THE CONSERVATION OF COMPOSITE LUGGAGE TRUNKS: CASE STUDIES FROM THE KINGS MOUNTAIN NATIONAL MILITARY PARK.

A Thesis

by

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ABSTRACT

The primary reason for conserving artifacts, archaeological or historical, is the preservation of information contained in those artifacts for future study. This thesis presents information on how to treat large, dry, composite artifacts using silicone oil while avoiding the invasive, possibly damaging, disassembly of constituent parts.

It explores treatments of conservation for large composite artifacts using three luggage trunks from the Kings Mountain National Park as case studies. Conservation of these trunks was part of a larger project completed at Texas A&M University's Conservation Research Laboratory.

A strategy used in the conservation of composite artifacts comprised of organic materials is use of polymers, specifically silicone oil. Silicone oil was used as the main treatment of the organic elements. Different catalyst methods were experimented with to treat different materials. In combination with the silicone oil, established treatments appropriate to the inorganic (metal) materials were used. This thesis also explored advantages and disadvantages of dismantling an artifact for treatment.

Implementing either preservation, restoration or dismantling the conservation methodology for this study was to actively remove agents of deterioration and stabilize the artifacts to prevent future deterioration and to retain their integrity.

This study found that although the use of different catalysts could be beneficial, results were mixed. Although known undesirable results were avoided, in certain instances the experimental catalyst produced different undesirable effects. More in depth

study would be required to ascertain if these results are avoidable or reversible. When possible, dismantling of an artifact should be avoided. In some cases however, it is more important to conserve the whole object at the expense of a particular part. Lastly, the findings of this study support the use of established conservation treatments in conjunction with more experimental methods. Treatments that do not conflict with others or un-do the results of each other can effectively be used to more completely treat composite artifacts.

DEDICATION

To my dad.

I’m not a “tap dancing lawyer” but thank you for not asking

“What are you going to do with that?”

ACKNOWLEDGEMENTS

Thank you to Dr. Smith for the opportunity to work on this project and to all of my committee members, Dr. Smith, Dr. Hamilton, Dr. Thoms, and Prof. Woodcock, for your support and guidance. My thanks are also extended to the National Park Service for allowing me to conserve and experiment on their collection.

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NOMENCLATURE

BTA	Benzotriazole
CRL	Conservation Research Laboratory
DBDTA	Dibutyltindiacetate
ER	Electrolytic Reduction
KIMO	King's Mountain
MTMS	Methtrimethoxy silane
NPS	National Parks Service
PEG	Polyethylene glycol
TAMU	Texas A&M University

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CHAPTER I

INTRODUCTION

The disciplines of art conservation and historic preservation have existed almost as long as art and buildings. As important cultural artifacts aged or became damaged artists, scholars, or other interested parties would fix them. Although conservation/restoration was being performed, it was not until the Renaissance that standards and ethical considerations were discussed (Dykstra 1996). By the 19th century there were essentially two main philosophies guiding preservation. One philosophy championed artists/architects intent (restoration or reconstruction), while the other focused on preserving the actual history of the artifact (Dykstra 1996, Coolidge 1944). It is from this second philosophy, first introduced by John Ruskin and later developed by William Morris, that most of today's conservation ethical standards were based (Coolidge 1944).

In the 1960's a huge movement to preserve historical structures and associated art and artifacts began. Architects, artists, and community leaders interested in preservation began to form groups to create ethical guidelines and to share treatment methods. This effectively established the modern day fields of conservation of historic and artistic works and historical preservation. Archaeological conservation has stemmed from the art and historical conservation fields, as the need for this type of conservation became apparent. Previously, archaeological materials were either hastily treated or not treated at all. Archaeological conservation is a newer approach and methodology of conservation, born out of the necessity to save archaeological materials before they degrade and become less relevant as historical documents and meaningless as historical artifacts. The primary reason for conserving objects, archaeological or historical, is the preservation of information contained in those artifacts for future study.

CHAPTER II

PURPOSE OF STUDY

Overview

This research investigates the expanded use of the silicone oil treatment on large composite artifacts. It was conducted as part of a project at Texas A&M University's Conservation Research Laboratory aimed at conserving artifacts from King's Mountain National Military Park. King's Mountain, located in South Carolina, is the historic site of a Revolutionary War battle between Patriots and Loyalists (National Park Service 2014a). This was one of the few battles in which no British soldiers, other than the commanding officer, were present. The National Park Service (NPS) manages the park and created/manages a museum that houses objects from archaeological excavations carried out in the park and collections acquired because of the relevance to the history of the battle.

King’s Mountain

The Battle of Kings Mountain, October 7, 1780, was a pivotal battle in the Southern campaign of the American Revolutionary War (fig.1). It was the first major Patriot victory after the British invasion of South Carolina in May of that year (National Park Service 2014a).

Fig. 1. “The Battle of King’s Mountain” painted by F.C. Yohn, 1875-1933. After his death, Ferguson’s whole forces was either killed or captured, stifling the British attempt to control the South (National Park Service 2014a, III-A:4).

The battle took place nine miles south of the present-day town of Kings Mountain, North Carolina in rural York County, South Carolina (fig.2).

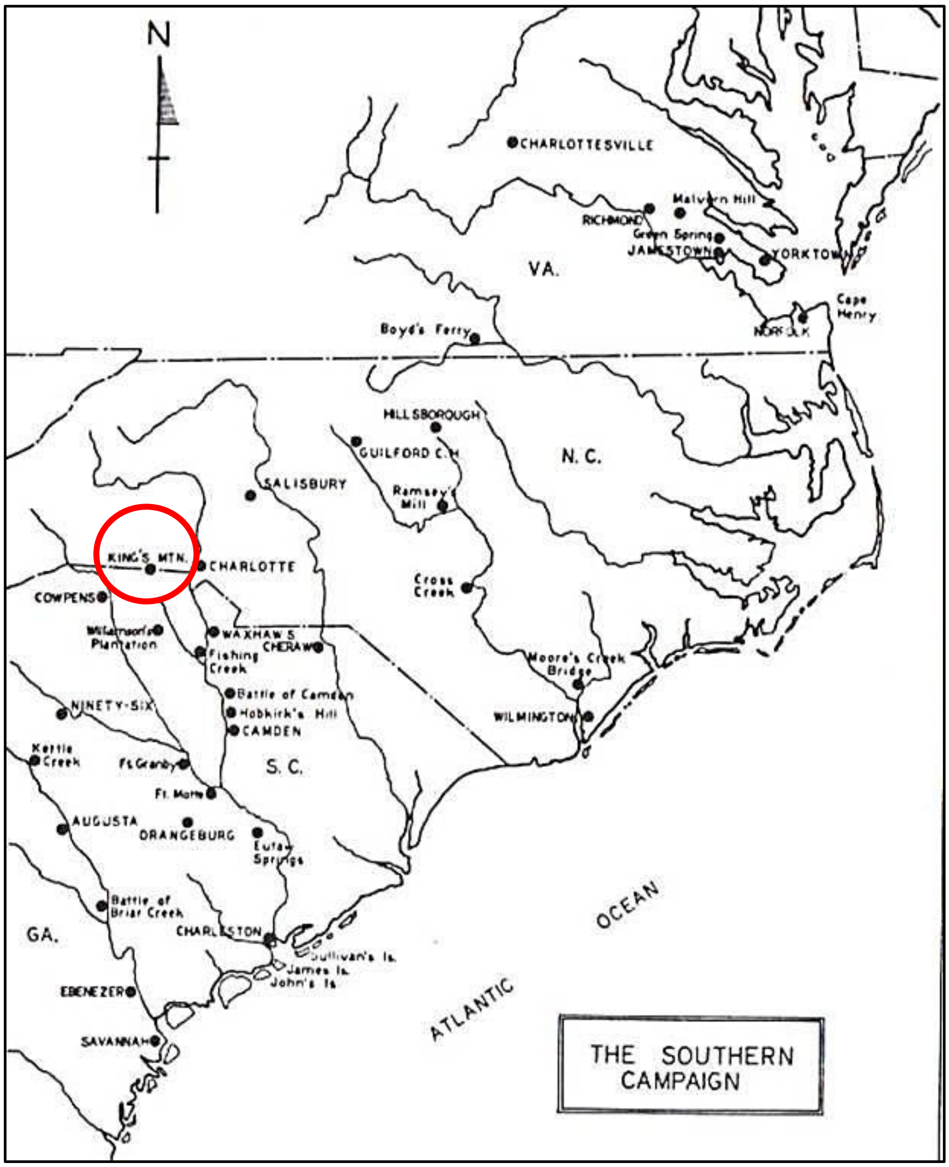

Fig. 2. Map showing the Southern Campaign (Moss 1990, vi). The battle of Kings Mountain took place on the North-South Carolina border.

In a surprising victory, the Patriot militia defeated the Loyalist militia which was commanded by British Major Patrick Ferguson, the only British person at the battle. Major Ferguson of the 71st Regiment of Foot (infantry), responsible for the design of the Ferguson rifle, was reputed to be the best marksman in the British army (National Park Service 2014a). Unfortunately for him, his skill with guns did not prevent his death at the battle. Ferguson's death and the defeat of the Loyalists militia effectively ended British General Cornwallis' plans to invade North Carolina and gave a much needed boost to the Patriots' morale (National Park Service 2014a).

Established in 1930, Kings Mountain National Military Park was first run by the War Department, and at nearly 4,000 acres is one of the largest National Military Parks (National Park Service 2014a). Even though the battle was recorded as being on the border itself, the park is located in South Carolina near the border with North Carolina (fig.3).

