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ASSESSING THE PAST: COLONIAL WILLIAMSBURG ARCHAEOLOGICAL COLLECTION

Emily Williams

1. Introduction

In 1927 the Reverend W. A. R. Goodwin persuaded John D. Rockefeller Jr. to finance his dream to restore Williamsburg, Virginia's eighteenth century capital, and to preserve it as a place where Americans could come to learn about their history. From the start archaeological excavation was undertaken in order to ensure that the buildings were restored accurately and authentically. Initially these excavations were focused on locating foundations and architectural features. However, it was rapidly realized that these archaeological endeavors produced vast quantities of materials which if stabilized, cleaned and studied could provide a wealth of information about the ways in which 17th and 18th century Virginians adorned themselves and their living spaces and thought about their world. The establishment of a conservation lab quickly followed this realization. Chemistry students from the nearby College of William and Mary were hired to develop treatments and adapt existing treatments for the needs of the excavated artifacts. Their methods were written up and circulated to a number of other museums and sites on the East Coast that were faced with similar problems (Thomas 1956). In the late 50's an English archaeologist, Ivor Nöel Hume, was hired. He brought with him new treatment techniques. Again, these procedures were widely disseminated through publications (Dunton 1964; Nöel Hume 1969) and lectures, and many of these methods are still used by historical archaeologists.

Colonial Williamsburg's seventy-five year commitment to archaeology and conservation has resulted in a very active field program, and a collection that is currently estimated at between 40 and 60 million artifacts. It is further estimated that the collection grows by up to half a million artifacts a year. The collection includes diverse materials such as ferrous alloys, copper alloys, lead artifacts, worked stone, ceramic, and glass as well as wood, leather, textiles, bone and archaeobiological materials.

The collection is housed in two separate areas: the study collection and boxed storage. The study collection consists of a portion of the total artifacts from each site, and is housed in drawer storage. These materials are chosen, according to feature and artifact type, based on the following criteria: 1) rarity, from the perspective of the collection as a whole, 2) ability to help date a site or feature, and most importantly, 3) ability to represent the predominant function of a specific site. The organic elements within the study collection are housed in a separate room where the humidity is theoretically controlled (to 50% Rh) and where light levels are kept low to help preserve the material. Artifacts in the study collection are generally treated prior to storage. The remainder of the collection is housed in a warehouse near the archaeological department. There are approximately 5000 boxes of material in storage currently. Material in these boxes may or may not have been treated previous to storage. Overall, the materials in the collection have been treated by a variety of methods and many of these methods, as well as the gradual deterioration of the storage facilities over the past 50 years of use, have implications for the stability of the archaeological pieces.

In 1998 the Archaeological Conservation lab began a project aimed at better understanding the environmental conditions within the storage areas and the condition of the collections. Elements of this study included facilities assessments of both of the buildings used to store the Foundation's archaeological collections and a search of the Foundation archives for any information on post conservation treatments and conservation programs. One of the keystones of the project was a systematic survey of the archaeological study collection based on material type and treatment method. The impetus for the survey was the need to better allocate available time between retreatment needs and the demands of freshly excavated material.

Additional aims of the project were:

• To corroborate anecdotal information regarding the efficacy of specific treatments

• To provide a framework for logical and efficient decisions regarding the treatment needs of the collection.

• To streamline and focus limited conservation resources and to avoid continually reinventing the wheel each time an artifact came into the lab for retreatment.

• To produce a quick, accurate and easily reproducible set of results which could readily be compared with similar initiatives at other institutions.

2. Survey Methodology

Borrowing from work done at the Museum of London (Suenson-Taylor & Sully 1996; Sully & Suenson-Taylor 1996), a Criterion Anchored Rating System or CARS survey was used to carry out the collection survey. This system establishes individual criteria for each material (e.g. cohesion, physical integrity and friability in the case of leather) and then allocates points per criteria based on percent damage. The criteria are designed to help assess the condition of the object from the macrostructure down to the microstructure. In the case of leather this means quantifying both the tears, losses and cracks and the cohesion of the piece on a fiber level. The advantages of this type of survey are that each criterion is rated according to a fixed, well-defined scale that allows for easier comparison than other more subjective methods and also for easily reproducible results. An additional benefit lies in speed. Although the individual criteria take time and thought to establish initially in order to provide meaningful results, once they are established it is possible to move quite quickly through the artifacts.

