REPORT TO THE TASMANIAN NATIONAL PARKS AND WILDLIFE SERVICE ON THE APRIL 1978 FEASIBILITY SURVEY OF THE SYDNEY COVE WRECK.

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Report - Department of Maritime Archaeology, Western Australian Museum, No. 9

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ACKNOWLEDGEMENTS

It is only fair to say that my part in the work done so far on the Sydney Cove wreck has been a small one. I advised Ken Atherton, during his stay in Fremantle prior to the April 1978 expedition, of appropriate equipment to be obtained, and acted as an advisor in Tasmania during the week long expedition to the site. But that expedition had been fully organised by the time of my arrival in Tasmania. Logistically the expedition was very similar to another visit to the site in October 1977, which had also been organised by the interested divers and the several interested Tasmanian institutions.

I have relied heavily on the Reports of Frank Ellis and Ken Atherton for the summary of early events.

The Tasmanian National Parks and Wildlife Service, and in particular Bob Tyson, have been very helpful in facilitating the preparation of this report.

My involvement in the project was made possible by the Western Australian Museum's placing me on loan to National Parks for the duration of the expedition.

I am indebted to Dr Neil North, Head of the Department of Materials Conservation and Restoration at the Western Australian Museum, for his information on the conservation requirement.

INTRODUCTION

In April - May 1978 the Tasmanian National Parks and Wildlife Service conducted a one week feasibility survey on the wreck of the Sydney Cove, with myself giving archaeological direction in an advisory capacity. The principal functions of this report are to briefly describe the archaeological activities carried out during that week and to point to new directions which might be taken in order to fully exploit the historical and archaeological potential of the site.

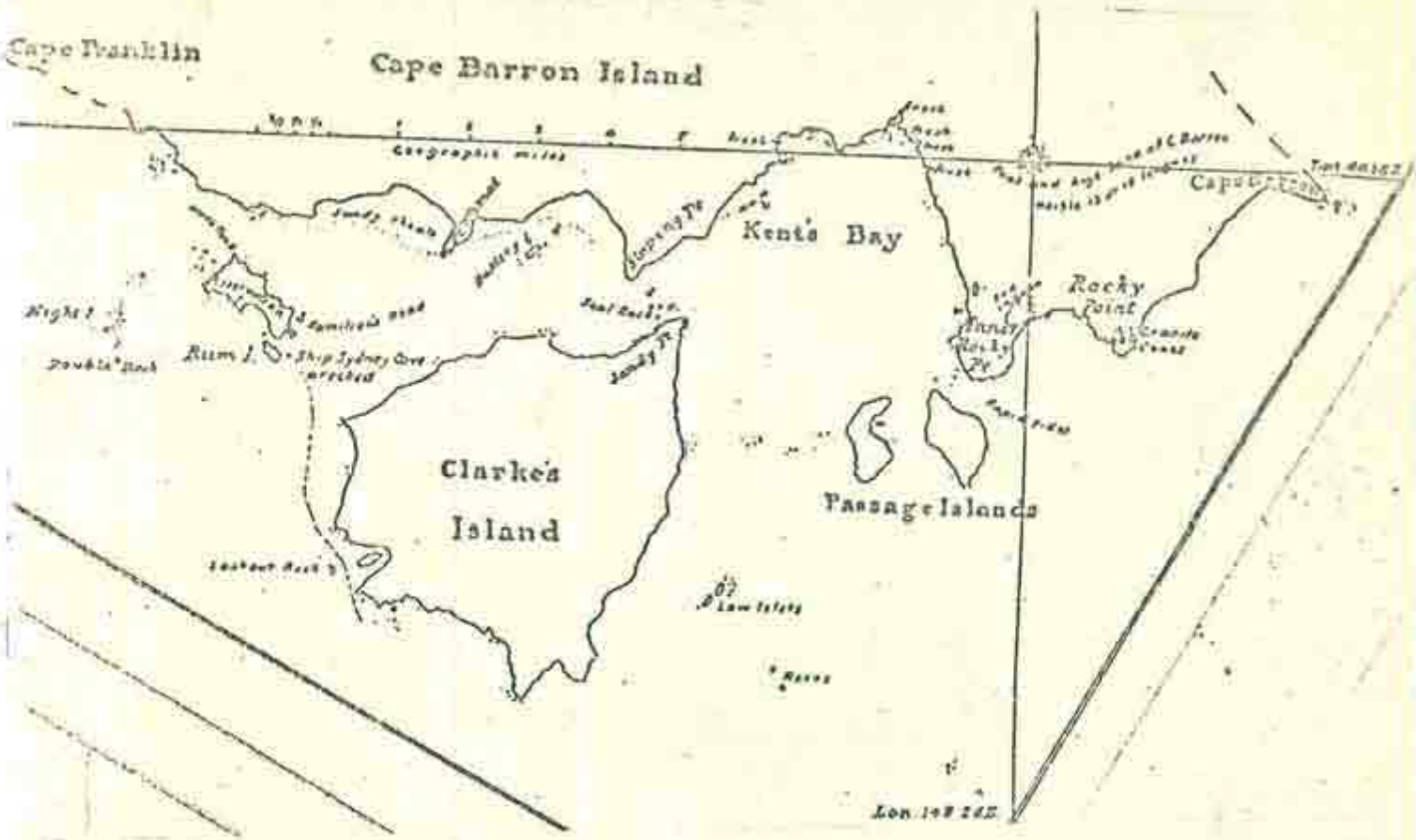
THE VOYAGE OUT

The Sydney Cove, a merchant vessel owned by Campbell, Clark and Company of Calcutta, sailed from Bengal under the command of Captain Guy Hamilton on 10th. November, 1796. She was laden with a speculative cargo of 7,000 gallons of spirits and a quantity of general merchandise, all intended for Port Jackson in New South Wales.

A month out of port the vessel experienced the first of a series of severe gales which were to buffet the ship for the remainder of the voyage, bringing damage to the rigging and causing leaks in the hull. The Indian crew suffered badly from the cold and two hands dropped dead under the continuous labour at the pumps.

THE WRECK AND THE AFTERMATH

On 1st. February 1797 the Sydney Cove rounded the South east corner of Van Diemens Land (Bass Strait being unknown at that time) and headed northward into more storms which made the ship leak at an accelerated rate. Some cargo was thrown overboard but the level of water increased to five feet in the hold, and the ship was settling fast as Captain Hamilton turned westward among the islands of Bass Strait in search of a safe place to run the ship aground. He stood in for Preservation Island, pressing on until she struck on a sandy bottom in 19 feet of water (Fig. 1).



(Fig. 1)

Flinders' chart of the Furneaux's Islands showing the track of the Sydney Cove.

The crew were safely landed on Preservation Island where a camp was established, and the men were employed in erecting tents, clearing cargo and food from the wreck and preparing the longboat for an ocean voyage.

Three weeks after the grounding the longboat, manned by 17 of the best of the crew, set out for Port Jackson to seek help, leaving about 30 people remaining at the site of the wreck. The Longboat was wrecked on the mainland coast some 220 miles south of Port Jackson, but all aboard got ashore and travelled along the coast. Fatigue and attacks by the aborigines reduced the number of survivors to three before they reached the settlement on 15th. May. As they trudged north these men discovered the first Australian coal, at a place called Coalcliff.

Soon after their arrival at Sydney the Colonial Schooner Francis was despatched for Preservation Island in company with the sloop rigged longboat Eliza. At the island the two vessels were loaded with cargo salvaged from the wreck, and the crew, and set a course for Port Jackson. However the Eliza was wrecked en route, and none of the men on board ever seen again.

A few months after the Sydney Cove had been wrecked Governor Hunter sent George Bass southwards in a whaleboat to discover Bass Strait and prove for the first time that Van Diemen's Land was a separate island. The opening of Bass Strait to shipping shortened the route to Sydney from the West by some 700 miles, and had a marked influence on the development of maritime trade to Australia.

The Francis sailed again for Preservation Island in February 1798, this time carrying Lt. Matthew Flinders. At Preservation Island scattered remnants of the ship and its cargo were found. Flinders surveyed the area and noted the presence of extensive herds of fur seals, which were to become the focus of a valuable export industry. The development of maritime industries in Bass Strait led indirectly to further depredations upon the wreck. In 1804 Governor King expressed concern about an American ship working in the area, whose crew were building a vessel from the Sydney Cove wreck and had erected a dwelling. King directed that if the Americans did not cease this activity then he would cause the King's mark to be put on the timbers of the vessel.

HISTORICAL SIGNIFICANCE

The Sydney Cove is one of the most important of Australia's shipwrecks.

It was the first merchant vessel to be wrecked in Australian waters after the establishment of the Colony. The cargo of rum on board the Sydney Cove represented the earliest form of extensive commercial activity carried out in the colony. Rum was at the centre of the far reaching social, economic

and political changes that were occurring in New South Wales at the time. The wreck itself is representative of the very beginings of trade between Australia and the outside world. It was the development of trade which enabled Australia to move from its limited status as a small convict outpost to become a colony of settlement, and eventually to become a nation.

The various sea journeys arising from the wreck of the Sydney Cove are also of considerable signigicance. These led to the recognition of Tasmania as an island and to the identification of important navigable channels through the eastern end of Bass Strait. The knowledge of the presence of fur seals near habitable islands caused the first European settlement to be made shortly after for the purpose of obtaining skins for export in accordance with a direction to generate income from the new colony. In other words, the attention drawn to the area by the wreck of the Sydney Cove led to the establishment of Australia's first export industry, and to the foundation of settlement in Tasmania.

DISCOVERY OF THE WRECK AND LEGISLATIVE PREPARATIONS

The position of the Sydney Cove wreck was charted accurately by Flinders, but as the timbers were gradually eroded below the waterline and the sand covered the wreckage over the years the site was forgotten.

The importance of any remains which might have survived from the wreck was recognised by the National Parks and Wildlife Service whose Scientific and Historical Advisory Committee considered legislative control over this and other marine relics in 1975. The introduction of Federal Legislation governing marine areas and the foreseen costs involved in implementing control over marine relics led to consideration of State legislation being set aside. In an appeal to the High Court of Australia on the validity of Federal control over previously State controlled areas, the Solicitor General for Tasmania referred to the historic marine wrecks as being regarded as highly important to the interests of Tasmania. In the absence of any specific State or Commonwealth legislation the only legal restraint to damage or loss of marine historic relics

was contained in the Commonwealth Navigation Act 1912-1973, which made no provision for the wrecks of special historic significance. The Federal legislation, the Historic Shipwrecks Act, 1976, was passed in December 1976. This Act applied immediately to the Dutch wrecks off Western Australia, and to waters off Commonwealth territories such as Norfolk Island, but requires a proclamation by the Governor General to declare the Act as applying to the coast of a State of Australia. Todate the Act has not been proclaimed for Tasmania.

The Sydney Cove was found on 1st. January 1977 by a group of divers whose main purpose was the production of a film about wrecks in Bass Strait. Leaders in the group appear to have been Messrs. L.Jensen, T. Clyne and K. Atherton, supported by N. Walkem, A. Clark and S. Beaston. The rudder was removed from the wreck partly because of a concern that the bronze fittings might be souvenired by other divers and sold as scrap metal. The rudder was taken to the Queen Victoria Museum in Launceston where it was received by the Museum's Director, Mr. F. Ellis. Other items accepted by the Museum included samples of wood, cane, lead, broken bottles, the top of a barrel and two pulley wheels.

After discussions with the Commonwealth Receiver of Wrecks the divers were informed that the relics could be held at the Queen Victoria Museum provided they received preservation treatment appropriate to expert advice, were not removed without the written consent of the Receiver of Wrecks, and would if required by the Receiver, be delivered to him upon demand.

On 29th. March 1977 a proclamation was signed by the Governor of Tasmania declaring the area in which the Sydney Cove wreck lies to be a State reserve under the National Parks and Wildlife Act, 1970 . The proclamation is administered by the National Parks and Wildlife Service (Fig. 2).

SCHEDULE II

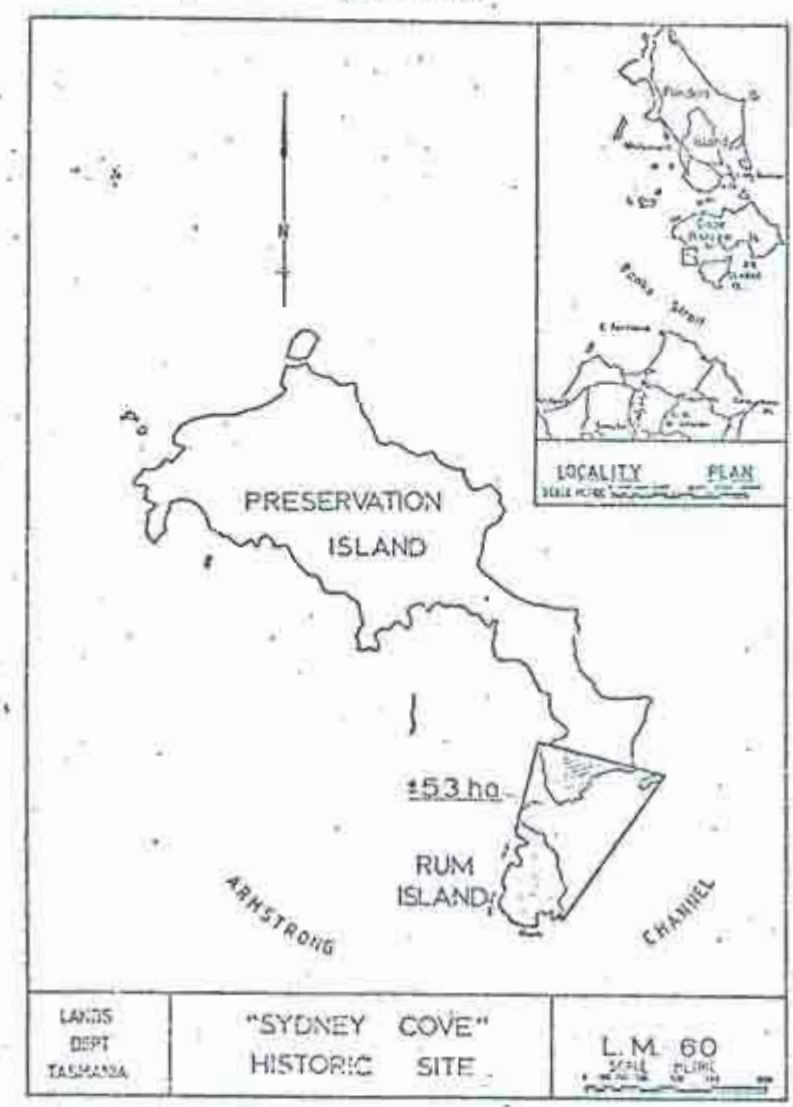


Fig. 2 - The area protected by Proclamation

EARLY WORK

Prior to the April 1978 Feasibility study there have been several exploratory diving expeditions to the Sydney Cove wreck. Of these the most important was a survey in October 1977 organised by the Queen Victoria Museum. The aim of the expedition, which involved four days of diving, was to expose and photograph the wreck.

Using Mr. B. Bensemann's fishing boat Tamalee as a diving and work platform, and Mr. V. Rautner's Jet Ejector Pump as a suction dredge for underwater clearing of sand, the four divers Messrs. K. Atherton, K. Trebilco, D. Carol and B.

Tyson (of National Parks and Wildlife Services) exposed sections of the site and measured two anchors and a cannon as well as some of the wooden structure of the wreck, including a section of the keelson and a mast step. A series of photographs were taken to illustrate individual objects and structure, and a survey was produced.

Subsequent to this expedition a report was compiled by Mr. Atherton and the other divers involved. This report indicated for the first time something of the archaeological potential of the site, outlining the considerable extent of the structural remains, describing the interesting context of the cannon and what appeared to be a gun carriage, and noting the presence of ceramics and glass on the site. The report was in itself testimony of the developing experience and expertise of the expedition members, who formed themselves into a body called the Tasmanian Underwater Research Group.

APRIL 1978 FEASIBILITY STUDY

The State Government of Tasmania made a special grant of $10,000 available through the National Parks and Wildlife Service to finance a feasibility study of the Sydney Cove.

The National Parks and Wildlife Service sent one of the Tasmanian Underwater Research Group, Mr. Atherton, to Western Australia to participate in fieldwork being carried out by the Western Australian Museum on the eighteenth century Dutch wreck Zeewijk and to see the work being done in the departments of Conservation and Maritime Archaeology at Fremantle.

