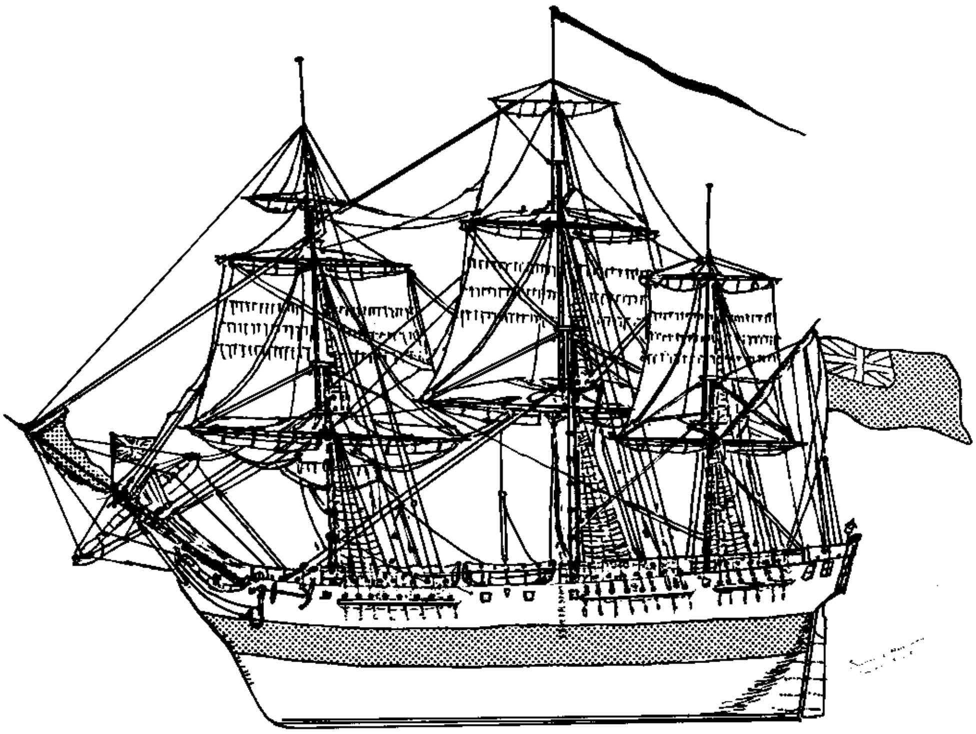
Australian Bicentennial Authority Project 1987 Expedition Report on the Wreck of HMS *Sirius* (1790)



Compiled by
Graeme Henderson & Myra Stanbury
November 1987
With contributions from
Sharon Towns
Bill Jeffery
Geoff Kimpton
Karen Atkinson
David Kelly

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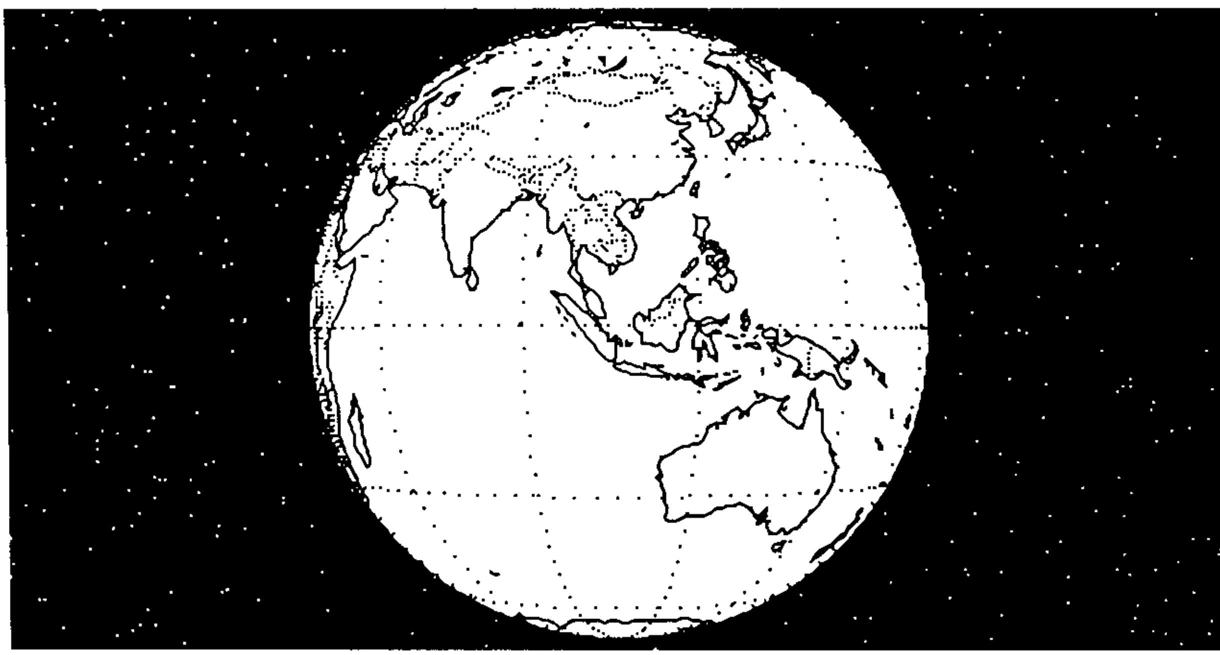

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Contents

Introduction

This report describes the archaeological activities carried out in the field during January-February 1987 by an expedition funded by the Australian Bicentennial Authority to conduct investigations into the wreck of HMS *Sirius* at Norfolk Island.

Previous reports have assembled some background about the ship and the findings of a preliminary examination of the site (Henderson 1984), and described the field activities of the February-March 1985 expedition (Henderson and Stanbury 1985).

Information in this report was collected by Myra Stanbury, Bill Jeffery, Sharon Towns, Geoff Kimpton, David Kelly, Karen Atkinson and myself. The photographs are the work of Patrick Baker, with artefact drawings contributed by Maree Edmiston. A more considered final report will be produced subsequent to further intended compilation of the results of recent archival studies, collection analysis and fieldwork.

Graeme Henderson

Acknowledgements

This expedition like those before it was funded by the Australian Bicentennial Authority. Permission to carry out the work was given by the Department of Arts, Sport, the Environment, Tourism and Territories, which initiated the project in 1983.

Mary Smith, Project Officer with the Australian Bicentennial Authority, arranged and coordinated many aspects of the expedition. Jan Edwards, Director, Special Events, was very supportive. All of the expedition members - Pat Baker, Geoff Kimpton, David Millar, Maree Edmiston, Karen Atkinson, Terry Arnott, Sharon Towns and Bill Jeffery, carried out their specialist roles and general duties with dedication. Filmmakers Rick Swansborough and Christina Tophan accomplished their work without disruption of the expedition schedule.

Norfolk Island Administrator, Commodore J.A. Matthew and Mrs Matthew made the team welcome at Government House. Government Minister David Buffett again provided assistance. Minister Geoff Bennett was also helpful. Puss Anderson found us an excellent workspace and then provided us with furniture. His restoration team again provided assistance above and below the water. Robert Varman, Curator, Norfolk Island Integrated Museums Programme continued his assistance. Old friends who continued to help and advise included Neil and Judy Tavener, Kerry Coop, Gill, Mavis, Jack and Karlene Hitch, Barley Christian, Mike Johnson, Peter Ely, Margaret Christian, Gordan Duval, Les Brown, Duncan Andrews, Gary Christian, Ted and Jan Semple, Merval Hoare, Ross Allomes, and Franklin Randall.

Works Depot staff gave general assistance, and Hospital staff (particularly Dr Monk) assisted with chemicals. Bob Towns joined as a volunteer for some days. Helen Kimpton made superb lunches and assisted with registration.

A special thanks is due to Jim Tavener who took leave from his work during the period of our stay to devote himself to assisting the project in a multitude of ways.

We have to thank John Womersley of the Heritage Conservation Branch of the Department of Environment and Planning in Adelaide for making Bill Jeffery available.

John Bannister and the Trustees of the Western Australian Museum again kindly made four staff members available for the expedition.

Ipec assisted with road freight and East West Airlines assisted with air flights and air freight. Bill Blucher of East West Airlines assisted during our stay on Norfolk Island. Peter Currie of Avon Inflatable boats loaned an inflatable boat for the excavation season.

Conservators Dr Ian MacLeod (Head, Dept of Materials Conservation, WA Museum) and Jon Carpenter contributed conservation advice even though they were not physically present during the January-February fieldwork.

Athol Douglas, formerly of the Western Australian Museum, identified the firearm escutcheon. The Cartographic Services Branch, Department of Land Administration, Perth, identified the pantograph.

Finally, thanks are due to Sue Cox for assisting with the typing of the manuscript and Jeremy Green for setting out the text.

Graeme Henderson and Myra Stanbury

The 1987 Expedition Report on the Wreck of HMS *Sirius*, Norfolk Island, 23 January to 11 February 1987

Graeme Henderson

Aims

After the 1985 excavation season it was expected that the underwater remains of the *Sirius* would lie in three distinct zones: the stranding site beneath and beyond the outer swell zone; the final resting position of the hull in the white water zone; and a jetsam area beneath the lagoon shoreward of the high reef platform. The indications from the 1985 season were that material on the stranding site (Site 1) (Fig. 1) was limited to two broken anchors and a small range of badly eroded hull fittings - principally sheathing tacks, lead sheet fragments, ballast pebbles and copper bolts. Similarly the area searched with a magnetometer in the Slaughter Bay lagoon (Site 4) was almost entirely barren of artefacts, so it was not expected that the remaining unsearched area of the lagoon would prove to be a rich deposit. The final resting position (Site 2) had not been found, but given the seabed topography it was not expected that much would have survived.

The aims for the fieldwork season underwater were as follows:

1. Locate and plot all remaining artefacts on the stranding site.
2. Search to locate the final resting position of the hull and plot artefacts if found.
3. Locate and plot remaining associated artefacts in the lagoon.
4. Excavate remaining moveable artefacts in initial stranding position.
5. Excavate moveable artefacts in the final wreck location if site was found and surveyed.
6. Excavate remaining associated artefacts in lagoon.

In addition it was intended that the following be achieved:

1. Monitoring of conservation and storage situation for material previously raised from *Sirius*.
2. Recording of artefacts in private hands or with the Government on Norfolk Island.
3. Promoting arrangements for long term curation of material derived from *Sirius* wreck. The funds in this grant did not themselves cater for provision of museum building or long term staff.

Logistics

The expedition was run on very similar lines to its predecessor, and most of the personnel had been on the 1985 expedition, so the logistical problems encountered were minor.

Expedition members obtained accommodation at Tavener's farm. A van and truck were hired for transport. The expedition was given the use of one of the boatsheds adjacent to the pier at Kingston for gear storage, artefact storage, conservation laboratory and registration office. Access was also given to the nearby Royal Engineer's Office for use as a drawing office.

Equipment freighted from Western Australia was kept to a minimum. An inflatable dinghy and outboard were loaned by a Sydney company, and some equipment was hired on the mainland.

During the first several days on site a 17 feet fibreglass runabout was hired, but with the arrival of the inflatable dinghy the latter proved adequate for all work outside the reef.

The concentration of efforts on the sites outside the reef (made possible because of favourable weather conditions) meant that no work was done inside the lagoon, and division into diving teams with separate projects was not necessary.

The Public Works Department made the Government work boat and crane available for filming purposes and re-positioning of a newly stocked anchor.

Personnel

The team number had to be reduced by one from the previous season, for cost reasons. Team numbers proved to be appropriate for in-water activities, although more advanced notice to local divers would have made it easier for them to participate. A future season would benefit from one extra person working on registration.

A list of the personnel is shown below.

Personnel worked as honoraries or were paid by their home institution. All personnel again paid a contribution of $120 each to the expedition.

A documentary film team consisting of Rick Swansborough (Director) and Christina Tophan accompanied the expedition.

Name	Institution or Background	Special Responsibility
Graeme Henderson	Western Australian Museum	Expedition Leader
Myra Stanbury	Western Australian Museum	Registration
Patrick Baker	Western Australian Museum	Photography
Geoff Kimpton	Western Australian Museum	Equipment Organisation
Mary Smith	Australian Bicentennial Authority	
Sharon Towns	Australian Bicentennial Authority	Conservation
David Millar	Diving Medicine (WA)	Doctor
Karen Atkinson	Maritime Archaeologist (WA)	Divemaster
Bill Jeffery	South Australian Dept of Environment	Survey
Terry Arnott	Museum Curator (VIC)	Plant Maintenance
Maree Edmiston	Diver (QLD)	Artist

Summary of Activities

22 January (Thursday)

1100 hrs. Personnel flew out of Perth and other places bound for Sydney.

23 January

Press meeting at Sydney airport, arrival at Norfolk 1320 hrs. Personnel established themselves at Jim Tavener's. Rick Swansborough and Christina to stay at Bounty Museum. Sea conditions are poor. Excavation equipment has not arrived.

24 January

Sea conditions are poor, some rain. Excavation equipment has not arrived. Survey bench marks are re-located. Hire equipment is organised.

25 January

Sea conditions remain poor. Equipment has still not arrived.

26 January (Public Holiday)

Sea conditions improving. Conservation equipment arrived but excavation equipment still awaited.

27 January

Sea conditions are excellent. Excavation equipment arrived in the afternoon. Shore survey was commenced. Puss Anderson made a boatshed available for base. Meeting with Administrator Commodore John Matthews, with Bicentennial Minister David Buffett, and with Chief Minister Geoff Bennett.

28 January

Sea conditions are excellent. Kerry Coop's boat was used to re-buoy the site. Survey and excavation work re-commenced on the stranding site. Diving work continued until 18.30 hrs. The inflatable dinghy was prepared for use. Discussions were held with Archaeologist Robert Varman. Norfolk divers joined work on site. Concentrations of artefacts were seen further inshore than before.

29 January

Sea conditions are excellent. Divers used the opportunity of the good weather to work in the newly found area further inshore. Finds for the day included a sextant, a gudgeon arm, large bronze screws, a pantograph, and a pump barrel. Finds were located with two theodolites on shore. The inflatable now replaced the hired runabout. Searches were conducted between the site and the pier. The registration and conservation sections are heavily overloaded with work.

30 January
: Sea conditions deteriorating. Divers continued to work inshore in the morning while possible. Large numbers of iron shot and musket balls are being found. Afternoon diving was aborted because of rising seas. An appeal for ice-cream containers (over the radio) helped with conservation storage problems. Many visitors are now coming through the boatshed each day.

31 January
: Sea conditions marginal. Some diving took place. In the evening Pat Baker gave a public lecture on Australian shipwrecks. Registration is still at a hectic pace.

1 February
: Sea conditions improving. Divers back working in shallow areas around iron ballast mound. Sorting and chipping of raised concretions engages many personnel, as does artefact drawing.

2 February
: Sea conditions good. Material near the jetty was buoyed, located and raised. More diving in shallow areas.

3 February
: Sea conditions poor. Registration, conservation, sorting and filming continued. In the afternoon we visited the Administrator for drinks and discussion.

4 February
: Sea conditions poor. Registration and drawing continued. Film re-enactment occupied some personnel.

5 February
: Sea conditions good. Diving included plotting of ballast mound. Registration backlog is almost completed. Graeme Henderson gave a public lecture on the *Sirius* in the evening.

6 February
: Sea condition poor. Registration and drawing continued, but no diving. School classes join visitors looking through the boatshed. Geoff Kimpton is making a stock for the anchor displayed at Kingston with the assistance of Franklin Randall.

7 February
: Meeting to discuss winding up of excavation season. Field conservation, drawing, sorting and registration continuing.

8 February
: Bill Jeffery is a father and Graeme Henderson has his 35th!!! birthday, so a holiday was declared.

9 February
: Gordon Duval advised on stone hatchet. More school groups. Divers recovered bronze furniture piece from site.

10 February
: Artefact photography, conservation, drawing and commencement of packing.

11 February
: Equipment was packed for air freighting and personnel attended an official opening of the new anchor display before departing for the mainland.

Methodology On Site

The in-water approach developed during the February-March 1985 season was continued during the 1987 season. Attention was limited to two areas:

Site 1, the initial stranding site, on the outer edge of the breakers.

Site 2, the gully between the outer reef and the high inshore reef platform, where it was thought likely that the *Sirius* hull finally broke up (Fig. 1).

An inflatable dinghy was used to convey teams of aqualung divers between the site and the pier, and to act as a tender for divers operating on the site. No dredge or airlift was used, because the intention was to plot and remove loose exposed materials rather than to excavate deep trenches.

Provenance of artefacts on Site 1 was established using the tape and compass method underwater. To relate this information to the above-water survey, marker buoys were placed above key positions, and the buoys related to shore positions using theodolite.

Site 2 presented survey procedural problems. Theodolite operators on shore had difficulty in seeing the marker buoys held by divers above artefact positions, and the divers had difficulty in maintaining position, because of the effect of wave buffetting and currents upon the buoys and attached rope. Tape and compass surveys proved impossible because of water movement and bubble screens. An alternative method was adopted, whereby a diver would maintain position by standing on the seabed above a group of artefacts, with one arm raised, while the two shore-based theodolite operators fixed his position. Given that water depth was (between swells) generally less than 2 metres on Site 2, this method presented a more conspicuous target for the theodolite operators. However, the diver was obliged to duck beneath each swell and then swim back onto station, and fixing of each position took considerable time, exhausting the target diver. Hence the number of fixed locations was kept to a minimum. Divers used sketch boards on the seabed to gather complementary data on artefact provenance.

Collecting divers were assigned to a location on the seabed, for example the seaward end of gully 1 (see Wrecksite Plan Fig. 2). Once in position the diver would fill a collecting bag and return to the

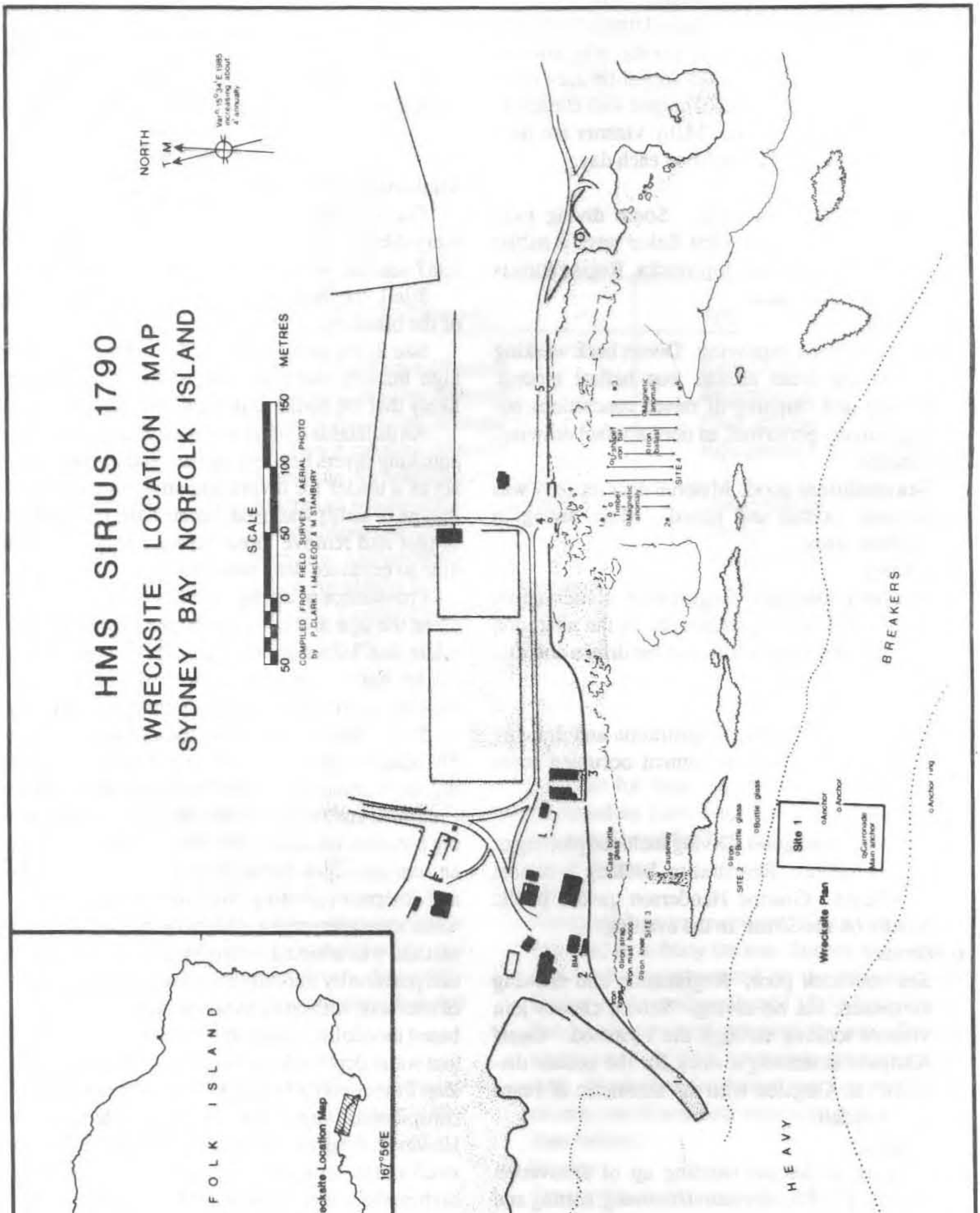
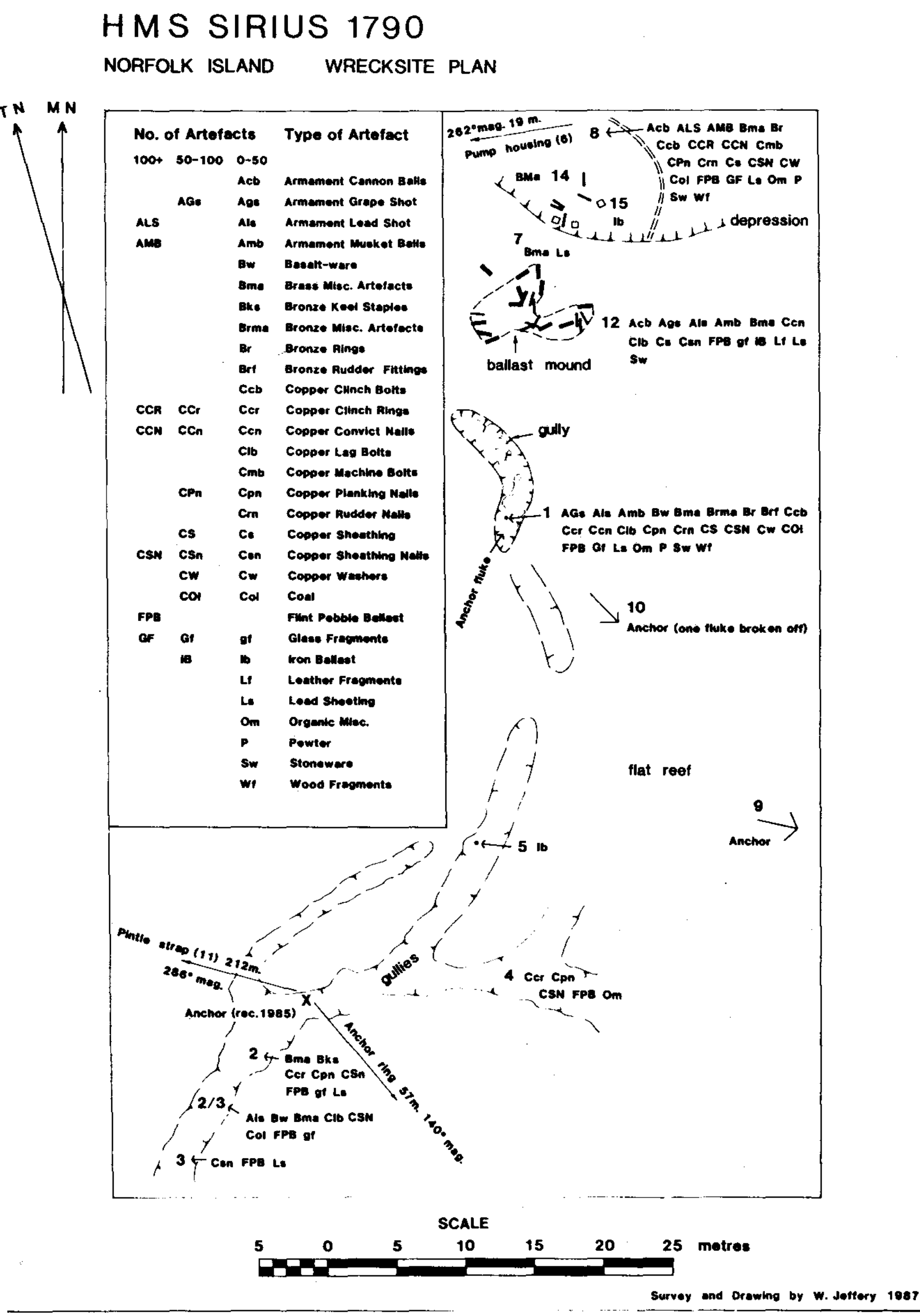


Figure 1. Locational map of the *Sirius* wreck site.



igure 2. Wreck site plan prepared by W. Jeffery, 1987.

dinghy. Concentrations of artefacts were found in seabed depressions. Some of these depressions were overlaid with loose naturally formed calcareous boulders, and flint pebble ballast from the *Sirius* . Other depressions were overlaid with hard iron concretions. In the former case, the boulders would be removed, and the flint pebbles collected along with other underlying artefactual material. In the latter case geo-picks were used to break out chunks of iron concretion from several locations, and these concretions were carried back to the field laboratory for excavation.

Discussion

It was intended at the commencement of the 1987 season that investigations would be carried out on sites 1,2,3 and 4, that is, the original stranding site, the gully between the reefs, the area east of the pier, and the slaughter bay lagoon. Sites 3 and 4 were not of high priority because it was judged that their easy accessibility from the land to early salvagers, and the obvious heavy contamination of the area with material from a number of periods, limited their archaeological potential. In the event, no attention was given to sites 3 and 4. Excellent weather conditions made diving possible on seven of the nineteen days spent on the island. During that time the work on Site 1 was completed, and the opportunity was taken to explore the potential of Site 2.

Divers only gradually became aware of the volume of material below the bubble screen. It was not until day 11 of the expedition that the presence of the ballast mound (dozens of iron ballast blocks) was realised. In that area material was found relating not only to the construction of the vessel, but also to its fitting out and manning. It is apparent that this is the location where the vessel finally broke up, and that a very substantial quantity of material still lies there.

The material on Site 2 offers the potential to examine in greater depth questions relating to the building, fitting out and manning of the *Sirius* . Comparisons can be made with the material from HMS *Pandora* , in Queensland waters. It also offers the opportunity to examine the processes involved in site formation. These questions will be developed with analysis of the existing collection, and may be further developed with another excavation season.

Recommendations

The recommendations of the 1985 Report to the Australian Bicentennial Authority on the *Sirius* were, essentially, as follows:

A. Excavation: Completion, in the following season, of the survey and excavation work, along the lines originally recommended.

B. Conservation: Initiation of treatment, by professional conservators, of Sirius material raised during the Bicentennial project, together with other Sirius material on the island, and other cultural material on the island.

C. Housing of the Collection: Discussions should take place to ensure that the collection is adequately curated and housed in the longer term, and to plan for public display of the collection.

D. Bringing Collection Together: When a museum on Norfolk Island is in a position to adequately curate material from the Sirius efforts should be made to bring together as far as possible material salvaged from the vessel since its loss.

E. Site Management: Consideration should be given to a) placing a plaque on the foreshore adjacent to the wreck, detailing significance, and cautioning divers of dangers; b) displaying an anchor on the foreshore adjacent to the wreck.

F. Archival Research: A considered final report on the project requires comprehensive archival work to be done: a) in the PRO in London; b) in Mitchell Library, NSW.

G. Public Education: To make the information emanating from the project available to the widest audience: a) encouragement should be given for the completion of the documentary film commenced during the 1985 fieldwork; b) consideration should also be given to the completion of a popular book, drawing on the fieldwork and archival study.

Most of these recommendations have now been achieved. The areas of wreckage known in 1985 have been surveyed and excavated; conservators have initiated a programme of treatment which is now being continued in an appropriate fashion by Norfolk Islanders; a full-time curator has been appointed on Norfolk Island to look after the housing, maintenance and display of the collection, and he is receiving advice on these issues; an anchor is displayed on the foreshore in a manner calculated to draw attention to the *Sirius* ; archival research has been carried out at a number of archival centres in London; a documentary film about the project is in the final stages of preparation, and the planning of a book on the subject is proceeding.

There remains the tasks of completing the film, continuing to encourage initiatives to effect appropriate public display of the collection, writing the popular book and the final report, and organising a plaque for the foreshore.

One other issue arose during the 1987 expedition. The search for the vessel's final resting position was successful, but the expectation of a very minor scattering of artefacts in this location proved to be incorrect. A substantial quantity of material was found close to a ballast mound, and it is probable that a good deal more material would become apparent with further examination of that area. The context, condition and range of this material is superior to that previously found on the stranding site, and has the potential to further the original aims of the project - giving greater understanding of how the ship was built, used and modified, how it broke up on the reef, and the events surrounding its loss. It is therefore recommended that a further season of excavation be arranged.

References

Henderson, G., (1984) *Report to the Australian Bicentennial Authority on the December 1983 Preliminary Expedition to the wreck of HMS* Sirius *(1790) at Norfolk Island.* Report- Department of Maritime Archaeology Western Australian Maritime Museum, No. 22.

Henderson, G., Stanbury, M., *et al.*, (1985) *Report to the Australian Bicentennial Authority on the 1985 Bicentennial Project Expedition to the Wreck of HMS* Sirius *(1790) at Norfolk Island.* Report - Department Maritime Archaeology Western Australian Maritime Museum, No. 24.

APPENDIX 1
Report on registration of artefacts from the 1987 expedition.
Myra Stanbury

1. Introduction.

Fundamental to any archaeological investigation is the systematic collection and organisation of information. Recording procedures vary within different fields of archaeology and are generally designed to suit particular types of sites and/or artefacts. Whatever the chosen procedure, it is essential that all field data be recorded as accurately as possible in order that information is available for future reference, both to present investigators and to subsequent researchers.

The registration of artefacts is an important part of field data documentation: unless an artefact can be identified and related to its archaeological context, it has little interpretive value. Over a number of years, a standard procedure for recording artefacts has been developed by the Department of Maritime Archaeology, Western Australian Museum (Green, 1981) and this system was adopted for the *Sirius* project. Essentially, the system is designed to allocate a single, permanent registration number to each object (or group of objects) by which it will always be identified, both in the field and master register.[1]

Ideally, the most efficient method of artefact recording is through the use of an on-site computer. Information entered directly onto a database system may thereby be processed and prepared for cataloguing and/or analytical applications during the course of the fieldwork.[2] Operational bases for maritime archaeological fieldwork, however, are not always suited to the use of such facilities. Likewise, the field environment is generally not conducive to the management of loose paperwork in the form of individual recording forms. A safer alternative is the use of a hard-cover registration book[3] and indelible ink. Short of the total loss of this document, it is better suited to the permanent preservation of information in circumstances where wind, water and other adverse elements are likely to result in loss or obliteration of written records. In the absence of an on-site computer, the latter form of documentation was the method of choice for the *Sirius* project.

2. Registration aims.

The aim of registration in the archaeological context, is to maintain an inventory of the artefacts recovered from a particular site during the course of survey and/or excavation. Most importantly, the objective is to permanently identify an object, (or group of objects), with the site in general and, more specifically, with a defined location on the site.

A register is primarily a master record of general information rather than a source of specific data compiled for particular research purposes. The latter is more conveniently stored on a system of data cards designed to include registration details and expanded information (Green, 1981: 258 - 259). Variables on the cards may be ordered and/or coded in such a way as to be compatible with a computer database system, thus making the input of data a standardised procedure.

Information recorded in the register includes the following: registration number; date of collection; name of finder (or donor); number and description of individual and/or groups of artefacts; material classification code; site location; present location and/or method of conservation storage; photographic record numbers and so on. In addition, special observations, relevant gross dimensions and weights are also recorded.

3. Registration Policy.

3:1 Site identification.

Artefacts recovered during the *Sirius* project are identified by the wrecksite code SI, (indicating *Sirius*), which is used as a prefix to the registration number. As stated in the 1985 report (Henderson, Stanbury et al., 1985: 67), this site identity label does not presume that all registered material is directly related to HMS *Sirius*.

Archaeological assemblages may frequently contain intrusive material that has been deposited on the site as the result of a variety of factors. Thus, in circumstances where two or more vessels have foundered in the same general vicinity, albeit at different points in time, material from one site is likely to have infiltrated and become mixed with that of the other. The extent to which this mixing has occurred will depend on a number of parameters: the proximity of the sites, wind and wave action, currents, seabed topography, geomorphology, and so on. In addition, sites in localities that are frequently used by shipping, local maritime industries or for public recreation are subject to contamination with modern artefacts that

1. This system is designed to obviate the use of separate field and Museum registration numbers which often leads to confusion, especially where permanent numbers can not be marked on objects until after conservation treatment.
2. The use of a portable Macintosh computer for recording data on wrecksites in Thailand has proved to be both a time-saving device and an efficient tool for aiding the development of research hypotheses: Green, 1987, pers. comm.
3. Books found suitable for field situations are Collins Account Books, 3880 Series which are ruled and paged.

may have been washed, accidentally lost or thrown into the ocean.

The presence of intrusive objects on shipwreck sites is archaeologically significant since such items may provide information regarding the movement and deposition of material, or indicate events that may have occurred subsequent to the loss of the vessel. It is necessary, therefore, to record these finds in the register even though they may not be permanently retained as part of a collection. The wrecksite prefix, therefore, applies in a general sense to the total area under archaeological investigation, as defined in the research objectives.

3:2 Numbering system.

Artefacts may be numbered in a variety of ways, the systems adopted generally aiming at easy retrieval of information. Two systems are operative in the Western Australian situation, the choice of application depending primarily on the anticipated size of the excavated collection of artefacts. Where a site is likely to produce a small and manageable collection of material, artefacts are registered with a simple sequential numbering system. With very large collections, however, material is registered according to its primary material classification: the first figure of the number indicates the primary group (see Appendix A) and the remaining three or four digits the actual registration number (Green, 1981: 257).

Based on the preliminary survey of the *Sirius* wrecksite (Henderson, 1984) and the small amount of material recovered during the 1985 expedition (Henderson, Stanbury et al., 1985), it was decided that a simple sequential numbering system would be most appropriate for this collection. Given the turbulent nature of the initial stranding site (Site 1), the diving constraints that it posed and the fact that material had been salvaged from the ship prior to its final demise, there was little reason to anticipate that large quantities of artefacts would be recovered.

Even if objects had survived, the probability of having optimum diving conditions in which to search for, locate, survey and excavate substantial amounts of material from the outer reef area was considered to be minimal. Only 28 per cent of the working dives (and diving time) during the 1985 expedition was spent on the stranding site (Site 1) (Henderson, Stanbury et al., 1985: 122). Twelve divers spent an average of 2.6 hours each (approximately 3 dives) on the site in a period of 25 days.

Hypothetically, twelve divers (working in teams of two or more) for one hour each per day, would be expected to achieve 12 man-hours of daily underwater work. At this rate, 36 man-hours would be accomplished in 3 days. Thus, the total number of hours (31) worked on the *Sirius* stranding site in 1985 effectively amounted to a little under 3 productive days' work. On this basis, approximately 1 day in 8 would be considered an average working probability for this site in a three week expedition period. Hence, a large collection of artefacts was not anticipated during the 1987 expedition.

3: 3 Individual and/or collective registration of artefacts.

Contrary to expectations, the first suitable day for diving (January 28, 1987) on the outer reef site (Site 1) was extremely productive. A large quantity of material was located and raised from areas designated 1 to 4 (see Wrecksite Plan). In the main, this consisted of non-ferrous metal objects with occasional glass and ceramic sherds, one or two iron artefacts and a quantity of ballast pebbles. The nature, range and relative frequencies of artefacts gave some indication as to what might be expected to have survived in each of these areas.

It was apparent that some artefacts, such as copper alloy sheathing nails, had survived in abundance, while more fragile material, such as ceramics and glass, was poorly represented. In consideration of the problems related to the surveying of in-situ artefacts on this particular site and the limited facilities for carrying out necessary conservation treatment, a registration policy was adopted that sought to compromise these two situations.

Essentially, all unique artefacts from within a given excavation area have been assigned an individual registration number. Where multiples of artefacts of similar type and material composition occur, however, these have either been cumulatively registered under one or two "dump" registration numbers (Green, 1981:257), or temporally registered under a group number.

For example, flint pebble ballast was ubiquitous in most of the areas being worked and its collection was largely inevitable. Artefacts buried in the ballast were often small and difficult to separate, particulaly in marginal diving conditions. It was often simpler, therefore, to collect the ballast in order to avoid the risk of losing potentially significant wreck material.

