not permit further differentiation among species.

I hope the information will help with your evaluation process. Best regards,

Jugo Ilic

Jugo Ilic MSc, Dr(Forest)Sc, FIAWSc

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[1] *Disclaimer*: The content of this letter is provided in good faith and whilst Dr Jugo Ilic has endeavoured to ensure that the information contained in it is correct and accurate at the time of preparation, he does not accept any liability arising from its use whether provided directly by the above-named client or indirectly from the client providing it to a third

Appendix 2 – SEM Metal Analysis

Dr Wendy van Duivenvoorde

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u CRICOS Provider No. 00114A

22 December

2019 REPORT ON THE RESULTS OF THE SEMI-QUANTITATIVE CHEMICAL ANALYSIS
OF THE *SOUTH AUSTRALIAN* SHIPWRECK METAL SAMPLES

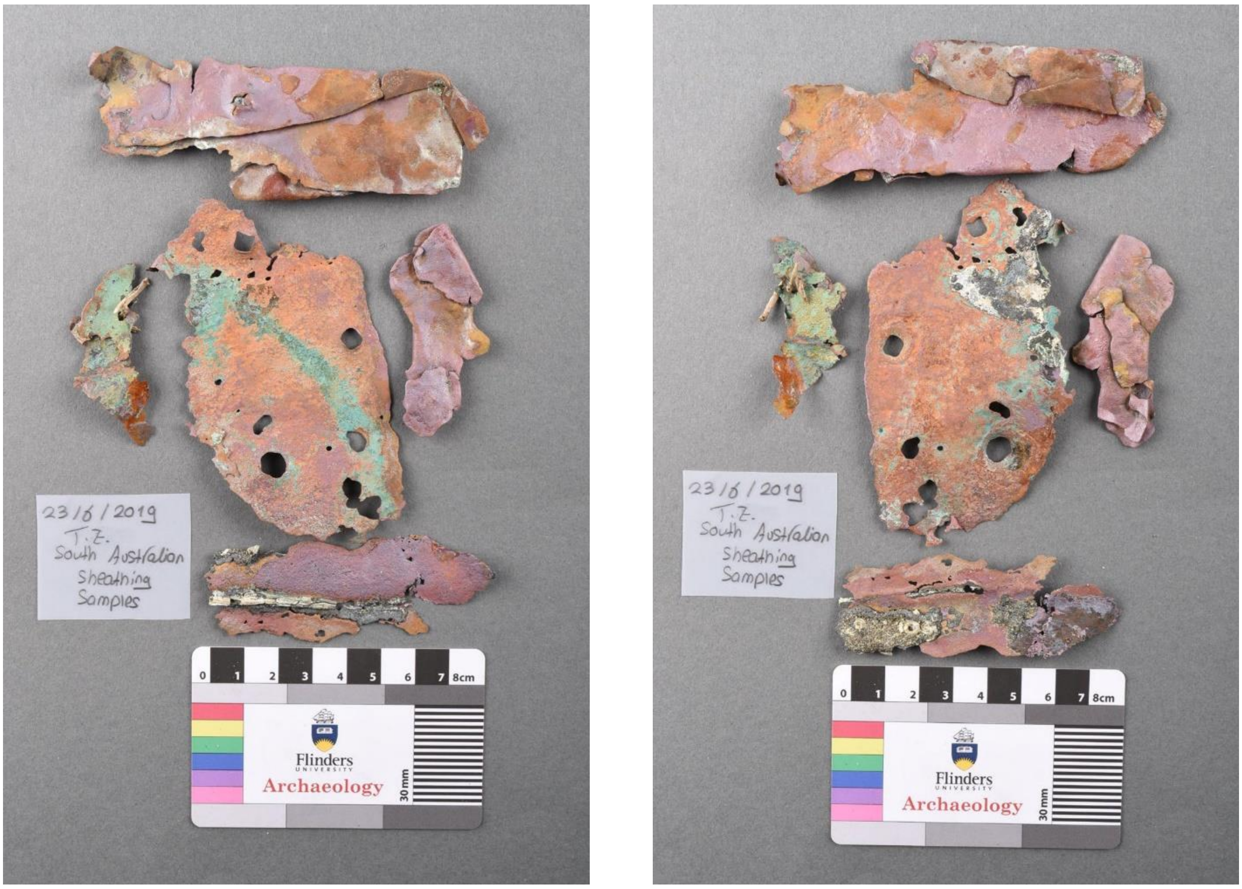
Introduction

Three fragments of copper-alloy sheathing and three bolts collected from the *South Australian* shipwreck site in 2019 were analysed to determine their elemental composition (Figs 1 and 2, Table 1). In addition, two copper-alloy bolts labelled as keel pins from *South Australian* in the SA Heritage Collection in Netley were sampled and analysed for comparison. The latter, however, have a different chemical composition, i.e. they are a zinc alloy, whereas those from the site are pure copper with carbon inclusions— this may possibly suggest that the bolts from the SA Heritage Collection come from another shipwreck site.

Sample number	**Label on sample bag**
SA0404	Keel pin, South Australian Shipwreck
SA0405	Keel pin, South Australian Shipwreck
SA Bolt 001	Bolt from *South Australian* ship's hull
SA Bolt 002	Bolt from *South Australian* ship's hull
SA Bolt 003	Bolt from *South Australian* ship's hull
SA Sheathing 001	Sheathing from *South Australian* ship's hull
SA Sheathing 002	Sheathing from *South Australian* ship's hull
SA Sheathing 003	Sheathing from *South Australian* ship's hull

Table 1 Samples analysed for elemental composition, *South Australian* shipwreck

Fig. 1. Bolt fragments used for analyses (*South Australian* shipwreck), samples nos 001 (a), 002 (b), and 003 (c). Photograph by Omaima Eldeeb.



a b

Fig. 2. Sheathing fragments, outer (a) and inner (b) faces (*South Australian* shipwreck). Photograph by Omaima Eldeeb.

Semi-Quantitative Chemical Analysis

The metal samples were analysed at Adelaide Microscopy, South Australia, using a FEI Quanta 450 FEG Environmental Scanning Electron Microscope (ESEM) (Fig. 3).[1] The FEI Quanta 450 is a High-Resolution Field Emission Scanning Electron and is used to image and analyse surface topography, collect backscattered electron images and characterise and determine a sample's elemental composition through x-ray detection with an SDD EDS detector.

Sample preparation for the sheathing and the bolts that were collected from the shipwreck site included embedding a small fragment of each sample in phenolic hot mounting resin for general use (brand: Struers MultiFast). The resin was added and set in a Struers CitoPress-10 hot mounting machine (Fig. 4). The mounted samples were then polished using a Struers TegraPol-11 diamond polisher to get clean, uncorroded surfaces for analyses (Figs 4–6).

The two so-called keel bolts labelled SA404 and SA405, that are registered as from *South Australian* in the SA Heritage Collection Storage, were drilled to extract a few mg of material from their heads—for each sample a brand-new titanium drill bit (1/16") was used to get an un-corroded metal sample to avoid any possible cross contamination.

Sample preparation included adding the drilled material from each fastener on 12mm aluminium stub with carbon tape tabs (Figs 7 and 8).

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[1] https://www.adelaide.edu.au/microscopy/instrumentation/quanta450.html

Fig. 3. FEI Quanta 450 FEG Environmental Scanning Electron Microscope, Adelaide Microscopy, University of Adelaide. Photograph by Wendy van Duivenvoorde.

Fig. 4. Struers CitoPress-10 hot mounting press. Photograph by Wendy van Duivenvoorde.

Fig. 5. Struers TegraPol-11 polisher. Photograph by Wendy van Duivenvoorde.

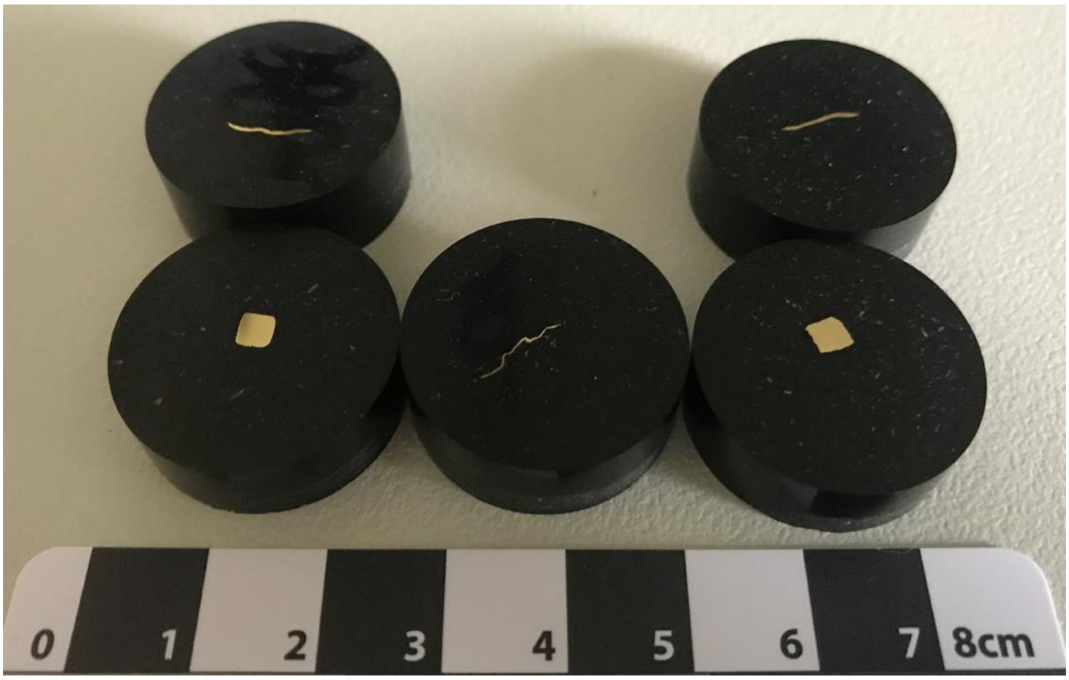


Fig. 6. Examples of samples embedded in black-coloured resin, the top two samples and bottom centre are all metal sheathing whereas the bottom samples on left and right are cross sections of fasteners (not *South Australian* shipwreck). Photograph by Wendy van Duivenvoorde.

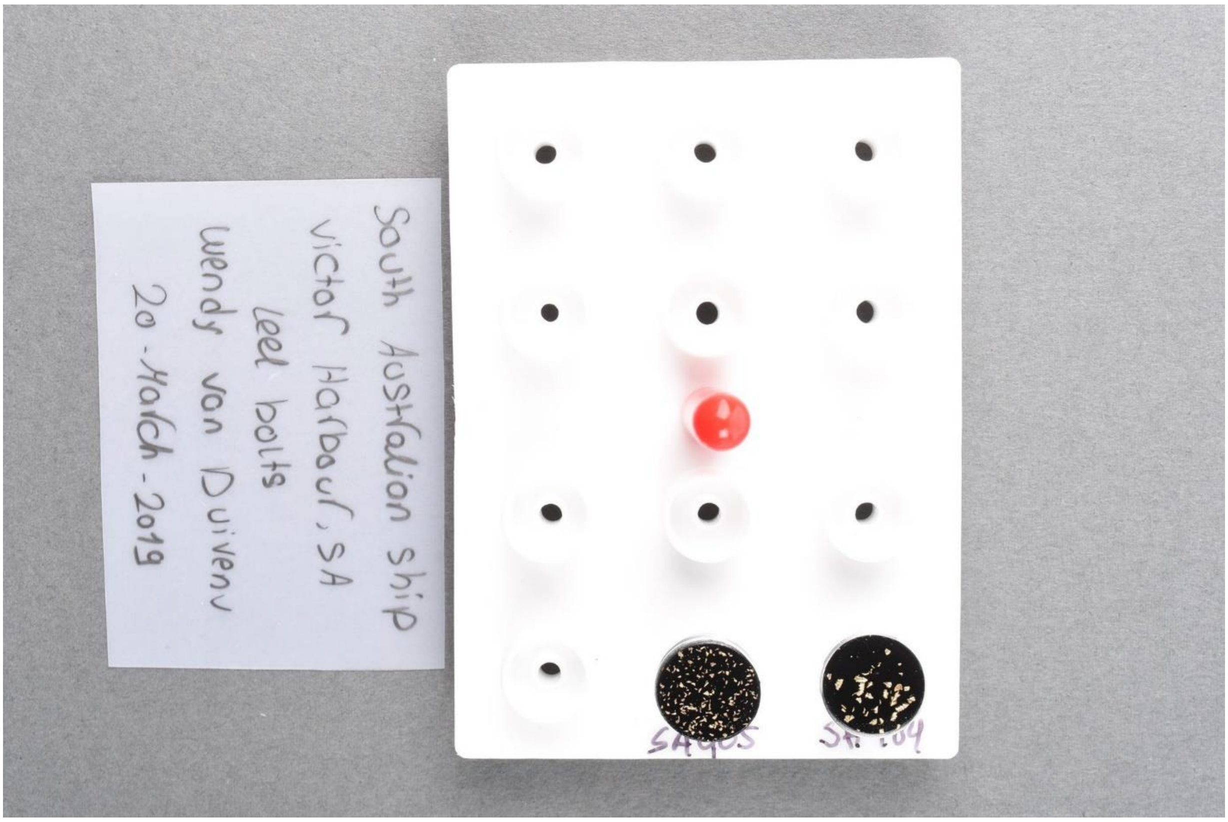
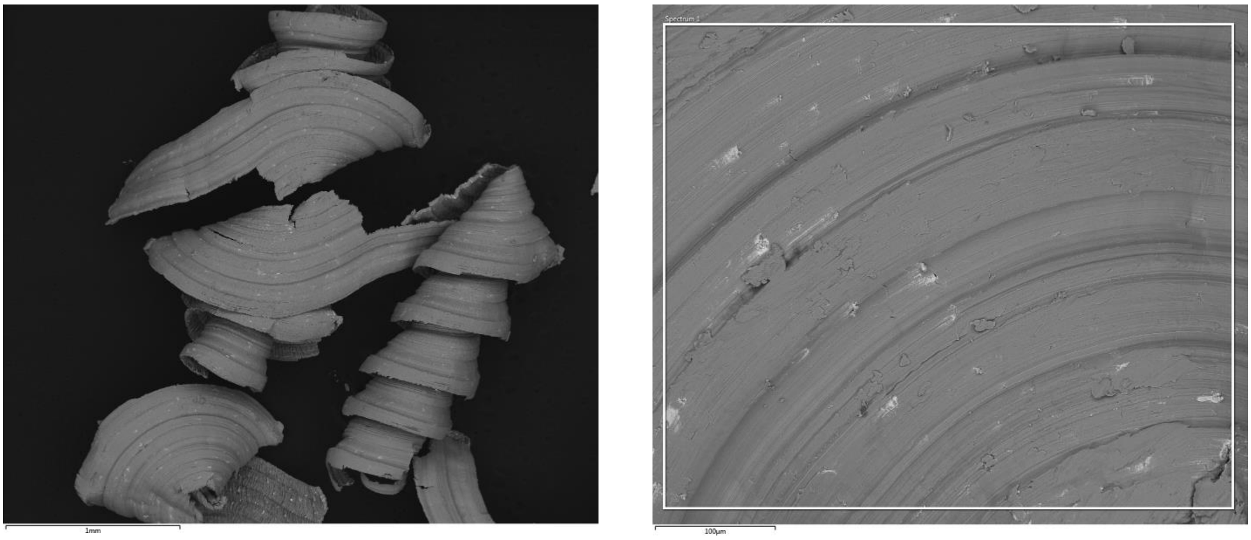


Fig. 7. Example of drill shavings mounted on aluminium stubs with carbon tape tabs (*South Australian* shipwreck). Photograph by Omaima Eldeeb.



a **b**

Fig. 8. Drill shavings of bolt (a) and magnified drill shaving showing spectrum analysed (b, Spectrum 1) (*South Australian* shipwreck, keel pin 0404). White-coloured inclusions are lead.

Micrographs by Wendy van Duivenvoorde.

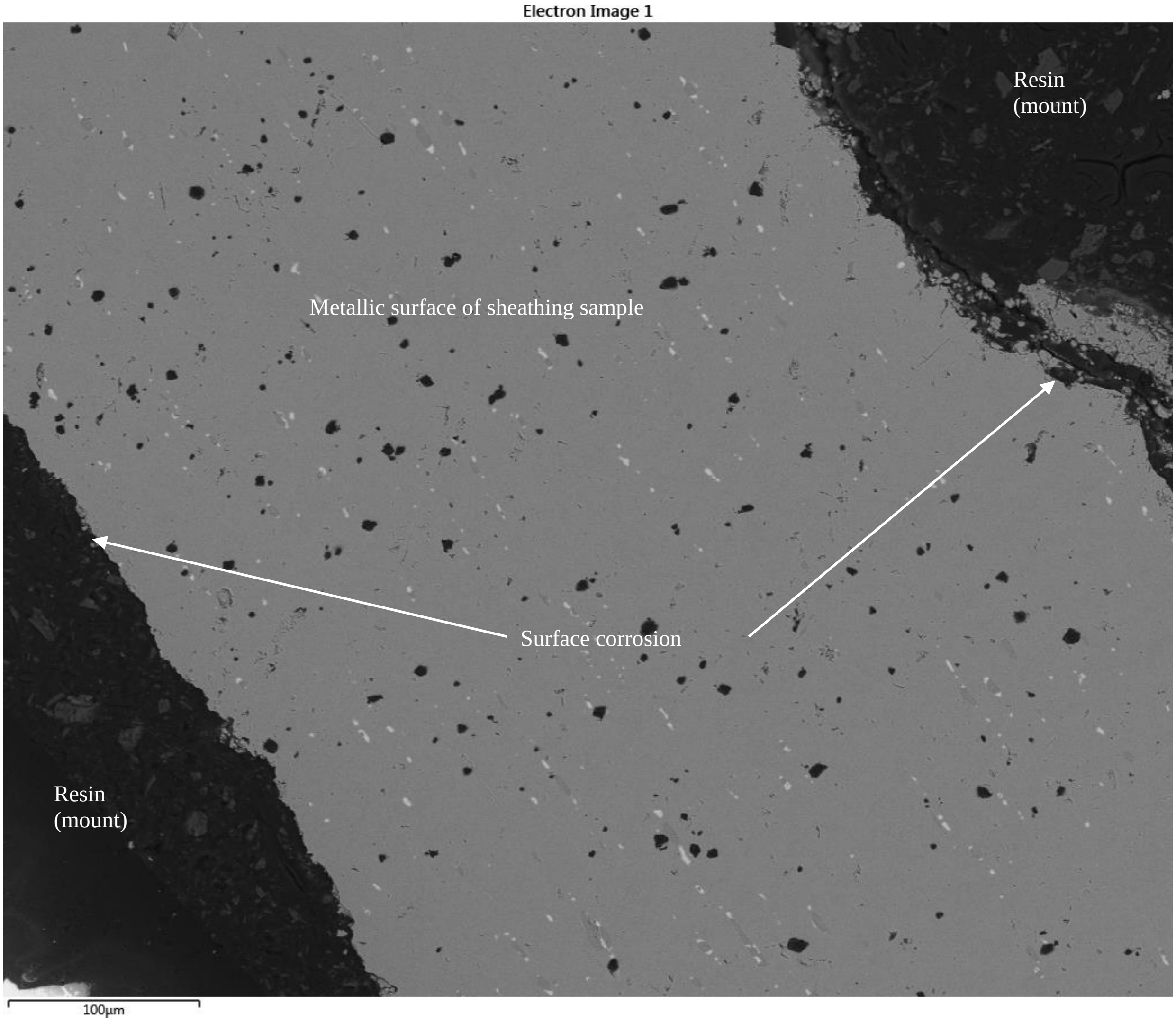


Fig. 9. Cross-section of sheathing fragment (sample no. 003), showing surface corrosion onedges and metallic surface of the sample. White-coloured inclusions are lead; black coloured inclusions are carbon. Micrograph of mounted sample. Micrograph by Wendy van Duivenvoorde.

