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Developments in Archaeological Conservation: A Perspective from Newfoundland and Labrador

Cathy Mathias

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Developments in Archaeological Conservation — A Perspective from Newfoundland and Labrador

CATHY MATHIAS

INTRODUCTION

THE RICH ARCHAEOLOGICAL RESOURCES of Newfoundland and Labrador have provided a large number of fragile or unstable artifacts which require expert reconstruction or conservation. Over the past seven years, approximately 30,000 artifacts have been treated at Memorial University of Newfoundland's conservation facility, which is part of the Department of Anthropology's Archaeology Unit. Most of these artifacts come from the site of the 16th century Basque whaling station at Red Bay, Labrador, and the 17th century English colony at Ferryland, Newfoundland.

In order to meet the particular preservation requirements of archaeological material from these and other sites in the province, specific conservation techniques have been developed. For instance, methods of bulk treatment of iron were developed by the Canadian Conservation Institute to deal with the huge numbers of nails and other iron objects found at Red Bay and Ferryland, and Memorial University's conservation laboratory has demonstrated the success of this and other methods of bulk treatment. The conservation laboratory has also made advances in demonstrating the importance of characterizing the burial matrix of the artifacts, as a basis for predicting the physical state of buried materials and projecting conservation needs in advance of excavation.

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ARCHAEOLOGICAL CONSERVATION

"Conservation basically aims to prevent objects' disintegration once they have been exposed to the atmosphere and to discover the true nature of the original artifact" (Cronyn 1990).

Archaeological conservation has attained maturity only within the last few decades. People have been restoring objects of both utilitarian and aesthetic interest for centuries, although conservation did not evolve until the nineteenth century when art restorers began to utilize analytical science to assist them in their work. Eventually a new respect for an understanding of materials and their aesthetic integrity developed, and this new philosophy became the backbone of conservation.

When buried, an object will undergo physical and chemical changes until it reaches equilibrium with the surrounding environment. After excavation, an artifact will once again begin this process of reaching equilibrium, only this time with the post-excavation atmosphere. Unless the skills of a conservator are employed, many artifacts will not survive the changes necessary to equilibrate with this new environment.

There are essentially two methods of conservation, "active" and "passive". Passive conservation involves providing a suitable storage environment for the artifacts. This includes controlling the relative humidity, temperature, light levels, insect pests and vandalism. Active conservation entails doing something to change an artifact.

Artifacts from New World historic sites present many problems to the conservator. During the fifteenth and following centuries, the properties of natural materials, such as animal hides, woods, and metals, were altered in order to create new materials, with specific characteristics intended for specific purposes. Once produced, these altered materials began to react with the ambient environment in the process of re-establishing an equilibrium state (Logan 1989). It thus becomes the conservator's job, through the practice of active and passive conservation, to arrest this process. Because most archaeological artifacts will be excavated from a burial environment, the archaeological conservator must have an understanding of the burial matrix. The great quantity of artifacts excavated from historic sites must also be considered by the archaeological conservator.

CONSERVATION'S BEGINNING IN NEWFOUNDLAND AND LABRADOR

The year 1978 saw the beginning of extensive research in the field of historic archaeology in Newfoundland and Labrador. Excavation of the sixteenth century Basque whaling site at Red Bay, Labrador, began under the direction of James Tuck of Memorial University of Newfoundland. This work continued for 16 years, with Memorial University overseeing the land site operation, and Parks Canada having responsibility for the underwater component. Both the land and the underwater site components yielded numerous fragile and unstable artifacts. Since these rich archaeological resources required special attention, proper provisions were made for their preservation after excavation.

The Canadian Conservation Institute (CCI) was invited to provide support to the land site excavations at Red Bay. This support continued for 12 years and during this time many treatments for the preservation of artifacts were developed. This was the beginning of archaeological conservation in Newfoundland and Labrador, which has since become an important part of the Province's archaeology.

It is not within the scope of this paper to describe all of the work done at CCI, much of which developed because of the nature and abundance of the archaeological resources of this Province (Argo 1981; Costain and Logan 1985; Vuori *et al.* 1989; Tuck and Logan 1986; Logan 1984, 1986; and Segal and Vuori 1984); however, a brief description of the work which was initiated by CCI and continued by Memorial is included.

BULK TREATMENTS FOR ARCHAEOLOGICAL ARTIFACTS

The Ferryland site produces approximately 3,000 artifacts per week. Because of the sheer quantity of artifacts that come from this and other historic sites, conservators have had to develop methods of bulk treatment of artifacts, rather than treating each individually. Because individual artifacts cannot be monitored when treated in bulk, it is important to have a sense of the overall condition of the total. Crucial to this is an understanding of the burial environment, which allows the conservator to determine the extent of deterioration of different kinds of material.