Needless to say, the amounts of ballast excavated from each area tended to be biased in terms of the experience and skill of individual excavators and the prevailing diving conditions of the day. Thus, more experienced excavators, in favourable diving conditions, were able to recognise and separate artefacts from unnecessary quantities of ballast, thus minimising this element in their finds. The individual collections of ballast from each area, therefore, tended to reflect operational skills and procedures rather than the quantitative distribution of ballast throughout the area. Consequently, it was more convenient to register the ballast from each area cumulatively, a new "dump" number being allocated with the filling of each large calico bag. A few large bags of ballast pebbles could be more easily washed and stored than an indefinite number of small bags (each with its own number). Furthermore, larger quantities of pebbles per registered lot were likely to be of more use for future display purposes: they would avoid the necessity of mixing several small consignments in order to achieve the same quantitative effect.

Within each diver's collection of artefacts, there were frequently objects that were either duplicated or found in number. For example, over 300 musket balls and 90 clinch rings were recovered by one diver from Area 8 on a single occasion; sheathing nails were rarely found in quantities of less than 20, reaching upwards of 350; and so on. To register and conserve each of these artefacts individually would entail an unnecessary amount of work and expenditure of time.

Where objects can be managed and treated by bulk methods, it has been demonstrated that larger numbers of artefacts may be processed in a shorter period of time (MacLeod & North,1980). In these situations, therefore, the management of artefacts is made easier by registering objects with similar attributes, from the same temporal location, together under a single number. Subsequently, if individual objects within the group need to be isolated for some specific reason, they may have an appropriate suffix (e.g. A,B,C; -1,-2) added to the registration number.

The grouping of objects is carried out with the aim of placing them into mutually exclusive categories. At the gross level, this division is made on the basis of material composition, such that all artefacts in the group may be subjected to the same bulk treatment process. Further divisions are made on the basis of commonality of form, size, structure, function and so on. Hence, a collection of lead shot (musket balls etc.) might be divided on the basis of a common diameter; clinch rings likewise; and, fastenings by a combination of factors such as length, head or shank characteristics, function, and so on.

4. Registration procedure.

4.1 The 1987 material.

In contrast to the 1985 season of work, which yielded a small and mixed assemblage of artefacts from a number of different site localities, the 1987 excavation produced a large quantity of material from several areas in the general vicinity of Site 1. Whereas 58 items (or groups of items) were registered in 1985 from underwater locations, 517 registered entries were recorded in 1987 bringing the total to 575. While many of the records refer to single artefacts, others relate to multiples of finds[4], where numbers of objects of a particular type were found in the same archaeological context. Thus, the total number of single objects far exceeds the total number of registered entries, amounting to something in the order of five and a half thousand.

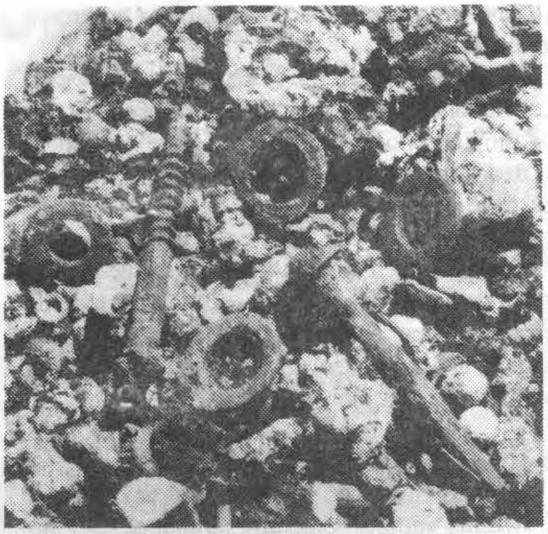


Figure 1. Unsorted artefacts.

4.2. Initial examination and sorting of excavated material.

The first phase of the registration process was the careful examination of excavated material immediately on its arrival ashore. Owing to the site conditions, it was virtually impossible to carry out normal excavation procedures whereby objects are individually recorded and separately bagged underwater by a team of two to three divers per gridded area. Instead, pairs of divers working in specific site areas placed their total collection of material from the dive into mesh or calico bags.

As each team of divers came ashore, their finds were emptied onto plastic trays[5] and labelled with name of finders, date and site locality. An initial inspection of the material was carried out in order to identify objects requiring immediate immersion in water to maintain their stability. Such artefacts were placed in small plastic containers on the appropriate tray or in larger receptacles where necessary. Having done this, each tray of finds could then be more closely examined and documented.

4. The policy of individual or group registration is discussed by Green, 1981:257.
5. The plastic "trays" were in fact the lids of Nally tubs used to transport expedition equipment and improvised for the purpose of artefact sorting.

Figure 2. Removing concretion from pantograph arm.

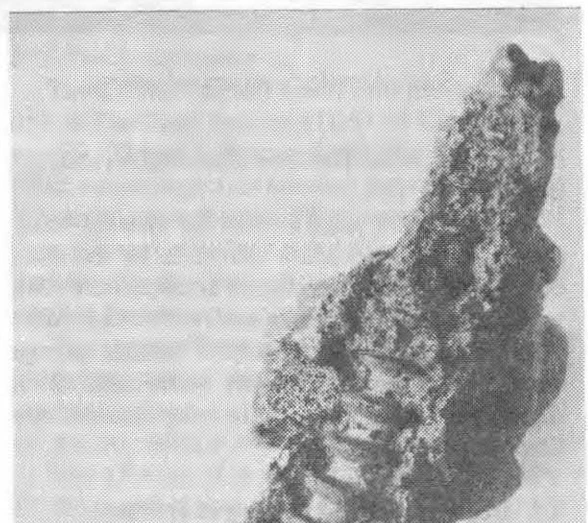


Figure 3. Copper lag bolt in concretion.

4.3 Treatment of objects prior to registration.

In order to safeguard the integrity of objects and ensure their safe removal from the seabed, it was frequently necessary to excavate material in conjunction with the substrate in which the objects were either embedded or firmly attached. As a result, many of the finds had to be excavated from large lumps of concretion[6] or separated from calcareous deposits before they could be identified and classified. These procedures were undertaken at the field laboratory by the archaeologists and field conservator.

Having undergone preliminary mechanical cleaning and/or de-concretion, the trays of artefacts were sorted into primary classificatory groups according to their material composition (see Appendix A). Volunteer workers, (in particular Mrs Helen Kimpton), assisted with this task. Artefacts were often small and fragmented and had to be carefully sought among the accompanying ballast pebbles and seabed debris. At times, it could take as much as 2 - 3 hours to sort one tray of material into gross categories, even for those with experienced eyes. It was not unusual to have four or more full trays after a single session of diving.

As material was sorted, it was placed in a series of plastic ice-cream containers[7] and kept wet where appropriate. At this stage, it could be safely and conveniently left on the marked trays to await closer

6. 'Concretion' is the term applied to the hard conglomerate which develops around artefacts as a result of the combination of corrosion products, seabed sediments, marine organisms and so on.
7. A small quantity of ice-cream containers included in the expedition equipment proved totally inadequate and additional supplies were kindly provided by the Norfolk Islanders in response to radio requests.

Figure 5. Copper clinch rings with Dymo tape registration tags.

embossed imprint on the tape. Labels made of "Tyvec"[9] have been successfully used on shipwreck excavations in the United States of America but this material has to be specially imported into Australia and is therefore extremely expensive.

Where possible, Dymo tape numbers are attached directly to the object, vinyl tags being attached with soft mono filament nylon fishing line 0.55 mm in diameter, and stainless steel tags with Monel stainless steel wire. If objects are fragile or have no secure point of attachment, they are encapsulated in bags made from tubular plastic netting, cut and knotted to the appropriate size, and the tag tied to the bag. These bags allow water or chemical solutions to circulate around the object and allow artefacts requiring the same form of conservation treatment to be bulk processed. Alternatively, artefacts are placed in individual plastic treatment containers and the tag placed inside. As a safeguard, the registration number is written on the lid (or outside) of the container with a black fibre tipped pen (Artline 70 by Shachihata, or similar).

Before being handed over to the conservator, care was taken to ensure that all registered artefacts were accompanied by a tag bearing their registration number.

5. Computerisation of artefact data

Computer systems have become one of the most convenient ways of storing, retrieving and organising information. On return to Western Australia, data pertaining to the *Sirius* artefacts, as recorded in the field register, was entered onto the Department of Maritime Archaeology main-frame Overtask computer[10]. The computer was acquired by the Department approximately 10 years ago for the purpose of cataloguing material recovered from the wrecks of Dutch East Indiamen lost on the Western Australian coast. Since that time, more sophisticated computer systems with packages specially designed to deal with archaeological material have come into being, making the Overtask system somewhat outmoded. Nevertheless, as a database facility, it is capable of storing and manipulating large amounts of information relatively quickly. Thus, it continues to be a practical means of organising basic information.

5.1. The Data System

The software package used to organise artefact data is *The Data System* (TDS) by Gander Software[11]. The package is not designed specifically for either archaeological or Museum purposes but rather for a broad range of general functions. At the time of its acquisition, in 1984, it was the only package compatible with the Overtask computer that could be adapted for artefact cataloguing.

The system allows for:

(a) the creation of data files, input and editing of information;
(b) the processing of information and its organisation into a variety of vertical or horizontal formats;
(c) the output of data.

While the applications (or utilities) of the package lack the versatility of newer software systems, a method has recently been devised for transferring database information from the Overtask to a portable Macintosh computer. Thus, selected data may be subjected to the wider range of software applications compatible with the Macintosh system.

5.2. The *Sirius* artefact file and input of data

The data file created for the *Sirius* material raised in 1985 contained insufficient room for the large number of additional records resulting from the 1987 expedition. Consequently, a new, enlarged file had to be created and the existing data copied. At the

9. "Tyvec" is the name given by Du Pont to a range of materials made of spunbonded high density polyethylene fibres. It is inert to most organic and inorganic chemicals including acids, bases and salts and is therefore suitable for labels that need to be immersed in these mediums.
10. Overtask OBS System 4
11. The Data System (1984), Gander Software Ltd., 3223 Bross Road, "The Ponds", Hastings, MI 49058

same time, the old file was re-formatted to include an additional field for descriptive information.

The present file has room for 1000 records, each with the following fields of information:

No	Name	Type	Len.	Description
1	REG. No.	I0000	4	Registration number
2	DATE	D0000	8	Date of collection (Month/Day/Year)
3	NO.	I0000	3	Number of objects
4	DESCRIPTION 1	A0000	50	Description of object(s) including
5	DESCRIPTION 2	A0000	50	dimensions, weights etc.
6.	CODE	I0000	2	Material code
7	LOCATION	A0000	50	Site location/coordinates
8	NOTES	A0000	50	Cross references, special observations etc.
9	STORAGE	A0000	50	Conservation medium and/or location
10	PHOTO	A0000	20	Black/white negative file no.
11	DRAWN	A0000	20	As above; yes/no.

Each field may hold up to 50 characters designated:

A	=	Alphanumeric letters, non-calculated numbers and symbols
D	=	Date. Entered MM/DD/YY
I	=	Integer (whole) numbers.

The length of the field is determined when the file is created and may only be increased or decreased by creating and re-formatting a new file, transferring the existing information and deleting the old file. The system lacks the flexibility of some packages and tends to be wasteful of computer space if fields are made unnecessarily long.

The input of the 1987 *Sirius* data was prolonged due to a malfunction of the computer which prevented multi-user operation for database work. Thus, the priorities of the Department had to be given first consideration. In addition, restricted keyboard operating times were necessary due to recent operator injury. Preliminary print-outs of the registered material were available, however, within five weeks, but the information still required a considerable amount of editing before it could be used for cataloguing and/or statistical computer analysis.

5.3 Processing and formatting of information

One of the most common ways of presenting or organising artefact information is in the form of a catalogue. This necessarily entails some kind of sorting process whereby artefacts may be ordered into mutually exclusive categories.

The Gander software system is capable of hierarchical sorting on six nested fields. This works well in relation to fields such as Field 1 (registration number) or Field 6 (material code) as artefacts can be sorted into primary material categories and registration numbers ordered sequentially within these groupings. The system becomes more problematical, however, with alphanumerical fields (description, location etc.) unless data input is uniformally formatted or key words are typed in the same manner.

If, for example, artefacts falling within the non-ferrous material category (Code 32) need to be further subdivided into say copper nails, brass nails or copper-alloy nails, then common key words need to be included in the descriptive field, typed and presented in the same manner, which will identify similar types of objects. Lack of uniformity due to mixed use of upper or lower case type, additional full-stops, commas and so on will lead to the record being treated independently and therefore its rejection from the group. Two records written thus, will be independently sorted:

(i) Copper nail;

(ii) Fragment of copper nail.;

since the two words 'Copper' and 'copper' will be identified separately.

A standard procedure for formatting descriptive data has not yet been formulated for use with the Gander software system. However, an attempt has been made with the *Sirius* material to effect a uniform input of data such that similar types of objects will be selectively grouped making the process of cataloguing easier. In most cases, the entries consist of one or two key words followed by additional descriptive information, for example:

Musket balls - eroded;

Coal - pieces of;

rather than:

Eroded musket balls; or

Pieces of coal;

Single or multiple word strings may then be selected to search for (or list) particular groups of objects.

The Gander system allows the various fields of information to be presented in a variety of vertical or horizontal formats, depending on the purpose for which they are needed. Prepared formats may be permanently stored for repetitive use of fields may be formatted for single report purposes.

6. Completion of registration procedures and artefact recording.

6.1 Marking of artefacts.

The final phase of the registration process is the numbering of the actual artefacts. When all conservation treatment is complete, each object must have its registration number written clearly on it in marking ink. Before this is done, however, the item must be cross-checked against the relevant entry in the registration book or computer print-out.

It frequently happens that, during the conservation process, registration tags become detached from the object or lost from the container in which the object is being treated. Tags necessarily need to be removed from objects for certain treatments to be carried out and, where several items are being dealt with at one time, it is possible for the wrong number to be re-attached to an object. Thus, it is essential to ensure that both object and number match (or closely fit) the original recorded description before a permanent number is written on the object.

6.2. Revision of registration data.

At the time the artefacts are initially registered, their exact identity may be masked either by discolouration, heavy layers of corrosion products, patination or other factors. Identifying marks, decoration or other important technological or artistic devices may not become apparent therefore, until conservation is complete. Based on these new observations, registration data may need to be revised. Likewise, alterations in weights and measurements or newly available dimensions will need to be recorded.

6.3. Artefact registration cards.

For research purposes, a system of printed data cards is a useful tool for storing expanded information. Those in use by the Department of Maritime Archaeology, Western Australian Museum are shown in Appendix B. In addition to the data recorded on the computer, the card has space for a small contact print of the object which enables easy identification. There is also room for more detailed photographic information and reference sources.

6.4. Artefact drawing.

One of the standard methods of recording archaeological finds is to draw them. Drawings, like photographs, are a visual reference of the archaeological process and may be studied and analysed long after the actual fieldwork is complete. Where objects are not physically accessible for research, a drawing can provide valuable information.

The aim of archaeological drawing is to impart graphic information as clearly, accurately and objectively as possible (Stanbury, 1985:9). Objects are carefully measured and drawn either to the same (1:1), an enlarged or reduced scale, depending on the size and nature of the artefact. Drawing techniques are based on standard technical and archaeological conventions and the materials used designed to produce quality results that will remain permanent and reproduce easily (Stanbury, 1985).

During the 1987 expedition, an attempt was made to draw as many of the unique objects as possible, together with representative examples from major artefact groups, such as fastenings. A room was made available in the Engineer's Building, next to the boatshed, as a drawing office. This served the purpose admirably, having a natural source of light and plenty of table space.

Several members of the expedition team (Maree Edmiston, Karen Atkinson, Geoff Kimpton and David Millar) assisted with the artefact drawing. This was carried out in non-diving periods when expedition members were not involved in their other expedition responsibilities.

In order to accomplish as much as possible in a short space of time, no attempt was made to complete all drawings to a stage suitable for publication. Instead, artefacts were either sketched in a record book along with essential dimensions or completed drawings left in pencilled form. In both cases, final ink drawings could be completed at a later stage. Although a number of drawings were fully completed during the expedition, much of the final work and preparation of the drawings for photographic copying was undertaken in the post-expedition period. Artefacts undergoing conservation treatment in Western Australia were checked against provisional drawings and alterations made where necessary. Finally, the drawings were photographically copied onto Kodalith film so that they could be reproduced at reduced scales for publication purposes.

6.5 Artefact Photography

The photographic recording of artefacts is, again, an essential part of the archaeological process. Wherever possible, artefacts are photographed insitu (during excavation), and at intervals pre- and post-conservation.

This work was carried out by the expedition photographer Patrick Baker.

Figure 6. Maree Edmiston explains the technique of artefact drawing to Norfolk Island students.

7. Summary and Conclusions

Both in quality and quantity, the archaeological material recovered from the 1987 *Sirius* expedition must undoubtetly serve as a measure of its success. Based on previous experience, however, there was little real expectation that this situation would arise. Even if the ultimate objective of the expedition was realized and artefact deposits indicating the final resting place of the *Sirius* were found, the probability of having conditions favourable for extensive excavation were considered likely to be minimal.

Initially, the discovery and recovery of large collections of material over two to three days posed no real problems. There was always the anticipation of bad weather and the knowledge that a backlog of registration work could be dealt with during these times. The continued favourable weather pattern, along with maintained levels of excavation did, however, begin to cause some difficulties.

Firstly, although the facilities in the boatshed were more than suited to the basic needs of the expedition, there was limited bench space for sorting and storing material awaiting documentation. Trays of artefacts had to be constantly moved to allow the inflatable dinghy and other equipment to be stored in the shed at night, making it difficult to keep trays in strict chronological sequence.

Secondly, within the shed, lighting levels were inadequate for detecting small objects when sorting the trays. Much of this work, therefore, needed to be carried out near the entrances to the shed posing two problems: firstly, the trays were an obstruction to divers and visitors moving in and out of the shed; and, secondly, care had to be taken to ensure that trays were constantly moved out of the line of direct sunlight.

Thirdly, insufficient plastic containers and nylon netting were included in the expedition supplies. This problem, however, was overcome by local donations of suitable containers and the purchase of nylon shade-cloth in lieu of the nylon netting.

Finally, the process of documentation could probably have been hastened by having two operators: a "clean-handed" scribe and a "dirty-handed" tagger and bagger.

In conclusion, the following points are made.

1. As soon as the conservation treatment of the *Sirius* artefacts is complete, each object should be marked with its registration number, consideration being given to the possibility of numbered tags having become mislaid and/or transferred to the wrong object.
2. A new vinyl Dymo tape registration number should accompany or be attached to the artefact to allow for easy identification. Numbers written onto small objects are sometimes difficult to read and may therefore be wrongly interpreted.
3. All artefacts should be re-examined in the light of provisionalidentification and/or recorded information in the field register and/or computer printouts.
4. Registration documentation should be revised where necessary on the basis of new information or analytical findings that may confirm or alter the registered identification of objects.

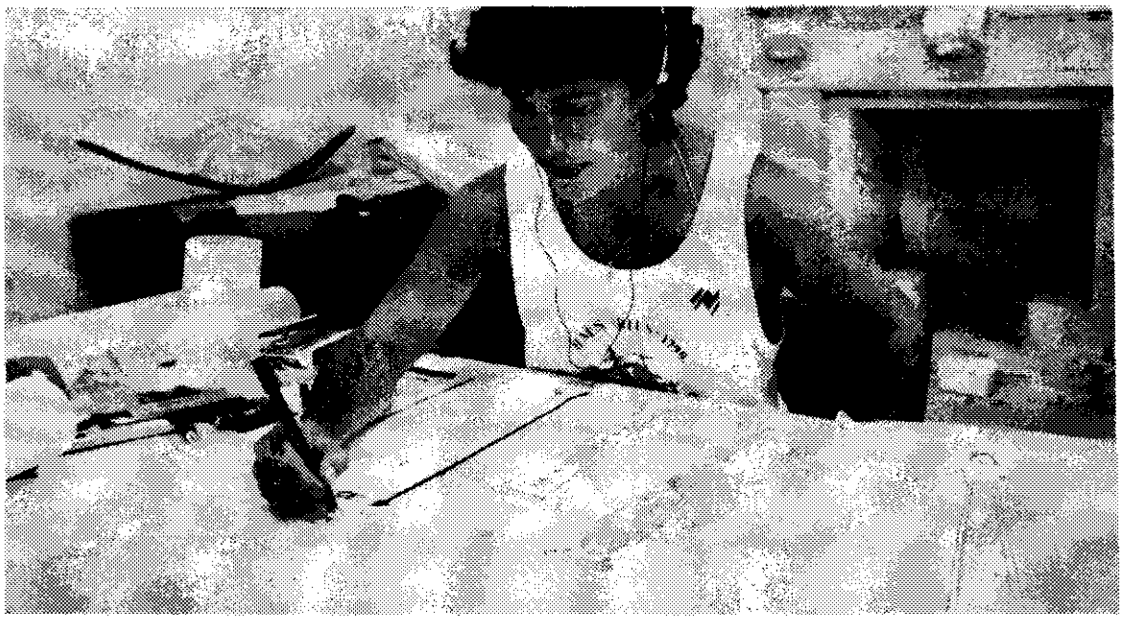


Figure 7. Maree Edmiston drawing an engraved brass fire-grate leg, SI 512.

5. When items 3 and 4 have been completed, registration detailsshould be entered into an official Museum register to be retained as an archival record.
6. For research and reference purposes information pertaining to each registered item (or items) should be recorded on a system of printed data cards.
7. Given the large quantity of material to be numbered, and the lackof Curatorial assistance on Norfolk Island, this task could be reasonably undertaken (with Curatorial supervision) by a team of local volunteers.
8. No artefact should be released from the collection for displaypurposes until it has been clearly marked with its registration number and a record kept of its new location.
9. Future expeditions to continue the work on the *Sirius* should makeprovision for (a) the completion of artefact recording of all registered material. This will entail further drawing of selected material and post-conservation artefact photography, and (b) the collection of data needed for the statistical analysis of various groups of artefacts.

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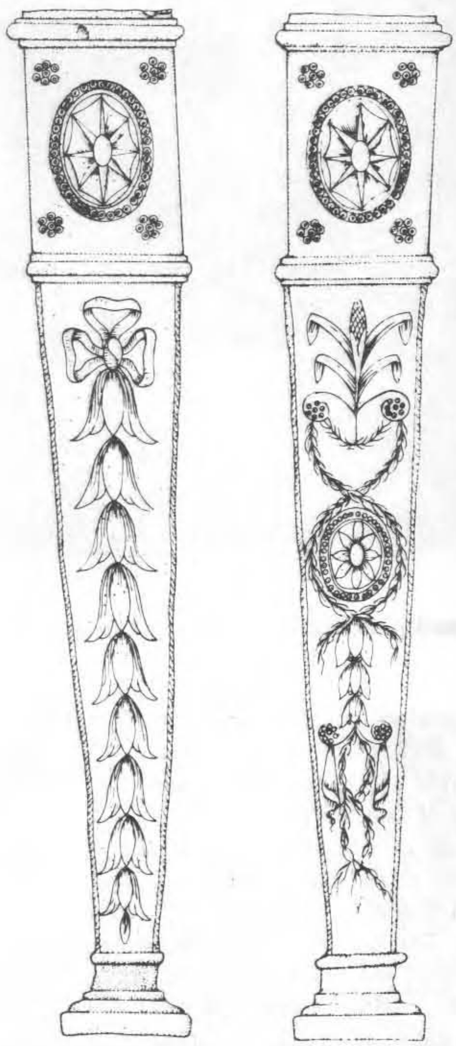

Figure 8. Brass fire-grate leg, SI 512. Scale 1:2.5.

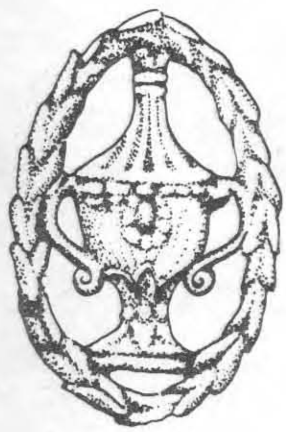

Figure 9. Brass furniture mount or cloak pin, SI 348. Scale 1:1.

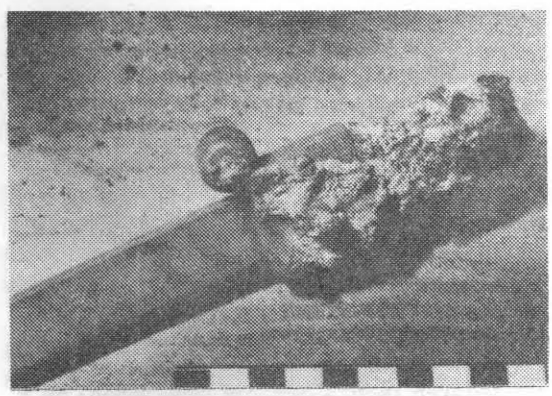

Figure 10. Pre-conservation photograph of pantograph arm, SI 239.

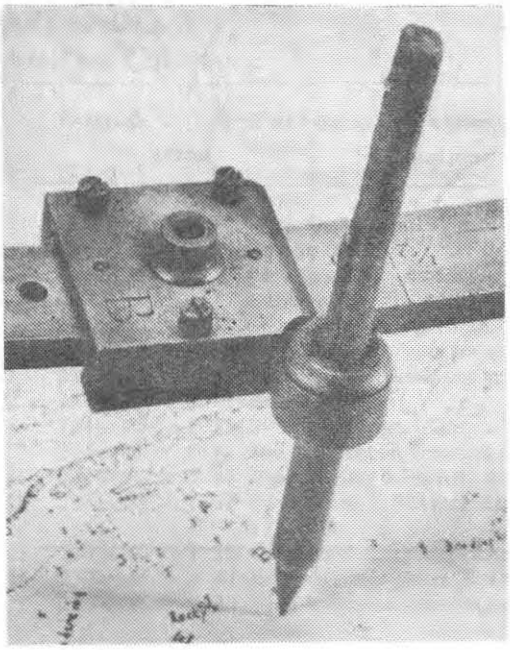

Figure 11. Post-conservation photograph of pantograph arm.

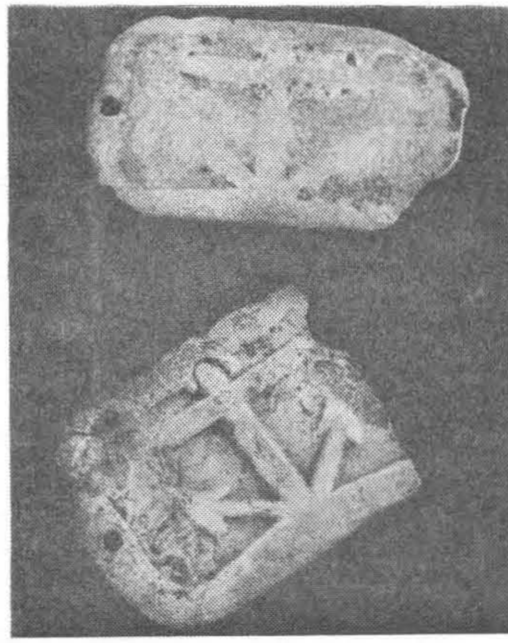

Figure 12. Brass shoulder-belt plates, SI 238 & SI 367.

APPENDIX A

Classification codes of artefact materials

1. STONE
10. Building
11. Slate
12. Coal
13. Ballast Stones
14. Sharpening and Grinding Stones
15. Flint
16. Chalk
17. Unspecified
2. CERAMICS
21. Stoneware
22. Earthenware
23. Majolica
24. Delft
25. Bricks
26. Tiles - Pipes etc.
27. Clay pipes
28. Patterned
29. Porcelain/china
3. NON FERROUS MATERIAL
30. Unknown
31. Bronze
32. Copper-Brass
33. Pewter
34. Lead
35. Silver
36. Gold
37. Tinfoil
4. MISCELLANEOUS
40. Human
41. Animal
42. Fruits, seeds etc
43. Resin wax etc.
44. Glass
45. Pitch, tar, oil etc
46. Rope, string, fibres, leather
47. Fabric
48. Marine - coral - shells
49. General miscellaneous
5. COINS
51. Silver
52. Copper
53. Gold
6. TIMBER
61. Ships main timbers
62. Armament
63. Cargo
64. Fittings
65. Tools
66. Bark/Bamboo
67. Miscellaneous
68. Dunnage
69. Charcoal/burnt wood etc.
8. FERROUS
81. Armament
82. Ships fittings
83. Tools etc.
84. Cargo
85. Ships structure
86. Concretions
87. Replicas

APPENDIX B
Front and Rear of Data Cards

PHOTOGRAPHY	BLACK AND WHITE	COLOUR	NOTES
IN SITU			
PRIOR CONS			
DURING CONS			
AFTER CONS			
PARALLELS			
DRAWINGS			
ADDITIONAL			

ADDITIONAL INFORMATION

WRECK	MATERIAL	SUB-DIVISION MATERIAL	REGISTRATION NUMBER	SUFFIX	ARTEFACT REGISTRATION CARD INDEX MARITIME ARCHAEOLOGY W.A. MUSEUM
DESCRIPTION					
LOCATION					
MATERIAL			FINDER		
DATE RECOVERED			NOTES		
DATE REGISTERED					
DATE IN CONSERVATION					
DATE OUT CONSERVATION					
CONSERVATION					
ANALYSIS			PRESENT LOCATION		

APPENDIX 2
Artefact Catalogue

1	19-Feb-85	1	44	Glass fragment - olive green, case bottle Air bubbles in glass	Site 3: Area 000 (Near ballast stones)
2	19-Feb-85	1	44	Glass fragment - olive green, case bottle Air bubbles in glass	Site 3: Area 000 (Near ballast stones)
3	21-Feb-85	1	34	Musket ball Diam 16.5 mm	Site 2: Area 000 (Gully between reefs)
4	21-Feb-85	15	44	Glass fragments - case bottle x 14; colourless x 1	Site 2: Area 000 (Gully betwen reefs)
5	23-Feb-85	1	32	Copper bolt with right angle bend	Site 5: Area A1 - 050/5.6 m
6	23-Feb-85	1	32	Copper bolt with brass nut and washer. Bent at right angles	Site 5: Area A1 - 050/5.6 m
7	23-Feb-85	1	32	Brass bolt with thread and nut.	Site 5: Area A4 - 050/19.4 m
8	23-Feb-85	0	32	Brass sheeting	Site 5: Area A1 - 050/5.6 m
9	23-Feb-85	1	82	Iron deck support.	Site 5: Area A4 - 050/19.4 m
10	23-Feb-85	1	82	Iron deck support [returned to site]	Site 5: Area A5 - 030/23.3 m
11	23-Feb-85	0	32	Brass sheeting 0.7 mm thick	Site 5: Area A2 - 010/13.0 m
12	23-Feb-85	1	32	Copper bolt. L. 365 mm; diam 17 mm.	Site 5: Area A3 - 040/ 12.8.80 m
13	23-Feb-85	1	32	Copper bolt L. 155 mm; diam 18 mm.	Site 5: Area A1 - 050/4.00 m
14	23-Feb-85	2	32	Brass sheeting - pieces T. 0.6 mm	Site 5: Area A1 - 050/5.6 m
15	23-Feb-85	1	32	Brass bolt:stress corrosion,cracking,poor casting- (gas bubbles)&waterborne erosion.L.298 mm;dia 19mm	Site 5: Area A2 - 040/9.2 m
16	23-Feb-85	1	25	Clay brick, pinkish colour with frogs.	Site 5: Area A - Datum area
17	23-Feb-85	1	82	Iron bolt L. 405 mm; diam. 29.3 mm(max) - 20 mm(min)	Site 5: Area 000
18	23-Feb-85	1	82	Iron strap plate with 25 mm diam hole. L. 510 mm; W. 89 mm; D.11.5 mm.	Site 5: Area A5 - 045/ 11.8 m
19	23-Feb-85	1	82	Wrought iron bolt with broken head. L. 340 mm; Head diam 24 mm; Shaft diam 22.5 mm	Site 5: Area A2 - 040/9.2 m
20	23-Feb-85	1	82	Wrought iron bolt. L. 204 mm; diam 15 mm.	Site 5: Area A2 - 040/9.2 m
21	24-Feb-85	1	25	Clay brick:frog on one side, 2 circular casting marks each end of other side. 230 x 113 x 77.5 mm	Site 5: Area A (Close to datum point)
22	24-Feb-85	1	25	Clay brick: Impressed mark 'HICKMAN' on one side. 230 x 113 x 77.5 mm	Site 5: Area A8 - 200/50 m
23	24-Feb-85	1	25	Clay brick: frog on each side, one with circular mould mark. 230 x 111 x 75.5 mm	Site 5: Area A8 - 200/50 m (Cf SI25 & SI27)
24	24-Feb-85	1	82	Iron shackle with eyebolt	Site 5: Area A10 - 211/49.2 m
25	24-Feb-85	1	82	Iron mast hoop	Site 5: Area A9 - 210/57 m
26	24-Feb-85	1	32	Brass bolt with remains of wood;"necking"of bar: extensive de-zincification. L.450 mm; diam 20 mm.	Site 5: Area A11 - 180/11 m
27	24-Feb-85	1	82	Iron bolt. L. 377 mm; diam 31 mm.	Site 5: Area A9 - 210/57 m
28	24-Feb-85	1	41	Whalebone - ? rib	Site 5: Area A7 - 180/19.5 m
29	24-Feb-85	1	82	Iron deck support Arms:L.460 mm & 450 mmm; W.60 mm; T.30 mm.	Site 5: Area A (?) 250/0.29 m
30	25-Feb-85	0	32	Brass sheeting. T. 0.7 mm	Site 5: Area B2 - 050/6.10 m
31	25-Feb-85	0	32	Brass sheeting. T. 0.7 mm	Site 5: Area B1 - 040/8.10 m
32	25-Feb-85	1	32	Brass bolt with wood attached.(C) Water and sand erosion. L. 370 mm; S.diam 21 mm	Site 5: Area B3 - 090/2.00 m
32	25-Feb-85	1	32	Copper bolt, complete (B) L. 235 mm; S.diam 20 mm	Site 5: Area B3 - 090/2.00 m
32	24-Feb-85	1	32	Bass bolt (A) L. 140 mm; H.diam 34 mm; S.diam 20 mm	Site 5: Area B3 - 090/2.00 m
33	25-Feb-85	1	32	Brass bolt L. 350 mm; diam 18 mm	Site 5: Area B5 - 120/5/10 m
34	23-Feb-85	1	0	Iron ring (De-registered- modern 44 gallon drum)	
35	23-Feb-85	0	32	Brass sheeting	Site 5: Area Near B9
36	25-Feb-85	1	32	Brass sheathing tack, round head, square shank. L. 29 mm; H.diam 9 mm; S.3 mm sq	Site 5: Area B1 - 040/9.2 m
37	02-Mar-85	1	84	Iron ballast. L. 955 mm; W. 145 mm; D. 125 mm. Wt. N/A	Site 4: Area 000 (045/4 m from 0 m on 40 m line)
38	02-Mar-85	1	41	Whalebone - rib ?	Site 5: Area 000 (Finder P. Ely)
39	02-Mar-85	1	41	Whalebone - small piece	Site 5: Area 000 (Finder P. Ely)
40	02-Mar-85	1	28	White china sherd from cup (Modern appearance)	Site 4: Area 000 (045/4 m from 0 m on 40 m line)
41	02-Mar-85	1	82	Unid. wrought iron fitting: flat bar divided for 2/3 length into 2 arms;domed fitment at one end.	Site 4: Area 000 (045/4 m from 0 m on 40 m line)
42	02-Mar-85	1	17	Unidentified black substance; hard body, T-shaped profile	Site 4: Area 000 (Slaughter Bay)
43	03-Mar-85	1	31	Bronze (or brass) bolt: possibly rudder fastening L. 255 mm S.diam 27-15 mm	Site 1: Area 000 (Stranding site)
44	03-Mar-85	1	31	Bronze/brass object, hooked at one end: probably keel staple. L.101 mm; W.17 mm; T.6 mm	Site 1: Area 000 (Stranding site)

45 03-Mar-85 44 32 Brass sheathing nails and fragments:assorted sizes L.53/37/23 mm;H.diam 14/8/6/mm;S.diam 6/4/3/ mm sq. Site 1: Area 000 (240/3.0 m)

46 03-Mar-85 1 31 Bronze ring - probably pulley coak O.diam 40 mm; I.diam 27 mm; Ht.32 mm. Site 1: Area 000 (240/3.0 m)

47 03-Mar-85 1 31 Bronze/brass object: probably part of keel staple. L.49 mm; W.9 mm; T.4 mm. Site 1: Area 000 (240/3.0 m)

48 03-Mar-85 0 34 Lead sheeting fragments Site 1: Area 000 (240/11.9 m)

49 03-Mar-85 1 15 Flintstone ? Site 1: Area 000 (240/3.0 m)

49 30-Jan-87 3 32 Copper alloy nails - assorted sizes Site 1: Area 001

50 03-Mar-85 1 83 Unidentified iron tool Site 1: Area 000 (240/3.0 m)

51 03-Mar-85 1 80 Unid. iron fragment Site 1: Area 000 (240/3.0 m)

52 03-Mar-85 1 31 Bronze fragment Site 1: Area 000 (Out from signal stations)

53 04-Mar-85 1 17 Chert - possibly Thames gravel Site 1: Area 000 (Beside carronade)

54 04-Mar-85 1 32 Copper bolt L. 275 mm; S.diam 17 mm Site 5: Area 000 ?

