Australian National Maritime Museum Information Sheet :

The Vernon Anchors and HMB Endeavour Cannon

Conservation of two important Australian maritime artefacts on display at the Australian National Maritime Museum -- an information sheet for curriculum unit Shipwrecks, Corrosion and Conservation.

Restoration and Conservation

Conservation is the preservation of artefacts to prevent further deterioration. **Restoration** is changing an artefact to return it as close to its original appearance as possible. The anchors from the vessel *Vernon* outside the Australian National Maritime Museum near Pyrmont Bridge, Darling Harbour, represent an example of conservation by application of a protective coating (both physical and chemical) for the iron and anti-rot preservatives for the timber. The cast iron of the anchors is from 1839 and the timber stocks date to 1905. They have not been returned to an 'as new condition'.

The cast iron cannon from the James Cook's HMB *Endeavour* on display in the *Navigators* exhibition has been conserved using oxidation-reduction techniques combined with physical protection. While the metal cannon is original, the timber and associated parts have been manufactured to copy how the cannon might have looked when used on board *Endeavour*.

It should be noted that neither of these processes are considered restoration. In most conservation projects restoration is not applied. An artefact with its wear, tear and decay can tell a truer story than an artefact altered in an attempt to return it to original condition. Conservators and curators at museums therefore take great care to consider the context in which artefacts will be displayed before undertaking projects. In some cases artefacts are no longer removed from where they rest on the sea floor.

The *Vernon* anchors

Background

These anchors are on public display outside the Australian National Maritime Museum. The ship *Vernon* was completed in 1839 and from 1871 to 1891 was moored off Cockatoo Island, in Sydney harbour, as a reformatory for ‘wayward and orphaned boys’. Following their use on the *Vernon*, the anchors continued to be used for mooring other vessels. The timber stocks dating from 1905 were once sheathed in copper to protect them. On each anchor, one of the iron flukes was bent back to avoid damage to a vessel’s hull. Each anchor bears the broad arrow symbol of the Royal Navy and one still shows the 1839 date of manufacture. During the 1980s members of the Seamen's Union suggested the anchors be preserved as a memorial to sailors and with funding from BHP the museum undertook the project to preserve the anchors and place them on display.

Treatment

Electrolytic stabilisation of the anchors was not considered an option for two main reasons. Primarily, such treatment would destroy the timber stocks or require their removal which would cause unnecessary damage. Secondly, it was considered that the anchors were in sufficiently good condition not to require electrolytic treatment to preserve the cast iron.

The preservation process was to remove the outer corrosion and the remains of protective paint by blasting and then coating the surface with a protective material. In 1992 after earlier temporary treatments, the iron surface of the anchors was blasted with copper slag then garnet polished (a more refined process than sand blasting). This revealed previously unnoticed inscriptions on the anchors. The timber stocks were masked for protection during this treatment. The iron was then treated with a zinc epoxy paint. The timber stocks were saturated with a zinc napthenate solution (copper napthenate is more effective at retarding the growth of organisms such as mould but causes green discolouration).

Display

The brief for this project was that the anchors would be displayed outside and in an accessible environment to visitors. This creates a challenge for the ongoing preservation of the anchors because the anchors are open to the elements of wind, rain, sun, hail, humidity, sea spray as well as attack by vandals. A display and mounting system was built for the anchors which includes an aluminium mesh on which the anchors rest. Mesh rather than solid metal allows water to drain away and aluminium was chosen because of its electrode potential relative to the iron in the anchors.

Monitoring

As the treatment used is less permanent than electrolytic techniques, the Vernon anchors are regularly inspected for deterioration. Being on public display as a memorial has also exposed the anchors to

vandalism (2 rings were repaired and refitted after vandalism in 1992). The anchors are also hosed with freshwater on a regular basis to reduce salt build up which occurs close to the sea.