Back in Tasmania work commenced on the construction of the baths to store in solution a cannon and two anchors. A one week feasibility survey of the wreck was organised on similar lines to that which had been conducted in October 1977.

a.) Aims

The principal aims of the expedition were directed towards survey rather than excavation. The one major exception to this rule was that the Tasmanian National Parks and Wildlife

Service were concerned that permanently exposed large items (a cannon and two anchors) should be raised because they were under threat from souvenir hunters. The first priority was to locate the keelson - if any of it had survived - and to expose the keelson for its full length to ascertain how much of the structure survived. Surveys of exposed material would then be carried out using triangulation and photography, while surveys of further material remaining hidden beneath the sand would be conducted using a magnetometer. Sample collection was to be limited. A secondary aim was to investigate with the magnetometer the areas on the island thought to have been occupied by the survivors. It was also hoped that the survey expedition would indicate the appropriate direction for the Tasmanian National Parks and Wildlife Service to take in terms of future work associated with this wreck.

b.) Logistics

Transport of personnel between Tasmania and Preservation Island was by a small charter aircraft belonging to Mr. R. Munro and the 32ft. fishing boat Tamalee owned by Mr. Bensemann. Most of the expedition equipment was also carried on the Tamalee. A larger vessel, the Flinders Trader, was employed to transport large objects from the site to Launceston. Transport between the camp on Preservation Island and the wreck site was provided by the Tamalee and an aluminium dinghy owned by Mr. Atherton.

Accommodation was provided on the island in a large shed owned by Mr. Bensemann, the lessee of the island. Some kitchen facilities were also provided in a converted bus in the same complex. Three expedition members slept on the Tamalee.

The Tamalee also served as a diving and work platform on site. The principal excavation tool, the Jet Ejector Pump, was situated in the well of Tamalee for the duration of the expedition. (Fig. 3 & 4.)

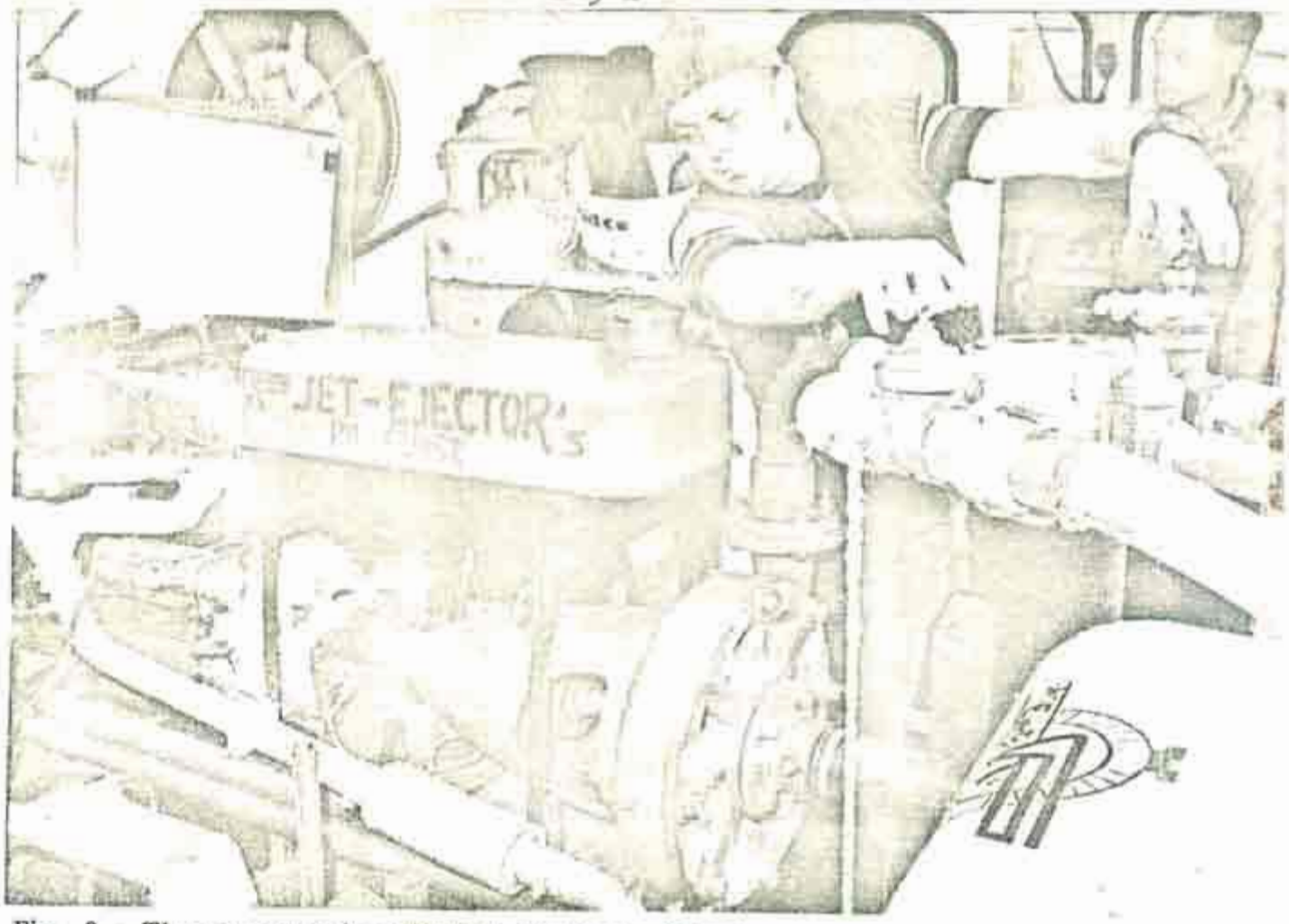


Fig. 3 - The pressure is adjusted. Photo K. Atherton

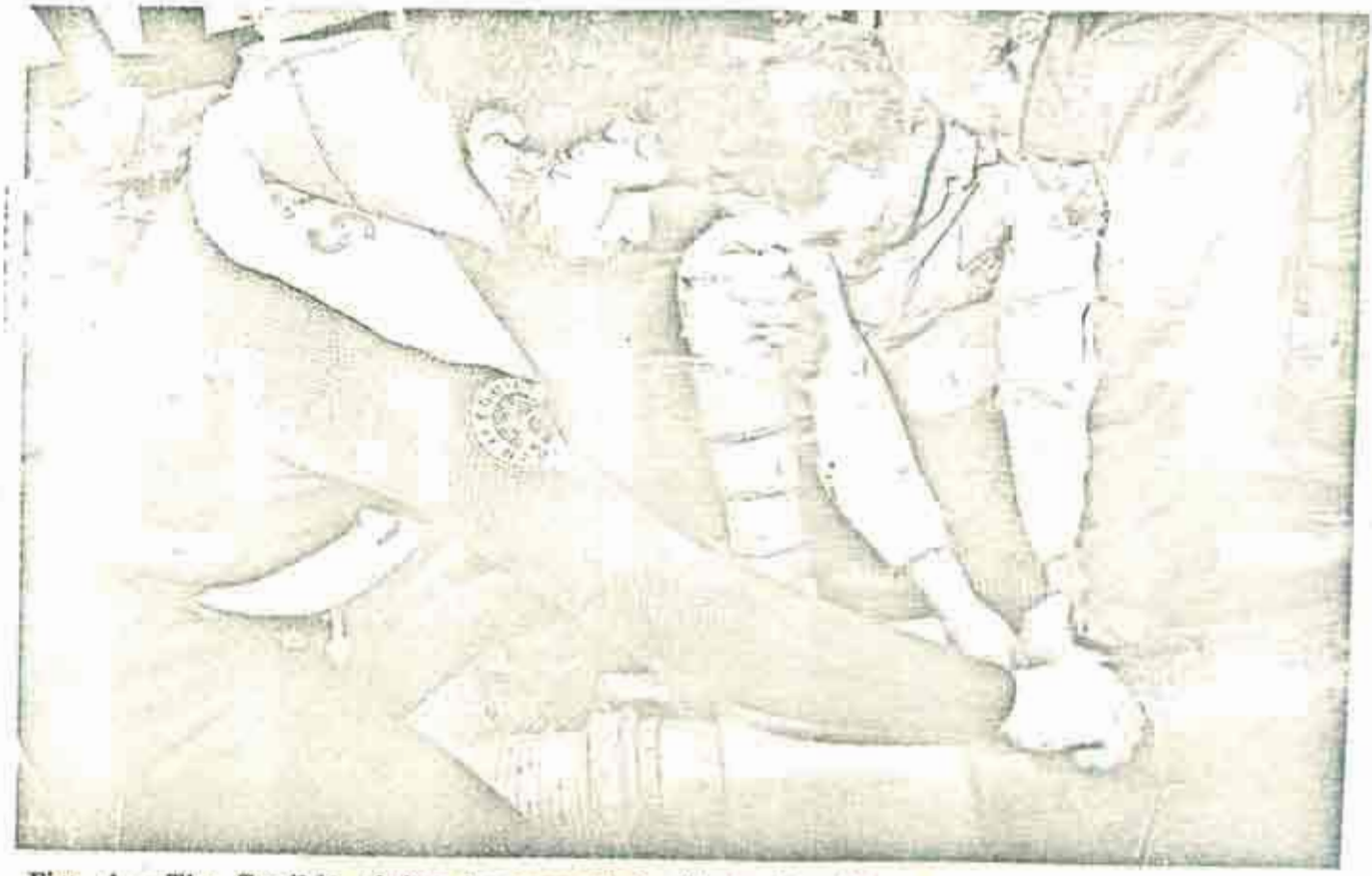


Fig. 4 - The flexible piping is assembled. Photo K. Atherton

A hookah (surface demand compressor) was stationed on the bows of Tamalee for use when necessary. The vessel also served as a briefing area and as a shelter and lunch point for resting divers. A second diving platform was provided by Mr. Atherton's runabout in which a hookah was permanently stationed. This provided the principal air supply without adding to the fumes in the Tamalee's well.

Communications with the mainland of Tasmania were maintained by the radio on Tamalee.

c.) Personnel

All of those involved in the October 1977 expedition were present: Mr. B. Bensemann skippering the Tamalee, Mr. V. Rautner maintaining his Jet Ejector Pump and Messrs. K. Atherton, K. Trebilco, D. Carol and B. Tyson providing their experience on site. In addition to this nucleus Mr. L. Jensen of the A.B.C. worked with above water filming and publicity, Mr. P. Mooney (National Parks) worked as a diver, Mr. J. Stockton worked on diving and registration, Mrs. K. Henderson cooked and assisted with registration, and Mr. P. Alexander worked as a diver. The National Parks and Wildlife Service had me flown across to Tasmania from Western Australia just prior to the commencement of the expedition to give archaeological direction in an advisory capacity. The expedition relied upon both paid and voluntary workers.

d.) Summary of Activities

29th. April: In the morning seven members flew from Bridport to Preservation Island, where the camp was set up. At 3.30p.m. Tamalee left Bridport, to arrive at Preservation Island at 9.45p.m.

30th. April: The pump was set up on the site and the clearing of sand from the wreck commenced, the principal aim being to find the keelson.

1st. May: Clearing of sand continued along the keelson to the mast step. The perimeter of ribs on the port side was also established. Star pickets were placed to form a reference system for survey work.

2nd. May: Two anchors and a cannon were exposed for survey. These were triangulated into the grid reference system. Clearing of keelson beyond the mast step was halted when the increasing concentration of artifacts meant that further clearing would disturb the site. An anchor was wrapped with rings of rubber sheeting in preparation for raising.

3rd. May: Bad weather prevented work being done on clearing, survey or anchor raising so diving was abandoned and preliminary tests with the magnetometer were done on the island.

4th. May: An anchor and a cannon were raised and relocated in deeper water. Triangulation of ship's structure commenced.

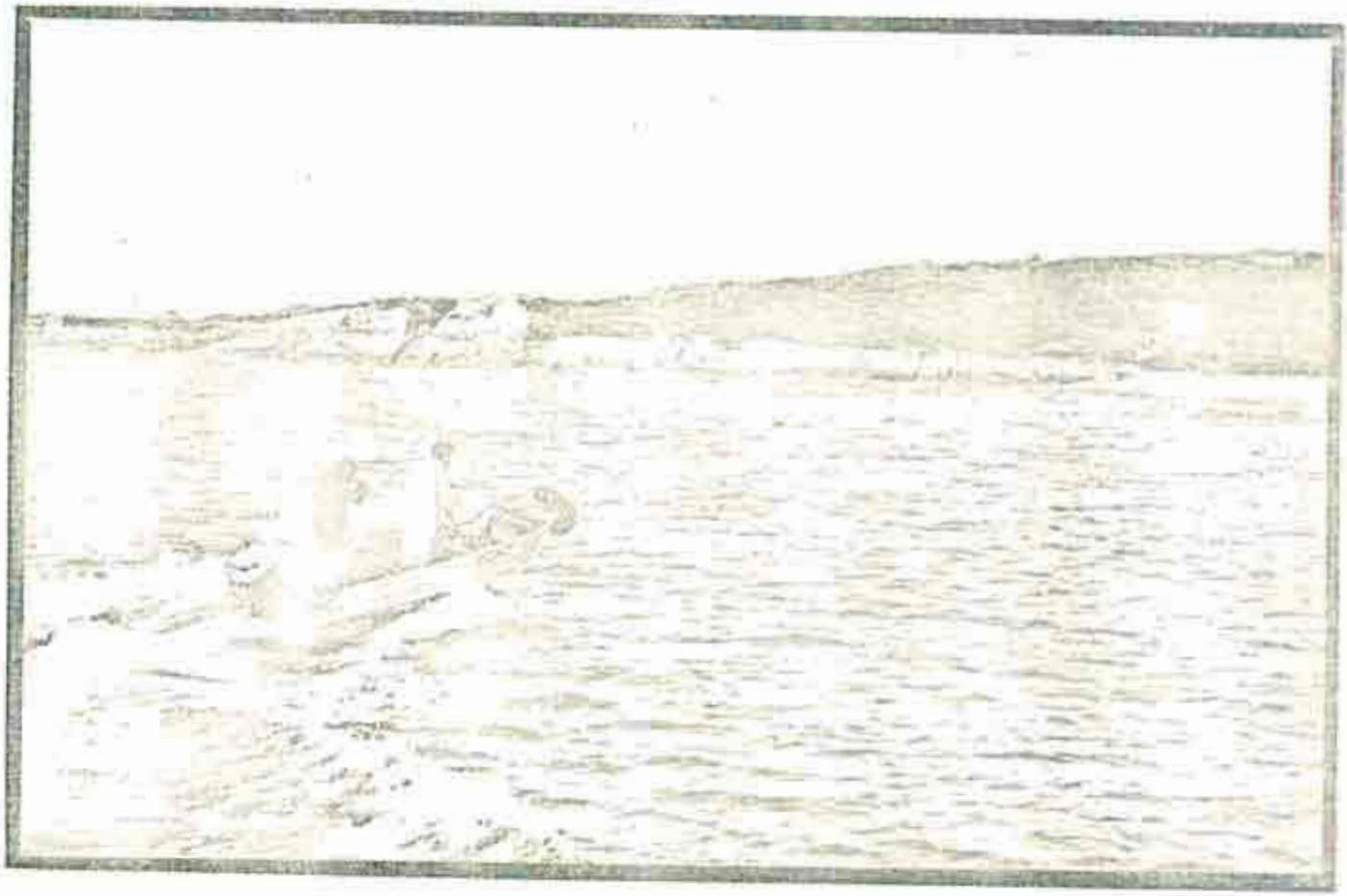
5th. May: The anchor and cannon were taken aboard the Flinders Trader which left for Launceston. Triangulation of the site was completed and followed by photomosaic runs of all the exposed structure. Re-filling commenced with the cannon area and continued on to the main site.

6th. May: Re-filling of the site continued while a magnetometer survey was in progress off the starboard side of the wreck. In the afternoon the pump and survey equipment were removed from the site.

7th. May: The expedition camp was closed down and members left for Bridport after carrying out a magnetometer survey of the area known as the survivor's camp.

E.) Description of Site Prior to Survey

The site is located between Preservation Island and Rum Island in a bay sheltered from the north, the west, and to some extent from the south-east. (Fig. 5). Ocean swells



(Fig. 5) The view towards Rum Island from the wreck site.
Photo G. Henderson.

from the south and the west do occasionally affect the site however, and diving had to be abandoned on one day of the survey because of the sea conditions.