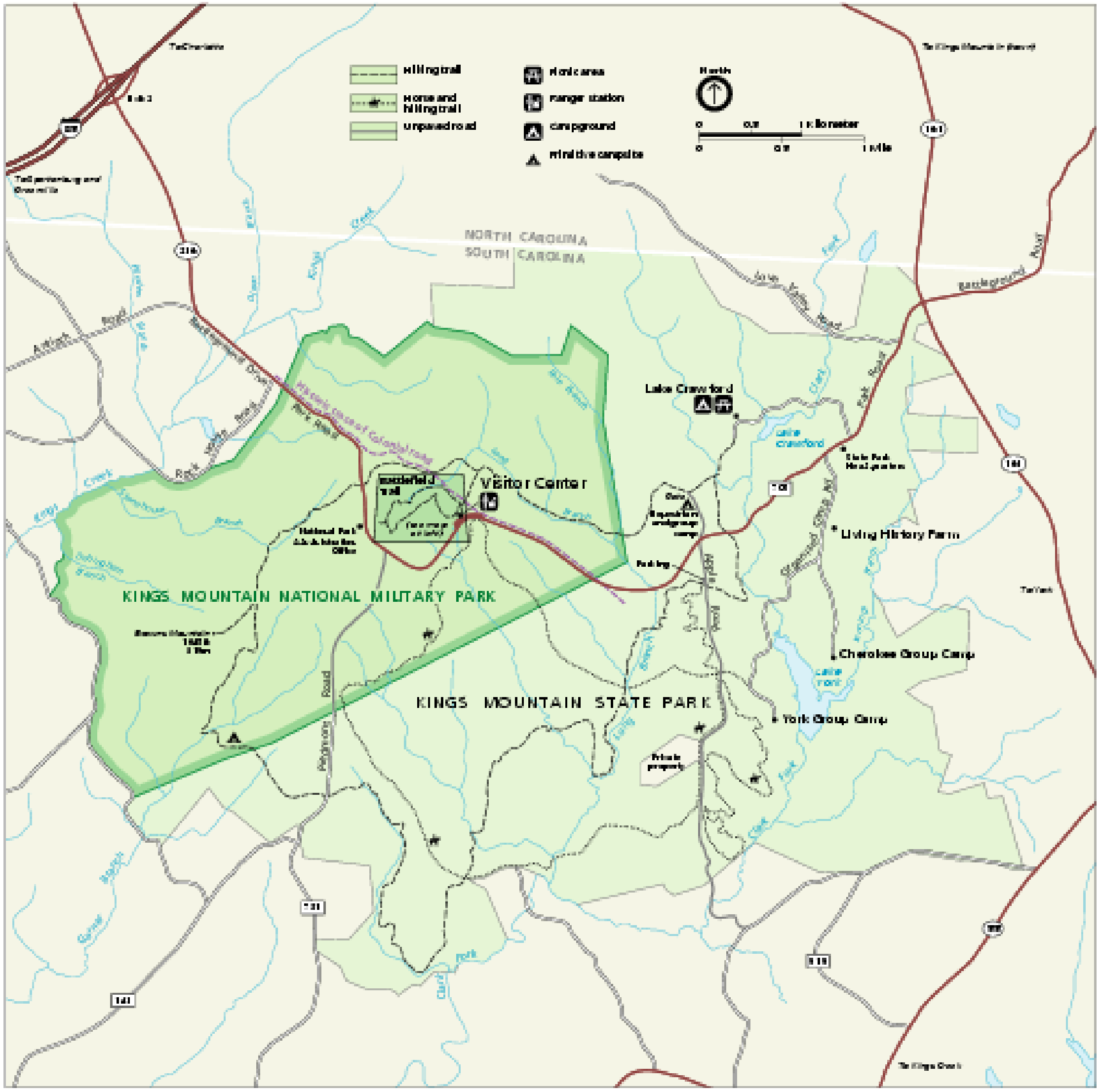

Fig. 3. Map from the NPS website outlining the park's borders (National Park Service 2014b).

On the 150th anniversary of the battle, October 7, 1930, President Herbert Hoover addressed a crowd of 75,000-80,000 people and described Kings Mountain:

> "This is a place of inspiring memories. Here less than a thousand men, inspired by the urge of freedom, defeated a superior force entrenched in this strategic position. This small band of patriots turned back a dangerous invasion well designed to separate and dismember the united colonies. It was a little army and a little battle, but it was of mighty portent. History has done scant justice to its significance, which rightly should place it beside Lexington and Bunker Hill, Trenton, and Yorktown, as one of the crucial engagements in our long struggle for independence."

This was the first time an American president had visited a Revolutionary War site in the South (National Park Service 2014a).

In addition to general park management, NPS has conducted many archaeological investigations throughout the park. Camping is available, and historical reenactments can be seen at the park during certain times of the year. There are historical buildings and a museum associated with the park. The museum curates artifacts found at or associated with the King's Mountain site.

The conservation of some these curated artifacts is part of two major projects NPS has begun concerning the Kings Mountain collection. Collaborating with the University of South Carolina, the park began to catalogue the entire collection in 1999; by 2010 95% of the archives had been catalogued (National Parks Conservation Association 2010). A major renovation of the park's museum and visitor center began in

2005 and as part of this renovation at-risk objects were identified and brought to Texas A&M University's Conservation Research Lab for conservation treatment (National Parks Conservation Association 2010).

King's Mountain Artifacts

The collection consists of 75 artifacts, mostly tools. Several of the artifacts were composite. Composite artifacts include an oil painting, cartridge box, auger, and heckle. There were also many single material objects such as a redware bowl, horn cup, and iron axe heads.

Of the many composite artifacts in this collection, three luggage trunks are the focus of this research (fig.4); all of the collection was conserved.

Fig. 4. Trunks before documentation and conservation treatments.

These trunks are part of the collection because they belonged to families related to men involved in the battle. Two of the trunks are "round-top" style 1770 -1890, and one is a "gold-rush" style trunk 1850-1865 (Edelstein and Morse 2000). The name "round-top" refers to the arching of the lid.

However, these trunks are also known as “hide covered” because of the rawhide covering or as “stagecoach” trunks (fig.5, Edelstein and Morse 2000).

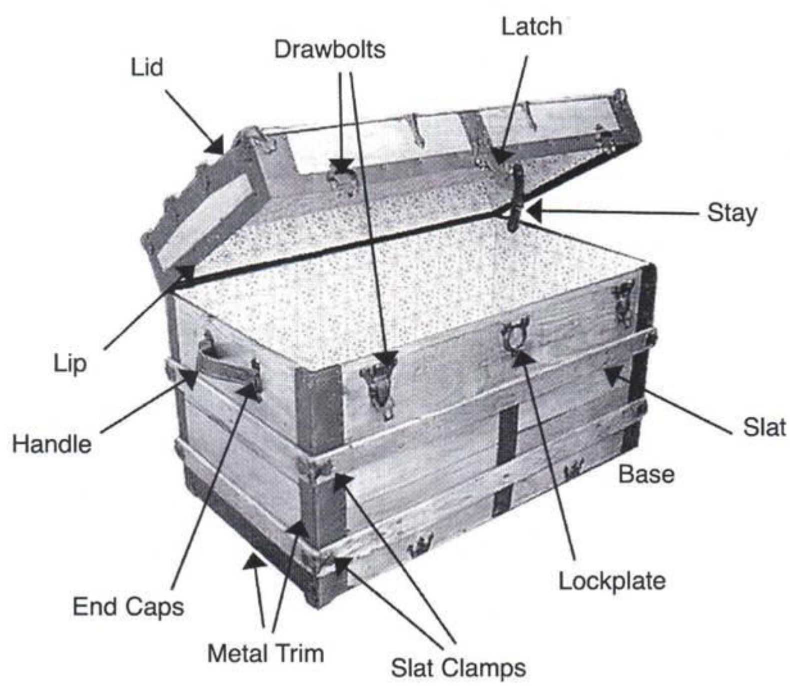

Fig. 5. Trunk anatomy (Edelstein and Morse 2000, 30).

The name "gold-rush" is given to trunks that featured shiny copper capped nails as decoration but they are also referred to simply as leather covered Civil War Era trunks (Edelstein and Morse 2000).

The trunks are the focus of research because they are the most complex composite artifacts in the collection. They have exterior leather coverings (two are rawhide, the other tanned leather), wood frames, metal fasteners and decorations of iron, copper, and tinned-iron. The two "round-top" trunks also have paper interior linings and interior textile stay fragments remaining that once held the lid open. All of the trunks are of a similar construction. Thin pieces of wood are nailed together to create boxes (bodies) and lids. The construction of the "round-top" lids differs slightly from the "gold-rush" lid in that the "round-top" has an extra step of molding a rounded arch in the wood for the lid. The lids are attached by iron hinges, which did not survive on all of the trunks. The trunks are covered in tanned leather or rawhide which is tacked on with nails. Decorative pieces of metal or leather are attached with cupreous-headed decorative tacks. On two of the trunks, the insides are lined with paper; this could happen before or after the outer leather is attached because it does not overlap with the leather. Handles (to lift the trunks from the outside, see fig. 5) and internal stays (to hold the lids open, fig. 5), like the surviving fragments of textile, are also added with iron tacks.

