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The 36th Annual Meeting of the American Institute for Conservation was organized around the theme of “Creative Collaboration.” The Objects Specialty Group organized two sessions of twelve presentations that highlighted different aspects of collaborating conservators: with artists, museum professionals, volunteers, scientists, international outreach, and other conservators.

Hugh Shockey discussed working with a living artist to get approval for cleaning the components of a complicated installation. This process involved all stages of planning, treatment, and final installation that culminated in a very pleased artist who continued to seek out conservation advice as the project came to fruition. Liz Brown documented the work necessary to re-build an object in collaboration with the artist when the public interacted with it a little too exuberantly. This led to valuable discussions of impermanence, public interaction, and artist’s intent. Anne de Buck discussed working with an artist on a performance installation where the museum needed to develop guidelines and methods for the future preservation of the work and all its working components (including duplication and replacement). The emphasis here came to be a focus on the artwork itself, not the interests of the museum or the artist. Molly Gleeson and Samantha Springer presented a paper on their work with Native Alaskan basket-makers. The traditional artists taught the conservators how to collect and process the natural materials that went into the baskets, giving them an insight into the strengths and weaknesses of the objects, and how to approach sensitive conservation treatments.

Ron Harvey and Nina Roth-Wells presented their work as co-conservators of natural history dioramas that incorporate both objects and painted surfaces. Their collaboration developed a holistic approach to retaining the early 20th century interpretation of the objects while conserving and updating their surroundings. Michaela Neiro discussed the necessary collaboration between conservators, curators, historic house managers, and volunteer docents to carry out the treatment of historic wall-paper in situ while the house was still open to the public. Rachel Perkins Arenstein, representing her fellow authors from the Integrated Pest Management Working Group, presented the history of the IPM-WG, the initiatives being pursued, and the challenges created by the “loose ad-hoc organizational structure” comprised of conservators, collection managers, and pest management professionals who make up the group. Brynn Bender presented on a similar large-scale project: the preservation of a collection of 18 river-running boats from the Grand Canyon. This involved coordinating not only the work of conservators, history “buffs,” river runners, architects, historians and park staff over five years, but also the incorporation of multi-disciplinary techniques to conserve everything from kayaks and motorized fiberglass boats to inflatable rafts.

Mersedeh Jorjani and her co-authors presented a tale of scientific collaboration in the research of marble repair adhesives. Conservators, conservation scientists, and material scientists worked together in order to aid conservators in making informed decisions in choosing adhesives based on carefully defined and tested qualities of the stone involved and the adhesives in common use. Judy Ozone and Abigail Mack demonstrated creative and unusual treatment approaches to a set of dissimilar materials, with a discussion of the ethical considerations that “governed every aspect of the process.” Paul Mardikian and Robert Neyland discussed the “rewarding collaborative research efforts” between national and international institutions and individuals to ensure the long-term preservation of the H.L. Hunley submarine, including the “critical role
played by the non-scientists”: politicians, collections managers, entrepreneurs and the general public. Unfortunately, Mardikian and Neyland were not able to submit their talk for publication in this volume, but the research will be published in another format.

The final presentation was by Melina Smirnou and Christie Pohl who talked about the creation of “Conservators Without Borders,” a grant-funded effort to bring conservation services to archaeological sites and collections facilities in developing and art-rich countries. Volunteer conservators undertake to advise local museums, archaeologists, and government officials on current standards for the treatment of archaeological finds, handling and packing, and storage conditions.

As Program Chair, I had the fun task of looking through a wide range of submissions, and the harder one of selecting the few that could fit in the time allotted to us. I want to give my thanks to the 2008 OSG Chair Ann Boulton who shepherded me through the process, and all the rest of the OSG Committee Chairs who provided me with insight and back-up.

