Publications

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The Ferryland Cross Revisited

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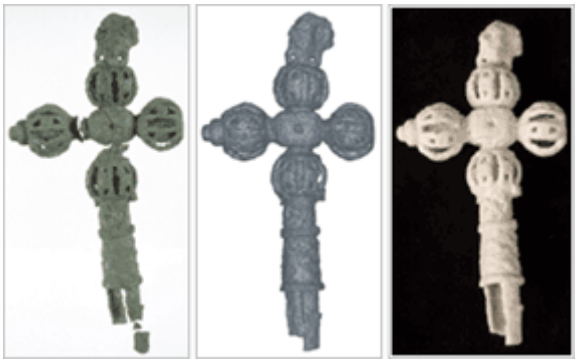
Conservation treatment in its broadest sense often encompasses much more than intervention in the laboratory. It may also involve a high level of documentation of the artifact, production of copies in case it cannot be saved, and long-term attention to its well-being. This multi-level approach is evident in the treatment of an artifact known as the "Ferryland Cross."

It was in the fall of 1985, during a short season of excavation at the site of the 17th-century Colony of Avalon, located in Ferryland, Newfoundland, that the unusual iron object was found in the remains of a forge. It was shaped like a cross, but the details were completely obscured by a thick layer of corrosion that had incorporated the gravel and sand of the soil matrix. The director of the excavation, Dr. James A. Tuck of Memorial University of Newfoundland, kept the object wet and brought it to the Canadian Conservation Institute for evaluation.

Preliminary examination revealed that it was indeed a cross, with a complex structure involving at least three different metals: iron; a yellow metal with a bright surface; and a yellow metal with a dull surface. These were analysed by energy dispersive X-ray spectrometry, which confirmed the presence of iron and identified the bright yellow metal on the surface as gold and the dull yellow metal as brass. X-radiography indicated the extent of corrosion.[1]



The Ferryland Cross in 2004 (left), the digitally reconstructed image (centre), and the plaster-based reproduction (right).

The Colony of Avalon was founded at Ferryland in 1621 by Captain Edward Wynne on behalf of George Calvert, the first Lord Baltimore. Avalon was one of several English colonies established in Newfoundland by entrepreneurs hoping to glean profits from a thriving seasonal fishery. Calvert, a Catholic convert who purchased a portion of the Avalon Peninsula, had intended his colony to be not only a source of personal profit, but also a place where both Protestants and Catholics could practice their religious beliefs. As such, the colony was unique in the New World. Why the cross was in the remains of a forge may never be known.[4,5]

Treatment of such a complex object is typically extremely difficult and often never completely successful, which proved to be the case for this cross. Not only did it contain three metals, which could interact with each other, but it also contained chloride contamination from the saline soil in which it had been found, which would cause it to react with moisture and oxygen. Chloride ion extraction was attempted but was unsuccessful.[2] Indeed, following its excavation in 1985, the cross underwent repeated examinations and a consolidation treatment in an attempt to stabilize its condition. Monitoring changes in the areas of active corrosion proved to be particularly problematic. Photography and radiography were used to document change, but it was difficult to collect accurate, mathematical measurements in the awkward, three-dimensional (3D) angles and curves.

Despite the best efforts of conservation science and practice, the cross continued to deteriorate. In 2003, when new cracks and breaks were observed, it was decided that the only way to prevent complete loss would be to isolate the cross from water and oxygen. Prior to enclos ing it in a dry, anoxic environment, it would be copied as accurately as possible so that its existing state and condition could be captured. An

accurate reproduction could also be used to fashion a custom-made support for the original pieces that would hold them together without adhesives. Avoiding the use of adhesives on the breaks was important not only because the breaks were very fragile and could be easily damaged, but because they had exposed details of construction that would be of interest to future researchers. Keeping the breaks as pristine as possible, both to monitor change and facilitate examination by scholars, was one of the goals of this phase of the conservation treatment.[3]

Copying the cross

The first step in making a copy of the cross was to create a high-resolution 3D colour digital record using laser scanning technology. This 3D imaging technology was developed by the National Research Council of Canada and licensed to Arius3D of Mississauga, Ontario, for commercial application. The scanning system consists of a laser with a motion control system to move it. The cross was scanned at the 3D Imaging Centre of the Canadian Museum of Nature in Gatineau, Quebec, using the Arius3D system. Each of the four pieces of the cross was scanned separately, and the scans combined digitally to produce a master version. The 3D scan captured the cross in great detail and stands as a permanent electronic record.