Criteria for each component were established following a literature review and interviews with the curators to collect anecdotal information about the condition of the collection and to identify their concerns. For example, in the case of leather there were concerns about appearance, in particular the presence of disfiguring yellow surface deposits, so a category that looked specifically at "surface interactions" was added. In the case of iron there were concerns about the condition of artifacts treated with pigmented black microcrystalline wax as opposed to those treated with plain microcrystalline wax. Again this was taken into consideration both when collecting the data and when analyzing it. Each of the individual survey components was carried out blind. Treatment methods were matched to artifacts only after data collection was completed so as not to create a bias based on the surveyor's assumption of how a treatment should perform. The results to date, particularly those of the leather, wood and iron surveys reported below, have been both fascinating and alarming, and promise to be of use not only to Colonial Williamsburg but also to other institutions with similarly treated materials.

3. Results

3.1 Leather

Aside from the previously stated goals, a further aim of the leather survey was to reevaluate the success of castor oil as a treatment method for leather. Two papers delivered at a conference in 1995 on the conservation of leatherwork challenged the use of polyethylene glycol (PEG, also known as Carbowax) followed by freeze-drying and suggested a return to the use of castor oil for treating waterlogged archaeological leather (Swann 1995; Goubitz 1995). Since a large portion of the leather in Colonial Williamsburg's collection was treated with castor oil in the 1950s and 1960s, there was particular interest in comparing past performance with present assertions.

The entire collection of leather objects was surveyed, a total of 197 items. Of the artifacts surveyed 132 were treated using castor oil. The remainder had been treated by a variety of methods. A small portion of these had also been treated in the 1930's but no treatment records could be located. In addition, 55 items from two other collections, the Maine State Museum and the Maryland Archaeological Conservation Lab at Jefferson Patterson Park Museum, were surveyed. This material provided a comparison, both in terms of chronology and treatment, with the Colonial Williamsburg collection. The Maine State Museum material consisted of shoe parts from the *Defense*, a revolutionary war privateer. They were treated with polyethylene glycol and freeze-drying between 1976 and 1980. The material from Jefferson Patterson Park represented two sites, Bierly Tannery, treated in 1988 using castor oil, and Stewart Shipyard, treated in 1993 using polyethylene glycol and freeze drying. Criteria noted in the survey were physical integrity, cohesion, friability and surface interactions. Additional fields recorded flexibility and any further comments relating to appearance or odor.

The results of the survey have been reported elsewhere (Williams & Harnett 1998; Williams et al. 1999) so they will be summarized briefly here. Castor oil fared poorly as a treatment method for waterlogged leather with an overall failure rate of 40.1%. In general each of the three criteria performed fairly similarly and it was rare for one criterion alone to cause a piece to fail. Thinner leather such as shoe uppers performed significantly better than thicker leather such as shoe soles or heels, suggesting that the castor oil does not penetrate well. The results are more interesting when the performance over time of castor oil is compared with that of polyethylene glycol and freeze-drying. The material treated with polyethylene glycol performed well with less than 4% failure rate overall (12% for surface interactions). Material treated with polyethylene glycol five years ago had a zero incidence of failure. Material treated eighteen years ago had a 6% failure rate. By comparison material treated with castor oil ten years ago had a 7% failure rate, material treated thirty years ago had a 33.33% failure rate and material treated forty years ago had a 54% failure rate. The results seem to indicate a definite link between the condition of castor oil treated material and the time elapsed since treatment. This link is not as evident for the material treated with polyethylene glycol and freeze-drying.