The FEI Quanta 450 with SDD EDS detector allows for a semi-quantitative analytical method of elemental composition by spot or area testing. As this method of analysis is a localized testing method, it is not necessarily representative for the composition of an entire sample. If possible, preferably three areas per sample are tested to ensure they are characteristic. The bolts were however analysed in their entirety as such fasteners, when embedded in epoxy, display the full cross-sectional surface of their shafts (in this case these sections measure a few by a few mm) (Fig. 6). The areas chosen for elemental determination are those that display solid metal and are free of any surface corrosion (Figs 8–11).

The following SEM settings were used during data acquisition: High-Vacuum, Kilovoltage: kV 20, Element Normalized, SEC table: default, standardless. The time per sample analysis was automated as the Quanta 450 is the fastest SEM EDS collector in Australia.

The sheathing and bolt samples were tested positive for the following elements: Cu (copper), Carbon (C) and Pb (lead). The elemental composition for the sheathing and bolts is listed in the following tables (Tables 2–3).

The make-up of the so-called keel pins is a little more varied and is listed in the Table 4.

The small white-coloured and black-coloured specks that can be seen in all recently collected sheathing and bolt samples were analysed (spot analysis) and the analyses confirmed these are lead and carbon inclusions, respectively (Figs 9–11, Table 5).

	Wt%			**Atomic %**		
Description	**C**	**Cu**	**Total**	**C**	**Cu**	**Total**
Sample Sheathing 001: spectrum 1	12.63	87.37	100	43.34	56.66	100

Sample Sheathing 001: spectrum 2	12.39	87.61	100	42.79	57.21	100
Sample Sheathing 001: spectrum 3	12.10	87.90	100	42.14	57.86	100
Sample Sheathing 002: spectrum 1	12.14	87.86	100	42.23	57.77	100
Sample Sheathing 002: spectrum 2	10.32	89.68	100	37.84	62.16	100
Sample Sheathing 002: spectrum 3	10.94	89.06	100	39.38	60.62	100
Sample Sheathing 003: spectrum 1	17.35	82.65	100	52.62	47.38	100
Sample Sheathing 003: spectrum 2	12.51	87.49	100	43.07	56.93	100
Sample Sheathing 003: spectrum 3	10.76	89.24	100	38.95	61.05	100

Table 2 Elemental composition of ship's hull sheathing, *South Australian* shipwreck

	Wt%					**Atomic %**			
Description	**C**	**Cu**	**Pb**	**Total**		**C**	**Cu**	**Pb**	**Total**
Sample Bolt 001: spectrum 1	31.00	68.63	0.36	100		70.46	29.49	0.05	100
Sample Bolt 002: spectrum 1	31.75	68.25	–	100		71.10	28.90	–	100
Sample Bolt 003: spectrum 1	31.00	68.63	0.36	100		70.46	29.49	0.05	100

Table 3. Elemental composition of ship's hull fasteners (bolts), *South Australian* shipwreck

	Wt%					**Atomic %**			
Description	**C**	**Cu**	**Pb**	**Total**		**C**	**Cu**	**Pb**	**Total**
Sample Sheathing 001: spectrum 4	83.36	16.64	–	100		96.36	3.64	–	100
Sample Bolt 001: spectrum 2	99.21	0.79	–	100		99.85	0.15	–	100
Sample Bolt 001: spectrum 3	–	–	100	100		–	–	100	100

Table 5. Spot analyses on inclusions in copper sheathing and bolts, *South Australian* shipwreck.

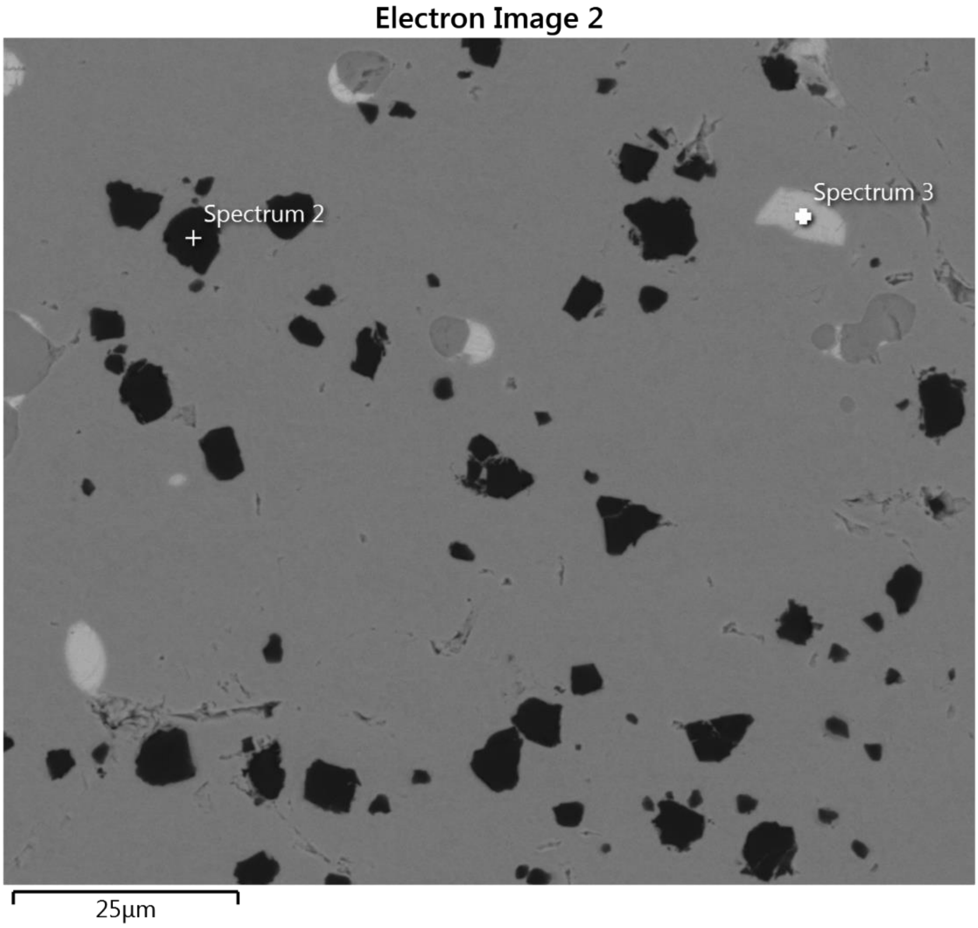


Fig. 10. Micrograph of mounted sample showing spot analyses on carbon (Spectrum 2) and lead (Spectrum 3) inclusions. (*South Australian* shipwreck, bolt sample #001). Micrograph by Wendy van Duivenvoorde.

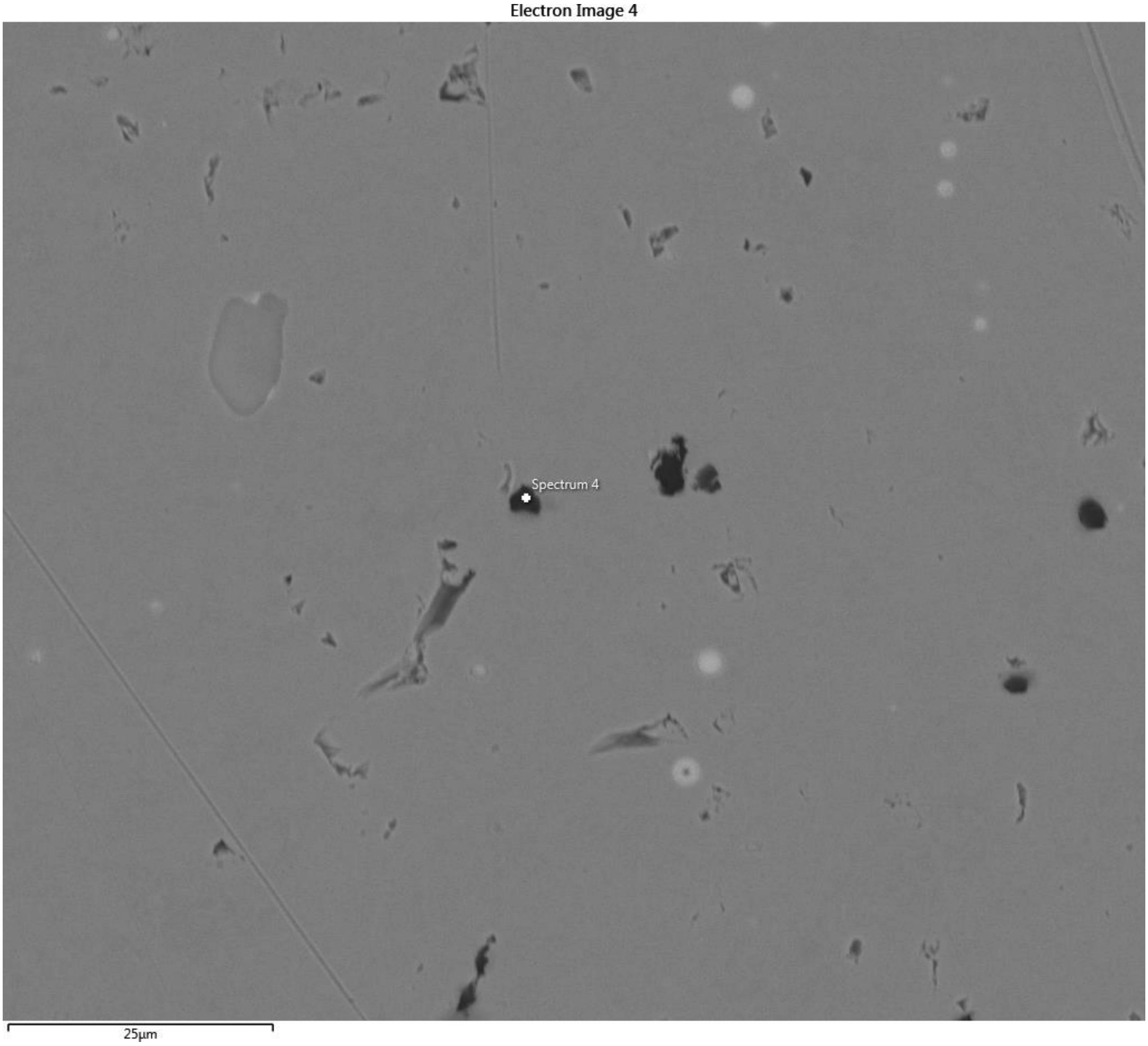


Fig. 11. Micrograph of mounted sample showing spot analysis on carbon inclusion (Spectrum 4). (*South Australian* shipwreck, sheathing sample #001). Micrograph by Wendy van Duivenvoorde.

Results

The sheathing and bolts collected from *South Australian* were made of copper. The copper itself is quite pure. It contains little or no lead but has some carbon added to it (Tables 2 and 3).

The so-called keel pins however are an alloy with a composition of about 63–68% Cu, 31–34% Zn, and 1-3% lead. Elements like Fe and Sn were measured

manually, but their presence is practically nihil— they are trace elements, i.e. iron or tin were not added in the manufacture of this alloy (Table 4). The composition of the keel pins is thus different from the material that was recently collected from the shipwreck site and resemble a post-1830s Muntz metal type of alloy, i.e. copper, zinc with a little bit of lead.

See for more information

Bingeman, J.M. 2018. Copper and Muntz metal sheathing: a global update. The *International Journal of Nautical Archaeology* 47.2: 460–471. doi: 10.1111/1095- 9270.12299.

Flick, C. 1975. Muntz metal and ships' bottoms: the industrial career of G.F. Muntz. *The Transactions of the Birmingham and Warwickshire Archaeological Society* 87:70– 88.

Knott, P. 2008. Ship parts. *Australasian Institute of Maritime Archaeology Newsletter* 27(4):21–22.

O'Guiness, C.M., N.R. Lipfert, E.A.R. Ronnberg and D.A. Scott 2010 Technical Analysis of Muntz Metal Sheathing from the

American Clipper Ship *Snow Squall* (1851–1864) *METAL 2010: Proceedings of the Proceeding of the Interim Meeting of the ICOM- CC Metal Working Group*:107–114. Charleston, South Carolina.

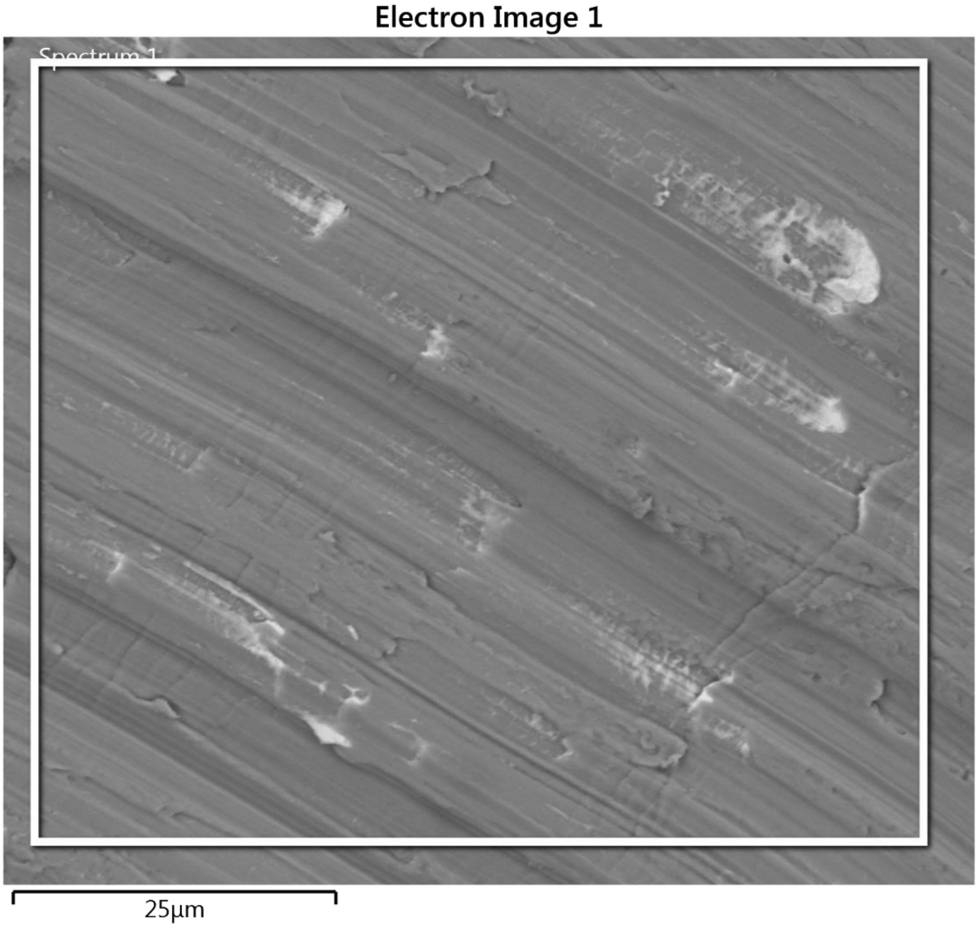
Scott, David A. 2011. *Ancient Metals: Microstructure and Metallurgy*, Volume 1.

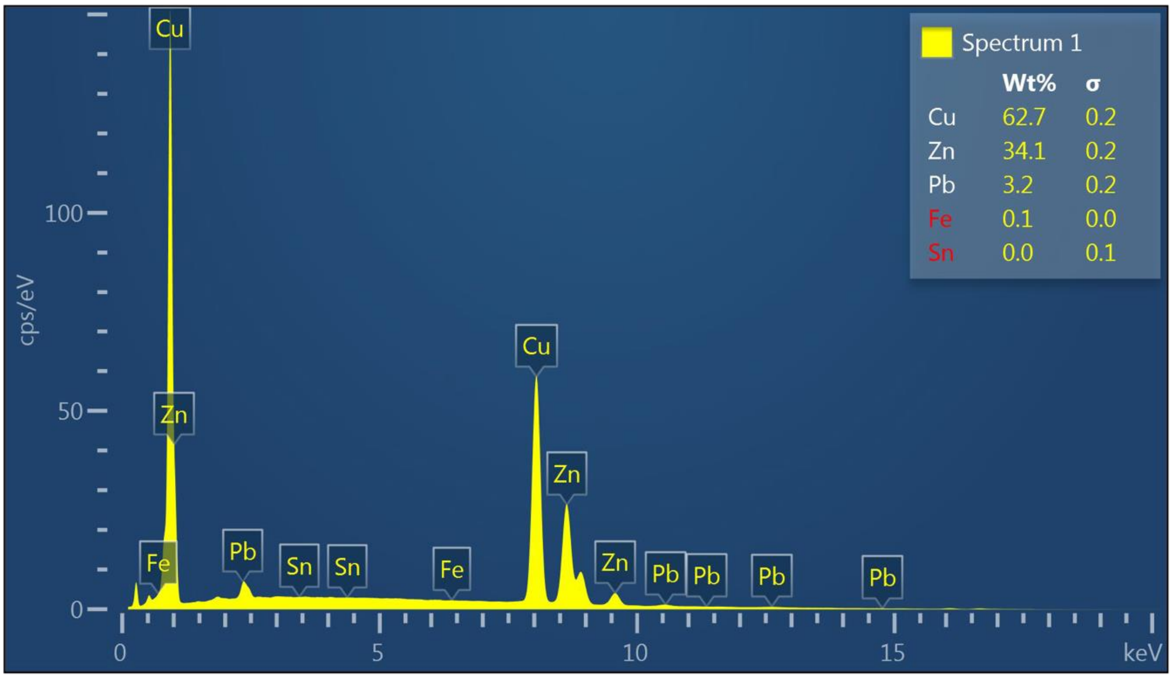
Lulu.com.