55 08-Mar-85 2 17 Rock samples Site 5: Area 000

56 08-Mar-85 2 17 Rock samples Natuaral calcarenite and basalt - Norfolk Is. Site 3: Area 000 (Possible ballast mound)

57 06-Mar-85 1 82 Iron anchor: Est.wt.1.4 + or - 0.2 tonnes [28 cwt] L. 4.55 m [14'11"];span of flukes 2.7 m [8'11"] Site 1: Area 000 (Stranding site)

58 12-Mar-85 1 81 Iron trunnion carronade:RH trunn.mark 37/953/18 P Wt. -cwt 2 qtr 9 lb; bore diam 127 mm [5"] Site 1: Area 000 (Stranding site)

59 28-Jan-87 1 32 Unid.copper alloy object; curved: possibly part of keel staple Site 1: Area 002 (250/14.5 m)

60 28-Jan-87 1 32 Copper alloy object:flat, tapered to round point, probably part of keel staple. L. 76 mm; T.8 mm. Site 1: Area 002 (250/14.5 m)

61 28-Jan-87 1 32 Brass spike, round head, square shank. (Similar to SI 032) Site 1: Area 002 (250/14.5 m)

62 28-Jan-87 1 32 Copper alloy spike: square head, square shank 2N 66 mm; Head 17 mm sq; Shank 11 mm sq (max). Site 1: Area 002 (250/14.5 m)

63 28-Jan-87 1 32 Unidentified copper alloy fastening L. 35 mm; H.diam 9-10 mm; S.diam 6 mm (min) Site 1: Area 002 (250/14.5 m)

64 28-Jan-87 1 32 Copper alloy planking nail:round head,square shank L. 47 mm; H.diam 10 mm; S. 12 mm sq (max) Site 1: Area 002 (250/14.5 m)

65 28-Jan-87 14 32 Copper alloy sheathing nails - some incomplete Site 1: Area 002 (250/14.5 m)

66 28-Jan-87 1 34 Lead sheeting roll Site 1: Area 002 (250/14.5 m)

67 28-Jan-87 5 34 Lead sheeting fragments Site 1: Area 2

68 28-Jan-87 1 32 Copper alloy nail fragment Site 1: Area 002

69 28-Jan-87 5 32 Copper alloy heads of planking nails Head diam c. 12 mm Site 1: Area 002

70 28-Jan-87 3 13 Flint pebble ballast Site 1: Area 002

71 28-Jan-87 1 32 Copper/bronze bolt, worn to taper at both ends probably rudder fastening. L. 217 mm; diam 20 mm Site 1: Area 002

72 28-Jan-87 0 34 Lead sheeting Site 1: Area 002

73 06-Mar-85 0 34 Lead sheeting Site 1: Area 002 (270/11.5 m)

74 06-Mar-85 1 31 Bronze keel staple Site 1: Area 002 (270/11.5 m)

75 06-Mar-87 7 32 Copper alloy planking nails Site 1: Area 002 (270/11.5 m)

76 28-Jan-87 1 32 Copper alloy disc with hole in centre - poss. coin Diam 25 mm Site 1: Area 001

77 28-Jan-87 1 32 Brass fitting with wheel - probably from sextant Wheel diam. Site 1: Area 001

78 28-Jan-87 1 34 Lead shot Diam 12 mm Site 1: Area 001

79 28-Jan-87 2 32 Copper pieces; flat, round Site 1: Area 001

80 28-Jan-87 2 21 Saltglaze stoneware sherds: pale buff body, medium brown mottle; clear inner glaze; incised lines Site 1: Area 001

81 28-Jan-87 5 44 Glass fragments - colourless, including part of tumbler base. Site 1: Area 001

82 28-Jan-87 3 44 Glass fragments - green, bottle Site 1: Area 001

83 28-Jan-87 0 32 Copper sheathing fragments, some with nail holes Nail holes: 12 mm sq Site 1: Area 001

84 28-Jan-87 0 13 Flint pebble ballast (1 bag) Probably from River Thames, England. Site 1: Area 001

85 28-Jan-87 1 13 Quartz pebble (ballast) Site 1: Area 001 (From among ballast stones)

86 28-Jan-87 1 31 Bronze pintle pin L. 260 mm; Diam 70 mm (max) Site 1: Area 001

87 28-Jan-87 1 31 Bronze pintle/gudgeon brace with 7 bolt holes. L. 121 cm; Site 1: Area 001

88 28-Jan-87 1 31 Bronze ring - probably pulley coak O. diam 43 mm; I. diam 21 mm; Ht. 31 mm Site 1: Area 001

89 28-Jan-87 1 31 Bronze ring - probably pulley coak O.diam 42.5 mm; I.diam 24 mm; Ht. 37 mm Site 1: Area 001

90 28-Jan-87 3 31 Bronze pieces: 1 curved w/countersunk screw hole. Probably parts of navigation instrumentSite 1: Area 001

91 28-Jan-87 1 32 Copper alloy ring O.diam 52.5 mm; I.diam 32.5 mm Site 1: Area 001

92 28-Jan-87 5 32 Copper lag bolts (screws). All but one very worn. H. diams 23 mm (max) - 15 mm (min) Site 1: Area 001

93 28-Jan-87 3 32 Copper alloy rudder nails: round heads, round to tapered shaft. H.diam 33 mm- 30 mm; L.122 mm Site 1: Area 001

94 28-Jan-87 1 32 Copper forelock bolt: round head and shank H.diam 35 mm; S.diam 18 mm; L.167 mm. Site 1: Area 001

95	28-Jan-87	0	34	Lead sheeting (1 bag)	Site 1: Area 001
96	28-Jan-87	73	32	Copper alloy sheathing nails + 12 fragments H.diam c.10 mm; L.38 mm; S.5 mm sq.	Site 1: Area 001
97	28-Jan-87	39	32	Copper alloy sheathing nails + 12 head fragments H.diam 15 mm; L.40 mm; S.6.5 mm sq.	Site 1: Area 001
98	28-Jan-87	1	32	Unid.copper alloy object: rectangular section, curved,tapered end.Probably part navigation instr.	Site 1: Area 001
99	28-Jan-87	1	82	Iron bolt (Not retained) Diam 29/30 mm	Site 1: Area 001
100	28-Jan-87	2	81	Grapeshot Diam 35 mm (A); 27 mm (B); wt N/A	Site 1: Area 001
101	28-Jan-87	0	13	Flint pebble ballast	Site 1: Area 002 - 003
102	28-Jan-87	1	44	Glass decanter stopper - colourless, lead glass	Site 1: Area 002 - 003
103	28-Jan-87	1	21	Basalt-ware body sherd of engine-turned object: probably vase or jug. [Cf Wedgewood & Bentley]	Site 1: Area 002 - 003
104	28-Jan-87	10	44	Glass fragments - dark green/colourless & aqua	Site 1: Area 002 - 003
105	28-Jan-87	5	34	Lead shot Diam 12 mm x 4; 11.5 mm x 1	Site 1: Area 002 - 003
106	28-Jan-87	0	32	Copper sheeting fragments	Site 1: Area 002 - 003
107	28-Jan-87	1	12	Coal - piece of	Site 1: Area 002 - 003
108	28-Jan-87	1	32	Brass fitting with wheel: probably part of sextant	Site 1: Area 002 - 003
109	28-Jan-87	0	34	Lead sheeting (1 Bag)	Site 1: Area 002 - 003
110	28-Jan-87	0	17	Rock sample from seabed - sandstone	Site 1: Area 002 - 003
111	28-Jan-87	32	32	Unid. copper alloy object: round shank, flared head with smaller half circle attachment.	Site 1: Area 002 - 003
112	28-Jan-87	44	32	Copper alloy sheathing nails + 33 fragments H.diam c.13 mm; L.41 mm; S.5.5 mm sq.	Site 1: Area 002 - 003
113	28-Jan-87	57	32	Copper alloy sheathing nails + 26 head fragments H.diam 13-15 mm;L.43 mm; S.5 mm sq.	Site 1: Area 002 - 003
114	28-Jan-87	1	32	Unid. copper alloy toggle-shaped object: probably worn fastening shank. L.36 mm; diam 8.5 mm (max)	Site 1: Area 002 - 003
115	28-Jan-87	0	32	Concretion with various artefacts + copper sheet [Only copper sheet with this no.]	Site 1: Area 002–003
115	28-Jan-87	6	32	Copper alloy nails H.diam 8 mm; L.21 mm	Site 1: Area 002 - 003
116	28-Jan-87	1	82	Part of wrought iron ring - in concretion w/glass Probably part of iron chain.	Site 1: Area 003
117	28-Jan-87	1	32	Copper alloy nail: round head, square shank H.diam 18 mm (max); L.59 mm; S.9 mm sq.	Site 1: Area 003
118	28-Jan-87	1	34	Lead scrap	Site 1: Area 003
119	28-Jan-87	0	13	Flint pebble ballast (1 bag)	Site 1: Area 003
120	28-Jan-87	1	31	Bronze object: probably part of keel staple	Site 1: Area 003
121	28-Jan-87	15	32	Copper alloy sheathing nails,assorted + 8 heads & 3 fragments	Site 1: Area 003
122	28-Jan-87	1	82	Wrought iron bolt, concreted	Site 1: Area 004
123	28-Jan-87	0	66	Bark	Site 1: Area 004
124	28-Jan-87	0	13	Flint pebble ballast	Site 1: Area 004
125	28-Jan-87	1	32	Copper alloy planking nail H.diam 13 mm; L.51 mm; S.8 mm sq.	Site 1: Area 004
126	28-Jan-87	1	32	Copper alloy tube; eroded Diam. 55 mm; L.105 mm.	Site 1: Area 004
127	28-Jan-87	1	32	Copper clinch ring O.diam 55 mm; I.diam 39 mm.	Site 1: Area 004
128	28-Jan-87	0	34	Lead sheeting (1 bag)	Site 1: Area 004
129	28-Jan-87	61	32	Copper alloy sheathing nails + 64 head frags & 15 shank fragments	Site 1: Area 004
130	28-Jan-87	1	32	Copper alloy nail N.diam 13 mm; L. 53.5 mm; S.9 mm sq.	Site 1: Area 004
131	28-Jan-87	2	32	Brass spikes, square shank sections (a)10 x 11.5 mm sq;(b)8.5 x 11 mm sq.	Site 1: Area 002
132	28-Jan-87	2	32	Copper alloy nails: round heads, square shanks. L.52/55 mm;H.diam 15/16 mm; S. 9/9 mm sq.	Site 1: Area 002
133	28-Jan-87	5	32	Copper fragments w/small round holes	Site 1: Area 002
134	28-Jan-87	2	34	Lead sheeting fragments	Site 1: Area 004
135	28-Jan-87	42	32	Copper alloy sheathing nails + 22 head frags & 4 shank frags. Assorted sizes.	Site 1: Area 004
136	28-Jan-87	1	31	Bronze keel staple L.73.5 mm; W.(O/A)41 mm.	Site 1: Area 002
137	28-Jan-87	1	32	Copper clinch ring O.diam 41 mm; I.diam 31 mm.	Site 1: Area 002
138	28-Jan-87	1	31	Bronze keel staple L. 141.5 mm; W.(O/A)21 mm; T.7 mm.	Site 1: Area 002
139	28-Jan-87	3	34	Lead sheeting fragments	Site 1: Area 002
140	28-Jan-87	1	32	Brass pipe w/turning marks. Evidence of wear marks in 2 places. L.212 mm; O.dia 25.5 mm; bore 18.5 mm	Site 1: Area 002
141	28-Jan-87	5	32	Copper alloy planking nails L.	Site 1: Area 002
142	28-Jan-87	62	32	Copper alloy sheathing nails + 21 head & 2 shank fragmets.	Site 1: Area 002
143	29-Jan-87	70	32	Copper alloy sheathing nails + 21 head & 2 shank frags. Assorted sizes.	Site 1: Area 001
144	29-Jan-87	3	32	Copper alloy planking nails (2 + 1 shank) L.41 mm; H.diam 9.5 mm; S.7.5 x 6 mm.	Site 1: Area 001
145	29-Jan-87	0	32	Copper fragments, small	Site 1: Area 001
146	29-Jan-87	11	44	Glass frgaments - colourless & green	Site 1: Area 001
147	29-Jan-87	1	32	Brass sextant, marked 0 to 120 degrees.	Site 1: Area 001
148	29-Jan-87	5	34	Musket balls Diam 14 mm x2; 15 mm x1; 15.5 mm x1	Site 1: Area 001
149	29-Jan-87	1	32	Copper - U-shaped piece L. 59 mm; W(O/A)19 mm; W.(arms)5 mm.	Site 1: Area 001
150	29-Jan-87	0	60	Wood fragments	Site 1: Area 001
151	29-Jan-87	0	12	Coal - pieces	Site 1: Area 001
152	29-Jan-87	1	44	Glass bottle top, green, w/ down-tooled string rim Bore diam 22.5 mm	Site 1: Area 002
153	29-Jan-87	3	44	Glass fragments - green	Site 1: Area 001

154	29-Jan-87	1	22	Terracotta (earthenware) sherd	Site 1: Area 001
155	29-Jan-87	8	44	Glass fragments - colourless	Site 1: Area 001
156	29-Jan-87	0	32	Copper sheathing	Site 1: Area 001
157	29-Oct-87	141	32	Copper alloy sheathing nails + 9 fragments	Site 1: Area 001
158	29-Jan-87	1	31	Bronze ring - probably pulley coak O.diam 41 mm; I.diam 26 mm.	Site 1: Area 001
159	29-Jan-87	1	32	Unid. brass object: probably part of navigation instrument.	Site 1: Area 001
160	29-Jan-87	1	32	Brass washer w/small section cut out; part of adj- ustment mechanism of sextant SI 147. Diam 18.5 mm	Site 1: Area 001
161	29-Jan-87	1	32	Copper pipe - piece of L. Diam 16 mm	Site 1: Area 001
162	29-Jan-87	5	32	Copper lag bolts (screws): round heads. 1 complete 4 incomplete. H.diam 23-27.5 mm; L.129 mm (max)	Site 1: Area 001
163	29-Jan-87	1	32	Brass tap - eroded	Site 1: Area 001
164	29-Jan-87	3	32	Copper rudder nails L. H.Diam	Site 1: Area 001
165	29-Jan-87	1	32	Copper clinch bolt w/broad arrow mark on shaft L.580 mm; diam 28 mm.	Site 1: Area 001
166	29-Jan-87	1	32	Copper clinch bolt L. 420 mm; diam 28 mm	Site 1: Area 001
167	29-Jan-87	0	32	Copper sheathing [Bulk]	Site 1: Area 001
168	29-Jan-87	91	32	Copper alloy sheathing nails + 7 frags	Site 1: Area 001
169	29-Jan-87	4	44	Glass fragments - 3 x green bottle; 1 x flat colo- urless	Site 1: Area 001
170	29-Jan-87	0	60	Wood fragments	Site 1: Area 001
171	29-Jan-87	4	34	Musket balls Diam 15 mm x2; 16 mm x2; 17 mm x1	Site 1: Area 001
172	29-Jan-87	2	32	Copper lag bolts (screws)	Site 1: Area 001
173	29-Jan-87	1	32	Copper rudder nail H.diam 30 mm; L. 130 mm; S.diam 16 mm	Site 1: Area 001
174	29-Jan-87	1	32	Brass ring with 3 rivet holes. Impressed '9' (or '6') on one side. O.diam 49 mm; I.diam 19mm;T.5 mm	Site 1: Area 001
175	29-Jan-87	1	32	Brass ring fragment	Site 1: Area 001
176	29-Jan-87	1	32	Copper alloy ring fragment with rivet holes: possibly part of sextant	Site 1: Area 001
177	29-Jan-87	1	32	Brass strap fragment: part of sextant ?	Site 1: Area 001
178	29-Jan-87	1	32	Copper clinch ring fragment (?)	Site 1: Area 001
179	29-Jan-87	1	32	Copper alloy planking nail (?) fragment: shank	Site 1: Area 001
180	29-Jan-87	1	34	Musket ball (?): semi-circular lead object, poss. badly cast ball	Site 1: Area 001
181	29-Jan-87	1	44	Glass decanter stopper, colourless, worn Diam. 21 mm (max)	Site 1: Area 001
182	29-Jan-87	2	44	Glass fragments - pale green, flat T. 4 mm & 5 mm	Site 1: Area 001
183	29-Jan-87	4	44	Glass fragments - dark green bottle	Site 1: Area 001
184	29-Jan-87	1	44	Glass fragment - colourless, with feather-etched design	Site 1: Area 001
185	29-Jan-87	7	44	Glass fragments - colourless	Site 1: Area 001
186	29-Jan-87	3	32	Copper alloy fragments - miscellaneous	Site 1: Area 001
187	29-Jan-87	2	12	Coal - pieces	Site 1: Area 001
188	29-Jan-87	0	60	Wood fragments	Site 1: Area 001
189	29-Jan-87	350	32	Copper alloy sheathing nails + broken fragments	Site 1: Area 001
190	29-Jan-87	2	32	Copper rose-headed forged ["convict"] nails L.51 mm (2");H.6 mm sq;S.3.5 mm sq.	Site 1: Area 001
191	29-Jan-87	10	32	Copper alloy nails - small	Site 1: Area 001
192	29-Jan-87	0	12	Coal - pieces	Site 1: Area 001
193	29-Jan-87	2	34	Musket balls Diam 15.5 mm x1; 15 mm x1	Site 1: Area 001
194	29-Jan-87	2	34	Lead shot - small Diam 9 mm & 11 mm	Site 1: Area 001
195	29-Jan-87	1	32	Brass washer: possibly from sextant O.diam 14 mm; I.diam 4 mm; T.3 mm	Site 1: Area 001
196	29-Jan-87	1	32	Unid. copper alloy fitting	Site 1: Area 001
197	29-Jan-87	1	32	Brass frag., flat, curved w/small rivet hole: prob.part of navigation instrument.L.27 mm;W.7 mm.	Site 1: Area 001
198	29-Jan-87	0	32	Copper sheathing fragments with ? horsehair	Site 1: Area 001
199	29-Jan-87	3	32	Unid. copper alloy fragments - miscellaneous	Site 1: Area 001
200	29-Jan-87	1	21	Saltglaze stoneware sherd	Site 1: Area 001
201	29-Jan-87	1	44	Glass fragment - amber, flat	Site 1: Area 001
202	29-Jan-87	9	44	Glass fragments - colourless, assorted	Site 1: Area 001
203	29-Jan-87	12	44	Glass fragments - green	Site 1: Area 001
204	29-Jan-87	1	81	Grapeshot Diam 33 mm; wt N/A	Site 1: Area 001
205	29-Jan-87	1	60	Unid. wood, shaped piece	Site 1: Area 001
206	29-Jan-87	1	41	Horsehair ? - sample	Site 1: Area 001
207	29-Jan-87	81	32	Copper alloy sheathing nails L. 42 mm; H.diam 13.5 mm; S.6x6.5 mm	Site 1: Area 001
208	28-Jan-87	1	84	Iron ballast stamped w/broad arrow; grey cast iron L.800 mm; W.95 mm; D.65 mm	Site 1: Area 002
209	29-Jan-87	169	32	Copper alloy sheathing nails L. 36.5 mm; H.diam 10 mm; S. 5 mm sq.	Site 1: Area 001
210	29-Jan-87	15	32	Copper alloy nails (assorted small) [1= L.33.5 mm; H.diam 5 mm; S. 3 mm sq.]	Site 1: Area 001
211	29-Jan-87	2	44	Glass fragments - colourless, small	Site 1: Area 001
212	29-Jan-87	1	33	Pewter fragment	Site 1: Area 001
213	29-Jan-87	1	32	Copper clinch ring (?) eroded O.diam 55 mm; I.diam 35 mm; T.6 mm.	Site 1: Area 001
214	29-Jan-87	1	32	Copper rudder nail H.diam 24 mm; L.140 mm; S.diam 15.5 mm.	Site 1: Area 001
215	29-Jan-87	1	32	Copper clinch ring, eroded O.diam 55 mm; I.diam 35 mm; T. 6 mm.	Site 1: Area 001
216	29-Jan-87	1	34	Musket ball + one half Diam 17 mm	Site 1: Area 001
217	29-Jan-87	2	44	Glass fragments - olive green, thick, bottle: possibly part of kick-up	Site 1: Area 001
218	29-Jan-87	1	34	Sounding lead - very worn, part only	Site 1: Area 001
219	29-Jan-87	1	32	Unid. brass object: probably part of sextant	Site 1: Area 001
220	29-Jan-87	24	32	Copper alloy sheathing nails and small nails, assorted sizes	Site 1: Area 001

221	29-Jan-87	1	32	Copper lag bolt (or lag screw), thread broken	Site 1: Area 001
222	29-Jan-87	1	60	Wood fragment	Site 1: Area 001
223	29-Jan-87	5	44	Glass fragments - colourless x 2; aqua & olive green	Site 1: Area 001
224	29-Jan-87	24	32	Copper alloy sheathing nails + 6 fragments	Site 1: Area 001
225	29-Jan-87	51	32	Copper alloy sheathing nails + 5 fragments	Site 1: Area 001
226	29-Jan-87	1	32	Brass object - flat, curved w/no visible markings: probably part of navigation instrument	Site 1: Area 001
227	29-Jan-87	1	32	Copper lag bolt (or lag screw), thread broken	Site 1: Area 001
228	29-Jan-87	2	32	Copper alloy rose-head planking nails L. 63 mm; H.10x11 mm; S.7x6 mm.	Site 1: Area 001
229	29-Jan-87	1	32	Copper alloy tack L. 26 mm; H.diam 11.5 mm; S.7x6 mm.	Site 1: Area 001
230	29-Jan-87	12	32	Copper alloy sheathing nails L.c.37-40 mm; H.diam 14 mm; S.6 mm sq.	Site 1: Area 001
231	29-Jan-87	12	32	Copper alloy sheathing nails L. 38 mm; H.diam 10 mm; S.5 mm sq.	Site 1: Area 001
232	29-Jan-87	1	44	Glass fragment - olive green, flat: probably case bottle	Site 1: Area 001
233	29-Jan-87	1	86	Concretion w/copper sheathing, part iron bolt & flat-sided mould of iron object. Bolt diam 25 mm.	Site 1: Area 001
234	29-Jan-87	0	13	Flint pebble ballast [bulk]	Site 1: Area 001
235	29-Jan-87	0	34	Lead scrap [bulk]	Site 1: Area 001
236	29-Jan-87	1	32	Bronze pump housing L.805 mm; O.diam 178 mm; I.diam (bore) 156.5 mm	Site 1: Area 006
237	29-Jan-87	1	31	Bronze pintle/gudgeon brace: rudder nail w/broad arrow (distal hole); lag bolt/screw (4th hole)	Site 1: Area 001
238	29-Jan-87	1	32	Brass plaque with anchor design: possibly shoulder-belt plate	Site 1: Area 007
239	29-Jan-87	1	32	Brass graduated arm from pantograph (mapping instr)L.545 mm; W.19 mm; T.5.5 mm	Site 1: Area 001
240	30-Jan-87	1	32	Brass pencil-shaped object: probably part of pantograph. L.107.5 mm;D.7mm	Site 1: Area 001
241	30-Jan-87	1	32	Copper bolt - head and part of neck	Site 1: Area 001
242	30-Jan-87	2	32	Copper rudder nails, 1 stamped with broad arrow	Site 1: Area 001
243	30-Jan-87	1	81	Grapeshot Diam 36 mm; wt N/A	Site 1: Area 001
244	30-Jan-87	1	32	Brass navigation dividers - part of arm	Site 1: Area 001
245	30-Jan-87	32	32	Brass button - round, flat, shank missing Diam. 15 mm.	Site 1: Area 001
246	30-Jan-87	2	44	Glass fragments - colourless; 1 x flat, feather- etched	Site 1: Area 001
247	30-Jan-87	66	32	Copper alloy sheathing nails + 8 head/1 shank frag L.c.37-40 mm; H.diam c.14 mm; S. c 6 mm sq.	Site 1: Area 001
248	30-Jan-87	89	32	Copper alloy sheathing nails + 3 shank frags. L. c 38 mm; H.diam c.10 mm; S. c 5 mm sq	Site 1: Area 001
250	30-Jan-87	306	34	Musket balls Diam 18 mm; total weight 9 kg	Site 1: Area 008
251	30-Jan-87	16	34	Musket balls - half balls Diam 18 mm	Site 1: Area 008
252	30-Jan-87	4	34	Lead shot Diam 13 mm - 14 mm	Site 1: Area 008
253	30-Jan-87	65	32	Copper clinch rings stamped with broad arrows O.diam 38 mm; I.diam 20 mm; T.5 mm	Site 1: Area 008
254	30-Jan-87	5	32	Copper clinch rings O.diam. 58-60 mm; I.diam 34 mm; T.10 mm	Site 1: Area 008
255	30-Jan-87	20	32	Copper clinch rings stamped with broad arrows O.diam 45-47 mm; I.diam 28 mm.	Site 1: Area 008
256	30-Jan-87	2	32	Copper lag bolts (screws) L.145 mm; H.diam 27 mm;	Site 1: Area 008
257	30-Jan-87	1	32	Unid. copper strap with 2 + one half bolt holes 2ne surface grooved.L.150 mm;W.19 mm;Ho.diam 11 mm	Site 1: Area 008
258	30-Jan-87	1	32	Unid. copper alloy fitting: possibly part of tap	Site 1: Area 008
259	30-Jan-87	0	13	Flint pebble ballast (1 bag)	Site 1: Area 008
260	30-Jan-87	20	44	Glass fragments - assorted	Site 1: Area 008
261	30-Jan-87	0	32	Copper sheathing with 3 nails in situ	Site 1: Area 008
262	30-Jan-87	4	32	Copper machine bolts (or "screw bolts")	Site 1: Area 008
263	30-Jan-87	7	32	Copper rudder nails and/or spikes	Site 1: Area 008
264	30-Jan-87	14	32	Copper rose-headed forged ["convict"] nails L. 62.5 mm; H.10 mm sq; S. 4 mm sq.	Site 1: Area 008
265	30-Jan-87	13	32	Copper rose-headed forged ["convict"] nails +26 fg L.44-47 mm (1.7-1.8");H.8 mm sq; S.4 mm sq.	Site 1: Area 008
266	30-Jan-87	28	32	Copper alloy sheathing nails	Site 1: Area 008
267	30-Jan-87	9	32	Copper alloy planking nails + 3 fragments	Site 1: Area 008
268	30-Jan-87	1	60	Wood fragment	Site 1: Area 8
269	30-Jan-87	1	32	Copper clinch bolt L. Diam.	Site 1: Area 008 (loose find)
270	30-Jan-87	1	44	Glass fragment - colourless	Site 1: Area 008 (loose find)
271	30-Jan-87	3	32	Copper alloy sheathing nails	Site 1: Area 008 (loose find)
272	30-Jan-87	3	32	Copper clinch rings O.diam/I.diam 2 x 35/20 mm; 1 x 50/35 mm	Site 1: Area 008 (loose find)
273	30-Jan-87	1	32	Copper sheathing with ? horsehair	Site 1: Area 008 (loose find)
274	01-Feb-87	1	21	Saltglaze stoneware sherd	Site 1: Area 008
275	01-Feb-87	1	44	Glass flat oblong head stopper, colourless: prob. medicine bottle. Ht. 40 mm; S.diam 14 mm (max)	Site 1: Area 008
276	01-Feb-87	1	44	Glass fragments - assorted	Site 1: Area 008
277	01-Feb-87	1	33	Pewter button with cone shank (loop missing) Diam. 20 mm.	Site 1: Area 008
278	01-Feb-87	18	34	Musket balls Dia/No 14.5/2;15/6;15.5/2;16/6;16.5/2. Av Wt 360 g	Site 1: Area 008
279	01-Feb-87	1	32	Copper clinch bolt with ring L.298 mm; H.diam 31 mm; S.diam 22 mm.	Site 1: Area 008
280	01-Feb-87	2	31	Unid. bronze fittings (both similar): probably part of navigation instrument.	Site 1: Area 008
281	01-Feb-87	1	32	Unid. copper object.	Site 1: Area 008
282	01-Feb-87	1	34	Lead tube - part only	Site 1: Area 008

283	01-Feb-87	5	32	Copper alloy nails - assorted sizes	Site 1: Area 008
284	01-Feb-87	0	34	Lead scrap	Site 1: Area 008
285	01-Feb-87	0	32	Miscellaneous copper fragments	Site 1: Area 008
286	01-Feb-87	0	13	Flint pebble ballast	Site 1: Area 008
287	01-Feb-87	1	32	Copper lag bolt (or screw) in concretion	Site 1: Area 001
288	01-Feb-87	64	32	Copper alloy sheathing nails + 6 fragments L.37 mm; H.diam 10 mm; S.5 mm sq.	Site 1: Area 001
289	01-Feb-87	39	32	Copper alloy sheathing nails L.41 mm; H.diam 13 mm; S.6 mm sq.	Site 1: Area 001
291	01-Feb-87	10	44	Glass fragments - dark green, bottle; some flat	Site 1: Area 001
292	01-Feb-87	1	83	Unidentified iron object: possibly tool	Site 1: Area 001
293	01-Feb-87	18	32	Copper alloy nails	Site 1: Area 001
294	01-Feb-87	5	32	Copper clinch rings + 1 fragment O.diam 2 x 46 mm; 3 x 36-37 mm	Site 1: Area 001
295	01-Feb-86	1	32	Copper washers - strip of 3 (diamond-shape)	Site 1: Area 001
296	01-Feb-87	2	32	Copper lag bolts (screws) H.diam 1 x 14 mm; 1 x 20 mm	Site 1: Area 001
297	01-Feb-87	9	32	Copper rose-headed forged ["convict"] nails	Site 1: Area 001
298	01-Feb-87	1	32	Copper alloy sheathing nail	Site 1: Area 001
299	01-Feb-87	2	44	Glass fragments - 1 x colourless, flat; 1 x black rim of vessel	Site 1: Area 001
300	01-Feb-87	1	11	Slate point ? - small section	Site 1: Area 001
301	01-Feb-87	1	32	Copper keel bolt with clinch ring, both stamped with broad arrows-several on bolt.	Site 1: Area 001
302	01-Feb-87	1	44	Glass fragment - green, bottle	Site 1: Area 001
303	01-Feb-87	0	32	Copper sheathing	Site 1: Area 001
304	01-Feb-87	9	32	Copper alloy sheathing nails	Site 1: Area 001
305	01-Feb-87	1	81	Grapeshot Diam 40 mm; wt N/A	Site 1: Area 001
306	01-Feb-87	109	32	Copper rose headed forged ["convict"] nails Av.L.47 mm; H.7 mm sq; S.3.5 mm sq.	Site 1: Area 008
307	01-Feb-87	102	32	Copper rose-headed forged ["convict"] nails Av.L.67 mm; H.8 mm sq; S.4 mm sq.	Site 1: Area 008
308	01-Feb-87	17	32	Copper alloy planking nails + 4 fragments L. 49 mm; H. 10x12 mm; S.5x6.5 mm	Site 1: Area 008
309	01-Feb-87	2	32	Copper alloy planking nails L. 49 mm; H.11x14 mm; S.7x9 mm	Site 1: Area 008
310	01-Feb-87	66	32	Copper alloy sheathing nails:15xlg,51xsm head + 3f	Site 1: Area 008
311	01-Feb-87	65	32	Copper clinch rings + fragments Av. O.diam 38/39 mm; I.diam 20 mm	Site 1: Area 008
312	01-Feb-87	18	32	Copper clinch rings Av. O.diam 45/46 mm; I.diam 27 mm	Site 1: Area 008
313	01-Feb-87	8	32	Copper clinch rings Av.O.diam 60 mm; I.diam 33 mm	Site 1: Area 008
314	01-Feb-87	25	34	Lead shot Diam (Av) 13 mm	Site 1: Area 008
315	01-Feb-87	34	34	Musket balls Diam (Av) 18 mm	Site 1: Area 008
316	01-Feb-87	0	32	Copper sheeting, overlapped, with rivets (9)	Site 1: Area 008
317	01-Feb-87	0	32	Copper fragments: 1x 20 mm wide band w/rivet; 1 x 30 mm wide w/folded edge.	Site 1: Area 008
318	01-Feb-87	19	32	Copper washers (diamond-shape) + 1 round	Site 1: Area 008
319	01-Feb-87	1	32	Copper bolt - round head, pointed end to shaft L.395 mm; H.diam 40 mm; S.diam 23.5 mm	Site 1: Area 008
320	01-Feb-87	1	32	Brass spike - square head and shank L.183.5 mm; H.24x23.5 mm; S.15.5x13.5 mm	Site 1: Area 008
321	01-Feb-87	2	32	Copper lag bolts (screws), 1 w/broad arrow L.150/125 mm; H.diam 25/27 mm; S.diam 15/15 mm	Site 1: Area 008
322	01-Feb-87	9	32	Copper machine bolts (or screw bolts) L.53 mm; H.diam 19/20 mm; S.diam 14 mm.	Site 1: Area 008
323	01-Feb-87	4	32	Copper rudder nails	Site 1: Area 008
324	01-Feb-87	1	80	Unid. iron fragment	Site 1: Area 008
325	01-Feb-87	1	44	Glass fragment - base of dark green case bottle	Site 1: Area 008
326	01-Feb-87	2	44	Glass fragments - green, bottle	Site 1: Area 008
327	01-Feb-87	49	44	Glass fragments - colourless, flat T. 4.5/5 mm	Site 1: Area 008
328	01-Feb-87	1	46	Reed or bristle: probably from broom	Site 1: Area 008
329	01-Feb-87	0	13	Flint pebble ballast	Site 1: Area 008
330	01-Feb-87	1	34	Lead sheet - piece of	Site 1: Area 008
331	01-Feb-87	2	34	Lead shot - 1 w/protruberance,1 w/hole & vertical mould line: probably cartridge shot. Diam 12 mm	Site 1: Area 001
332	01-Feb-87	4	34	Lead shot Diam 11.5 mm x 1;12 mm x 1;12.5 mm x 1;16 mm x 1	Site 1: Area 008
333	01-Feb-87	0	34	Lead shot - small	Site 1: Area 001
334	01-Feb-87	1	32	Brass foot with bone wheel & circular fitting: probably from sextant.	Site 1: Area 001
335	01-Feb-87	1	32	Unid. brass hook fitting.	Site 1: Area 001
336	01-Feb-87	1	32	Copper rose headed, forged ["convict"] nails	Site 1: Area 001
337	01-Feb-87	31	32	Copper alloy sheathing nails (large head)	Site 1: Area 001
338	01-Feb-87	23	32	Copper alloy sheathing nails (small head) + 7 frag	Site 1: Area 001
339	01-Feb-87	1	44	Glass fragment - colourless, flat T.3.5 mm	Site 1: Area 001
340	01-Feb-87	1	34	Lead washer (or sheathing frag) w/square nail hole Hole 3.5 mm sq.	Site 1: Area 001
341	01-Feb-87	1	32	Copper keel staple	Site 1: Area 001
342	01-Feb-87	43	32	Copper alloy sheathing nails + fragments	Site 1: Area 001
343	01-Feb-87	1	32	Unid. brass ring with 4 holes O.diam 146 mm;I.diam 90 mm;Hole diam 16 mm; T.13mm	Site 1: Area 008
344	01-Feb-87	0	60	Wood fragments	Site 1: Area 008
345	01-Feb-87	9	44	Glass fragments - green; includes rim section of wide mouth container	Site 1: Area 008
346	01-Feb-87	18	44	Glass fragments - colourless, flat T. 3-4 mm	Site 1: Area 008
347	01-Feb-87	2	29	Porcelain sherds w/blue on white "Willow" pattern	Site 1: Area 008
348	01-Feb-87	1	32	Brass medallion,oval-shaped;classical urn bounded by laurel wreath:prob.mirror or furniture fitting.	Site 1: Area 008
349	01-Feb-87	10	32	Copper clinch rings O.diam 38 mm; I.diam 20 mm	Site 1: Area 008
350	01-Feb-87	1	32	Copper clinch ring O.diam 59 mm; I.diam 33 mm	Site 1: Area 008