The field of archaeological conservation broadly categorizes burial environments as being wet or dry (Watkinson 1983). Generally speaking, the climate of Newfoundland and Labrador is controlled by proximity to the Atlantic ocean. According to Heringa (1981), the soils of this province have a fairly high moisture content, thus categorizing the archaeological sites as wet sites. Since artifacts excavated from a wet burial environment will have to be kept wet, this means that most treatments in this Province must initially involve an aqueous phase.

Iron artifacts are problematic because of their sensitivity to the geochemical environment. These artifact types have a high ion exchange capacity and thus are susceptible to the chemical and electrochemical action of the surrounding environment (Nace 1965). While corrosion occurs in almost any environment, some environments will be more corrosive than others (Dowman 1970). Moist air is more corrosive than dry air, acidic solutions more corrosive than basic ones, and salt water is more corrosive than fresh water (Evans 1981).

Since iron artifacts comprised a large portion of the Red Bay collection, a bulk treatment was developed for this material. An extensive research project examining different holding solutions for iron began at CCI in the early 1980s under the direction of Charles Costain (Costain and Logan 1985).

Organic artifacts were also preserved at the Red Bay site. Usually this type of material is completely decayed before the time of excavation; however, because of the high moisture content of the site's soil matrix, organic artifacts were preserved which would have deteriorated in a dry site.

Structural materials made of wood, and barrel parts, constituted the largest component of the organic materials from Red Bay. Essentially the conservation treatments for these artifact types prevent the collapse of the material's structure upon drying (Young and Wainwright 1981). Research by Grattan (1981), McCawley *et al.* (1981), Grattan and Mathias (1986), Spriggs (1981), Barbour and Leney (1981) and Florian and Renshaw-Beauchamp (1981), to mention just a few, have all contributed to the development of the polyethylene glycol (PEG) treatment, whereby organic artifacts are vacuum impregnated with PEG, which supports the material's structure.

Once conservators developed the system for treating artifacts in bulk, non-conservators could carry out the treatments. When this point was reached in 1985, it was decided that Memorial University would be responsible for the bulk treatment of the iron and wood from Red Bay, with CCI supervising the operation.

CONSERVATION AT MEMORIAL UNIVERSITY

In 1987 Memorial University extended its excavations at Red Bay to include an eighteenth century English fur trading post, from which approximately 15,000 artifacts were excavated. However, CCI could not extend its services to the conservation of this material in addition to that of the Basque occupation. Therefore, in the fall of 1987 Memorial University hired a full time conservator who is a member of the Department of Anthropology's Archaeology Unit.

Not only has the conservation branch of the Archaeology Unit supported Unit excavation projects, it has provided support to the Newfoundland Museum's conservator by assisting with training sessions and by providing laboratory space. Memorial University students have been exposed to conservation through the laboratory's volunteer program and through a course in archaeological conservation. In addition, this exposure has provided the students with additional career options. For example, Wade Greeley, an archaeology graduate of Memorial University, will soon complete his training in conservation; he has assisted with the conservation of the Ferryland and the prehistoric Port au Choix projects.

The most recent project involving archaeological conservation is the excavations of a seventeenth century Colonial Period plantation at Ferryland, on the Avalon Peninsula. Excavations began in July 1992 under the direction of James Tuck, and with the financial support of the Canadian-Newfoundland Tourism and Historic Resources Cooperation Agreement through the Historic Resources Division of the Department of Tourism and Culture. The conservation for this project has been directed by Memorial University with the Canadian Conservation Institute providing consultation and treatment services for complex artifacts.

THE FERRYLAND PROJECT

The town of Ferryland, located approximately 80 km south of St. John's, has been occupied since the sixteenth century (Harper 1960), and the Ferryland Project has focussed primarily on the seventeenth century. The Colony of Avalon was founded in 1621 when George Calvert (later to be given the title of Lord Baltimore) sent Captain Edward Wynne with a group of West Country and Welsh settlers to Ferryland in that year (Pope 1986). Artifactual evidence indicates that the site has seen some sort of human activity continuously since that time.

To date, a total of 43 weeks of digging have resulted in approximately 125,000 catalogue entries representing about 500,000 artifacts. The excavation crew has varied in numbers from two to 25 and, given the richness of the site, there is a laboratory crew of equivalent size.