Questions

1. What factors were considered before undertaking conservation work on the cast iron of the Vernon anchors?

2. Why was electrolytic conservation not chosen as a technique?

3. Epoxy paints form hard resinous surfaces. How will this protect the metal from corrosion?

4. What additional protective benefit does zinc provide in the epoxy paint? (Consider redox potential)

5. What deterioration do the organic timber stocks face and what was done to prevent this?

6. What compromise was considered in the choice of treatment of the timber stocks?

7. Why is an aluminium support used for the anchors on display?

8. Why use mesh rather than solid aluminium? (Consider environmental factors that promote corrosion)

9. Why are the anchors regularly hosed down, even though water is a factor in corrosion?

10. What other challenges do the anchors face on public display?

HMB *Endeavour* Cannon

Background

During its voyages, Captain Cook's *Endeavour* was damaged when it struck part of the Great Barrier Reef in June 1770. In an effort to float it off the reef by reducing weight, Cook ordered six cannons and other heavy items thrown overboard. On the charts he made, Cook recorded the location of this incident (possibly for later recovery or perhaps simply because he kept detailed records of all aspects of his voyages). In 1969 researchers used a magnetometer to scan the reef in the area shown on Cook's charts. The six cast iron cannons were discovered very close to where Cook had indicated, invisible under two centuries of coral growth. Underwater explosives were used to free the cannons from the coral. The wooden stocks, if they survived, were not retrieved.

CAPTION: The original cast iron cannon is displayed on a replica gun carriage 'run out' to its firing position by gun tackles.

Treatment

After recovery from the sea floor, the cannons were transported in sea water then left to soak in a sea water solution with 10% formalin to kill any bacteria present. Hammers were used to remove hard coral from the surface. Core drilling of the cannons' bores recovered wadding, cannon balls and the residue of powder charge from some of the cannons!

The cannons were then placed in 2% NaOH for a week during which time gas evolved from the surface which was found to be 80% hydrogen.

Using the cast iron cannons as the cathode and mild steel anodes (including a bar inserted inside the cannons' bore for good current distribution), electrolytic treatment in 2% NaOH was maintained for many weeks. A current density of around 10 amps per square metre was used (less would be too slow, more would cause damage to the artefact surface by hydrogen gas bubbling). This required approximately 4 volts across each bath. After a two week period during which the baths' chloride concentrations rose from 0.008M (300ppm) to 0.013M (460ppm), the solution was discarded and replaced.

Subsequently, baths were changed weekly and the cannons washed with fresh water at each change. It took many weeks before the chloride concentration levelled out at around 5 x 10-4 M (20ppm). During this time brown rust patches were seen to disappear and the surface layers hardened.

After electrolytic treatment, prolonged washing was carried out to remove remaining chloride and hydroxide. This took 5 months with fortnightly changes using distilled water with chromate ions (8.7 x 10-3M), pH > 8.5. (An iron oxide, chromic oxide surface protective layer forms).

The cannons were dried for 48 hours at 120° C. They were then immersed in molten microcrystalline wax which was kept at 135° C for 5 days until no gas bubbles were evident. Allowing the wax to cool to just above melting point (80° C) before removing the cannons from the wax ensured maximum penetration of wax. This wax treatment is reversible. This is significant as it allows for the possibility of better treatments in the future.

Display

One of the *Endeavour* cannons can be found in the *Navigators* exhibition in the National Maritime Museum. The original cast iron cannon has been placed in the recreated wooden stocks to show how it might have appeared on the decks of the *HMB Endeavour*.

CAPTION: The cannon is well enough preserved for the Royal Navy broad arrow, the British Royal emblem and other identifying features to be clearly visible.

Questions

1. How might the rapid growth of coral have protected the metal cannons from greater corrosion?

2. Electrolysis replaces iron chlorides / hydroxides with magnetite not the original iron. Why is this still an appropriate conservation technique?

3. Why is the chloride level monitored during electrolysis?

4. What problems might occur if too high a voltage / current were applied during electrolysis?

5. What is the function of the final wax coating?

6. Why is it considered beneficial for the wax coating to be 'reversible'?

7. How does conservation differ from restoration?

8. When residues of powder charges were analysed, traces of sulfur and carbon were detected but not potassium nitrate (the main ingredient in gun powder). Why?

References

Pearson, C. Report 508 *Restoration of cannon and other Relics from HMB Endeavour*, (623.42 PEA, ANMM library)

ANMM archives Files C07.0688 & C07.0688\2, *Conservation Vernon Anchors* 9088-9089 (extracts from these archives are available in the ANNM library)