The primary objective of the present conservation project is to present information on how to treat large, dry, composite artifacts using silicone oil while avoiding the invasive, possibly damaging, disassembly of constituent parts. The large size of some artifacts from the Kings Mountain Military Park assemblage requires that treatment strategies needed to be developed, and in some cases, amended to suit the needs of the artifacts. The presence of variations within the composite trunks from the Kings Mountain collection makes standardization of treatment difficult. The treatment accorded these three trunks adds to the research and development of alternative catalyzation methods for the treatment of these artifacts.

Due to their uniqueness and material diversity I selected the “gold-rush” and “round-top” trunks for my study because they were the largest of artifacts received and offered the most challenging conservation approaches.

CHAPTER III

METHODOLOGY

Overview

The focus of archaeological conservation is on objects that constitute an important part of the archaeological record, usually excavated materials (Pye 2001). The goals of archaeological conservation are to actively remove agents of deterioration and stabilize the artifacts to prevent future deterioration. The purpose of conservation is to stabilize the artifact while retaining its integrity and diagnostic attributes. Since archaeological materials are usually in a state of degradation or decay, it is important not to lose trace materials that could prove to be significant (Pye 2001). The responsibility of a conservator is to decide the extent of treatment on an artifact. This can range from conservation to restoration to reconstruction. When deciding on a conservation methodology, the conservator should choose to implement the least invasive strategy that results in not only stabilization of an artifact but retains authenticity. Restoration alters the appearance of the artifact but can be done in ethical and reversible ways, that transforms the artifact to an earlier state. This process is more invasive than simply conserving the artifact. Reconstruction is a complete manufacturing of a new artifact, thus creating a replica. Frequently, in archaeological conservation the practice of reconstruction is limited to making a mold of an extremely fragile artifact prior to any conservation treatments. This process ensures that information is not lost if the artifact does not survive treatment.

All types of conservation (art, architectural, historical or archaeological) are subject to guidelines and ethical considerations. All artifacts are unique in terms of degree of degradation and required methods and materials needed to ensure long-term preservation. There are many treatment options available for different materials. The conservator determines which treatment regimen is best for individual artifacts. Considerations for the choice of treatment include materials and methods of manufacture, processes of deterioration, and the deleterious environmental factors affecting the artifact. Post-treatment storage and display of the artifact is also a consideration when selecting a treatment strategy (Pye 2001). There are many factors to consider when deciding to implement a conservation or restoration strategy on an artifact. Treatment decisions become more difficult when the artifact is comprised of several types of materials, also known as a composite artifact. Due to the presence of different materials in their composition, composite artifacts may require multiple and non-conflicting treatment strategies.

Composite Artifacts

Artifacts are designated as composite if they are comprised of different materials. During conservation, they may or may not be disassembled or broken down into their component parts. The diverse nature of possible treatments for composite artifacts is as individual as the artifacts themselves. Composite artifacts are a conundrum due to the fact that they can be made of "contrasting materials" that require different methods of cleaning and stabilization (Cronyn 1990, 93). Often the different constituents of composite artifacts can be harmful to each other. For example, if an artifact is comprised of two differing metals the more noble metal, meaning the metal with the higher atomic number, will absorb electrons released from the less noble one, or metal with lower atomic number, preventing the noble metal from corroding (Hamilton 1999). Furthermore treatment methods applied to conserve one element of the artifact may be less beneficial or even harmful to another component in the same artifact. As the conservator, “a decision has to be made as to whether a compromise is attempted or whether one material, being more sensitive, must be stabilized correctly and the other one must suffer the same treatment” (Cronyn 1990, 93-94). If a compromise of treatments cannot be made, a composite artifact may need to be dismantled.

Dismantling is often used in the course of treatments for art conservation and historic preservation. Paintings frequently have to be removed from frames, stretchers or strainers to be properly conserved. Entire buildings have been taken apart and rebuilt in a different location to preserve them. However in the case of archaeology, the dismantling of an artifact may result in the loss of important information (Cronyn 1990). Conservators frequently choose not to dissemble an artifact, and instead try to simply preserve the artifact. This can be done using strict environmental controls rather than attempting a conservation treatment. Environmental control is especially favored as a treatment if the artifact is housed in a museum. The conservator may choose to do partial treatments with the intent of stabilizing as much as possible without the loss of any information. Since there is an almost infinite variety of composite artifacts, generating a set of standard treatments seems unlikely, however, general examples and guidelines can be developed. The conservator has many choices regarding a composite artifact from simple preservation without disassembly to partial treatments in order to stabilize the artifact and retain as much information as possible to complete dismantling to preserve the artifact. The uniqueness of composite artifacts comprised of organic and non-organic materials creates another choice a conservator must make when developing a treatment strategy.

A strategy used in the conservation of composite artifacts comprised of organic materials is to implement the use of polymers, specifically silicone oil. The use of silicone oil on organic materials is well documented in the field of conservation. Since the early 2000's, Texas A&M University's (TAMU) Nautical Archaeology Program and conservation laboratories have been successfully treating water-logged organic materials with cross-linked silicone oils (Smith 2003). The silicone oil process also works well on dry organic materials and the treatment of dry organic artifacts using polymers is commonplace at TAMU's Conservation Research Laboratory (CRL).

The Silicone Oil Treatment

Silicone oils are polymers, composed of repeating units that can be chemically combined with the matrix of an archaeological artifact to eliminate biological and environmental activities, with the intent of making an artifact stable and chemically inert, called passivation (Smith 2003). In waterlogged organic artifacts, silicone oils, although very different from polyethylene glycol (PEG) are used in a similar way in that both fill the spaces in the cells of the artifact that are filled with water. However, because water and oil do not mix (unlike PEG which does mix with water), artifacts undergoing the silicone oil treatment must first complete a dehydration process, culminating in a functionalized polymer replacing solvents within the matrix of an artifact (Smith 2003). In the case of dry or desiccated artifacts, functional polymers tend to chemically bond with cell walls of the organic artifact; thus the silicone oil is used to coat the cells rather than fill a void. In some cases polymers may also fill voids if the cell structure permits. To complete the treatment artifacts are placed under vacuum, the cross-linker is used to help the artifact drain excess oil, and finally the silicone oil is catalyzed (Smith 2003). Catalyzing the silicone oil essentially makes the cross-linked bonds permanent, thus the process is not reversible.

The prescribed procedure for the silicone oil treatment, in most cases, calls for objects to be submerged in the oil. In special circumstances, a slight vacuum is applied to ensure the penetration of the polymer solution throughout the entire artifact. Due to size and materials, parts of the process must occasionally be changed to better suit the needs of the artifacts. Some artifacts are too large to be submerged in a polymer solution. Furthermore, some artifacts cannot or should not be put under vacuum, including completely waterlogged wood, dried or desiccated wood or artifacts simply too large to fit in the vacuum vessel. At ambient pressure and room temperature, polymer processes will effectively permeate and stabilize organic substrates (Smith 2003).

Modern conservation focuses on preventive measures whereas in the past the focus was on restoration or “rectifying (visible) damage on individual objects” (Pye 2001, 24). Leather treatments tend to be more restoration orientated than the treatments for most other materials. Many trends in leather conservation have come and gone, most of them aiming to restore the flexibility and suppleness of old, brittle leather. Heat is frequently discouraged in the treatments, as all leathers have a shrinkage temperature, which when reached will distort the leather. The shrinkage temperature “will depend on the raw material, the methods of tannage, the amount and type of deterioration the leather has undergone during its lifetime…” (Thomson 2006, 60). The shrinkage temperature of an old piece of leather is not the same as its shrinkage temperature when it was new, because of the chemical changes that have occurred over the artifacts lifetime (Thomson 2006). Higher shrinkage temperatures are seen more in dryer leathers and “it is therefore possible to use treatments involving heat on new or partially degraded leather objects provided that they are relatively dry” (Thomson 2006, 61). During treatment heat can be used, if kept below the shrinkage temperature, to help reshape the leather.

Due to their long-term stability, silicone oils replace the need for leather dressings. Leather dressings are intended to restore leather that has become “firm, hard and cracked” from the loss of “fatty materials” (Thomson 2006, 63). Mixtures of fats and oils have been used as dressings in the final touch-up of leather for years. Recently, however, use of leather dressings as part of the conservation process, to make leather pliable, has fallen under scrutiny (Angus et al. 2006). Dressings, such as wax, are often only used for aesthetic rather than preservation reasons and may not add to the conservation process (Angus et al. 2006). All dressings consist of a “greasy” substance such as fish oil, PEG, or lanolin which leaves the leather with a “greasy” feel or appearance which can lead to problems in the future. Often these materials will leave the leather with a sticky property which attracts and holds dirt, and other particles (Angus et al. 2006). With the silicone oil treatment, a desirable look and feel can be achieved so the aesthetic need for leather dressings is removed, as is the “greasy” appearance (Smith 2004).

As leather ages and deteriorates, it loses collagen which is the fatty material that allows the leather to be flexible. This may have a deleterious effect on the surface texture of the artifact. The loss of collagen can cause shrinkage, cracking, or brittleness in leather. Since leathers are manufactured using a broad range of methods and materials, the loss of collagen and the rate and range of deterioration will differ from artifact to artifact.

> “Basically what conservators have to deal with is an active chemical reaction. Thus each type of leather may have some specific mechanism of deterioration because of its own particular make-up. But because of the common denominator present in all leathers, the collagen protein- the component that gives it integrity- there must be many deterioration mechanisms in common with all leathers” (Florian 2006, 36).