Your sincerely,

Wendy van Duivenvoorde

KeelPin404
20-Mar-19





KeelPin404
20-Mar-19

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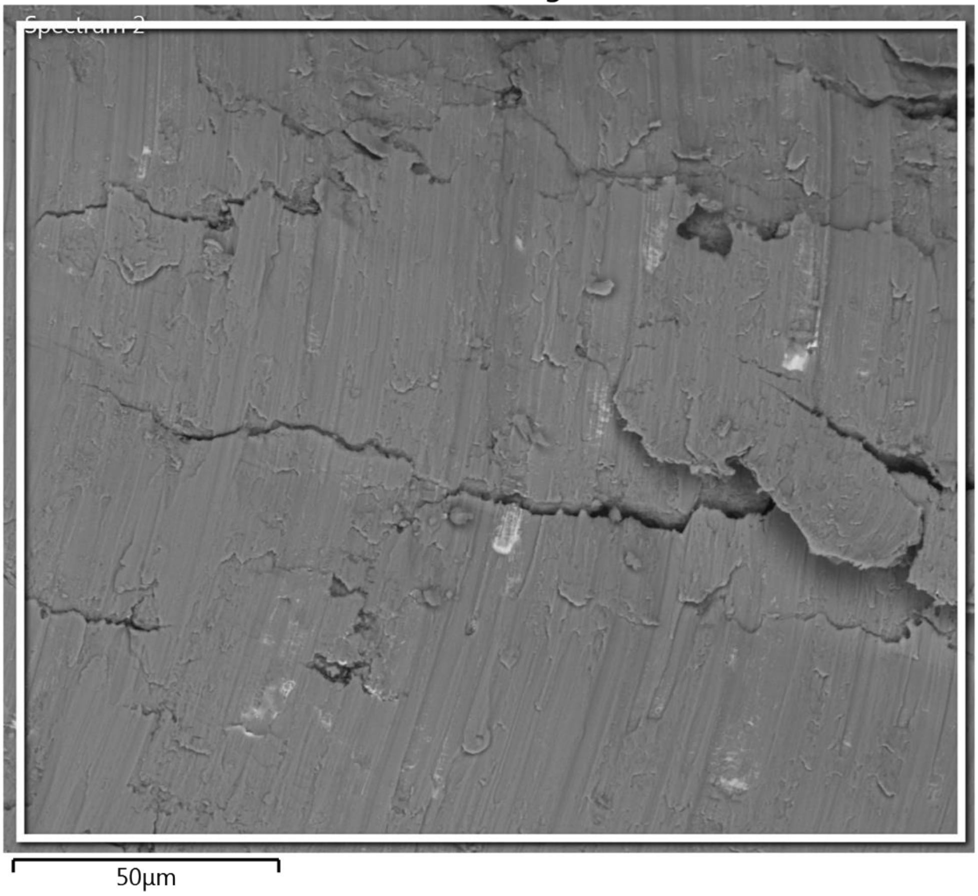

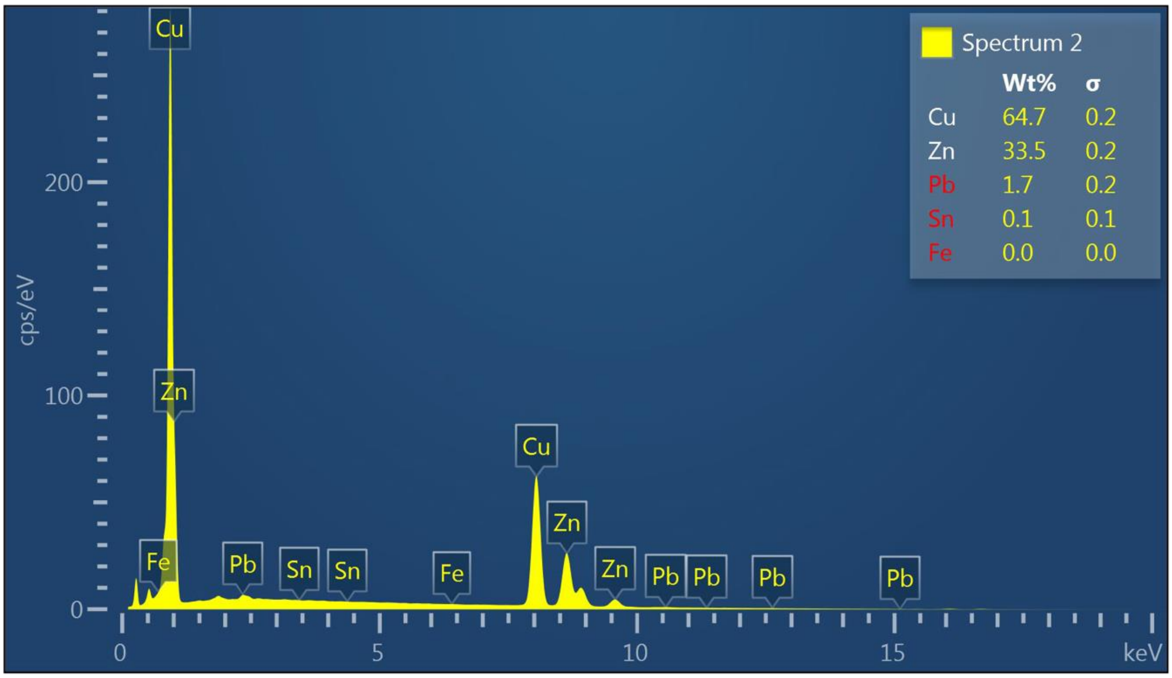

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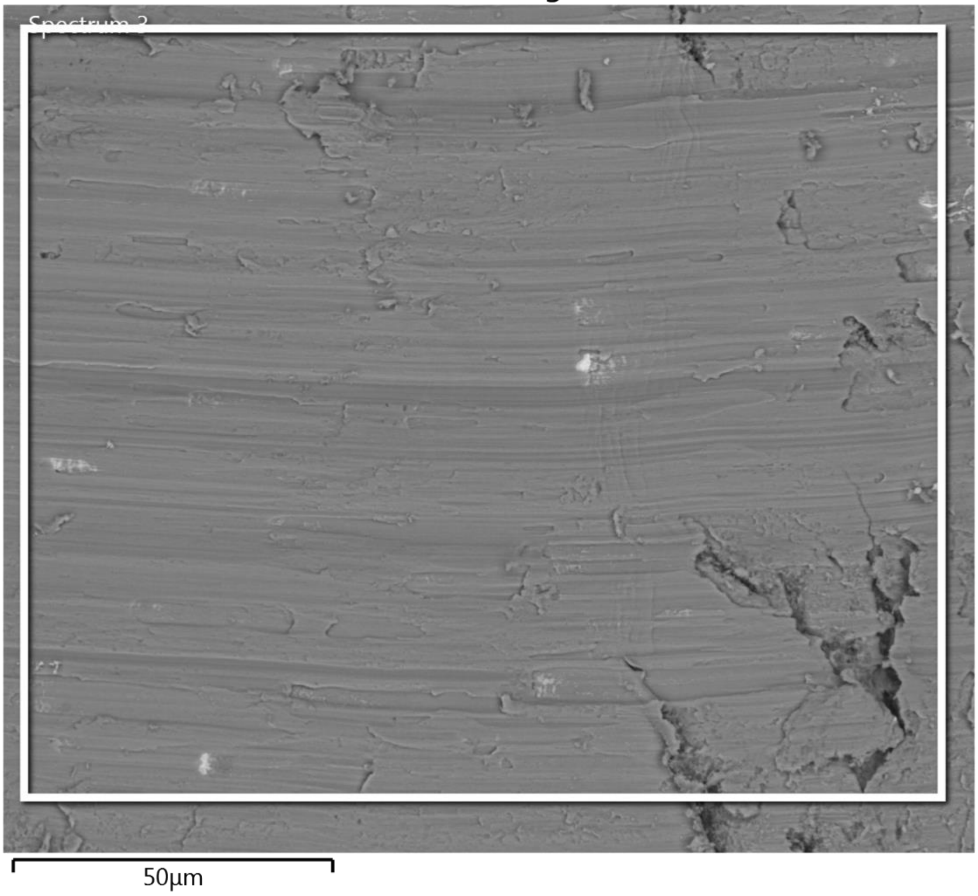

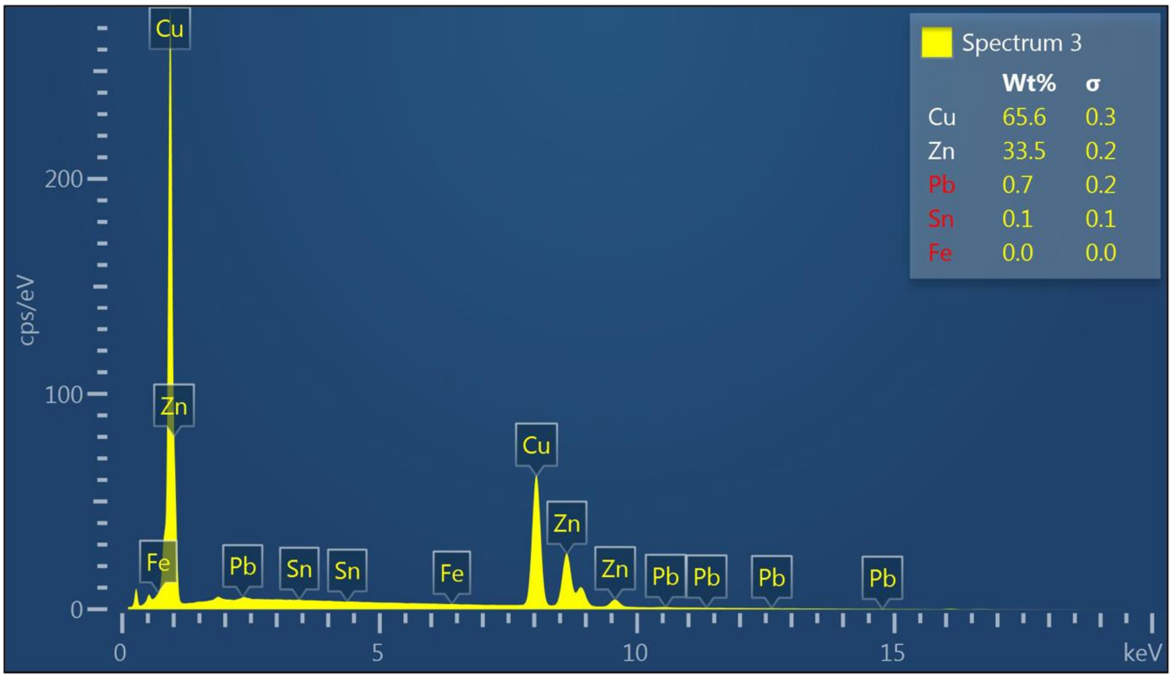

KeelPin404
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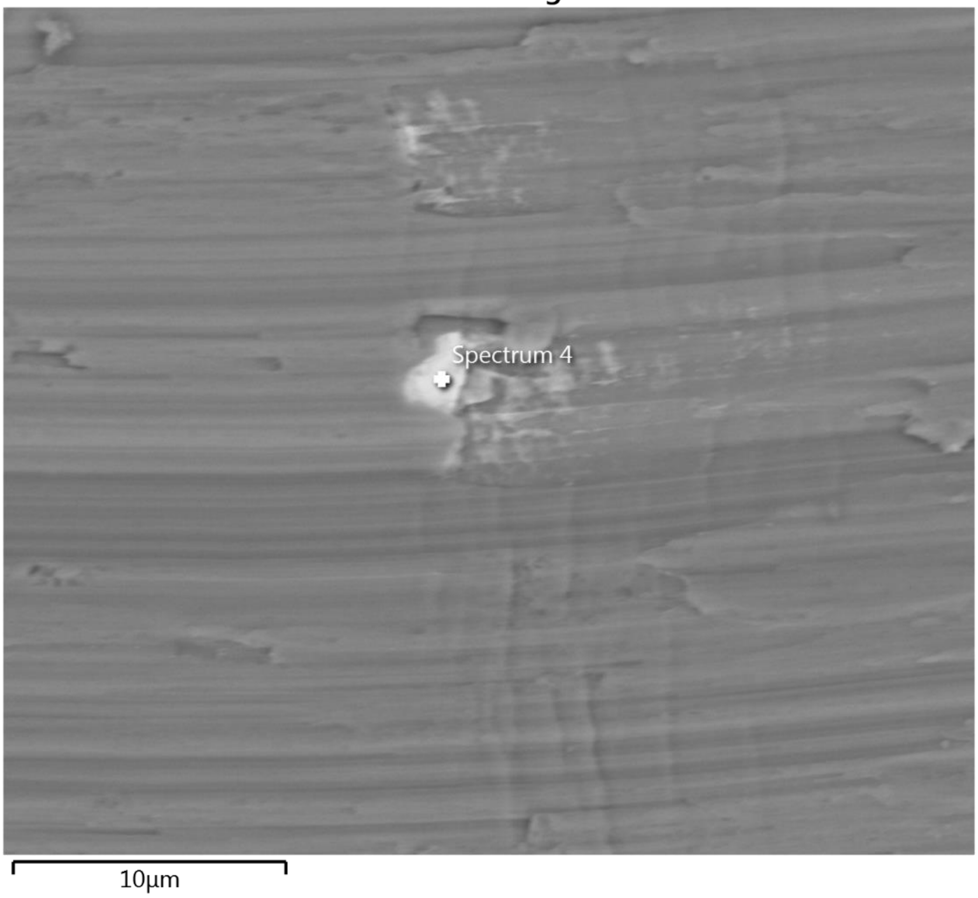

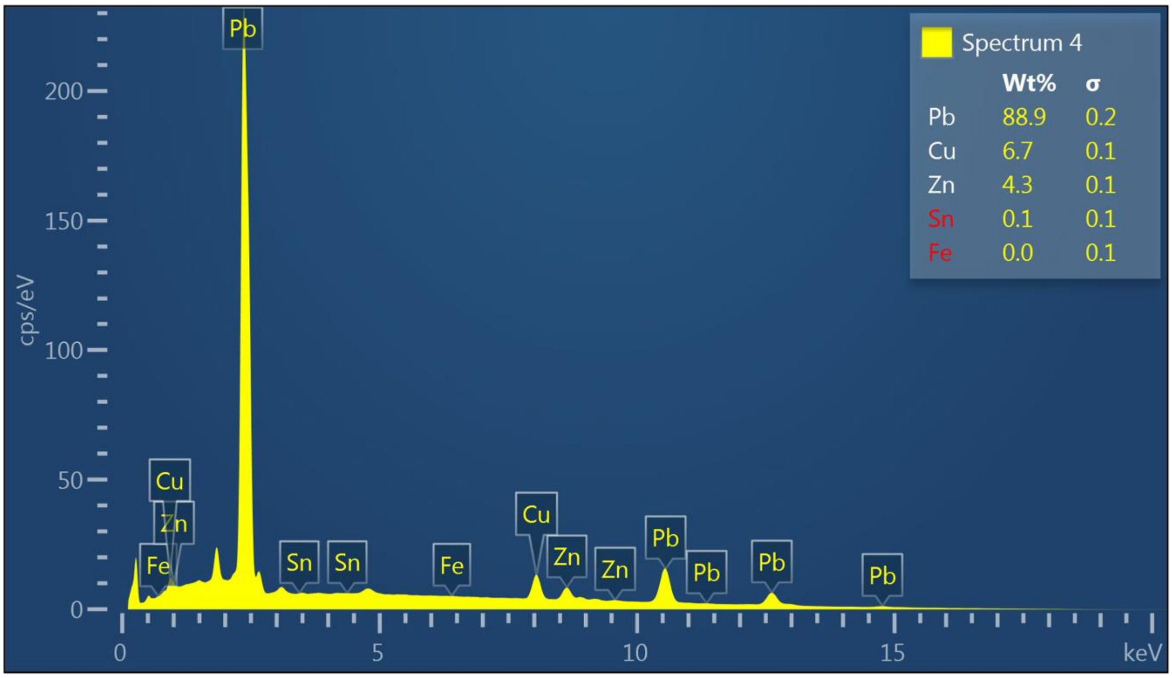

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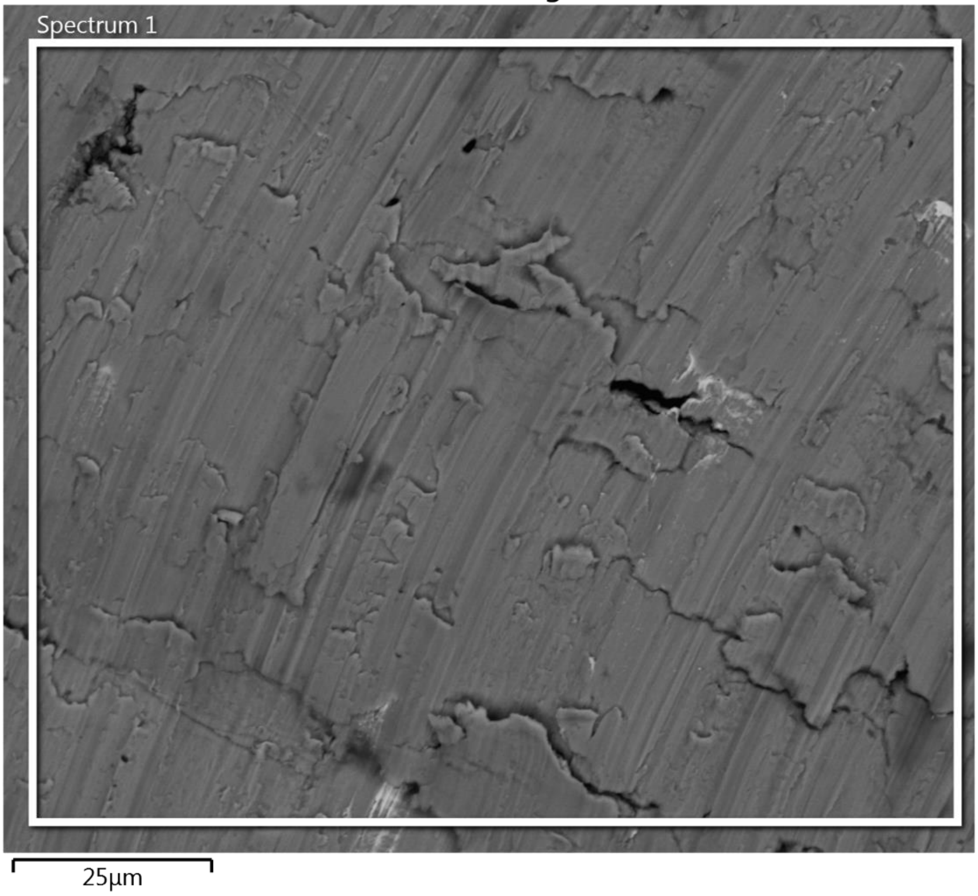

