Report to the Department of Home Affairs on the April 1979 Expedition to establish the Identity and Archaeological Potential of the Pandora Wreck.

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Introduction

In April 1979 I directed a brief survey on the wreck of the Pandora on behalf of the Federal Government's Department of Home Affairs. This report describes the archaeological activities carried out, presents the findings of the expedition in terms of the identity of the wreck and looks at the Pandora's archaeological potential.

Acknowledgements

The expedition was arranged and financed by the Department of Home Affairs in Canberra. The Director of the Western Australian Museum John Bannister, made me available to the Department of Home Affairs for the duration of the expedition. The photographs are the work of Pat Baker.

At Thursday Island we were given friendly assistance by Brian O'Brian (O.T.C.), Dr. Peter Holt (G.P.), and Mike (local diver).

On the Lumen we were given every co-operation by Bill May and his complement. En route back to Perth we were helped by Dr. Rod McLeod (Queensland Maritime Museum), and Ted Louis and his friends.

Steve Domm and Ben Cropp have both given me the benefit of their knowledge of the site.

The unreserved good will shown to us by all our contacts during the expedition auger well for the future excavation of the Pandora wreck.

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1. HISTORICAL BACKGROUND

A) The Bounty Episode

Lieutenant William Bligh sailed with Captain Cook on the last of his voyages of discovery in the Pacific and was an eye witness to Cook's death. In 1787 he was given the command of an armed transport, the H.M.S. Bounty, for an expedition to the South Seas. Bligh was instructed to gather breadfruit trees in Tahiti, and to carry them to the West Indies sugar plantations as a potential food supply for the slaves.

The plants were loaded and the Bounty left Tahiti on 4th April, 1789. Just as day was breaking, on a morning three weeks later, Bligh was rudely awakened by the senior master's mate Fletcher Christian with three seamen, and forced on deck. The crew, exasperated by Bligh's discipline and allured by the dissipation of the beautiful islands, had mutinied. Bligh with 18 loyal men was set adrift in an open boat, which with great determination was sailed through Torres Strait to Timor where Bligh obtained a passage back to England via the Cape of Good Hope.

The British Government fitted out the frigate Pandora under the command of Captain Edward Edwards to search for the mutineers. Fourteen men were captured at Tahiti. They told Edwards that Fletcher Christian with eight of the crew and some natives had sailed to an unknown destination. This destination was in fact Pitcairn Island, where the mutineers had wrecked and burnt the Bounty ashore in January 1790. But Captain Edwards was unable to find them and set a course for home.

The prisoners were confined in irons in a specially built wooden cell 11 feet by 18 feet, situated on the quarter deck and referred to as 'Pandora's Box'. The entrance was a 20 inch square scuttle on top, which was bolted down at all times.

B) The Wreck and the Consequences

On 28th August, 1791, the Pandora was approaching Torres Strait. The yawl was sent to examine an opening in the Great Barrier Reef at 11° 20' south, and at 5 p.m. signalled that a passage had been found but as night was coming on it was ordered to return to the ship. At that time the soundings gave 110 fathoms. At 7 p.m. however, the lead line gave only 50 fathoms, and then the vessel suddenly struck so hard on the reef that with every surge it appeared that the masts might come crashing down. Soon there was three metres of water in the hold and the prisoners, fearful that the ship was going down, broke their irons in readiness. But, the unfeeling Captain Edwards ordered them to be handcuffed and legironed again with all the iron that could be mustered, while sentinels were ordered to fire into the box if the prisoners moved.

As the ship went down, Captain Edwards leapt from the stern and swam to the pinnace. The bosun's mate, William Moulter, threw the scuttle overboard, thus allowing those of the prisoners who could rid themselves of their hand and leg irons, to scramble through the opening in the top of their cell, and struggle upwards to the water surface and air. Four of the Bounty men; George Stewart, John Sumner, Richard Skinner and Henry Hillbrandt, were drowned, as well as 31 of the Ship's Company.

The survivors camped on a tiny nearby sand cay for a time before setting out for Batavia, which they reached safely. Arriving back in England in June 1792, six of the ten surviving mutineers were sentenced to death. Meanwhile, Bligh, with two more ships, had already left for Tahiti to again attempt to gather breadfruit plants. He was successful in this objective but ironically the breadfruit was shunned by the Negro slaves in Jamaica. Thus, the trials and tribulations were all of no account.

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2. HISTORICAL SIGNIFICANCE OF THE PANDORA

The story of the Mutiny on the Bounty and its remarkable train of events, has often been described as one of the greatest sea stories of all time. In terms of the historical events associated with the Pandora it is outstanding as the most spectacular shipwreck in Australian Waters.

Even the story of the tragic experiences of the Batavia survivors palls when compared with the romance and tragedy of the Bounty mutiny and its consequences.

Like the Dutch wrecks on the Western Australian Coast the Pandora is rather more important in global history than in Australian history. The Dutch ships were lost while on a passage from Holland to the East Indies: the Pandora was wrecked while heading home to Britain from Tahiti. In neither case were the vessels intending to pursue any intercourse with Australia.

The broad significance of the Bounty episode is to be measured in terms of the European penetration of the Pacific - what Alan Moorhead (1966) has described as 'the fatal impact'. That penetration commenced with the arrival of Captain James Cook in the Endeavour, was accelerated by Fletcher Christian and his band of mutineers, and completed when the economic exploitation of the region reached its peak in the nineteenth century.

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3. DISCOVERY OF THE WRECK AND LEGISLATIVE PROTECTION

The question of the discovery of the Pandora was not part of my brief. Suffice it to say that two private vessels were searching in the vicinity of Pandora Entrance, with the assistance of the R.A.A.F. in the form of a magnetometer carrying Neptune aircraft, when the wreck was located on 16th November, 1977.

The finding caused the Federal Government to proclaim the Historic Shipwrecks Act to apply to waters off the Queensland coast.

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4. THE APRIL 1979 EXPEDITION

A) Aims

The aims of the expedition were to positively identify the wreck as the Pandora, and to assess the wreck's significance as an archaeological site. It was also intended that some comment be made as to the feasibility of recovering material for research and display.