Howard Wellman, OSG Program Chair 2008
BRINGING OUT THE “BLING”: DECADENCE IN GLASS

L. H. (HUGH) SHOCKEY JR.

ABSTRACT

During the spring and summer of 2007, the Smithsonian American Art Museum’s Renwick Gallery presented the work of four craft artists in the exhibition From the Ground Up: Renwick Craft Invitational 2007. Preparations for this exhibition led to close collaboration between the artists and the museum’s object conservators. This collaboration focused on the installation of Bancketje, the massive glass assemblage created by artist Beth Lipman. The work consists of several hundred individual glass components installed on a narrow twenty-foot long table recreating a Dutch Renaissance feast. The collaboration began in the planning stages of the exhibition. The artist expressed reluctance with having conservators clean the glass components prior to her arrival for installation. Following an explanation of logistics and time constraints, she gave the conservators permission to proceed. To allay her most pressing concerns, the artist was assured that her labeling system would be retained for installation.

Before the scheduled installation date of the Renwick Invitational, Conservation Intern Rachel Penniman, Contract Conservator Michelle Savant, and Smithsonian American Art Museum Conservator Hugh Shockey proceeded with the week-long process of cleaning the glass with detergent in water and carbon dioxide snow. Lipman’s concerns about conservation cleaning methods evolved into elation when she arrived at the museum. She exclaimed “it’s [the glass] never looked better” and explained that our work elucidated her vision of opulence and excess, which she sees as central to the meaning of her work. During the remainder of the installation, Lipman continued to seek out our advice regarding materials.

This successful collaboration had three results: it aided the Renwick’s acquisition of the work; it gave the artist and conservators new appreciation and respect for each other’s abilities and intent; and it excited our museum colleagues, who in turn generated additional public interest about the work and preservation methods through gallery talks and lectures.

1. INTRODUCTION

The Smithsonian American Art Museum’s (SAAM) Renwick Gallery collects and exhibits the works of American craft and decorative artists. The Renwick Gallery’s Craft Invitational is a biennial exhibition of the United States’ leading craft artists as chosen by a jury of curators from across the nation. The Renwick Invitational of 2007 exhibited the works of four artists: Paula Bartron, Jocelyn Chateauvert, Beth Lipman, and Beth Cavener Stichter. Each of the artists required assistance from the object conservators at SAAM, but none more than Beth Lipman with her sculpture Bancketje (Banquet), 2003 (fig.1).

1.1 BETH LIPMAN

Beth Lipman is an internationally exhibited artist who uses glass as her primary medium. Lipman blows, sculpts, and kiln-forms glass into a wide variety of representative objects that she then assembles into still lifes, often directly referencing art historical masterworks of still life paintings. Using the symbolic language of still life and its compositional elements, she seeks to comment on the opulence and excess of contemporary consumer culture including the waste and decay. Her choice of glass, often clear, as the medium for representing the ephemeral adds a new dimension to the historic still life, limiting the viewer’s ability to possess the work visually and denying tactile familiarity with the represented subject matter.
As a glass artist, Lipman’s working process is by necessity collaborative (fig. 2). She has taken the idea of collaboration further by actively soliciting other artists to contribute objects made by their hand, not hers, for inclusion in the final assembled work. Additionally, for her larger compositions, Lipman actively seeks the input of volunteers and assistants with the installation and final arrangement of her large works. This collaborative spirit can result in a virtually “new” installation of a sculptural work at each new venue.

Fig. 1. Bancketje (Banquet), 2003. Gallery installation photograph from the Museum of Glass Tacoma, Washington (Courtesy of the Museum of Glass, Tacoma, Washington)

Fig. 2. Beth Lipman (in black with yellow arm guard) working in a glass hot shop studio with assistance (Courtesy of the artist)
1.2 CURATORIAL INTEREST

Prior to the installation of *From the Ground Up*, Renwick Gallery Curator Jane Milosch contacted the conservation department to discuss her desire to acquire Lipman’s *Bancketje* for the permanent collection. Milosch presented specific concerns about the work. These included questions about the work’s current condition and the museum’s ability to maintain the work. The catalyst for her questions had been concerns expressed by the Renwick Gallery’s acquisition committee. Members of the committee had expressed serious reservations regarding the work’s current exceedingly dirty and hazy condition and the available resources of the museum to provide continuing maintenance of the work.

With the committee’s apprehension in mind and with the curator’s expressed desire to acquire the work, the responsibility fell to the objects conservators to address the concerns and provide the curator with answers for the acquisition committee. The response to Milosch was that the sculpture would first need to be wet-cleaned for it to look its best for the upcoming exhibition and that the work was an excellent candidate for maintenance with carbon dioxide snow cleaning. Her response to the answer was positive and she felt that it would allow her to return to the committee with a solid proposal that addressed their concerns. This in turn raised the stakes for a successful cleaning and installation of *Bancketje* as part of the Renwick Invitational exhibition.