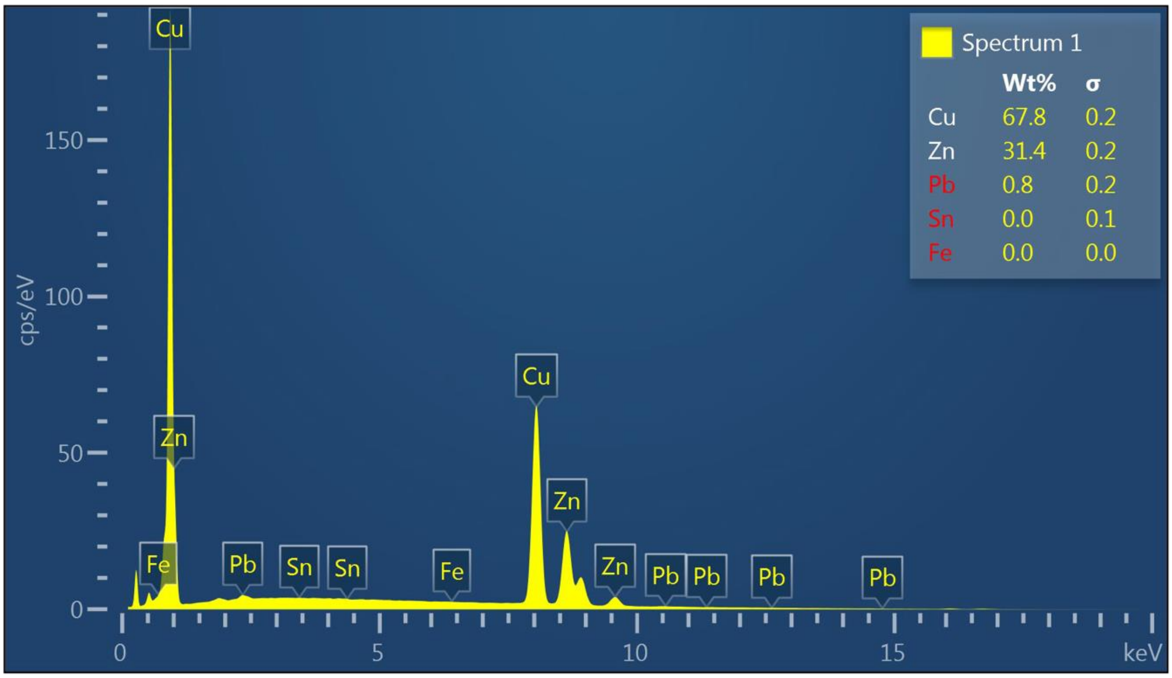

KeelPin405
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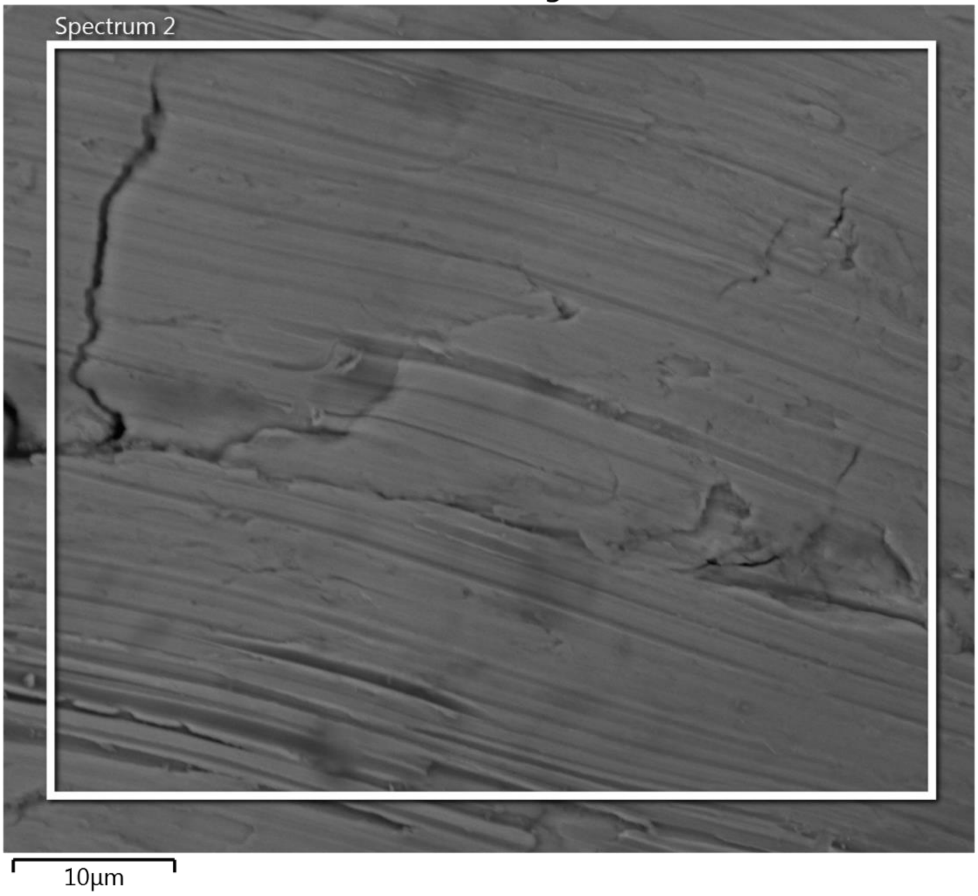
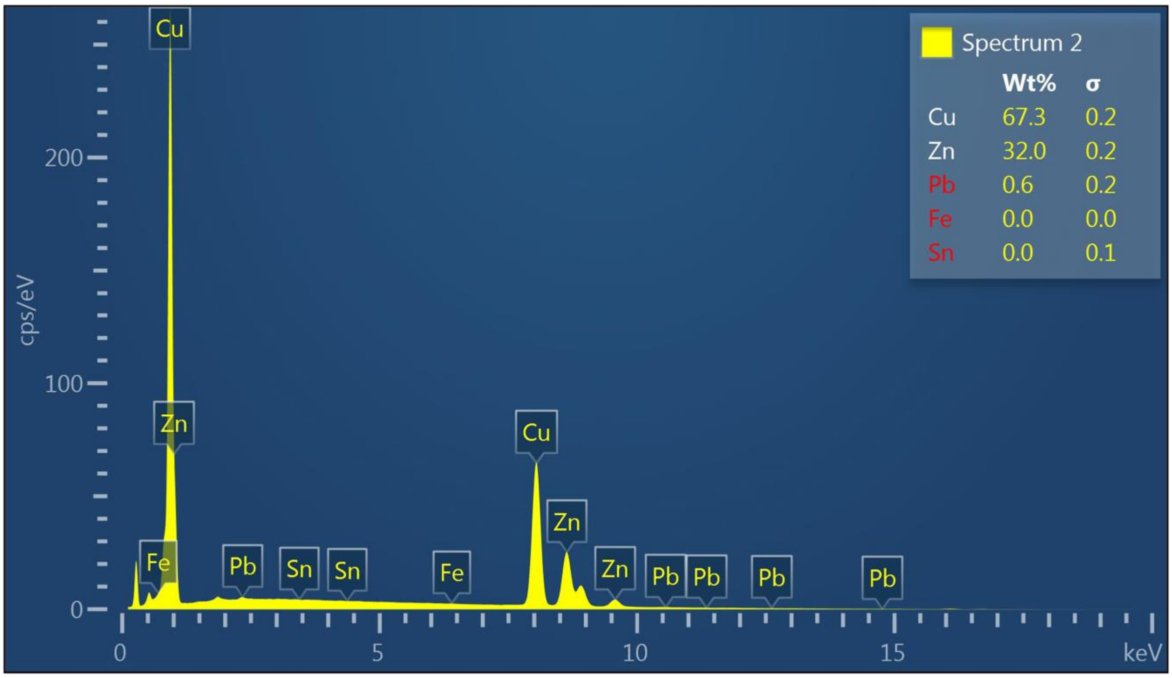
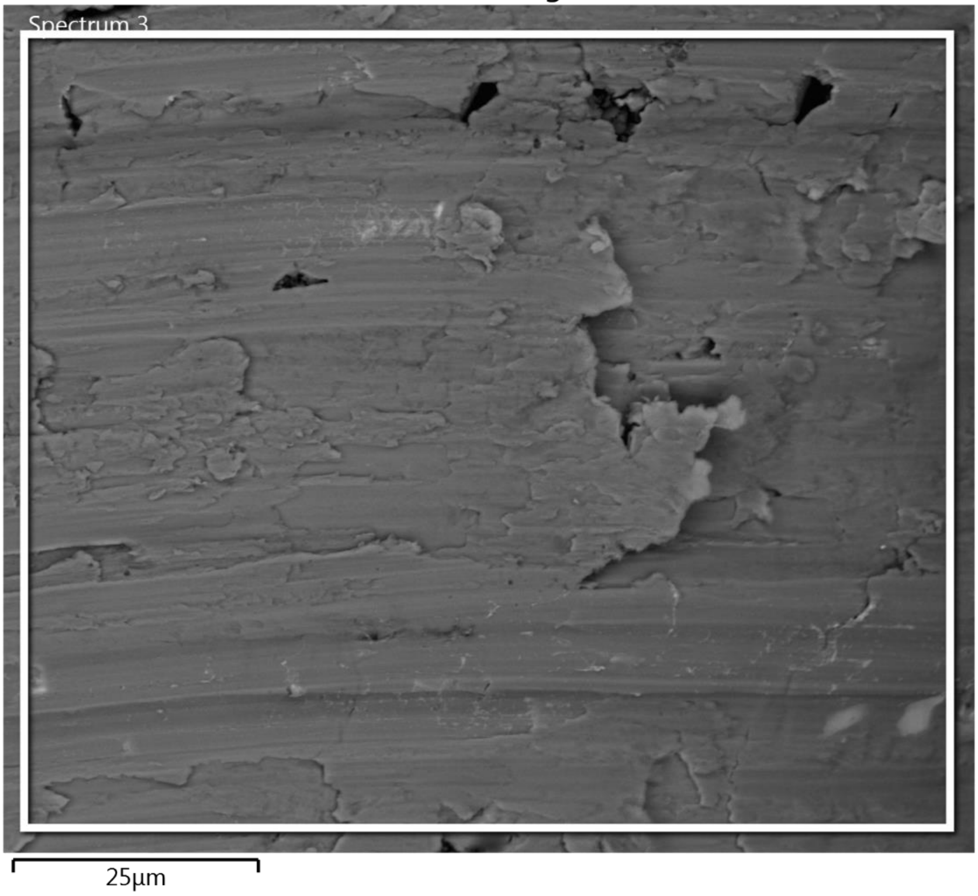