B) Logistics

The expedition members assembled at Thursday Island for the boat journey out to the wreck site, Transport to and from the site was by the 27 metre MV Lumen, a Department of Transport vessel normally used for servicing navigation aids. The Lumen, commanded by Bill May, provided full accommodation for expedition members and was equipped with radio, radar, echo sounder and gyro compass. The Lumen had a cruising speed of approximately 10 knots, and took one day for the voyage from Thursday Island to Pandora Entrance, and $4\frac{1}{2}$ days from Pandora Entrance to Cairns.

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An 18ft. Hercules aluminium dinghy carried on the Lumen served as the diving tender. This was quickly placed overboard or brought back on deck by a hydraulic hoist on the Lumen. The air supply was aqualungs, which were re-filled on Lumen with a high pressure compressor. A hookah unit was intended as a back-up supply if necessary and as an air supply for the airlift pipe. As a safety precaution contact was made with Dr. Peter Holt at Thursday Island, who offered assistance should the need arise, and two medical oxygen cylinders were carried onboard in readiness for oxygen recompression treatment.

The diving schedule was a morning dive of 25 minutes without decompression, followed 4½ hours later by an afternoon dive of 20 minutes, with 3 minutes decompression at 10 feet. Spare tanks were held over the side of the tender.

C) Personnel

The members of the expedition were Steve Domm, Ben Cropp, Pat Baker and myself. Ben Cropp and Steve Domm assisted Bill May in his course to Pandora Entrance, and in locating the wreck site using compass bearings to cays visual bearings to reefs and the echo sounder, and Steve Domm assisted in survey work in the sea bed. Pat Baker was diving safety officer and photographer. I had the broad responsibility of ensuring that the aims of the expedition were achieved.

D) Summary of Activities

18th April: The expedition members flew into Horn Island and arrived at Thursday Island at 1700 hrs. Contact was established with the Lumen and accommodation arranged on shore.

19th April: We contacted Brian O'Brian (radio communications) and Dr. Peter Holt (a G.P. with experience in decompression sickness treatment). Star pickets were purchased on the island. At 1600 hours we departed for the site on the Lumen.

20th April: The Lumen arrived at Pandora Entrance at 1400 hours. With a low swell and little breeze the site was quickly located and buoyed. At 1505 hours divers entered the water and located the wreck in c25 metre visibility. The Lumen then anchored and we went ashore to inspect the island.

21st April: The breeze had increased to c15 knots and the water was quite choppy. Divers entered the water at 0930 hours and commenced marking out the site. A photomosaic coverage was also obtained. At 1430 hours a second dive commenced. Surveying and object photography were carried out.

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22nd April: The breeze had increased to c20 knots and some swell had developed. No diving took place because of the danger of the tender capsizing. The divers were shown a mid-to-late nineteenth century wreck several miles from the Pandora site. During the afternoon the wind remained high.

23rd April: The wind had decreased to c18 knots but the swell was higher. Lumen returned to the Pandora site but the marker buoy had gone and, as the seas were too rough for searching, the Lumen left for Cairns at c0900 hours.

24th April: We motored towards Cairns,

25th April: We continued towards Cairns,

26th April: We continued towards Cairns.

27th April: We arrived at Cairns at c1200 hours. At 16.40 we departed on a flight south-bound. Pat Baker and myself stopped at Brisbane to examine further wreck material.

28th April: At 0800 hours we met Dr. Rod McLeod at the Queensland Maritime Museum and examined and recorded material raised previously from the Pandora site. We left for Sydney at 1005 hours. At c1200 hours we arrived at Sydney and visited the Mitchell Library where we looked at published material relating to the Pandora wreck. At 1430 hours we visited Mr. Ted Louis to examine and record further material raised from the Pandora site. The flight to Perth commenced at c1800 hours.

E) Description of Site

Bearings taken at the wreck site at Pandora Entrance on the Great Barrier Reef by Bill May (skipper) and John Graves (mate) on the gyro compass were as follows:

142° true to Large Cay

252° true to North Cay

224½° true to Middle Cay

The site is situated between normally breaking reefs to the south-east and north-west, and a small pinnacle to the south. The depth of the wreck is 100 feet, varying several feet with the tide.

The wreck lies in a level bed of coarse coralsand and is 40 metres in length, with the bow pointing 150°. No rock outcrops were to be seen and coral growth on the wreck was minimal. The distribution of material indicates that the ship did not break up as a result of turbulence. Rather, it settled into the sea bed and the marine worms gradually ate away the upper wood construction of the vessel, allowing iron and other heavy more durable objects to sink vertically into the sand below. Exposed copper sheathing at the stem indicates that the wreck is lying on its port side.

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No wood was seen because airlifting was not possible (due to the weather deteriorating). However, given the conditions on the site - deep water, no turbulence on the seabed, level deep sand around and over the wreckage - it is to be expected that a very substantial portion of the wooden structure lies buried in the sand. Exposed upper sections of chain plates give some indication of the level of timber destroyed by teredo.

Swimming from bow to stern the major items to be seen exposed above the sand are as follows:

a large anchor with one arm erect, an area of copper sheathing standing proud from the bottom and clearly showing the profile of the stem (this would seem to indicate that the teredo reached the water line at the bows), copper tubing (possibly part of the pumps), an anchor and a group of cannon, the capstan, another anchor and cannon, the ship's stove, several jars, another anchor, and the copper fittings of the sternpost and rudder.

Intermingled with the material were lead deck scupper pipes, chain plates and a variety of iron work. The lack of exposed copper sheathing other than in the bow section would seem to be an indication that the rest of the ship is buried in the sand up to or above the water-line, and would thus be well preserved. Copper fittings were in excellent condition, showing no physical sign of damage. The large jars observed also appear to be intact from what can be seen of them. Iron objects have retained their shape well, and have comparatively little encrustation.

F) Methodology on Site

(i) Diving Procedures

Divers usedaqualungs and entered and left the water together. On the seabed all divers remained on the wreck site (and thus within vision of each other. They would at the completion of their bottom time assemble at the base of the buoy rope, and ascend to the tender dinghy via that line. Decompressing divers held onto the buoy rope at 10 feet depth

(ii) Triangulation Survey

Marker pegs were hammered into the sand at either end of the site and at 10 metre intervals between, and a survey tape was attached between the pegs. It was originally intended that a second tape be used to triangulate from this base line.