The tides are strong, the main movement of water coming from the west through the narrow channel between Preservation Island and Rum Island. This sometimes made returning to the workboat in the evenings difficult for the divers and survey work had to be arranged accordingly. The wreck lies buried in sand on a gently sloping bottom at three to four metres depth of water. Sea grass covers part of the site, and this stabilises the sand in the area. Visibility was excellent at times, but cloud and tide rushes reduced the number of hours suitable for photography on site.

F.) Methodology on Site.

i. Exposing the Site.

The Jet Ejector Pump was powered by a Holden 179 six cylinder petrol engine. The pump forced water through two fire hoses at 75lbs. per cubic ft. to the sea bed where 'T' junctions fitted with vanes provided a suction at the working end of heliflex tubes of four inch diameter. The same pump was used to provide a small water jet on the sea bed.

The two suction tools were used to suck sand from positions being exposed, through the heliflex pipe to spoil dumps off the wreck site. The water jet threw spoil a shorter distance and created suspension clouds in working areas, so it was not used for heavy clearing operations. Two spikes on the mouth of the suction tools were intended to prevent artifacts from accidentally being sucked through the dredge. The pump was sufficiently powerful for the two dredges to be used simultaneously on the site. Care was taken to direct spoil down-current to avoid immediate refill of the site by settling of suspended material (Fig. 6).

Fig. 6 - The dredge is used to expose starboard floor planking. Photo: K. Atherton

Clearing commenced at the forward end of a major timber which soon proved to be the keelson. This was exposed for a length of 15 metres. Moving towards the stern of the ship the sand covering the keelson grew deeper, and the concentration of artifacts became heavier. For both these reasons clearing of the keelson ceased at the first mast step. The dredging then followed the extremities of individual ribs on the starboard side of the vessel to ascertain the perimeter of the site. A third area cleared was that of the anchors and cannon.

On completion of the recording and lifting operations the dredges were used to direct spoil back on to the site from the spoil dumps and other sandy areas. This was essential to protect the site from the effects of currents and rough seas, as well as the attacks of marine organisms and souvenir hunt-

ing divers. Two days of re-filling were necessary to cover the site after the first three days of clearing.

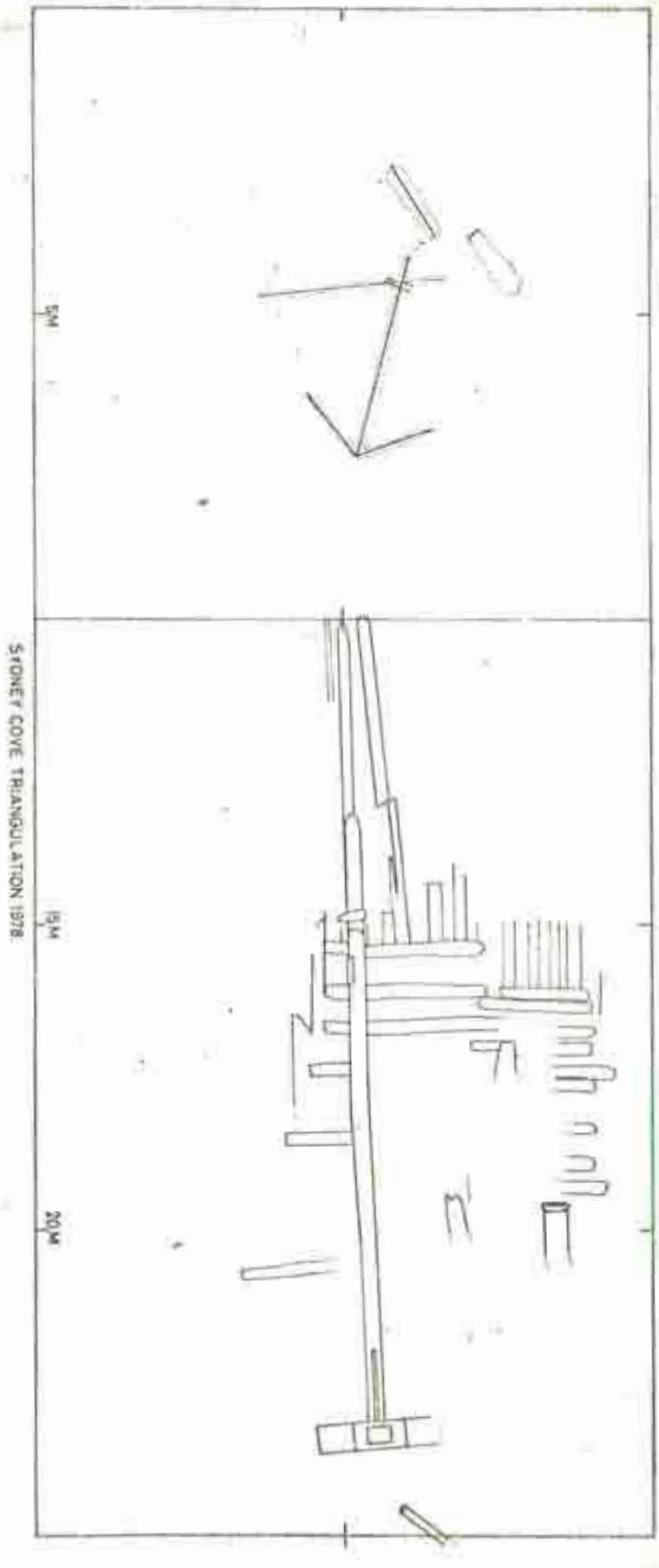
ii. Triangulation

Once the axis of the keelson had been established star pickets were set up at five metre intervals on either side of the site to form by triangulation a rectangle 10 metres wide by 25 metres long, starting at the forward end of the keelson. Then a survey line was laid around the star pickets enclosing the first five metres of the keelson and a sketch made underwater on plastic drafting film of all the structural features which had been exposed, including the keelson, ribs and hull planking. The points to be located were then numbered on the sketch and triangulated. A selection of 20 points had numbered plastic markers tacked on to the structure. (Fig. 7).

(Fig. 7) Ribs are marked with square tags, while the triangulation markers are round. Survey lines delineate the areas. Photo G. Henderson.

This procedure was repeated at five metre intervals until an area 15 metres by 10 metres had been triangulated. More star pickets were then set up forward of the beginning of the keelson, and the anchors and cannon were incorporated in the survey. At the close of the expedition the star pickets comprising the basic grid were left in position to

. provide reference points for future work on the site (Fig. 8).



(Fig. 8) The triangulated survey.

iii Photography

Several Nikonos underwater cameras were available on the expedition, with 15mm, 28mm and 35mm lenses. All camera carrying divers recorded, wherever the opportunity arose, general shots showing techniques employed, detail shots of structural aspects, and shots of specific items found on the site in context. Visibility for photographic recording was variable: cloudy conditions generally prevailed, and the tide sometimes brought suspended material from the dredge spoil back on to the site. Nevertheless the conditions for photography were excellent on 4th. May.

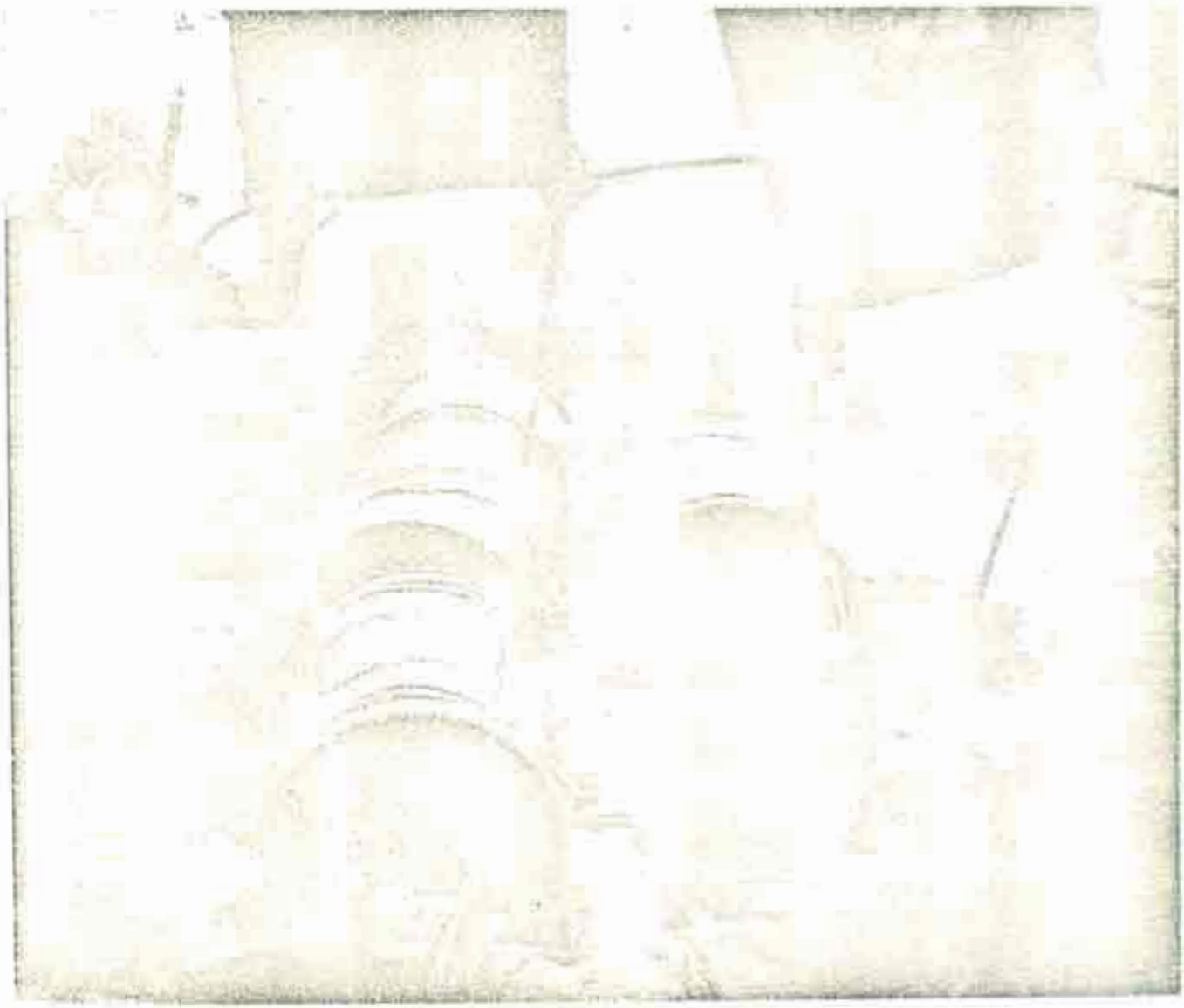
On that day a photomosaic coverage was obtained of the area (15 metres by 10 metres) bounded by the star pickets. Survey lines were laid across the site at one metre intervals and a three metre cross laid on the starting end of the first survey line. The flight then commenced along the first survey line at a height of two metres with exposures at every metre. The cross was shifted forward regularly to ensure a two dimensional scale in each shot, and the plastic numbered positions tacked on to various structural features were designed to link up the triangulated survey with the photomosaics. The photomosaics could then be used to add detail to the triangulated survey.

This procedure was repeated at one metre intervals along the 15 metre length of exposed keelson. It was intended that the measuring cross provide the necessary data for the re-orientation under the enlarger of negatives which were not truly vertical.

iv. Raising Operations

Prior to the commencement of dredging on the wreck two anchors could be seen exposed on the seabed. In addition a cannon, attached to what appears to be a gun carriage, lay shallowly buried under the sand beside the anchors. The National Parks and Wildlife Service and the Queen Victoria Museum were both concerned for the security of the two anchors and the cannon. Before the feasibility survey started, work

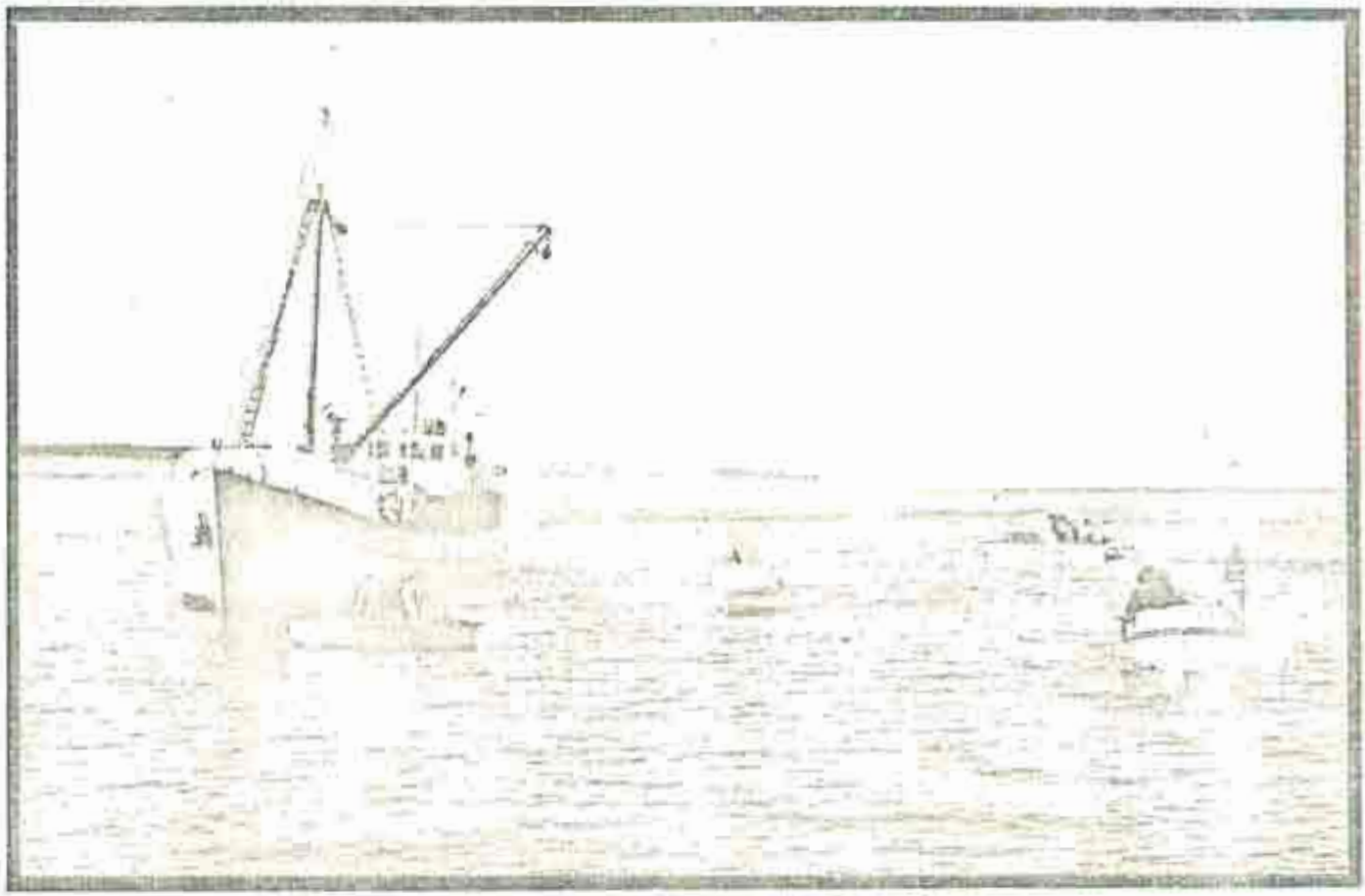
had commenced on the construction of tanks to hold these items when raised. Dredging in the area soon showed that one of the anchors could easily be freed from the seabed, being only lightly attached to the complex concretions of wreck material in the area. The small contact points were chipped clear without damage to the anchor, and then the entire object was enveloped in a roll of plastic sheeting, designed to prevent chemical deterioration of the anchor before treatment. Then a series of lifting points were selected and wrapped with rubber sheeting prior to the attachment of rope strops for lifting. (Fig. 9)



(Fig. 9)

The drums are filled with air.
Photo K. Atherton.

In the absence of lifting balloons six 200 litre steel drums were used for this operation. When the weather and tide permitted, the anchor was floated to the surface and shifted into deep water in readiness for lifting aboard the Flinders Trader. (Fig. 10)



(Fig. 10)
The Flinders Trader raises an anchor on board.
Photo G. Henderson.

The second anchor was heavily embedded in the concretion surrounding the gun carriage. As the expedition schedule did not allow the time for the prolonged delicate chipping work necessary to free this anchor it was left undisturbed.