351	01-Feb-87	1	32	Copper rudder nail L. 138 mm; H.diam 25.5 mm; S.diam 14.5 mm	Site 1: Area 008
352	01-Feb-87	2	32	Brass spike sections, square-head, square shank: possibly part of same. H.18x18.5 mm sq;S.11 mm sq	Site 1: Area 008
353	01-Feb-87	1	32	Copper alloy planking nail L. 88 mm; H.13 x 15 mm; S.7x9 mm.	Site 1: Area 008
354	01-Feb-87	1	32	Copper bolt - head of H.diam 39 mm; S.diam 25.5 mm	Site 1: Area 008
355	01-Feb-87	4	32	Copper machine bolts (or screw bolts)	Site 1: Area 008
356	01-Feb-87	28	32	Copper washers (diamond shape in strip)	Site 1: Area 008
357	01-Feb-87	1	32	Unid. copper strip	Site 1: Area 008
358	01-Feb-87	0	34	Lead sheet + square of lead 41 x 42 mm.	Site 1: Area 008
359	01-Feb-87	1	41	Bone fragment	Site 1: Area 008
360	01-Feb-87	91	32	Copper rose-headed forged ["convict"] nails Av.L.67.5 mm; H.4 mm sq; S.5x6 mm	Site 1: Area 008
362	01-Feb-87	124	32	Copper rose-headed forged ["convict"] nails Medium size.	Site 1: Area 008
363	01-Feb-87	23	32	Copper alloy sheathing nails (large head)	Site 1: Area 008
364	01-Feb-87	171	32	Copper alloy sheathing nails (small head)	Site 1: Area 008
365	01-Feb-87	0	46	Wood fragments and bristle: possibly from broom	Site 1: Area 008
366	01-Feb-87	1	83	Unid. de-mineralised cast iron object, broken in two pieces. Probably tool.	Site 1: Area 008
367	02-Feb-87	1	32	Brass oblong plaque with anchor design: possibly shoulder-belt plate.	Site 1: Area 008
368	02-Feb-87	1	33	Pewter button with cone shank (loop missing) Fragile. Diam 19 mm	Site 1: Area 008
369	02-Feb-87	2	44	Glass fragments - green, flat	Site 1: Area 008
370	02-Feb-87	1	32	Brass beading fragment: similar, but larger than beading on SI 573: poss from fender	Site 1: Area 008
371	02-Feb-87	5	34	Musket balls Diam 13 mm x1; 14 mm x1; 14.5 mm x1; 17 mm x1	Site 1: Area 008
372	02-Feb-87	1	32	Unid. brass,oval-shaped object: flat upper surface & domed inner surface;central hole;milled edge	Site 1: Area 008
373	02-Feb-87	1	32	Unid. copper alloy flat,right-angle object w/rib marking. W. 10-13 mm	Site 1: Area 008
374	02-Feb-87	1	32	Brass ramrod pipe from land pattern musket.	Site 1: Area 008
375	02-Feb-87	1	32	Unid. copper fragment,round section;de-mineralised	Site 1: Area 008
376	02-Feb-87	48	32	Copper alloy sheathing nails:18 lg & 30 sm heads + 20 fragments;some w/copper sheathing attached	Site 1: Area 008
377	02-Feb-87	1	32	Copper fragment	Site 1: Area 008
378	02-Feb-87	2	32	Copper alloy planking nails +1 fragment.	Site 1: Area 008
379	02-Feb-87	1	81	Cannon ball Diam 90 mm; wt 1 kg	Site 1: Area 008
380	01-Feb-87	0	32	Copper sheathing	Site 1: Area 001
381	01-Feb-87	1	32	Copper keel bolt w/clinch ring & broad arrow stamp L.560 mm; H.diam 45 mm;S.diam 35 mm; R.diam 60 mm	Site 1: Area 001
382	01-Feb-87	13	32	Copper alloy sheathing nails + 1 planking nail shank fragment.	Site 1: Area 001
383	01-Feb-87	2	21	Saltglaze stoneware sherds with incised lines: both fit together.	Site 1: Area 001
384	01-Feb-87	0	60	Wood fragments	Site 1: Area 001
385	01-Feb-87	0	44	Glass stopper fragment, colourless	Site 1: Area 001
386	01-Feb-87	4	44	Glass fragments - green, bottle	Site 1: Area 001
387	01-Feb-87	1	81	Grapeshot with remains of fabric bag Diam 38 mm; wt 100 g	Site 1: Area 001
388	01-Feb-87	1	81	Grapeshot Diam 39 mm; wt 100 g	Site 1: Area 001
389	01-Feb-87	1	81	Grapeshot Diam 39 mm; wt 65 g	Site 1: Area 001
390	01-Feb-87	1	81	Grapeshot Diam 36 mm; wt 30 g	Site 1: Area 001
391	01-Feb-87	1	81	Grapeshot - half Diam 38 mm; wt N/A	Site 1: Area 001
392	01-Feb-87	7	81	Grapeshot - broken Diam range 35 - 38 mm	Site 1: Area 001
393	01-Feb-87	1	81	Grapeshot Diam 25 mm; wt 25 g	Site 1: Area 001
394	01-Feb-87	1	81	Grapeshot + 2 broken halves Diam 21.5 mm; wt 15 g; Diams 21.5 & 24.5 mm	Site 1: Area 001
395	02-Feb-87	1	32	Brass tap spiggot, eroded	Site 1: Area 008
396	02-Feb-87	1	32	Copper alloy bolt, eroded L.770 mm; S.diam 30 mm	Site 1: Area 011
397	02-Feb-87	1	31	Bronze pintle/gudgeon brace, eroded L.	Site 1: Area 011
398	02-Feb-87	1	32	Brass tap	Site 1: Area 008
399	02-Feb-87	0	32	Copper sheathing fragment w/ piece of coal	Site 1: Area 008
400	02-Feb-87	1	81	Cannon ball Diam 87 mm; wt 1 kg	Site 1: Area 008
401	02-Feb-87	0	81	Cannon ball - half Diam 94 mm; wt. N/A	Site 1: Area 008
402	02-Feb-87	1	81	Cannon ball Diam 128 mm; wt N/A	Site 1: Area 008
403	02-Feb-87	1	12	Coal - pieces	Site 1: Area 008
404	02-Feb-87	2	44	Glass fragments - green	Site 1: Area 008
405	02-Feb-87	0	32	Copper sheathing	Site 1: Area 008
406	02-Feb-87	1	32	Brass tube: possibly part of telescope of sextant O.diam 18 mm; I.diam 14 mm	Site 1: Area 008
407	02-Feb-87	2	15	Gunflints	Site 1: Area 008
408	02-Feb-87	1	32	Copper keel staple with ragged points L.197 mm; W.32 mm; D.95 mm.	Site 1: Area 008
409	02-Feb-87	12	32	Copper alloy planking nails, some J-shaped +5 frag	Site 1: Area 008
410	02-Feb-87	42	32	Copper alloy nails - assorted + fragments	Site 1: Area 008
411	02-Feb-87	44	32	Copper alloy sheathing nails (small head)+ 13 frag	Site 1: Area 008
412	02-Feb-87	20	32	Copper alloy sheathing nails (large head)	Site 1: Area 008
413	02-Feb-87	1	32	Copper lag bolt (or lag screw)	Site 1: Area 008
414	02-Feb-87	2	32	Copper machine bolts (or screw bolts) L.33.5/54 mm; H.diam 20/19 mm	Site 1: Area 008
415	02-Feb-87	1	32	Copper rudder nail L.127 mm; H.diam 25 mm; S.diam 15 mm	Site 1: Area 008
416	02-Feb-87	2	32	Copper alloy square-headed spikes w/square shanks H. 19/16 mm sq; S.12/10 mm sq	Site 1: Area 008
417	02-Feb-87	70	34	Musket balls Diam c. 18 mm	Site 1: Area 008
418	02-Feb-87	188	34	Lead shot Diam c. 13 mm	Site 1: Area 008

419	02-Feb-87	67	32	Copper rose-headed forged ["convict"] nails 8x L.67.5 mm; 39x L.48 mm; 20x L.32.5 mm + 40 frag	Site 1: Area 008
420	02-Feb-87	0	60	Wood fragments	Site 1: Area 008
421	02-Feb-87	1	32	Brass navigational dividers, head only	Site 1: Area 008
422	02-Feb-87	14	32	Copper clinch rings O.diam 38 mm; I.diam 20 mm; + 1 frag of large ring	Site 1: Area 008
423	02-Feb-87	13	44	Glass fragments - colourless, flat; + 2 x green bottle	Site 1: Area 008
424	02-Feb-87	3	81	Cast iron rod fragments: possibly langridge Diam. 12 - 19 mm	Site 1: Area 008
425	02-Feb-87	0	13	Flint pebble ballast	Site 1: Area 008
426	02-Feb-87	0	32	Copper washers in strip (diamond-shape)	Site 1: Area 008
427	02-Feb-87	3	33	Pewter buttons - round with cone shanks. Fragile. Diam 1x 26 mm; 2 x 25 mm.	Site 1: Area 008
428	02-Feb-87	1	32	Brass wrist escutchen from land pattern musket.	Site 1: Area 008
429	02-Feb-87	1	32	Brass ring: possibly part of sextant O.diam 43 mm; I.diam 11 mm	Site 1: Area 008
430	02-Feb-87	1	31	Bronze ring - probably pulley coak O.diam 57 mm; I.diam 30 mm; Ht 55 mm	Site 1: Area 008
431	02-Feb-87	1	32	Brass ramrod pipe from land pattern musket. L. 105 mm	Site 1: Area 008
432	02-Feb-87	1	44	Glass - colourless, circular bottle base with dome shaped basal profile. D.30 mm	Site 1: Area 008
433	02-Feb-87	1	32	Brass ramrod pipe from land pattern musket.	Site 1: Area 008
434	02-Feb-87	1	32	Brass button - round, flat, turned wavy lines on upper,outer edge;cone shank w/loop remains.D.25 mm	Site 1: Area 008
435	02-Feb-87	1	29	Porcelain sherd	Site 1: Area 008
436	02-Feb-87	1	43	Unid. piece of yellow substance: possibly amber	Site 1: Area 008
437	02-Feb-87	1	32	Copper clinch ring O.diam 37 mm; I.diam 22 mm	Site 1: Area 008
438	02-Feb-87	6	32	Copper washers (diamond-shape) + 2 round washers	Site 1: Area 008
439	02-Feb-87	1	11	Slate fragment	Site 1: Area 008
440	02-Feb-87	13	32	Copper rose-headed forged ["convict"] nails	Site 1: Area 008
441	02-Feb-87	207	32	Copper alloy sheathing nails (small head)	Site 1: Area 008
442	02-Feb-87	67	32	Copper alloy sheathing nails (large head)	Site 1: Area 008
443	02-Feb-87	10	32	Copper alloy planking nails + 4 frags	Site 1: Area 008
444	02-Feb-87	1	32	Brass spike - square-head & shaft,stamped w/arrow, broken lower end. H. 25x26 mm sq; S.15 mm sq.	Site 1: Area 008
445	02-Feb-87	1	32	Copper spike - square head & shaft L.135 mm; H.20 mm sq; S.10 mm sq.	Site 1: Area 008
446	02-Feb-87	8	34	Musket balls Diam 13 mm x2; 15 mm x1; 17.5 - 18 mm x5	Site 1: Area 008
447	02-Feb-87	1	34	Lead tube - part only O.diam 28 mm; I.diam 17 mm; L.42 mm	Site 1: Area 008
448	02-Feb-87	9	44	Glass fragments - colourless, flat	Site 1: Area 008
449	02-Feb-87	0	34	Lead scrap	Site 1: Area 008
450	02-Feb-87	0	32	Copper sheathing fragments	Site 1: Area 008
451	02-Feb-87	14	44	Glass fragments - green, bottle	Site 1: Area 008
452	02-Feb-87	1	81	Cannon ball Diam 88 mm; wt 1 kg	Site 1: Area 008
453	02-Feb-87	0	13	Flint pebble ballast	Site 1: Area 008
454	01-Feb-87	1	21	Saltglaze stoneware sherd - pale buff body, medium brown mottle	Site 1: Area 001
455	01-Feb-87	13	32	Copper alloy sheathing nails - (9 x large head)	Site 1: Area 001
456	01-Feb-87	1	44	Glass fragment - colourless: possibly from stopper	Site 1: Area 001
457	01-Feb-87	0	34	Lead scrap	Site 1: Area 007
458	01-Feb-87	0	32	Copper sheeting fragments	Site 1: Area 001
459	01-Feb-87	0	13	Flint pebble ballast	Site 1: Area 001
460	02-Feb-87	2	32	Copper clinch ring - sections of O.diam 65 mm; I.diam c.30 mm	Site 1: Area 001
461	02-Feb-87	1	32	Copper rose-headed forged ["convict"] nail	Site 1: Area 001
462	02-Feb-87	11	32	Copper alloy sheathing nails	Site 1: Area 001
462	02-Feb-87	3	44	Glass fragments - 2 x flat colourless; 1 x green	Site 1: Area 001
463	02-Feb-87	1	32	Copper sheet - rectangular, with 4 bolt holes Diam 2x21 mm;1x12 mm;1x14 mm; L.415 mm; W.160 mm	Site 1: Area 001
465	02-Feb-87	0	32	Copper sheathing	Site 1: Area 001
466	02-Feb-87	1	81	Grapeshot with fabric (in concretion) Diam 38.5 mm; wt 95 g	Site 1: Area 001
467	02-Feb-87	1	81	Grapeshot Diam 39 mm; wt 100 g	Site 1: Area 001
468	02-Feb-87	1	81	Grapeshot Diam 38.5 mm; wt 80 g	Site 1: Area 001
469	02-Feb-87	1	81	Grapeshot - broken Diam 35 mm; wt 65 g	Site 1: Area 001
470	02-Feb-87	1	81	Grapeshot - eroded Diam 34 mm; wt 45 g	Site 1: Area 001
471	03-Feb-87	1	81	Grapeshot Diam 39 mm; wt 95 g	Site 1: Area 001
472	03-Feb-87	1	81	Grapeshot Diam 39 mm; wt 75 g	Site 1: Area 001
473	03-Feb-87	1	81	Grapeshot Diam 36 mm; wt 35 g	Site 1: Area 001
474	02-Mar-87	1	81	Grapeshot Diam 22 mm; wt 10 g	Site 1: Area 001
475	03-Feb-87	4	81	Grapeshot - all broken Diam 31.5 mm x2; 36 mm x1; 39 mm x1	Site 1: Area 001
476	03-Feb-87	14	32	Copper alloy sheathing nails (6x large head)	Site 1: Area 001
477	03-Feb-87	0	32	Copper sheathing	Site 1: Area 001
478	03-Feb-87	2	44	Glass fragments - green	Site 1: Area 001
479	03-Feb-87	1	17	Stone hand axe - basalt type rock. Possible origin New South Wales (aboriginal)	Site 1: Area 001
480	03-Feb-87	1	31	Bronze ring - probably pulley coak O.diam ; I.diam	Site 1: Area 008
481	03-Feb-87	1	21	Basalt-ware base sherd of engine-turned vessel: probably vase or urn. [Cf. Wedgewood & Bentley]	Site 1: Area 001
482	03-Feb-87	1	32	Bronze pump housing - part of	Site 1: Area 001
483	03-Feb-87	1	60	Wood fragment	Site 1: Area 001
484	28-Jan-87	3	32	Copper lag bolts (screws) - 2 broken	Site 1: Area 002 - 003 (From

concretion SI 115)

485	28-Jan-87	1	32	Copper bolt head	Site 1: Area 002 - 003 (From concretion SI 115)
486	28-Jan-87	1	32	Brass pin - shaft only, rolled head missing L. c. 20 mm (To be measured)	Site 1: Area 002 - 003 (From concretion SI 115)
487	28-Jan-87	1	32	Brass washer - circular: probably part of sextant O.diam 26.5 mm; I.diam 5.5 mm; T. 3 mm	Site 1: Area 002 - 003 (From concretion SI 115)
488	28-Jan-87	1	32	Brass screw with milled edge: probably adjusting screw from sextant	Site 1: Area 002 - 003 (From concretion SI 115)
489	28-Jan-87	1	32	Unid. brass tube w/end section cut away: possibly from sextant. L.39 mm;O.diam 11 mm;ID.7mm	Site 1: Area 002 - 003 (From concretion SI 115)
490	28-Jan-87	1	32	Unid. brass ring (incomplete), w/attachment: poss. lens mount from sextant. Diam 27 mm	Site 1: Area 002 - 003 (From concretion SI 115)
491	28-Jan-87	1	32	Unid. copper fragment	Site 1: Area 002 - 003 (From concretion SI 115)
492	28-Jan-87	0	34	Lead scrap	Site 1: Area 002 - 003 (From concretion SI 115)
493	28-Jan-87	2	34	Lead shot Diam 12 mm	Site 1: Area 002 - 003 (From concretion SI 115)
494	28-Jan-87	7	34	Lead shot - small: probably pistol shot	Site 1: Area 002 - 003 (From concretion SI 115)
495	28-Jan-87	7	44	Glass fragments - colourless, flat T. 2-4 mm	Site 1: Area 002 - 003
496	28-Jan-87	141	32	Copper alloy sheathing nails (large head)	Site 1: Area 002 - 003 (From concretion SI 115)
497	28-Jan-87	131	32	Copper alloy sheathing nails (small head) + 9 frag	Site 1: Area 002 - 003 (From concretion SI 115)
498	28-Jan-87	1	32	Copper bolt - bent at right angles L.c.125 mm; H.diam 25 mm; S.diam 15 mm	Site 1: Area 002 - 003 (From concretion SI 115)
499	28-Jan-87	0	60	Wood fragments	Site 1: Area 001
500	28-Jan-87	11	44	Glass fragments - colourless, flat; + 1 green bot- tle	Site 1: Area 001
501	04-Feb-87	1	46	String - small piece, two-stranded Diam 3 mm; strand diam 2 mm	Site 1: Area 001 (From concretion)
502	02-Feb-87	1	81	Grapeshot with fabric Diam 38 mm; wt 100 g	Site 1: Area 001
503	02-Feb-87	1	81	Grapeshot Diam 40 mm; wt 75 g	Site 1: Area 001
504	02-Feb-87	9	81	Grapeshot Diam 34-38 mm; wt 55-80 g	Site 1: Area 001
505	02-Feb-87	10	81	Grapeshot - 1 broken Diam 38-41 mm; wt 55 (broken shot) - 110 g	Site 1: Area 001
506	02-Feb-87	9	81	Grapeshot (or canister shot) (2 x halves only) Diam 22-26 mm; wt 10-30 g	Site 1: Area 001
507	02-Feb-87	0	47	Fabric and string from grapeshot	Site 1: Area 001
508	02-Feb-87	3	81	Grapeshot, halves + 9 fragments Diam 38 mm x2; 39 mm x1	Site 1: Area 001
509	02-Feb-87	1	62	Unid. wooden plug (?) with brass wire coil; iron- impregnated: possibly fuse from canister shot	Site 1: Area 001 (In conc.w/grapeshot 502-508)
510	02-Feb-87	11	44	Glass fragments	Site 1: Area 001 (From concretion)
511	02-Feb-87	0	81	Grapeshot w/remains of fabric and marling in situ. Diam 35-42 mm	Site 1: Area 001 (From con- cretion)
512	05-Feb-87	1	32	Brass fire-grate leg, Classical design, engraved 3 sides w/bell flowers & patera	Site 1: Area 012
513	05-Feb-87	1	34	Lead shot Diam 14 mm	Site 1: Area 012
514	05-Feb-87	1	44	Glass fragment - green, bottle	Site 1: Area 012
515	05-Feb-87	0	32	Copper sheathing	Site 1: Area 012
516	05-Feb-87	1	81	Cannon ball Diam 128 mm; wt 5 kg	Site 1: Area 012
517	05-Feb-87	1	12	Coal - pieces	Site 1: Area 001
518	05-Feb-87	16	44	Glass fragments - various	Site 1: Area 001
519	05-Feb-87	2	20	Ceramic fragments:1x white glazed E/ware footrim of plate; 1x basalt ware w/ribbed pattern	Site 1: Area 001
520	05-Feb-87	2	60	Wood fragments - small	Site 1: Area 001
521	05-Feb-87	0	32	Copper sheathing	Site 1: Area 001
522	05-Feb-87	41	32	Copper alloy sheathing nails (21x large head & 20 small head)	Site 1: Area 001
523	05-Feb-87	2	81	Grapeshot with remains of fabric: 1 broken Diam 22 mm; wt 20 g	Site 1: Area 001
524	05-Feb-87	1	81	Grapeshot (or canister shot) Diam 25 mm; wt 15 g	Site 1: Area 001
525	05-Feb-87	1	81	Grapeshot Diam 34 mm; wt 35 g	Site 1: Area 001
526	05-Feb-87	6	81	Grapeshot Diam 34-38 mm; wt 40-85 g	Site 1: Area 001
527	05-Feb-87	1	32	Brass cabinet or furniture fitting - oval w/relief moulded patera design; short pedestal	Site 1: Area 012
528	05-Feb-87	1	34	Musket ball Diam 16 mm	Site 1: Area 012 (With concretion of SI 512)
529	05-Feb-87	1	32	Brass buckle - oval (in 2 pieces), pin missing D. 37 mm (max), 22 mm (min); T. 2 mm.	Site 1: Area 012
530	05-Feb-87	1	32	Unid. brass object: possibly part of dividers	Site 1: Area 012
531	05-Feb-87	9	32	Copper alloy sheathing nails	Site 1: Area 012
532	05-Feb-87	1	32	Copper rose-headed forged ["convict"] nail L.65 mm; H.9 mm sq; S.4 mm sq	Site 1: Area 012
533	05-Feb-87	0	32	Copper sheathing	Site 1: Area 012

534	05-Feb-87	0	32	Coper sheathing	Site 1: Area 012
535	05-Feb-87	0	13	Flint pebble ballast	Site 1: Area 012
536	05-Feb-87	17	44	Glass fragments - colourless flat; green flat; amber & green bottle.	Site 1: Area 012
537	05-Feb-87	1	81	Cannon ball Diam 127 mm; wt 3 kg	Site 1: Area 012
538	05-Feb-87	1	34	Musket ball - half Diam 19 mm	Site 1: Area 012
539	05-Feb-87	1	44	Glass fragment	Site 1: Area 012
540	05-Feb-87	2	32	Copper alloy sheathing nails (large head)+3 shanks	Site 1: Area 012
541	05-Feb-87	6	32	Copper alloy sheathing nails (5x large head;1x sm)	Site 1: Area 012
542	05-Feb-87	1	21	Saltglaze stoneware sherd	Site 1: Area 012
543	05-Feb-87	6	44	Glass fragments - 5 x green; 1 x colourless	Site 1: Area 012
544	05-Feb-87	1	81	Cannon ball Diam 94 mm; wt 0.75 kg	Site 1: Area 012
545	05-Feb-87	1	81	Cannon ball Diam 85 mm; wt 1 kg	Site 1: Area 012
546	05-Feb-87	1	81	Cannon ball with clear mould line Diam 88 mm; wt 1 kg	Site 1: Area 012
547	05-Feb-87	1	81	Cannon ball Diam 131 mm; wt 3 kg	Site 1: Area 012
548	05-Feb-87	1	81	Grapeshot Diam 40 mm; wt 100 g	Site 1: Area 012
549	05-Feb-87	1	81	Cannon ball Diam 94 mm; wt 3 kg	Site 1: Area 012
550	05-Feb-87	1	46	Leather shoe sole - part only	Site 1: Area 012
551	05-Feb-87	1	81	Grapeshot Diam 25 mm; wt 12 g	Site 1: Area 012
552	05-Feb-87	1	32	Copper bolt L.405 mm; H.diam 39 mm (max); S.diam 25 mm (J.Tavener)	End of Kingston Pier
553	05-Feb-87	1	86	Concretion with remains of arrow head	Site 1: Area 001
554	05-Feb-87	0	32	Copper sheathing	Site 1: Area 001 (From concretion)
555	05-Feb-87	6	32	Copper alloy sheathing nails + fragments	Site 1: Area 001
556	05-Feb-87	5	81	Grapeshot Diam/wt 40/90;40/95;39/75;40/80(broken);39/N/A	Site 1: Area 001
557	05-Feb-87	6	81	Grapeshot - some broken Diam/wt 35/75;34/70;34/67;33/45(Broken);35/0;36/0;	Site 1: Area 001
558	05-Feb-87	3	81	Grapeshot (or canister shot) - 2 broken Diam/wt 23.5/25;26/0;22/20 (2 halves)	Site 1: Area 001
559	05-Feb-87	0	81	Grapeshot fragments Diam c.34 mm x8	Site 1: Area 001
560	05-Feb-87	1	32	Unid. brass frag., flat w/broad arrow mark: prob. part of second sextant. T. 4 mm	Site 1: Area 001
561	05-Feb-87	1	60	Wood fragment	Site 1: Area 001
562	05-Feb-87	1	82	Unid. metal (iron) pipe with screw thread	Site 1: Area 002 - 003 (From concretion SI 115)
563	05-Feb-87	1	84	Iron ballast block - grey cast iron, no markings L.915 mm; W.150 mm; D. 150 mm	Site 1: Area 001
564	05-Feb-87	1	21	Basalt-ware ceramic sherd: possibly Wedgewood T. 2 mm	Site 1: Area 001
565	01-Feb-87	0	32	Copper sheathing	Site 1: Area 001 (From concretion)
566	01-Feb-87	19	32	Copper alloy sheathing nails 12x large head; 7x small head	Site 1: Area 001 (From concretion)
567	01-Feb-87	7	81	Grapeshot Diam/wt 39/70;36/70;36/55;34/75;33/45;38(half);36B	Site 1: Area 001 (From concretion)
568	01-Feb-87	0	47	Fabric from grapeshot in concretion	Site 1: Area 001 (From concretion)
569	01-Feb-87	1	12	Coal - pieces	Site 1: Area 001
570	01-Feb-87	0	34	Lead sheet fragments	Site 1: Area 012
571	02-Feb-87	1	32	Brass fragment with ribbed pattern	Site 1: Area 008
572	30-Jan-87	1	34	Musket ball Diam 17 mm	Site 1: Area 001
573	09-Feb-87	1	32	Brass strip with beading along both edges:possibly part of fire-grate or furniture (Close to SI 512)	Site 1: Area 012
574	28-Jan-87	0	32	Copper alloy sheathing nails	Site 1: Area 002 - 003 (From concretion SI 115)
575	28-Jan-87	1	44	Glass fragment	Site 1: Area 002 - 003 (From concretion SI 115)

APPENDIX 3

Sirius objects for Australian Bicentennial Authority Exhibition.

Myra Stanbury

Figure 1. Neil Tavener and Maree Edmiston examine the stone hatchet head, SI 479.

Figure 2. Stone hatchet head, SI 479.

Edge-ground hatchet head: SI 479
(1.01.07.09.01)

Excavated from an area of heavily concreted iron shot (i.e. grape shot, canister shot and cannon balls), this stone hatchet head was distinguished from accompanying flint ballast pebbles by its unnaturally shaped edge. Accurate identification of the tool was crucial to the determination of its origin and the explanation of how it came to be among the remains of the *Sirius*.

It was conceivable that the Thames flint ballast that the ship was carrying could contain a stone axe. Alternatively, a member of the crew may have acquired it as a curiosity when the vessel was stationed in Sydney, or from Capetown during a voyage to procure grain. Stone axes have been found on Norfolk Island which pre-date Cook's visit and tend to indicate settlement by Pacific voyagers around A.D. 900 - 1100 (Specht, 1978). Thus, it could possibly have related to earlier pre-European visits to the island.

Examination of the artefact by Australian prehistorians indicates that it is a tool made and used by Australian Aborigines, probably originating from a source somewhere in New South Wales. The tool has been fashioned from a flattish pebble, probably obtained from a creek or river bed. The edges have been bi-facially ground to form a cutting edge suitable for woodworking.

Analysis of surface residue on the hatchet head suggests that beeswax was used to secure the hatchet handle. This would probably have been a wrap-around handle made of wood that could be easily bent without undue fracture of the wood fibres. Stone hatchets were used to remove bark from trees and for chopping or splitting wood.

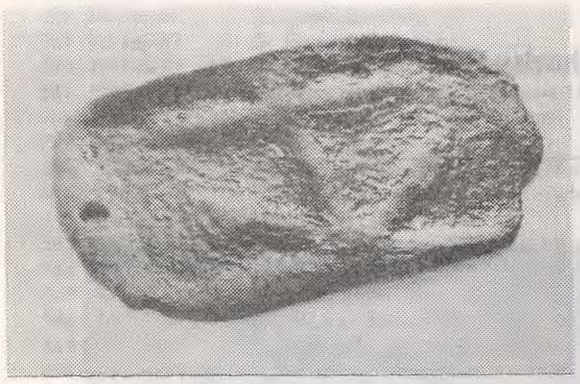

Figure 3. Brass shoulder-belt plate, SI 238.

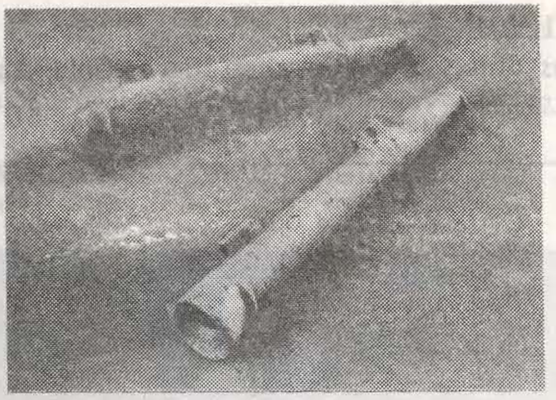

Figure 5. Brass ramrod pipes from Land Pattern muskets, SI 374 & 431.

Brass shoulder-belt plate: SI 238.
(1.01.07.09.01)

This item has not yet been positively identified but would most likely be a shoulder-belt or cross-belt plate from the uniform of either a Naval Officer or Officer of the Royal Marines. Black leather shoulder-belts or cross-belts were part of Naval dress uniform, being fastened on the chest with a decorative plate, and having the sword suspended on the left side. There were no regulations governing the shoulder-belt or cross-belt plates worn in the Royal Navy, but they were normally oval and made of gilt brass. They bore either the design of a foul anchor or the ship's name or a device of some kind (Wilkinson-Latham, 1973: 97,99).

Figure 4. Brass furniture mount or wall fitting, SI 348.

Brass furniture mount or wall fitting: SI 348
(1.01.07.09.03)

This oval fitting represents an urn surrounded by laurel leaves. It is typical of the motifs and style of Neo-Classical furnishings. A central attachment point on the reverse of the objects suggests that it may have had a pedestal similar to that of the oval patera wall fitting (SI 527). It seems likely, therefore, that it served a similar range of functions.

Brass ramrod pipe from Land Pattern musket: SI 431
(1.01.07.09.04)

This trumpet-shaped upper ramrod pipe was introduced as a fixture on Land Pattern muskets c. 1750 when new production weapons were made with steel rather than wooden, brass-tipped ramrods. The internal diameter of the pipe is considerably smaller than that of pipes used to retain wooden, brass-tipped ramrods.

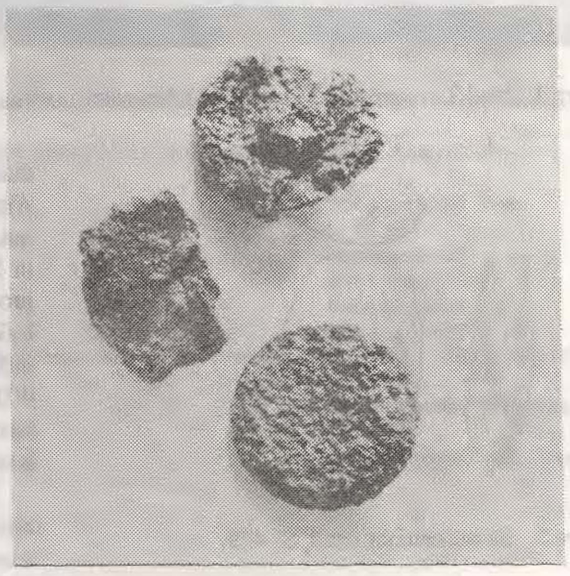

Figure 6. Pewter uniform buttons, SI 427.

Pewter buttons: SI 277,368,427 (x3)
(1.01.07.09.05)

The buttons on Royal Navy uniforms generally conformed, both in style and number, to statutory dress regulations. On full dress uniform, buttons were usually of gilded brass (gilt), their pattern and quality reflecting service rank or status. Buttons on working dress were unlikely to be so ornate and these plain, round pewter examples probably satisfied the need.

Figure 7. Brass wall fitting, SI 527.

Brass wall fitting: SI 527
(1.01.07.09.06)

This oval patera wall fitting is typical of the Neo-Classical furniture styles. A small screw thread at the base of the pedestal has broken away but would have allowed the fitting to be screwed into the wooden cabin wall. Its most likely function would have been as a hook for hanging hats or other items of uniform apparel, although it could also have served as a curtain tie back (Gentle & Field, 1975 and Schiffer, 1978). The quarters reserved for the senior officer, whether Captain or Admiral, on the stern upper deck were often luxuriously furnished. Curtains would have been used across the doorways and windows of the stern galleries to block out light and draughts (Lavery, 1984).

These pins were also used as decorative supports for mirrors: the mirrors were hung by a cord and tilted out from the wall to avoid too much direct reflection of light. Whether they served this purpose on board ship, however, has not been determined.

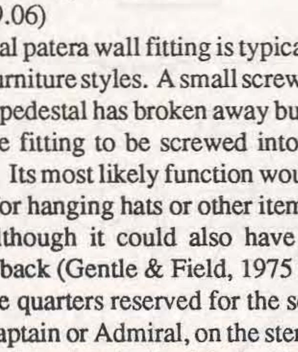

Figure 8. Brass wrist escutcheon from Land Pattern musket, SI 428.

Brass wrist escutcheon from Land Pattern musket: SI 428
(1.01.07.09.07)

Wrist escutcheons of this shape were a typical feature of Land Pattern muskets of the eighteenth century. The escutcheon was held in place by the single screw through the rear of the trigger guard.

Brass furniture for firearms was manufactured by brass founders in London and/or Birmingham according to patterns issued by the Board of Ordnance. The finished components would be delivered either to the Ordnance contractors or directly to the central depot, the Tower of London. From this central point, sets of components were distributed to a relatively small number of London gun makers known as 'rough stockers and setters up' who finished up the rough stock blanks and set up the completed weapons. The finished weapons were then delivered to the Tower of London and issued against specific requisitions.

At the time the *Sirius* set sail from England two types of Land Pattern musket were in issue: Long and Short Land muskets, the main structural difference being one of barrel length - 46 inches compared to 42 inches. Short Land muskets were, however, being used in most regiments by this time, replacing the Long Land muskets. The latter were frequently cut down owing to wear, damage or a desire to up-date them.

Brass sextant: SI 147
(1.01.07.09.08)

The sextant is the most convenient and accurate hand-instrument yet devised for measuring angles, whether horizontal, vertical or inclined. The name refers to the actual arc, which occupies a sixth of a circle (60 degrees), and not to the angle that can be measured. Although constructed on the same principles as the quadrant, it was far more accurate and extended the range of angular readings from 90 to 120 degrees. It has been in use since about 1730.

The sextant is exclusively used in observations at sea: it is held in the hand, measures an angle by a single observation, and will give very accurate results even when the observer has an unstable support, as on board ship. By measuring the angular distance between the Moon and the Sun, or a fixed Star, early navigators were able to determine the longitude of a place - lunar distance method.

The arc of the *Sirius* sextant is calibrated from 0 to 125 degrees, each degree being further subdivided into two parts equal to 30 minutes. A variety of brass objects such as a small tangent screw (SI 488); an adjusting washer (SI 160); and the arm pivot (which would have supported the index mirror)(SI 219), are probably all parts of the appendages commonly associated with this instrument.

