Voyages in time

Historical article

Bruce W Piggott

North Queensland X-Ray Services, Townsville, Queensland 4814, Australia
Correspondence email bkpiggy@optusnet.com.au

Abstract While working at Townsville General Hospital in 1999, I was approached by the local museum to x-ray some artefacts from two shipwrecks. The excavated artefacts, mostly covered in coral and barely recognisable, were from the historically and scientifically significant shipwrecks of the Bounty and Pandora. With the aid of radiography, the conservator was better able to assess, handle and restore these valuable artefacts, which helps further research and education into maritime archaeology. With this material evidence, archaeologists can draw more accurate conclusions about a variety of issues regarding life in the 18th century, while we retain a permanent display to show people the importance of archaeological conservation in the role of history.

Key words: artefacts, coral concretion, conservation voyages, maritime archaeology, radiography, valuable resource.

Introduction

When I accepted an offer by the local Museum of Tropical Queensland (MTQ) conservator, Mr Andy Viduka, to x-ray some ‘shipwreck bits’, little did I realise how valuable the resource of radiography would be to investigative Maritime Archeology. Radiographic assistance has helped determine the types of materials in artefacts that are encrusted in a coral concretion, thereby facilitating successful conservation.

Incredibly, these artefacts were excavated from the shipwreck sites of the Bounty and Pandora, two of His Majesty’s, that is George III, (1760–1820) ships that share remarkable yet infamous journeys through the South Seas in the 18th Century. Through the crews actions, these vessels will be irrevocably bonded throughout time. A brief history, starting over 200 years ago, will help set the scene for a fitting and marvellous twist of fate in modern day Townsville.

Voyage 1 – His Majesty’s Armed Vessel Bounty

In 1787, the Bounty sailed from England, initially bound for Tahiti. After five months there, the Bounty, fully laden with breadfruit, headed for the Caribbean to fulfil her trade mission. Just west of Tahiti, the infamous mutiny led by Fletcher Christian and 22 crew took place.

The legendary Captain William Bligh and 18 crew were set adrift in a 23-foot launch. He navigated the 6700 km to Timor in 41 days; a brilliant feat of seamanship in a small open boat. He returned to England but never saw Fletcher Christian or the Bounty again.

The Bounty fled eastwards and after leaving 16 mutineers at Tahiti, the remainder of the crew, with several Tahitian Islanders, settled at Pitcairn Island. Purportedly, to escape discovery from the outside world, the Bounty was then scuttled by the mutineers in 1791 (Figure 1).
Voyage 2 – His Majesty’s Ship Pandora

The British Admiralty, determined to hunt down the mutineers, dispatched the 24-gun frigate, Pandora, under the command of Captain Edward Edwards from England in 1790. After capturing 14 of the surviving mutineers in Tahiti, the Pandora searched the South Pacific Islands unsuccessfully for the remaining mutineers. From the time Edwards arrested the mutineers on Tahiti, he treated them badly. This worsened with the construction of a small, poorly ventilated cell to house the prisoners on the quarterdeck – the infamous ‘Pandora’s Box’. After a fruitless search of several Pacific islands, Edwards gave up on catching the missing mutineers and, running short of supplies, the Pandora turned west for England via Timor through the Torres Straits. The Great Barrier Reef lived up to its name and on the 28th August 1791, the Pandora, still with prisoners incarcerated in Pandora’s Box, struck a reef. She finally settled in a lagoon, before sinking, killing 31 crew and four prisoners. Captain Edwards and survivors miraculously replicated Blight’s earlier open boat journey through the reef and Torres Straits to reach Timor. They were eventually transported to England where the remaining prisoners faced disciplinary charges. (Figures 1 and 2).

The shipwrecks

Scientific significance

The Bounty was stripped of personal possessions and other equipment for settlement on Pitcairn Island and then set alight before she sank off the main boat landing. In 1998, an archaeological team from James Cook University (JCU) started the first of two expeditions to recover artefacts from the shipwreck site as well as the island, where descendents of the mutineers still live. Surprisingly, organic material from the shipwreck in the form of rope and timber survived. A major find was the last remaining four pounder gun, which was sent to Townsville for conservation and treatment with other artefacts.