Despite the common deterioration mechanisms, various methods of manufacture leathers react to treatments differently. Leathers can be tanned using a range of materials. Leather artifacts of different ages, originating from different species of animals, and animal hides of varying thicknesses will all react in a unique manor. The goal of the treatments presented here is to use the silicone oil to return some of the flexibility and suppleness. An electric iron, set on low heat, may be used to reshape a leather artifact that was treated with the silicone oil process. Tests indicate that the use of elevated heat accelerates catalyzation of the silicone oil, promoting artifact stability. Since there are many catalysts, including tin-based and titanium structured additives (vapor catalysts), that can be used in conjunction with functional polymers, the application of heat, such as through the use of an electric iron, offers more customization than chemical catalyzation. Unlike the vapor catalyzation, which can cause the formation of a white precipitate on the surfaces of artifacts, heat processes require less post-catalyzation mechanical cleaning. Furthermore, as the heat source is applied cautiously, not meeting or exceeding the shrinkage temperature, it can be used to reshape the leather without causing any adverse effects. Experiments indicate that shrinkage does not occur.

Other Materials

Both "gold-rush" and "round-top" trunks contained metal components that were partially exposed on the surface, due to the construction of the trunks. This makes conservation of the entire component impossible and could mean metal components may need to be retreated or replaced in the future. Most of the metal components used on the trunks are iron. On all of the trunks, however, decorative tacks with cupreous (any metal material containing copper: brass, bronze, or pure copper) heads are used. As such, a combination of iron and cupreous conservation treatments are required to conserve the trunks.

Both cupreous and iron materials can undergo electrolytic reduction (ER) to remove corrosion causing salts and to stabilize the metal. ER reduces corrosion to a metallic (less corrosive) state, removes chlorides (the cause of corrosion in metals), and mechanically cleans artifacts (Hamilton 1999). In standard treatment the artifact is attached to a negative cathode and placed in a bath of electrolyte solution with a positively charged anode (Hamilton 1999). Typically the electrolyte solution is made of approximately 5% sodium hydroxide in deionized water; however sodium carbonate or sodium sesquicarbonate may be used in place of sodium hydroxide. ER can be applied as a "spot treatment" by only reducing accessible areas or the metal piece can be removed and submerged. Submergence is more effective but it does require dismantling. In addition to being less effective, as it does not conserve the entire component, "spot treatment" also is much more likely to cause damage to the surrounding materials since the sodium hydroxide used in electrolytic reduction is harmful to wood and leather. As the safest choice, extensive mechanical cleaning on the accessible parts of the unremoved metal is the conservation treatment used here for both copper and iron pieces. Any removed metal pieces may undergo the submersion ER treatment.

Due to the characteristics and the possible condition of wooden material, the wood components of the trunks are prone to damage and deterioration, therefore the wooden components were treated first. During this stage of treatment all of the metal components were coated entirely in silicone oil, which may help prevent its future deterioration. Furthermore the metals receive a chemical coating, tannic acid for iron which forms ferric tannate and benzotriazole (BTA) for copper, which creates a protective film. These chemical treatments help keep the metal stable and prevent future corrosion.

The two “round-top” trunks have paper linings and remains of textile hinges. Both the paper and the textile are dirty and discolored, and several areas of the paper are torn or peeling. Since they are similar organic materials, basic cleaning is similar, and both can be treated with silicone oil like the leather. However, the paper requires some extra treatment for partial restoration to re-adhere the sections that are lifting from the wood surface, as well as fix tears. A Wishab Sponge (a conservation tool made vulcanized latex, like a large crumbling eraser) was used to clean the paper and textile, since it is effective and gentle. Wishab Sponges come in a variety of firmness, the lightest of which can be used on a range of fragile materials. The Wishab Sponge was also used to clean the rawhide since easer-like conservation tools are recommend for removing especially stubborn dirt from rawhide (Canadian Conservation Institute 1992). Ethulose adhesive, a cellulose paste, was used to repair the paper tears and keep it attached to the wooden sides, when necessary Japan paper is used to fill in areas of material loss. Although there is a wide selection of adhesives sold by conservation suppliers for use on paper, wheat starch paste, a cellulose based material is recommend as the most stable and as producing the most suitable results (Canadian Conservation Institute 1993).

Reversibility vs. Retreatability

All three trunks present the conservator with the ethical dilemma of choosing reversibility or retreatability as the appropriate conservation treatment. Choosing to reverse or retreat an artifact is dependent upon the condition of the artifact as well as the impact the treatment may have on the state of the artifact.

Reversibility is the concept of allowing the conservation treatment to an artifact to be undone allowing the artifact to be “returned” to its original state. The concept of reversibility was originally a tenant of Historic Preservation, which was the original conservation movement that current Art and Archaeological Conservation ethics and standards are based on. As part of the Secretary of Interiors Standards, which can be seen in detail at http://www.nps.gov/tps/standards.htm, reversibility is still a very salient topic for the field of Historic Preservation, especially if the goal is to have an historic property added to the National Register (National Park Service 2014c). The reason that reversibility is so important for build conservation is that depending on the approach taken (preservation, rehabilitation, restoration or reconstruction) major changes to the materials, structure or physical appearance may be made intentionally or otherwise and it is important that these changes can be undone. During artifact conservation only minor changes, most commonly changes in color but also size or texture, are expected or allowed. Many of these changes are not reversible even for treatments that are considered reversible by the conservation community.

Retreatability is the concept of applying a conservation treatment to an artifact and thereafter only being able to reapply the same application, or other non-conflicting treatments. Once the conservation treatment is applied to the artifact, the treatment becomes a permanent part of the artifact. The treated artifact cannot be returned to its “original” state but can be retreated if and when the original treatment degrades to remain adequately conserved.

Due to the potential of treatments causing future harm to the artifact, the concept of reversibility of treatments became integral to conservation ethics. Unfortunately, reversibility is just a concept rather than a reality (Jackman 1982). Many traditional treatments use organic materials to stabilize artifacts that over time tend to crosslink or chemically bond with the artifact. In those instances complete removal or reversibility is no longer possible and often causes damage to the stability of an artifact. Since a truly reversible treatment does not exist, and because the ethics of conservation are ever-changing, replacing the impossible statute of reversibility with the achievable goal of retreatability has been proposed by some in the archaeological conservation community (Smith 2003).

Treatments have fallen in and out of favor throughout the history of material conservation. It is now evident that as the materials used to conserve artifacts degraded they create new problems. These materials, such as PEG and leather dressings, fell into disuse and are being replaced by treatments thought to be less harmful. Furthermore, these less harmful treatments are held to be reversible. As previously discussed, no treatment is truly completely reversible. There is always, at the microscopic level, a trace of the previous conservation efforts. It is more practical to stabilize an artifact in the present to prevent the loss of information and retreat later than to allow all of the information to be lost as the artifact degrades away.

Retreatability is especially important for archaeological conservation because information can be lost by a delay, or complete lack of action which occurs when conservators are not willing to treat artifacts because they cannot do so in a “reversible” way. If these artifacts are to be utilized for study it is important they are preserved; if they are not going to be cared for it would have been better to leave them undisturbed in the first place. This is the practice for some nautical sites that do not have the resources for conservation. The site is recorded but the artifacts are not removed, thus the decay process is not altered and the artifacts may be recovered at a later date when conservation is possible.

Silicone oil treatments, although not reversible, are successful in conserving many types of artifacts without negative effects including, change in shape or texture, or extreme color changes that may be associated with other traditional treatments available (Smith 2003). In addition to these silicone oils benefits the process allows for the artifacts to be retreated.

To clean, actively remove agents of deterioration, and stabilize the artifact a variety of treatments were considered before developing a conservation plan for artifacts. The organic materials (wood, textile, paper and leather) allowed for the use of the silicone oil treatment with either heat or vapor catalysts. Although the process is not reversible the treatment is exceptionally long lasting and the artifacts could be retreated in the future if necessary either with silicone oil or other non-water based treatment. Since metal is not stabilized by silicone oil, appropriate treatments are used in combination with the silicone oil.

Summary

As I stated earlier, the goals of conservation are to actively remove agents of deterioration and stabilize the artifacts to prevent future deterioration. The purpose of conservation is to stabilize the artifact while retaining its integrity and retaining its diagnostic attributes. Composite artifacts present a unique set of problems for the conservator and their selected method of conservation. The decision to dismantle an artifact that may result in the loss of information or simply preserve the artifact, using strict environmental controls is a crucial decision that is made before applying treatment to a composite artifact. The existence and use of metal and leather in the construction of the composite artifacts require the use of a silicone oil treatment on the leather and spot treatments on its metal components. Due to some noted ethical issues associated with reversibility, the treatment plan for the King’s Mountain trunks was to treat each without dismantling in a manner that leaves the trunk re-treatable.

CHAPTER IV

TREATMENT

Assessment

As I noted in Chapter 2, the collection of artifacts in my study is quite large and presents a variety of options for conservation treatments. The artifacts from the King's Mountain included a "gold-rush" trunk (designated KIMO 51), a small "round-top" trunk (KIMO 155), a large "round-top" trunk (KIMO 162)(fig.6), an oil painting, horn cup, bayonet, cartridge box, an auger, saw, heckle, scythe, and sickle, in addition to many other small tools.

Fig. 6. Pre-conservation photo, KIMO 162 is the large "round- top" trunk to the left and KIMO 155 is the small "round-top" trunk on the right.

As with all newly received collections, upon receipt I examined the artifacts documenting the number, materials, and condition. Due to their uniqueness and material diversity I selected the trunks KIMO 51("gold-rush"), KIMO 155 (small "round-top"), and KIMO 162 (large "round-top") for my study because they were the largest of artifacts received and offered the most challenging conservation approaches.

All of the collection was photographed and notes were made about the condition of the artifact as a whole as well as any areas that needed special attention. Pre-conservation measurements were also recorded.