1.3 PREPARING FOR THE STORM

With the exhibition looming, all departments with involvement in executing the show convened a meeting. High on the list for this gathering were questions for Beth Lipman, who attended via telephone. Each department had its own concerns about the installation of Beth Lipman’s *Bancketje*. Registration had concerns about the space and personnel time needed to move, unpack, and condition report the sculpture following its arrival, indicating that they only wanted to handle the work once. Exhibit Design and Installation expressed serious concerns about scheduling and logistics, particularly the unpacked work’s impact on the installation of sculpture from the other three artists. Conservation had questions about the time and space needed to clean such a large volume of work. Finally, the artist communicated her hesitance to allow the work to be unpacked and cleaned prior to her arrival.

It became apparent during the meeting that waiting for Lipman to arrive would not be a viable option since the installation of the entire show was scheduled for one week. Registration indicated that it would take at least two days to unpack and condition report the work. Conservation estimated approximately five days to wet-clean the surface and remove old silicone adhesive residue. The artist indicated that it would take her between two and four days to install the work not including installation of her other works in the show. With reality plainly visible, the artist finally agreed to allow Registration to unpack the components and Conservation to clean the work prior to her arrival for installation.

Lipman’s primary concern regarding the cleaning of the work was the removal of the Sharpie marker numbers placed on the components to indicate their placement on the table. She was also concerned about complete removal of the residual silicone caulk adhesive on the surface, since as she explained it helped her remember the general orientation of the components as they had been installed as part of the finished work. The SAAM conservators indicated that they would gladly reapply the numbers to the surface of the glass using a Sharpie marker after cleaning since it could be easily removed during installation with ethanol and that they would leave small traces of the silicone caulk adhesive for her to use as placement guides. While
remaining slightly hesitant Lipman agreed to allow SAAM’s object conservators to move forward with the proposed cleaning.

2. TREATMENT

The treatment of Beth Lipman’s *Bancketje* presented itself as a fairly straightforward wet-cleaning of stable contemporary soda-lime glass. The extraordinary aspect of the treatment included both the organization of such a large quantity of individual objects for one work, approximately 450, and the logistics of setting up a temporary treatment area in the Renwick’s exhibition space, roughly one mile from the primary objects conservation lab at the Lunder Conservation Center. The organization, setup, and supply acquisition for the project was greatly assisted by the Lunder Center’s Technician Susan Edwards. Also required for the project was the help of additional conservators. This help came in the form of then Conservation Graduate Student Rachel Penniman and Contract Conservator Michelle Savant.

Organization of the treatment materials required consideration of all potential needs for the treatment, including cleaning, drying, potential mending, and adhesives for installation. The necessary supplies had to be packed at the primary lab. These materials were then transported on hand dollies to the Renwick since vehicle access to the Renwick is severely limited due to its close proximity to the White House and its strict security procedures. Once onsite, the supplies were unpacked and arranged into a temporary treatment area with workstations for three conservators (fig. 3).

In preparation for treatment, the Registration staff unpacked the glass components onto Tyvek covered moving blankets placed on the floor of the gallery. Placement of the components on the floor was requested by conservators to prevent the possibility of glass components being accidentally knocked off tables onto the floor. This request proved to be wise, since as the artist-packed Sterilite bins were unpacked by registrars, it became apparent that the available table supply would have been inadequate (fig. 4). Following unpacking and condition reporting by the Registration staff, conservators conducted their own assessment of the numerous glass components. Conservators noted potential problems such as; applied gold luster and craft paint, prior artist repairs, awkward centers of gravity, intentionally loose pieces, and preassembled works with difficult or impossible-to-reach interstices (fig. 5). Prior to beginning treatment, additional Tyvek covered blankets were placed in close proximity to the space where the work was to be installed for receiving the cleaned components and reducing the total transport distance for installation.