The Pandora was discovered 110 km east of Cape York in 1977 and was immediately protected by the Historic Shipwrecks Act. It is one of Australia’s best preserved sites, having lain undisturbed for 186 years. Pandora is not a typical shipwreck, that is the crew did not have time to remove possessions or equipment before she sank, virtually intact, into a soft sandy seabed. Since 1983, nine expeditions involving archaeological excavation have been conducted resulting in approximately 5000 artefacts for examination.

Archaeological significance

While the story of the Bounty has been popularised through literature and movies, it has focussed mainly on Bligh and Christian. Now material from the site itself will result in the first detailed picture of life in the settlement.

Excavation of the Pandora provides material evidence of the real life objects from the period of the late 18th Century. With these objects, archaeologists can now provide us with a better understanding of seafaring life in that period. Wider inferences about society, culture and life in general can also be made.

The Townsville connection, the ‘hunter’ meets the ‘hunted’

Until 1999, The Maritime Archaeology Section of the Queensland Museum was based at its Brisbane South Bank Campus. During 1999–2000, the Maritime Archaeology Section was transferred to Townsville to be located in the new purpose-built museum, to become home of the Pandora. This unique looking building is also a centre for archaeological conservation in Queensland – providing research, education, conservation and storage facilities. With the arrival of Bounty artefacts in Townsville, it is ironical and very fitting that the conservation of the Bounty’s four pounder gun should take place alongside the three guns recovered from the Pandora site. Nigel Erskine, team leader from the JCU expedition to Pitcairn Island, commented that this was the nearest thing to a meeting of the two ships that has ever occurred.

Conservation

Examination of excavated materials is fundamental to archaeological conservation, which aims to identify the nature of artefacts for recording and treatment processes.

Where feasible, initial examination is carried out without intervention – this is achieved using various forms of electromagnetic (EM) radiation. This usually involves visible light examination by the naked eye and binocular microscope if necessary. In order to understand what the conservator is looking at, he/she must have a good knowledge of not only the materials and how they decay but also the technology of that period. Documentation from the excavation site includes information about where the artefact was found e.g. grid measurements, mapping, sketches and photos.

The conservator looks at the shape, construction, any remaining materials and deterioration products plus the adhering materials, in this case, a coral concretion (calcium carbonate). Due to this coral encasement, the amount of information may be severely limited (Figure 3).

Therefore, other wavelength energies in the EM spectrum must be employed to help distinguish materials. The first of these are infrared and ultraviolet light, helping to determine external materials. X-rays are considered the most important tool to help determine what internal materials are present, with an indication of their condition and the original shape of the object. This helps the conservator to sort the artefacts into those requiring investigative cleaning, those not meriting cleaning and slag. The assistance, generously donated by the Townsville...
General Hospital (TGH), was in the form of general radiography and computed tomography (CT) scanning. Industrial high-density radiography, which emits high-energy gamma rays from a radioisotope source, was also used on one of the larger items – a swivel canon (Figure 4).

Use of both these imaging modalities has helped evaluate how best to handle an object if a material has been eroded to a hollow state, thus avoiding breakage (Figure 4). In certain cases, a cast can be made from the hollow section to replicate the original object. These imaging modalities have also determined how best to initiate successful methods of conservation e.g. removal of coral by mechanical methods. This is particularly important for complex or intricate objects especially when they are not intact (Figures 5 and 6). X-rays can reveal the presence of dowels, cracks, marine borer or insect damage in organic materials such as wood and depth of graphitisation on small cast iron elements.

Radiography of the artefacts

For our part, this required several sessions between 1999 and 2001. Over 120 artefacts were transported to the TGH Medical Imaging Department from the Museum – a very labour intensive job (big van, strong careful driver required) as most of the artefacts were immersed in large water tubs to halt any further deterioration (Figure 7). Over 90% of the artefacts were from the Pandora. The size of the artefacts varied considerably from approximately a small 6 cm to a very long and irregular 60 cm. The weight was similar in variation – 0.1–7.0 kg approximately. The materials consisted of wood, copper, brass, cast iron, pewter, either singly or as a composite – this was always an exciting part of proceedings as you never really knew what would be revealed. Great caution was used to avoid breakage when moving these fragile artefacts from the wet tanks to the x-ray table, particularly as they were partially or completely encrusted in concretion and coral can be sharp. The Shimadzu general room selected was prepared for use with lots of plastic sheets and absorbent ‘blueys’ on the floor, table and cassettes.