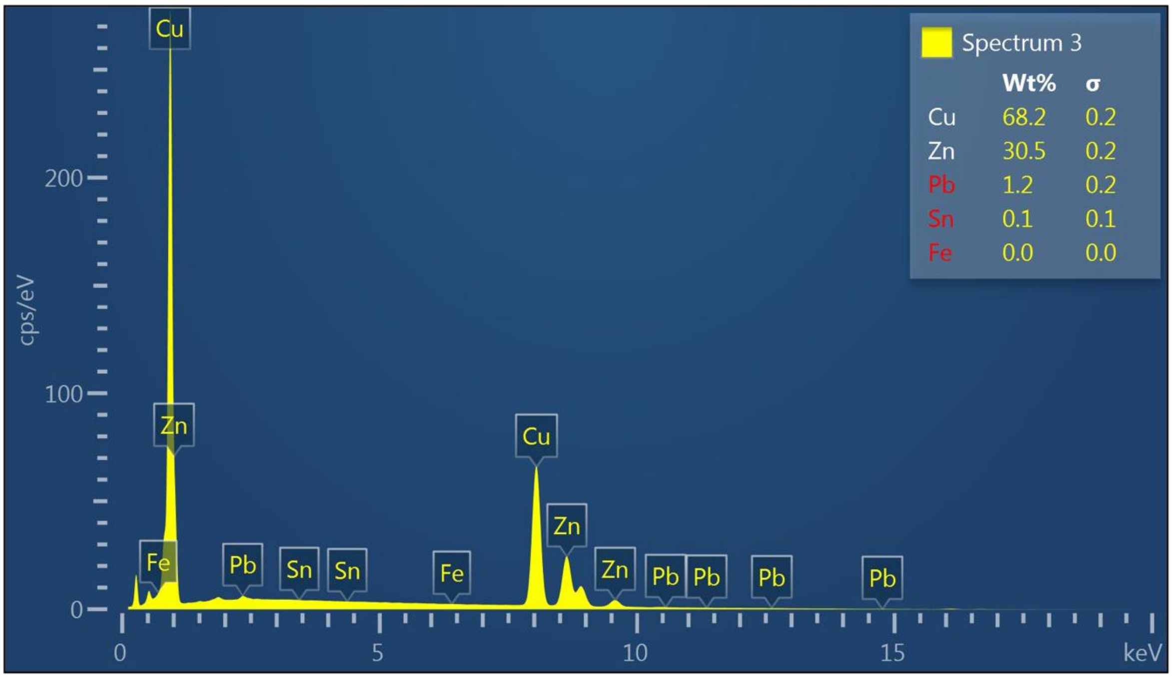


Spectrum 2	Wt%	σ
Cu	67.3	0.2
Zn	32.0	0.2
Pb	0.6	0.2
Fe	0.0	0.0
Sn	0.0	0.1

KeelPin405
20-Mar-19

Electron Image 3

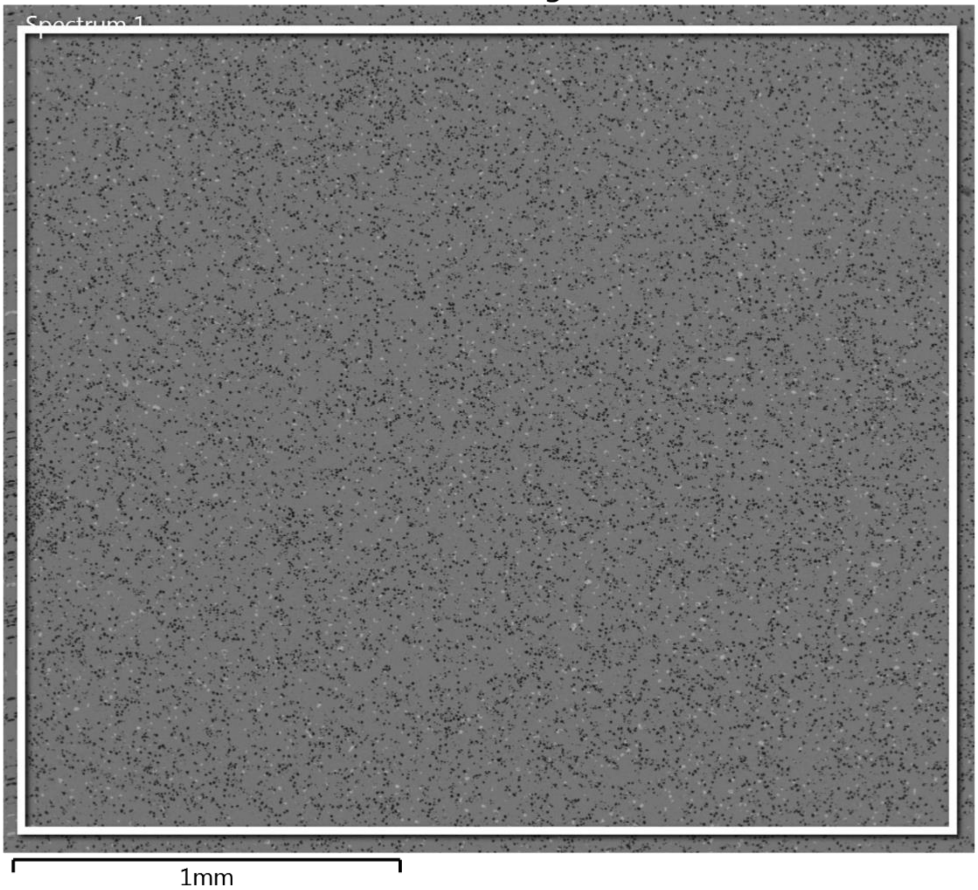


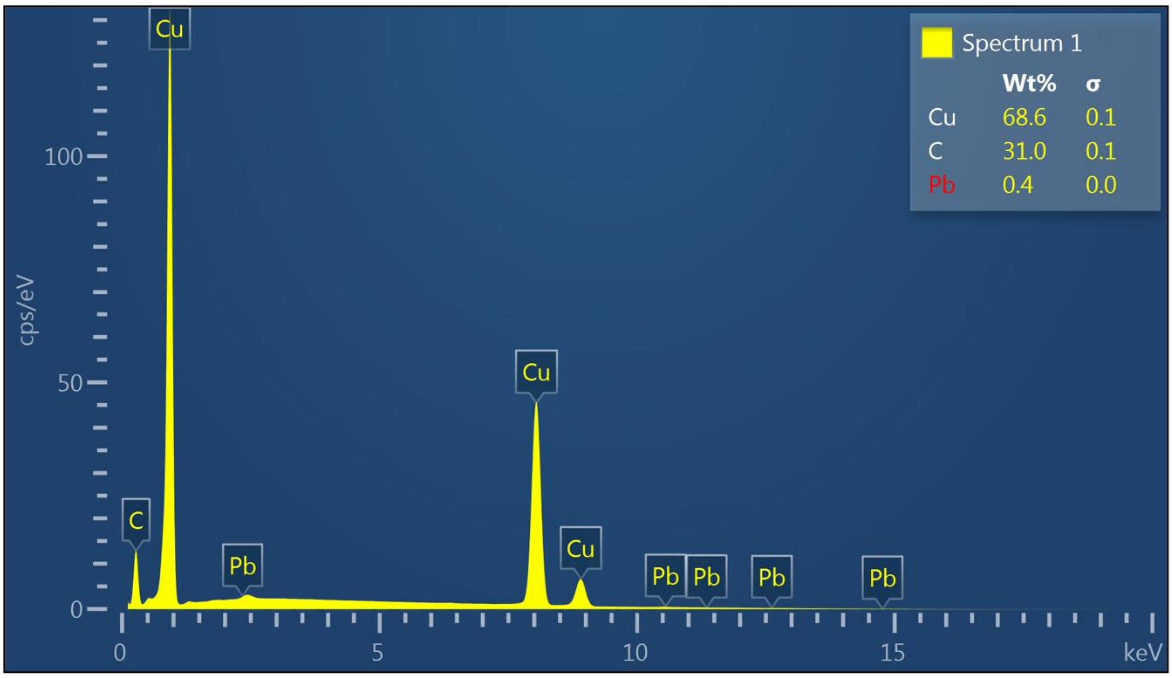


Bolt1

24-Sep-19

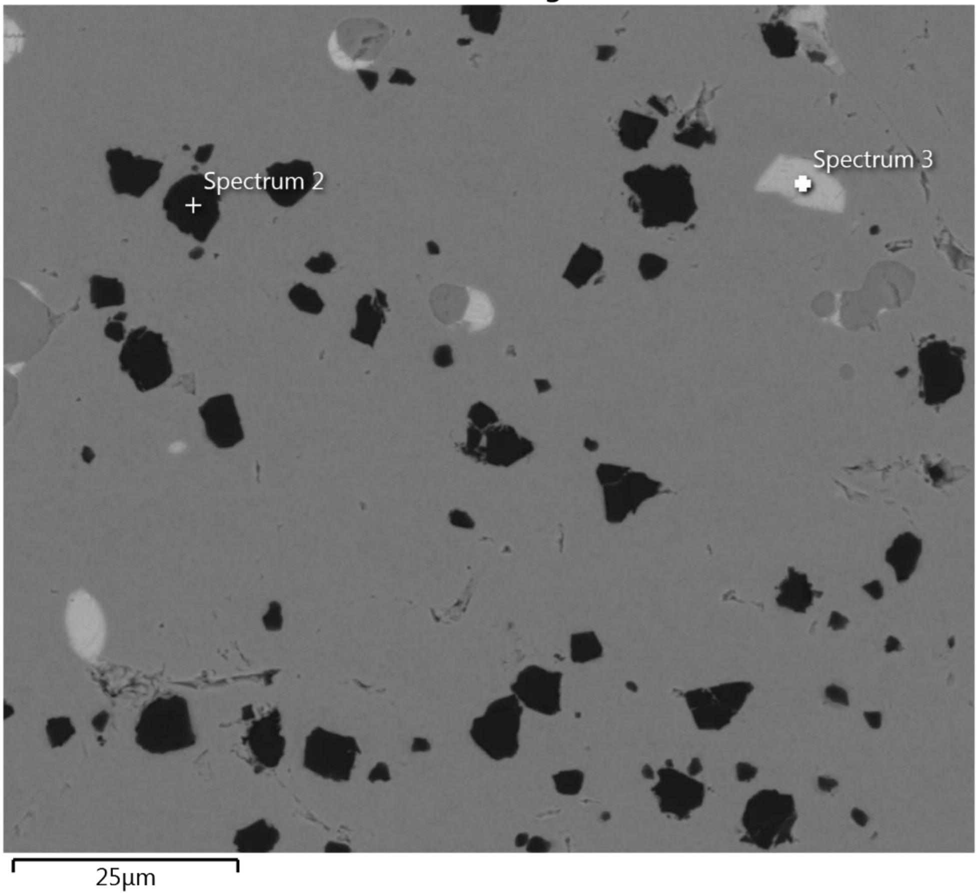
Electron Image 1

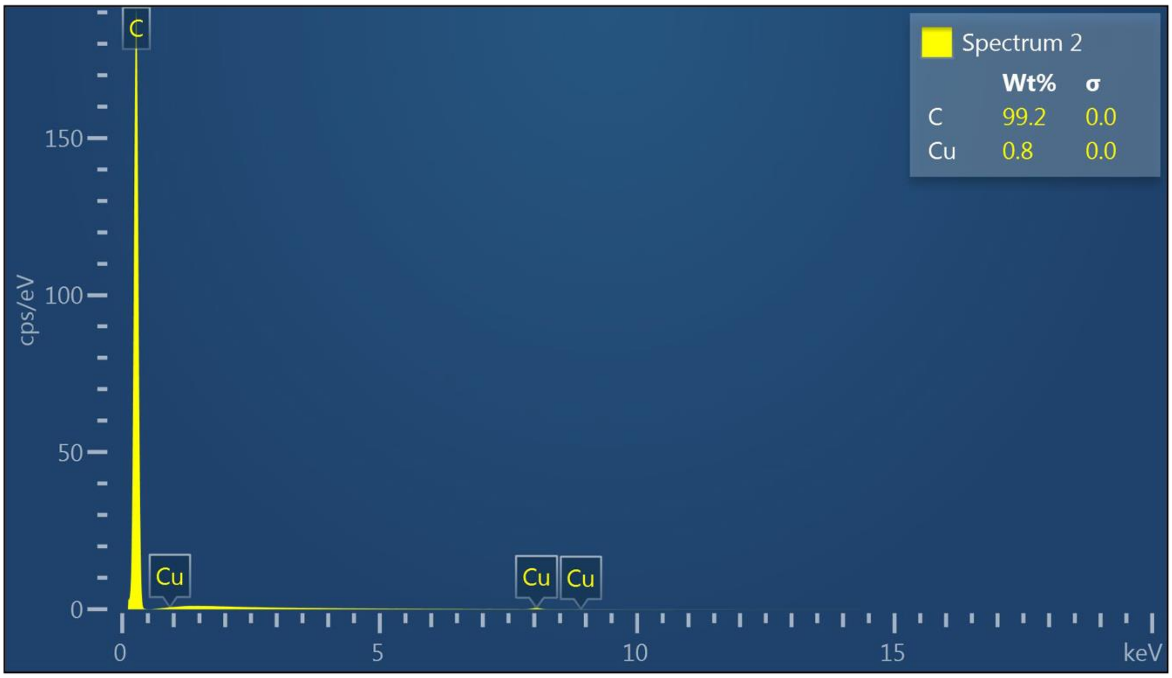




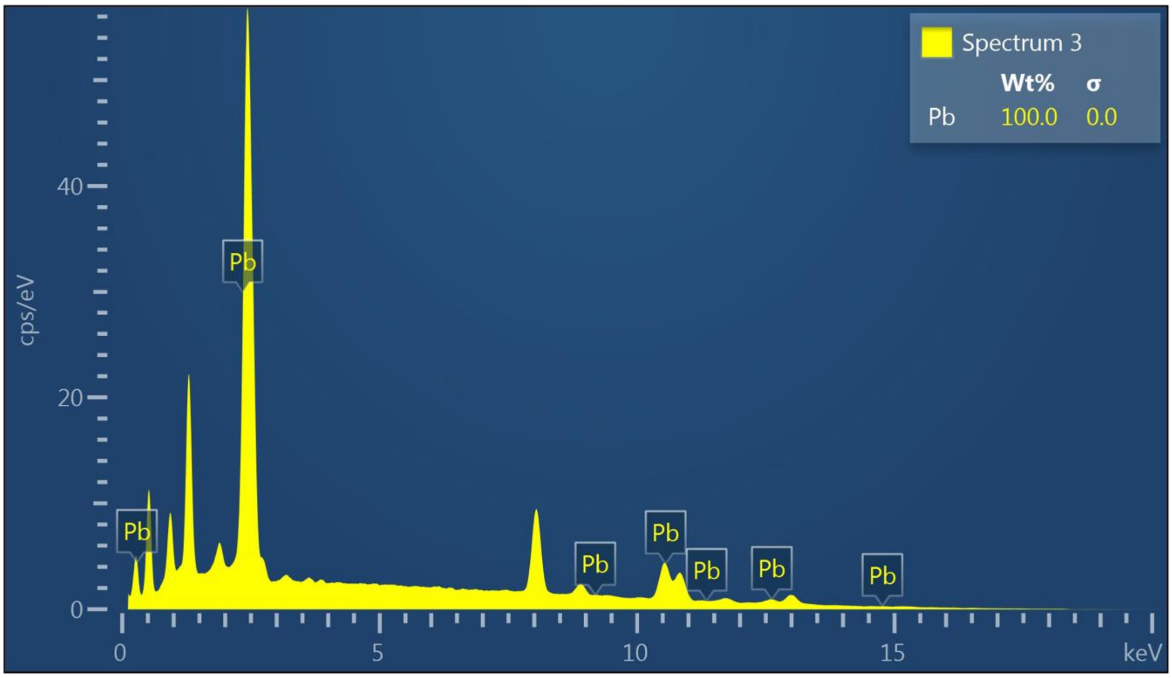
Bolt1
24-Sep-19

Electron Image 2



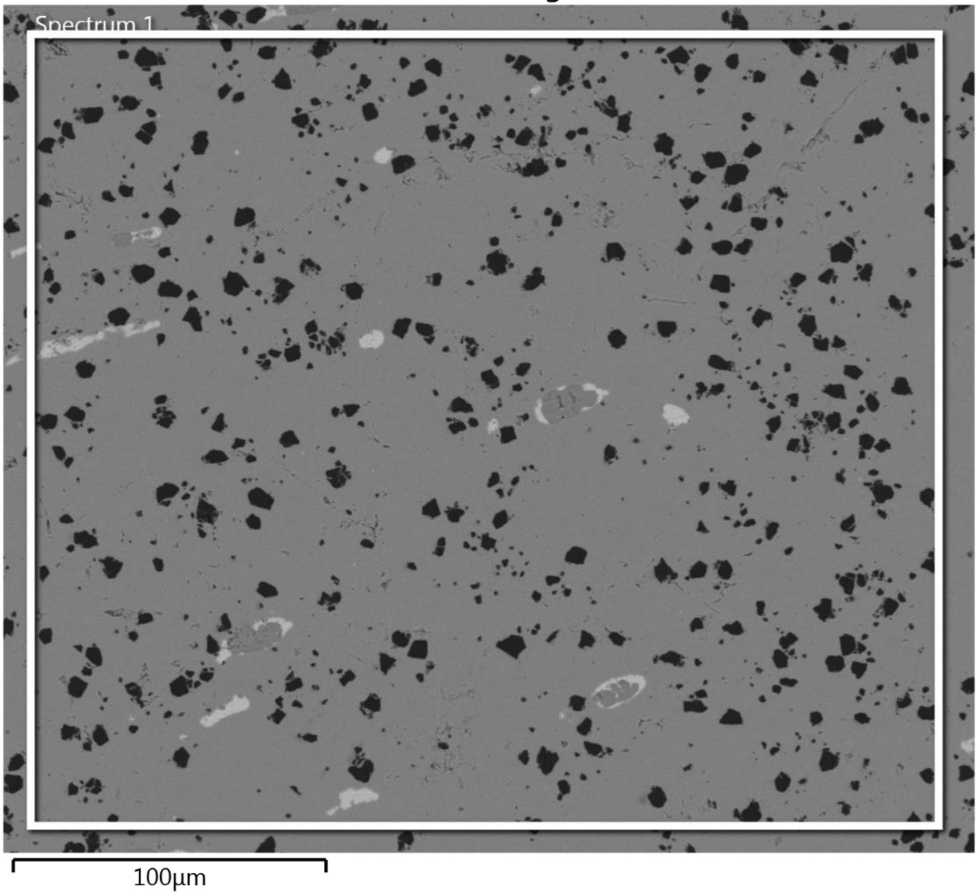


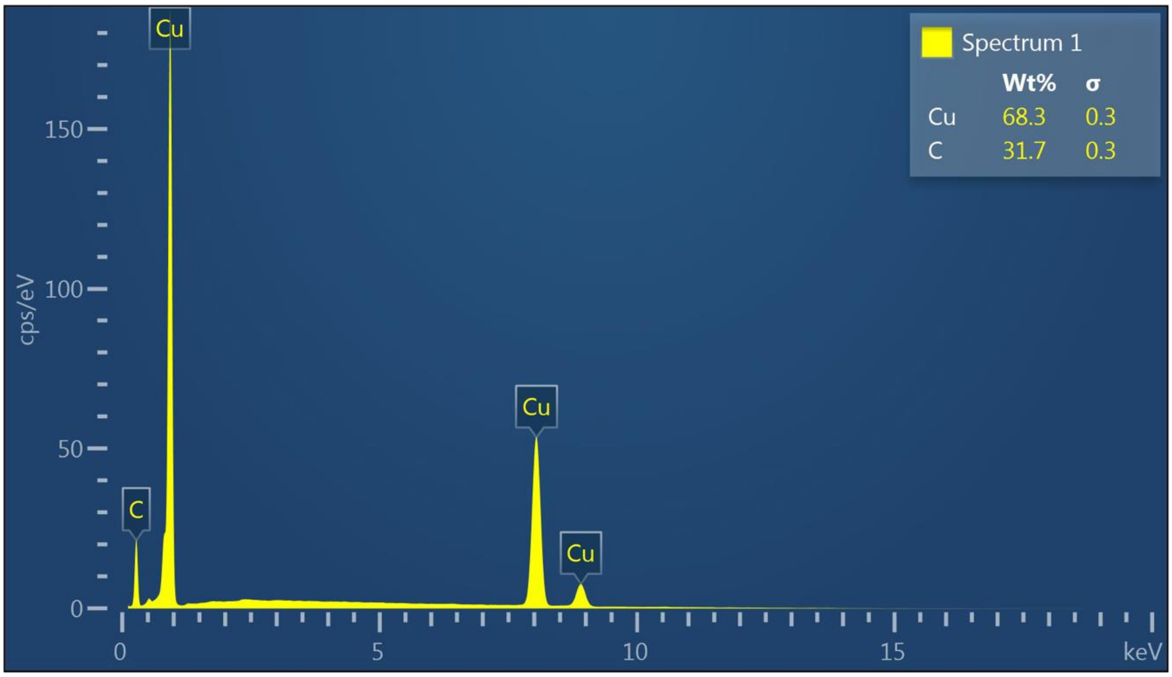
Bolt1
24-Sep-19



SAS_Bolt_002
26-Aug-19

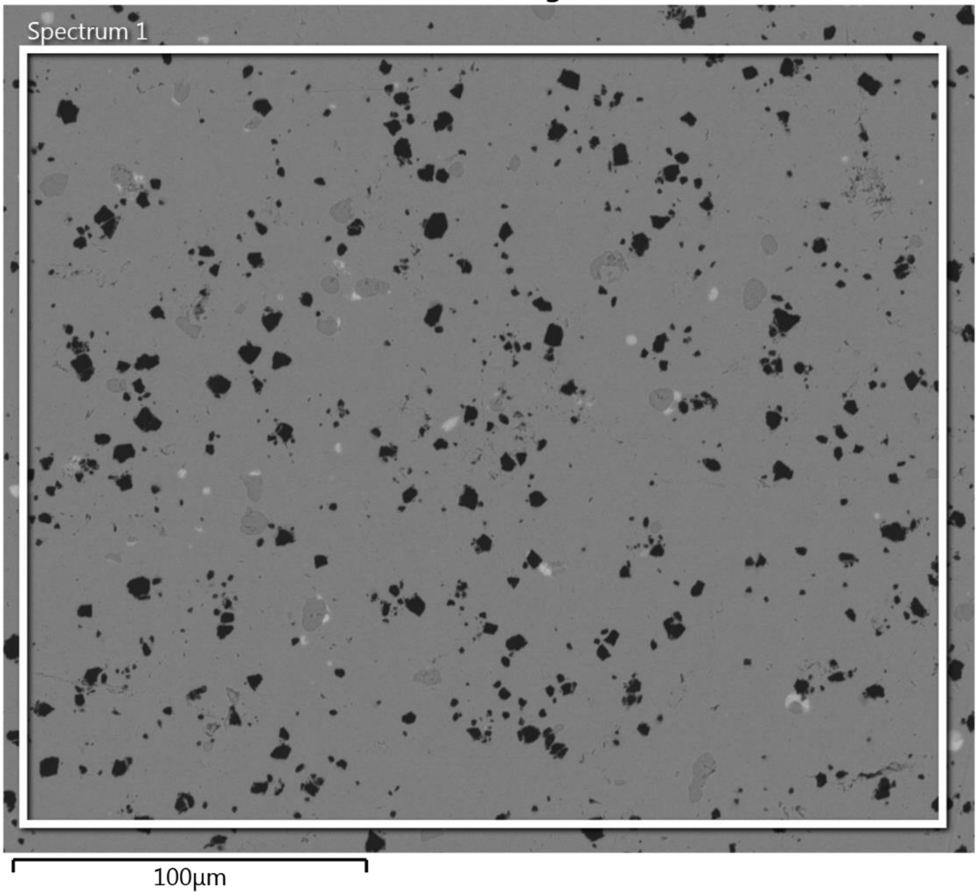
Electron Image 1