Among the finest instruments available at the end of the eighteenth century were those made by Jesse Ramsden in his premises at Picadilly, London. In 1775, Ramsden had introduced his dividing engine which enabled him to accurately divide scales on all types of scientific instruments which had previously been executed by hand. Ramsden's machine permit-

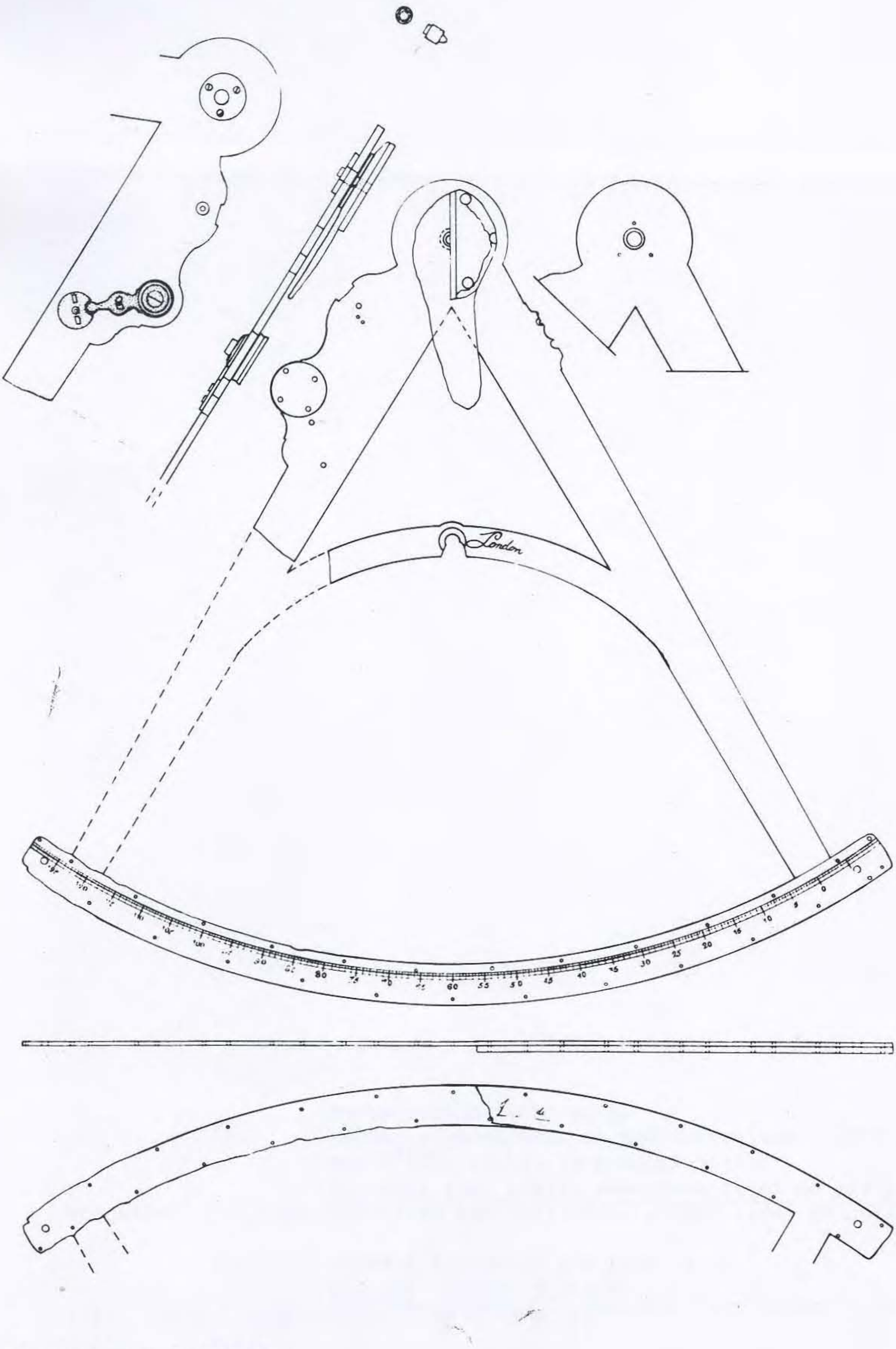

Figure 9. Brass sextant, SI 147.

ted a sextant to be subdivided to 10 - minute intervals in a period of about half an hour. Having received an indemnity of 615 pounds sterling from the Board of Longitude for the invention, he was unable to take out a patent which resulted in his competitors quickly building similar engines. Nevertheless, his instruments continued to be among the best and Captain James Cook used a Ramsden sextant on his second voyage.

The *Sirius* sextant bears the engraved word *London* in copperplate script on the right hand side of the cross-bar but unfortunately no maker's name can be identified on the broken left-hand part.

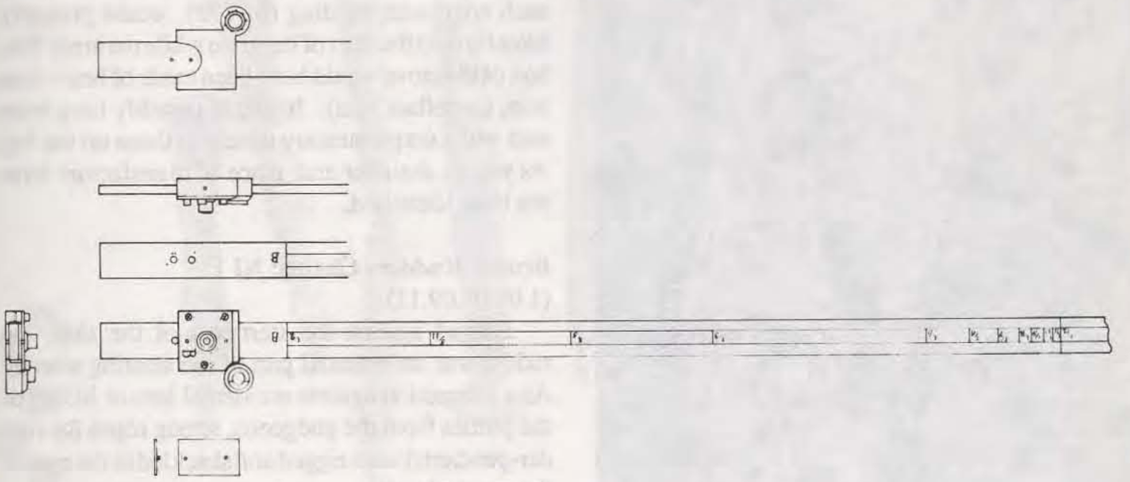

Figure 10. Brass pantograph arm, SI 239.

Brass Graduated Pantograph Arm : SI 239
(1.01.07.09.09)

The pantograph is a kind of parallel link-motion instrument designed to copy maps, plans or other drawings to the same, a larger, or a smaller scale. It was invented between 1603 and 1605 by the German astronomer, Christoph Scheiner, and greatly improved in 1743 by the Parisian craftsman, Claude Langlois.

The device consists of four brass bars, jointed in pairs, one pair being twice the length of the other. Small castors (SI 77, 108 & 334) support the instrument parallel to the paper, so that it can move freely over the paper in all directions. One long bar has a tracing point (SI 240), and a short arm has a pen held by a sliding head that is set to the ratio required. To vary the pressure of the pen on the paper, the pen holder is loaded with small weights. A fine thread passing round the top of the instrument enables the draughtsman (or cartographer) to raise the pen from the paper while the tracing point is passed from one part of the original plan to another, thereby obviating false lines on the copy. On the other long bar is a pivot point in the form of a heavy brass disc (or weight).

The pantograph arm from the *Sirius* bears no maker's name. It is graduated in the proportions of 1/2, 5/11, 2/5, 1/3, 1/5, 1/6, 1/7, 1/8, 1/9, 1/10, 1/11, 1/12. The letter 'B' engraved on the sliding frame and on the arm indicates that this would have been one of the short arms of the instrument, the pen holding device having broken away from the sliding frame. The instrument has been precision-made, small dots on the screw heads and sliding frame indicating the correct position for individual screws.

Acknowledgements

The identification of this object was made possible by the assistance of the Cartographic Services Branch, Department of Land Administration, Perth, Western Australia and staff of the Department of Surveying, Wembley Technical College, Perth, Western Australia.

Figure 11. Brass fire-grate leg, SI 512.

Brass fire grate or stove leg: SI 512
(1.01.07.09.10)

Naval warships of the eighteenth century had no regular system of heating since the danger of combustion prevented the lighting of fires about the decks. Officers, however, sometimes had small stoves fitted in their cabins or in the wardroom, but ordinary seamen had no such comforts: they had to rely on the effect of massed human bodies for their warmth when cruising in cold climates (Lavery, 1984).

The finely engraved brass leg recovered from the *Sirius* wrecksite would undoubtedly have belonged to the Officer's quarters, if not to the Captain's cabin itself. Its straight or regular lines are typical of the Neo-Classical forms of furniture which gradually replaced the serpentine Rococo designs from the 1760s (Tomlin, 1972). The most popular Neo-Classical motifs were all drawn from Roman sources and included round or oval paterae, strings of husks or bell flowers, urns, griffins and winged sphinxes. Examples of some of these decorative devices may be seen on three sides of the brass leg. The fourth side (which would not have been visible), is undecorated and bears rough filing (or casting marks) only.

In the top of the leg is a threaded hole into which a finial would have been screwed, thus making the grate an extremely handsome piece of craftsmanship (Schiffer, 1978). A plain brass strip adorned along each edge with beading (SI 573), would probably have formed the skirt of the grate while the main fire-box of the stove would have been made of heavy cast iron, (to reflect heat). It might possibly have been cast with complementary motifs to those on the leg. As yet, its designer and place of manufacture have not been identified.

Bronze Rudder- Chains: NI 11
(1.01.07.09.11)

Hinged against the sternpost of the ship, the rudder was an essential part of the steering system. As a precaution against accidental loss or lifting of the pintles from the gudgeons, strong ropes (or rudder-pendants) were rigged and shackled to the eyes of the spectacle plate.

The ropes led inboard on each side of the ship through shackles secured to the hull and thence to manned tackles inboard. In the event of the tiller breaking or the upper part of the rudder being damaged in action, this system of ropes could be used to keep the rudder under control.

This rudder-chain section consists of a shackle with two links, one of which has provision for being opened. This would provide the facility for rigging the ropes and/or altering the length of the chains as required.

The item is on loan to the ABA exhibition by Peter Ely of Norfolk Island.

Bronze Spectacle Plate: NI 2
(1.01.07.09.12)

Whereas some ships had rings welded to the fifth rudder pintle to which the chains of the rudder-pendants were made fast, British Naval vessels had a special bronze spectacle plate (Bugler, 1966). Cast in a single mould, it consisted of a band containing two spectacle extensions with eyes.

The spectacle plate was fastened to the trailing edge of the rudder at point just above the waterline (above the fifth pintle) and the chains of the rudder-pendants shackled to the eyes.

The spectacle plate bears the name *BERWICK* , the original name of the *Sirius*. Built as the *Berwick* in the Thames in 1780, the vessel was intended as an East-Country man (for trading in the East Indies). In loading the first cargo, the *Berwick* caught fire and was burnt to the wales. The British Government, needing a roomy ship for sending stores abroad, purchased the hull c1781 and carried out repairs with "the refuse of the yard" (Henderson, 1984). In September 1786, the *Berwick* was taken into dock at Deptford and on October 25 commissioned as a ship of war named *Sirius*.

This item is on loan to the ABA exhibition by Kerry Coop of Norfolk Island.

Cannon Balls
(1.01.07.09.13)

Figure 12. Ship's fastenings.

Ship's Fastenings
(1.01.07.09.14)

A variety of fastenings have been recovered from the *Sirius* wrecksite. They include quantities of sheathing nails used to fasten the copper sheathing to the hull; long copper drift bolts with clinch rings and stamped with the 'broad arrow' mark, for fastening the keel; rudder nails and lag bolts (or screws), used to fasten the pintles and gudgeons to the rudder and sternpost; machine bolts, for securing ironwork to the hull; planking nails; spikes and so on.

N.B. The rose-headed forged ["convict"] nails (e.g. SI 532) would probably have been part of the cargo of stores being taken to Norfolk Island to be used for building or other domestic purposes.

Ballast
(1.01.07.09.15)

The distribution of weight in a sailing ship could decisively affect the trim, and therefore the sailing quality of the vessel. The master, responsible to the Captain for the technical aspects of sailing the ship, was in charge of the stowage of ballast, cargo and other materials in the hold. This was an important point of duty as both the safety and performance of the vessel depended on correct stowage.

Iron ballast was laid down first, fore and aft in the main hold, followed by shingle. Iron ballast blocks weighing approximately 105 kg (232 lbs) each have been recovered from the *Sirius* wrecksite. They are stamped with the broad arrow mark signifying Royal Navy property and have a hole at each end where they would have been chained together to prevent any movement as the ship pitched and tossed.

The shingle ballast was laid on top of the iron ballast and formed a bed into which the casks of provisions could sink. The shingle ballast from the *Sirius* consisted of flint pebbles. They are typical of the type of stones found in the River Thames and for each ton taken on board, British ships were bound to pay the corporation of the Trinity-house 1*s* . 3*d*.

The actual amount of ballast for a particular ship was usually settled by her designer, and this was enforced by the orders of the Navy Board. A ship of 400 tons, carrying 20 guns, could be expected to carry approximately 50 tons of iron and 60 tons of shingle ballast (Falconer, 1815: 30).

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APPENDIX 4

Conservation Report on the 1987 *Sirius* Expedition Kingston, Norfolk Island

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Acknowledgements

Mary Smith, Project Officer from the Australian Bicentennial Authority, for allowing me the opportunity to participate in this expedition, and more importantly, for her assistance throughout the expedition.

Graeme Henderson, Curator Western Australian Maritime Museum and expedition leader for his support, advice and encouragement. Dr Ian MacLeod, Department Materials Conservation, Western Australian Maritime Museum, for his patience, support, ready advice and knowledge. Terry Arnott of the Maritime Archaeological Association of Victoria, for his 'hands on' assistance and procurement abilities. Myra Stanbury of the Western Australian Maritime Museum for her on-site advice and help. Puss Anderson and the members of the building restoration team on Norfolk Island, for their unflagging assistance and equipment provision. Peter Ely, Gary Christian (Tattie) and the staff at the Works Depot for their invaluable time and essential skills. Mr Bob Towns, my father, for his timely presence and assistance during the hectic last days of the expedition.

Most importantly, all the expedition members and people from Norfolk Island whose friendship made the expedition a success and a constant pleasurable memory.

Introduction

This report will cover the material conservation programme carried out on Norfolk Island for the *Sirius* Expedition. This was the third expedition of the series with reference being made to previous reports. Treatments and inspections carried out other than on expedition material will also be presented.

An additional report details discussions and recommendations for the proposed Norfolk Island Museum. This will cover building choice and environmental requirements, storage procedures and furniture recommended for a range of object material types and basic en-mass treatments by the people of Norfolk Island on the existing collection.

PART 1: The Expedition material

1.0 General Discussion - Overview

The conservation treatment carried out during the expedition consisted primarily of on-site, first-aid field work.

The necessary equipment and dry chemicals were purchase in Sydney and flown to Norfolk Island. The working conditions were luxurious compared to those of many expeditions. The success of the expedition is evident from the amount of material raised and treated - some 1000 artefacts. This has obvious implications for the conservation procedures and treatment, which are discussed below. The assistance, cooperation and friendship of the Norfolk Islanders played an essential role in the conservation of the artefacts; without such rallying support very little 'hands on' treatment would have occurred. The wreck material raised during the 1987 expedition is presently undergoing treatment which was initiated during the expedition. The long term stabilization of the collection is essential to its survival.

2.0 Conservation Procedure and treatment

2.1. Preliminary Arrangements

A number of chemicals and items of equipment were required for the expedition. These were obtained from Sydney.

- 4 x 84 litre polyethylene tubs (with hand holds)
- 40 kg sodium carbonate
- 40 kg citric acid
- 10 kg thiourea
- 40 kg sodium bicarbonate
- 2 kg microcrystalline wax paste
- 250 ml Paraloid B67 in petroleum spirits
- 250 ml petroleum spirits
- 20 metres black polyethylene sheeting
- Range of dental tools
- Range of brushes
- Hammer
- 120 cm x 90 cm x 100 cm polyethylene tub - this could not be accommodated by the commercial air-flight and thus was not taken

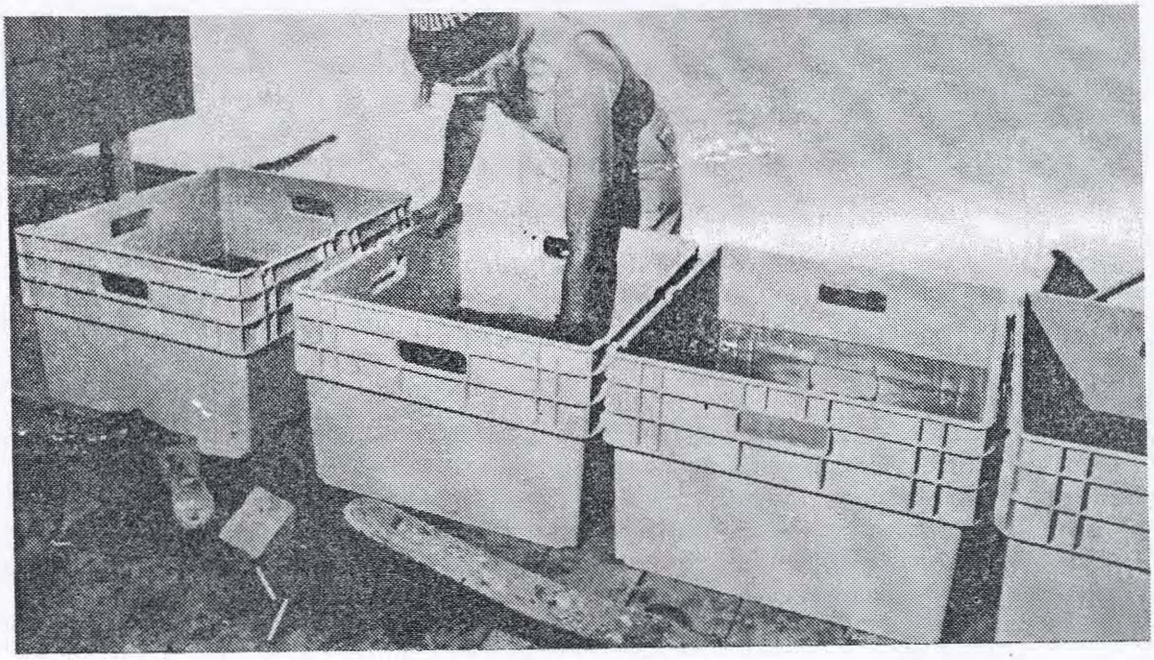

Figure 1. Sharon Towns treating copper and copper alloy artefacts in polyethylene tubs with hand holes.

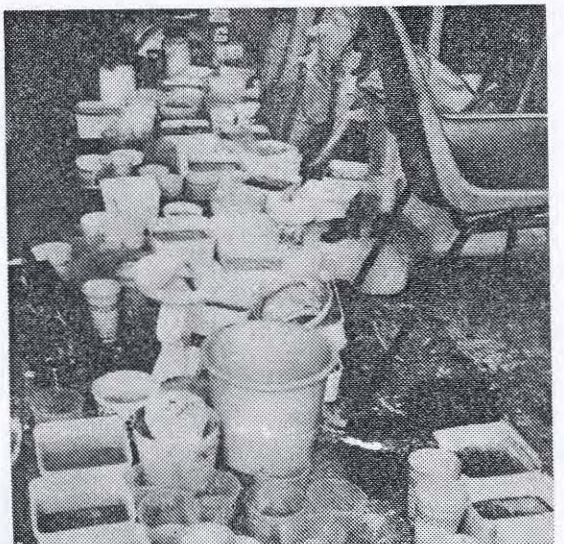

Figure 2. Individual groups of artefacts soaking in a variety of plastic containers.

As the necessity arose, materials and equipment were either purchased or procured on the island.

- One enamel bath tub
- 6 nail brushes
- 1 scrubbing brush
- Roll chicken wire
- 15 metres shade cloth
- 2 buckets
- Kitchen scales (500 gm)
- 500 gm alum
- 100 ml glycerine
- 5 litres kerosene
- Many pairs of rubber gloves
- Many containers (ice-cream, margarine, etc)

Discussions took place between myself and Dr I. MacLeod, Head of Materials Conservation, Western Australian Maritime Museum, regarding the forthcoming expedition, the 1985 expedition, requirements for treatment procedures, supplies etc. This was an on-going occurrence during the expedition.

2.2. Treatment Procedure

The conservation area was set up at one end of the boat shed at Kingston. Here the artefacts and the tubs of solution were assembled and the work carried out. Treatment of copper and copper alloy material took up 90 % of the time available and the tubs were used exclusively for the treatment of this material.

A large quantity of containers - over 100 (ice-cream, margarine, yoghurt, etc), were required for soaking the numerous groups of artefacts in citric acid/thiourea solution, and these were obtained through community radio requests.Jon Carpenter (Conservator, Western Australian Maritime Museum) in his reports, "Treatment of an Anchor, HMS *Sirius* (1790) Norfolk Island" and "Treatment of a Carronade HMS *Sirius* (1790) Norfolk Island", June 1986, describes the various water sources on the island and their respective purities. Rain water was used throughout the treatments. Spring water which is stored in the local fire truck was used at the completion of the expedition for long term desalination.

Outlined below according to material type, is the treatment that the artefacts underwent during the expedition. Appendix A - lists the artefacts treated.

(a) Iron:

After deconcretion, the iron artefacts were placed in a bath tub in 2% wt/vol sodium hydroxide solution (pH 14). The cast iron artefacts consisting of canister shot and cannon balls, were wrapped in chicken wire prior to submerging.

The artefacts remained in this solution for the duration of the expedition. Prior to leaving, they were transferred to a 44 gallon drum with a fresh solution of sodium hydroxide. The drum was then placed at one end of the tank with the carronade undergoing treatment at the Works Depot.

(b) Copper and Copper Alloys:

Two chemical treatments were used - (i) citric acid/thiourea wash followed by sodium carbonate/ sodium bicarbonate solution; and (ii) sodium carbonate/sodium bicarbonate solution.

(i) After deconcretion, the copper based artefacts were placed in a 5% citric acid/1% thiourea solution wt/vol (pH 3-4) for varying lengths of time, depending upon the rate of removal of the concretions and coralline material. They were regularly scrubbed with a nail brush to clean the surface. (The condition of the metal was a determining factor in the length of time the artefact was submerged. Unsound, porous surfaces were only in the solution for 3-12 hours).

Once the concretions were removed as completely as possible, the artefact was rinsed in water and placed in a 5% wt/vol sodium bicarbonate/sodium carbonate (1:1) solution (pH 11).

Single registration numbers often comprised up to 100 artefacts, e.g. copper nails. These were placed as groups in individual containers (ice cream) with the mild acid solution.

Note: In the presence of strong sunlight a chemical cross-linking occurred between the thiourea and Cu^{++} causing a sticky coating to form on a number of artefacts. Acetone, kerosene and petroleum spirits were tested on the artefacts for removal of coating with a negative result in each case. The artefacts were then placed in 10% wt/vol citric acid to strip the coating off. This proved successful after 24 hours soaking. The artefacts affected were S1- 141, 283, 294, 296, 297, 307, 308, 309, 311, 312, 313, 322, 323, 338, 355, 360, 362.

Prior to the completion of the expedition (10/2/87) three tubs of fresh 5% wt/vol sodium carbonate/ sodium bicarbonate solution were made up and all the copper-based artefacts left soaking. Spring water stored in the fire truck was used, being the least contaminated on the Island.

(ii) Particularly delicate and significant artefacts (S1 - 147, 238, 239, 240, 244, 348, 406, 421, 434, 486, 512, 529, 530) were placed in a 3% wt/vol sodium carbonate/sodium bicarbonate solution (pH 10-11). At the termination of the expedition these artefacts were returned to the Western Australian Maritime Museum for laboratory conservation treatment.

(c) Lead

The lead material consisted primarily of musket shot and lead sheeting. No treatment was carried out on the lead artefacts during the expedition. Prior to departure all the lead material was placed in spring water from the fire truck to desalinate.

(d) Pewter

One artefact identified as pewter, was kept stored in fresh water. After discussions with Dr. MacLeod an alum solution was recommended - 1 tablespoon alum in 7 litres of spring water. However, it was decided to transport the pewter to the Western Australian Maritime Museum for positive identification and laboratory treatment. Thus, the recommendation was not carried out.

(e) Mixed Metals - Copper, Alloy & Iron, Copper Alloy & Tin-plate

Because of the close association of the different metal types a gentle desalination treatment was initiated. The artefacts (S1 - 108, 219, 245, 277, 334, 368, 427) were placed into a 3% wt/vol sodium carbonate solution (pH 12). These artefacts were also transported to the Western Australian Maritime Museum.

(f) Glass, Ceramics & Stone

The glass and ceramic materials were immediately placed in fresh water and desalination commenced. Prior to departure from the Island, the water was replaced with spring water from the fire truck. The ballast stone and concretions were kept dry.

(g) Wood

The recovered wooden material was placed immediately in fresh water. Samples were taken back to the Western Australian Maritime Museum for timber analysis and treatment testing. The wood left on Norfolk Island was placed in spring water (fire truck) for desalination prior to departure.

(h) Fabric

Fragments of fabric and rope were discovered and these were placed immediately into fresh water. All the fabric samples were sent to the Western Australian Museum for treatment. One particular object consisted of a concretion of iron grape shot with part of the fabric bag and twine still in situ. This was kept in salt water throughout the expedition and transported to the Western Australian Maritime Museum for laboratory treatment.

(i) Leather

One fragment of leather was recovered and placed in fresh water for the duration of the expedition. It was initially intended to soak the leather in a 25% glycerine solution but it was later decided to send the artefact to the Western Australian Maritime Museum for laboratory treatment.

2.3 Long Term Conservation Treatment Requirements

The 1985 *Sirius* expedition report Appendix b "Report on the Condition of Museum Material in the Pier Store Museum, Kingston 1985" by Dr Ian MacLeod, gives guide-lines for the treatment of a range of material types and should also be used as a reference source.

As the recovered material is to remain on the Island, the museum curator becomes responsible for the stabilization and preservation of the *Sirius* artefacts. The majority of the artefacts have been left in various solutions undergoing desalination. They will require only minimal attention and are presently located on the lower floor of the Pier Store building. Outlined below is the step-by-step treatment for recovered marine artefacts and the subsequent requirements for those in solution. Conservation treatment for marine artefacts aims at preventing the occurrence of salt problems which results in the loss of irreplaceable material through 'bronze disease', salt efflorescence, and ferric chloride attack.

(a) Iron

The 2% wt/vol sodium hydroxide solution in the 44 gallon drum should be tested for chloride concentration once a week for the first month, then once every two weeks for six months until a new solution is required. The solution can be changed when the chloride salt levels plateau out over a number of readings.

To prepare a fresh solution - 200 litres of fresh water (fire truck) in the drum requires 4 kg of sodium hydroxide (caustic soda).

(b) Copper and Copper Alloys
(Remove July 1987)

(i) All the copper artefacts in the 5% wt/vol sodium carbonate/sodium bicarbonate solution will remain in solution for at least six months. Samples of the solutions should be taken and chloride salt levels recorded as with (a). The solution should be changed when the readings plateau. The tubs hold 52 litres of water to the bottom line visible on the inside of the tub wall.

To prepare fresh solution - 1300 grams sodium carbonate plus 1300 grams sodium bicarbonate in 52 litres of water.

Probably 2-3 solution changes will be needed over the six month soaking period. This is essential to remove chloride salts and so prevent future bronze disease' problems.

(ii) Once the treatment is completed the artefacts should be soaked in fresh water for 3-4 weeks to remove alkaline residue. At least two water changes will be required.

(iii) The artefacts should then be allowed to air dry thoroughly.

(iv) Each artefact requires numbering. This is carried out using 20% Paraloid B67 in petroleum spirits and India ink.

(v) Finally the artefact is given a protective coating of Incralac - an acrylic resin in acetone.

Note: Untreated copper-based artefacts - a bilge pipe, three gudgeons and a long rod, recovered on this and previous expeditions require basic conservation treatment. Line the large polyethylene tub procured towards the end of the expedition, with black polyethylene sheeting and make up the following solutions.

Citric acid/thiourea solution: submerge and cover the objects with at least 6 inches of water, taking note of the volume (litres). Then add 10 kg of citric acid and 2 kg of thiourea for each 200 litres of water. (5% wt/vol citric acid: 1% wt/vol thiourea solution).

The artefacts are cleaned in this solution for approximately 1-2 days to remove coralline material. Scrubbing with a bristle brush assists in its removal - a shorter or longer time being required depending on the surface of the artefact. Porous, powdery, pitted surfaces require much less time in solution - up to five hours only. The artefact is then removed and placed into the sodium bicarbonate/sodium carbonate solution and left to soak (see (i) above for details).

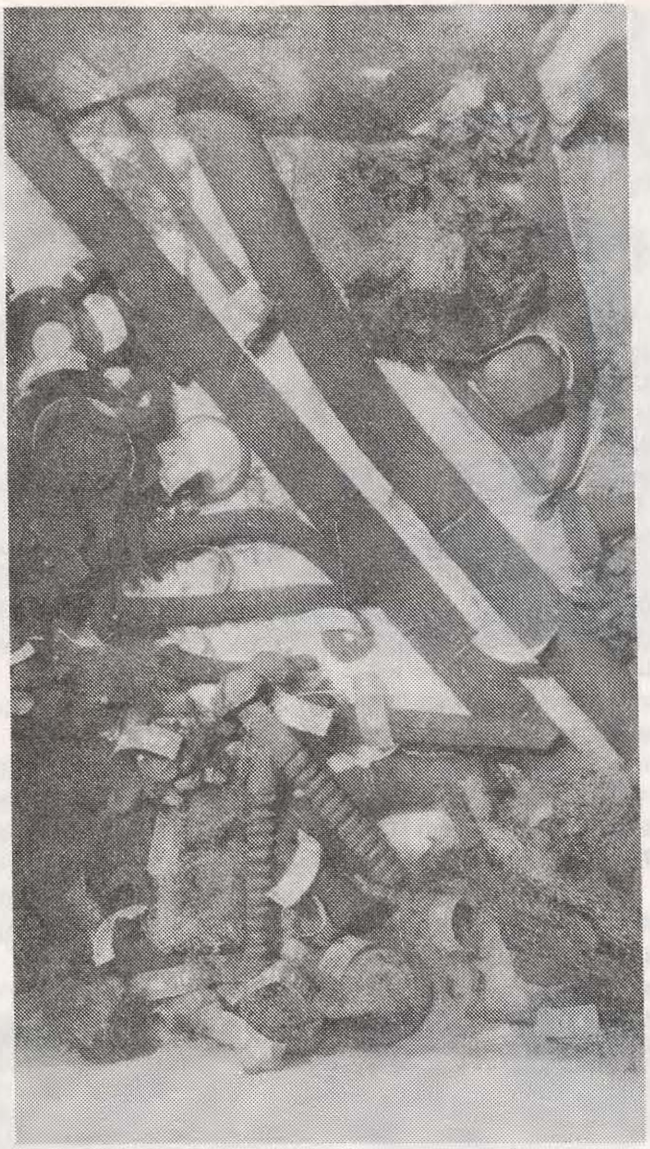

Figure 3. Copper and copper alloy objects undergoing treatment.

(c) Lead (Remove March/April 1987)

The lead can be desalinated over 2-3 months. Again solution samples should be taken as for (a) and the water replaced with fresh as required. At the completion of desalination the lead is allowed to air dry and is then numbered. Lead does not require any coating.

(d) Glass, Ceramics and Stone (Remove May 1987)

Glass and ceramics material will require desalination for at least 4 months, with a fresh water change after two months (April) using spring water from the fire truck or rain water. At completion of desalination the material is allowed to air dry andthen numbered.

All the ballast stones should be thoroughly washed in fresh water to remove surface salts, gravel etc. This need only be an overnight wash. The stone concretions should be kept dry at all times.

(e) Wood

Note: This material must be kept wet at all times.

The wood will require desalination for at lest two months, with a fresh water change after each month. The wood must not be allowed to dry out or shrinkage and warpage will occur to the structure. The Western Australian Maritime Museum is undertaking testing to determine the most appropriate treatment - this information will be forthcoming.

PART 2: Public inspections and treatment

During the expedition several artefacts were inspected and treated. Due to the limited time available only basic first aid work or the continuation of previous treatment could be carried out.

1. *Sirius* Carronade and Anchor (1985) - Public Works Depot

The carronade and anchor were inspected and discussions carried out with Peter Ely and Gary Christian to assess the progress to date and any problem areas. The electrolysis appeared to be proceeding well. The anode plates in the carronade tank were quite heavily encrusted with sodium chloride around the water line. As the electrolysis had been underway for 12 months there were discussions as to whether the solution should be changed.

Titration of each solution had been regularly carried out by the Norfolk Island school science teacher, Ross Allomes, to assess the chloride ion concentrations. Unfortunately, he was unaware that there were two sample solutions and the samples were mixed in testing. Hence the results obtained are unreliable and difficult to interpret confidently (see Appendix C). Further testing of the solutions has been undertaken by Neil Tavener as he has access to analytic equipment.

On the second visit to the Works Depot, the hydrogen evolution from the carronade was quite severe and the rectifier unit adjusted accordingly to less than two volts. Because a 44 gallon drum was to be placed in the carronade tank, it was decided to move the carronade cradle along towards one end. This provided an opportunity to rotate the carronade on its cradle and allow filming of the carronade.

The carronade was lifted out of solution and the cathode rod removed. Cut black rubber tyre tubes were placed under one side of the carronade and fed under it as it was rotated by hand on the cradle. The cathode rod was relocated and the carronade lowered into the solution. The surface of the carronade was very soft and laminating particularly around the cascabel and cascabel mouldings, although the muzzle appeared to be intact.

It was decided that the electrolysis treatment of the carronade should cease to allow a conservator to examine the surface and decide on the treatment progress. Electrolysis was commenced on the anchor.

Recommendations

Once some consistent readings are taken by Neil Tavener and it is established that the plateau of salt concentration in the solution has been reached, the solution should be changed. It is recommended that a conservator be present when this takes place, in order to examine closely and assess the surface condition of the carronade.

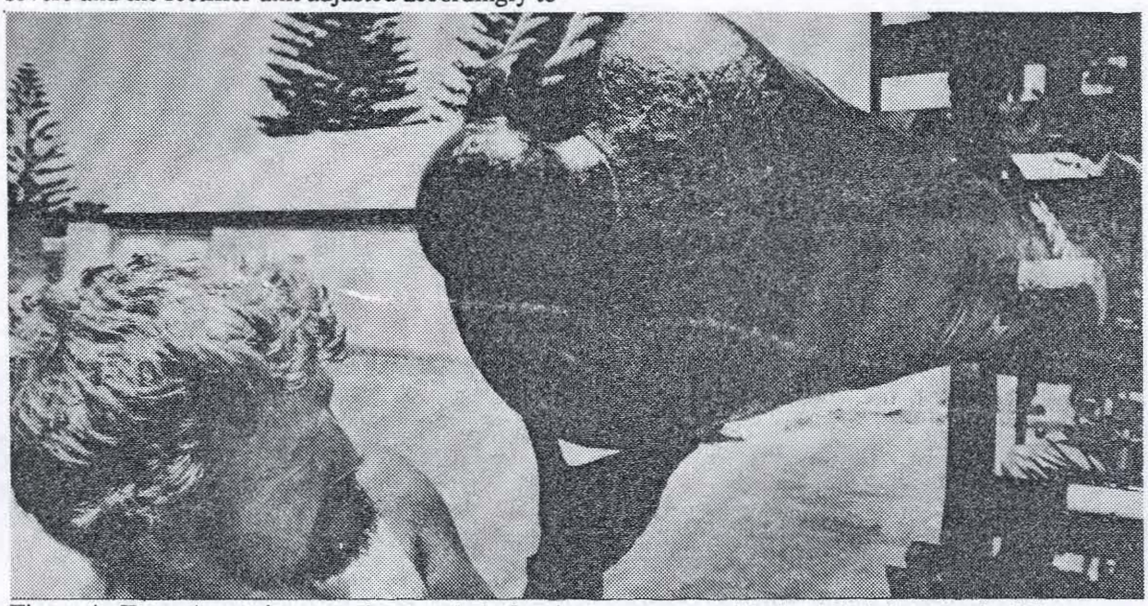

Figure 4. Terry Arnott inspects the cascabel of an iron cannon outside the Administration building.

2. The Two Administration Cannon

These two cannon were treated by Dr MacLeod in February 1985 (see "Conservation Report 1985 *Sirius* Expedition - Norfolk Island" Part 3 - Treatment and Analysis of Artefacts). The condition of both cannon was very good two years after treatment. Slight corrosion was occurring on the horizontal surfaces (top side) but the coating was predominantly intact and sound.

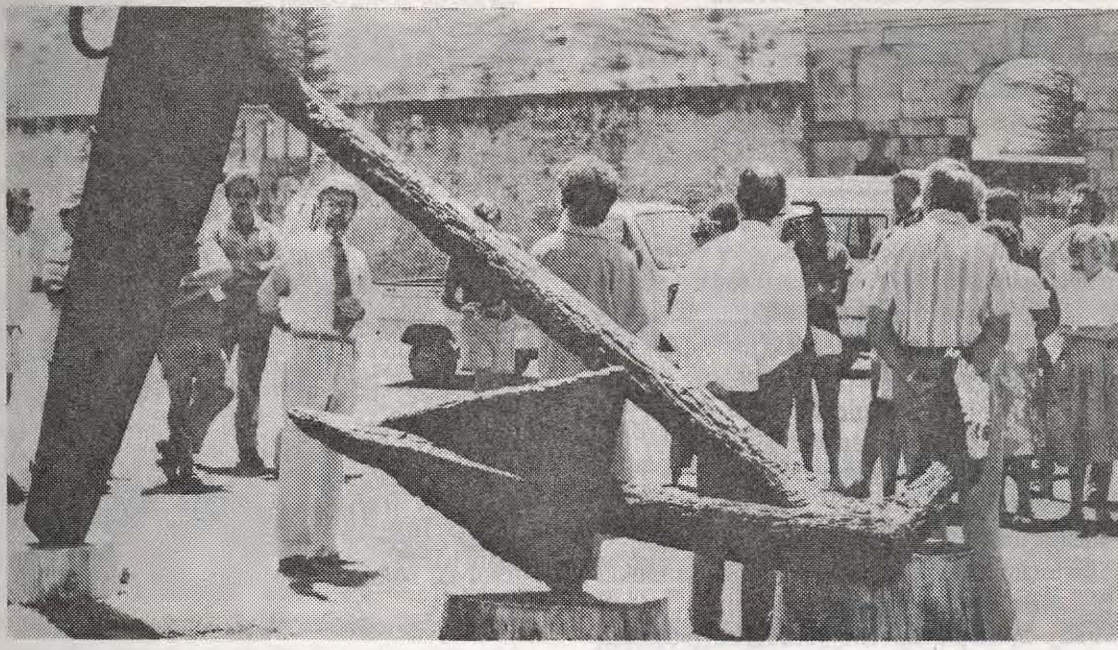

Figure 5. *Sirius* anchor with newly fabricated wooden stock.