Artifact types range from seeds to wheelbarrows to cannon balls. Although the collection is varied, most of it is inorganic. Approximately one quarter of the artifacts are made of iron, much of which has been manufactured into nails. The ratio of iron nails to other iron object types was higher than at previously excavated historic sites in the province.

For the treatment of iron artifacts, X-radiography has long been a useful tool. Because iron objects are prone to deterioration in all but a very dry environment, one cannot guarantee 100% success for any conservation treatment (Logan 1985). Thus it has become routine for most conservators to X-ray all iron objects. This provides the conservator with a permanent record of the artifact, should it be lost in conservation. Equally important, the X-ray will reveal areas of mineralization within the object, where the pseudomorphic replacement of the original iron object by a mineral makes it vulnerable to certain chemical treatments. Other information provided by an X-ray includes the degree of corrosion, location of cracks and areas of weakness beneath corrosion layers, evidence of construction and surface decoration.

A survey of 246 iron artifacts excavated during the 1992 field season demonstrated the fragile nature of iron found in a burial environment such as Ferryland. Of the 246 surveyed, only 66 of those were in good condition, that is, with little corrosion and no structural damage such as cracking. Generally speaking, 63% of all iron artifacts from Ferryland require special care for survival.

During the 1986 field season an iron cross was found at the site of what is believed to be the 1622 forge (Figures 1-2). The cross was lined with brass, and a few flecks of gold gilding remained on the surface of the iron. Scanning electron microscopy/X-ray energy spectrometry (SEM/XES), a scanning electron microscope

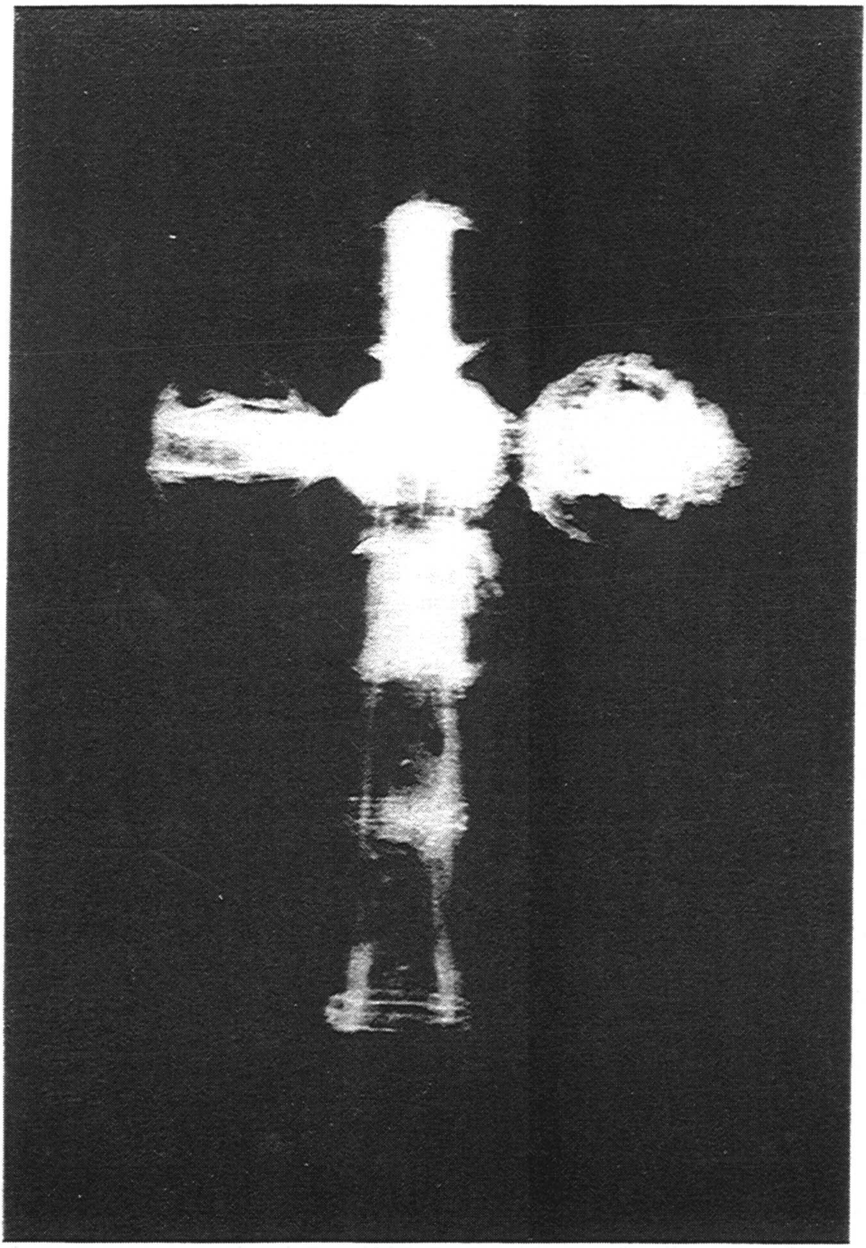

Fig. 1. X-ray of an iron cross excavated from "the forge" at the Ferryland site.