The pre-conservation condition of KIMO 51(fig.7), the "gold-rush" trunk, was poor. The leather was dry, brittle and had shrunk.

Fig. 7. KIMO 51("gold-rush") pre-conservation photo.

When accessing the condition of metal it is rated in terms of the extent of the active corrosion; the choices being mild, moderate or extreme. Mild corrosion would show the start of rust or patina, moderate corrosion is more extensive than mild and may include flaking, and metals in the state of extreme corrosion are more rust or bronze disease than actual metal.   The metal exhibited states of moderate corrosion. The wood component was in the best condition of all of the materials.

The small "round-top" trunk KIMO 155 (fig.8) was in similar pre-conservation condition. Although the rawhide and wood components were dirty but in good condition, the leather and metal were poor. Some sections of the leather decoration were degraded to the point of flaking into powder when brushed or touched.

Fig. 8. KIMO 155(small "round-top") pre-conservation photo.

The metal was moderately corroded. The small remnants of textile were discolored with some rust but were otherwise in good condition. The paper was in poor condition, discolored, dry and flaking.

The large “round-top” KIMO 162 (fig.9) was also in poor condition pre-conservation. Similar to KIMO 51 and KIMO 155, the surfaces of KIMO 162 were dirty but the rawhide and wood were in good condition. Additionally, as with KIMO 155 the paper was in poor condition, dry, discolored, and flaking, and the textile while discolored was in good condition. The leather was in poor condition, powdery in some areas. The metal exhibited moderate corrosion.

Fig. 9. KIMO 162(large “round-top”) pre-conservation photo.

After my initial examination and before I begin treatment of each artifact, I researched each trunk type to determine when it was made in order to understand the materials and process used to create the artifacts, as well as to establish historical context. I reviewed relevant technical information on conservation treatments to ensure an appropriate conservation methodology for each artifact. I determined that a standard conservation methodology such as mechanical cleaning, electrolytic reduction (ER) or silicone oil treatments would be appropriate for most of the artifacts. Each material was mechanically cleaned using tools appropriate to that material (e.g. soft or fiberglass brush, Wishab Sponge, dental tool, etc.). Repairs were done as necessary, as there are tears in the paper that required the use of ethulose adhesive. Silicone oil was applied topically and catalyzed using heat or vapor. Metal components were given a final coating of stabilizing chemicals (such as tannic acid or BTA) to facilitate future preservation.

The KIMO 51("gold-rush") is a flat box shape, constructed of wood. The wooden structure is covered with engraved – hand-tooled leather with a flower design pattern (fig.10). The trunk is reinforced with large brass fittings which when new gave the trunk a golden shiny appearance and as a result it was commonly known as a "gold-rush" trunk.

Fig. 10. KIMO 51 ("gold-rush") pre-conservation. Close up of the leather tooling, note the flower design in the center of the photo, near the tear in the leather.

As the trunk aged, the brass fittings corroded to almost the same tone as the iron components (fig.11). The dry, brittle leather had shrunk away from the fittings and the surface dirt rendered the decoration very obscured.

Fig. 11. KIMO 51 ("gold-rush") pre-conservation. The once shiny brass fittings are now almost the same color as the iron strap they hold in place. As the leather has dried it has shrunk away from the fittings.

KIMO 155 (small “round-top”) was constructed of wood as well but covered in rawhide and lined with paper. Although rectangular in shape similar to the KIMO 51 the rounded appearance of the lid defines this style of trunk as “round-top”. Even though it was smaller than KIMO 51 and KIMO 162, KIMO 155 was still covered with decorative metal components and strips of leather edging defining the sides of the trunks (fig.12).

Fig. 12. KIMO 155 (small “round-top”) pre-conservation photo noting the decorative leather and metal components

KIMO 162, the large "round-top" trunk, is constructed of wood covered in rawhide and lined with paper. Like KIMO 155, KIMO 162 has decorative metal components and strips of leather edging defining the sides of the trunks (fig.13). Additionally KIMO 162 has faded writing on the lid.

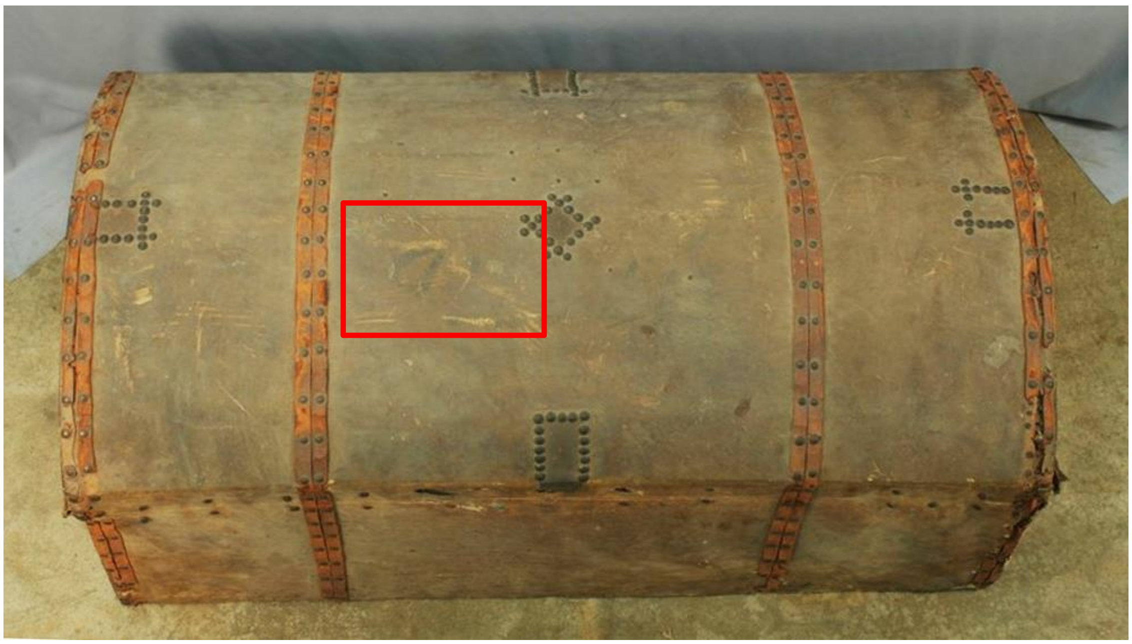

Fig. 13. KIMO 162 (large "round-top") pre-conservation documenting the leather and metal decorations. Also note the faint writing to the left of center.

As with KIMO 51, brass was used as decoration and to reinforce KIMO 155 and KIMO 162 but the brass pieces are smaller and not as visually dynamic as the larger brass pieces of “gold-rush” trunk. Both types of trunks were made with paper lining inside however the paper linings from KIMO 155 (fig.14) and KIMO 162 (fig.15) are present but there is no lining in KIMO 51 (fig.16).

Fig. 14. KIMO 155 (small “round-top”) pre-conservation photo showing the interior paper lining and the textile stay (attached to the middle on the lid on the left side and hanging down).

Fig. 15. KIMO 162 (large "round-top") pre-conservation interior view documenting condition of paper lining.

Fig. 16. KIMO 51("gold-rush") pre-conservation photo of the condition of the interior, note there is no paper lining.

Conservation Planning

My research for the trunks included a range of topics from articles on treatments, materials and conservation ethics (Angus et al. 2006; Canadian Conservation Institute 1992 and 1993; Cronyn 1990; Jackman 1982) to the history of trunk making from 1770-1930 (Edelstein and Morse 2000). From this research an appropriate conservation plan is developed for each trunk.

Originally the conservation plans called for each trunk to be treated as a whole. This means that under the original conservation plans none of the trunks were to be dismantled. The trunks were cleaned mechanically with appropriate tools for each material. For example the Wishab Sponge (vulcanized latex) was used to clean paper and textile. The Wishab Sponge acts something like an erasure; it crumbles as it gentle rubs away dirty. It comes in a variety of firmness which can be used on a wide range of materials. Additionally, any necessary repairs to the textile, paper or leather were done at this time. All of the organic materials of the trunks were treated using a slight alteration to the silicone oil process. The published silicone oil process calls for artifacts to be submerged in the oil, often under vacuum (Smith 2003). Due to the size of the trunks it was not possible or necessary to submerge them or apply vacuum pressure. Instead the oil was applied topically, the trunks were allowed to drain, and the oil cross-linked by applying a catalyst (heat or vapor). After that process was complete the metals were treated; each of the metals was treated according to type and accessibility.

After initial investigations, it became apparent that the best procedure to treat KIMO 51, the “gold-rush” trunk, would be to partially dismantle contrary to the original conservation plan. It is not unusual to have to change conservation plans. As more is discovered about the artifact and the condition it is in plans are modified to better suit its conservation needs. Both KIMO 155, the small “round-top”, and KIMO 162, the large “round-top”, were treated as a whole in accordance with my original conservation plan.

Although the construction of all these trunks is similar the difference in material requires different process for conservation. KIMO 155 and KIMO 162, the “round-top” trunks are covered in rawhide while KIMO 51, the “gold-rush” trunk, is covered in tanned leather. Different processes are used on the coverings and the condition of the tanned leather and rawhide on the trunks were in different states of decay. Rawhide does not become as friable as tanned leather over time. The leather of the rawhide trunk had become brittle. Further changes to the conservation plan include catalysts by heat rather than vapor for the tanned leather pieces. It is thought that controlled heating in combination with the silicone oil process returns flexibility and strength to the leather while preserving it.