The cannon was likewise heavily concreted to the gun carriage and so could not on that occasion be chipped free without the likelihood of damaging other material. The expedition was not equipped to either raise or conserve the gun carriage with its complex concretions, and was left undisturbed.

While clearing the anchors a second small cannon was exposed. The gun was found to be entirely free of any concreted contact points with the seabed. As the gun could clearly be raised without damage to itself or the surrounding material it was lifted in place of the first cannon. Two drums were sufficient to float the gun in like manner to the anchor.

Clearly the raising of one anchor and one cannon does not entirely solve the problem of security for the remaining items against souvenir hunters. Nevertheless the publicised raising of one gun, in the absence of publicity about two guns, should discourage at least some of the potential souvenir hunters. Secondly, it would not have been wise to raise the complex structure associated with the first cannon in the absence of appropriate excavation and conservation facilities.

The anchor and the cannon were winched from the water on to the Flinders Trader and transported wet to the reservoir overlooking Launceston, where they were placed in water (still wrapped in plastic) to await the completion of the conservation tanks.

Other than these two heavy objects, few items were rqised from the site. Sample fragments of glass bottles (both the typical cylindrical shape and the square sided case bottle shape) were found beside the keelson and raised. One complete cylindrical bottle was also raised. Sample collections of non ferrous sheathing tacks and fastening [illegible] beside the keelson were also raised, together

with a number of concretions, a piece of bamboo and ceramic fragments from beside themast step.

In order to expose the keelson some items had to be shifted. A great number of small logs of wood (generally termed 'dunnage') were found above the keelson aft of the mast step. These were packed into a potato sack and reburied in the hole left by the cannon which had been raised, thus preventing their dispersal or deterioration. The position of these bags is recorded on the survey.

Quantities of well preserved rope were also exposed, including a heavy cable and a plaited boat fender. In each case the dredge was removed from the area, photographs taken and sand replaced over the items in situ to prevent damage. Aft of the mast step a number of shoes were found on top of the keelson. Several of these were gently moved to one side on a slate and re-buried, but when more shoes were exposed the dredging of the keelson was abandoned.

v. Examination of Structural Features

The examination of the hull of the Sydney Cove wreck indicated a lightly built vessel, which compares closely in many aspects with the hull of the 107 ton snow brig James Matthews, which was excavated in Western Australia (Henderson, 1976).

The keelson of the Sydney Cove was uncovered for a length of just over 15 metres. For most of this length the keelson was surmounted by a rider keelson - a longitudinal beam of roughly the same width as the keelson. The rider keelson was 24cm in width, compared with 23cm on the James Matthews' keelson. On the upper surface of the rider keelson a number of longitudinal grooves were to be seen. (Fig. 11).

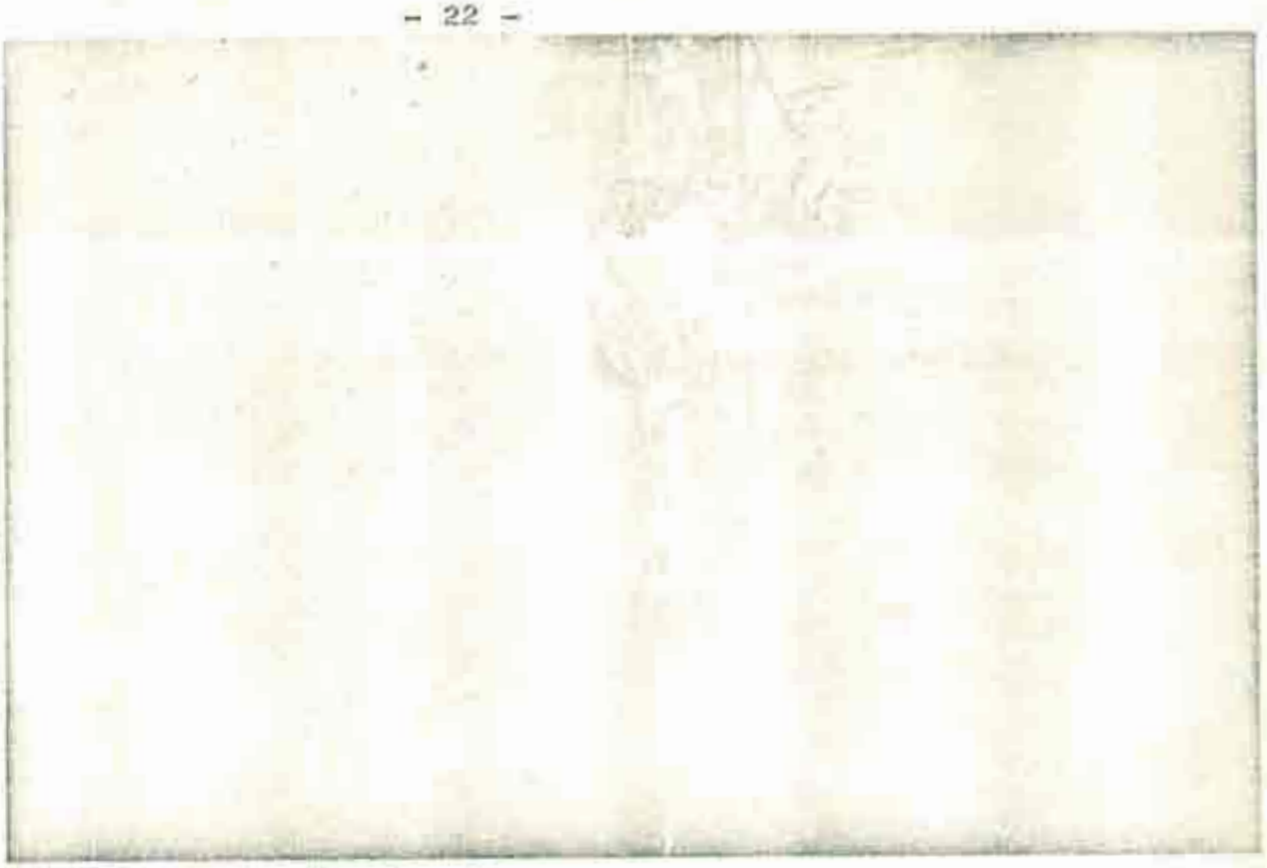


Fig. 11 - The groove for the staunchion post in the centre of the keelson.
Photo: G. Henderson

Looking at the piece from above it measured approximately 1.00m by 0.25m, while the groove to accept the tenoned heel of the 'mast' was 0.16m by 0.12m (the length of the groove running across the keelson). The 'mast step' was not cleared sufficiently to be able to be certain that it is bolted into position in this orientation to the ship. If so it is most unusual. A slightly similar piece has been located on the wreck of the British frigate Dartmouth, lost in 1690 (Martin, 1978). On that wreck the piece appears to form a large transverse rider, with a groove to accept the tenoned heel of an upright pillar under a gun deck beam. (Fig.12& .13

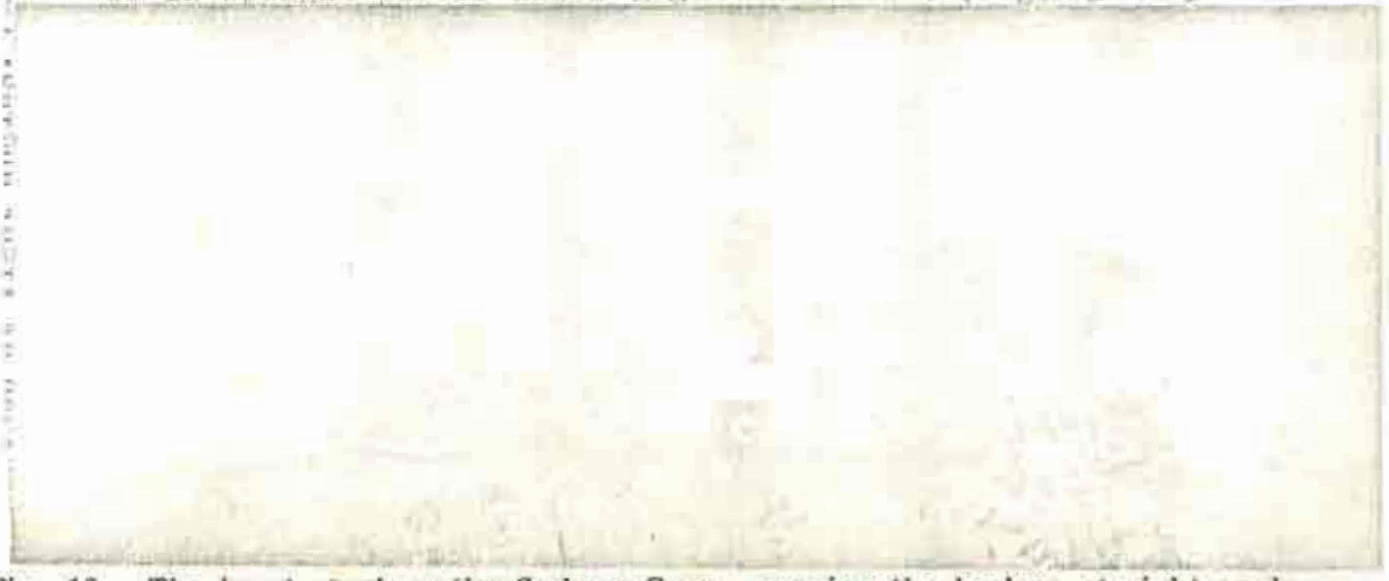
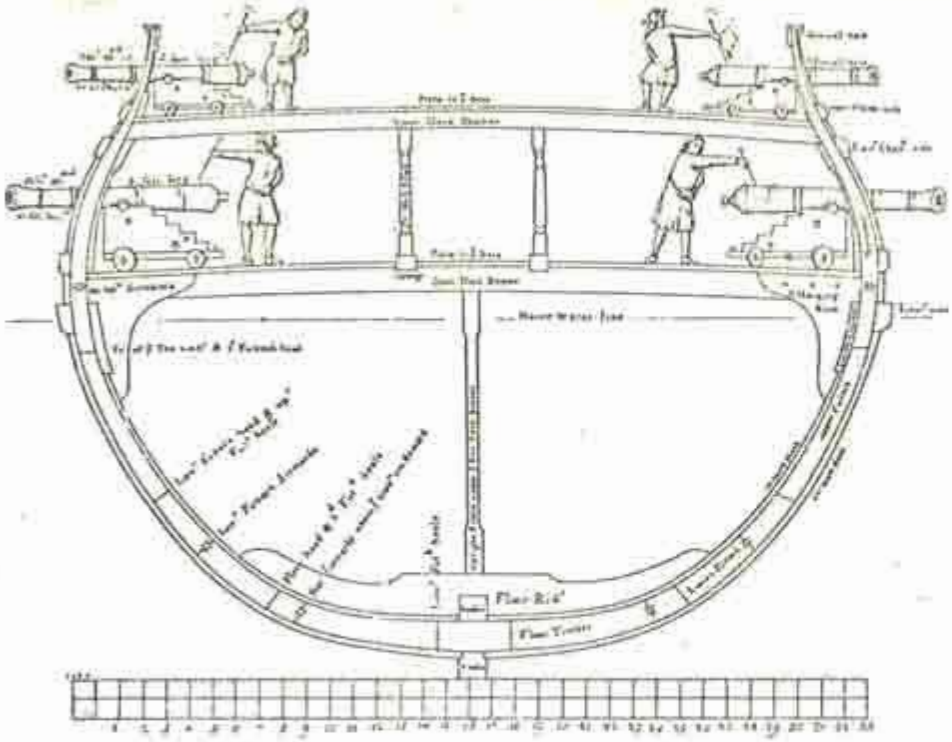
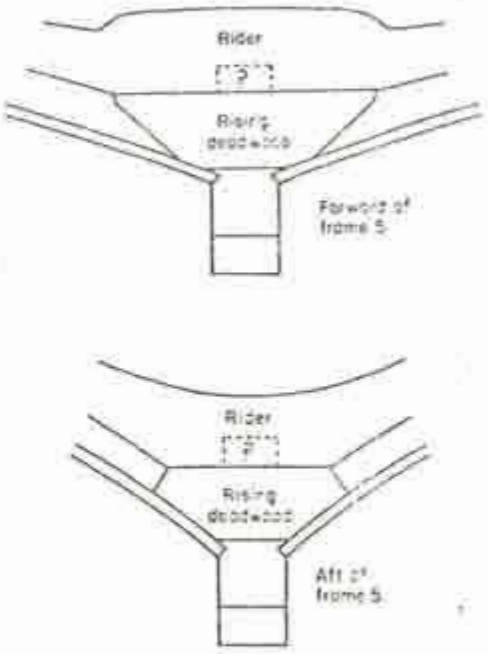


Fig. 12 - The 'mast step' on the Sydney Cove, crossing the keelson at right angles.
Photo: G. Henderson



. Keltridge's midships section of a small warship, 1684, redrawn for clarity. Note the overlaps on the joints between paired frames, and the use of floor riders.

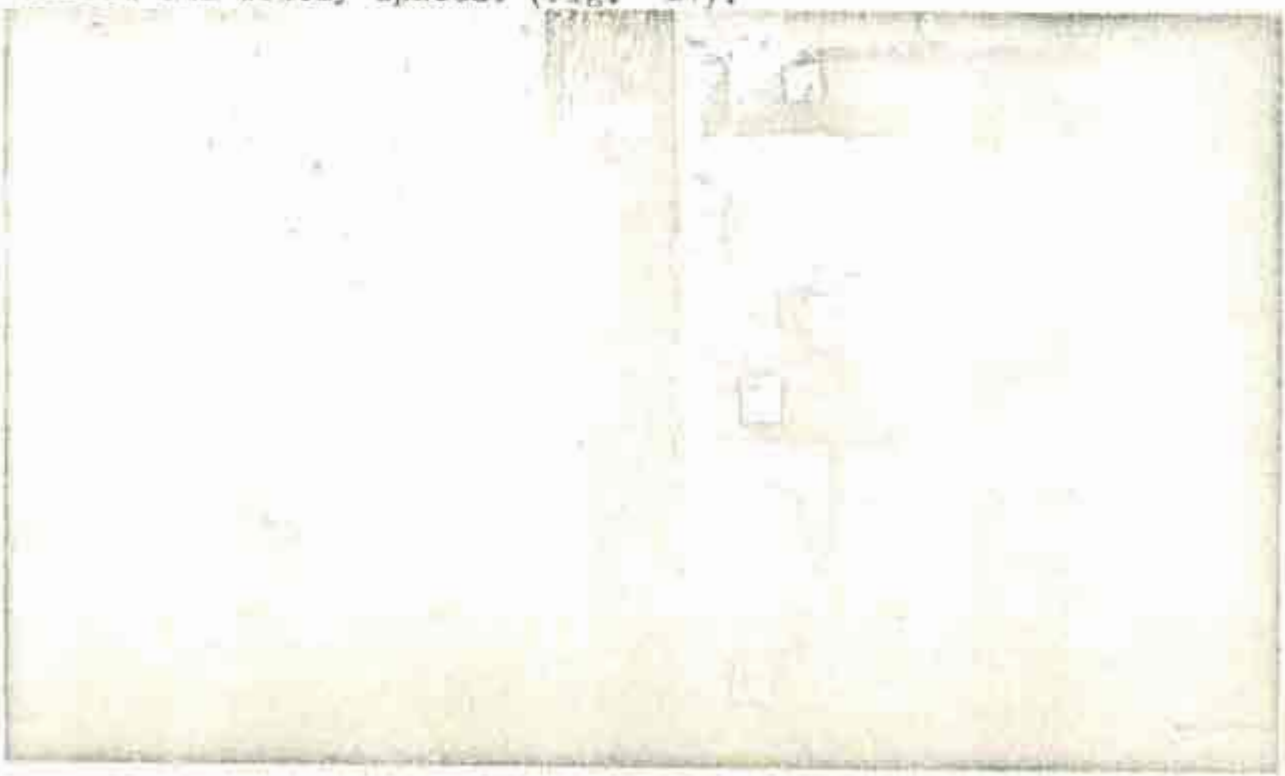


Suggested arrangements of the lower frame sections fore and aft of frame 5.

(Fig.13) Two illustrations from Martin showing the floor rider

A small knee which had butted on to the Sydney Cove's keelson and 'mast step' was removed on a previous expedition.