Fig. 2. Iron cross after treatment

(SEM) and X-ray diffraction (XRD) analysis of the iron corrosion products detected iron, silicon, small amounts of aluminum, and traces of potassium (Sirois 1986). Sirois (1986) concluded that one of the concretion products was an iron silicate, the tenacity of which made the conservation of the cross very time-consuming.

The cross required 180 hours of treatment time; because of its composite nature an aqueous chemical treatment probably would have resulted in further deterioration and therefore was not possible. Instead, the corrosion was removed by mechanical cleaning with an abrasive unit. Working much like a small sandblaster, aluminum oxide powder and glass beads were used as abraders (Logan pers. comm. 1992). Chlorides were extracted from the corrosion using nitrogen gas in a soxhlet apparatus, which is an enclosed glass system. This method of chloride removal for fragile iron has been described by Scott and Seeley (1987).

The conservation treatment used for the cross could not be applied to the bulk of the artifacts from the site because time, person power and funding were not available for such an endeavour. What was clear was that we needed more study to enable us to plan a conservation strategy for the Ferryland site. In particular we needed to learn more about the soil matrix which defines the conditions with which the buried artifacts equilibrate. Since ceramic and iron artifacts comprised most of the artifact collection, it was decided to concentrate our study on these artifact types.

Analysis of the Ferryland Site

At Memorial University we conducted a study of the iron artifacts and the associated soil matrix, with special emphasis on the mineralogy of corrosion products.

The results from this study indicate that the soil is dominated by quartz, feldspars and clay minerals. Corrosion products consist of admixtures of quartz, feldspars, chromite, magnetite, goethite, lepidocrocite, clay mineral phases and unidentified phases.

It appears that iron artifacts will be well preserved in areas where the burial environment is characterized by a low moisture content, high percent of silicates and low concentration of clay minerals. This is in contrast to areas with a high percent of clay mineral phases and consequently high moisture where iron artifacts are not likely to survive, although organic artifacts will.

Other factors such as a soil's pH will also affect the corrosion rate of the burial matrix. Further study in this area is ongoing at the Archaeology Unit conservation lab with the hope that a better understanding of the kinetic parameters affecting the burial environment eventually will be realized.

Iron artifacts from the Ferryland site have been successfully treated with an aqueous 1% (weight/volume) sodium hydroxide solution for approximately one year with regular changes of the solution.

Although iron is the dominant artifact type at Ferryland (Figures 3-6), the next largest artifact type is ceramic vessels (Figures 7-8). The destruction of the Colony of Avalon by the Dutch and French in 1673 and 1696, respectively, resulted in great physical damage to ceramic artifacts. This, in addition to the weight of overburden, has left us with thousands of ceramic shards.