After completely conserving all components KIMO 51 (“gold-rush”) was reassembled. During the reassembly some restoration efforts were made. The cupreous fittings, which are the defining characteristic of this style of trunk, were polished to an almost new appearance. Furthermore to help maintain integrity and to flatten the leather to a like new state, the leather pieces were attached to each other using sheer nylon and invisible thread. In addition to making the leather components more cohesive, this allowed for the leather to be stretched more flatly against the wooden body of the trunk.

KIMO 51 – The "Gold-Rush" Trunk

The "gold-rush" trunk, KIMO 51, was treated first. A rating system of excellent, good, fair and poor is used to evaluate all objects (and materials) before and after conservation. An object in excellent condition requires little to no conservation. An object in poor condition may have material loss or structural damage; it is an object in need of extensive treatment. Based upon my initial examination and assessment, KIMO 51 had a condition rating of poor. It is a composite artifact made of wood, tanned leather, paper, iron and cupreous materials.

KIMO51 is comprised of a wood box with an exterior of which is covered in tanned leather. The wood was in good condition; however the tanned leather was in poor condition. The tanned leather is decorative with incised and stamped decorations of lines, curls and flowers. Over time the decoration was obscured as the tanned leather shrunk and dried. The trunk is held together by iron nails and tacks. The leather is attached by decorative iron nails with cupreous heads. All of the metal components ranged from good to poor condition, exhibiting mild to moderate corrosion. On the bottom surface of the wood is written: Yorkville S.C. 6 #8 G.R. Ratchford 99 RMRR (fig.17). The fragments of the handles, made of paper and leather, were placed inside the trunk. These were also in poor condition.

Fig. 17. KIMO 51("gold-rush") pre-conservation photo noting the writing on the bottom of the trunk, "#8. G.G. Ratchford 99 RMRR Yorkville S.C. 6" Ratchford was one of the Patriots at the battle.

The decision was made to partially dismantle after evidence of pests and rot were discovered near the edges of the tanned leather on the surfaces facing the wood. During the initial visual investigation of the condition of the artifact the minor pest damage and areas of rot were found.

During the beginning of the mechanical cleaning, insect carcasses were found between the wood and the tanned leather, which lead to a more thorough investigation of the extent of the insect infestation and damage. At this time red rot and white mold were found on the inside of some of the tanned leather pieces (figs.18 and 19).

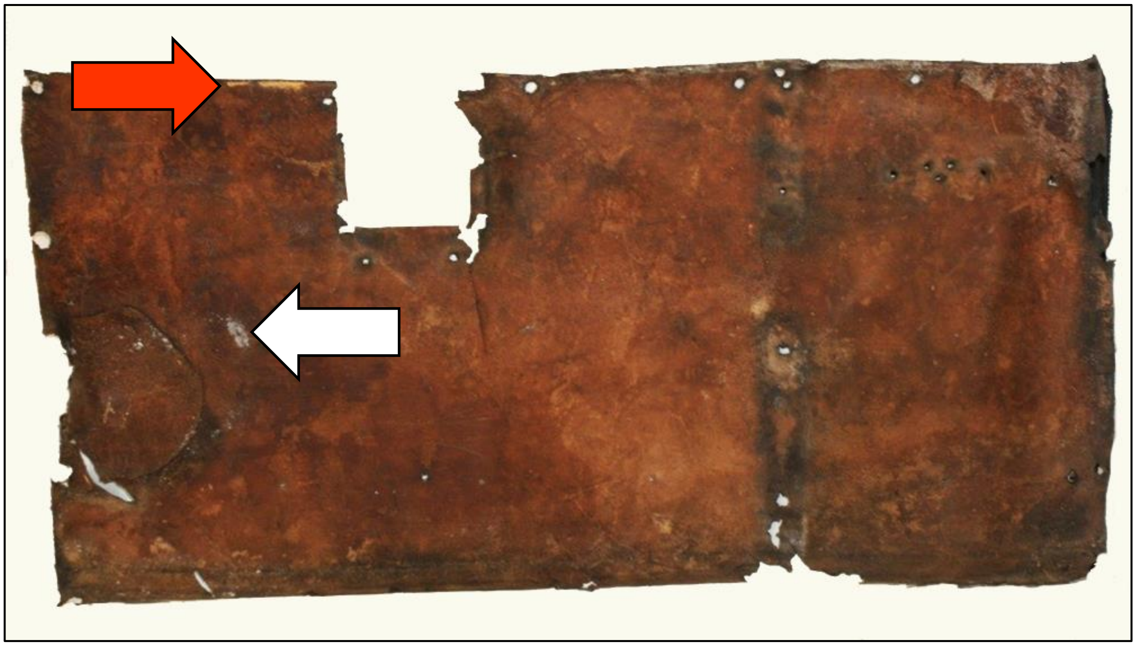

Fig. 18. KIMO 51("gold-rush") interior view of one of the leather piece, small spots of powdery orange rot and white mold are visible.

Fig. 19. KIMO 51("gold-rush") close up of the wood during the dismantling. Note the white mold, and brown debris left by the leather.

It was then I decided that KIMO 51 should be partially dismantled to better facilitate stabilization of the artifact (fig.20). Although dismantling was not a part of my initial conservation plan, the decision to partially dismantle was a necessary deviation.

Fig. 20. KIMO 51(“gold-rush”) dismantling in progress.

Dismantle does not mean completely dissemble. Components of the artifact are carefully removed in order to maintain the structural integrity of the artifact. These items are documented and treated in such a way that they can be returned to their original position after treatment. The condition of the tanned leather required additional restoration treatment.

The tanned leather had pulled away from the metal fasteners in several areas (fig.21), and in order to keep it in place and offer additional stability and support to the decorated layer it was decided that the tanned leather pieces should be (re)connected. Thus in addition to rot/mold removal and the planned silicone oil treatment an additional restoration treatment of sewing the tanned leather together was added to the modified conservation plan.

Fig. 21. KIMO 51("gold-rush") pre-conservation. This photo documents the condition of the back and left side of the trunk. Again, note the material loss, and leather shrinkage.

As previously stated, the tanned leather was fastened with iron and cupreous nails/tacks and bands. Therefore during the partial dismantling, as the decorative leather was removed, steps were taken to remove the decorative metal but the structural fasteners, all of which were iron nails, were left in place to ensure the structure of the trunk was not compromised (fig.22).

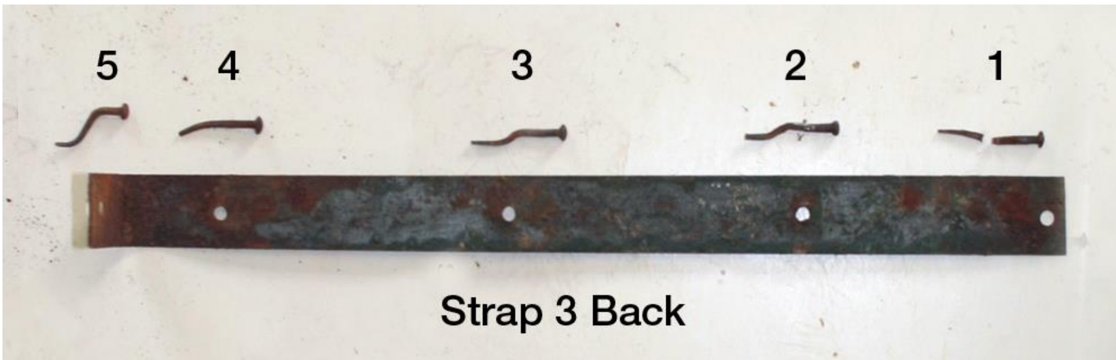

Fig. 22. KIMO 51("gold-rush") metal components. During the dismantling each of the metal components were carefully documented before treatment so they could be returned to the proper position.

All tanned leather components were mechanically cleaned first with an assortment of brushes and dental tools. This involved carefully removing areas of rot and mold. In some small areas the rot had become very powdery and was easy to brush away. Removing the rot resulted in the tanned leather being slightly thinner in those small areas. The leather underwent an initial flattening with the steam iron, on a low setting, and weights. The purpose of this step was to help smooth the surface of the tanned leather back out since over the years it shrank and became puckered away from the wood body and metal fastenings. After that the tanned leather pieces were saturated with a mixture of 80 % silicone oil, which is a mixture of two different densities of oil, SDF1 66% and SDF5 34%, and 20% MTMS and then allowed to drain using 100% MTMS to remove excess oil. It is during this process that attempt to obtain the desired appearance is made. Ideally the leather should be more supple and flexible without any greasy/oily feeling or residue. The steam iron was used again after this to catalyze the oil and to provide additional flattening or shaping. Various settings, from low to just below steaming, were used to try to achieve the best appearance and textures. DBDTA vapor is commonly used for catalyst in the silicone oil process but using the iron instead was another necessary deviation from the original conservation plan.

Occasionally with the use of vapor catalysts may result a very hard white precipitate forming on the object. This precipitate can be mechanically removed. However due to the thinness and friability of the tanned leather removal of the precipitate has a high potential for surface damage. As such, heat was used as a catalyst rather than vapor on the tanned leather in order to avoid the appearance of the white precipitate on the leather and thus avoid possible damage caused by trying to remove the hard white substance. After treatment nylon was attached to the edges of the tanned leather pieces via “Invisible Thread” so the pieces could then be connected to each other when reattached to the wood of the trunk (fig.23). The leather treatments produced a variety of results ranging from poor to excellent as discussed in the next chapter.

Fig. 23. KIMO 51(“gold-rush”) highlighting an area in which the brown nylon and invisible thread was used to attach leather pieces to one another.