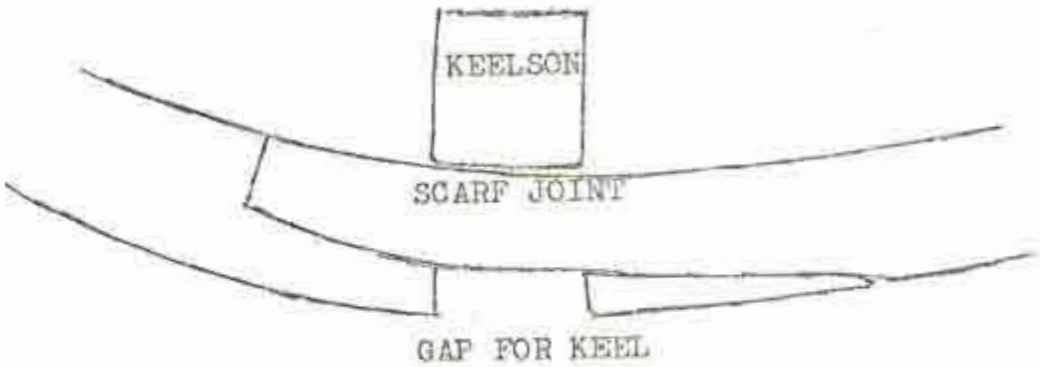
The ribs measured on the Sydney Cove were relatively narrow and widely spaced. (Fig. 14).



(Fig.14)

Ribs four, five and six (see plan) with gaps of 39cm. Photo. G. Henderson.

The rib width at the keelson was 21cm (compared with 16cm on James Matthews) and the space between ribs was 39cm (compared with 16cm and less on the James Matthews) The James Matthews was double framed, so the extra rib in each case meant that effectively the gap of 16cm was only between every second rib, making a much more heavily built vessel than the Sydney Cove, which has only single ribs at the keelson. While the floor ribs are single the futtocks - middle timbers between the floor and top timbers - overlap side by side with the floor timbers for part of their length and may be double. On the other hand it may be merely a more simple jointing than the commonly used butt chock system. On the starboard side of the vessel ribs were traced to over four metres of their length. Some floor timbers were joined by a scarf joint extending over the keel, with a gap in the lower half of the joint to leave room for the keel (Fig.15)



(Fig. 15)

A sketch of the joint on rib three. Not to scale.

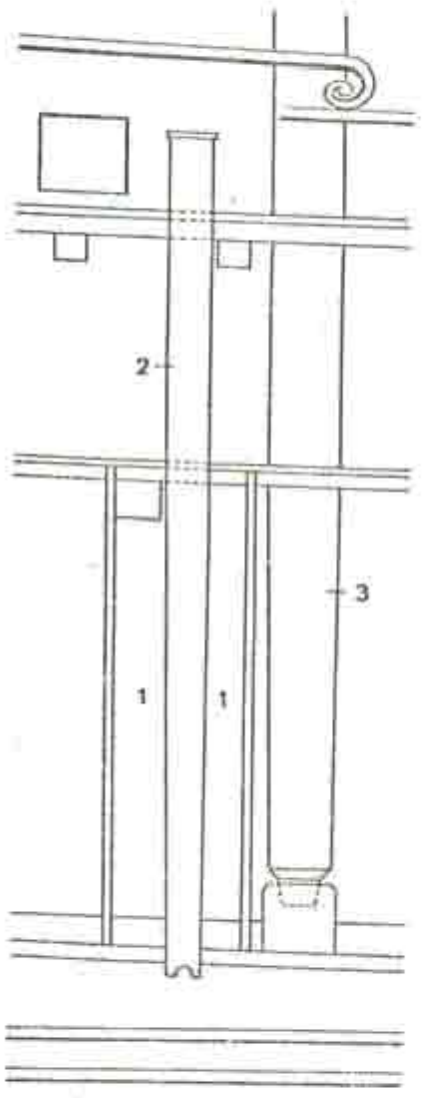
The Sydney Cove does not have inside (ceiling) planking on the hull. The thickness of the outside planking was 7cm (compared with 9cm on the James Matthews. However the James Matthews was provided with ceiling planking of 7cm, making a total thickness of planking of 16cm.) A single planked hull is weaker and required additional measures for the protection of cargo.

The survey of the Sydney Cove did not show conclusive evidence of sheathing on the vessel's planking (only the inner surface of the planks was exposed) but numerous small fragments of corroded copper, and many brass sheathing tacks scattered about this site were a positive indication. Well made brass nails found among the timbers were presumably for fastening planks on to ribs, and iron bolts were used to hold the frame together.

The Sydney Cove was furnished with one of the old round wooden suction pumps. These pumps were operated by a lift action on deck and represented back breaking labour for the crew. In merchant vessels, where even a small quantity of water might cause damage to the cargo when the ship heeled, the lower futtocks were often cut off short of the keel to facilitate the flow of bilge water to the lower end of the pump barrel. The upper end of a pump barrel was located on the Sydney Cove. (Fig. 16)

A cylindrical timber of approximately one metre in length and 0.15 metres in diameter lay close to the 'mast step'. This piece showed indications of wear from cables, and may have been associated with a windlass.

Clearing of the cannon associated with the gun carriage ceased when it became obvious that the complex should not be raised without extensive preparations. However Report No.2 gives a description of this material as surveyed in October 1977.



(Fig. 16) Pump well in a merchant ship of 1805 (from Steel's Shipwright's vademecum). 1. pump well, 2. pump, 3. mainmast. Note that the short mast step may indicate a transverse orientation.

vi. Magnetometer Survey

A seagoing proton magnetometer was used to conduct a search for iron concentrations in an area 15 metres by 10 metres immediately off the port side of the basic wreck site gridded rectangle. Every two metres a survey line was run out for 10 metres. A diver then swam along the lines with the magnetometer 'fish' on a long cable, stopping every two metres for a recording to be taken. The magnetometer console was positioned aboard the Tamalee. In order to prevent interference from metallic objects worn by the diver the diver remained on the surface and dangled the fish just above the seabed for each recording. The readings flashed on to a digital screen on the magnetometer console at two second intervals and were noted on paper by the operator. Within the area surveyed four targets were indicated along one survey line, showing a large concentration of iron in that area. (Fig. 17) Lack of time prevented any widening of the search area.

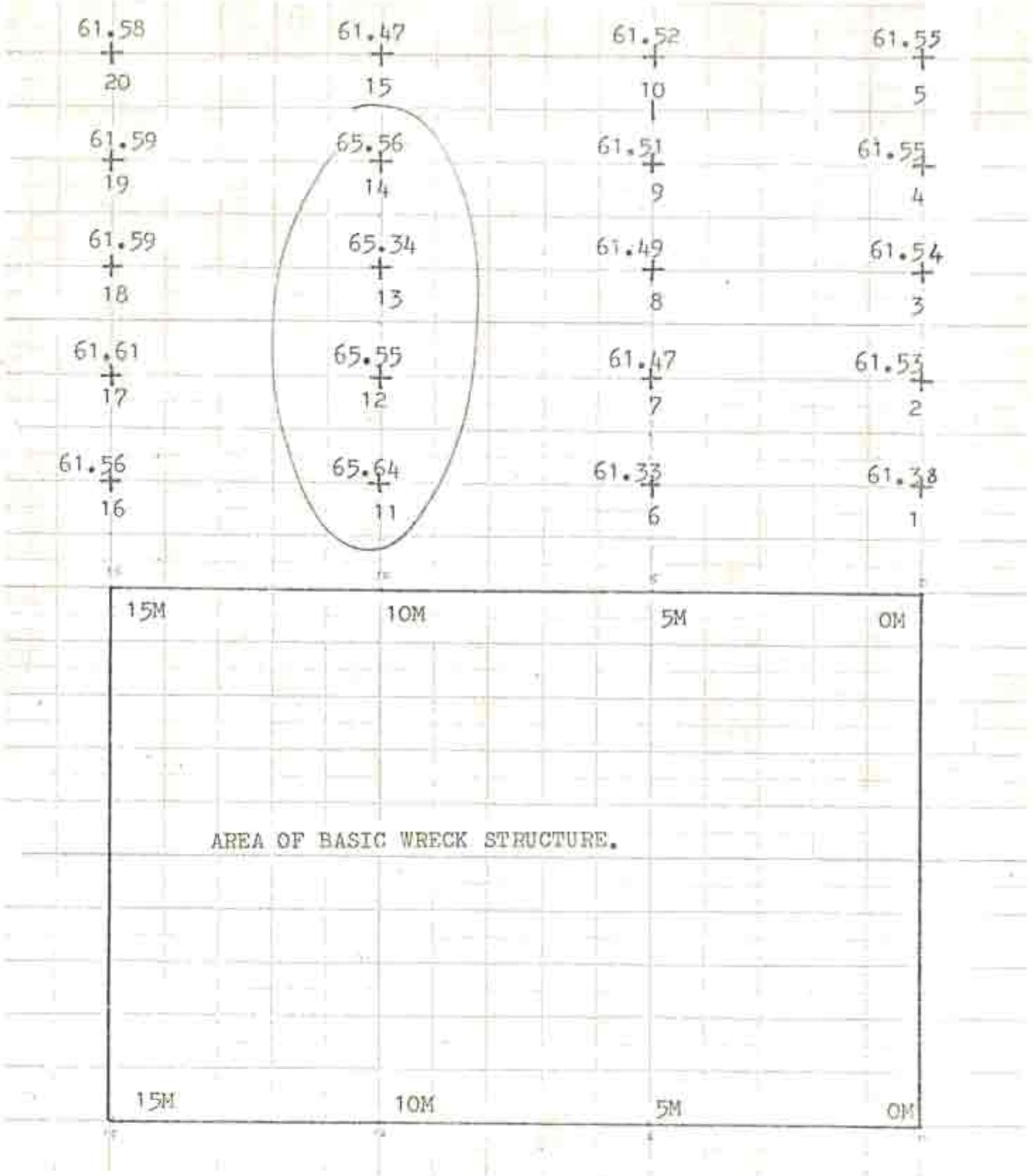
g.)Methodology on the Island.

i. Maintenance of Collection

On the island a field registration system was established. Items were numbered with a dymo machine and packed in separate containers. The register entry in each case gave the date of finding, the area from which it was recovered, and a description of the item. Sketches and photographs were taken for further records (Fig. 18). Some concretions were raised from the site for examination. A few of these were registered as samples, but in most cases the item was cracked open for inspection and sketching and then disposed of. The opened specimens proved to be iron fastening bolts and fragments of iron barrel hoops.

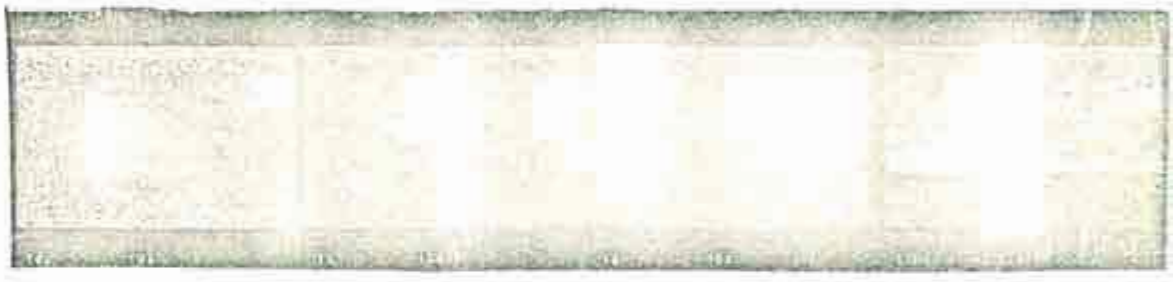
ii. Magnetometer Survey

It is known from the documentary records that the survivors of the Sydney Cove wreck spent some months on Preservation Island during which they erected tents and a house, and salvaged a variety of material from the wreck. The expeditiondid not have time for an extensive survey of the vicinity of occupation, so it was decided to use the



(Fig. 17)

The readings indicate targets in positions 11 to 14.



(Fig. 18) a) Blue and white ceramic fragments and non-ferrous fastening nails
b) glass bottle and barrel staves
c) Barrel base and concretions.

Photos. J. Stockton

magnetometer to examine the locality where local tradition has it that the survivors built their house. (Fig. 19)

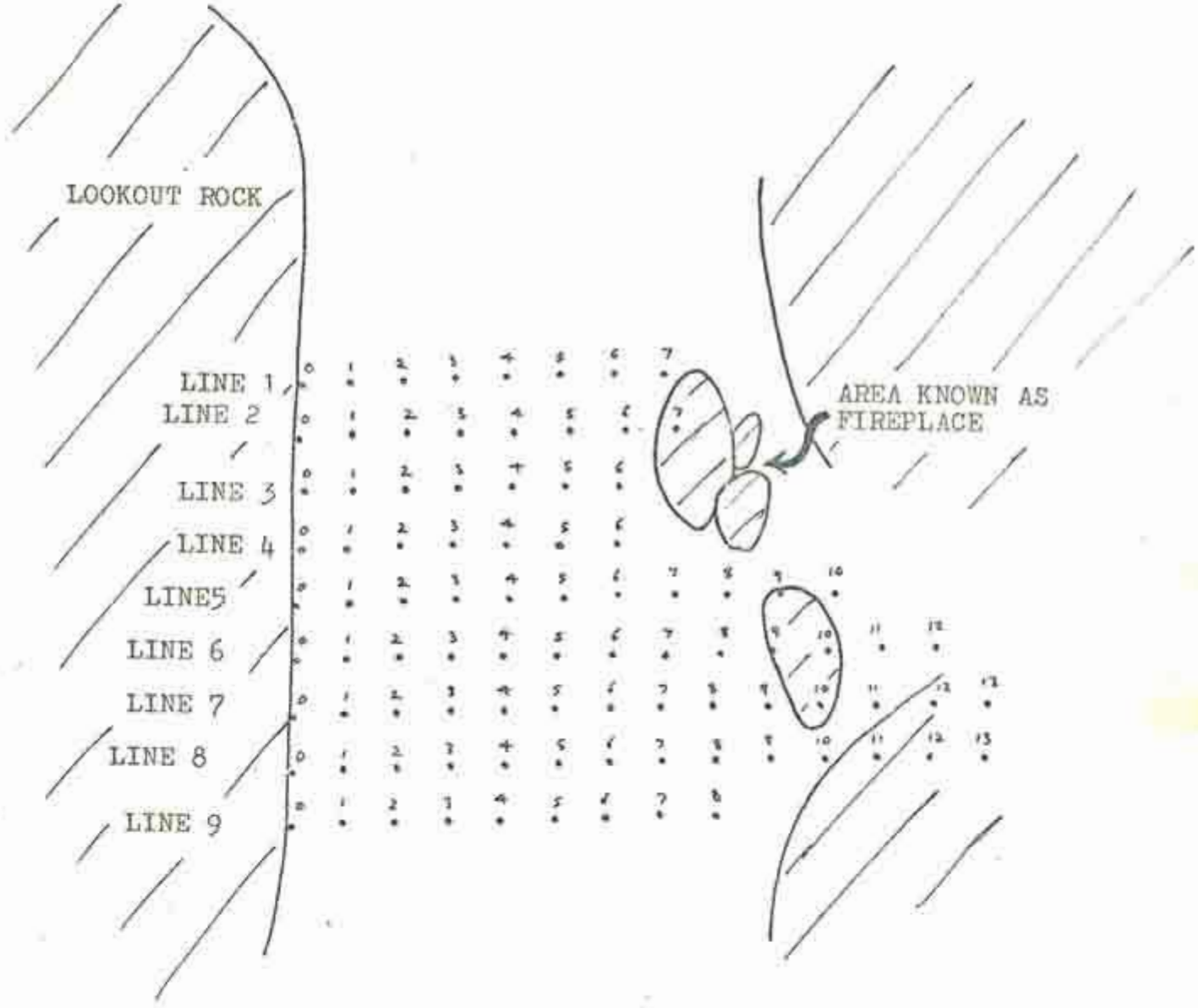
(Fig. 19) Aerial photograph showing south end of Preservation Island.

Photo Lands Department.

This position is a grassy slope between two granite peaks, at the end of the island closest to the wreck. The high granite peak is known as lookout rock while the smaller outcrop shelters what is said to have been a fire place. Survey lines one metre apart were laid out from the base of the lookout rock, in a direction of 50° orientation across the grassy slope to the adjacent outcrop of rock. Readings were taken with the magnetometer at one metre intervals along these lines. (Fig.20)

(Fig.20) Readings a re taken from the magnetometer.
Photo K. Henderson.