3.2 Wood

The bulk of the wood fragments in the collection were recovered from anaerobic, waterlogged contexts and treated shortly after excavation. A total of 225 artifacts were surveyed (three artifacts were not included due to problems of access). Of the total surveyed, 138 (61.3%) were treated with various mixtures of polyethylene glycol, 40 objects were treated with alum, and 47 artifacts were either untreated or the treatment records could not be located. Alum was used to treat waterlogged wood in Denmark as early as 1859 (Brinch Madsen et al 2001). Although initial results were promising it is no longer commonly used in the treatment of waterlogged wood since it does not penetrate wood as well as polyethylene glycol. As a result the surface of the wood may be treated while the interior of the wood remains untreated and vulnerable to collapse. Additionally, when alum treated wood is stored in areas where the humidity fluctuates the alum can recrystallize, causing a volumetric change which can force the wood apart (Grattan & Clarke, 1987: 168). Criteria noted in the survey were physical integrity, cohesion, and surface interactions, an additional yes/no field was kept to record warping, and the thickness of the piece was recorded along with any special comments.

Only 10 artifacts, or 4.4% of the collection, were in unsatisfactory condition overall. This was significantly lower than expected, as there were a number of outstanding retreatment requests for wooden artifacts. However, it is important to consider not just the overall results but also the results within the individual criteria. These show individual areas of concern which may be important but may be counterbalanced by a high score in another area. Failures in areas such as physical integrity or cohesion are indications of a failure in the structure of the artifact as a whole. The alum treated wood tended to score highly in the surface interactions category having an attractive, if somewhat light, appearance with few residues from treatment. However, it also had fairly high failure rates in the physical integrity and cohesion categories (32.5% and 22.5% respectively). In some extreme cases the objects were crumbling to the touch and in a very fragile condition. Interestingly, while these objects would have been instantly flagged for treatment in a decorative arts or social history context, archaeological curators are often so used to seeing artifacts in multiple fragments that they do not always question whether or not the artifact should be in that condition. Material treated with polyethylene glycol was considerably more successful in these categories (physical integrity and cohesion) but was less successful in terms of appearance. PEG treated material tended to have a waxy appearance and feel, be overly darkened and have excess powdery white PEG on the surface. This is due in large part to the high concentrations of PEG used by early conservators, as well as the manner of application, and it is less likely to be a factor with modern PEG treatments [1]. However, since curators most often note appearance as a reason for re-treatment it was an important phenomenon to note.

3.3 Iron

Due to the large number of iron artifacts in the study collection a different approach was taken to this material. Rather than attempt to survey the entire population, seven large sites were selected, ranging in excavation date from 1958-1985 (Charette 1998). These provided a cross section of treatment methods over time. The primary questions asked were:

- What percentage of the material is unstable?

- Which treatments were used for objects from each site and in what proportion?

- What is the percentage of unstable material for each treatment method?

- What is the percentage of unstable material per site?

It was felt that the answers to these questions could be used to extrapolate the answers for the entire collection with a high degree of accuracy.

The results of the survey indicated that approximately 27% of the total collection of iron artifacts is actively corroding. This figure includes all active artifacts, giving equal weight to both artifacts that have one small pin-prick of active corrosion on the surface and those that are heavily spalling or where the majority of the surface is actively corroding. While this number is high it is not as high as was expected based on anecdotal information. It provides a useful statistic for planning purposes, however, and when the information is broken down by treatment type the results are more interesting. Five treatment methods were commonly used in Williamsburg between 1958 and 1985. These methods are:

- Electrolysis followed by a coating of microcrystalline wax (either plain or pigmented).
- Electrolysis followed by a lacquer coating, typically sprayed on as a coating of Krylon™ (a proprietary preparation of an acrylic resin in an aerosol cannister) or painted on as a 25% solution of Acryloid B-72 in 50:50 toluene:acetone.
- Manual cleaning without desalination, usually followed by a wax coating.
- Boiling, manual cleaning and a wax coating.
- Washing, manual cleaning and a wax coating.