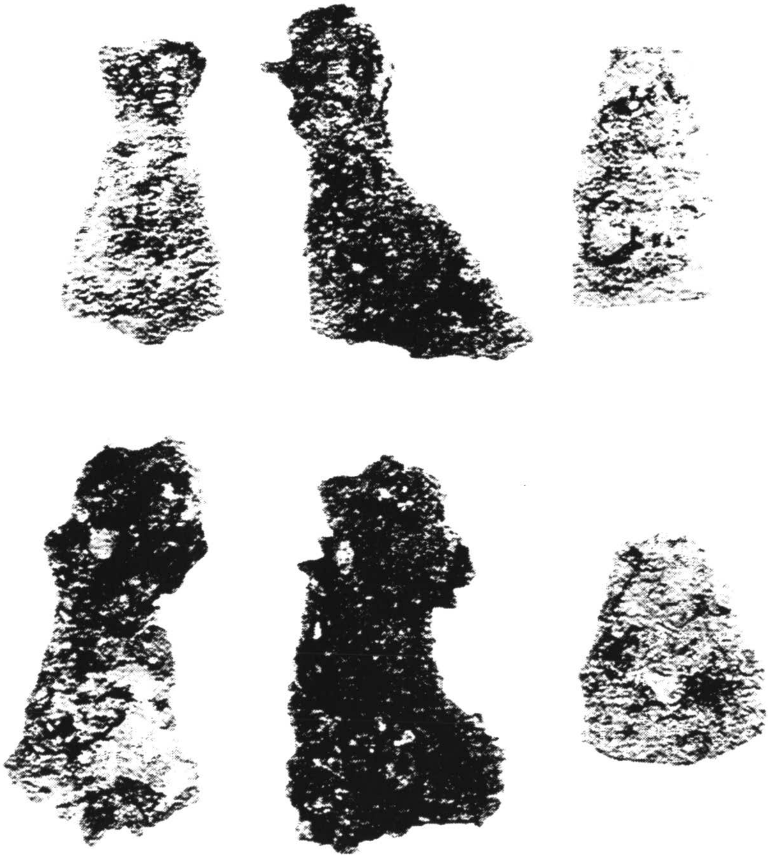

Fig. 3. Iron axes excavated from the Ferryland site, shown before treatment.

The sorting and restoration of these shards is necessary for scientific and public interpretation. A former crew member from the Red Bay Project, Rhoda Earle, demonstrated the skills necessary for such work and was therefore sent to Parks Canada in Ottawa for a two month internship. Although she had no formal conservation education, the eight years of working as a field and laboratory assistant in Red Bay proved to be invaluable training.

Fig. 4. Iron axes, shown after treatment.

CONCLUSION

Any archaeological project which has fragile or unstable artifacts must have a conservation strategy. Otherwise information will be unnecessarily lost because of the reactive nature of the burial environment and improper handling of the objects after excavation. As demonstrated for the Red Bay and Ferryland archaeological projects, characterization of a site's soil matrix can provide a basis for predicting the degree of preservation or deterioration of various artifact types. This complements information obtained from the corrosive products of iron by various analytical means, such as X-ray florescence, X-ray diffraction, and scanning electron microscopy/X-ray energy spectrometry (Gettens 1963; North *et al.* 1977; Zucchi *et al.* 1977; Argo 1981; Gilbert *et al.* 1981; North 1982; Turgoose 1985; Sirois 1986).

Many people have contributed to the conservation of archaeological material in Newfoundland and Labrador. Memorial University's approach to conservation is unique in its extensive use of non-conservators. Of the 25 people working in the laboratory of the Ferryland Project, only a few had any formal training in conser-

Fig. 5. Iron pick-axe excavated from the Ferryland site, shown before treatment.

vation. Although interns of conservation training institutes have joined the project, the majority of the employees are members of the Ferryland community who see the site as an alternative employment opportunity in light of the failing fishing industry.

Traditionally, many people from this Province are very craft oriented, and possess the skills necessary for creation and manipulation of objects, skills that are essential for archaeological conservation. This has definitely been the case for those who have participated in the conservation of this Province's archaeological remains, and for this we are grateful.

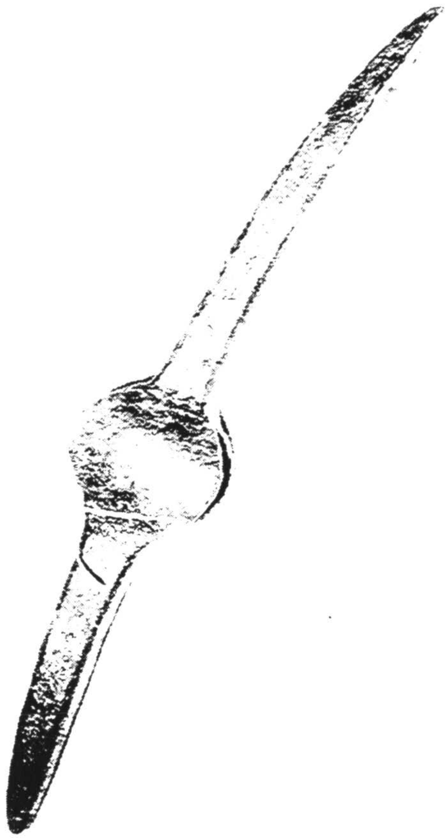

Fig. 6. Iron pick-axe, shown after treatment.

Fig. 7 Ceramics exposed during excavation at the Ferryland site, found near the remains of the outbuilding or barn.

Fig. 8. Close-up of ceramics exposed during excavation at the Ferryland site, found near the remains of the outbuilding or barn.

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