It was found in each case that a downward gradient of readings occurred in moving away from the lookout rock, where the soil wqs relatively deep, towards the outcrop where the soil became very shallow. Several anomalies indicate targets, which can if necessary be further investigated in the future by a fully equipped expedition (Fig. 21).



(Fig.21)
Sketch of magnetometer positions at Lookout rock. Taken from sketch by J. Stockton. (Not to scale)

ARCHAEOLOGICAL SIGNIFICANCE.

In assessing the archaeological significance of the Sydney Cove it is necessary to consider the importance of the remains to Tasmania and to Australia, as well as in international terms. The site can be conveniently divided into three major aspects:

i. the hull and equipment belonging to the ship
ii. the cargo and the crew's possessions
iii. material left on the islands but associated with both these sources.

The feasibility survey has established that a substantial portion of the hull survives intact. The keel and keelson remain locked together, holding in place the floors and futtocks, to which large areas of planking are still attached. There is sufficient archaeological context on the seabed to warrant a comprehensive excavation as opposed to archaeological salvage. A three dimensional recording system will be necessary for the proper survey of the hull on the seabed. The favourable site conditions - shallow calm water with generally good visibility - make this a straightforward project. In terms of both the quantity of structure surviving and the prevailing site conditions the Sydney Cove may be compared with the wreck of the James Matthews, wrecked in 1841 near Fremantle (Fig.22) The archaeological potential of a number of items of ship's equipment surviving on the Sydney Cove wreck is also very good and the excavation of some of these items, for example the cannon and gun carriage complex, demands considerable forethought and care. Within Australian waters the Sydney Cove's timbers are the only eighteenth century substantial ship structure known to have survived. Overseas, archaeological work has been carried out on a number of late eighteenth century wrecks (Mayhew 1974, Ericsson 1975, Stenuit 1976, Lightley 1976), but few of these involved substantial structure. During the second half of the eighteenth century naval architecture was rapidly becoming a well disciplined and well documented subject in Europe, but the same does not necessarily apply to India, where it is likely that the

Fig. 22 - The quantity of structure on the Sydney Cove wreck may be comparable with that recorded on the James Matthews site

Sydney Cove was built. For smaller square rigged vessels built in India during the eighteenth century it may be expected that some elements of traditional, and some of transitional shipbuilding will be found, with a resulting lack of standardisation.

The cargo items and crew's possessions lying on the Sydney Cove will when excavated constitute the only large collection of post settlement eighteenth century archaeological material relating to Australia. Very little archaeological material from land sites of the foundation years has survived, and theSydney Cove material is of course all accurately dated. Nor is it likely that substantial sources of such material will be found on other Australian sites in the future, so the Sydney Cove represents the one opportunity for such a collection to be made. Despite the fact that some cargo was thrown overboard from the Sydney Cove, and a great deal is known to have been salvaged by the survivors, the survey has shown that substantial quantities of ceramics, glassware and other material has remained on the site. The sand has protected these items well and it may be expected that as the excavation moves towards the stern of the vessel an increasing number of intact items will be recovered.

On Preservation Island shards can be seen lying at the mouths of mutton bird burrows over an area of several hundred metres in length, while the magnetometer survey has indicated that further material lies buried in the area where local tradition has it that the survivors built their house. The island is the site of the first European occupation of Tasmania, and as such has great significance for Tasmania. However it is unlikely that either a large collection or much intact material will be obtained from the land sites, and in these areas a minimum of excavation and a maximum of survey procedures would seem to be the best course for establishing patterns of occupation.

AFTER THE SURVEY

a.) Work on Results

i. Maintenance of Collection.

Divers from the April 1978 expedition have offered to do the work involved in transferring the anchor and cannon from the reservoir to the soon to be completed baths, under the supervision of National Parks. It is also hoped that some work can be done on registration and general maintenance of the material from earlier expeditions - in particular the identification and drawing of the individual components of the rudder.

ii. Reports

Besides this brief preliminary report prepared for the National Parks, a more comprehensive report, encompassing detailed descriptions of the material raised on this and early expeditions, is being prepared by a group of the divers involved for publication by the Tasmanian National Parks and Wildlife Service.

iii. Formation of the Maritime Archaeological Association of Tasmania.

Because of the devlopment of activities connected with the Sydney Cove over the past two years the Tasmanian Underwater Research Group found it necessary to formalise its organisation. The Maritime Archaeological Association of Tasmania was formed on 10th. June 1978. This Association guarantees any institution which accepts the responsibility for a programme of maritime archaeology a permanent source of assistance. The group of divers who now have experience working on site with archaeologists will stay together and work towards promoting a responsible attitude among the diving fraternity towards maritime archaeological sites.

RECOMMENDATIONS

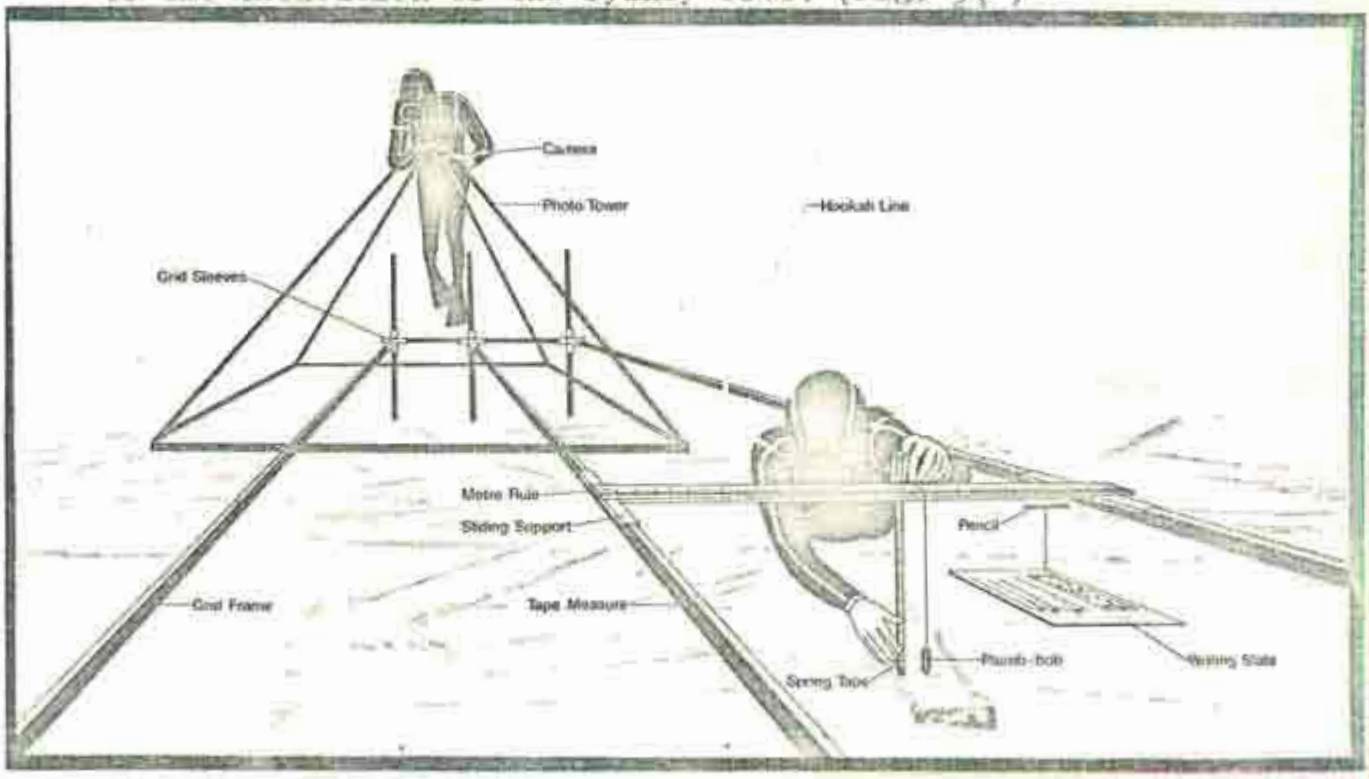
There are only three known substantial post settlement eighteenth century shipwrecks lying in Australian waters - the Sirius, the Pandora, and the Sydney Cove. The Sirius, flagship of the first fleet to the east coast, was a vessel with enormous significance to Australia's history, but the wreck, lying on a shallow turbulent reef close to the Norfolk Island settlement, is likely to have broken up almost as much as the Dutch East Indiamen which, some years before, had crashed on to the reefs on the west coast of Australia.

The Pandora has little direct relevance to Australian history but will, upon its proper excavation provide an exciting illustration of an episode in the 'Mutiny on the Bounty' story. In comparison then, the Sydney Cove has much to offer Australia. The importance of the ship to Australia's history, and the good state of preservation of the wreck, make it essential that a thorough excavation be conducted on the site.

There are two aspects to the field work involved: the excavation of the wreck underwater, and the work on the camp site of the survivors.

a.) Excavation of the Wreck

The similarities between the wrecks of the Sydney Cove and the James Matthews geographically (both sites in protected, shallow water on sand bottom surrounded by sea grass) and in terms of the material being dealt with (a similar quantity of structure in a similar state of preservation), make it possible to draw heavily on the experience of the James Matthews excavation in outlining an approach to the excavation of the Sydney Cove. (Fig. 23)



(Fig. 23) A three dimensional recording grid could be constructed for the Sydney Cove wreck.

A three month season (100 days) would be appropriate for the thorough survey of the hull and its contents, and the raising of all items from the wreck except the timbers of the hull. On site approximately two weeks would be taken up in exposing the wreck, eight weeks in survey and raising operations, and two weeks in re-burying the hull and closing down the operations.

A large fishing boat (preferably the Tamalee) would be hired for 10 days at approximately $200 per day (total $2,000) to transport equipment and some personnel to and from the island at the commencement and conclusion of the expedition. The charter plane would be employed to bring in further personnel (approximately $2000)

For work on site the principal items of equipment would be a large airlift compressor ($30 per day = $3000), dinghy and motor (purchased new and sold at end of expedition for approximately $500 loss), airlift tubes and piping (approximately $500), hookah compressor and hoses (purchased new and sold at end of expedition for approximately $300 loss), raft construction (approximately $800), fuel for airlift, hookah and dinghy (approximately $800), survey and collecting equipment (approximately $500). To save on work boat charter costs, the air lift would be run from the shore. The raft would be used as a diver and hookah platform on site and the dinghy for general transportation to and from shore. If a water dredge could be safely housed on the raft that may be cheaper, but this seems unlikely. National Parks already has some of the necessary underwater survey equipment. Gridding, etc. for three dimensional work would also be necessary (approximately $200)

In camp on the island (assuming that access to Mr. Bensemann's shed is made available) provisions for dark-room facilities, drawing facilities, water, and more extensive cooking operations would be necessary (approximately $1000). In order to make maximum use of the three month period, photographic processing and drawing of artifacts and survey data would be done on a daily basis. Other aspects to be

considered in connection with the camp would be radio (HF unit and walkie talkie units from National Parks?), first aid (from National Parks, particularly snake bite antivenene), field allowances (a decision will be necessary as to who is paid what), boat and engine spares, and on site conservation equipment (detailed in Appendix 1).

The hull timbers of the Sydney Cove will be left on the seabed after the three month excavation season. The results of the survey will show whether it will be advisable in terms of research and display to raise the timbers of the ship. If so, a second season of excavation, again roughly three months, would be necessary.

b.) Work on Survivor's Camp

The material buried on land is under considerably less threat of destruction (with several isolated exceptions) than the material on the seabed, and thus there is little urgency for excavation. In addition, it may be expected that both in terms of research and display, excavation underwater will be more profitable than on land. On the other hand, both aspects belong to the same shipwreck and should be kept under the one control for continuity. In addition, the cheapest time for investigation of the land material will be while the camp facilities on the island are open for the underwater work. At that time the accommodation, communications, equipment and personnel will be there on the island for both aspects. A careful visual survey and a comprehensive magnetometer survey of the areas would be the first steps.

c.) Personnel

In order to make the expedition feasible economically the problem to be solved is how to obtain the necessary large number of people for the work, and the wide variety of skills and expertise required, on a shoestring salary budget without unduly limiting the continuity of the work.

i. Maritime Archaeologist

Obviously it will be necessary to employ (on salary, contract or loan from another institution) an experienced maritime archaeologist to give archaeological direction and co-ordinate the work. He should have a background in history or historical archaeology, and maritime archaeology.

Experience with the 18th. and 19th. centuries, and with Australian history, would be helpful. On this project it will also be essential that he be able to co-ordinate volunteer divers and students.

ii. Maritime Archaeological Association of Tasmania.

To date, most of the work on the site has been done by volunteer divers. The three month expedition as outlined will have to rely on the same source of labour, as indeed will probably all future large expeditions to Tasmanian wreck sites. Within the Association a variety of applicable skills have been developing and it will be the task of the maritime archaeologist to utilise these various skills where they are best suited. It is hoped that the Association will be able to provide people with skills in survey procedures, photography and motor maintenance on site and above water, as well as roles such as camp cook and storeman. In order to facilitate Association involvement it will be necessary to hold the expedition over the December, January, February period, to coincide with annual holidays.

iii. Students

It is envisaged that students from Sydney University, doing Ms. J. Birmingham's course in historical archaeology, be involved in a variety of aspects of the work on a volunteer basis. It may also be possible to involve students from A.N.U. and the University of Tasmania on a similar basis.

iv. Expertise from Other Institutions

Because of the great importance of the Sydney Cove wreck to Australia as a whole as well as to Tasmania it should be possible to obtain co-operation from a number of institutions on specialised aspects of the work. When the

work gets under way it might for example be of benefit to consult with a coastal geomorphologist from the University of Tasmania in regard to the rate of erosion of the beach on Preservation Island where the survivors first landed, or the rate of consolidation of the sea grass beds overlying the wreck. Ms. Birmingham of Sydney University might be consulted regarding colonial artifacts of the 1790's, and staff of the Department of Prehistory at A.N.U. in relation to the methods employed in the survey of the survivor's camp. The Bass Strait Study being conducted by the Victorian Institute of Marine Sciences will be focussing a wide variety of disciplines upon the area, and I recommend that National Parks approach the organisers with a view to utilising some of this expertise and equipment while it is in the area (see attached Circular, Appendix 2).

d.) The Alternatives - a Single Excavation or a Permanent Programme.

As outlined above, the excavation of the Sydney Cove could be carried out over a three month period by obtaining a maritime archaeologist on contract or loan. Such a short term plan does not cater for the preparation of the expedition or the digesting of the results for publication. Nor does it provide for the necessary continuing maintenance of the collection and the joint preparation of displays by the maritime archaeologist and display personnel. It is highly undesirable that a collection be assembled and then left unused. The alternatives are a contract over say 2 to 3 years to complete all work on the Sydney Cove, or a permanent position to develop the potential of Tasmanias' other historic shipwrecks after the Sydney Cove project is completed. The Conservation aspect is covered in Appendix 1.

e.) Sources of Funding Assistance.

Two sources of Federal Government funding which have in the past been helpful for the Department of Maritime Archaeology at the Western Australian Museum are the Heritage Commission and the Australian Research Grants Committee. Three A.R.G.C. Grants are currently funding aspects of this Department's field work. One of these, the Zeewijk Project, has many similarities to the proposed work on the Sydney Cove

wreck. Between one and three staff members coordinate the work, assisted by between ten and fifteen volunteers. The wreck lies near an uninhabited island some 50 kilometres from the coast. The Museum provides the basic plant and permanent research staff while the A.R.G.C. grant provides the fieldwork expenses, including charter, travel, special equipment etc, the grant budget being $10,950 in 1978. The grant has been operating on the Zeewijk site for three years. If a similar grant was obtained for the Sydney Cove it would cover boat and plane hire, magnetometer hire, raft construction and a variety of the other special requirements.

Given sufficient publicity an approach to industry can also be extremely helpful. During the most recent excavation on the James Matthews wreck Atlas Copco made available at no cost a 175cfm compressor for the duration of the season, making a saving of over $2000. The right approach to that company would very likely result in a similar offer being made. The current wreck inspection expedition being made to the North West Coast was facilitated by the donation of a radar by Coastal Electronics, a number of air fares by MacRobertson Millar Airlines, a dinghy by Beaufort, two trail bikes by Honda, etc.

APPENDIX 1

CONSERVATION REQUIREMENTS - DR. NEIL NORTH

In determining and costing the conservation requirements for a particular maritime archaeological programme there are many problems which arise. The three main points which need to be decided before a conservation programme is initiated in Tasmania are:

1. Is this going to be a continuing conservation programme or is it going to terminate when the Sydney Cove work is finished? If it is going to be a continuing programme, have arrangements been made with other parties (museums etc) who would be interested in using professional conservation services? These two points are important in determining the rate of capital depreciation which must be written into the costing and strongly affect staff recruitment.