Although electrolysis still has its place in the panoply of treatments for iron artifacts from a marine context, many archaeological conservators working with terrestrial artifacts have recently begun to move away from electrolytic stripping (Cronyn, 1990:175 & 191). The primary reason for this lies in the fact that electrolysis has the potential to remove large amounts of information from the surface of an iron artifact. This information may be present in the form of pseudomorphs and/or casts of associated organic material, as well as tinning, silvering, enamels or even paint on the surface of the object. All of these may be lost through the injudicious use of electrolysis. Additionally, conservators have come to realize that the original surface of the artifact is usually preserved somewhere in the corrosion layers and that electrolysis will cause this to be lost, thereby affecting the accuracy of future studies.

Colonial Williamsburg has followed this trend over the past fifteen years. Viewed from this perspective it is interesting that the iron that was treated electrolytically is significantly more stable than iron treated by any other method. The reason for this can be attributed to its greater efficiency at removing chlorides. While not advocating a return to the wholesale use of electrolysis the survey recommended that its use for larger artifacts, such as hoes or cannon balls, be reviewed and that for such pieces, once they have been thoroughly x-rayed and examined in order to assess condition prior to treatment, electrolysis may not be amiss (Charette 1998). In terms of desalination one other fact was of additional interest: of the two other chloride removal methods simple washing or passive diffusion appears to be more successful than boiling. This seems contrary to popular wisdom that the heating of the iron helps to reduce chloride ions. Whether this is because shorter boiling times were used than washing times is currently being investigated. The report concluded that passive diffusion should remain the desalination method of choice for small artifacts, those in poor condition or where the potential loss of information that may result from electrolysis is deemed unacceptable.

The survey also provided information on the relative merits of coating systems. Iron treated with a lacquer coating was four times more stable than iron coated with microcrystalline wax, even when desalination methods and other treatment factors were taken into account. One reason for this may be the thickness and consequent weight of the wax coating, which leads to cracking allowing the iron to be exposed to the atmosphere. Even a small break in the coating may accelerate corrosion by concentrating oxygen and moisture at the point of the break, creating a concentration cell. This results in pitting, which in turn stimulates the concentration cell to further activity (Schweitzer 1989). The main reason that wax performs poorly as a coating in comparison to lacquer is that "wax is not an efficient water vapor barrier for corrosion protection" (Horie 1987:88). Therefore over time moisture will penetrate this coating leading to renewed corrosion. Although slightly glossier than wax coatings, acrylic resins such as Acryloid B-72 and Acryloid B-44 have the advantage of being significantly easier to remove than wax should the piece require remedial treatment.

Additional information on the effects of pigments in wax coatings was also gained. Microcrystalline wax pigmented with lamp black was used heavily at Colonial Williamsburg from the 50's to the early 80's on the theory that active corrosion would more noticeably contrast with the surface, and the object would therefore receive treatment faster. It continues to be used in many regional archaeology labs today. The results of the survey indicated that the lampblack appeared to make the wax denser so that the corrosion progressed much further beneath the surface before eventually pushing all the wax off. When past treatment records were consulted, it was found that actively corroding artifacts that had been coated initially with plain wax were uniformly identified and retreated much earlier, and retained more of their original surface, than those coated with the pigmented wax.

4. Observations

4.1 Duration of the Survey

Embarking on this project, it was believed that working primarily in the four month period between field projects the survey could be completed within two years. This assessment was bolstered by a fairly small initial survey that took less time than anticipated. However, it quickly proved to be somewhat naive. The process of establishing solid criteria for the collection proved to be more time consuming than expected. There was also "surveyor burnout" (a malady which makes the surveyor beg to monitor pest traps rather than survey another object). Field seasons were extended and other projects received priority. Most importantly, however, the project produced such a wealth of information, not only about the condition of the objects and the success of their past treatments but also about Colonial Williamsburg's own internal processes, that analyzing the data took longer than expected. The numerical values assigned to condition scores also allowed the conservation staff to continue to use the information to answer questions that had not originally been postulated.