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However the tidal current made the tapes difficult to handle so during the following dive an 'L' shaped piece of metal piping was laid with the foot (1m) along the base line and the head (3m) across the object being located. The position of the object was then taken in terms of the distance along the base line and the distance away from the base line. This proved quite satisfactory and the first 10 metres (working from the stern) were surveyed by this means. Weather conditions precluded the completion of the manual survey, but the information which was obtained could be used in conjunction with the photographic survey to provide a scale for the photomosaic run.

(iii) Photomosaic

A run of vertical photographs was taken at regular intervals along the site, swimming from bow to stern at a constant height above the seabed and using a Nikonos camera with a 15mm lens. The prints could then be joined together at equal scale and the objects drawn as a plan view of the entire site. This method was well suited to the conditions on the site (deep water and good visibility) and the photographic run was completed well within one 20 minute dive by one diver.

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Oblique photgraphs of individual objects were also taken as an aid to analysis of the photomosaic.

(iv) Excavation Techniques

It had been planned to use an airlift, operated by a Hookah unit, to expose within a trench some sections of the timbers of the ship, and hopefully some small artifacts useful for identification purposes. The weather became unsettled before this plan could be put into operation, and as the surface level contained no exposed items suitable for the purpose, only one item was raised, that being a small salt-glazed stoneware jar which proved to have no identifying markings. The cannon may well have provided clues to identification, but were not raised because of the various logistics problems envisaged after such an operation.

5. THE IDENTIFICATION QUESTION

A) Some Observations about Material on the Site

(i) Anchors

At the beginning of the nineteenth century, and the years previous to this, the Royal Navy used what were termed Old Plan Long Shanked Anchors (Cotsell 1856). These anchors, generally with a wooden stock, had a long narrow shank, straight arms and very large palms which presented a good holding surface. Early in the nineteenth century Perings Improved Anchors, with short shanks and long arms were introduced, and the curved arm of the present day was added soon afterwards.

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The anchors on the site investigated fitted the old plan, suggesting a vessel of the beginning of the nineteenth century or earlier.

The Pandora had gained an extra bower anchor at Tahiti (from the Bounty). When the Pandora struck the reef at Pandora's Entrance Edwards put out his small bower anchor and then let go the best bower 'under foot'. When the vessel went down she had another anchor catted on the bow.

Fig. 9 : The mid nineteenth century Admiralty Anchor.

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(ii) Cannons

During the eighteenth century, iron cannons replaced brass in both the French and British navies. Better casting methods produced an iron gun that was both lighter and more durable, although brass continued to be used for some small guns.

In addition the light barrelled British carronade proved itself at the Battle of the Saints Passage in 1782, and was widely used from that date.

The Pandora was a 6th rate frigate of 24 guns. In 1792 such a vessel would have carried 22 nine pounders on the main deck and 2 six pounders on the quarter deck (Archibald 1968), although Colledge (1969) states that the Pandora built in 1779, carried 22 nine pounders and 2 three pounders. The dimensions of iron guns used by the Navy in 1779 are given by George Smith (Blackmore 1976) as 8'5" (9pdr), 7'0" (6pdr) and 4'6" (3pdr). At Rio de Janeiro a volley of 15 guns was fired, while at one of the Pacific islands a 6pdr cannon and an 18 pdr carronade were fired. The lengths and number of guns on the investigated site are not yet known. Six iron guns were clearly exposed, but the guns, cut loose before the ship sank, may lie between the wreck and the reef, and, as it is recorded that the vessel went down on her side, many guns may be buried within the wreck. As expected, no brass guns were seen.

(iii) Fire Hearth

Prior to 1781 naval cooking arrangements were very simple but in that year the Navy Board ordered that no more fire hearths of the old type were to be purchased, as it was entering into a contract with a Mr. Brodie for the supply of fire hearths of a new design, built of iron (Bugler 1966).

Fig 11. : Looking into the fire hearth on the seabed

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The Brodie stove was adopted, and was used in the Naval service until 1810 when the Lamb and Nicholson Patent was introduced as an alternative.

Fig. 12 : Henderson sketches the fire hearth

The range consisted of two large boilers constructed between the main side plates over an enclosed fire box. The uptake terminated in a cowl on the forecastle deck. After about 1783 the galley funnel was made of iron.

Fig. 13 : A fire hearth on a later vessel, showing the galley funnel

On the site investigated, a stove was observed, which appears to be a Brodie Stove. Beside the stove, an iron object, appearing to be a cowl lay in the sand. The stove would thus be consistent with a British Naval vessel of between 1781 and 1810.

In frigates and small ships the fire hearth was placed under the forecastle (Steel 1805). But on the site investigated, the stove is situated in the stern of the vessel, where the quarter deck would have been. (See Figs, Plates).

Fig. 14 : An eighteenth century frigate showing the fire hearth in the forecastle.

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The distribution of other material on the wreck precludes the possibility that the stove could have moved from bow to stern, so the vessel must have been fitted out in an extraordinary manner. The Pandora took on breadfruit plants at Tahiti and these were stored towards the stern of the ship, forcing the officers to vacate their accommodation in that section of the vessel. A stove under the quarter deck of the Pandora would have kept the deck very hot, to the advantage of the tropical plants. The stove in the stern of the investigated wreck is therefore a very strong indication that it is indeed the Pandora.

(iv) Copper Sheathing and Fastenings

In 1761 the British Navy experimented with copper sheathing on the Alarm. After about 1780 the iron bolts etc in the hull below the waterline were replaced by copper fastenings, and copper sheathing proved so successful that by the end of the century the underwater hulls of most large warships were protected in this manner (Macintyre & Bathe , 1968). The site investigated had copper sheathing on the stem, and this has survived in excellent condition, showing the profile of the stem where the wood has disappeared. A copper fastening bolt runs through the stem, and another such bolt was found in the stern section. This evidence indicates that the vessel went down after 1780. The angle of the stem from the vertical indicates that the vessel sank on her port side, as illustrated in midshipman Peter Heywood's sketch.

(v) Capstan

Frigates and small ships of the end of the eighteenth century had their capstan on the quarter deck (Steel 1805). On the site investigated the capstan was observed a little forward of the stove.