The wood structure of the trunk was also mechanically cleaned with brushes and dental tools and then topically saturated with a mixture of 80 % silicone oil (SDF1 66%, SDF5 34%) and 20% MTMS. As previously noted, the trunks are too large to submerge, so the oil was painted on until the wood seemed to no longer absorb it. Once saturation was reached excess oil was removed using 100% MTMS. Unlike the tanned leather pieces, the wood components were catalyzed according to the original conservation plan using DBDTA vapor for 10 applications. Using the vapor catalyst was acceptable for the wood even though during the process a white precipitate may form because the wood was a harder organic material and did not possess the same risk of surface damage during removal as that of the leather.

In order to maintain structural integrity some iron nails were not removed from the trunk. Since they were not removed they also underwent the silicone oil treatment. Silicone oil is only a treatment for organic materials however the use of it on these iron pieces was unavoidable. After the silicone oil treatment was complete these metal components were also treated appropriately for their material type. Exposed areas, such as the nail heads, were cleaned with fiber glass brushes and then the iron was coated with 3 applications Tannic Acid in ethanol and covered with Krylon Clear Acrylic Spray in acetone painted on with a brush. Tannic Acid turns the surface of the iron into Ferris tannate which is stable but does turn the iron a black color. Krylon Clear Acrylic Spray is one of two ways, the other being microcrystalline wax, to seal metal to preserve it from environmental factors.

Metal that was part of KIMO 51("gold-rush") decorations was removed and treated separately. To ensure that each piece was returned to its original position, the metal was treated in batches. For example, each band that held the leather in place had approximately five nails/tacks that fastened it to the wood; all of these pieces would constitute one small batch. This batch was documented, labeled, and treated all together separate from the other metal batches. All metal underwent mechanical cleaning (brushes and dental tools), then if the metal was in poor condition, meaning it was moderately to extremely oxidized, it was also treated by electrolytic reduction (ER). The ER treatment severs several functions in the conservation process. ER removes salts, reduces Ferris iron to a stable state, and removes flaking layers. The duration of the ER treatment was determined by salinity content. Since none of the metal in KIMO

51("gold-rush") had a high salinity content of 35 ppm, the ER treatments were short lasting only 7 days. All metal components, ER treated and mechanically cleaned, were then passed through three rinses of boiling de-ionized water. After which, all iron pieces were coated with Tannic Acid in ethanol and cupreous items, after being polished as a restoration measure, were coated in benzotriazole (BTA) in ethanol. All metal items removed were coated in microcrystalline wax and excess wax was removed mechanically. As previously stated the chemical coatings help keep the metal in a stable state and the wax preserves the metals from environmental influences.

Once all treatments on all individual components of KIMO 51 were complete the components were organized to begin the reassembling of the trunk. As a part of my conservation plan, nylon and clear thread were added to the leather to help stabilized the artifact as a whole. The leather was then wrapped around the trunk and the metal components were reattached to hold it in place (fig.24).

Fig. 24. KIMO 51("gold-rush") during the process of reattaching the conserved leather and metal components.

During this process round wooden stir sticks, the size of the nail holes, were used to hold leather and metal pieces in place. These were removed as the nails were put back. Additionally wax was added to any nails and holes that appeared loose after reassembly. This was not an anticipated outcome of the disassembly and will be discussed in the results.

KIMO 155 – Small “Round-Top” Trunk

The two "round-top" trunks, KIMO 155 (small) and KIMO 162 (large), were treated identically and without dismantling. KIMO 155 and KIMO 162, the “round-top” trunks, were treated simultaneously after KIMO 51, the “gold-rush” trunk. The original conservation plan was carried out in that neither of these trunks required disassembly because no evidence of insect infestation or rot/mold was found. As with KIMO 51, KIMO 155 and KIMO 162 were also in poor condition.

The smaller trunk, KIMO 155, is a wood trunk with rawhide covering and tanned leather decoration (fig.25). Fasteners are iron and cupreous.

Fig. 25. KIMO 155 (small “round-top”) pre-conservation photo showing the front and right side.

The interior of KIMO 155 has paper and textile components (figs.26 and 27).

Fig. 26. Interior of KIMO 155 (small "round-top"), pre-conservation photo detailing the condition of the paper.

Fig. 27. KIMO 155 (small “round-top”) pre-conservation textile detail.

The rawhide was cracked, and the tanned leather and the paper were friable, from age and dryness. As a result some areas of the paper were lifting from the wood surface or flaking. The paper also had some areas of discoloration. The metal fasteners were moderately oxidized. The textile was discolored but structurally stable.

KIMO 162 – Large "Round-Top" Trunk

The larger "round-top" trunk, KIMO 162, is also a wood structure covered in rawhide with tanned leather decoration. There is an American Express sticker on one side (fig.28). Written on the bottom are the words "SP&Co", "Troy", and the number 94 (fig.29). Similarly to KIMO 155 (small "round-top"), interior paper and textile are present (fig.30). The textile pieces are smaller than in KIMO 155 but were also stable yet discolored. The paper was lifting from the surface and flaking from dryness. Additional there were areas with tears as well as water stains on top of the expected, age produced, discoloration. Metal components were iron are cupreous, both types were moderately oxidized.

Fig. 28. KIMO 162 (large "round-top") pre-conservation side view, note the American Express sticker on the left of the lid.

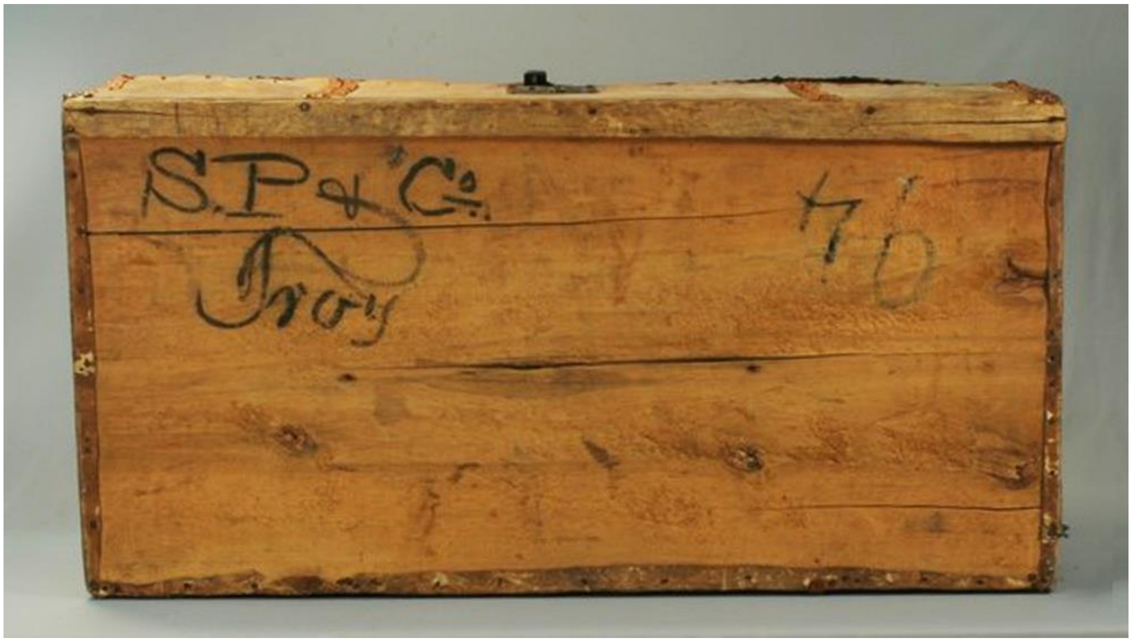

Fig. 29. KIMO 162 (large "round-top") pre-conservation bottom view showing writing: S.P + Co. Troy 94.

Fig. 30. Interior of KIMO 162 (large "round-top"), pre-conservation photo. Note the small remnant of textile hinge in the upper left corner.

Mechanical cleaning was the first step in treatment for all components. The metal fasteners were cleaned with fiberglass brushes. This removed the surface corrosion, and all components were taken down to bare metal for chemical treatment. The wood, rawhide, and leather were cleaned with soft brushes. Additional the rawhide, textile and the paper were cleaned with a Wishab sponge. The sponge effectively and gently removed much of the surface dirty which significantly brightened the appearance of these components. After the mechanical cleaning the paper that was torn and flaking off of the wood was reattached using 5% ethulose adhesive in ethanol and Japan Paper (fig.31) The ethulose was mixed with ethulose because although it would dissolve in water, water cannot be used with the silicone oil treatment. Next both trunks were treated using the silicone oil process.

Fig. 31. KIMO 162 (large “round-top”), Japan paper, the white paper, was used to help fill material gaps and close tears.

Since both trunks are mostly made of organic materials they were covered in silicone oil in their entirety. As previously stated the silicone oil does not treat metal, but it does not harm it as such the metal components did have to undergo the treatment but afterwards received material appropriate conservation measures. A mixture of 40% silicone oil (SFD1 66% and SFD5 34%) and 60% MTMS was topically applied, again due to the size of the artifacts submersion is not possible. This was a less viscous mixture than that used on KIMO 51, because the silicone oil had to penetrate more layers since KIMO 155 and KIMO 162 were not dismantled. Excess oil was removed with 100% MTMS as the trunk drained over a period of several days. Once the desired texture was reached, no surfaces were oily feeling and the rawhide was not softened, each trunk was catalyzed in a human body bag using DBDTA vapor for 10 applications (fig.32).