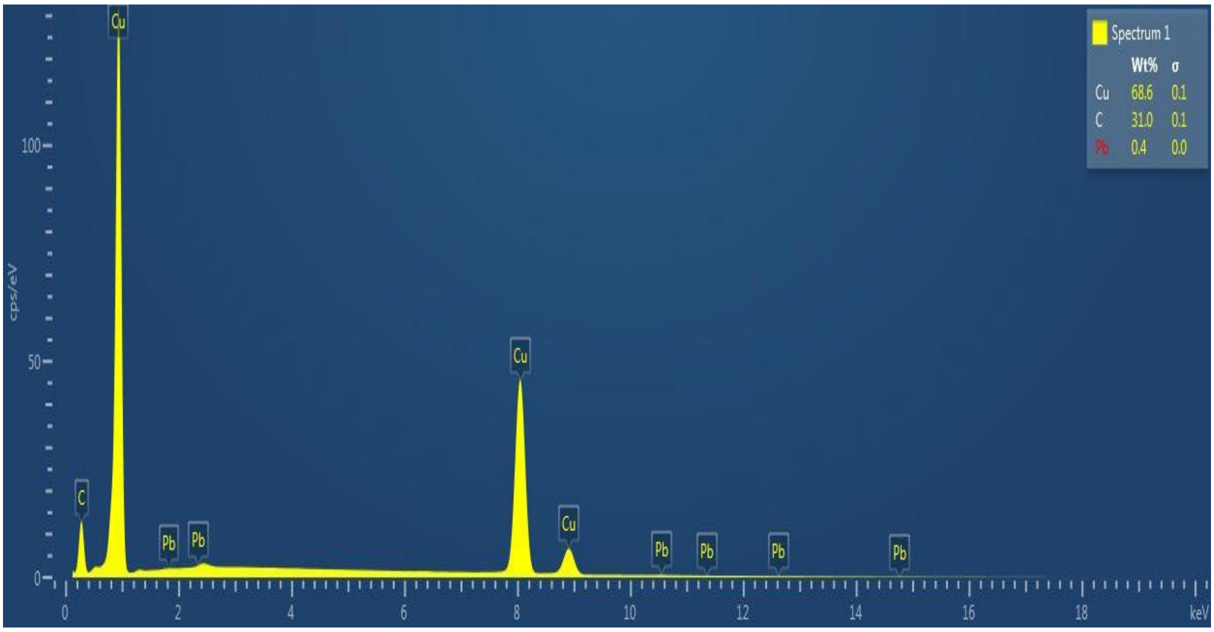




SAS_Bolt_003
26-Aug-19

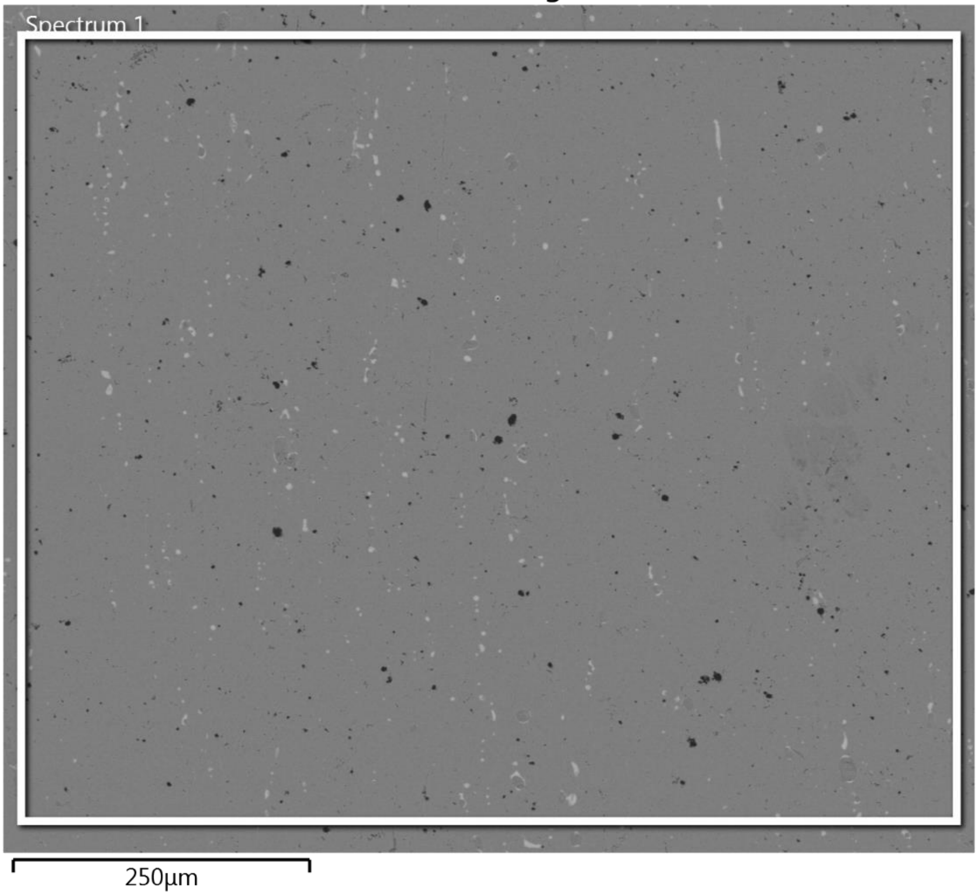
Electron Image 1

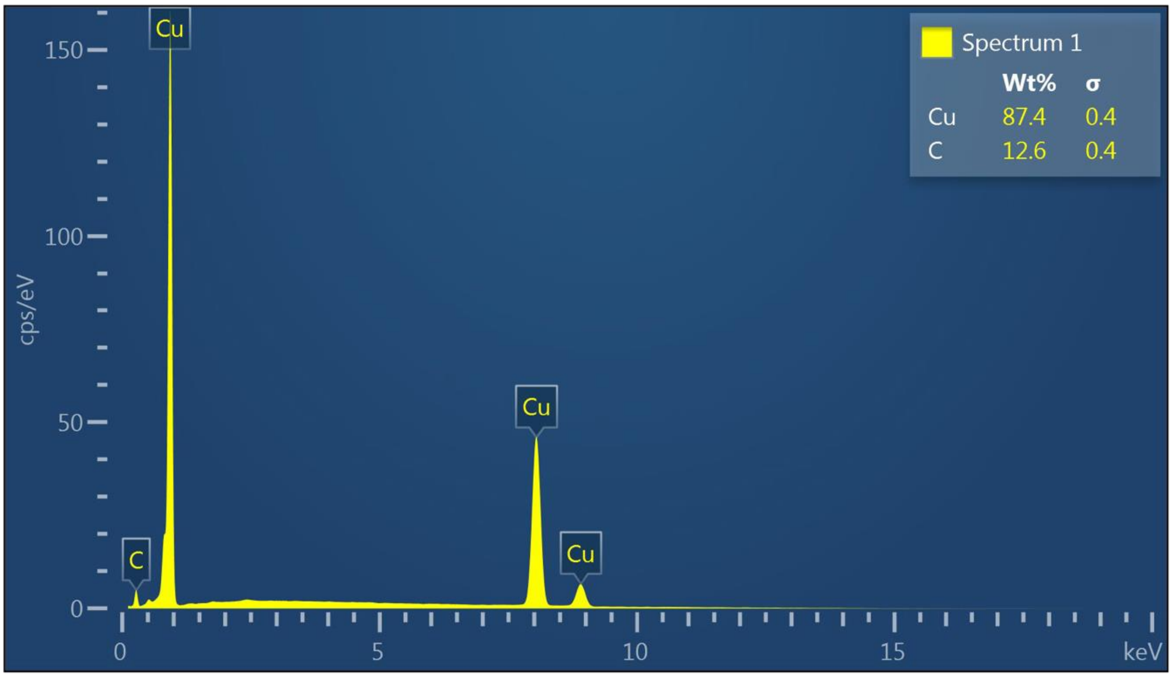




SAS_Sheathing_001
24-Sep-19

Electron Image 1





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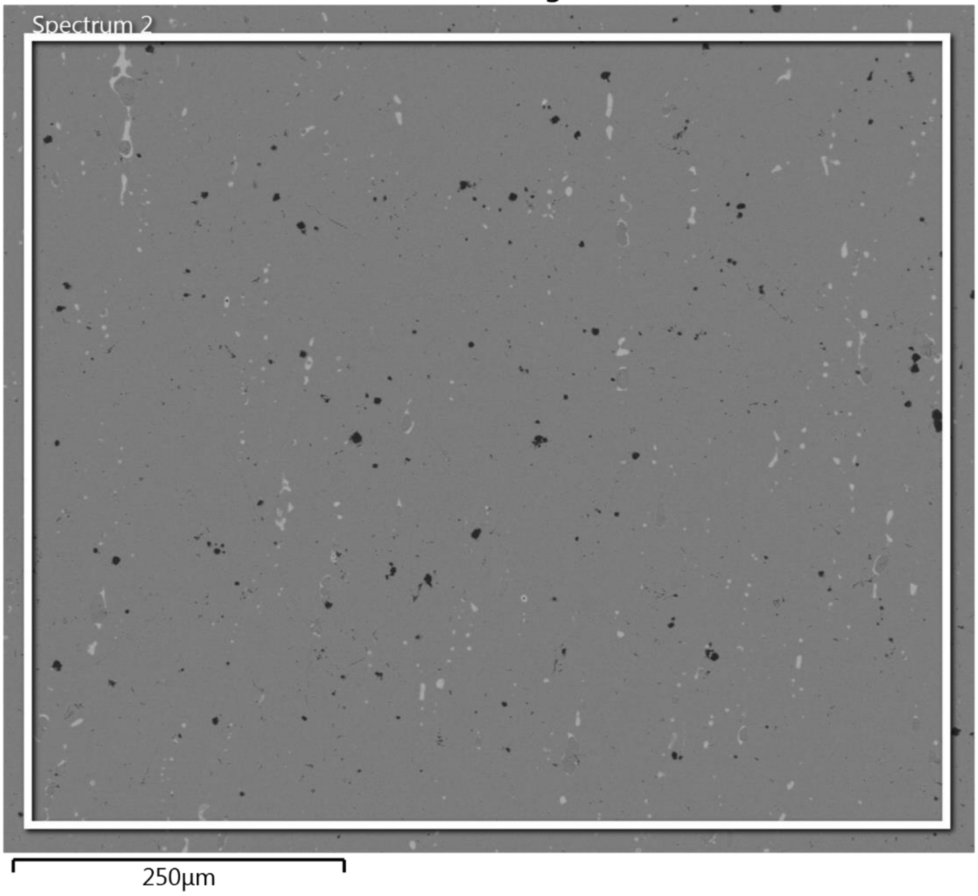
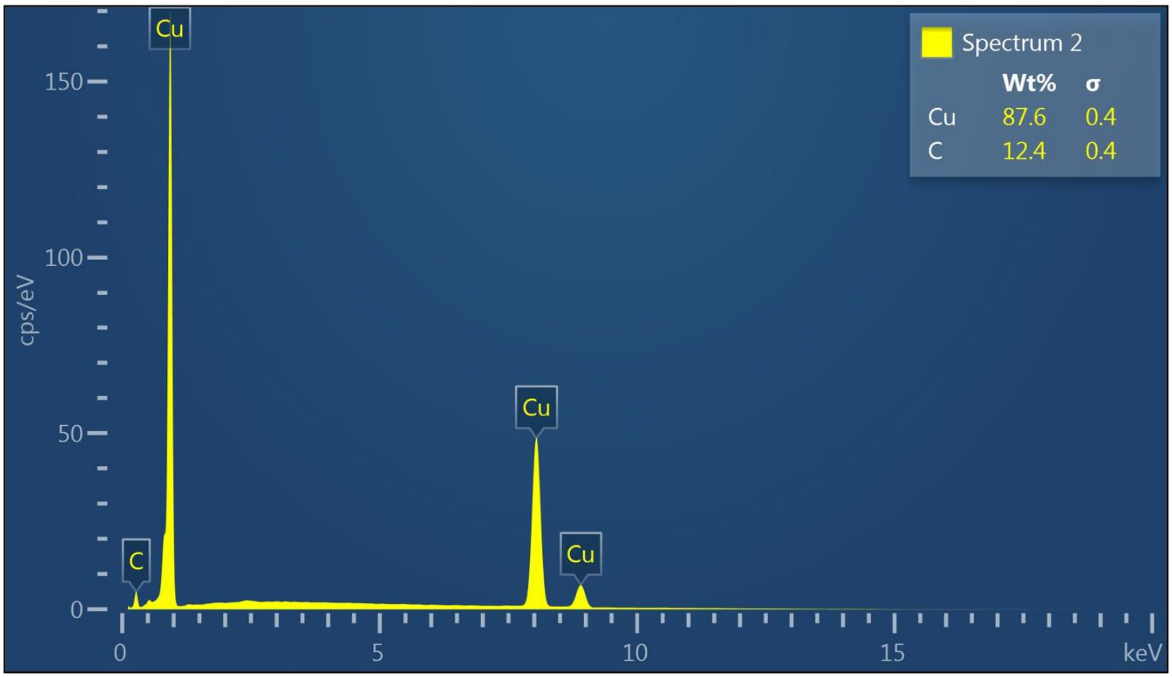
SAS_Sheathing_001

24-Sep-19

Electron Image 2





SAS_Sheathing_001
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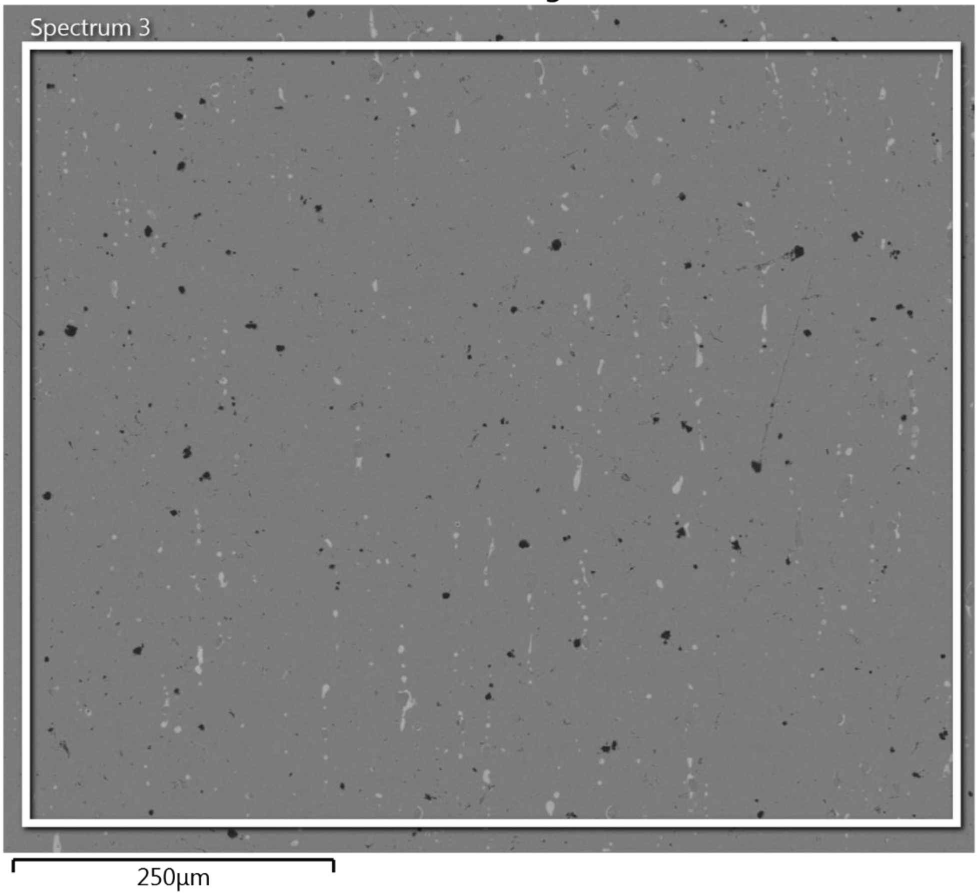

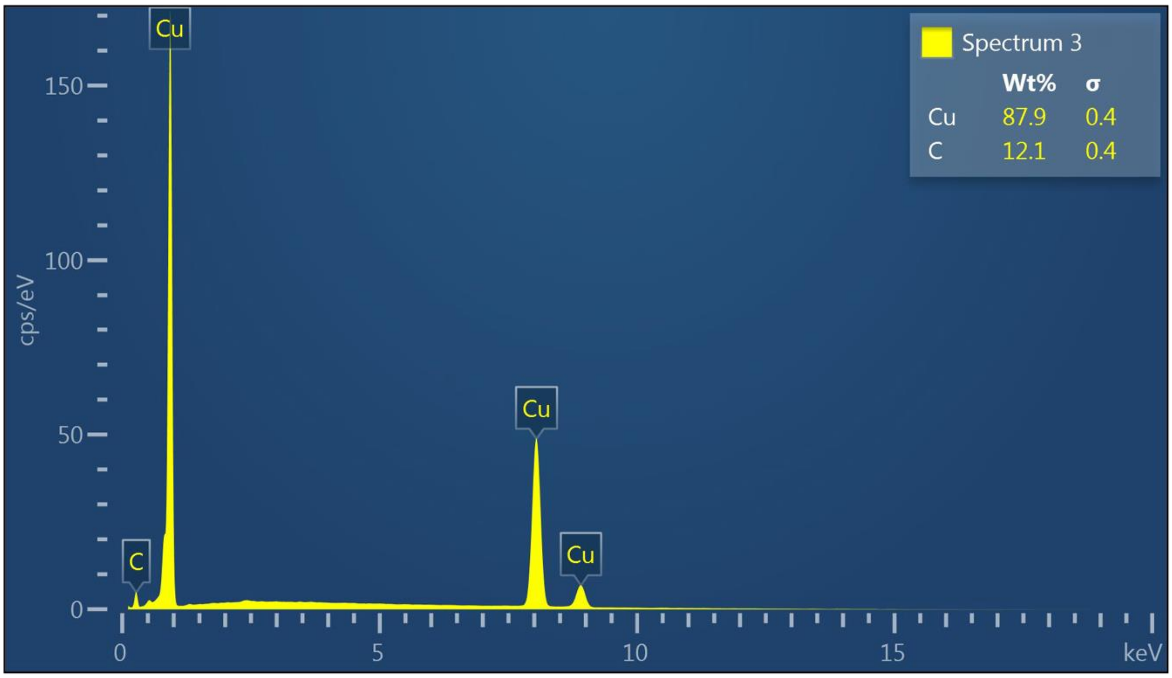

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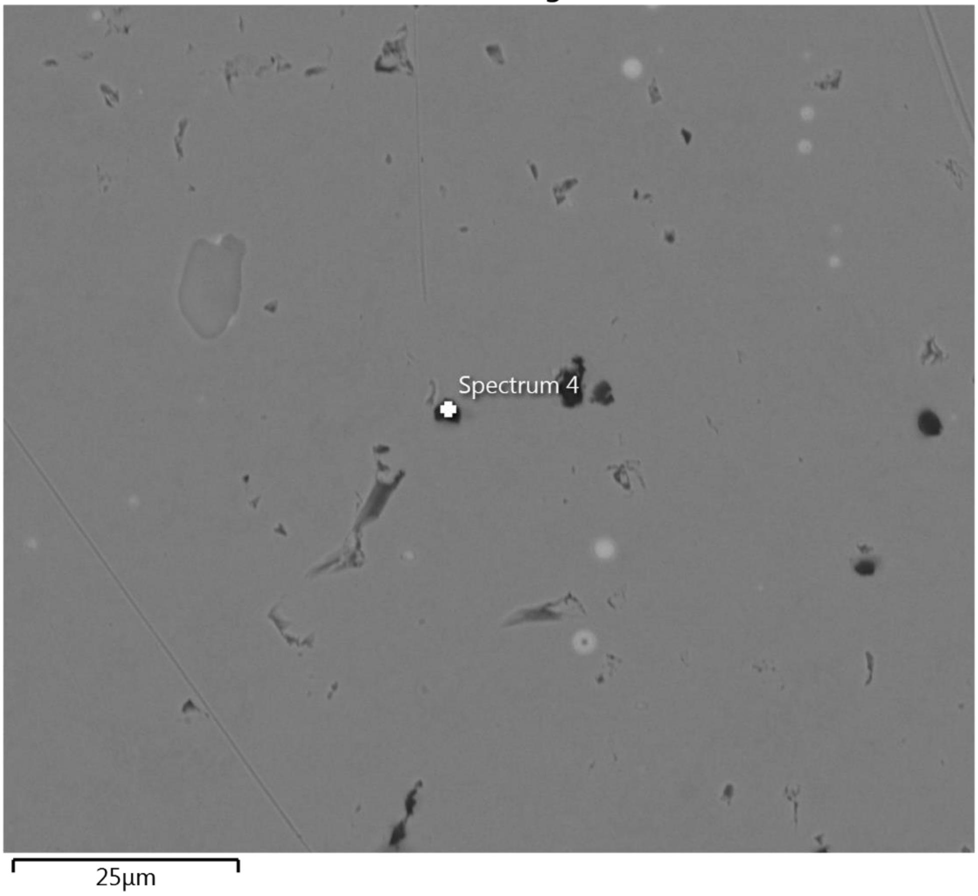