(vi) Pumps

Large ships carried four main pumps and had bilge pumps as well. Smaller ships had two, placed on either side of the mast. Small pumps were fitted for other purposes such as wash pumps. The common pump was a long wooden tube whose lower end rested upon the ship's bottom, between the timbers in the well. Falconer (1780) wrote that common pumps were very rarely used in ships of war, unless of the smallest size. The most useful pump at that time was the chain pump, which was universally used in the navy by that date. The machine consisted of a chain, to which, at certain distances from each other, a number of plates were attached. Working on a sprocket wheel, the chain passed downward through a tube, the 'back-case', and returned upward through another tube, called the 'round-chamber' bringing the water up from the well in a continuous stream.

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The Pandora is known to have carried chain pumps, but on the site investigated several sections of common pumps were observed. A section of copper tubing probably from the lower part of a common pump was raised, and another section of copper tube was seen forward of the midships. This could perhaps be seen as conflicting evidence, but Steel (1805) gives the following table:

To be fitted with pumps	- 36 ton frigate	- 330 ton merchant
In number	2	2
Size of copper	1'0"	0'7"
Size of Chain	0'7"	
And two wood pumps with brass chambers, size	0'7"	

Steel's table would indicate considerable advancement towards the use of copper/brass in pumps in the years 1780-1805. The copper tubing raised from the site investigated was 6.7" internal diameter. It seems probable that the Pandora would have carried both chain pumps and common pumps. Edwards' journal indicates that more than two pumps were carried (Thomson, 1915).

(vii) Pintles

Two copper rudder pintles have been raised from the site investigated, and more rudder/stern post fittings can be seen on the wreck.

The pintle which is housed in the Queensland Maritime Museum was measured and had a pintle diameter of 60mm (2.4"). Steel (1805) gives for his 36 gun frigate a gudgeon hole of 1-7/8". The 24 gun Pandora at 520 tons could be expected to be between these figures. The width of jaw of the pintle measured was 250mm, compared with 255mm on a gudgeon (in the W.A. Museum collection) from the frigate Success (504 tons, 28 guns). The Success gudgeon hole was 65mm, very close to the 60mm diameter pintle from the site investigated. Thus the pintle measured is fully consistent with the site being the Pandora.

(viii) Spectacle Plate

The upper tiller position on a rudder was of little use as a jury rig, for if the rudder sustained action damage, it would almost certainly be below this position, and the rig would then be useless. On the H.M.S. Victory (Bugler 1966) excellent jury steering arrangements were fitted and could be rigged very quickly even when the upper part of the rudder had been shot away.

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A special bronze spectacle plate with band 1'10" x 2'6" containing two spectacle extensions with $1\frac{1}{2}$" diameter eyes was provided 23'9" above the heel of the rudder. Ropes were rigged and shackled to the spectacle plate eyes. These ropes were then led inboard on each side of the ship through shackles secured to the hull and to manned tackles inboard, thus improvising a simple and effective secondary steering arrangement (Fig.).

A similar piece was found on top of the shallow reef adjacent to the site investigated (Plate). When the Pandora struck the shallow reef, damage to the stern post and rudder was incurred, resulting in sections being beaten away. It is curious that the spectacle plate (from the top of the rudder) was deposited on the shallow reef whereas the pintles (from lower parts of the rudder) went down with the ship.

Fig. 17 : Diagram showing the spectacle plate on H.M.S. Victory

However, it is quite conceivable that the pintles were firmly held to the gudgeons and sternpost while the rest of the rudder was dashed to pieces on the rocks. On some ships built in the north of England at the beginning of the nineteenth century the pintles were put into the braces, and the rudder put together in that situation, but on the site investigated the parallel pintle arms show clearly that they came from the rudder. The presence and nature of the spectable plate is fully consistent with a British warship of the late eighteenth century.

(ix) Storage Jars

Three large jars have been observed on the site investigated, and one of these was raised when the wreck was found.

Fig. 18 : The jar at right, from the Pandora, compares well with the jar at left from a wreck off Britain.

This jar, 750mm high, shows no sign of glazing and is made of pink earthenware. It has a thickened rim and vestigial arched handles enclosing applied plaques with the raised initials T.M.F. (Fig.).

Fig 20 : The jar from the Pandora has a plaque which compares with E & F.

Similar jars of Iberian origin have been found in Britain (Ashdown 1972) and the United States (Hume 1970), and have been dated to the second half of the eighteenth century (Ashdown), being common in the period 1745-80 (Hume).

Fig. 21 : Oil jars in use

Ashdown calls them oil jars but acknowledges a variety of functions, including water nd wine storage. Chapman (1775) shows similar jars, described as water beakers, situated immediately below the quarter deck of his privateer frigate. (Fig.)

Fig. 22 : Note the water beakers situated in the stern

Fig. 23 : A storage jar from an American colonial site

The particular nature of the Pandora's mission was such that a large quantity of readily available fresh water was required in the stern of the vessel for the breadfruit plants. The Pandora is known to have called, on its outward voyage, at Santa Cruz, Tenerife, for water and wine, and at Rio de Janeiro to complete her water. Santa Cruz seems a particularly likely place for a vessel to have picked up Iberian storage jars.

B) The Position of the Wreck

Edwards and Hamilton both refer to the depth as being 15 fathoms (90 feet) when the Pandora went down. Both referred to the sand cay, 3 or 4 miles from the wreck. Hamilton gave the position of Wreck Reef as Lat. 11° 22'S, Long. 143° 38' E.

C) The Date Range of Artifacts Raised and Observed

No single object has been seen which proved that the wreck investigated was lost in 1791. Nor is such an object expected. Even an item bearing a date can only show that the vessel was lost after that time. The first approach I have taken has been to look at fittings and other objects and ask when that particular type was first introduced. The old plan anchors had been used for centuries but were replaced by Perings anchor. The lack of brass cannon is consistent with a later eighteenth century vessel, the iron fire hearth indicates a vessel of post 1781, the copper sheathing indicates a vessel of post 1780, the copper pump tube suggests a late eighteenth century or early nineteenth century vessel, and the large storage jars with their plaques suggest a vessel of between 1745-1800. Looking at these various dates of introduction of items, it seems certain that the vessel went down after 1781.

Whereas introductory dates for types are clearly useful, terminal dates (the second approach) are more difficult. Obsolete items may well continue in use for some time in specific instances, indicating a falsely early date for a wreck. Old plan anchors, for instance, are to be found on the Lancier wreck (1839). However, Pandora was an almost new naval vessel, and generally may be expected to have been given modern equipment. She carried old plan anchors, suggesting early nineteenth century or earlier, the fire hearth looks like the Brodie stove, suggesting a date of pre 1810, the spectacle plate was identical in shape to that on the H.M.S. Victory, suggesting the late eighteenth century, and the large storage jars suggest a date prior to 1800.