Where corrosion appeared active, a dental tool was used to remove loose corrosion. The top surface was re-waxed with lamp black pigmented microcrystalline wax paste and polished.

The cannon were slung and lifted from the carriages with a fork lift and the underside face of the trunnions inspected. They appeared relatively stable with only light surface corrosion. The loose rust was brushed clean and the surfaces degreased with kerosene. Because these surfaces are in permanent contact with the carriage, they were coated twice with 20% wt/vol Paraloid B67 in petroleum spirits and a coat of microcrystalline wax paste.

Recommendations

Regular maintenance (annually) of the coating should be carried out to ensure that corrosion is not occurring. The pigmented microcrystalline wax paste can be rubbed on areas where breakdown is observed - this is available from the Museum Curator, Robert Varman.

3. *Sirius* Anchor (1982)

The maintenance for this anchor was discussed as the Works Depot (Gary Christian) carries out a regular treatment programme. A commercial corrosion inhibitor - 'Corton' (a Tanco product) was used with approximately 3-4 coatings being applied. During the expedition a timber stock was fabricated and attached to the anchor by Geoff Kimpton (See Appendix 7). This has the advantage of raising the anchor at an angle to allow better water rub-off and less contact of the surface of the anchor with the mounting blocks, thus reducing moisture traps and hidden corrosion spots.

Recommendation

That the maintenance programme be continued (six monthly intervals) - preferably on site to avoid excessive handling and possible damage.

4. *Mary Hamilton* Bell:

The bell from the shipwreck of the *Mary Hamilton* is positioned in the school grounds. It is hung from an angle iron post, exposed to the environment - direct sunlight, extreme temperature changes, salt, moisture, physical damage and constant usage.

The bell shows 'bronze disease', has three cracks around the rim, internal abrasion from the clanger and overall dirt and paint splatters. The support arm is corroding heavily, staining the bell surface.

The bell was removed and degreased with kerosene. The paint splatters were mechanically removed with a scalpel and acetone. All surfaces of the bell were coated with microcrystalline wax paste and polished.

Discussions with the school administration highlighted the need to carry out regular maintenance of the surface coating, and to provide an alternative environment - preferably indoors to reduce temperature fluctuations and salt contamination. Alternatively, a shelter cover could be built over the bell with a more sympathetic support structure. Any iron components in direct contact with the bronze will become sacrificial anodes and actively corrode.

Recommendations

That the bell be placed inside a suitable building. The nuts should be undone and the U-bolt and nuts be coated heavily with microcrystalline wax paste where they are in direct contact with the bronze.

5. Norfolk Island Museum Collection

See 1987 Conservation Report (Appendix 7). Five buildings were inspected for suitable usage and environmental factors. Recommendations and long term conservation programmes are discussed.

6. Summary and Conclusions

The 1987 *Sirius* Expedition was extremely successful in terms of material finds and recoveries - with approximately 5000 individual artefacts recovered. The en-masse conservation of this material was initiated during the three weeks of the expedition. Guide-lines and step-by-step procedures for continued monitoring of the artefacts are included in this report. The community interest generated by the 1985 Expedition was consolidated during the 1987 Expedition.

In conclusion the following points are made:

1. The treatment of the recovered artefacts should be continued through to completion
2. A step-by-step treatment procedure is presented for the on-going conservation of the recovered artefacts (see point 2.3)
3. That high quality storage of the *Sirius* material is a major priority for its long term preservation, once treatment is completed.
4. A number of recommendations are listed regarding storage practices and materials (see point 5)
5. Regular maintenance of previously recovered large artefacts. For example, a preservation programme should be set up for the anchor and cannon (see Part 2)
6. The condition of previous expedition recoveries is notated in the accompanying 'Norfolk Island Museum Collection Report', March 1987. The situation of the artefacts is desperate with much active deterioration and irreversible damage occurring. It is recommended that the storage of all the collection be rationalized and practically resolved before any conservation treatment is initiated.

APPENDIX A - Artefacts Treated

IRON

SI	100	116	122	204	243
	292	305	324	379	387-394
	400-402	452	466-475	502-506	508-509
	516	523-526	537	544-549	551
	556-559	567			

COPPER

SI	59-65	68	68	71	74-79
	83	86	86	88-94	96-98
	106	111-115	117	120-121	125-127
	129-133	135-138	140-145	149	156-168
	172-179	186	189-191	195-199	207
	209-210	213-215	220-221	225-231	241-242
	247-249	253-258	261-267	269	271-273
	279-281	283	285	287-289	293-298
	301	303-304	206-313	316-323	335-338
	341-343	349-357	360-364	367	370
	372-378	380-382	395	398-399	405
	408-416	419	422	426	428-431
	437-438	440	445	450	455
	458	460-463	465	476-477	480-482
	484-485	487-491	496-498	515	521-522
	527	531-532	534	540-541	553-555
	560	565-566			

APPENDIX B
Report on the Condition of Museum Material in the Pier Store Museum, Kingston, 1985

Ian MacLeod

General Observations

The collection is currently housed on the lower floor in the Pier Store, one of the historic buildings down by the quay at Kingston. The building itself is only a few hundred metres from the shore and is often covered with a fine mist of sea spray. The restored structure suffers from the problems that are generally found with salt saturated sandstone structures that have recently undergone major environmental changes, such as being made watertight after long periods of exposure to the elements. Initial inspection of the building showed that it was damp and musty - the lower gallery door had not been open for some time and as a result the air had become stale.

A layer of salt laden, loose mortar-sandstone dust covered objects within a sixty centimetre margin around the walls which were fretting and had large patches of salt crystals/mortar/sandstone dust which came away if brushed against. The problem of salts migrating into the interior of the building should gradually diminish until a new 'steady state' is attained in four or five years time.

During the time of the *Sirius* expedition approximately 10,000 cm^3 of dust, salt and rock debris was removed from around the skirtings. The objects that were covered with debris have been physically cleaned of the loose material and sorted according to their nature and source. The preliminary cataloguing was performed by Myra Stanbury of the WA Museum.

Iron Objects
Wrought iron

All the iron objects in the collection are in urgent need of conservation treatment for, without positive steps being taken to arrest their accelerated corrosion, the remaining archaeological information will be lost. Many large iron fittings from Crank Mill are in dire need of treatment - layers of rust up to 2 mm thick are falling off the teeth of the main drive gear wheel. All the iron objects recovered from the Kingston area have high levels of chloride salts in them and are inherently unstable.

The treatment of iron artefacts all revolves around washing the objects 'free' of chloride ions. The washing needs to be done in sodium hydroxide (caustic soda) solutions containing approximately twenty grams of sodium hydroxide per litre of solution (2 wt%). The sodium hydroxide provides a strong driving force to help remove the aggressive chloride ions.

In the absence of sophisticated conservation equipment the storage of iron artefacts in such caustic solutions not only prevents further decay/corrosion of the metal but it actively assists in the ultimate stabilization process viz. chlorides come out of the iron into the caustic solution. If electrolysis facilities are made available then the overall treatment time for artefacts is greatly reduced. For example, an old iron axe may need soaking in caustic soda solutions for two years to stabilize it but the treatment time would be about three weeks if the object was suitably electrolysed. Once the artefacts have undergone basic stabilization treatment they need to be given a coating of a protective lacquer to help exclude the moist salt air from the metal surface for without such physical barriers the corrosion process will start off again.

Cast Iron

The treatment of cast iron objects requires similar techniques to those described above except that treatment times are normally much longer. Corroded cast iron will often have a very soft graphitized surface and this layer bears all the inscriptions, if any are indeed present. If given rapid electrolysis (high current) in caustic solutions, the evolving hydrogen gas will blast the outer surface away and so obliterate all the archaeological details such as weight and foundry marks. Removal of the chlorides from a wrought iron anchor may take as little as seven months whereas a carronade, such as the one just raised from the *Sirius*, will take between four and six years of gentle electrolysis. The number of man-hours involved in such extended electrolytic procedures is not all that great since the treatment virtually looks after itself once the initial deconcreting and preparation of anodes, cradle etc. has been done. Regular weekly checks on the solution levels (to make sure the cannon surface does not become dry) and periodic measurement of chloride levels will ensure that the treatment is progressing satisfactorily.

As the salt levels in the wash solution builds up there is a slowing down of the rate at which they are being released until a plateau is reached. Once plateaus have been established the solution needs to be changed. During the first periods of electrolysis, bore water, such as from Horrock's Bore, would be suitable but for the final treatment period fresh rain water should be used for making up the caustic baths. After the chloride removal is effected the cast iron object must be washed free of residual caustic, dewatered and then impregnated with a microcrystalline wax. Currently the wax impregnation facility is only available at the Western Australian Museum.

Copper-brass-bronze

A large number of artefacts made from copper and its alloys are currently housed in the Pier Store. A cursory inspection of the objects showed that many of them have localized severe corrosion (pitting) and that most of them are suffering from some form of corrosion due to (i) the previous site history and (ii) their present storage conditions. Amongst the material is the greater part of a set of rudder pintles and gudgeons from the *Sirius* which are in need of basic conservation treatment. Removal of non aesthetically important corrosion products and coralline material is effected by soaking the artefacts in tubs of a wash solution comprising of 5 wt% citric acid, 1 wt% thiourea. The cleaning of the softened materials and subsequent washing in a mixture of sodium carbonate and sodium bicarbonate goes a long way in stabilization of the artefacts. Total treatment time for such materials ranges from ten to eighteen months and involves three or four changes of the washing solutions over that period.

Ceramics-glassware

Many of the bottles from the early settlement period are opalescent and some are actively exfoliating. Because of phase changes brought about by prolonged burial in a salty environment and because salt solutions that have penetrated the glass crystallize and blister the surface layers, it is essential that these materials are treated. In most cases simple washing for two months in 'tap water' followed by a few months in deionozed (rain) water will normally prevent further damage. A number of consolidants are available which effectively stabilize the already damaged surface. Similar problems occur in ceramics where salt crystallization will often destroy the glaze; adoption of a routine washing procedure will normally lead to effective stabilization of most salt affected ceramics.

Textiles

Materials of plant or animal origin are well susceptible to deterioration through weathering brought about by rapid changes in relative humidity and by the action of sunlight. The accumulation of dust, grit and salt accelerates the rates at which cotton, wool, silk etc. breakdown since their abrasive action is most marked when objects are being moved around (handled). Washing the textiles using appropriate non-ionic detergents will normally enhance the condition of the object through the simple removal of dirt and grime. Proper storage away from direct sunlight and from insect attack will normally prolong the life of a garment. The examples of fragments of old military uniforms found on sites in the Kingston - Arthur's Vale area are in a delicate condition and need consolidation either by couching down onto a supportive backing or by using a lamination technique.

Work Proposals

As soon as a curator - conservator is/are appointed it is essential that treatment of most of the archaeological iron work commences as much of this material is in very bad repair. Pending the arrival of a controlled current-voltage source some electrolysis work could be performed using a modified commercial battery charger.

Treatment of the massive wheel sections from the crank mill can await the availability of the large steel tank being used to treat the *Sirius* anchor.

Immediate treatment of the massive bronze rudder fittings from the *Sirius* could take place using large, commercially available, plastic tubs.

Glass and ceramic materials could begin desalination by simply immersing them in plastic tubs ('fish baskets').

All the above proposals are suggestions on a FIRST AID basis and are no real substitute for a systematic treatment of the objects over a period of eighteen months to two years. For massive and fragile items such as a *Sirius* carronade it may be possible to use facilities currently being made available at the Administration Works Depot.

APPENDIX C

Titrations of Chloride Ion Concentrations for Carronade and Anchor, Carried out by Ross Allomes

TABLE 1 Titrations

Sample	T (days)	*$AgNO_3$ (ml)	√T (days)	Cl^- (ppm)
1	30	12.65	5.48	1796.3
2	37	13.05	6.08	1853.1
3	59	18.35	7.86	2605.7
4	67	18.60	8.19	2641.2
5	72	19.25	8.49	2733.5
6	79	6.70	8.89	951.4
7	86	14.70	9.27	2087.4
8	93	14.90	9.64	2115.8
9	100	15.30	10.00	2172.6
10	114	15.20	10.68	2158.4

*Average ml silver nitrate (2 titrations) required to change colour of sample to a definite orange-brown.

FORMULA

$C_1 \times V_1 = C_2 \times V_2$

Where C = Chloride ion concentration in parts per million

V_1 = Sample volume in ml

C_2 = Silver nitrate concentration in parts per million

V_2 = Average volume of silver nitrate required.

i.e. Chloride ion = $\frac{355 \times \text{ml } AgNO_3}{2.5}$

APPENDIX 5

Report on the Norfolk Island Museum Collection, Kingston, Norfolk Island for Robert Varman, Curator 23.1.87 - 11.2.87

Sharon Towns
Curator of Conservation
New South Wales Branch, Museums Association of Australia

Norfolk Island Museum Collection
Kingston, Norfolk Island
January 28 - February 4 1987

The Norfolk Island Museum's collection is presently housed in the lower floor of the Pier Store at Kingston, 20 metres from the shoreline.

The following pages will discuss the five buildings inspected for usage as proposed museum facilities. The general condition, storage, requirements and treatment of the collection are detailed, together with long-term recommendations for its conservation.

Reference is made to Dr Ian MacLeod's 'Report on the Condition of Museum Material in the Pier Store Museum, Kingston, 1985'. This discusses the collection's environment, condition and treatment, and makes recommendations for its conservation. This report will reinforce and enlarge on the fundamental points made in the 1985 report. If these recommendations are not initiated in the near future, further deterioration and loss of irreplaceable material will occur. Little, if any, work has been carried out after the submission of the 1985 report.

1.0 Proposed Museum Buildings

1.1. Pier Store

Environmental conditions

The top floor was extremely hot, humid and stuffy as there is no insulation or air-flow ventilation. Over a number of days the internal heat builds up and has no avenue of escape. The lower floor is cooler as the top floor acts as a buffer, but again, lack of ventilation causes stagnant air. Both floors have uncovered windows although no direct sunlight appears to penetrate and the illumination levels do not seem excessive. There is a fine layer of dirt and salt over windows, floors and objects, while the walls of the lower floor have a thick (2-3 cm) encrustation of salt crystals/mortar/sandstone dust which powders at the touch. Insect activity is predominantly that of spider and cockroaches. No aggressive activity was observed.

Function

Because of the position of the Pier Store building, its persistent and prevailing problem will be salt erosion of the building fabric and salt deposition on the housed objects. This will be almost impossible to eliminate and will present a constant maintenance and preservation problem to the housed collection.

The high temperatures in the top floor area must be reduced or much damage will occur to various material types while chemical degradation processes will be accelerated.

This building is <u>not</u> suitable as a museum for housing artefacts. However, if it is considered the only viable option, the choice of artefacts to be housed there must be restrictive and selective and wholly dependent upon the prevailing environmental conditions. Treated metal artefacts are recommended for display.

The building is <u>not</u> suitable as a storage area, but should be used entirely for display for which its layout is ideal.

It is recommended that open display be avoided at all costs and that sealed display cases be installed for all the exhibits. The choice of display case must be versatile enough to accommodate the rotation of artefacts for each new exhibition.

1.2 The Engineer's Building

This three-room building is diagonally opposite the Pier Store.

Environmental Conditions

The building appears to buffer the fluctuating external temperatures and humidity as there is good air-flow through ventilation when the building is opened daily. The internal relative humidity appears acceptable, even if constantly on the high side due to the high moisture content of the air.

The windows are uncovered and the front rooms would have direct sunlight during the afternoon hours. The illumination and ultra-violet levels are probably on the high side.

Again, salt deposition occurs from blow-in air but the fabric of the building does not suffer salt efflorescence and appears to be in very good condition.

Function

It has been suggested that this building house the land archaeological collection. This would appear a suitable suggestion with the three rooms not only displaying the material but acting as a permanent storage place for small to medium sized artefacts as well. This is detailed in 2.3.

The usage of the courtyard for stone artefacts is not entirely desirable as the stone will be subject to wind and water erosion, salt crystallization with associated exfoliation of the surface, and extreme temperature changes which will break up and crack the fabric of the stone. Unless overhead covering can be provided, the courtyard should not be used as a display area.

The small kitchen at the back of the building would best be used as a small conservation workshop as it has running water, bench space and so on.

1.3 Youth Centre

This building has been proposed as the display area for the *Sirius* material. It consists of a large hall with a high ceiling and two smaller rooms at one end.

Environmental Conditions

Due to the high ceiling arrangement the temperature and humidity problems are not readily evident. There is again no air-flow ventilation and by the end of the day temperatures could be quite high inside the building. The west side of the building heats up considerably and the four windows allow direct afternoon sunlight to penetrate.

The illumination and ultra violet levels are probably higher than desirable. The ceiling also accommodates twelve banks of fluorescent lighting, high in ultra violet. The lighting system will probably not be sympathetic to the envisaged display: tungsten spot-lighting may be more effective. The condition of the building inside and out is excellent.

Function

The proposed function of the building for the *Sirius* material is acceptable. The small room could be used as bookshop, and the other as a small display room for sensitive material that relates to *Sirius* or as a display material store area. It is felt that all the storage of artefacts should be centralized (see 1.5).

1.4 10 Quality Row

This house is to be restored as a period home.

Environmental Conditions

Environmental control mechanisms should be thoroughly rationalized before the house is restored, so as to reduce future problems.

The control and buffer fluctuating internal relative humidities and temperatures, the ceiling area should be well insulated. The verandah should offer further protection from heat problems, particularly at the west side of the building. The illumination and ultra violet levels can be controlled with the installation of appropriate curtaining which will also assist in humidity control. The curtains should be kept closed when the house is not being inspected.

Salt, dust, dirt and insects can be reduced and eliminated by regular housekeeping maintenance - at least weekly, if not daily.

Function

The proposed function of the building appears suitable, with the emphasis on local domestic artefacts and furnishings. Artefacts such as furniture, wooden and ethnographic objects from the Pier Store collection could be safely housed here.

1.5 Commissary Building

The basement level consists of one large room and two smaller rooms. The northern wall is below ground level; the floor is uneven flag sandstone covered in a thick layer of dirt.

Environmental Conditions

The temperature and relative humidity appear stable, if somewhat on the high side - the building fabric appears to buffer the external fluctuating conditions. The walls are rendered and partially painted in spots. There does not appear to be a moisture problem but in several areas a bright green colouration was noted on the back wall of the main room and the front wall of the left hand room. This is either a type of fungal growth or a chemical deposition from a previous function of the building. These rooms may be entirely unsuitable during winter with the likelihood of moisture entrapment and mould growth. There is however, some air-flow through the large open spaces.

There are uncovered windows along the front (street) side of the building but the illumination levels do not seem excessive.

There is overall a thick dirt layer on the floor which must be cleaned up before usage. There is also the likelihood of drop-through dirt from the floor above due to slightly gappy floor-boards.

On the whole, the rooms are in excellent size offering ideal storage dimensions, and with conservation and renovations should prove an ideal storage area for the entire collection.

Function

It is highly recommended that the building be refurbished and renovated to become the storage facility for the Museum collection.

Requirements

(a) The rooms be thoroughly cleaned out of unrelated material, floors cleaned, walls scrubbed down.
(b) Walls painted, ceiling covered with closely woven hessian to catch drop-through dirt.
(c) Windows permanently covered with boards on the inside to eliminate natural light.
(d) Rooms fumigated before storage of artefacts takes place - then annually to ensure insect infestation does not occur.

The above indicates the problems encountered with each building inspected, showing how most can be readily and economically overcome. The artefacts which are not highly susceptible to temperature and relative humidity fluctuations can be accommodated in these environments: predominantly inorganic materials such as metal, glass, stone and ceramic. The organic collection has not been discussed and consists of wood, leather, paper, photographs, fibres, shell, bone, featherand so on. These are highly susceptible materials (see 2.1) with this in mind the usage of the Pier Store and Youth Centre could in fact be reversed, with the *Sirius* material (mainly inorganic) being displayed in the Pier Store (in sealed cases) and the Norfolk Island Collection displayed in the Youth Centre which would appear a more stable environment for the organic-based artefacts in this collection.

Ideally all the buildings which are to house artefacts should be air-conditioned to stabilize environmental conditions and reduce the salt problems in the structure of the building. If the heritage aspects of the building or economics are not favourable towards this being implemented, it is suggested that the lower floor of the Pier Store be lined with an internal wall of gyprock with an adequate breathing space, being provided by the formwork.

2.0 The Collection

2.1 Artefact Material Types

The collection consists primarily of metal artefacts.

- 60% iron and copper alloys - in association with other materials such as wood, glass, etc.
- 10% wood, basketry and fibre artefacts
- 15% glass, ceramics and stone
- 10% photographs and paper artefacts
- 5% additional organic material such as bones, feathers, shell, textiles, etc.

(See appendix A - Artefact Environmental Requirements)

2.2 Present Condition of the Collection

The Norfolk Island Collection is generally in a very poor condition.

Metal

All the metal artefacts are suffering corrosion problems due to salt infestation. This causes 'bronze disease' of the copper alloys and ferric chloride attack to the iron artefacts. The severity of the problem can be readily observed in flaking, lamination of wrought metal structures, and weeping pustular sores on the *Bounty* cannon. Irreplaceable material is being lost.

Wood, Basketry, Fibre

The wooden artefacts are suffering from physical damage with broken areas and scuffed, desiccated surfaces. There does not appear to be any insect infestation of these artefacts.

Ceramics, Glass, Stone

The archaeological pieces are in some cases suffering opalescence and salt crystallization with associated exfoliation. Others are in fragments which may become dislocated resulting in the loss of the whole object. Physical damage to this material type is an ever present problem, either due to vibration, shock or accidents.

Leather, Bone, Feather etc

This material on the whole appears good with slight drying problems. Leathers must be kept flexible or cracking and distortion will occur. Both excessive handling and extreme environments will readily damage this material. They are deteriorating from the present storage conditions.

Paper and Photographs

Presently these are stored in overcrowded conditions conducive to deterioration. This overcrowding is causing tears, distortion and paper loss. Photographs are fading and are being scratched and abraded. There is salt and dirt over everything causing staining and chemical degradation. The archival and visual history of Norfolk is at high risk.

2.3 Storage Requirements

The collection urgently requires treatment, but this would be pointless if high quality storage is not implemented to protect the collection from further deterioration. Below are listed the storage requirements in terms of furniture types, materials, design and procedures.

Furniture

Should be constructed of timber and coated four times with polyurethene lacquer and allowed to fully cure before it is used. Flexible shelving, cupboard and drawer units are the most readily adaptable to a museum collection. Fittings which can be easily altered are desirable, and are in the long term the most economical. (Such units are those made by Brownbuilt or Dexion).

(a) Open shelving is suitable for most artefacts, e.g. tools, building materials, wreck material, etc.

(b) Cupboards are suitable for more susceptible artefacts or archival material, e.g. archaeological material. They can be fitted with adjustable shelves or slide-out drawers.

(c) Drawers or plan cabinets are excellent for flat textiles, documents, photographs, etc. The Norfolk Island Collection will most probably require a predominance of shelving and cupboard units.

(d) Larger objects such as furniture, machinery, etc, should be raised off the ground on pallets which fully support the object underneath. They should

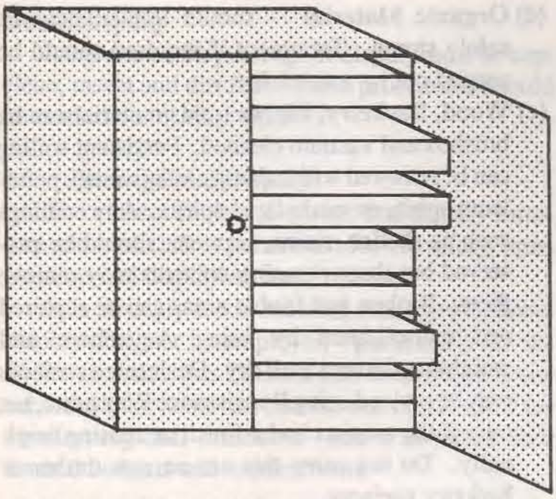

Figure 1. Adjustable draw cupboard with gasket seal.

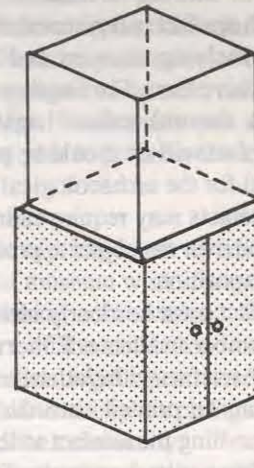

Figure 2. Display case with lower storage cupboard.

be set aside as a group in an uncrowded, accessible position. Do not pile objects on top of one another or physical damage will occur. Because of the weight of many of the objects, extra provision may have to be made for stronger shelving or support systems.

Storage Materials

Conservation quality products are necessary to protect, stabilize and preserve the objects. These products are stable, acid free, fume free, etc. and will not impart damage to the stored object. Such materials that will be required are:

- acid free tissue
- archive text
- acid free envelopes
- archival boxes
- calico dust covers (in some cases)

Design

The designing of a storage area involves the input of curatorial, registration and conservation expertise. The registrar will arrange each object sequentially for ready recall and location; the conservator will divide the collection into material type.

(a) All paper and photographic material must be stored in a stable, high quality environment such as a bank vault, government archives, etc. Such a location should be sought out and negotiated for usage. The storage should consist of plan cabinets and archival boxes.

(b) The land archaeological material can be stored in adjustable draw cupboards, e.g. a gasket seal around the internal opening of the door will eliminate dust and salt entry problems (see Fig. 1).

(c) The overflow *Sirius* material when not on display can either be stored in the Commissary Building (see (d)) or in cupboards provided below the display cases (see Fig. 2). This will depend upon the design of these cupboards.

(d) The design for the Commissary store is dependent upon the range and dimension of the artefacts to be stored. Fig. 3 is just one idea.

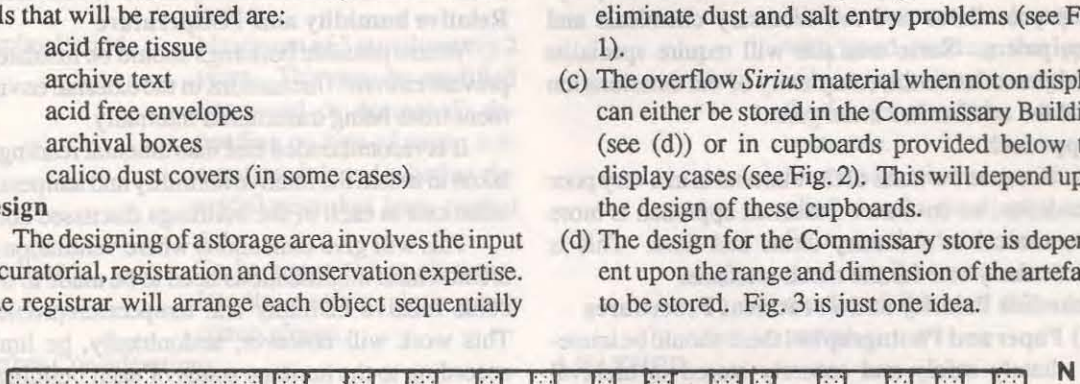

Figure 3. Possible design for the Commissary

Procedures for Storing Artefacts

Once each artefact is registered, it is placed into storage. All shelving, drawers and cupboards are lined with Archive Text. For fragile pieces - slightly padded (with dacron) calico bags/pillows upon which the artefact will sit should be provided. This would be ideal for the archaeological collection.

Larger artefacts may require calico dust covers which are fitted over the object to protect them from dirt and salt deposition.

Each artefact must be clearly identified with its registration number and name. Either a paper tag can be tied onto the artefact with cloth tape or the relevant information can be printed onto the calico cover. This avoids handling the artefact to locate it.

Each artefact has its own space. Do not stack or overcrowd as physical damage will result.

Because of the salt problem it is necessary to protect the surface of the artefact with a dust cover or a bag. However, fragile and easily broken artefacts such as glass bottles and ceramic plates should be kept uncovered.

2.4 Treatments

The long term preservation of the collection dictates that each artefact in the collection must undergo stabilization treatment. Norfolk Island can carry out the majority of remedial and first-aid treatments that are required.

Below are listed such treatments, their step-by-step procedures and the necessary chemicals and equipment. Some artefacts will require specialist treatment due to the complexity of the deterioration that the artefact has undergone.

Approach

Because the mass of the material is in a very poor condition, an en-masse treatment approach is more economical in monetary terms and time. This is particularly true for the metal artefacts.

Schedule Priority and Treatment Procedures

(a) **Paper and Photographs** - these should be immediately safely and securely stored in archival boxes. The photographic collection must be archivally photographed with B/W film. Only copy prints should be used for display, publications and public access - the originals must always remain in storage.

(b) **Metal** - should be mass treated as soon as possible. See both Dr Ian MacLeod's and the 1987 *Sirius* reports.

(c) **Ceramic, Glass and Stone** - if treatment is required see both of the above reports and information on consolidants for procedures. The fragments and broken artefacts can be repaired using 20% wt Paraloid B72 in acetone (acrylic resin). After treatment the artefacts should be sympathetically and systematically stored.

(d) **Organic Material** - should immediately be safely stored. Treatment if required should be carried out by a specialist.

(e) **Wood, Basketry, Fibres** - this material can be brushed and vacuum cleaned. Persistant soiling can be removed with a damp cloth (water), petroleum spirits or methylated spirits. Any coatings such as shellac, stains, wax etc. should be preserved but these cleaning solvents may remove them. Broken and friable areas can be repaired and consolidated by using Aquadhere and weighting the area until dry. Desiccated surfaces may be revived using Renaissance Wax paste, but only if the artefact had a finish or coating originally. Do not carry this out on raw timber or basketry surfaces.

Specialist Input

It is recommended that in the near future a conservator carry out a detailed assessment of the collection to identify and ascertain which artefacts require specialized conservation treatment.

3.0 Long Term Requirements and Objectives

Presented below is a priority rating and general discussion on the long term conservation requirements of the collection.

3.1 Environmental Controls

It is pointless carrying out treatment or expending energy, money and time on display and storage, if certain environmental controls are not carried out.

Relative humidity and Temperature

Where possible buildings should be insulated to prevent extreme fluctuations in the external environment from being transmitted internally.

It is recommended that instrumental readings be taken to assess the relative humidity and temperature situations in each of the buildings discussed above.

This will give indications where ventilation and architectural modifications need to be made to overcome relative humidity and temperatureproblems. This work will however, undoubtedly, be limited according to the heritage status of each building.

Light

No natural light should be allowed to enter any of the above buildings. Simple curtaining, blinds or shutters (internal) will eliminate this problem. Artificial lighting should consist of tungsten spot-lighting with dimmer switches. For example, Coolbeam globes are excellent. Avoid fluorescent lighting as it has a high ultra violet component.

Salt Deposition

This prevailing problem is unavoidable no matter how well all doors and windows are sealed. Thus, all artefacts, particularly metal items, must be well coated with either a lacquer or wax coating. Regular housekeeping and brushing of surfaces will also reduce salt and dirt deposition.

Housekeeping

All areas, be they storage or display must be kept clean, insect and dirt free. These procedures should be carried out at least weekly.

3.2 Storage and Display

The correct choice of storage and display furniture and materials is paramount for the safety, preservation and display of the collection.

It is strongly recommended that a professional display designer be employed - particularly for the *Sirius* material. Ms Barbara Cameron-Smith is one such designer who has carried out much work for smaller, regional museums. She is aware of their limited budgets and requirements.

3.3 Stabilization

The stabilization of the collection does not stop with high quality storage, display or treatment. It is an on-going expense and as such, must be budgeted and allocated for. Some treatments are repeated as often as once a year to preserve the artefacts.

3.4 Policies

It is extremely important to have a policy for every aspect of museum work, for example - acquisitions, exhibitions, conservation. These establish the parameters of the collection - its direction or change of direction, legal aspects, etc. These policies must be flexible to satisfy the changing needs of the collection and the community.

Adequate budgeting for the collection must be made and an independent source of finance sought. This could be through sponsorship, entry fees and/or the sale of publications and souvenirs.

APPENDIX A
Artefact Environmental Requirements

PAPER

Temperature	20 + - 2°C
Relative Humidity	55 + - 5%
Illumination	Maximum of 50 lux. No spot lighting
Ultra Violet Light	Maximum of 30 microwatts/ lumen
Display Period	Maximum of 3 months every 2 years. This may be modified (increased or decreased) depending on type of paper, colouration, ink and whether deacidification has been carried out.
Handling	To be supported at all times. Handle wearing clean white cotton gloves.
Further Considerations	Objects should be protected from S02, dust and salt laden air.

TEXTILES

Temperature	20 + - 2°C
Relative Humidity	55 + - 5%
Illumination	Maximum of 50 lux. Use of incandescent spot lighting to be avoided.
Ultra Violet Light	Maximum of 30 microwatts/ lumen
Display Period	6 months maximum every 2 years. 3 months every 2 years for very fragile textiles.
Handling	Wear clean white cotton gloves and handle carefully as little as possible.
Further Considerations	It is very important to avoid any tension and stretch on the materials at all times Well constructed dummies with good padding that provides support for the weight of the fabrics should be used for costumes. No pins or stitches can be applied to make the display well fitting on the dummies. Any fragile textile must be displayed flat, and fully supported.

LEATHER

Temperature:	20 +- 2°C
Relative Humidity:	55 + - 5%
Illumination:	Maximum of 250 lux. No spot lighting to be used.
Ultra-Violet Light:	Maximum of 80 microwatts/ lumen U.V.
Display Period:	According to condition of leather, stability and importance of dye/colour.
Handling:	White gloves
Further Considerations:	Do not allow to come in contact with iron.Do not use any adhesive tape or label on leather.Light conditions may

be varied (increased or decreased) depending on the condition of the leather and stability of dyes.
Protect from S02

LACQUERWARE

Temperature:	20 + - 2°C
Relative Humidity:	55 + - 5%
Illumination:	Less than 50 lux. No spot lighting
Ultra-Violet Light:	Maximum of 30 microwatts/ lumen
Display Period:	6 months, no more than once every 2 years.
Handling:	Handle wearing clean white cotton gloves.

BONE AND IVORY

Temperature:	20 + - 2°C
Relative Humidity:	55 + - 5%
Illumination:	Less than 150 lux. Use of incandescent spot-lighting to be avoided.
Ultra-Violet Light:	Maximum of 80 microwatts/ lumen
Display Period:	6 months maximum in any two year period.
Handling:	Clean, white cotton gloves to be worn when handling

Further Considerations: If these material are combined with other types of material then the lowest recommended values for any of the materials in a piece are to be recommended for the whole object.

Bone and ivory require good, even support and should not be subjected to pressure which could result in distortion over time.

Rubber pads and rubber adhesives should not be used near ivories as the sulphur from rubber can cause stains.

Contact with iron, copper alloys and coloured materials may also cause staining.

CERAMICS

Temperature:	20 + - 2°C
Relative Humidity:	55 + - 5%
Illumination:	Not restricted
Ultra-Violet Light:	Not restricted
Display Period:	Not restricted
Handling:	With great care (two hands). Not to be carried by handles

Further Considerations:

Hand painted and/or repaired ceramics have more specific requirements:

Illumination:	Max of 150 lux Avoid incandescent spot-lighting
Ultra-violet light:	Max of 80 microwatts/lumen
Display Period:	Some hand painted ceramics may be susceptible to light damage and require a display limitation of 6 months to be set.

GLASS

Temperature:	20 + - 2°C
Relative Humidity:	55 + - 5%
Illumination:	Avoid direct/hot lights
Ultra-Violet Light:	Not normally restricted
Display Period:	Not limited
Handling:	Very carefully (two hands). Not to be carried by handles.

Further Considerations:

Painted, repaired, weeping and exfoliating glass have more specific requirements:

Temperature and relative humidity: as above, however weeping and exfoliating glass requires a stable RH between 45 - 47% which can be maintained by using conditioned silica gel beneath small holes in the base of the showcase and a fan to ensure adequate air circulation.

Illumination:	Max of 150 lux. The use of incandescent spot-lighting is to be avoided.
Ultra-violet light:	Max of 80 microwatts/lumen Display period: Not restricted provided it is kept in the conditioned environment.
Pollutants:	Protection from So2 is required for all glass objects.

STONE AND MARBLE

Temperature:	20 + - 2°C
Relative Humidity:	55 + - 5% Protect from condensation and direct action of water.
Illumination:	No restriction unless painted.
Ultra-violet Light:	No restriction unless painted.
Display Period:	No limit
Handling:	Wear clean white cotton gloves

Further Considerations:

The main consideration is pollutants

Marble is susceptible to discolouration and staining It should never be dusted with a cloth as this tends to force dirt particles into it.