2. What buildings are available? If a suitable building is already available this is obviously much cheaper than if it has to be constructed. The requirements for a conservation building are detailed later.

3. Is the sole conservation requirement that of getting a good job done at the lowest possible cost. If this is the case then, depending on the answers to points 1 and 2, the feasibility and cost of having the work done at the W.A. Museum should also be considered (provided the W.A. Museum agreed!). An intermediate possibility is that the simple and generally inexpensive treatments can be done in Tasmania and the complex, and generally capital intensive, work could be contracted out to the W.A. Museum. However contracting out this work will prevent Tasmania from developing the expertise which could be needed again in the future.

These three general points must be considered and a firm decision made before embarking on a conservation programme as they are crucial factors in the total cost.

In considering specifically the 'Sydney Cove' conservation it should be appreciated that a three month excavation season will probably require at least two man - years of conservation and quite possible more if a large number of artifacts are recovered. In the following programme I have taken into account the proposed excavation programme, the on - site conditions and the probable nature and number of the artifacts to be recovered. This has been done through consultation with Graeme Henderson.

I have considered the conservation programme to be in three stages, namely, on - site conservation, storage prior to treatment, and actual treatment. The artifacts themselves are more conveniently discussed by considering them in the following groups.

GROUP (A) : (Simple) - All artifacts except those containing iron or large pieces of wood.

GROUP (B) : (Iron) - Iron artifacts, both large and small; wrought and cast.

GROUP (C) : (Timber) - Large piece of timber - generally part of the ships structure.

ON-SITE CONSERVATION:

With a three month field excavation, close attention must be given to the problem of storing the artifacts between the time they are exposed on the seabed up until they are delivered to the conservation laboratory. As a general rule the artifacts should not be allowed to dry out.

GROUP (A) : These are best stored in 44 gallon drums, suitably cut. These drums are cheap, rugged and strong enough to be transported safely even when full of artifacts

and water. The on-site conservator should remove concretions from these objects, when this can be done safely, to reduce storage space requirements.

REQUIREMENTS (A) : 44 gallon drums
Suitable lifting equipment

GROUP (B) : Small objects can be stored under 2% Caustic Soda solution in 44 gallon drums. Large objects, such as cannons and anchors, should be left underwater in some quiet place where they can be readily raised again when it is time to leave. Cast iron objects must never be allowed to dry out. For transportation they should be wrapped in sacking or crated and kept wet, preferably with caustic soda solution.

REQUIREMENTS (B) : 44 gallon drums
1 X 44 NaOH
Bags and Sacking
Suitable lifting equipment

GROUP (C) : These present the biggest problems in on-site storage. If a very calm and sheltered place is available these can be stored in the sea. However as they are relatively fragile and easily moved by wave and tide action care must be taken. Alternatively they can be stored on land, but in this case storage tanks will have to be built or the timbers sealed into plastic containers. It is crucial that the timbers are not allowed to dry out.

REQUIREMENTS (C) : Polythene Sheeting and Tubing
Fungicide
Lifting and Shifting equipment

STORAGE AT CONSERVATION LABORATORY PRIOR TO TREATMENT:

During an excavation a large amount of material is recovered in a fairly short time. As this greatly exceeds the throughput of the conservation department, this

material must be held in suitable storage at the laboratory until it can be treated.

GROUP (A) : For these small artifacts the best storage containers are small plastic bins (20 l capacity). The number needed obviously depends on the quantity of artifacts but, probably, at least 50 will be required. If copious floor space is available these can be stored on the floor but if space is limited some form of shelving will be required.

REQUIREMENTS (A) : Plastic Bins ($7.00 each)
Panacide
Shelving (if necessary)

GROUP (B) : Small iron objects can, if necessary, be safely stored in the same 44 gallon containers that were used for on site storage. Storage in caustic soda solution also protects the drums from rusting. With 44 gallon drums it is difficult to find individual artifacts and a better storage system is to use rectangular steel tanks.

With large iron objects special storage tanks must be constructed. By a suitable choice of style these tanks can also be used later as electrolysis treatment tanks. We have found mild steel, suitably reinforced, to be best but corrosion resistance must be considered in fabrication. Ours are made locally and a typical tank, 4 X 2 X 1 metre, costs approximately $700. The number of tanks needed is dictated by the quantity and type of artifacts needing storage. On occasion, the raising of some large artifacts will need to be delayed until storage facilities are available. This is a matter for consultation between the maritime archaeologist and the conservator.

These large iron objects are generally stored outside and some means, such as a fork lift, must be available for shifting large artifacts as needed. Large cast iron

artifacts will also need special steel cradles so as to prevent damage to their soft graphitized surface when being moved. These cradles are constructed in our workshop and cost approximately $50.00 in materials.

REQUIREMENTS (B) : Steel Tanks ($700 each)
Cradles ($ 50 each plus labour)
Fork Lift
Caustic Soda (1 X 44 Gallon drum / Tank)
Lifting Straps - alkali resistant

GROUP (C) : Large pieces of wood, such as ships timbers, are stored in steel tanks which are the same design as those used for storing large iron objects. The wood storage tanks are generally appreciably larger than the iron storage tanks (up to 6 X 3 X 2 metres) and must be coated with an appropriate paint to prevent corrosion. For moving heavy timbers a forklift is required. These tanks can also be used later as wood treatment tanks provided some forethought as to placement and design is used.

REQUIREMENTS (C) : Steel tanks ($1000)
Surface coating for tanks
($150 / tank)
Fork Lift
Panacide

CONSERVATION TREATMENT (STABILIZATION AND CLEANING):

GROUP (A) : Treatment of this group of artifacts can be done relatively easily and at comparatively little cost. This group includes a wide variety of materials all with different treatment methods. Consequently I will not describe each treatment procedure but just list the basic equipment needed.

REQUIREMENTS (A) :

1. Water treatment (distillation or deionizer - 1000 litres/day capacity)
2. Conductivity meter and cell ($1000)
3. Vacuum pump and glassware ($1000)
4. Ph meter and electrode ($600)
5. Laboratory Oven (at least 1 m^3 capacity and of type used for drying glassware - temp up to 150°C)
6. Hand held vibrating tool ($100)
7. Electric hot plate (flat surface laboratory type 20 X 30 cm)
8. Washing Machine - Top loading type (secondhand)
9. Small rectifier/transformer - output maximum 4 volts, 30 amps ($150)
10. Top loading balance (0-1200g accuracy 0.01g $ 200)

GROUP (B) : At present, wrought iron artifacts (small and large) are best treated by electrolysis and this can be done in the same tanks used for storage of the artifacts. Large cast iron objects, such as cannon, are generally also treated by electrolysis but the process is much slower and more hazardous than with wrought iron. Small cast iron objects are best treated by using a hydrogen reduction furnace. With the Sydney Cove artifacts it would be first necessary to test the iron objects to determine if these treatment methods were suitable.

REQUIREMENTS (B) : (In addition to items listed in Group A above)

1. Large rectifier/transformer (up to 8 volts 150 amps output)
2. Mild Steel anodes (at least 6 @ $5.00 in material, formed in workshop)
3. Chloridometer (Buchler - Cotlove type for determining chloride concentrations in small samples - $2000)

4. Hydrogen Reduction Furnace (extreme care needed in design manufacture and testing)
5. Analytical Balance (0-250g with accuracy .0001g $2500)
6. Chemicals and Glassware : Allow $500 / year but very dependent on quantity and type of artifacts

GROUP (C) : The treatment of ships timbers is a very slow and a very costly business. The most satisfactory method currently available is P.E.G. treatment. The following costs, which are based on the 'Batavia' timber treatment will give an approximate idea of the amounts involved.

1.	Conversion of three storage tanks to treatment tanks	($2000)
2.	Oil heaters for tanks	($2500)
3.	Polyethylene Glycol	($25000)
4.	Dehumidification Chambers	($11000)
5.	Operating Costs (fuel oil, electricity)	$1000 / year
6.	Other chemicals and minor equipment	$ 500 / year

These costs are based on a three year treatment programme and, by extending this to nine years, these could be reduced to slightly less than 50%. Wages however must also be taken into account.

GENERAL REQUIREMENTS:

In addition to the specific items mentioned above there are two other general requirements which have to be met, namely, a building and staff.

1. BUILDING:

A conservation laboratory building should incorporate:
(a) Office space (possibly shared with maritime archaeology).

(b) Clean conservation area (including chemical analysis).

(c) 'Dirty' Treatment Area.

(d) Outside storage area and treatment area for large objects (particularly those which have to be shifted mechanically).

(e) A wood, and metal-working shop or, at minimum, access to one in reasonable proximity.

(f) A dark room for photography or, at least, access to one.

In the clean conservation area there should be a plentiful supply of electric power points, a gas outlet and, at least, two large sinks. A fume cupboard, with a built in sink, is also essential.

In the 'dirty' treatment area a good supply of two phase and a few three phase power points are needed. This area should also be capable of having a forklift or similar lifting device used in it. This area should have a tap capable of taking a garden hose and floor level drainage to dispose of spilt liquids. Washroom facilities should be provided with showers in case of chemical spillage onto skin or clothes.

2. STAFF:

Finding the right person to direct the conservation programme is the single most crucial factor for successful conservation. This person must have both a chemistry background (preferably with some research experience), and a training in the conservation of marine archaeological artifacts.

Marine artifact conservation is essentially chemical processing and this requires a good and broad knowledge of chemistry. As marine artifact conservation is still a developing science it is virtually guaranteed that some unusual problems will arise with the treatment of the

Sydney Cove material. The conservator must be prepared for this and must be able to solve such problems on his own initiative (remember he will be working in relative isolation - the nearest people he can turn to for advice will be in Perth).

The excavation of the Sydney Cove will produce quite a wide variety of materials in need of conservation. The conservation of these will require a person trained in and familiar with the numerous different conservation treatments. Unfortunately there are not many such people in Australia.

The only marine archaeology training currently in Australia is the on-job training done at the W.A. Museum. The conservation course which was recently established at the Canberra C.A.E. does not include any such work and as a consequence their graduates, when they occur, will be totally unsuitable for this type of work without further training. Some marine archaeological conservators are available overseas but the cost of attracting them to Tasmania may proove prohibitively high (comparable wages in Canada are $20,000 to $25,000 per annum).

From necessity, the best approach in your case would be to hire a conservator, who has been trained in maritime archaeological conservation, from the W.A. Museum. In this case the salary range you would need to consider is $12,000 to $15,000 with initial appointment closer to $12,000. If the appointment is to be temporary these would have to be higher.

To maintain a reasonable throughput of material I recommend a staff of two, namely, a maritime archeological conservator (as described above) and a technical assistant. Current salaries for technical assistants at W.A. Museum are in the range $5000 to $9000 per annum depending on age, qualifications and experience. The technical assistant needs only to have a background in chemistry (up to

matriculation level) and an interest in this type of work. I recommend this assistant as 'non-conservation treatment' commitments will probably take six man/months per year and thus leave insufficient time for one person to treat a reasonable quantity of artifacts. This six man/months for other commitments is made up of four months for on-site conservation, one months annual leave and one month for administration, publicity, interviews etc.

Circular No. 1 - May 1975

Victorian Institute of Marine Sciences

The Bass Strait Study — an Invitation to Participate

In North America, Europe, South Africa, New Zealand and elsewhere, continental shelves have received extensive scientific attention in keeping with their increasing utilization and with growing awareness of their potential.

In the vast area of the continental shelf around Australia, very little sedimentological research has been undertaken to date, in the light of the scientific complexity of the shelf, its resource potential both living and non-living, and its close proximity in relation to major population centres and shipping lanes, it is indeed surprising that no major study of this region has yet been conducted.

The Victorian Institute of Marine Sciences proposes to initiate such a study.

WHY UNDERTAKE A MAJOR STUDY OF BASS STRAIT?

Bass Strait has many features which make it a most unusual continental shelf area to explore, thereby justifying such a specific major study. It is the part of the globe where a number of various subtropical and subantarctic water masses occur. It is open to the Southern Ocean and the Tasman Sea. It is subject to high wave energy, complex tide and current regimes and unusual sea-floor topography. Its semi-enclosed nature is further accentuated by its shallow ridges spanning much of the two entrances to the Strait (see map). In consequence, Bass Strait is certainly not a simple system, and its various sub-regions, which show considerable differences in dynamics, sediment, and biological patterns, demand individual study and assessment.

The utilization and resource potential of Bass Strait is great, and it is of national importance to improve our knowledge as utilization proceeds. For example, the populations and embayments of Victoria and northern Tasmania, where major population concentrations occur, are significantly affected by marine processes which are generated in Bass Strait. Also, because of its central position, Bass Strait will inevitably increase in importance as a receiving basin for wastes, and its semi-enclosed nature highlights the potential risks if this proceeds without adequate knowledge. Exploitation of offshore oil and gas also generates marine engineering problems and creates the need for knowledge of dispersal patterns of possible spills of hydrocarbons.

Improved knowledge of all aspects of this exciting, rough and often dangerous stretch of water must help in regard to further exploration and definition of its resource potential.

EARLIER BASS STRAIT STUDIES

In 1972 the Royal Society of Victoria conducted an important symposium on Bass Strait in which, for the first time, the available scientific data on this unique continental shelf area were summarised. In so doing, the Royal Society demonstrated most effectively that our data were completely inadequate for the understanding and management of such an important waterway, resource, and receiving basin.

The introductory paper to the symposium pointed out that, although in recent years there had been some increase in scientific investigation in Bass Strait, essentially related to oil exploration, the general situation was still extremely unsatisfactory. The two major criticisms of scientific investigation in the Strait made at the symposium remain valid today. First, scientific activity has been poorly co-ordinated, having been conducted randomly as regards problems, and spatially as regards long-term interests. Secondly, scientific research in Bass Strait has unfortunately been segmented according to scientific disciplines, specialist responsibilities, and political boundaries, to the detriment not only of our general understanding of the Strait, but also of an appreciation of it as an area of major significance.

At the 1972 symposium a definitive view was expressed as to the prospects for scientific investigations in Bass Strait. It was felt that the comprehensive and systematic program of scientific research necessary to develop an understanding of this important stretch of sea would not be possible until a multidisciplinary catalyst could be identified.

THE BASS STRAIT STUDY – AN INITIATIVE OF THE VICTORIAN INSTITUTE OF MARINE SCIENCES

Now, in 1978, the Victorian Institute of Marine Sciences (VIMS) proposes to undertake this important catalytic role. Its broad structure and comprehensive objectives enable VIMS to provide an effective focus for major studies such as this, by both co-ordinating the available scientific resources which have increased substantially since the time of the 1972 symposium, and also by developing additional resources to contribute to the study. In this way VIMS will extend the scope of marine research into areas of major importance to the community which are beyond the limitations of various individual research groups and government agencies.

THE BASS STRAIT STUDY – BROAD OBJECTIVES

The Council of VIMS has therefore embarked on a major multi-disciplinary study of Bass Strait, which it proposes to start in 1979. The primary objective of the study is to develop knowledge of the structure and processes of Bass Strait as a marine system, and considerable emphasis will be placed on the conduct of a scientific baseline study of good quality. However, the general program of obtaining a systematic, overall understanding of Bass Strait will be designed so that it will also provide results of immediate significance to the Strait's management and utilisation. In addition, specific issue-oriented research projects will be directly concerned with topics such as waste disposal, transport, resources, offshore structures, substrate stability, coastal zone impacts and recreation.

Study elements, which have been listed below, provide a general scientific and operational framework for the study. They do not coincide with individual scientific disciplines but identify major and often multidisciplinary tasks.

There are many obvious interactions between the study elements, and individual research projects will be conducted as part of the most appropriate study element. The study elements provide the basis for related mission-oriented or management studies, which will be conducted in both the early and later stages of the study.

The proposed study elements are

- Bathymetry
- Geological evolution
- Water movements and circulation
- Atmospheric interactions
- Geochemical transport
- Sediment transport and deposition
- Continental shelf ecosystem
- Coastal zone interactions

Associated study elements will be:

- The Bass Strait islands
- Continental shelf management and utilisation potential
- Community involvement and education

Brief comments on each of the study elements are provided separately.