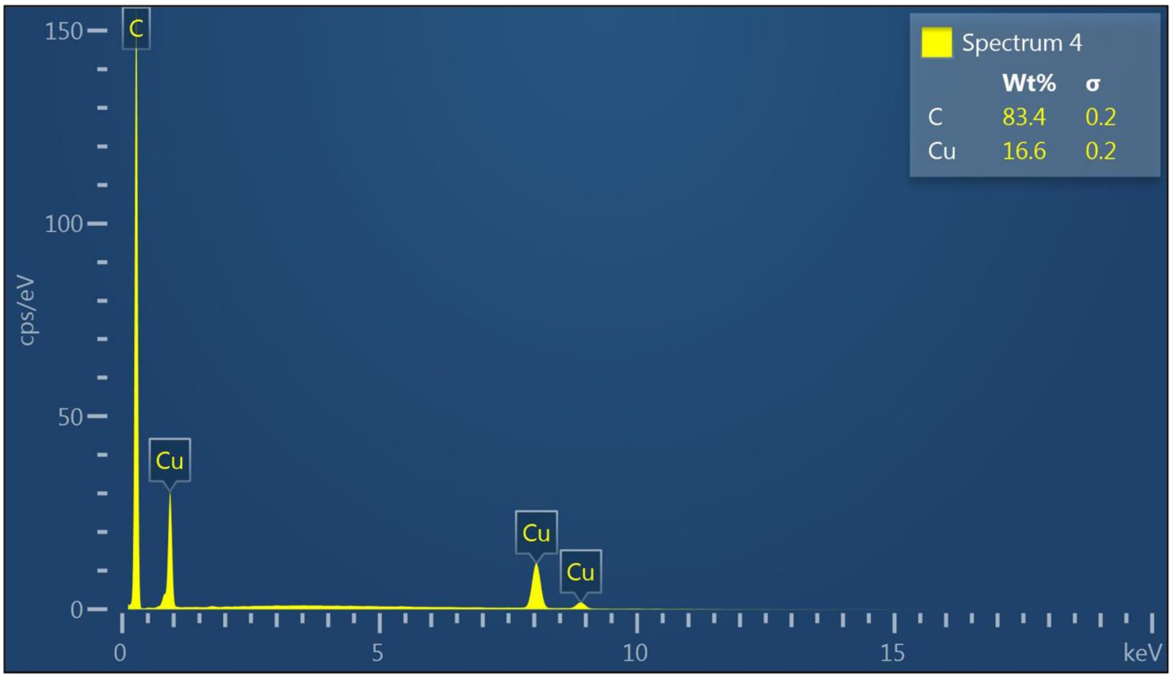

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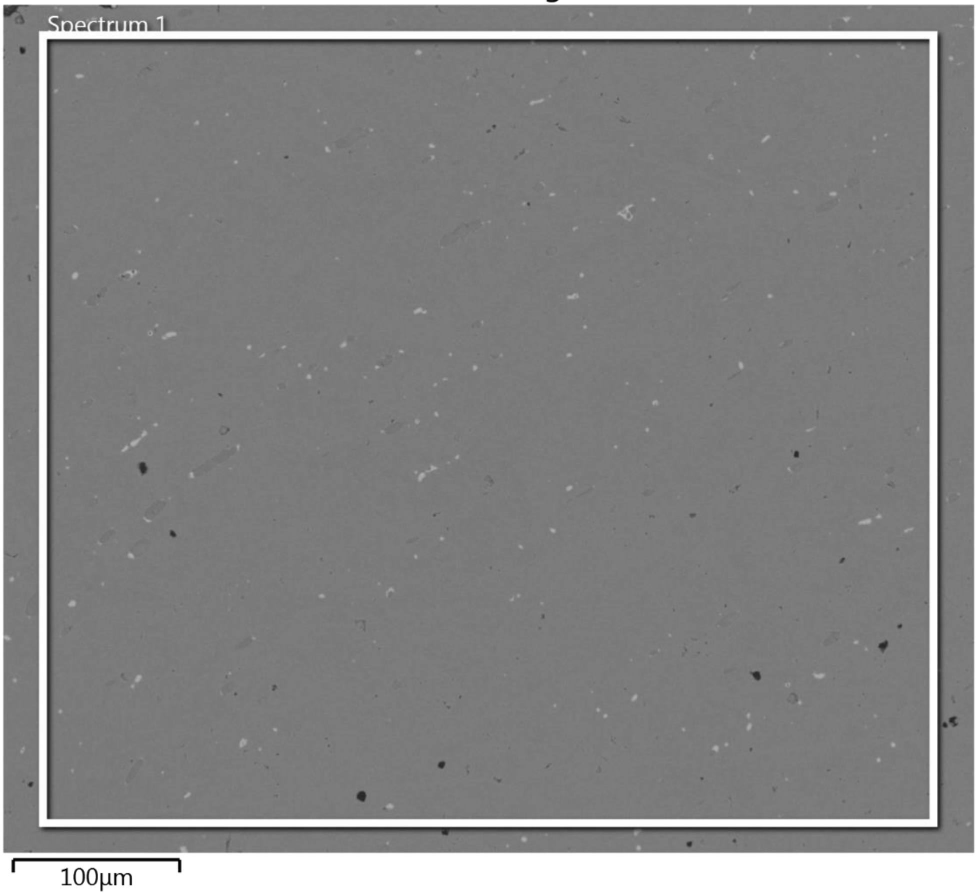

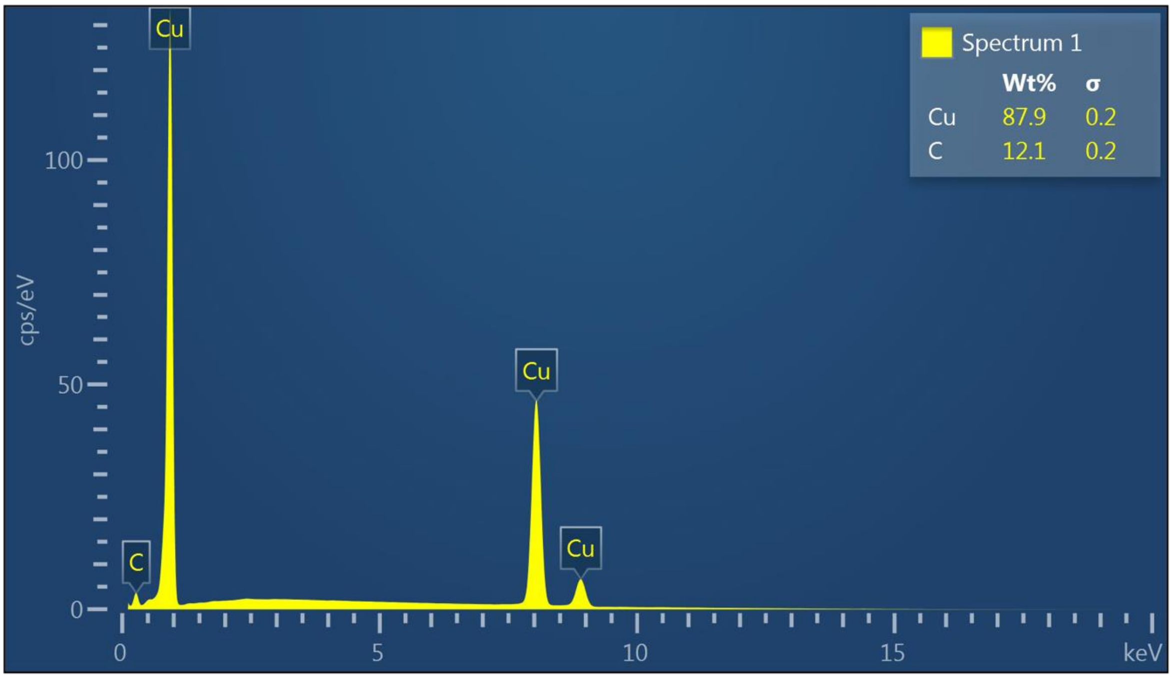

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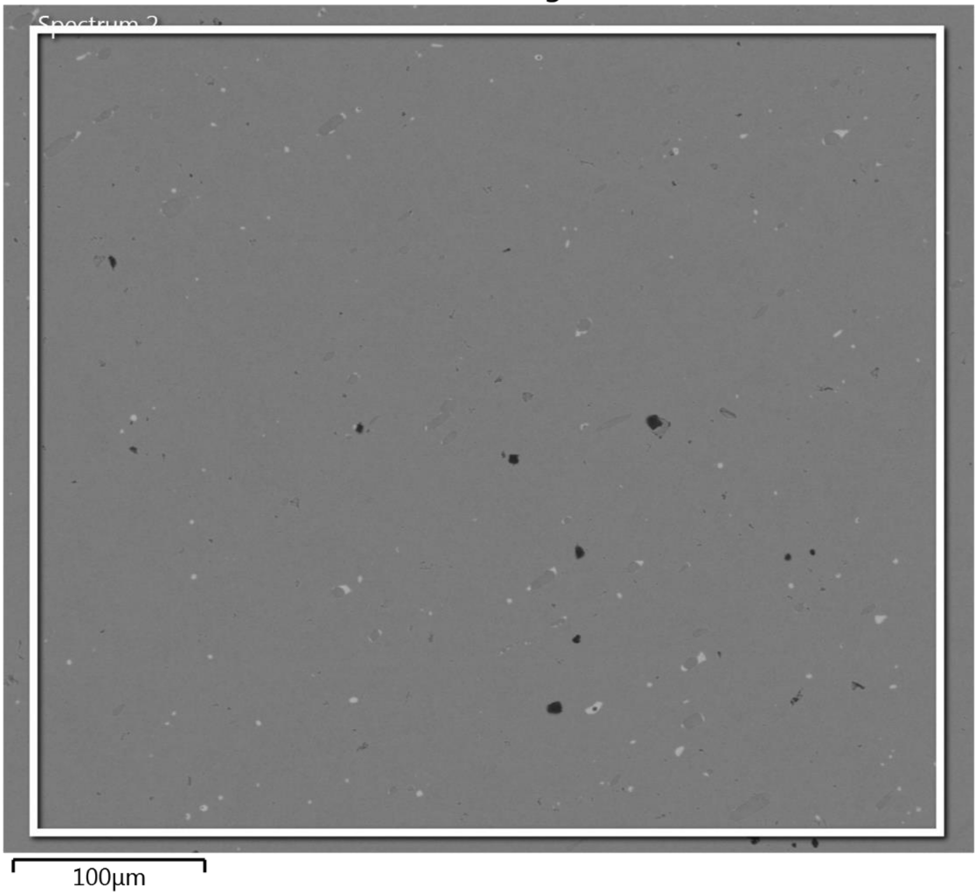

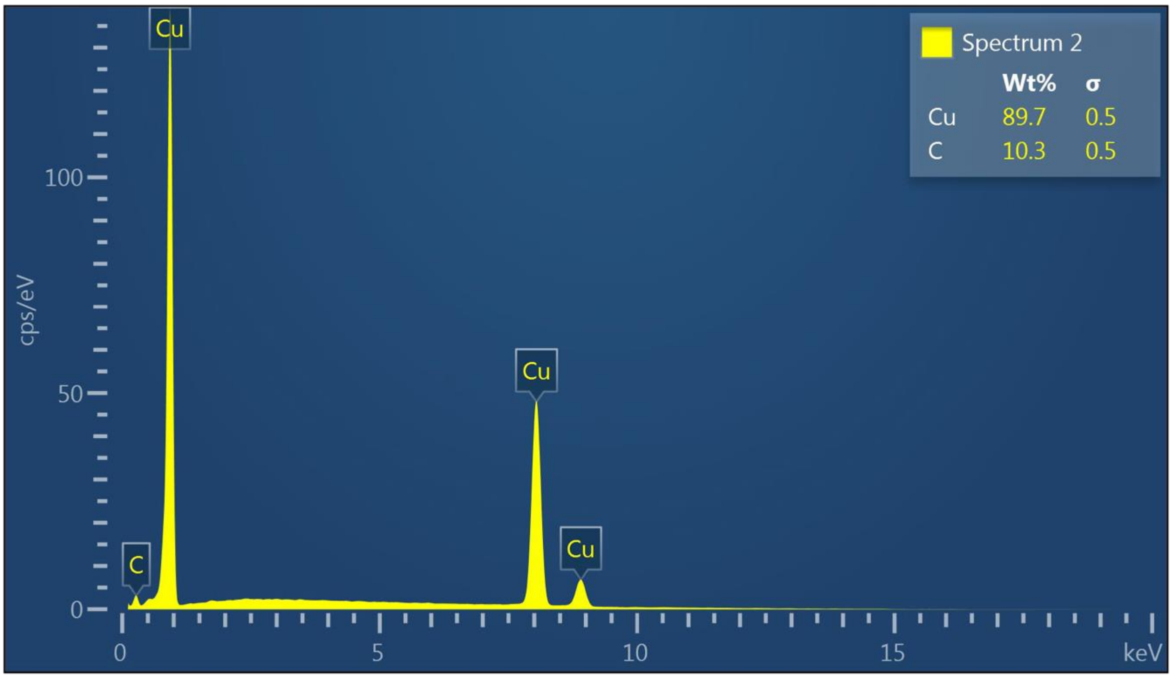

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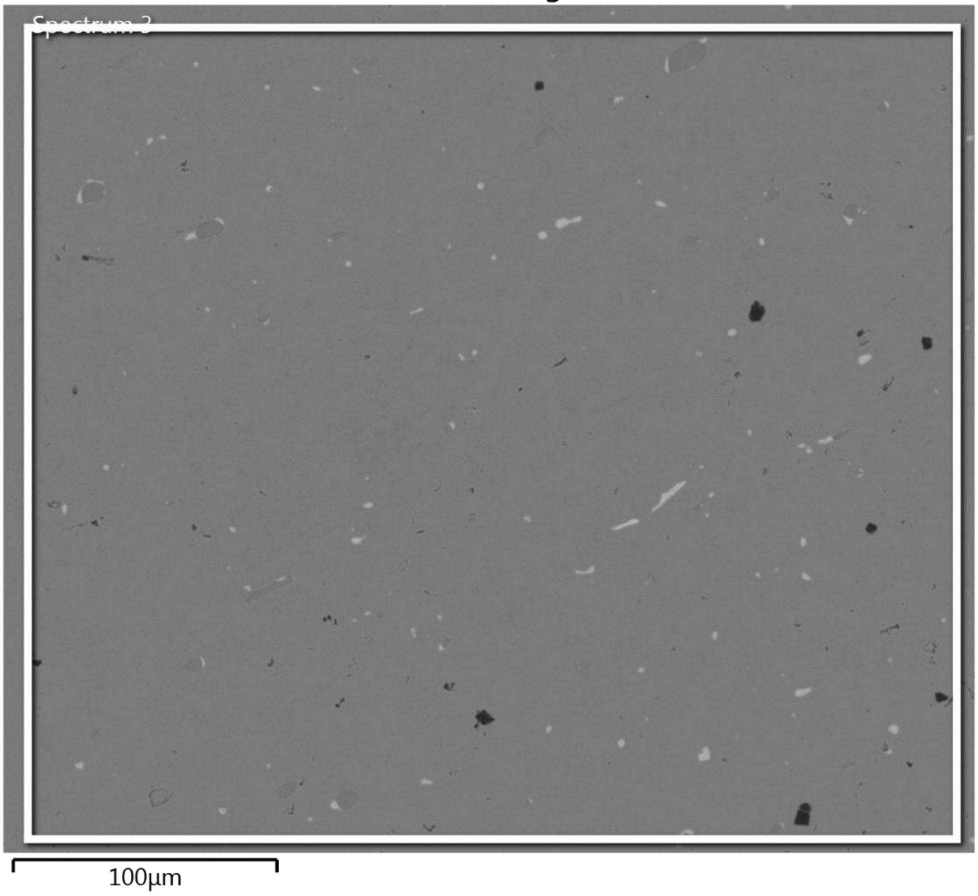

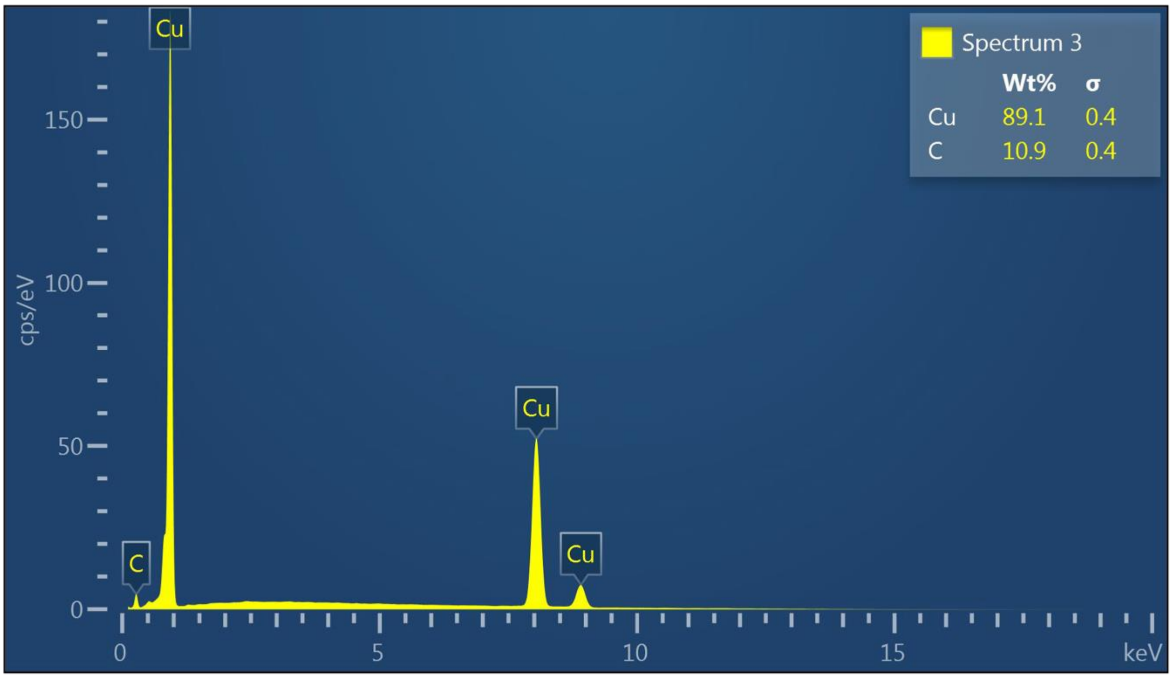

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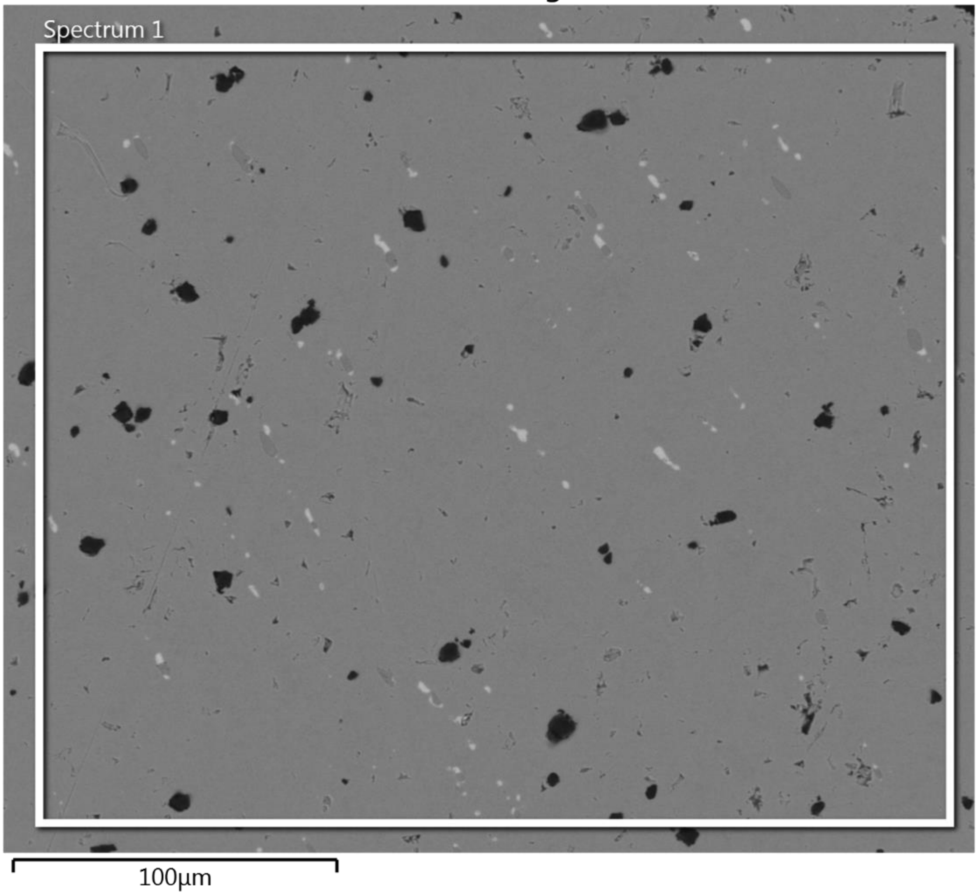