APPENDIX B - Museum Management

SECTION I Some Basic Considerations of the Function and Operation of a Museum

1.0 Below are some guide-lines on the nature and function of a museum. Even though the Norfolk Island Museum may not strictly conform to these guide-lines, it is a matter for consideration in its planning stages.

1.1 A Definition

A museum is an organized and permanent non-profit institution, essentially educational or aesthetic in purpose with professional staff, which owns and researches tangible objects, maintains them and displays them on a regular basis.

1.2 The Function of a Museum

(i) Curatorial

The curatorial function includes the acquisition, identification and maintenance of a museum's collection. To carry out these tasks, space allocation is essential for the following:

- office and administration area for at least one full-time curator and volunteer staff
- preparation/workshop area for research, basic conservation work and display preparation
- space for the museum's records
- storage area for objects not on display
- fire and general security facilities

Overall space relegated to the above curatorial functions would ideally be 38% of the total area.

(ii) Display

Museum displays make sense of objects in the collection. Selected artefacts are researched and presented in a meaningful context. Apart from semi-permanent displays (up to five years) space should also be allocated for temporary exhibitions. These can be co-ordinated by the museum itself or be brought in from another museum. Temporary exhibitions help to encourage local residents to revisit the museum on a regular basis.

Roughly 35% of the museum's area should be devoted to both temporary and permanent displays.

(iii) Service and Preparation

Sufficient space should be made available for basic construction facilities such as benches, sinks, etc. These areas should have easy access to delivery bays.

(iv) Education and Public Function

A museum should be prepared for and capable of carrying out general public functions such as lectures, school tours, films etc. Public areas should include:

- theatrette and/or classroom facilities
- administration and reception area
- cloak -room facilities
- sales counter

1.3 Safe environmental conditions are vital for the long term security and preservation of museum objects. Light and fluctuations of temperature and relative humidity and damp can be extremely damaging to artefacts. Wherever possible, exhibition areas should be free of direct sunlight. Both storage as well as display areas should be monitored frequently. (Advice on light levels and temperature and relative humidity requirements are available from the Association's conservation department).

1.4 No matter how big or small, museums should be able to fulfill the above basic functions and conditions. Many community museums do not and as a result, can neither attract sufficient interest from the people who visit them, nor funds for future development.

SECTION II A Management Plan for the Collection

2.0 Keeping full and up-to-date records of all the material held in the collection is sometimes a significant problem. The two main reasons for this can be (1) lack of time and (2) lack of adequate staff. Record keeping is the least glamorous and most time consuming task within museum operation. Yet, in some ways, it is the most important job.

2.1 At the base of any good museum, no matter how big or small, is its sound records system. Even with a small collection it is vital that comprehensive records of the details of all objects and material exist. Without easy access to this information a great deal of the history and relevance of objects can be lost over time. It is important to establish a tried system of managing and recording the collection. The advantages of such a system are as follows:

(a) It provides a reference source for research and details on the history and origin of each object.
(b) It identifies each object with a reference number.
(c) It records the current location of each item (including storage and display).
(d) It records legal title.
(e) It records the value of the material for insurance or re-sale.
(f) It monitors the on-going condition of objects and records conservation work done on them.

2.2 Fundamental to an effective records system are institutional policies which clearly delineate how and why the collection is to be maintained. These are:

(a) A Statement of Purpose Why the collection exists and the rationale for its development.

(b) Collections Management Policy Development and implement a collections policy which delineates the subject area, acquisition, loan and disposal of the collection.

(c) Conservation Policy Develop and implement a conservation policy projected over at least five years that will address the particular needs of the collection.

(d) Public Programme Policy If displays are to be developed, then the nature, scope, frequency and budget of exhibitions must be considered to and agreed upon.

(e) Management and Development Policy A plan should be devised to incorporate what labour is to be used (whether paid or volunteer) to catalogue, research, conserve, maintain and display the collection.

2.3 A standard record system, recommended by the Museums Association needs to be implemented. It is not unduly complex but it is comprehensive. It would comprise:

(a) **An Object Record Sheet.** Information on objects is recorded and a sheet completed for each. It records - the registration number, the object name and type, how it was acquired, its value, its dimension, materials, condition and full description as well as its history, manufacture and current location.

(b) **Numbering the Object** . Each object is allotted a registration number which is permanent and marked directly on it. It is crucial that standard marking procedures are followed according to museum practice. The Museums Association can provide a low cost manual on the types of material to use and the location of the number on each type of object.

(c) **Classifying or Indexing the Object.** This is a process of indexing the collection under reference of subject headings. It is usually done on a card system or in some cases by computer. A classification system is also available through the Museums Association.

(d) **A Collection Register** . This provides an immediate brief and permanent means of identifying each object. A high quality and custom made register with acid free pages is available through the Museums Association.

2.4 A management plan and record system is ideally devised by someone trained in museum work. However, many volunteer museum workers have undertaken the task. Training workshops are held regularly by the Museums Association and its field staff are willing to give specific advice at any time.

2.5 Some small museums have used Community Employment Programme (CEP) staff to help register and catalogue objects. It may be wise to seek more advice from the relevant government department.

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(b) Collections Management Policy Development and implement a collections policy which delineates the subject area, acquisition, loan and disposal of the collection.

(c) Conservation Policy Develop and implement a conservation policy projected over at least five years that will address the particular needs of the collection.

(d) Public Programme Policy If displays are to be developed, then the nature, scope, frequency and budget of exhibitions must be considered to and agreed upon.

(e) Management and Development Policy A plan should be devised to incorporate what labour is to be used (whether paid or volunteer) to catalogue, research, conserve, maintain and display the collection.

2.3 A standard record system, recommended by the Museums Association needs to be implemented. It is not unduly complex but it is comprehensive. It would comprise:

(a) An Object Record Sheet. Information on objects is recorded and a sheet completed for each. It records - the registration number, the object name and type, how it was acquired, its value, its dimension, materials, condition and full description as well as its history, manufacture and current location.

(b) Numbering the Object. Each object is allotted a registration number which is permanent and marked directly on it. It is crucial that standard marking procedures are followed according to museum practice. The Museums Association can provide a low cost manual on the types of material to use and the location of the number on each type of object.

(c) Classifying or Indexing the Object. This is a process of indexing the collection under reference of subject headings. It is usually done on a card system or in some cases by computer. A classification system is also available through the Museums Association.

(d) A Collection Register. This provides an immediate brief and permanent means of identifying each object. A high quality and custom made register with acid free pages is available through the Museums Association.

2.4 A management plan and record system is ideally devised by someone trained in museum work. However, many volunteer museum workers have undertaken the task. Training workshops are held regularly by the Museums Association and its field staff are willing to give specific advice at any time.

2.5 Some small museums have used Community Employment Programme (CEP) staff to help register and catalogue objects. It may be wise to seek more advice from the relevant government department.

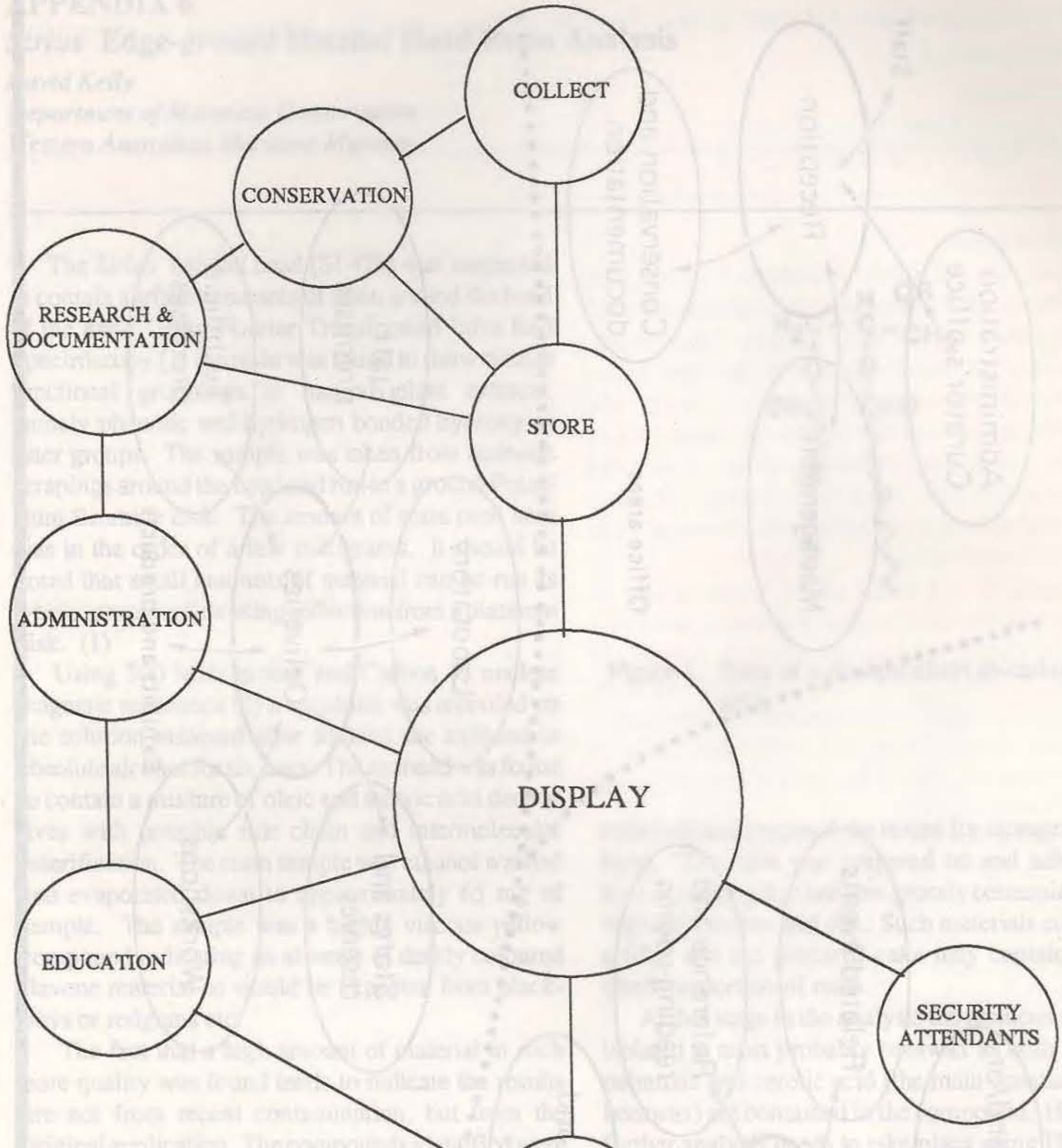

Figure 1. Relationships between museum activities.

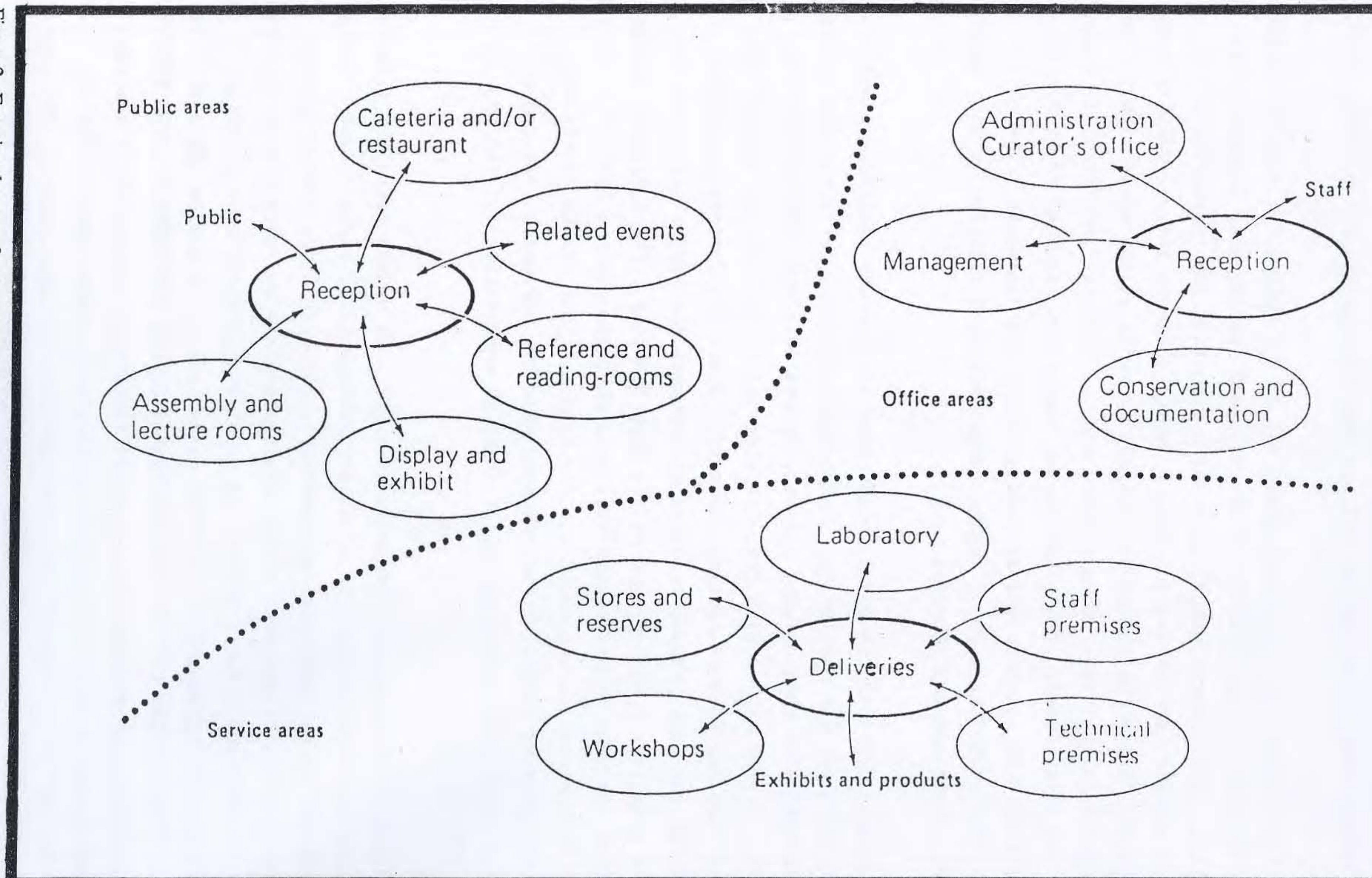

Figure 2. Functional areas of museum activities.

APPENDIX 6.
Sirius Edge-ground Hatchet Head Resin Analysis

David Kelly
Department of Materials Conservation
Western Australian Maritime Museum

The *Sirius* hatchet head (SI 479) was suspected to contain surface remnants of resin around the head of the axe. Using Fourier Transformed Infra Red Spectroscopy (1) the resin was found to show similar functional groupings to natural plant extracts, namely phenolic and hydrogen bonded hydroxy or ester groups. The sample was taken from resinous scrapings around the head and run in a ground Potassium Bromide disk. The amount of resin used here was in the order of a few milligrams. It should be noted that small amounts of material can be run as whole sample solids using reflection from a platinum disk. (1)

Using 300 MHz proton and Carbon 13 nuclear magnetic resonance (2) a spectrum was recorded on the solution obtained after soaking the axehead in absolute alcohol for six days. The axehead was found to contain a mixture of oleic and stearic acid derivatives with possible side chain and intermolecular esterification. The resin sample was ethanol washed and evaporated down to approximately 65 mg of sample. The sample was a highly viscous yellow compound indicating an absence of darkly coloured flavone material as would be expected from blackboys or redgums etc.

The fact that a high amount of material in such pure quality was found tends to indicate the results are not from recent contamination, but from the original application. The compounds identified were all derivatives of oleic and stearic acids and are commonly found in vegetable extracts.

[Derivatives of simple aliphatic carboxylic acids (alkanoic acids) are widespread in plants and animals. Saturated fats are esters derived from straight-chain carboxylic acids of high molecular weight and from glycerol (1,2,3-propane triol) See Fig. 1].

Beeswax is mainly the myricyl ester of palmatic acid, myricyl palmitate, with little free cerotic acid. This is a stable ester in which the replaceable hydrogen in the parent acid has been exchanged for monovalent alkyl radicals. Beeswax is therefore a chemically inert material and can last for long periods of time where it is protected from mechanical attrition and photochemical degradation.

It is possible the axehead resin was *Xanthorrhoea* or *Triodia* , where the absence of darkly coloured flavone material related to these plants can be explained by the methods from which the Aboriginals collected and prepared the resins for storage in cake form. The resin was prepared on and adhered to leaves, causing it to become grossly contaminated by vegetable matter and dirt. Such materials constitute a filler and the prepared cake may contain only a small proportion of resin.

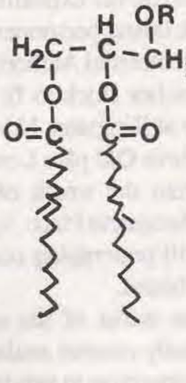

Figure 1. Ester of a straight chain di-carboxylic acid.

At this stage in the analysis the resinous material isolated is most probably beeswax as both myricyl palmitate and cerotic acid (the main constituents of beeswax) are contained in the compound. However, further analysis needs to take place using High Performance Gas Liquid Chromatography (available in the conservation laboratory) to determine the ratios of carbon chain lengths within the compound. The myricyl palmitate is a C_{16} (sixteen carbon unit chain) compound as the second highest molecular weight fatty acid from the stearic acid chain. Using High Performance Gas Liquid Chromatography the ratios of the stearic acid degradation products can be found and therefore it will be known whether or not the resin is beeswax.

Notes:

1. The Fourier Transform Infra Red Spectroscopy was carried out at the Government Chemical Laboratories with Mr Geoff Richardson.
2. The 300 MHz Fourier Transform Nuclear Magnetic Resonance was carried out at the University of Western Australia's Organic Chemistry Department in conjunction with Dr Emil Ghisalberti.

APPENDIX 7

Construction of an Anchor Stock for the *Sirius* Anchor Displayed at Kingston, Norfolk Island.

Geoff Kimpton
Department of Maritime Archaeology
Western Australian Maritime Museum

1. Introduction

During the 1987 *Sirius* expedition it was decided jointly by Norfolk Island personnel and members of the Australian Bicentennial Authority *Sirius* Project, to construct an anchor stock to fit the HMS *Sirius* anchor on display at Kingston, Norfolk Island. The anchor is one of three Old plan Long- shanked iron anchors raised from the wreck of the *Sirius*: one being located in Macquarie Place, Sydney; the other, raised in 1985, still undergoing conservation treatment on Norfolk Island.

Situated in the midst of the newly renovated buildings of the early convict settlement, the *Sirius* anchor is a focal attraction to residents, visitors and tourists to Norfolk Island. The fabrication of a stock was certain to add to its display attraction and further draw attention to the role played by HMS *Sirius* in the early history of Norfolk Island and the European settlement of Australia.

The construction of the stock was a joint undertaking, the design and carpentry work being carried out by Geoff Kimpton (Expedition Member, Western Australian Maritime Museum) and Franklin Randall (Miller and Carpenter, Norfolk Island Restoration Team); and, the metal work by Peter Ely (Tradesman Engineer, Norfolk Island Administrative Works Depot). In addition, tools were loaned by Neil Tavener and the services of a crane made available for lifting purposes.

2. Specifications of the proposed anchor stock.

The stock of an anchor is 'the transverse beam which cants the anchor when the arms fall in a horizontal instead of a vertical position' (Cotsell, 1856: 5). In other words, the anchor stock held the anchor level, allowing one of the flukes to sink into the seabed and hold the ship fast (Lavery, 1984:107). Although an inconvenient appendage, the anchor was incomplete without it and unable to perform its function.

Early anchor stocks were of wood, that used by the Admiralty being described as follows:

> '... is formed in the simplest manner of two pieces of timber; is readily converted from timber of small siding; may be shipped or fixed to the anchor without interfereing with the shackle, and by means of the hoops can always be kept set up taut upon the square or shank of the anchor' (Cotsell, 1856:115; 116, Fig. 1).

As there were no original specifications available to work from, it was decided to adapt those used to construct a replica stock for the HMS *Investigator* bower anchor, and reproduced by Carpenter (1986) in the report, *Conservation of an anchor from the wrecksite of the HMS* Sirius *(1790)* . The *Sirius* anchor (NI 20) was 15 feet 1 inch long (4.62 m) compared to the *Investigator* 's 14 feet (4.267 m) (Carpenter, 1986: 24). So, the plans for the *Sirius* ' stock had to be proportionally increased.

Calculations were based on the formula that:

> ' The length of the stock whether of wood or of iron, is equal to the length of the shank of the anchor measured from the outside of the "crown" to the extreme end of the "square"', and 'The size of the stock at the *middle*, when of *wood*, is one inch to the foot in length, at the ends half an inch;....')(Cotsell, 1856:114).

Imperial measurements of feet and inches were used rather than metric conversions to simplify construction and comply with measurements of the period. The final plan is illustrated in Figure 1.

3. Materials used to fabricate the stock.

The local restoration team, led by Puss Anderson, were approached as to the availability of suitable timber for fabricating the stock. They were able to produce two lengths of Norfolk pine, milled to the specified size of 16 feet x 15 inches x 7 1/2 inches (4.88 m x 0.38 m x 0.19 m) (Fig. 2). Timber of this dimension is very hard to obtain, even on Norfolk Island where the large pines are plentiful. Here, for conservation reasons, strict rules exist with regard to the felling of these magnificent trees. The timber proved to be ideal, being green and of fairly striaght grain with a few knots and terrestrial borer holes to add a touch of authenticity.

The original stock from the *Sirius* anchor would most likely have been made from oak (Bugler, 1966: 70). Since this would have been far too costly to import, if not practically impossible to obtain in the dimensions required, the pine was an acceptable alternative. Having acquired the timber, Peter Ely (Tradesman Engineer at the Norfolk Island Administrative Works Depot), offered to assist with the fabrication of the steel bands and caps.

The bands for wood stocks were originally made of forged iron and would have been 'smith welded' - a term defined as 'the joining together of clean

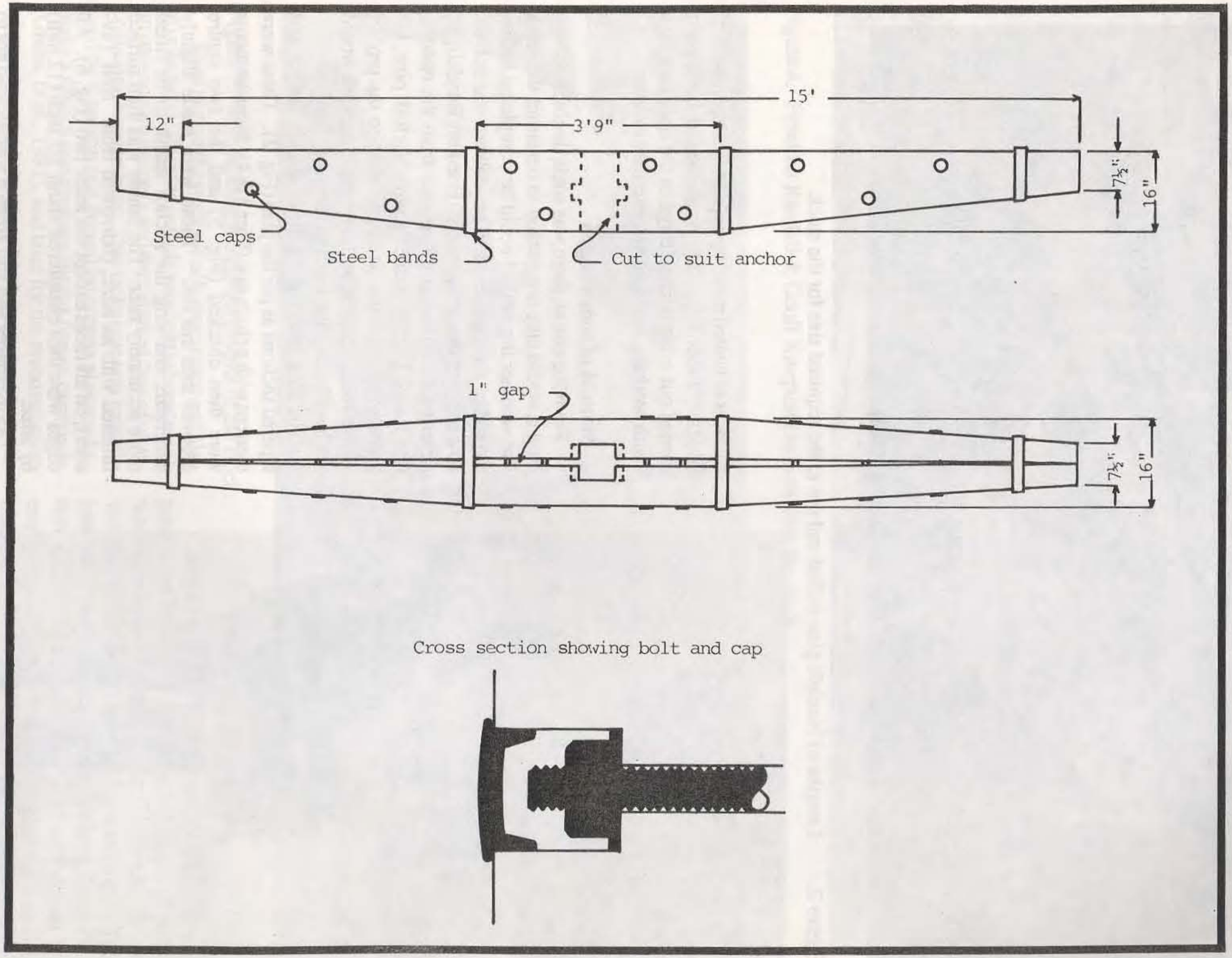

Figure 1. Plan of anchor stock for the HMS *Sirius* anchor (NI 20).

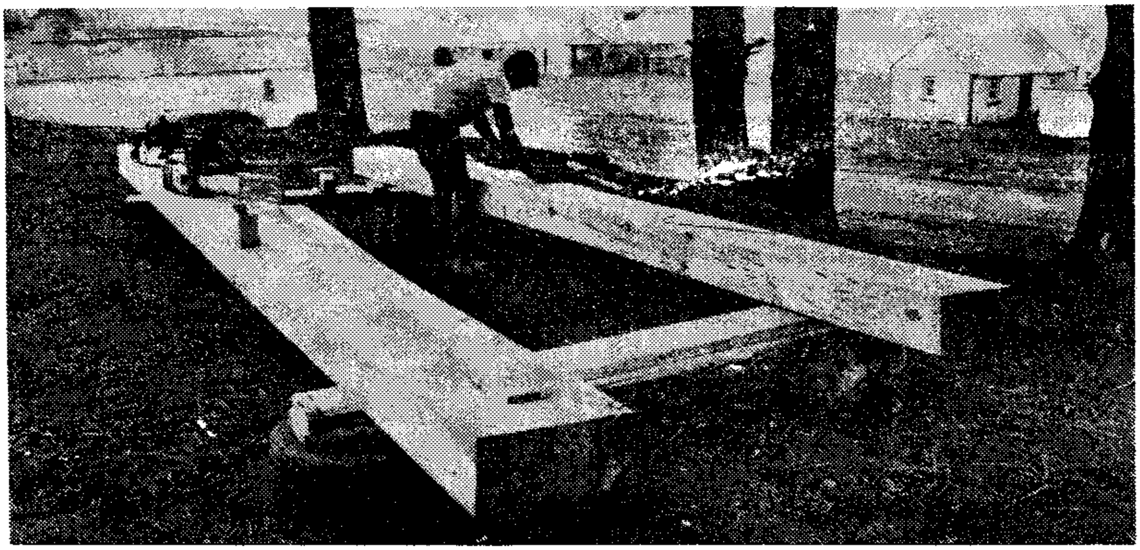

Figure 2. Lengths of Norfolk pine milled and cut to the required size for the stock.

Figure 3. Geoff Kimpton chain-sawing the stock to the correct shape and size.

surfaces of heated metal by applied force or pressure' (Bugler, 1966: 68). The work would have been carried out using a small forge in the dockyard by a smith working with two hammermen or mates.

4. Method of construction

From the outset, there was some doubt as to how long it would take one person to construct the stock and whether the project could be completed before the end of the expedition. The problem was solved, however, by the assistance of Franklin Randall, an experienced miller and carpenter from the restoration team. Used to working with Norfolk pine, his knowledge, expertise and dedication to the project were a valuable asset, without which the work would not have been completed in the given time.

The first task was to mark out the length and tapered sections as per the plan (Fig. 2). These were then cut with a chain saw (Figs 3 & 4). Measurements were then checked (Fig. 5) and the two centre grooves then cut out. These were made slightly undersize, enabling the anchor shank to be fitted more accurately later. The timber was then surface finished with an adze, (borrowed from Neil Tavener), on all faces except the inner two (Fig. 6). All edges were then chamfered about 1/2 inch (12 mm) by adze.

As the timber was still green it was decided not to tar the stock in the traditional manner because this would seal the timber and cause the inside to rot. When the timber dries out which will take at least 5 years (according to local experienced mill workers), the stock could be tarred to make it look more authentic and preserve the timber.

Figure 4. Franklin Randall & Geoff Kimpton chain-sawing the stock.

Figure 5. Re-checking the measurements of the stock.

So as to give the stock a black appearance and also give an aged effect the outside was lightly burnt using an oxy-acetylene torch and then rubbed free of charcoal using hessian bags. This technique was initially used by Kimpton and Powell on oregon pine used to make a replica gun carriage for the *James* carronade (Green, et al., 1981), and later for the reconstruction of a truck carriage for one of the bronze guns from the Dutch East Indiaman *Batavia* [1]. In both instances, the technique had produced an aesthetically pleasing appearance and could be used with confidence on the *Sirius* anchor stock.

Using a piece of timber to temporarily take the position of the anchor shank, the two pieces of stock were then drawn together using G-clamps. Holes were bored and the threaded rods cut to length. The iron bands were then made using 2 inch x 1/2 inch (50 mm x 12 mm) flat-bar, welded at each corner to enable easier fitting. These were then painted flat black. Caps to hide the nuts and give the appearance of roved studs were turned up by Peter Ely: these were also painted flat black.

By using a crane to lift the anchor from its mounting blocks, the two halves of the stock were

(1) Both the *James* and the *Batavia* gun carriages were made by Colin Powell and Geoff Kimpton to plans prepared from original specifications by Jeremy Green, all of the Department of Maritime Archaeology, Western Australian Museum. Both guns and carriages are on display at the Western Australian Maritime Museum, Fremantle.

positioned so they could be fitted to the anchor shank (Fig. 7). The final chisel work was carried out and the stock aligned to the anchor shank (Fig. 8). The unit was then bolted together and the iron bands wedged on (Fig. 9).

To make the anchor look more complete an iron ring approximately 18 inches (46 cm) in diameter was also fabricated out of 2 inch (50 mm) steel tube. At a later date, the appearance of the ring could be improved by binding it with rope in keeping with anchor rings of that period (Fig. 11). The use of hemp anchor cables made it essential that some form of protection was provided to prevent the cable chafing against the iron ring.

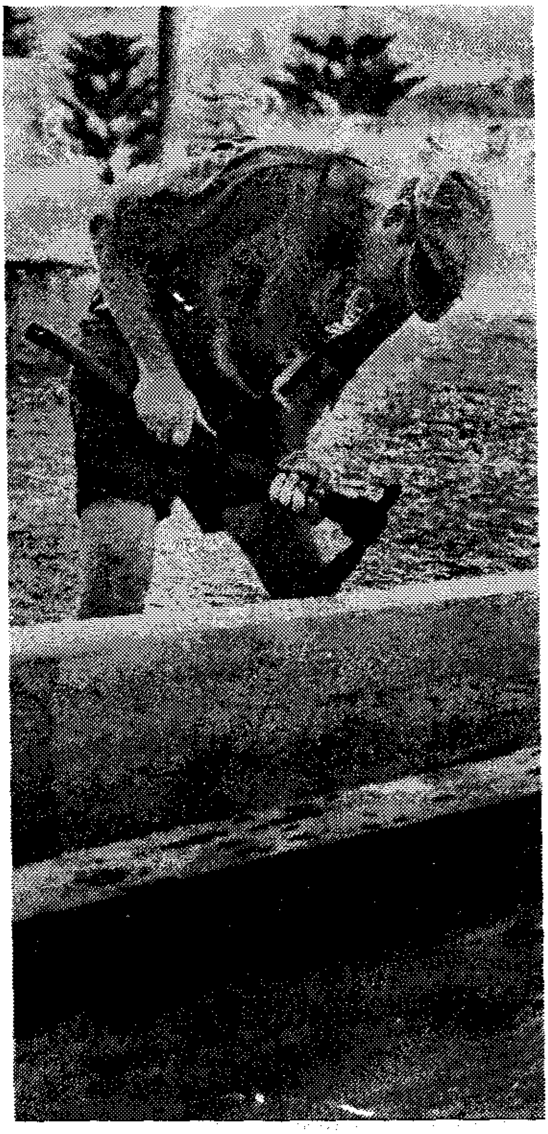

Figure 6. Adzing the outer surfaces of the stock.

5. Conclusions

The execution of this project was undertaken with the kind permission of the Norfolk Island Administration as part of the Australian Bicentennial Authority *Sirius* Project. Without the cooperation of Norfolk Island personnel with regard to the provision of materials, tools, lifting equipment labour and expertise, the construction of the anchor stock could not have been successfully completed in the limited duration of the expedition.

The entire project took two men five days to complete, the most time-consuming aspect being the adzing which, if done by a skilled tradesman of the day, would almost certainly have been completed in half the time.

The finished stock weighed 9.8 cwt (0.5 tonne) and has hopefully added more interest to the display of the anchor. The anchor and stock were remounted on blocks of Norfolk pine in place of the previous cement supports, further adding to the overall appearance.

As a tribute to the work undertaken, the anchor was re-dedicated at a small ceremony conducted by the Norfolk Island Administrator, Commodore J. A. Matthews, on the final day of the *Sirius* expedition. During the Bicentennial celebrations on Norfolk Island in 1988, an Official Plaque will be erected at the site commemorating the loss of HMS *Sirius*.

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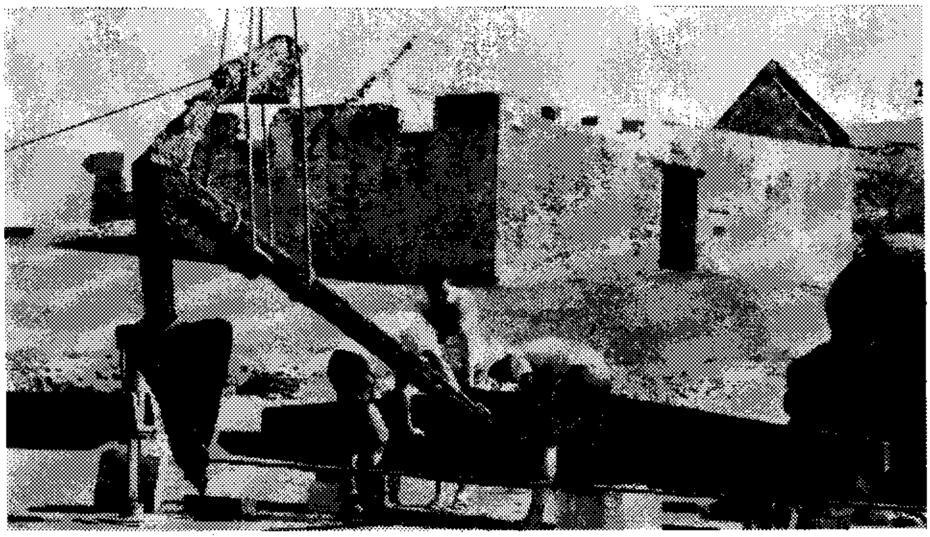

Figure 7. Positioning the stock prior to securing it to the anchor shank.

Figure 8. Final alignment of the two halves of the stock.

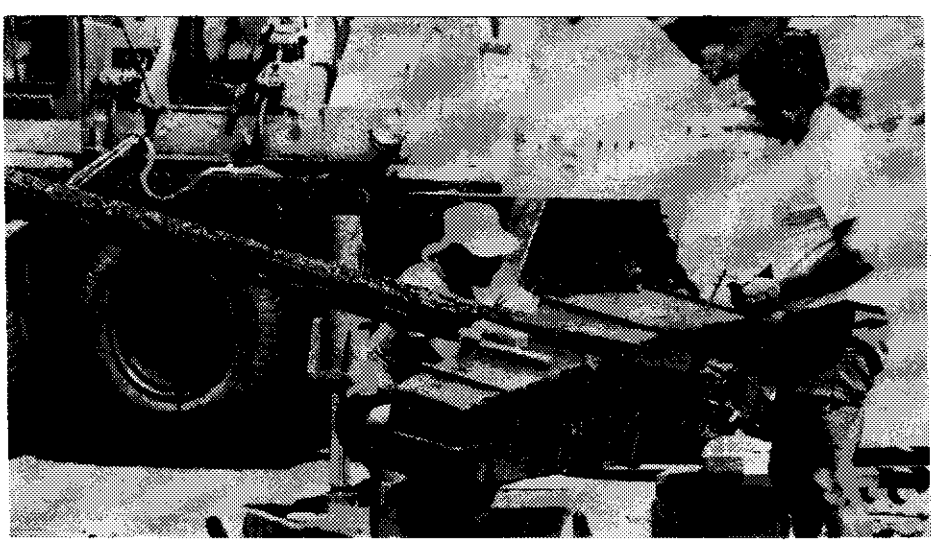

Figure 9. Bolting the unit together and fitting the steel bands.