4.2 Documentation

Although refreshingly well documented when compared to other collections, it was found that the treatment records at Colonial Williamsburg were not always an accurate account of what had really happened to an object. For example, FTIR analysis of residues from leather shoes documented as having been treated with castor oil turned out to also contain polyethylene glycol (PEG), indicating that early conservators may have experimented with a mixed PEG/castor oil treatment program before finally adopting PEG treatments outright. Also, changes in the accession number system employed in the archaeological collection made it difficult to match some of the older treatment records to objects. The survey team was fortunate in having access to drawings, photodocumentation and a curator with a 35-year knowledge of the collection and its history, all of which were very helpful in matching objects with records. However, the extra time involved highlighted a weakness that we believe exists not only in the system of documentation used at Colonial Williamsburg, but most likely exists in other institutions as well. Conservation records, particularly those produced prior to the age of databases, are often maintained separately from object records and may become separated from the objects when changes occur in accessioning patterns, or when records are moved from one location to another. The older records consisted primarily of the details of the treatment and in some cases a line or two about the condition of the object prior to treatment; they seldom included any of the technological or analytical information that is valuable to archaeologists. As a result, the curatorial staff had been unwilling to expend the resources necessary to make sure that they reflected changes to the cataloging system or even to list them as associated documentation within the catalog system. The format of the treatment records has been altered to highlight the technical information valued by the archaeologists. Conservators are working more closely with the archaeologists on a site by site basis to identify specific information that should be recorded for both current and future excavations. Conservators are also working with the curators and volunteers to ensure that all the old conservation records reflect changes in accession information and identification.

Access to a curator who had 35 years of experience with the collection and a good memory was important for the survey. However, the reliance on human memory pointed out problems in the way decisions are documented, problems that must be resolved before he retires and valuable information is lost. Additionally, there were some startling lacunae in the curator's memory. For example, when it came to surveying the copper alloy artifacts in the collection, he believed that we might encounter "one or two" untreated artifacts in the study collection, primarily "straight pins and other common artifacts". In fact, nearly half the copper alloy artifacts in the study collection, including some very important pieces, were untreated. On discovering the large number of untreated artifacts in the collection, the curator placed a very high value on having them treated, citing the aesthetic and intellectual value of the patina and the desire to improve on the "pickled" appearance of the past. Although potentially creating huge amounts of work for the lab, the conservators saw this as welcome evidence of the change in approach to treatments that has occurred during his tenure.

4.3 Collaboration

Structurally, the archaeological conservation lab and the archaeological curators are located in different departments within different divisions. The inclusion of the curatorial staff in the design of the survey components was extremely beneficial. Not only did it allow conversations about collections care that might otherwise have been somewhat forced to occur naturally, but it also gave the curators a sense of ownership over the survey results. This sense of involvement not only made it easier to begin implementing the necessary changes in the way both treatments and decisions are documented. It also meant that the curators were willing to invest some of their financial and human resources into the remediation efforts, a very important factor considering the economic climate and the size of the collection.

5. Conclusion

As each independent component of the survey was completed its results were compared both with standard lab treatments and with the other components of the survey. As a result we have tweaked treatments and are reassessing the long-term priorities of the conservation lab. Remediation of past treatments has been divided into Phase I, urgent treatments that should occur in the next 1-5 years, and Phase II, actions that may occur in the next 5-10 years. These in turn have been fed into a larger blueprint for collections care that includes planning for a new storage building and improving the way in which we document treatments and decisions. The conservation staff is also working to facilitate further collaboration and cross-discipline training with the curators, to ensure that they continue to feel involved in and fully understand the activities of the conservation lab.

This project has already proved valuable for the collection at Colonial Williamsburg. It has helped prioritize retreatment needs and redirect limited resources in ways that will optimize the benefit to the collection. It has also helped identify areas where research should be undertaken or focused. Since many of the treatment methods covered in the survey have been used on other sites in the region, it is hoped that the results of the survey can also serve as a basis for prioritizing conservation work in other collections

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Endnote

1. The most common method seems to have been to soak the wood in 50-75% PEG 600, followed by a painted coating of PEG 4000; the concentration of the latter is not known.

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