Thus, the material examined would seem to indicate a vessel lost between 1781 and 1800.

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D) The Type of Vessel Indicated by the Nature and Quantity of Material

The number of anchors on the site (at least 5) indicate a large vessel equipped for a lengthy voyage. The Pandora, venturing into unknown waters, would have been liberally supplied with anchors. At least six cannons could be seen exposed on the site and there would undoubtedly be more beneath the sand. On the recently discovered wreck at Point Cloates in Western Australia three cannons could be seen on initial inspection, but excavation in the stern section has revealed a further five guns, and more are to be expected in the bow section. Thus, the immediate observation of six exposed guns on the site investigated would suggest that at least twice that number may be expected. It is the indication of a large, well armed vessel such as a naval frigate, a large East Indiaman or a large privateer. The iron fire hearth is fully consistent with a British naval vessel such as a frigate. The single observed capstan would suggest a frigate rather than a larger naval vessel but a second capstan could well have been buried on the site. The diameter of the copper pump tube is consistent with a vessel of the Pandora's size. Similarly the rudder pintle dimensions match well the gudgeon dimensions of the H.M.S. Success, a frigate of similar tonnage to the Pandora. The spectacle plate suggests a vessel built for action. The storage jars are entirely consistent with the nature of the Pandora's mission.

Thus, it can be said that the site investigated was a large well armed vessel, prepared for voyaging in unknown waters.

E) Other Wrecks in the Vicinity

Torres Strait and the Great Barrier Reef was an area notorious for the loss of shipping in the early nineteenth century. There does not appear to be any comprehensive account of such vessels but Bateson (1972) mentions a number of wrecks between the years 1780-1825 which need some consideration. These are as follows:

Mersey - a ship of 350 tons, lost in Torres Strait in 1805 on a voyage from Sydney to India with a cargo of timber

Fame - A convict ship of 464 tons, lost in Torres Strait in 1817 on a voyage from Sydney to Batavia

Henry - A convict ship of 386 tons, lost in Torres Strait in 1825 on a voyage from Sydney to Batavia.

The convict ships would have carried a number of guns, but the number of anchors and the size of the pintle jaws on the site investigated suggests a larger ship than these vessels. The records available do not suggest any losses in the area between 1780 and 1800 of large well armed vessels, prepared for voyaging in unknown waters. Nor are large privateers known to have been active in that area.

F) General Aspects of the Site

The length of exposed wreckage (40 metres) compares well with the 114½' (35 metres) gun deck of the Pandora. The wreck is heeled over on its port side (indicated by the orientation of the stem) which is consistent with midshipman Heywood's sketch and Captain Edwards' description of the Pandora heeling over as it went down. The anchors, one at either end of the site and others within the wreckage, are curiously distributed but consistent with the Pandora sinking on its own anchor.

G) Conclusions Regarding Identity

All the available evidence supports the conclusions that the site investigated is in fact the Pandora. Unless a bell (or the felloe of the wheel, or a capstan base) is found with the name Pandora stamped on it in documentary form (and that is not very likely), then the identification must be based on the locality of the site and the artifacts found. Such is the case with most wrecks, like the Batavia (1629), the Sydney Cove (1797), and the James Matthews (1841), each of which has been satisfactorily identified. When all the evidence relating to the locality and artifacts is considered, the identity of the Pandora is quite conclusive. The wreck lies at Pandora Entrance close to breaking reefs, in the approximate depth of water indicated by the survivors. The bearing taken at the time to the sand cay leads a searcher to the vicinity of the wreck. No other similar wrecks are known to lie in that vicinity. The extent and nature of the wreckage indicates a frigate of the Pandora's size, fitted for an extraordinary mission and the artifacts are all from the period the Pandora was lost.

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6. Archaeological Significance

To adequately assess the archaeological significance of the Pandora wreck it is necessary to consider the importance of the site to Australia, to the Pacific Region, and to Britain. For this analysis the site can conveniently be divided into three aspects: the hull and equipment belonging to the ship: the cargo and the crew's possessions: material left on the nearby sand cay by the survivors.

A) The Hull and Equipment Belonging to the Ship

During inspection of the Pandora wreck site the observed distribution of material exposed on the seabed indicated that the vessel had been subjected to very little disturbance after settling on the bottom. During the bottom time available on the expedition no trenching could be done, so no timber was seen. Nevertheless, because of the prevailing conditions on the site it may be expected that from a level of about 30cm under the sand, the whole of the lower portion of the ship will have survived as an intact timber structure. This will include the full length of the keel and keelson, ribs and planking up to a level a little below the waterline on the starboard side, and considerably above the waterline on the port side. Judging from the superficial layer inspection of the wreck, and the site conditions - deep water, level sand, no rock and no turbulence - the Pandora may prove to be one of the best preserved shipwrecks in Australian waters. Certainly the conditions for preservation are infinitely superior to those on any other pre-1800 wrecks in Australian waters.

Muckelroy (1978) has constructed a table of five classes (based on condition) of wreck sites in British waters, based on topography (% of bottom sedimentary deposit), deposit (range of sediments), slope (average over whole site), sea horizon (sector of open water for 10+ km), and fetch (maximum offshore distance). Muckelroy's 1st Class site has 100% of bottom sedimentary deposit, a range of sediments between gravel and silt, a minimal slope over the whole site, an open water sector of less than 90°, and an offshore distance of less than 250km. The Pandora wreck fits comfortably into this 1st Class site condition. On a 1st Class site one can expect extensive structural remains, many organic remains, many other objects, and coherent distribitions. The Mary Rose (1545) and the Vasa (1628) are examples of this class, while the Batavia (1629) would be a 2nd Class site, the Vergulde Draeck (1656) a 3rd Class site. The actual sinking circumstances of the Pandora were somewhat similar to those of the Vasa: in each case the ship simply filled with water, sank to the bottom intact, and remained there undisturbed. The Vasa had the additional advantages of a teredo-free mud bottom, which enabled the survival of the upper levels of the vessel.