The treatment method was as follows:
1. Reduced silicone caulk residue from the surface with single edge razor blades and scalpels.
2. Washed with a 1.5% (v/v) mixture of Triton XL-80N in water applied by soft absorbent cotton cloth or Kimwipes EX-L.
3. Rinsed with deionized water using soft absorbent cotton cloths, Kimwipes EX-L, or flowing water.
4. Dried with Kimwipes EX-L and warm air as necessary.
5. Removed lint with carbon dioxide (CO₂) snow.
6. Relabeled according to artist’s numerical system using Sharpie marker.
Fig. 3. Temporary treatment workstation in the Renwick gallery. Conservators from right, Michelle Savant and Rachel Penniman. (Photograph by Hugh Shockey)

Fig. 4. Conservator Rachel Penniman reviewing a small portion of the components during unpacking by the Registration staff (Photograph by Hugh Shockey)
Fig. 5. Component from *Bancketje* showing applied gold craft paint, artist’s repair to bowl, and individual glass fruit epoxied into the bowl requiring cleaning as an individual unit (Photograph by Rachel Penniman)

Fig. 6. *Bancketje* elements before and after cleaning. Left image: Before treatment condition at previous venue showing cloudiness of the glass (Courtesy of the Museum of Glass, Tacoma, Washington). Right image: After treatment on exhibit at the Renwick Gallery with no visible cloudiness of glass (Photograph by Hugh Shockey)
2.1 VISIBLE RESULTS

The visual change after cleaning was characterized by an increase in clarity and an enhancement of the glass’ reflectivity resulting in a more active and vibrant surface quality overall. Although difficult to reproduce in photographs the difference was readily apparent to the artist when she arrived (fig. 6). Her approval of the treatment results was evident in her outwardly displayed excitement (hugs and accolades for the conservation team). With additional components remaining to be cleaned following her arrival, conservators met with the artist to discuss and prioritize the remaining pieces to establish a hierarchical treatment list. This allowed conservators to continue cleaning the remaining elements while allowing the artist to begin installing the work in a fluid workflow without adding delays to the process. The total timeline for treatment from first to last component was five full working days.

3. INSTALLATION

Installation of Bancketje required collaboration between three to five people at any given time, including the artist. The people assisting the artist were professional art handlers, conservators, and a graduate student intern of craft and decorative arts. The process of installation began by placing the artist’s full-scale template along the side of the table in the proper orientation as determined by the artist (fig. 7). The artist, with assistance, began the process of placing components on the table. This process can be characterized into the following steps:

1. Location of large anchor pieces that do not have variable locations.
2. Addition of the first layer of components onto the table surface.
3. Addition of the second layer of elements onto the existing glass components and table surface.
4. Addition of the final components at various locations around the table and composition.
5. Refinement of the final arrangement as necessary.

3.1 PUTTING IT ALL IN PLACE

Throughout the installation process, the artist used a variety of cues to determine approximate component placement. While the template served as a two-dimensional guide to the table surface, Lipman used the residual silicone caulk as a three-dimensional guide. Between memory and referencing the adhesive residue, she was able to recreate the location of elements stacked on top of one another. Once she had determined the location she wanted, she would then apply silicone caulk as an adhesive, and tape, weight, or prop the component into place. During the process of building the assemblage, the artist actively solicited the opinions of not only the people assisting her, but also of staff working in varying capacities during the exhibition installation. To varying degrees Lipman would incorporate the suggestions of others into the final composition of the work.

3.2 FINAL TOUCHES

With the final adjustments in place, Lipman spoke with SAAM’s lighting designer Scott Rosenfeld. He recounted her instructions to put as much light as possible on the work, “think glass porn” she said to him. Rosenfeld approached the conservation staff for direction on preservation lighting requirements while informing them of the artist’s request. This immediately prompted a discussion between the conservator and artist regarding the stability of the paint on the surface of the table. Her response was simple, the table was far less important visually than
the glass and the high lighting levels helped her emphasize the visual excess of the work. She indicated that as far as she was concerned the table could be repainted glossy black if it faded without impacting her artistic intent. Rosenfeld then proceeded to light the work intensely using a creative mixture of standard incandescent and halogen sources, exploiting the warm transparency of the standard lamp with the white glittery sparkle of the halogen (fig. 8). The assemblage was then checked for the appearance of streaks, fingerprints, lint, and Sharpie marker residue on the glass surfaces. These were treated locally with ethanol, detergent in water, or CO₂ snow.