The conservator, armed with his information from his initial assessment would position the artefact in the plane or angle that he thought would get the most information. Due to the irregular and slippery nature of the artefacts, different foam or radiolucent props were employed to assist in holding the artefacts in position. Superimposition of structures from our two dimensional images often required several exposures in varying angles to separate the target material(s). More often than not, the exposures were educated guesses based on the conservator’s initial artefact assessment and often required a range of exposures varying the kVp/mAs/screens. This was particularly true of composite materials e.g. wood and metal, metals and very irregular coral encrustations. When the conservator was satisfied that he had extracted the maximum information, we would document the exposure –kVp, mAs, FFD, number of exposures, grid, screen type. All x-rays were cross-referenced to the MTQ artefact registration number and permanently labelled. All x-ray film was processed through a Kodak M6 Processor. The general guide for exposures is listed in Table 1.

Maximum detail was achieved with tight collimation, lead rubber beneath and around the cassette to absorb scattered radiation from the coral concretion and metals. Fine tube focus of 0.6 mm was used whenever possible. As can be seen from the exposure range the lighter end of the range (12 mAs/50 kVp) was fine for a small intaglio seal, requiring a high degree of detail (Figure 5). On the other hand, the brass sextant required an exposure in the mid range (Figure 6). Attenuation of x-rays is primarily dictated by the density of the materials, so some helpful diagnostic rules for artefacts are: metal is denser than its corrosion products; silver metals are denser than iron metal and;
coral concretions have a similar density as bone but can reach much greater thicknesses, up to 12 cm.

Tomography has been used by conservators before to interpret the contents of artefacts, for example to visualise an inscription on the lip of a bow. We did not have access to normal tomography but instead were persuaded, in the interests of science, to perform one selective Helical CT scan of an elaborately carved Polynesian war club, excavated from the Pandora site. Using CT to scan organic material, such as wood, provides excellent surface detail with no superimposition of structures. Having permanent images (axial and 3D) of this original detail is invaluable because the intricately carved surface will inevitably shrink and crack due to the restoration and drying process of the wood (Figure 8). The ultimate goal for the museum staff was to obtain the raw data from the Picker PQ 2000 and create holographic 3D images for a museum display but unfortunately, museum staff were unable to access the CT data.

To minimise deterioration of these permanent records, all the radiographs taken so far have been archived in acid free folders and stored on edge in a cool, dark storage cabinet at the MTQ. Sadly for us, the MTQ now has its own x-ray cabinet and wet processing tanks, which are producing great results and have eliminated all the transport and handling problems (Figure 9).

Complementary radiography

As a point of interest, another type of radiography that has also been used in maritime archaeology is neutron radiography. This uses neutrons, usually generated in a fission reactor, as the primary beam. In contrast to x-rays and gamma rays, whose attenuation depends on the nuclear cross section, a neutron beam will pass through metals only to be absorbed by organic materials. A neutron radiograph can show wood below copper sheathing or even a paper letter inside a lead glass bottle. Neutrons can penetrate lead, so this form of radiography can be used to examine lead and lead bronze. Once again, access to resources like neutron and industrial radiography and CT, usually is geographically limited and, if it is accessible, relies on generous benefactors for their use.

Conclusion

The HMAV Bounty and HMS Pandora share a colourful and infamous history – featuring a mutiny, courageous seamanship and the inhumane Pandora’s Box. Forever bonded together in his-

Figure 7 (L) Conservator, Mr Andy Viduka selecting an artefact from the large water tubs, ready for x-ray.

Figure 8 (R) A) Photo of Polynesian war club, demonstrating irreparable damage that is cracks in the wooden surface. This damage inevitably occurs once out of the water and as the wood dries out over a period of time. B) 3D CT image of the club, preserving the original surface forever.

Figure 9 The newly acquired x-ray cabinet in the lab at MTQ, Townsville.