Given that the hull is in an excellent state of preservation what is the potential of the site as a study of eighteenth century shipbuilding? Plans became more widespread during the eighteenth century (Lyon 1974): the English Navy Board required constructional drawings from 1716 onwards, and

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these became increasingly comprehensive as the century progressed. So far as the archaeological remains of such vessels are concerned, the importance of the evidence is thereby to be seen in a study of the details of ship construction, and in ascertaining the extent of which the established specifications were followed in practice, or were modified in the course of the life of the vessel. The Pandora, being well documented, provides a perfect opportunity for such studies. Because of the isolated position of the wreck, and the depth of water, the detailed study of the ship's timbers would be facilitated by raising the entire hull and restoring it in a museum.

Britain does have an eighteenth century war ship, the H.M.S. Victory, but the scale is not comparable. The U.S.S. Constitution, a frigate built in 1797 and restored in the United States, is also considerably larger. The raised hull of the Pandora would provide the means for detailed comparison with these larger warships, a venue for the study of the smaller frigates with which Britain ruled the seas, and would represent in a better way than any other surviving remains the scientific vessel of that era to which Cook, Bligh and Dalrymple belonged.

B) The Cargo and the Crew's Possessions

The condition of the wreck favours the survival of material relating to both the cargo (in this case the breadfruit plants) and to the crew's possessions. The earthenware jars already observed are likely to have been associated with the care of the plants on the homeward voyage. Deeper levels may well yield the wooden containers of the breadfruit. It is unlikely that any of the crew would have been trapped below decks when the ship went down, but the circumstances of the foundering were such that very few of their possessions were taken with them. Thus, given careful excavation study could go beyond the technological aspects of the vessel, to the social aspects of the crew's accommodation and their activities in the lower parts of the vessel, resulting in new light on the life on a British scientific expedition of the eighteenth century, for officers, crew, and mutineers. Already, the superficial examination of the position of the ship's fire hearth has provided food for thought regarding the housing of the cargo of plants and the resulting conditions for the unfortunate mutineers.

C) Material Left on the Nearby Sand Cay by the Survivors

The survivors did not remain long on the sand cay and are not known to have left items. Heavy seas wash right over the sand cay thought to have been visited, so the potential is very limited here in terms of excavation.

D) Conclusion

The Pandora wreck has a very good archaeological potential in terms of the Bounty Episode. The wreck encapsulates evidence about the breadfruit plants, about the mutineers and about their captors. In order to reveal and extract such information however excavation must be conducted with

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meticulous standards. The excavation will result in a huge archaeological collection consisting of the wooden hull, at least 24 cannon, at least five anchors, the fire hearth, and all the well preserved material from the lower sections of the ship, which will probably include many more intact ceramic items, glassware, wooden barrels, personal possessions etc.

How does the Pandora wreck compare with other seventeenth and eighteenth century wrecks in Australian waters? The known wrecks of this period are the Trial (1622), the Batavia (1629), the Vergulde Draeck (1656), the Zuytdorp (1712), the Zeewijk (1727), the Sirius (1790), the Pandora (1791) and the Sydney Cove (1797).

Of these, the Trial has a certain pre-eminence as being the earliest wreck in Australian waters, but the site is in poor condition. The Batavia is the earliest of the Dutch East Indiamen and has yielded an amazing collection of material. The Sirius (earliest of the post settlement sites), has not been investigated by archaeologists, but because of its location the site may be expected to be in relatively poor condition. The Sydney Cove was the first of the merchantmen trading with Australia to be lost, and is in good condition. In terms of site condition it may be expected that the Pandora will prove to be a better wreck than all of these, including the Sydney Cove and the Batavia. In terms of specific Australian historical/ archaeological significance the Pandora ranks below the Sirius and the Sydney Cove. In terms of international archaeological significance the Pandora, by virtue of its condition, age, and the special nature of the vessel, may be said to rank closely behind the Batavia. Summing up it may be said that by virtue of the background of the Pandora it is the most spectacular shipwreck in Australian waters, and it will no doubt prove to be the best preserved of the seventeenth and eighteenth century (the earliest phase) shipwrecks in Australian waters.

7. Recommendations

A) Preliminaries

(i) Site Security

The Pandora wreck is one of the most important shipwrecks in Australian waters. The exact position of the site is known to a large number of people, including the crews of the R.A.A.F. search aircraft, and the vessels Beva, Reverie and Lumen. Less than a month after the site's initial discovery a private diver from Cairns independently located and dived on the wreck, having sailing directions with him. To date the diving fraternity have acted responsibly, but the site could well be pillaged in a manner which would nullify its archaeological importance. Coastal surveillance aircraft covering the area should be asked to report on vessels stopping at the cays. If the area is not utilised commercially then the Minister should consider making the area of the cays and the wreck site a prohibited area under Part II, Section 7 of the Act. The sand cays are not suitable as a tourist attraction, so anyone loitering in the area could be presumed to be interested in the wreck.

(ii) The Material Raised

Items I know to have been raised from the site to date are as follows: 1 large earthenware jar with the initials TMF (Queensland Maritime Museum); 1 copper pintle (Queensland Maritime Museum); part of a copper pump tube (Queensland Maritime Museum); 1 copper bolt 990mm in length (Queensland Maritime Museum); 1 spectacle plate (Ted Louis, Sydney); 1 black glass bottle 300mm high (Ted Louis, Sydney); (Fig.)

Fig. 24 : A pintle raised from the site. Drawing by courtesy of the Queendland Maritime Museum.

1 black glass bottle neck (Ted Louis, Sydney.

Fig. 26 :

A glass bottle raised from the site.

Peter Moon (Sydney) mentioned that he had several bones, a copper pintle is lying in a N.S.W. dive shop, and John Heyer has bones and wood? in London. A saltglazed stoneware jar raised during the inspection expedition is undergoing treatment with the W.A. Museum's Department of Materials Conservation.

This material all requires treatment in a conservation laboratory. The copper items I examined were by then all suffering from bronze disease, which is particularly unfortunate because the unpitted edges on the items showed that they had been in excellent condition when raised. The glass bottle showed rainbow coloured exfoliation flakes and the large earthenware jar had one of its plaques hidden by concretion, thus for the present reducing its value as an identification pointer.