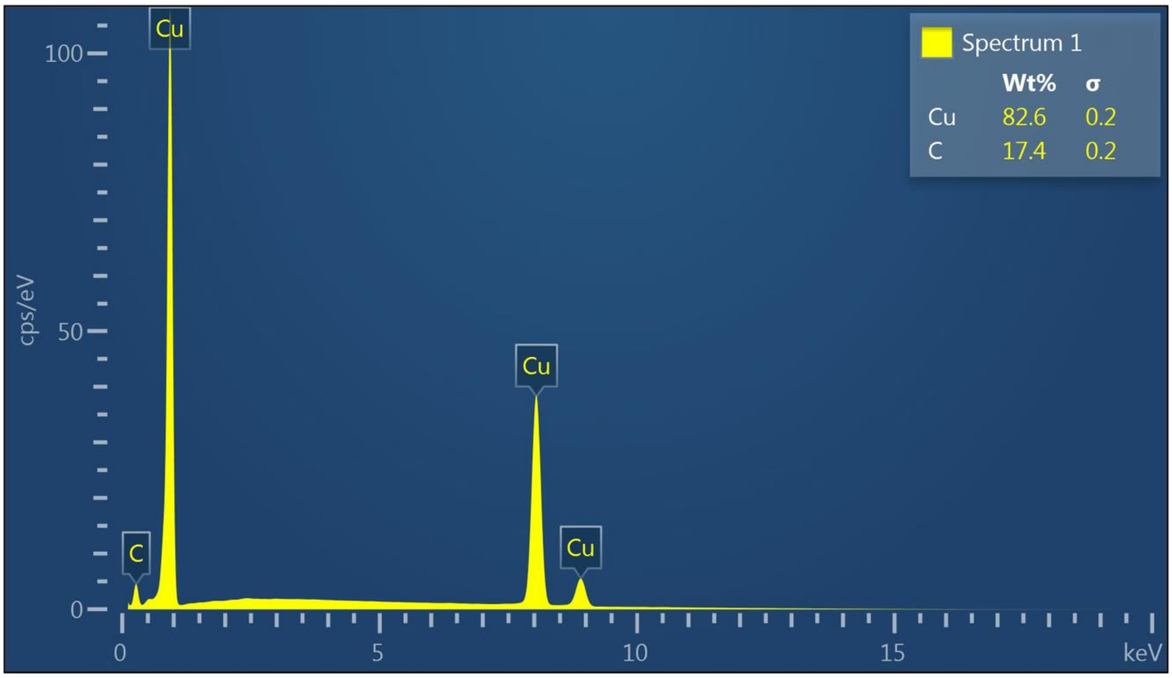

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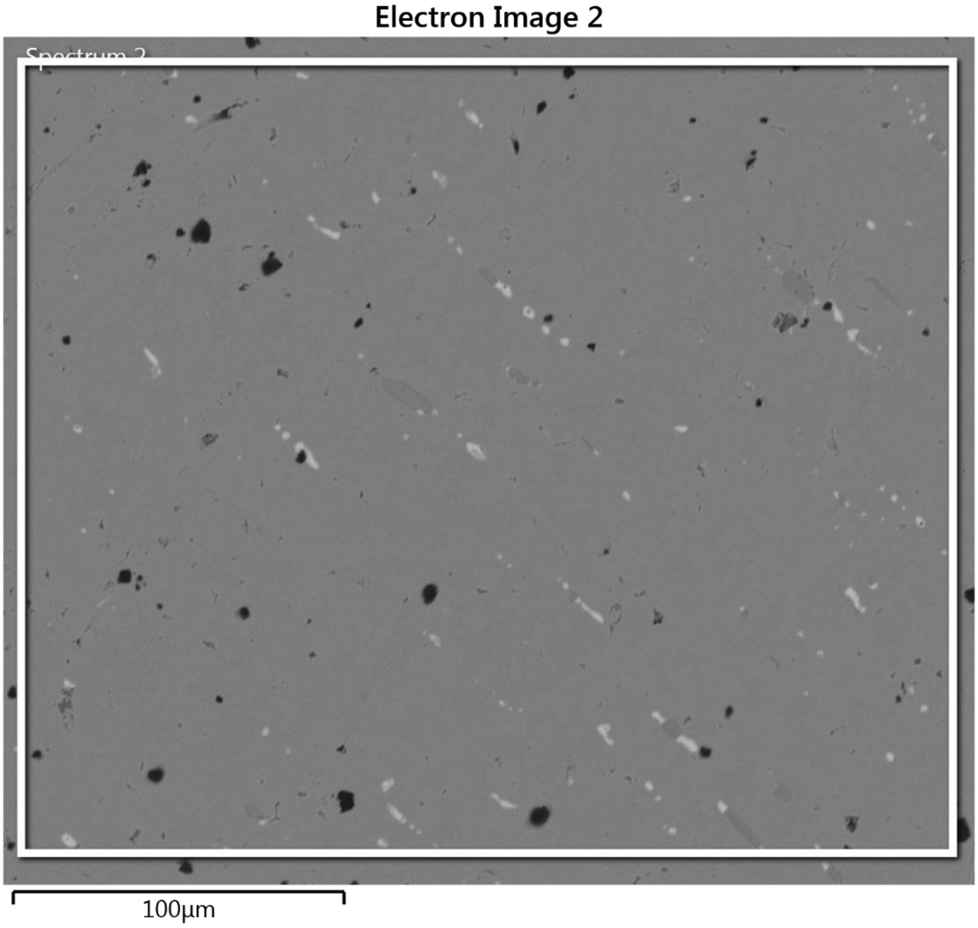

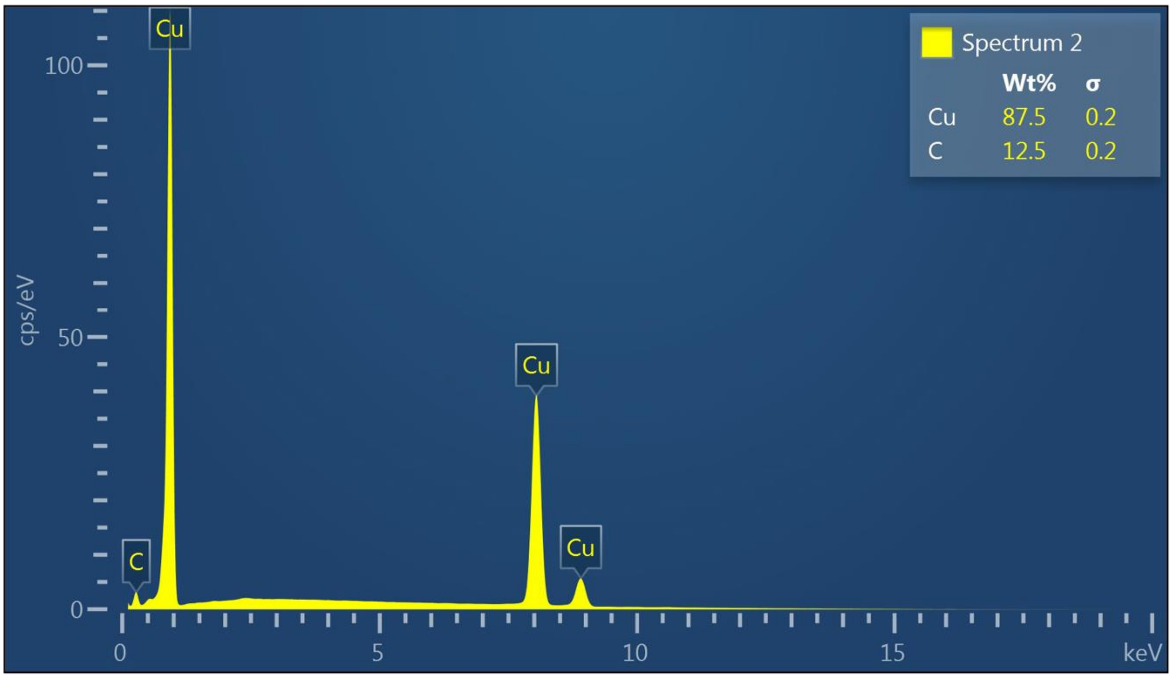

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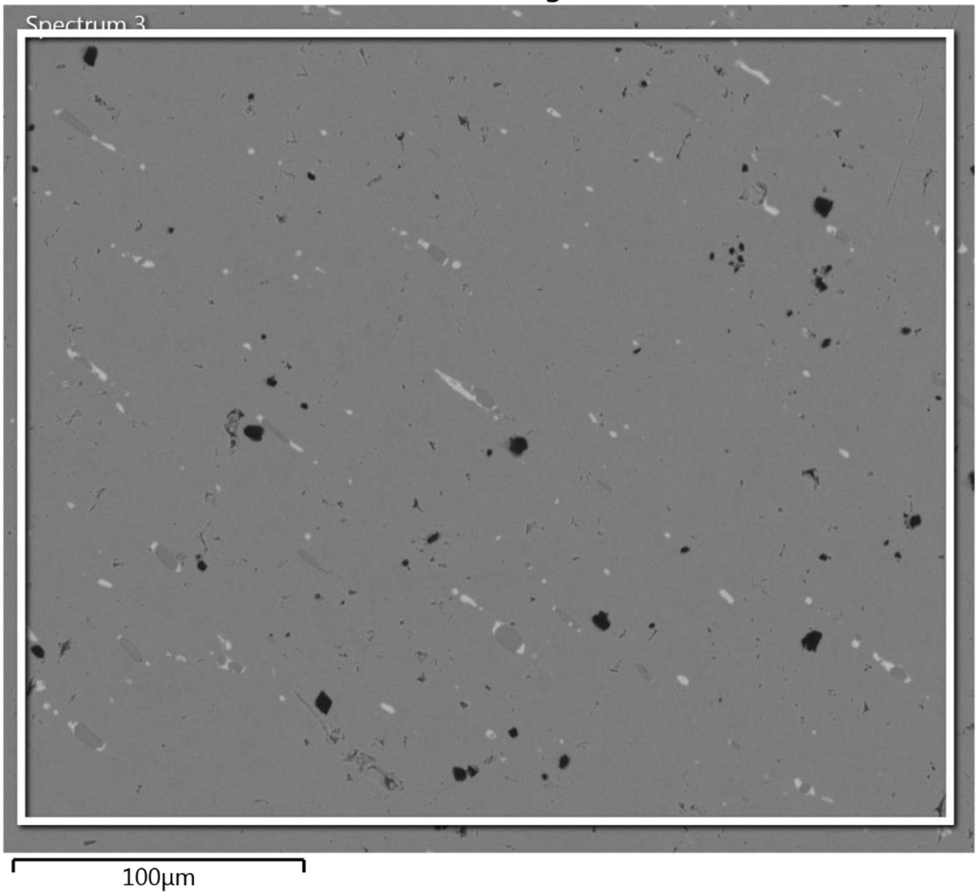

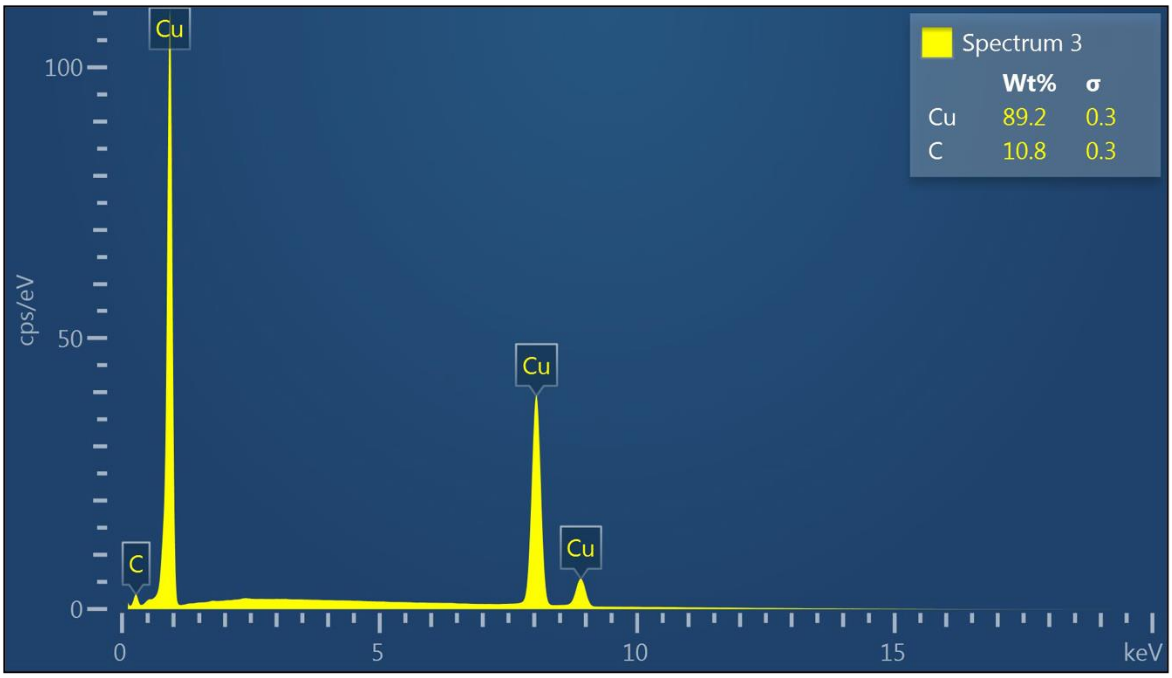

Appendix 3 – Account of Encounter Bay Whaling

G.B.W. in the *South Australian Register* (Barrow 1947:5–8)

"…I was down at the fishery one fine bright morning and talking to Clarke, the headsman, when the whiff or small flag at Rosetta Head was hoisted. The men were lounging about smoking, some in their bunks half asleep, other enjoying dog-fight or game of quoits, when a shout was heard from the blacks' camp. The flag was only going up when they first saw it, and at their shouting the whole fishery was instantly in commotion. Each man knew his boat and particular duty. The harpoons, lances, lines, and other paraphernalia were always kept ready in the boats, and also a keg of fresh water. The headsman was down among the first, and then the cook rushed to them with the scran-bags. These were waterproof canvas bags, one for each boat, containing beef, port, damper, and a good supply of each for they could not know when they might return. All is ready: the extra hands start the boats on rollers, for there was a fixed way or slide for each and then, with a rush, they are off – three good boats – and to each a crew, well up to their work, and straining every muscle to be before their comrades. The headsman chooses his own crew; and as the same men, if good, are chosen year after year, he generally has the best for a long and strong pull. The whales, a lot of them, have been sighted coming along the coast from the north, and, therefore, out of sight of the boats; but the look-out directs them which way to pull, by holding out a small flag. We scamper along the neck of the land at our best paces and climb the steep hill at the end, up a path meandering among huge granite boulders. We gain the top just as the boats come sweeping past and the day is so fine and calm that we can hear the shouts of the steersmen as they goad on the pulling hands to increased exertion. That is unnecessary, for every muscle is in violent tension and the boats seem to spring from the water at every stroke. The steersman guides with his long oar and sweeps the boat's head wherever necessary and when required, within a very small circle. We had only gained the summit of the Head when the look-out pointed to the north, and, about two miles distant, we saw a blow or spout and could distinguish the huge bodies of first one, then two, in all five fine fish. They were coming leisurely down the coast, right in a line with their enemies, and remained rolling about, occasionally leaping out of the water, and they diving, showing their flukes, and making a report like the discharge of a big gun as they struck the water. When nearing the Head, and about a mile from the boats, they seemed to change their minds, and, after a longer dive under water than usual, came up with their spouting in a direction right out to sea. This change was at once observed by those directing the boats, which were swept round, and a hard pull in chase was kept up manfully, Clarke's boat keeping the lead, and the other two separated at distances of about one hundred yards all in a line, and evidently the men were straining every nerve.

‘There she blows,’ cried the look-out, as the jet of water was thrown up like a fountain, ‘they can’t miss them;’ and now commenced such a state of excitement as is seldom seen. He stamped and jumped about, and from his mouth, which contained a great part of a fig of tobacco there issued such a torrent of strange and fearful oaths that we though he must have gone mad.

He had a large spyglass, and from time to time gave us information as to how they were getting on. At last we heard that one of the boats was fast to a fish, and then his language and excitement reached the climax, and throwing his sou’-wester on the ground, he danced upon it and ground it into the earth; then taking it up he gave it a slap against his thigh, put it on his head, shut up his glass and commenced filling his pipe, for the boats were all out of sight. It was now noon and we remained smoking and yarning with the look-out, whose blood was up, about whales. In the course of this he gave us some of his experiences and hair-breadth escapes… From the hill we could now and then see specks on the water which were the returning boats, to us almost out of vision, but the blacks could see them distinctly, and the huge monster they were slowly towing to the station. We watched the two which had last left till their long steady sweep had made them, and then down again to the huts. Here was all bustle. The carpenters, or more correctly, boat-builders, with the coopers and extra hands, were making all ready for the trying out or boiling the oil. The ‘tryworks’ was a large black shed open at all sides. down the centre were four enormous boilers, set in the first, which was over the furnace, was overflowing, it would run into the second and settle, then that full, into the third, and so on. From the last, which was ladled out into the casks. Just under the ‘look-out’ there was a large barge, with a couple of derricks rigged, and all the gear necessary for securing and operating on the whale when brought alongside. Everything was in perfect order, and lighting their pipes, the extras strolled away to the Head to see how the boats were getting on with their towage.

They were now well in sight, and the whale with a small flag stuck into it, loomed large. All the boats were in a line, and pulling long steady stroke, came towards us at the rate of about two miles an hour. It would be sundown before they reached the bay, but we decided to wait for them and get a wrinkle about cutting the blubber from the fish and other delicate operations. The wind, which was from the west, was in their favour, and after a time we heard the song, in which all joined, as they cut their weary way through the sea. About six o’clock they were close into the Head, greeted with cheers by the whites and most diabolical screams from the excited, raging, raving, and jumping natives. The work is nearly over. The boat goes to meet them, carrying a kedge and stout hawser; the kedge is thrown over about three hundred feet from the barge, and the great carcase is pulled alongside and made fast by a toggle through the jaw to the hawser, the flukes or tail is secured by another hawser, to which a strong purchase is fixed, and then all is bowsed tight. The rolling tackle is passed round the fish and all is secure.

The fish is on its back and the white belly shows an enormous surface above the water. It puts you in mind of a gigantic pig scalded and all the bristles off. All is now sung and the men go to the meadsman's house to get their grog.