Three high-definition plaster-based reproductions (also called 3D prints) of the cross were subsequently made using 3D printing technology. This technology was developed at the Massachusetts Institute of Technology and licensed to several companies. The reproductions of the cross were made by the Computing and Network Services of the University of Alberta in Edmonton using a Z400 3D printer from Z Corporation. Working from the digital information on the cross, the 3D printer gradually built each model of the cross, one layer at a time, working from the bottom up. First, a thin layer of a plaster/resin powder was spread over the printing area, and then a water-based binder mixture was sprayed on, in the manner of an inkjet printer. Wherever the spray touched the plaster/resin mixture it hardened, creating a solid cross section of the cross. The printing area was then lowered 0.1 mm (0.004 in.) and a new layer of fresh powder was sprayed. This process was repeated until the 3D model was complete. The resulting plaster models of the cross were then strengthened by dripping a low-viscosity, clear epoxy resin onto them. One model was painted with acrylic colour to match the original. The replicas will remain as permanent records of the present condition of the cross.

Protecting the cross from water and oxygen

A form-fitting base of silicone rubber was made for the cross using one of the consolidated models as a mould. A surround and support for the rubber base was then built of Plexiglas and the visible parts of the support covered with grey sueded polyethylene with a self-adhesive acrylic backing. Finally a Plexiglas inner lid was made to fit over the support. The pieces of the cross were then mounted on the silicone rubber support. When this was complete, Escal vapour barrier film was stretched under the base and over the Plexiglas lid. Sachets of RP-A oxygen and water vapour absorber were then inserted and the bag sealed. As oxygen was absorbed the bag pulled inwards, losing 20% of its volume and providing verification that the seal was intact. A loose fitting outer cover of opaque grey Plexiglas, with a window slightly smaller than the inner lid, was placed over the bag assembly, thus concealing everything except the cross and mount. This type of enclosure not only produced the necessary dry anoxic environment, but could be created and maintained with a minimum of specialized tools and expertise — an important consideration in view of the facilities and resources at the display location in Ferryland.

Results

In addition to stabilizing the artifact, this recent phase of treatment of the Ferryland Cross has had several positive results:

- As anoxic cases are traditionally expensive and technically complex, the type of design developed during this project will be particularly beneficial for many smaller museums with limited budgets.
- Laser scanning technology coupled with a 3D printing technique was found to be very useful in the making of high-quality reproductions.
- Information from the scan and reproductions can be used to monitor future changes in the condition of the cross.

Suppliers

Escal and RP-A (made by Mitsubishi Gas Chemical Co.) are distributed by:

Keepsafe Systems
570 King Street West
Toronto ON M5V 1M3
Tel.: (416) 703-4696 or 1-800-683-4696
Web site: www.keepsafe.ca

1. Logan, J.A. "The Cross from Ferryland." *CCI Newsletter* No. 1 (December 1987), p. 11.

2. Removal of chloride ions from archaeological iron that is unevenly corroded and contains additional material other than iron is extremely difficult to accomplish without damaging the object. In the case of the cross, chloride ion extraction was attempted using a washing method that would not alter the corrosion products holding the cross together, nor affect the brass and gold. Unfortunately, as is typical with benign methods, this procedure was not effective at removing the chloride embedded deeply in the corroded matrix.

3. Logan, J.A., R.L. Barclay, P. Bloskie, C. Newton, and L. Selwyn. "Saving the Ferryland Cross." In *The Conservation of Archaeological Materials: Current Trends and Directions* (conference proceedings, November 13–17, 2005, Colonial Williamsburg, Virginia). Forthcoming.

4. Tuck, J.A., and D.T. Robbins. "A Glimpse at the Colony of Avalon." pp. 237–249 in *Archaeology in Newfoundland and Labrador 1985* (edited by C. Thomson and J. Sproull Thomson). St. John's, NL: Newfoundland Museum, 1986.

5. More information can be found on the Web site for Colony of Avalon, Ferryland, Newfoundland (www.heritage.nf.ca/avalon).

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