After treatment, these items should be registered, fully recorded and brought together as a single collection in suitable housing with a responsible institution. Otherwise it is inevitable that the individual items will be dispersed, will deteriorate, and be lost from the Nation forever. The Federal Government would seem to have both a legislative and moral responsibility for ensuring that the collection is so maintained by some responsible institution, because of its Historic Shipwrecks Act, and the role of the R.A.A.F. in assisting to reveal the position of the site.

B) Excavation of the Wreck

Now that the position of the site is known, it is necessary that excavation of the wreck be undertaken. The Western Australian experience has shown that only the proper excavation of important shipwrecks in isolated areas can save them from destruction by looters with explosives.

(i) Logistics Problems

During any sustained period of activity on the Pandora wreck four logistics problems have to be catered for:

a) Distance from mainland cities. The site is some 70 miles from the nearest part of the mainland (Cape Grenville), some 150 miles from the nearest port serviced by a regular commercial airline (Thursday Island) and some 400 miles from the nearest small city (Cairns). An expedition's plant would have to be ferried out to the site from the nearest port by a large expedition boat, or be transported by some passing vessel. Supply runs would have to be kept to a minimum, so an expedition would need to plan for self sufficiency.

b) Distance from habitable land. Three sand cays lie within three miles of the wreck site. One of these cays is partially covered with grass and very small bushes and although only a few feet above high tide it would be large enough for an expedition camp to be established. However, it would be totally unsafe during a cyclone and provisions would have to be made for complete evacuation of both personnel and equipment in such circumstances to the Sir Charles Hardy Islands (50 miles away) or Thursday Island (some 150 miles away). For this reason an expedition would need at all times at

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its disposal a vessel large enough to carry all personnel. A small island (Raine Island) 10 miles from the wreck has the ruins of a building which could in the event of an evacuation, house some of the more bulky expedition equipment such as tents, water and fuel.

c) Depth of site. The water depth (30.5m) on the wreck site presents several logistics problems. Firstly there is the safety factor. It is possible that a diver would overstay his bottom time and experience the bends. For this reason the expedition would require adequate radio communications in order to keep itself informed as to the whereabouts of the nearest operating helicopter. The second problem about water depth is that an individuals bottom time is restricted to less than one hour per day, reducing productivity. Thus, a relatively large number of diving personnel would be required to get the work done on a daily rotation system.

d) Weather conditions. South-easterly winds blow during the winter and north-westerlies during the midsummer monsoon. Tropical cyclones can develop between November and April. On average, about three Coral Sea tropical cyclones hit the coast of Queensland each year. During the period of the south easterlies, there are few calm spells on the wreck site. The advice of d divers who have previously visited the area was that the transitional periods offer the best weather, but this also brings the possibility of a cylcone. Perhaps December would be the best month, and for a two month season perhaps mid November to mid January.

February was right in the middle of the cyclone period, although March was considered reasonable. Obviously the advice of the Bureau of Meteorology would need to be obtained before an expedition's dates were finalized, and on site regular radio schedules would be required to keep up-to-date on weather developments.

(ii) <u>Excavation Approaches and Methods</u>

The excellent conditions of the site dictates the approach to be taken in excavation. A large number of heavy, relatively durable items can be raised in a straight-forward manner not requiring a great deal of time. However, there will also be a great number of small or delicate items - material which will be lost during excavation unless a painstaking approach is maintained. There is in addition, the question of distribution within the wreck - only the most detailed recording methods will provide this information with the accuracy needed to exploit the full archaeological potential of this site.

The complete excavation of the wreck could be broken into two distinct phases; the excavation of the contents of the ship; and the raising of the hull itself. The excavation of the contents of the ship would require two 3 month seasons of work given reasonable weather conditions, while the raising of the timbers might require another two

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similar seasons. The second stage planning would be dependent upon information gathered during the first stage.

a) The excavation of the contents of the ship. The site should be gridded in a manner such that 3 dimensional recording could be achieved (Henderson 1977). Air-lifting would then proceed from one end of the site to the other, all objects other than the ship's timbers being removed as they were revealed and recorded. Heavy objects such as cannon and anchors would be raised with air bags and towed to an anchorage position where they would be left on the seabed awaiting transport to a laboratory on a vessel with lifting gear. Lighter objects would be taken to the sand cay and stored in plastic lined baths dug in the sand.

b) The raising of the hull itself. The same grid system would be used to record the timbers which would then be labelled, sawn into manageable sections on the seabed, raised with airbags or a small winch and stored in water filled plastic lined pits on the sand cay, awaiting transport to the laboratory.

c) Excavation equipment. For work on site there is a need for an all weather craft to function as a diving platform and support for the air-lift compressor. The minimum size for such a vessel is about 10 metres, and a vessel of 10-12 metres would be ideal. The vessel should also have sufficient speed and range for an amergency run to the nearest port (Thursday Island, 150 miles). I used such a boat during the cyclone season on a recent excavation of a wreck at Pt. Cloates. The site was 150 miles from the nearest port, and the winds encountered on site were regularly between 15-25 knots. That vessel was a 10 metre, 18 knot aluminium Star Craft, powered with a Ford 6 cycliner 180hp diesel engine and costing the W.A. Museum $19,900 in 1977, (radio, compass, echo sounder, safety equipment etc. were extra). I would recommend purchasing such a vessel, which could be re-sold on completion of the work.

The second major requirement is an airlift compressor of at least 50 cfm but sufficiently compact to fit snugly into the well of a workboat during heavy weather. The W.A. Museum purchased a 50 cfm unit in 1978 for $3800. This is approximately 7cwt and is powered by a 20 hp petrol Kawasaki engine. Airlift units can be hired.

An inflatable runabout of 18-20 feet would be necessary for ferrying divers between the wreck site and the sand cay for their diving shifts, to avoid interruption the work boat during the day. In addition several aqualungs, a high pressure compressor, hookah, safety equipment (oxygen cylinders), fuel supplies, collecting equipment (lifting bags), and gridding would be necessary.

d) Equipment for the sand cay camp. This would include an equipped kitchen/eating tent, an equipped office/ darkroom tent, an equipped registration/conservation tent, lighting plant, freezer, maintenance equipment and spares. Personnel would provide their own one man sleeping tents but some provision would be necessary for weather protection in case of a long spell of heavy rain and wind. Radio communications would best be situated on the two larger boats. Depending on the nature of the boat for the transport of personnel and equipment, a small jetty might be necessary for getting the larger items (such as lighting plant, freezer and high pressure compressor) from the boat to the shore.

e) Personnel Transport - The ideal vessel for transport of personnel and equipment would be an Army or Navy landing barge of sufficient size to carry all expedition members, plant and artifacts from and to Thursday Island (or perhaps the mainland south of Portland Roads where there is an air strip and a road out). Such a vessel could be beached at the sand cay for loading and unloading operations. It would of course be dependent upon the Australian Army or Navy in Queensland in making available for the duration of the expedition the craft and an officer competent to skipper the vessel. If the landing craft was not fitted with a winch then this would need to be fitted.