NATURE AND ORGANISATION OF THE STUDY

The Bass Strait Study will involve the major fields of physical and chemical oceanography, marine biology, and marine geosciences, together with coastal and offshore engineering studies. In addition, other aspects and disciplines will be included within the various study elements. It is expected that the study will involve co-operative and co-ordinated marine research by academic institutions; agencies of State Governments and of the Commonwealth Government; industry; and private or amateur interests. Preliminary planning is under way now. *Phase 1* is planned to be of two years duration (1979-80), and *Phase 2*, the major study, will follow.

STUDY STRUCTURE

Although the detailed structure of the study will be developed later, VIMS plans to make an early appointment of a marine scientist as *Study Director*, in the first instance for two years (Phase 1). The Study Director will be responsible for detailed planning of the study and the co-ordination of its operations and results, and will also have direct involvement in some aspects of the study.

VIMS also plans to provide some funds to assist research projects where necessary, by means of a limited number of *Research Fellowships*, either appointed through research grants from VIMS to participating research groups, or appointed directly by VIMS.

In addition, VIMS intends to provide funds intended to *support projects* of investigation in the study. For example, funds could be used to provide a necessary item of equipment or some technical assistance.

VIMS places high priority on the *provision of vessels* for this study and accepts responsibility for ship time for approved projects.

The Bass Strait Study is an ambitious project but VIMS is encouraged by the fact that a number of research groups have already either commenced or are planning projects in Bass Strait. These groups will obviously provide an important contribution, especially to its early stages. However, VIMS will encourage and assist as many individuals or groups to participate at as early a stage as possible. VIMS also recognises the importance of ensuring that the study is planned to be comprehensive from the very beginning. It seeks to ensure that no relevant aspects are overlooked, even if some cannot be implemented immediately.

PRELIMINARY PLANNING

Preliminary planning now underway, is concerned with establishing a general framework of objectives for the study and, more particularly, to finalise the preliminary planning for Phase 1. For this purpose VIMS has appointed a Study Planning Committee consisting of marine scientists from universities, government departments and industry. Outlines of study proposals are being sought between now and July from all interested persons, so that the Study Planning Committee may compile an overall program by the end of July, 1978. This will provide the basis for subsequent and more detailed program and financial planning.

BASS STRAIT STUDY – PHASE 1

Phase 1 is a necessary preparatory stage for the subsequent major program. It will start as early as possible in 1979 and will be of about two years duration. It will consist of a desk study and a related research program. The latter will concentrate particularly on those areas of study where data deficiencies are most acute and critical, and also on issue-oriented projects which can already be defined.

Phase 1 will result in:

1. Reports on those investigations which have been completed during Phase 1 – both of a scientific nature and those which have management and utilisation implications.
2. A comprehensive and systematic review and analysis of the available information on Bass Strait, using current information together with the data obtained in Phase 1 to fill some of the major and critical information gaps.

3. A detailed research prospectus for Phase 2 of the Bass Strait Study. This will define objectives and priorities for Phase 2.

BASS STRAIT STUDY – PHASE 2

Phase 2 will be the major phase of the Bass Strait Study, during which the scope and intensity will increase. Problems and issues identified as important during Phase 1 will be addressed. Duration and completion dates of Phase 2 projects will vary. Many may be completed within 2 years; others may proceed longer. The objectives and time table for each study element will be subject to regular review.

INVITATION TO PARTICIPATE

Preliminary planning of the Bass Strait Study has already proceeded sufficiently for the Study Planning Committee to have identified a [illegible] number of studies which [illegible] be appropriately [illegible] into Phase 1. However the study of Bass Strait will be considerably more effective if it can include a wide range of expertise and interests within each of the proposed study elements.

ACCORDINGLY VIMS INVITES PERSONS WITH AN ACTIVE INTEREST IN BASS STRAIT TO BECOME INVOLVED IN THE STUDY.

[illegible] are [illegible] to conduct research in association with the Bass Strait Study are asked to advise VIMS as soon as possible of their interest. This should be followed by submission of a brief outline proposal for studies or projects. VIMS also recognises that many individuals or groups may have a particular interest in the Bass Strait Study, but may not have a direct research interest. VIMS would be particularly pleased to be advised of such interests, whether general, or in one or more of the study elements.

OUTLINE PROPOSALS for associated projects need be no more than about 2000 words, (i.e. no more than four or five pages) but should provide, where possible, the following information:

* name of project
* names of person responsible for the project and associated professional staff
* project objectives and justification
* outline of study plan
* advice regarding possible interaction between proposed project and current or possible projects in this or other study elements.
* vessel requirements – including [illegible], duration, location and [illegible] of vessel required (cost estimates for ship time are not required).
* resources required for the project to proceed (include estimates of grade of staff and major items of equipment and any other special requirements for funds).
* project timetable, including likely commencement and completion dates.

Outline proposals should be submitted to VIMS by [illegible] 1978. This will enable the Study Planning Committee to proceed further with developing the first draft of a general program for the Bass Strait Study.

More detailed proposals will be required by the end of June, and further information on the requirements will be supplied by VIMS to those who submit outline proposals. This will allow a [illegible] Bass Strait Study program to be compiled by August [illegible]. This will involve the prospective participants in the Bass Strait Study in the development of the study program by convening meetings and workshops.

Outline proposals and requests for further information should be directed to:

John Thompson,
Secretary,
Victorian Institute of Marine Sciences
147 [illegible] Place
MELBOURNE, VIC. 3002,
Tel: 651 1992

Victorian Institute of Marine Sciences
14 Parliament Place
Melbourne
Victoria 3002
Telephone 651 1998

ADDITIONAL INFORMATION ON THE BASS STRAIT STUDY

OUTLINE PROPOSALS

In the preliminary planning of the Bass Strait Study, VIMS has sought and been provided with considerable assistance from a wide range of experts, particularly those who are actively involved in marine research at present.

Such a wide program of consultation has been difficult to reconcile with the time constraints associated with the end of the financial year of commerce and industry, and the budget procedures of State and Commonwealth Governments.

Thus, although VIMS has called for outline study proposals by June 2, 1978, this date should be seen as a target date. Please note the following points:

- Please let VIMS know *immediately* of your potential interest in the Bass Strait Study, even if you cannot produce an outline proposal by June 2, 1978. It would be most helpful if you could discuss your possible involvement with the Secretary.
- Submit outline proposals by June 2, or as soon as possible afterwards. More detailed proposals will be required by the end of June. This information is urgently required, particularly for financial planning purposes.
- VIMS proposes to hold a workshop meeting soon, to provide for a general consideration and discussion of the Bass Strait Study.
- It should be stressed that there will be some opportunity for further development of the program of the Bass Strait Study between July and the end of 1978.
- It should also be stressed that Phase 1 is a precursor to the definition of problems and priorities for the major study in Phase 2, planned to start in 1981.

STUDY ELEMENTS

The proposed study elements are often multidisciplinary and represent very broad task areas within which individual projects will be undertaken. Phase 1 of the study will consist of a detailed desk study together with basic projects required to allow Phase 2 to be developed, and other more specific projects. While the definition of important expenses for the Bass Strait Study is not yet final, the following general comments may be of assistance. Study elements will be further

defined as a result of outline proposals for projects submitted to VIMS, and meetings and workshops.

1. BATHYMETRY

There will be a constant demand for bathymetric data, detailed in some cases, to serve the objectives of various study elements and projects, such as geological evolution (geological structure, strand lines formed at different sea levels), biogeography and pre-history (land bridges and faunal migration), water movements, sediment dynamics, benthic biology, substrate engineering. Bathymetric data already obtained by Esso-BHP could possibly provide some detail, but specific field surveys may be required in areas such as the outer margins and the Bassian ridge.

It is also recognised that all study elements have the need for appropriate navigational and position fixing capabilities, on a routine basis.

2. GEOLOGICAL EVOLUTION (alternatively *Geological Materials and Evolution*)

The structure and evolution of the passive continental margin of southern Australia, in response to long-term separation of the Australian and Antarctic plates, is a major scientific focus. This is also of importance in relation to deep-seated resources, such as hydrocarbons. Geophysical techniques such as magnetometry, and geological data from field sampling and oil company bore cores, could be applied to studies of the tectonic evolution of Bass Strait, the nature and distribution of volcanic activity and of sedimentation.

The Quaternary history of Bass Strait (in relation to sea level changes, sedimentation, and tectonics) is particularly relevant to various other study elements. Shallow sub-bottom profiling, supported by coring, is required for all study elements which are concerned with the substrate. Sediment dynamics, seafloor stability and benthic biology are closely linked, and information relevant to potential resources of sand, gravel and placer deposits could be obtained.

3. WATER MOVEMENTS AND CIRCULATION

Major projects will include studies of the entire wave spectrum of the Strait, ranging from the tidal regime to wind waves, and the development of a model of circulation of Bass Strait. This basic oceanographic information is of importance to most other study elements especially those concerned with movement and transport of dissolved and particulate materials, including wastes.

It may be appropriate to place early emphasis on investigations of the tidal regime in Bass Strait, using data from existing and temporary installations and also taking current measurements. This information will facilitate the development of computer models which would incorporate wind data as well. The available information on harbour oscillations is not adequate, and this requires particular attention.

Ocean wave statistics (using measurements from all platforms and rider buoys) for open shelf and shallower water would give valuable data for wave forecasts. They have particular relevance to the design and dynamics of offshore structures in Bass Strait which experiences long period swell conditions. Measurement of shelf turbulence which is related to sediment dynamics and pollution dispersal, could be undertaken. Routine hydrographic sections and spot hydrographic measurements in all seasons of the year would give valuable data.

A knowledge of slope flow dynamics is essential for understanding upwelling and pollution dispersal; the necessary measurements would require a technically ambitious program likely to be part of Phase 2.

4. ATMOSPHERIC INTERACT

While more intensive meteorological observ itself could be subsi studies from all pla regime may well diff an essential data in In the Strait, and a offshore engineering.

5. GEOCHEMICAL PROCESSES

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6. SEDIMENT TRANSPORT AN

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In Phase 1, the main its properties, rather topography as an indi and their distributio geomechanical strengt sediment sources - be determination of mode the shelf and the cor sectional information sought.

7. THE CONTINENTAL SHELF

Little systematic work To achieve the ultimat ecosystem(s), work in and benthic organisms

Initially the greatest zooplankton and phyto be expected to give an seasonal variation at

4. ATMOSPHERIC INTERACTIONS

While more intensive use could be made of data from the existing meteorological observing network of Bass Strait stations, the network itself could be substantially extended. Further air-sea interaction studies from all platforms are required, as the offshore meteorological regime may well differ from that onshore. Surface wind measurements are an essential data input for a circulation model and for wave forecasting in the Strait, and such studies have particular relevance to coastal and offshore engineering.

5. GEOCHEMICAL PROCESSES (alternatively *Chemical processes and transport*)

Major studies will include behaviour of nutrients; behaviour of trace constituents of seawater, including trace metals and pigments; distribution of hydrocarbons; and the influence of phytoplankton on water composition. Inputs, dispersal patterns and residence times of dissolved pollutants and other wastes will be emphasised. Hydrographic sections across Bass Strait at different seasons will again be required and, where possible, they will relate to the planned national Marine Pollution Monitoring Network.

Chemical transport patterns and water-sediment interactions are of particular importance with respect to waste disposal, in areas such as around the entrances to Western Port and Port Phillip Bay, along the Ninety Mile Beach in the vicinity of the proposed outfall, and along the northern coast of Tasmania.

6. SEDIMENT TRANSPORT AND DEPOSITION (alternatively *Sediment Transport and Geomechanics*)

The long-term objectives of this multidisciplinary study element are to identify sources and sinks and to determine paths and rates of sediment movement and deposition. It will form part of the proposed national shelf sediment dynamics program, SEDS (Sediments, Environments, and Dynamics of Shelves). Its four basic components are sedimentology and Quaternary stratigraphy; large-scale water movements; sediment-transport interactions; regional patterns of near-bottom flow and sediment transport. Sedimentation models developed as a result will be directly relevant to such questions as substrate stability and its response to disturbance, and the performance of structure foundations; dispersal of dumped spoils and solid wastes; coastal erosion and supply of sediment to beaches.

In Phase 1, the main emphasis probably will be on aspects of sediment and its properties, rather than on dynamic studies. These could include bottom topography as an indication of dynamic conditions; surface sediment types and their distributions; Quaternary stratigraphy of the substrate; geomechanical strength, structure and fabric of the sediment substrate; sediment sources - both from benthic organisms and land-derived inputs; determination of modern sedimentation rates; sediment interactions between the shelf and the continental slope and submarine canyons. Preliminary regional information on bottom currents and wave activity could also be sought.

7. THE CONTINENTAL SHELF ECOSYSTEM

Little systematic work has been done on the fauna and flora of Bass Strait. To achieve the ultimate aim of understanding and utilising the Bass Strait ecosystem(s), work in each of the three major areas of *plankton, fisheries* and *benthic organisms* is urgently required.

Initially the greatest emphasis could be placed on plankton work, both zooplankton and phytoplankton. The early stages of such a program would be expected to give an initial broad picture of the nature, distribution and seasonal variation of plankton in the Strait. It would be important to extend

the program to the immediately-adjacent oceanic waters of the bounding continental slopes at each end of Bass Strait. Not only would this provide basic information for ecological and prospectivity studies, but would be highly relevant to fisheries programs, and also would supply important oceanographic information in conjunction with hydrographic data on aspects such as nutrient status and temperature.

Initial work on benthic organisms could be done partly in conjunction with work in interacting study elements. Bass Strait sediment has a particularly high content of biogenic carbonate, and sediment-organism relations are of importance. Microbiological and other studies may also be feasible using sediment core samples.

Various agencies have statutory responsibilities and conduct on-going programs in fisheries research. Because the projects undertaken in the Bass Strait Study will be developed to complement and extend these programs, joint planning and co-operation with the relevant agencies will be encouraged.

8. COASTAL ZONE INTERACTIONS

VIMS is very aware of the significance of Bass Strait in controlling many of the processes of the coastal zone. For example, water circulation, tidal oscillations, surges, longshore drift, erosion and deposition need to be understood in detail for adequate shoreline protection and coastal zone management. Studies to be undertaken by VIMS could extend the scope and area of the environmental studies in Victoria and Tasmania, and the work of various responsible State agencies and other authorities. The wide range of scientific and technological disciplines taking part would enable VIMS to plan its programs to gain maximum interaction with other coastal studies and their needs, and hence provide maximum usefulness.

A clear understanding of the Bass Strait system, and especially of the boundary conditions is important in dealing with problems of the coastline. For example, water movement studies around areas of actual or potential waste inputs (such as Geelong - Port Phillip - Western Port; Northern Tasmania; Ninety Mile Beach) would readily be interlocked with existing programs.

9. THE BASS STRAIT ISLANDS

The Bass Strait islands are an integral part of Bass Strait and could receive attention from a variety of viewpoints. These might include studies related to geological evolution, pre-history, avifauna and biogeography. Additional studies could relate to social, economic and historical aspects and to increasing recreational use. It is likely that such programs would be largely desk studies.

10. CONTINENTAL SHELF MANAGEMENT AND UTILISATION

This element would form the basis for a review of the objectives and results of previous continental shelf studies, and a consideration of the management and utilisation of shelf areas elsewhere in the world. This desk study would not only influence the development of the Bass Strait Study but would also identify issues of economic, political and social implications of the development of the Bass Strait region.

11. COMMUNITY INVOLVEMENT AND EDUCATION

This element recognises the need to involve the wide range of individuals and groups who have a particular interest in Bass Strait, and to make maximum use of the study for training purposes. In keeping with its educational role, VIMS aims to ensure that the study results and conclusions should be disseminated as widely and effectively as possible through schools and educational institutions and the community generally.

REFERENCES

1. Ericsson, C., 1975. The instruments from Her Imperial Majesty's frigate Nicholas 1790. JNA 4:1 pp65-72

2. Henderson, G., 1976. James Matthews excavation, summer 1974. Interim report. The International Journal of Nautical Archaeology and Underwater Exploration. 5:3 pp245-251

3. Lightley, R., 1976. An 18th. century Dutch East Indiaman, found at Cape Town, 1971. JNA 5:4 pp305-316

4. Martin, C., 1978. The Dartmouth, a British frigate wrecked off Mull, 1690. JNA 7:1 pp29-58

5. Mayhew, D., 1974. The Defence. Search and recovery, 1972-73. JNA 3:2 pp312-313

6. Stenuit, R., 1976. The wreck of the pink Evstafii, a transport of the Imperial Russian Navy lost off Shetland in 1780. JNA 5:3 pp221-243