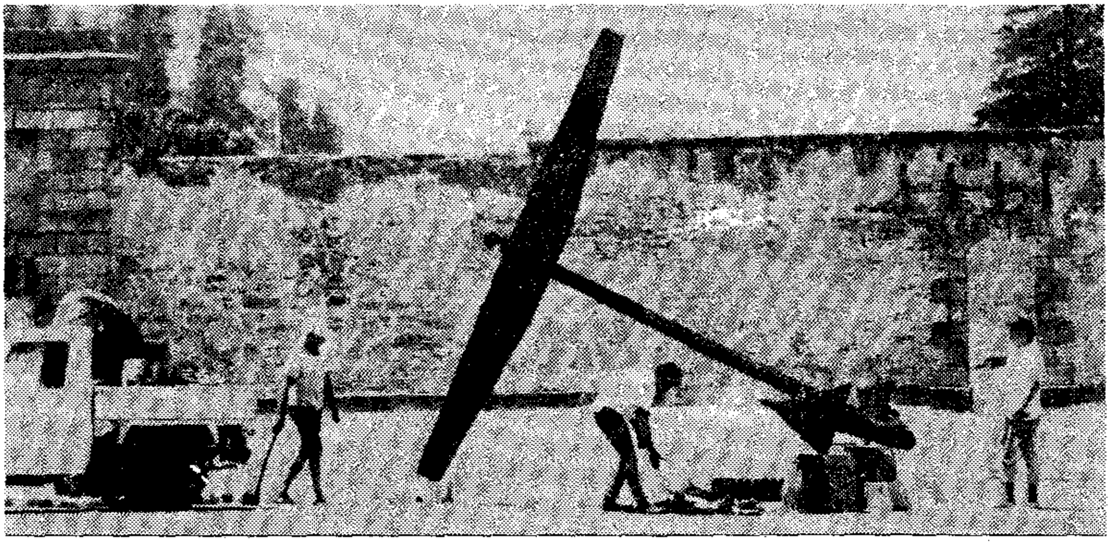

Figure 10. Completed anchor stock.

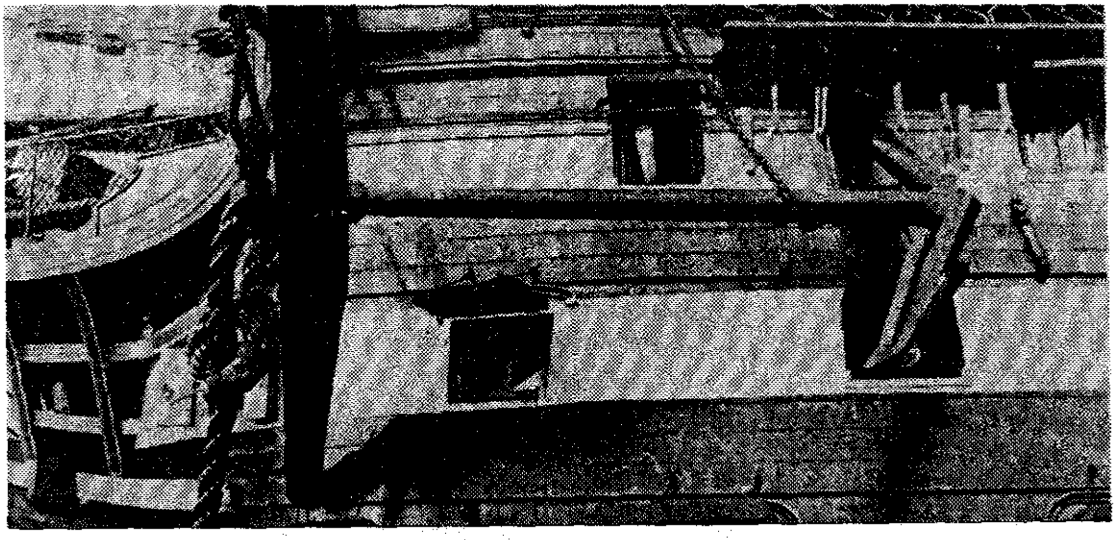

Figure 11. Anchor held to the side of the ship showing the rope-bound ring.

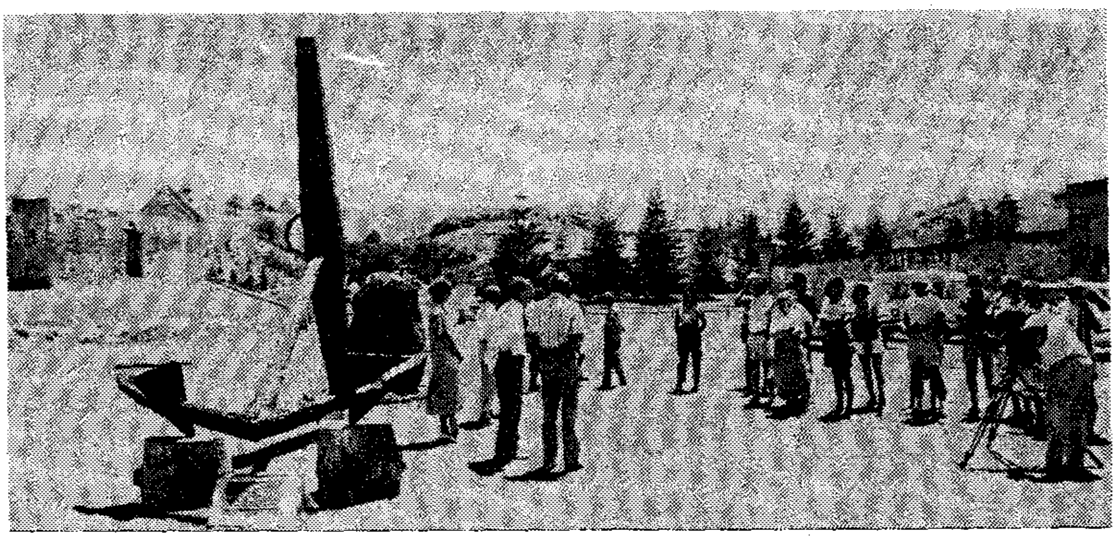

Figure 12. Re-dedication ceremony.

APPENDIX 8.
Dive Master's Report

Karen Atkinson

The favourable sea conditions experienced on the 1987 expedition allowed divers to investigate the gully areas inshore of the 1985 'stranding site' (Site 1). Since this was determined to be the final resting place of the *Sirius* the diving was concentrated there. Of the 17 available work days, 9 days were suitable to dive this site. Considering that near perfect conditions were necessary to work the newly found deposits - we were extremely fortunate.

Although this area was continually under white water, there was little danger to the divers. Becoming disoriented and heading in the wrong direction was the only concern, this was overcome by waiting for the white water to lift to orientate oneself. Because of the extreme shallowness of the site, the inflatable was anchored in deeper water out of the break zone. Two-way radios were used, and land based team members were called to assist at the pier. Since the work shed was located conveniently close to the pier, all the medical equipment was kept there, with the doctor either at the shed or as part of the diving team. A telephone on the jetty was noted in the case of emergency transport being necessary.

Recommendations

The system of each diver noting their dive times on a prepared notice-board worked well. We could institute a more efficient changeover of divers by having a schedule of dives and divers for each day. This would enable planning around the known dive times, to maximise in-water time when the weather is favourable.

Dive Details

Name	No of Dives	No of Hours
Graeme Henderson	10	11.5
Patrick Baker	11	14..25
Geoff Kimpton	8	11
Terry Arnott	9	11
Bill Jeffery	8	10.75
David Millar	10	16
Karen Atkinson	9	11
Maree Edmiston	11	13
James Tavener	8	9
Steve Richards	1	1
Barley Christian	1	0.75
Kerry Coop	1	1.5
Neil Tavener	1	1
Total	88	110.75

APPENDIX 9.
A preliminary inquiry into the identity and provenance of two guns believed to be from the wreck of HMS *Sirius* (1790).

Myra Stanbury

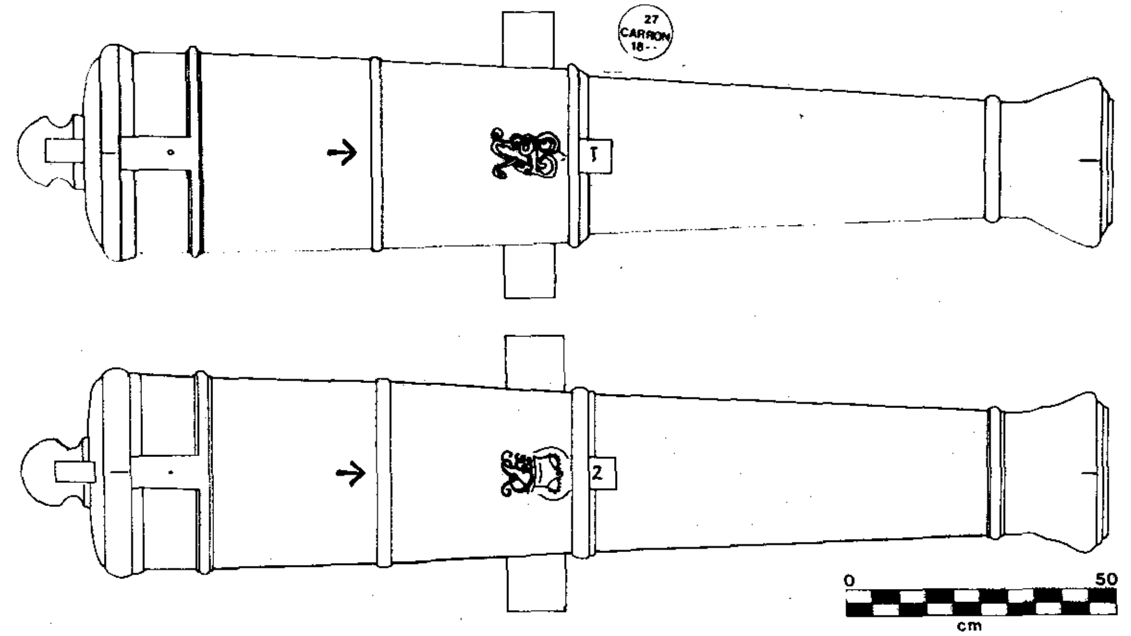

Figure 1. Two Blomefield pattern iron guns at Norfolk Island, No.1 [NI 41] & No.2 [NI 21].

1. Introduction

On 19 March, 1790, the flagship of the First Fleet, HMS *Sirius*, ran aground and was wrecked on a reef in Sydney Bay, Norfolk Island (Henderson, 1984). Following the immediate rescue operations, as much as possible was salvaged from the wreck before it finally went to pieces in January 1792.

Among the salvaged items were the ship's guns, with the exception of two carronades which had fallen overboard when the masts were cut down (Henderson, 1984:15). Captain Hunter made the decision to recover the armament in January 1791 (Henderson, 1984:15) and all the guns (save the two aforementioned) were said to have been 'hauled ashore with their carriages' (Henderson, 1984:15).

Two iron guns, mounted on reconstructed carriages, are located outside the Norfolk Island Administration building in the New Miltary Barracks. It is a long accepted belief that they were recovered from the *Sirius*, yet markings discovered on the trunnion of one of the guns by this author in 1985 (Henderson, Stanbury et al., 1985:88) raises doubt as to the validity of this assertion.

The following inquiry, therefore, is a preliminary attempt to assess whether or not these particular guns could have originated from the *Sirius* or have an alternative provenance.

2. Description of the Guns

During a feasibility study in 1983 (Henderson, 1984) and the first Australian Bicentennial Authority expedition to investigate the wreck of HMS *Sirius* in 1985 (Henderson, Stanbury et al., 1985), the two guns were examined, measured and drawn. As shown in Figure 1, the guns conform to the Blomefield pattern[1]. Yet it will be noted that both have an irregular shaped muzzle caused by a flattend area just in front of the muzzle astragal and fillets.

In 1976, the guns were flown to Western Australia for treatment at the Conservation Department laboratory of the Western Australian Museum. The guns had been painted with black enamel over red oxide primer and treatment was initially designed to remove the layers of paint. After removal it was observed that the two guns had:

> 'areas 9" (23 cm) back from the muzzle which [had] seemingly been machined in recent times as these areas (completely around the circumference and 2" (5 cm) in width [were] smooth compared to the rest of the cannon surface' (Owen, 1978:95)

It would seem therefore, that the mishapen appearance of the muzzles is the result of some mechanical interference to the guns, at some recent date

1 Major General Sir Thomas Blomefield, Bart., 1744-1822, was appointed Inspector of Artillery and Inspector of the Royal Brass Foundry at Woolwich in 1780: Blackmore, 1976:82.

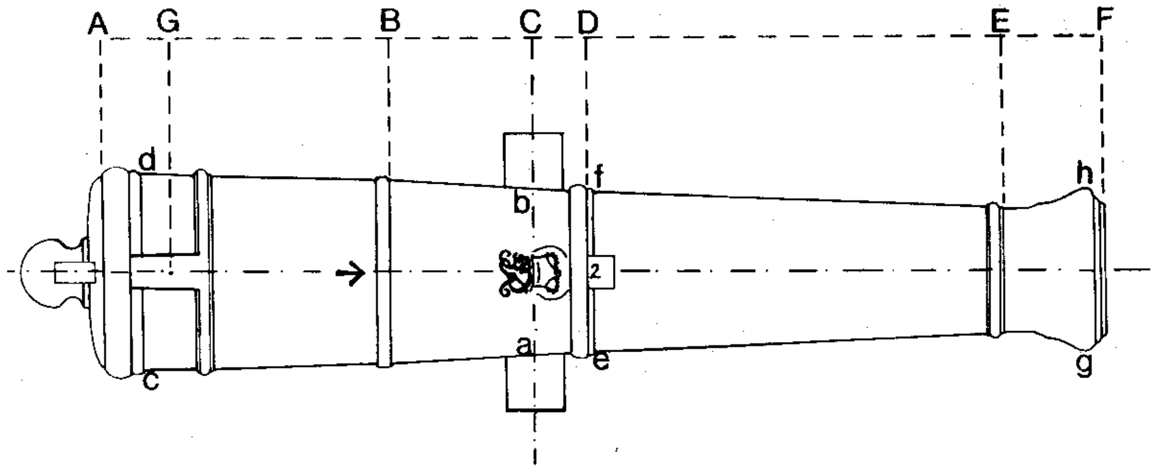

Figure 2. Standard dimensions of guns based on Boxer (1853).

though for what purpose is not yet clear. Both pieces have an overall length of 1.97 m (77.56 ins or 6 ft 6 ins) and an 'official' length of 1.835 m(72.24 ins or 6 ft)[2]. Other standard dimensions based on those specified by Boxer (1853) (see Fig. 2) are given in Appendix A. Both guns have a breech loop on the cascabel and vent patches drilled for a flintlock ignitor. Immediately in front of the first reinforce ring of each gun is an incised broad arrow and the second reinforce in each case bears the monogram of George III in relief. The foresight patch of one gun (NI 41) is incised 1, while the other gun (NI 21) is incised 2.

Apart from these markings, no others were initially identified when the guns were re-examined in 1985. In 1976, the guns had required extensive mechanical cleaning to remove surface scale and rust prior to being coated with anti-corrosion products. No mention is made however in the treatment report of any noticeable weight or other significant marks, but these may have been obscured by the heavy layers of paint and the degraded nature of the guns' surfaces.

By 1985, the two guns were in need of restoration treatment as they were suffering from surface corrosion, particularly noticeable in areas exposed to greatest sunlight (MacLeod, 1985:53). The previous protective coatings were removed and the surfaces of the guns restored with a microcrystalline wax paste which was coloured with lamp black. The treatment left the guns with an aesthetic (and protective) burnished appearance (MacLeod, 1985:53) subsequent to which, regular indentations were observed on the left-hand trunnion of gun 1 (NI 41).

Close observation and photography indicated that these were casting marks, normally expected on trunnions but previously unnoticed in this instance. The remains of three marks were visible, the upper indicating a number ending with the Figures 27; the middle indicating the name CARRON; and the lower the Figures 18( )3 (Fig. 3). The markings were further confirmed by another observer during the 1987 expedition.[3]

It was common practice for iron founders to mark the trunnions of their guns with serial numbers, the name or initials of the firm, the date of manufacture, the proof charge of the gun and so on. The discovery of these marks therefore, is significant to the identification of these particular pieces, but equally raises questions as to their age and therefore their exact provenance.

3. Discussion

The major question that arises from the trunnion markings of the Norfolk Island gun (NI 41) is that of the date of the piece. If, as it appears, the figures 18( )3 refer to the date of casting (1803), then it is difficult to argue a case for this gun having come from the wreck of the *Sirius*. If, on the other hand, this figure is disregarded as referring to a date, then the guns must be shown to conform to a size of gun documented as having been carried on board the vessel at the time of its wrecking.

3.1. Guns from the *Sirius*

Considering the second part of the question first, the *Sirius* was listed as being armed with 20 guns (Henderson, 1984:3), interpreted to be 'fourteen six-

2 The 'official' length is taken as the distance from the base ring to the end of the muzzle; Hughes, 1969:21.
3 The markings were examined independently by Sharon Towns, Conservator to the expedition.

Figure 3. Left-hand trunnion markings of gun No. 1 [NI 41].

pounder cannon and six six-pounder carronades' (Evans, 1975:3.2)[4]. Based on the actual recovery of a trunnion carronade from the *Sirius* wrecksite in 1985, the latter assumption may be deemed incorrect. Markings on the right hand trunnion of this piece indicate the serial number 37,953 followed by the proof charge mark 18P, indicating an 18-pounder carronade (Henderson, Stanbury et al; 1985:68-69; Carpenter, 1986:32). The calibre of 127 mm (5 ins) is also consistent with 18 pounder ordnance.[5]

Alternative documentary sources simply refer to the *Sirius* armament as being 'carronades' and 'six-pounders'[6] suggesting that only the long guns were six-pounders. The additional guns carried as cargo are said to consist of:

'Iron guns	4	twelve-pounders
	2	six-pounders
Brass guns	2	six-pounders'
		(Evans, 1975:3.3)

Discussing the fate of the various guns, Evans (1975) indicates that the guns carried as cargo were all landed in Sydney soon after the arrival of the First Fleet (1975:4.1). Of the ship's armament, eight guns were off-loaded at Dawes Point (Point Maskelyne) in 1788 before the *Sirius* sailed for the Cape of Good Hope for stores, but some of these were taken on board again on the vessel's return to Sydney.

Evans suggests that four guns were left in Sydney (1975:4.2) making the number of pieces on board the *Sirius* at the time of her wrecking six carronades and ten guns (1975:4.3). Of these, two carronades were lost on the wrecksite. Four guns saved from the wreck were taken on board the *Marquis Cornwallis* in 1796 (Evans, 1975:4.4) but whether they were guns or carronades is not known.

The ultimate fate of the *Sirius* guns has thus been a matter for speculation and conjecture for some time, no positive proof indicating the exact number of guns re-loaded on board at Sydney, or the type of guns taken by the *Marquis Cornwallis*. Even if the latter were six-pounder guns, six would have been left on Norfolk Island to be accounted for. If only two remain, what happend to the rest?

It may be concluded, however, that the guns carried on board were six-pounders, a type of gun favoured by the Royal Navy at that time (Hughes, 1969:111).

3.2. Comparison of the Norfolk Island Guns with Standard Gun Specifications

The dimensions of the Norfolk Island guns (Appendix A) were compared with standard specifications for six and nine-pounder iron guns as given by Boxer (1853) (Appendix B & C). In all save the calibre dimension (which is absent for the Norfolk Island guns), the measurements of the 6 ft six-pounder gun most closely approximate those of the Norfolk Island guns (Appendix C). Since calibre rather than length is the more significant variable in determining the poundage of a gun[7], an assessment of this dimension becomes important to the conclusive identification of the Norfolk Island guns as six-pounders.

It will be noted from the six and nine-pounder specifications (Appendices B & C) that, whereas the length of the gun may vary, the calibre (bore diameter), trunnion diameter and trunnion length are all constant and relate to the size of shot. Hence, a bore diameter of 110 mm (4.2 ins) corresponds to a proof charge of 9 lbs and a 93 mm (3.668 ins) diameter to a proof charge of 6 lb.

A significant point is that there appears to be a reciprocal relationship between the bore diameter and the diameter of the trunnions. Assuming this relationship to be constant, it may be deduced that the bore diameter of the guns on Norfolk Island are in the order of 90 mm (3.54 ins). An additional 3 mm

4 The assumption that the carronades were six-pounders appears to have been based on a statement by Judge-Advocate David Collins who refers to the 20 mounted guns as being 'but six-pounders': cited by Evans, 1975:3.2.

5 The Calibre of 18 pounder ordance is cited as 5.292 ins (134 mm) by Douglas (1855:90)

6 Letter from Governor Phillip to Secretary Stephens on 31 October 1789: cited in Evans, 1975:3.2

7 Variations in the lengths of guns was in part due to the principle that with equal charges, and guns of equal weight, but different lengths, the velocity of shot increased with the length of the bore. Experimentation in the 18th century, however, showed that the increase in velocity was relatively small (Douglas, 1855:101)

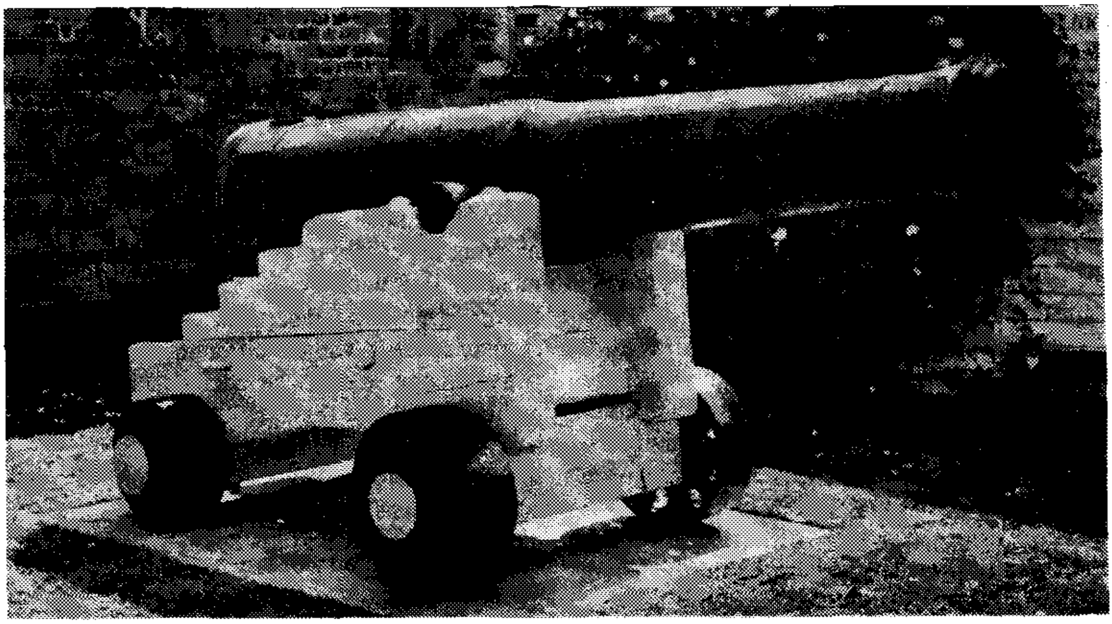

Figure 4. A 32-pounder Carron gun at the military fort at Queenscliff, Victoria.

allowance for wear would reasonably equate this measurement with those given by Boxer (1853) that is 3.668 ins (93.7 mm), for the calibre of a six-pounder gun.

Given that the dimensions of the Norfolk Island guns do comply with given specifications for six-pounder guns, it remains to consider whether the length of the gun bears any relation to its function.

3.3. Length and Function of Guns

The firing range of a gun was related to a number of factors which include the size of the charge; the calibre of the gun; and, the length of the bore. Guns of equal calibre but different lengths were thus used in different situations, depending on the practical merits of the particular piece.

Accordingly, guns were classified as Field pieces, Garrison pieces and/or Ship guns to indicate their function on land or at sea. The sizes of guns commonly used in the various categories are listed in tables published in the 18th century by Muller (1757) and Smith (1779)[8]

Iron Guns 6 pdr	Muller (1757)		Smith (1779)	
	Lgth ft. ins. [old]	Wt Cwt. q. lb	Lgth ft. ins.	Wt Cwt. q. lb
Field	4-6	4-3-10		
Garrison	6-1		6-1	12-0-0
Ship	7-0	7-1-14	8-0	19-0-0
Other			6-0	16-2-0
			6-6	18-0-0
			7-0	19-0-0
			7-6	20-2-0
			8-0	22-2-0
			8-6	23-0-0
			9-0	24-0-0

TABLE 1: English land and naval ordnance in use in 1756 (Muller) and 1764 (Smith). Compiled from various sources.

8 Tables reprinted in Blackmore, 1976:400-402; Edson, 1985:135, and Ruhge, 1983:101.

In contrast to Coast Artillery which could be fired from fixed and stable platforms, ship armament was often in motion on all three planes. In order to overcome the difficulties imposed by unstable gun platforms, therefore, ships' guns were customarily used at very short range (Hughes, 1969:112-113).

The iron six-pounder Ship guns were listed as being either 7 ft or 8 ft in length (Table 1) placing them in the mid to upper range of the six-pounder guns of the period. Field and Garrison guns, in contrast, were much shorter in length.

The Norfolk Island guns have an official length of 6 ft (72 ins), and are therefore shorter than would be expected for a Ship gun. Indeed, their length compares more favourably with the Garrison guns of 6 ft 1 in. According to Evans (1975:1.3), an iron gun in Macquarie Place, Sydney, (believed to have come from HMS *Sirius*) also has an official length of 6 ft 1 in and weighs 16 cwt 2 qrs 14 lbs. Again, this length corresponds with the length of a Garrison rather than a Ship gun.

Interestingly, Evans notes that a ship carriage constructed according to Steel's table of 1790 for a six-pounder would be too long and too 'low-slung' for this gun (1975:6.3; Fig. 3). A carriage was subsquently constructed based on data from Muller's *A Treatise on Artillery* of 1780.

The issues raised here are twofold. Firstly, if six-pounder Ship guns were either 7 ft or 8 ft in length, then Steel's ship carriage would have been designed to fit a longer gun, which it would adequately do. Secondly, John Muller was noted for designing guns which were considerably shorter than the standard (or "old") measurements of guns. Consequently, the Muller equivalent of a 6 ft 1 in (73 ins) six-pounder Garrison gun measured only 5 ft 3 in (63 ins) in length and a 7 ft (84 ins) Ship gun only 4 ft 4 ins (52 ins) in length.[9] It follows, therefore, that the carriages designed for "new pieces" or Muller pattern guns would have been correspondingly smaller than Steel's carriage.

The major consideration, however, is whether or not both the Norfolk Island guns and the Macquarie Place gun are in fact Ship guns or Garrison guns? If they were Ship guns, then the *Sirius* must have been carrying a shorter range ordnance than one would expect. Alternatively, shorter six-pounder guns were being used.

A National Gun Survey being undertaken by Green[10], lists only one six-pounder Carron gun. This has an overall length of 1.39 m (55 ins) and is therefore almost 2 ft shorter than the Norfolk Island guns in overall length (77.56 ins). No date is given for the gun, but it was recovered from the wreck of the wooden clipper ship *Young Australia*. This vessel, built in 1853, was wrecked off Moreton Island, Queensland, in 1872, having spent some years in the England-Australia passenger trade (Coleman, 1987:pers. comm; Loney, 1982:20). It is likely, therefore, that the gun dates at least from the time the ship was commissioned[11] or perhaps even earlier.

In 1839, the British Admiralty adopted a policy of unifying the calibre of guns carried as ship's armament in line with similar moves made by other European powers (Robertson, 1968:175-76). The reorganisation favoured different patterns of 32-pounder long gun, to be accompanied by small numbers of 8-inch shell guns. Old guns and carronades were "scrapped" in large numbers to give way to new ordnance. Hence, it is probable that these outmoded guns were readily available for use on merchant ships, such as the *Young Australia*.

3.4. Trunnion Markings

Among the guns registered by Green (10) from locations throughout Australia are ten smooth bore guns manufactured by the Carron Company of Falkirk, Scotland between the years 1797 to 1813. Of these, three are 32-pounders, six are 24-pounders and one is a six-pounder.

A 32-pounder located at the military fort at Queenscliff, Victoria, serves as a comparable example to the Norfolk Island guns. It is cast in the same Blomefield pattern and bears the same style of George III insignia and broad arrow (Fig 4). In similar fashion to the other recorded Carron guns, the left-hand trunnion bears a five figure serial number, the name 'CARRON' and the date (1810). On the right hand trunnion is the mark '32 P', indicating the proof charge of the gun.

It is significant that the serial numbers from all the recorded guns are five figure numbers, the first figure giving some indication as to the period of manufacture. Hence, serial numbers and dates have been recorded as follows:

Gun	Date	Serial No
SB 241b	1797	56719
SB 241b	1800	60756
SB 241b	1803	63911
SB 241b	1803	63914
SB 241b	1806	69990
SB 241b	1807	71242
SB 321b	1810	76260
SB 321b	1811	77836
SB 321b	1813	80837
SB 61b	?	?

9 See Table X in Rughe, 1983:101, reprinted from John Muller, *A Treatise on Artillery*, 2 nd ed., 1763.
10 Green, J.N., Western Australian Maritime Museum. This survey is being sponsored by a grant from the War Memorial Museum, Canberra.
11 Private vessels were frequently equipped with small arms. The Carron Company for example, was also a shipping firm and prided itself on having its ships completely equipped for defence: see Robertson, 1968:125.

The consistent presence of the serial number, name and date on the left hand trunnion suggests this was a standard manufacturing practice for this particular company. Accordingly, the Norfolk Island guns comply with this standard.

Unfortunately, it is difficult to accurately decipher the first three digits of the serial number on the Norfolk Island gun due to surface erosion. If these could be confirmed as being either '63-' (or possibly '64-') then the 1803 date could be safely assumed to be correct as such a serial number would be consistent with others of that period.

It is perhaps interesting to note that the earliest Carron gun recorded in Green's survey is dated 1797, (post-dating the *Sirius* wrecking by seven years). Many of the guns have been acquired by their present holders from undocumented sources, hence their original provenances and functions are not known. In some cases, however, the guns are reported to have been acquired for the specific purpose of coastal defence. Guns of 24 and 32 pound calibre were designed for Sea Service and Fortress use and were generally in the order of 9 ft or 9 ft 6 ins in length (Edson, 1985:135).

4. Conclusions

An attempt has been made to critically examine two iron guns on Norfolk Island with a view to establishing their accurate identification and the likelihood of them having come from the wreck of HMS *Sirius*.

Both guns have been cast in the Blomefield pattern, a style of gun common in the late 18th and early 19th century. Allowing for minor differences in surface erosion, the dimensions of the guns are essentially equal and both bear corresponding marks on the first and second reinforce.

Given that the guns on board the *Sirius* at the time of its loss are documented as having been 'six-pounders', the actual dimensions of the Norfolk Island guns have been compared with standard specifications in order to verify their size. The results of this comparison indicate the Norfolk Island guns do comply with the specifications of a six-pounder iron gun of 6 ft length.

While the confirmed poundage of the guns may support the view that the guns are from the *Sirius*, their length raises some doubt as to whether in fact they are Garrison guns as opposed to Ship guns. Eighteenth century tables indicate that six-pounder Ship guns were 1 to 2 ft longer than the Norfolk Island guns, and that the latter are more in keeping with the size of Garrison guns. As such, the guns would have had a land-based rather than a naval function.

Although the Norfolk Island guns are of similar length (if not style) to the iron gun in Macquarie Place, Sydney, (which is thought to originate from the *Sirius*), the same argument concerning length applies to this gun also. A 6 ft six-pounder gun was a relatively short piece, considering the longest were 9 ft in length. It is possible, however, that this was one of the six-pounder guns being carried on the *Sirius* as cargo and intended for use on shore to protect the new settlement. It could thus rightfully have been intended as a Garrison gun and its size would conform to this function.

Markings on the left-hand trunnion of one of the Norfolk Island guns clearly associate the manufacture of these guns with the Carron Company of Falkirk, Scotland. Remains of a serial number and a date are shown to be consistent with standard casting marks on the left-hand trunnion of other Carron guns from Australian sources.

Although the serial number is not fully identifiable, the figures '18( )3' beneath the word 'CARRON' are clearly discernible. Based on the comparative trunnion markings of documented Carron guns, it may be concluded that this figure refers to the year the gun was cast. This being so, the two guns on Norfolk Island cannot be deemed to have come from the wreck of HMS *Sirius*.

In order to further clarify these arguments and substantiate this conclusion, however, documentary sources relating to the history of Norfolk Island need to be reviewed with the aim of establishing the fate of the guns raised from the *Sirius* and the provenenace of the two iron guns presently situated on Norfolk Island.

APPENDIX A

Dimensions of Norfolk Island Guns

	metres	inches	Lengths	metres	inches
Length [official]	1.83	72.20 [6'0"]	AB	0.520	20.47
Length [overall]	1.97	77.56 [6'6"]	AC	0.790	30.91
Weight	17cwt	-	AD	0.880	34.45
Preponderance	N/A	-	AE	1.640	64.37
Charge	-	-	AF	1.835	72.24
Windage	-	-	FG	1.700	66.93
Diameter of bore	N/A [muzzle of guns covered with a wooden cap]		GL	0.160	6.30
			Diameters	metres	inches
Trunnions-diam	0.09 [90mm]	3.54	A	0.345	13.58
Trunnions - length	0.10	3.9	cd	0.358	14.09
Proof charge	- 6 lb		B	0.330	12.99
			ab	0.310	12.20
			D	0.305	12.01
			ef	0.280	11.02
			E	0.215	8.46
			gh	0.290	11.42
			F	0.220	8.66

Note: The weight marking of 17.0.0 was found on gun No.1 (N1 41) in 1987 on the underside of the base ring

APPENDIX B

Specifications for 9 POUNDER IRON GUN (Boxer, 1853)

	1	2	3	4
Length (Official)	8'6"	7'6"	7'	5'6"
Weight	28.5 cwt	26 cwt	25 cwt	18 cwt
Preponderance	2.759 cwt	2.357 cwt	2.125 cwt	1.607 cwt
Charge	3 lbs	3 lbs	3 lbs	3 lbs
Windage	0.12"	0.12"	0.12"	0.12"
Diameter of bore	4.2 [110 mm]	4.2	4.2	4.2
Trunnion diam.	4.2	4.2	4.2	4.2
Trunnion length	4.33	4.33	4.33	4.33
Proof of charge	9 lbs	9 lbs	9 lbs	9 lbs
Lengths (ins)				
AB	29.14	25.715	24.0	18.86
AC	43.71	38.571	36.0	28.29
AD	47.92	42.771	40.2	32.49
AE	91.2	80.5	75.25	59.3
AF	102.0	90.0	84.0	66.0
FG	96.48	84.435	78.48	60.75
GL	7.83	7.9	7.83	7.48
Diameters (ins)				
A	15.37	15.5	15.42	16.0
cd	15.27	15.4	15.33	14.85
B	14.45	14.58	14.5	14.02
ab	13.48	13.55	13.46	13.08
D	13.16	13.17	13.1	12.68
ef	12.49	12.53	12.46	11.97
E	9.72	9.76	9.72	9.44
gl	11.5	12.235	12.24	12.6
F	9.03	9.03	9.0	9.47

APPENDIX C

Specifications for 6 POUNDER IRON GUN (Boxer, 1853)

	1	2	3
Length (Official)	7'6"	7'	6'
Weight	21 cwt	20 cwt	17 cwt
Charge	2 lbs	2 lbs	2 lbs
Windage	0.118"	0.118"	0.118"
Bore diam	3.668 [93 mm]	3.668	3.668
Trunnions:	3.668	3.668	3.668
Length	3.8	3.8	3.8
Proof charge	6 lbs	6 lbs	6 lbs
Lengths (ins)			
AB	25.714	24.0	20.57
AC	38.571	36.0	30.86
AD	42.239	39.668	34.52
AE	80.448	75.314	64.51
AF	90.0	84.0	72.0
FG	84.96	78.952	66.97
GL	7.13	7.2	7.18
Diameters (ins)			
	1	2	3
A	13.95	13.92	13.96
cd	13.79	13.8	13.83
B	13.04	13.05	13.05
ab	12.09	12.14	12.11
D	11.84	11.86	11.8
ef	11.23	11.22	11.18
E	8.7	8.71	8.7
gh	10.475	10.81	11.46
F	8.05	8.08	8.08

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