Should such a vessel not be available, a number of alternatives exist. The various options would need close consideration because the cost factor can become quite prohibitive with large vessels offering shipboard accommodation The requisites for the expedition vessel are firstly that it be on hand to provide transport of the party (it need not be comfortable, nor provide bunks or food) to the nearest port at any time in case of a cyclone. The vessel does not need to provide any accommodation for the duration of the expedition, as personnel would stay on the sand cay. Secondly, the vessel might be large enough to also take the expedition plant and artifacts (although an alternative to this aspect would be the charter for several days at the commencement and conclusion of the expedition of a vessel for that purpose). I have not sought quotes on such vessels, but Steve Domm did mention to me that an acquaintance of his had offered his 60ft. salvage vessel Tortoise (9 knots) for 2 months for $5000.

f) Personnel. Because of the depth of water on the site a large team of divers would be required. As their daily work time on the sea-bed would be limited, each of the divers would have another function on the expedition. The list of personnel might be made up as follows: Director (a maritimearchaeologist), Field Co-ordinator/ Diving Officer, a second Archaeologist, Mechanic, Field Conservator, Photographer, Boat Skipper. In addition a number of volunteers (often university students or retired professionals are best) including Cook, Doctor (Dr. Peter Holt of Thursday Island has stated his enthusiasm,)Surveyor, Artist, Registration Officer,

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Assistant Conservator, Assistant Mechanic. In the final analysis the list would be modified depending on the availability and combinations of particular talents, but a team of 10 to 15, including 5 to 7 on wages, would be appropriate.

(iii) Costs and Funding

To make costs realistic on any maritime archaeological project, consideration must be given to all possible means of economising without prejudice to safety or the standard of work. This could be done on the Pandora by maximising the number of volunteer workers, by ensuring that these volunteers provide their own mainland transport to Thursday Island, their own basic diving and camping equipment and food, and by camping on the sand cay rather than on board an expensive vessel. Other major costs would be avoided by approaches to sponsors and other institutions.

If an Army/Navy landing craft could be obtained it would reduce costs very considerably. Perhaps an exercise might involve the transport of plant and personnel, setting up of moorings, and building a small jetty. An excavation of the spectacular nature of the Pandora would attract sponsorship from both National and Internation Companies. Beaufort Australia would likely supply an inflatable boat (they have to Ben Cropp, and the W.A. Museum), Atlas Copco would likely provide an air lift compressor hire free (as they have done for the W.A. Museum in the past), a shipping company might be found to provide transport of plant and artifacts from Thursday Island to a central laboratory, Ansett Airlines may be prepared to provide free mainland flights for personnel to and from Thursday Island (M.M.A. have done for the W.A. Museum), several large mining companies may be induced to support the purchase of the work boat (B.H.P. and Woodside Petroleum contributed to the W.A. Museum's Kimberley inspection trip). The excavation of the Pandora will inevitably attract worldwide attention by all sections of the news and documentary media, so companies would stand to benefit from a sponsoring association with the work.

Several Federal Government funding agencies, such as the Heritage Commission and the A.R.G.C. Committee, have assisted projects at the W.A. Museum in the past. Inevitably the balance would need to be provided by whichever Institution is delegated responsibility by the Federal Government for the excavation. The fund raising and expedition planning programme itself would be a full-time job for an expedition organiser for 6-12 months prior to the commencement of the field work.

C) Treatment of the Material Raised

The collection of material which would be raised from a complete excavation of the Pandora wreck may be expected to be larger than any existing collection in Australia, including (assuming that a large section of the Pandora hull does indeed still survive) the Batavia. Whereas much of the material from the Batavia was scoured from the site and dispersed by heavy seas, such material has probably

remained within the Pandora wreck. At present the only laboratory in Australia equipped to process such a collection is that at the W.A. Museum, but distance alone would preclude the work being done here.

Three other alternatives would appear worthy of some consideration:

i) In the State of N.S.W. the Museum of Applied Arts and Sciences has for some time been considering establishing a Maritime Archaeology/Conservation section, and is considered likely to be given the responsibility by the State Government. When the Conservation Laboratory is established it might be that that institution could be pursuaded to take on Phase 1, the processing of the Pandora's contents while either the Federal Government or the Queensland Government prepare for Phase 2, the task of treating the ship's timbers.

ii) In Queensland the State Government is said to have been giving consideration to setting up a Conservation Laboratory, but I have no knowledge of any details. The Queensland Maritime Museum has a very attractive waterfront property in Brisbane.

iii) If neither of the above alternatives eventuate in the near future an alternative might be for the Federal Government to set up a Central Conservation Laboratory in Canberra, or to assist in setting up such a laboratory in one of the States, such as N.S.W.

D) Display

The discovery of the Pandora wreck presents Australia for the first time with the opportunity of obtaining a collection so spectacular that it would provide the appropriate display material for a National Maritime Museum. Such a Museum, with the Pandora wreck display forming a centre piece and telling part of the story of the European opening of the Pacific, could utilize the Federal Government's Dutch wreck material to tell of Australia's discovery, Cook's cannon to tell of the East coast exploration, Flinder's anchor to tell of coastal surveys, and so on. It is difficult to envisage a more exciting opportunity to create a National Maritime Museum than the excavation of the Pandora wreck. Public interest would be maintained at a high level as the various phases of excavation, conservation and display progressed.

If such a Museum were to be created Sydney would seem to be the most appropriate venue, it being situated in what might be termed a location central to the States, on the seashore, at the place where the European occupation of the Australian continent began. Some, or all of the material might go to Queensland when several Museums are likely to be interested in creating a display about the Pandora wreck. Discussions between the Federal Government, the N.S.W. Government and the Queensland Government might conceivably result in joint funding and a sharing of the material between a National Maritime Museum in Sydney, and a Museum in Queensland.

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