Fig. 32. KIMO 162 (large "round-top"), due to their size both "round top" trunks were catalyzed inside a body bag.

The body bag was the only air-tight container large enough to accommodate the trunks. Each trunk was catalyzed separately. After the silicone oil treatment was complete final treatments to the metal were carried out. These treatments could not have been done before the silicone oil treatment as the MTMS would have undone them, since MTMS acts the same way as the solvents used in the chemical solutions. The iron components received three coats of tannic acid in ethanol, and the cupreous pieces three coats of BTA in ethanol before all metals were sealed in Krylon Clear Acrylic spray in acetone painted on with a stiff brush. Spraying the Krylon directly on the metal would have been uncontrolled and would result in Krylon on the other materials. To avoid this, the Krylon was diluted in a container with acetone so it could be applied directly to the metal while avoiding other surfaces.

Most of the treatment results were as excellent as expected. Some of the more experimental treatments produced a mix of results ranging from disappointing to much better than anticipated. Results will be discussed in detail in the next chapter. The treatments and results were documented and the collection was returned to King's Mountain National Military Park for display.

CHAPTER V

RESULTS

Evaluation

After treatment, the trunks were evaluated, based on the appearance and texture of the visible surfaces. Much like the pre-conservation evaluation, after treatment materials are rated as poor, fair, good or excellent. Success is determined based on how well each material met certain criteria established for that specific material. All materials should be stable after conservation, but there should not be excessive changes in color, size or texture. Acceptable changes are those that restored the material's appearance to how it looked or felt in use, or those that would help in the interpretation or display of the artifact. Initial findings suggest that the results are mixed and will be discussed in detail.

After catalyzation, silicone oil treated artifacts can be handled to a greater degree without the risk of damage to the artifact, or other materials in close association. "Conservation is also responsible for balancing the need for access and use with the requirement for long-term preservation, so that the cultural heritage survives into the future, for future interpretation, and re-interpretation" (Pye 2001, 24). Many treatments and preservation practices only account for long-term preservation and actually limit access and use. In addition to making artifacts more accessible, the silicone oil treatment can take hundreds of years to break down, so the long-term well-being of the artifact is assured and artifacts can be handled. Furthermore, the artifacts conserved with silicone oil can be retreated with silicone oil if necessary.

Mechanical cleaning was the first treatment done on the three trunks for all materials. On the leather and rawhide cleaning with soft brush produced fair to good results. On the rawhide of KIMO 155 (small “round-top”) and KIMO 162 (large “round-top”) the Wishab Sponge was also used and produced an excellent result. The sponge removed more surface dirt and significantly brightening the rawhide and making surface markings clearer. A Wishab Sponge was used to clean the paper and textile on KIMO 155 and KIMO 162 (the “round-top” trunks). Much like the rawhide the results were excellent.

All of the metal components were mechanically cleaned with fiberglass brushes. The results of this treatment were good. The visible surfaces were taken down to bare metal. Since several of the metal components were removed during the partial dismantling of KIMO 51(“gold-rush”) those elements also underwent electrolytic reduction (ER) with excellent results. Some restoration was done in that all of the cupreous pieces were polished to the state they would have been when new. The cupreous materials were coated in BTA, and the iron components in tannic acid, and all metals were coated in Krylon clear acrylic spray to help prevent future corrosion. Even though the tannic acid does change the color of the iron, these treatments were successful and would rate as excellent.

The ethulose adhesive was also an effective and successful treatment. Tears in the paper in the “round-top” trunks, KIMO 155 (fig.33) and KIMO 162 (fig.34), were repaired using the ethulose adhesive and material loss was replaced with Japan Paper.

Fig. 33. KIMO 155 (small "round-top") after conservation interior view, the paper is now darker.

Fig. 34. KIMO 162 (large "round-top") after conservation interior view.

The adhesive is stable and did not discolor the original paper and the Japan Paper was thin enough that it did not cause wrinkling or unevenness in the surface of the paper. This treatment receives a rating of excellent.

Due to the different types of catalysts used the silicone oil treatment presented with the most varied results. Specifically, the heat catalysts on the tanned leather offered mixed results. When the iron was set just before steaming, which was too hot a temperature, the tanned leather shrunk and stiffened which rates as a poor result. The shrinkage could be mediated by stretching while the tanned leather was still hot; however the stiffening appears to be permanent. Although the change to texture was not desirable, the stiff leather was sturdy and stable. The tanned leather that was catalyzed at a lower temperature, in the middle range below steaming, had good results. The leather overall was less brittle although not as soft as it possibly should have been. The areas with red rot were no longer flaking. The most noticeable change for all of the organic materials was a darkening of color which is a common result in silicone oil treated materials which was expected and is acceptable.

KIMO 155 and KIMO 162 did have the slight darkening characteristic of the silicone oil treatment, but the overall result was excellent (figs.35 and 36). There were little to no changes other than the color. The artifacts are stable and can be retreated.

Fig. 35. KIMO 155 (small "round-top") after conservation front view, the rawhide now has a brighter, less dusty looking quality.

Fig. 36. KIMO 162 (large "round-top") after conservation front view.

Lastly, some other small restoration was done to KIMO 51 the “gold-rush” trunk (fig.37). Since there was evidence that the tanned leather was large pieces that degraded to smaller pieces under the metal decoration the leather was reconnected. Invisible thread and brown nylon were used and the result was good. After the coverings were restored it was necessary to add wax as a stabilizer as several of the nails had loosened. Although this treatment was successful, it indicates that dismantling as a treatment would rate either fair or poor. From a distance the restorations, the thread and wax, are not noticeable, but they are obvious upon close inspection.

Fig. 37. KIMO 51(“gold-rush”) after conservation front view.

Finally, overall post-treatment result of the “gold-rush “ trunk, KIMO 51, was good. The “round-top” trunks KIMO 155 and KIMO162 rated excellent for overall post-treatment results.

CHAPTER VI

CONCLUSION

The primary reason for conserving artifacts, archaeological or historical, is the preservation of information contained in those artifacts for future study. This research and thesis documented and disseminated information on how to treat large, dry, composite artifacts using silicone oil while avoiding the invasive, possibly damaging, disassembly of constituent parts.

Silicone Oil

The use of silicone oil is not a reversible treatment. Use of the crosslinking chemical, MTMS, renders the treatment essentially permanent. There are methods that could possibly be used to undo the treatment but at great risk of physical damage or extensive material loss to an artifact. However, silicone oil was the appropriate treatment for the trunks due to the condition of the leather and rawhide material. The treatment is also suitable to the artifacts purpose, as a display object, and storage environment. As South Carolina is warm and humid the silicone oil will continue to catalyze from the environmental conditions adding to the stability of the treatment.

In summary, the silicone oil treatment used is as follows: manual application of the silicone oil to the artifact, the artifact is allowed to drain so excess oil is removed. This step involves the addition of more cross-linker to help the artifact drain. Once the desired texture and appearance is achieved, the artifact is catalyzed using a vapor catalysts. The end-of-process texture and appearance is an important consideration in the treatment of dried and desiccated artifacts. Certain materials will not maintain the desired textures or appearances when the silicone oil is catalyzed using vapor deposition catalyzation, thus it can be necessary to use another method of catalysts, such as heat. However, the use other catalysts, especially heat, can also produce mixed results concerning texture. In order to maintain proper appearance it is important to be working with the proper heat settings for the material being treated. Once the silicone oil is cross-linked and catalyzed the artifact will be stabilized, however, the process cannot be reversed without causing major damage to the stability of the artifact. All and all, this is a good process for large, composite artifacts.

Dismantling

From the results of this project, it can be concluded that dismantling of an artifact for treatment may not be the best course of action. Although it was necessary to ensure the stability of particular materials the dismantling seemed to lessen the integrity overall, as discussed in the results it was necessary to add wax to help anchor loose fittings. It should not be inferred that dismantling should never be considered as a treatment option. Dismantling allowed for better access to the entirety of leather and some of the metal components of KIMO 51("gold-rush") which allowed for better treatment on those materials. I would still recommend dismantling for artifacts in a similar preservation condition, as long as it is known that the artifact will not be handled excessively in the future.

Other Materials

The conservation processes, such as ER, used on the metals were already well established and the results of this project fully support them. The use of the Wishab Sponge is also wide spread in the conservation community, and again the results of the use of the sponge in this project were excellent. I would highly recommend the Wishab Sponge for mechanical cleaning of most artifacts. Although a wide variety of animal and plant adhesives are used for paper conservation, the ethulose adhesive also had excellent results and would be recommended for paper in similar conditions.

Large Composite Artifacts

Every artifact is unique and should be treated in a way that meets the individual conservation needs of the object. However, the processes used to treat these trunks are applicable to similar artifacts in similar pre-conservation conditions. Again, due to the variable nature of decay and conditions it would not be appropriate to suggest the methods as a standard for the treatment of large composite artifacts. The success of the treatments indicates that they could be used as recommendations and general guidelines.

Further Research

After the catalyzation process is complete, artifacts conserved using silicone oils are considered to have been stabilized. However, the use of heat on leather had mixed results and there is great opportunity for more experimentation. Furthermore, the decomposition of the treatment can also be studied. At this point the metal components of the trunks seem stable. In the future it may be necessary to treat them separately or to replace them. As access was limited to many of the metal components corrosion may be ongoing. However, the preservation of the wood around them may help to slow the degradation of the metal by the change in the environment; this is also something that may benefit from future study. Lastly, other composite wood, metal and leather artifacts could be treated in this manner to determine if the treatments can be used as a general guideline or if they were only appropriate for these individual items.

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