Fig. 7. The process of installation, from top left to bottom right: full scale template and components laid out along the length of the table; Lipman setting primary elements onto the table top; Lipman asking for input on positioning and composition from helpers; and setting final placement with silicone caulk and masking tape (Photographs by Susan Edwards)
4. ONGOING MAINTENANCE

Ongoing maintenance, particularly dusting, of Bancketje requires consideration of many of the factors encountered with preparing the work for exhibition. These include: the total volume of individual items, the complex arrangement of components, the wide variety of surface textures, and the time required to achieve satisfactory removal of surface dirt and grime from a work on open display. The maintenance of the sculpture has largely been made possible with the use of the SAAM conservation lab’s CO₂ snow generation equipment. The equipment allows for an individual conservator to remove accumulated dust from the entire surface of the work in a period of forty-five minutes to one hour. A brief overview of CO₂ snow cleaning technology was
presented by the author as an unscheduled presentation during the morning break of the AIC Objects Specialty Group Session in Denver. The following section provides a condensed summary of the topic.

4.1 CARBON DIOXIDE SNOW BASICS

Carbon dioxide (CO₂) snow is made up of solid crystals of CO₂ that are generated by a nozzle apparatus fed from pressurized carbon dioxide liquid or gas (fig. 9). The particle size varies from micron to sub-micron depending on source and nozzle geometry. The solid snow crystals have the ability to penetrate the thin turbulent air boundary surrounding all surfaces in the atmosphere. After penetrating this layer, the snow particle impacts the soiling material and displaces it largely by momentum transfer. The CO₂ crystal then sublimates to a gas at room temperature. CO₂ snow has been used in industry for critical cleaning applications including the removal of contamination from silicon wafers and coated optical surfaces. It is most effective at removing particulate soiling matter from hard surfaces. It is not effective on bound particulates or heavy grease type accretions and soiling, nor is it effective on “soft” energy absorptive substrates.

5. CONCLUSION

The final result of the installation of Bancketje was a work that mesmerized the audience. The experience of the conservators and the artist working together gave each a new and different appreciation of the other’s skill sets. The uniqueness of the sculpture and the experience of its installation provided excellent opportunities for the public to learn about the process of exhibitions and the extent of dialogue between artist, curator, and conservator. Beth Lipman has continued a dialogue with the SAAM object conservation staff, actively seeking to learn more about materials and their stability over time. It is a fine but rewarding line for a conservator to walk by providing information about materials and methods to an artist while not impacting their creativity or expression. When successful, the artist can leave the experience with a larger toolbox and may be better equipped to execute their creative vision.

5.1 FROM THE ARTIST

The following is the response from Beth Lipman regarding her experience working with conservators during this project:

“Working with Hugh Shockey and his team at SAAM’s Renwick Gallery was a turning point for me in many ways. I don’t consider myself savvy to structural concerns, and usually build risk into my creative process. ‘Will this piece of glass support its own weight or not?’ is a question I ask over and again. In the end, I am still responsible for my work’s immediate and long-term stability. My meeting and working with Hugh enabled me to understand the possibilities of what realistically can be accomplished. Now I have an ally. I strongly encourage artists that I know in the field to contact a conservator and have a good long discussion if they have reached an impasse with their work technically. It can change their life.”
ACKNOWLEDGEMENTS

The author would like to thank his colleagues and the staff at the Lunder Conservation Center for their help that made Bancketje a success story. These people are: Susan Edwards, Technician, for always knowing what is needed, Julie Heath, Lunder Program Coordinator, for turning this into a public program, Helen Ingalls, Conservator, for collegial advice and quality help, Rachel Penniman, Conservator, for excellent and efficient hands, and Michelle Savant, Conservator, for hard work and good humor. A copious amount of thanks must go to Renwick Curator Jane Milosch for her support and understanding of conservation, as well as her superb taste in artists. Finally the author would like to thank Beth Lipman for her openness and friendship.

NOTES

1. Carbon Dioxide Snow (SCO2, CO2 Snow) is a cleaning technique that is typically used in critical cleaning applications (i.e. decontamination of silicon microchip wafers and high performance optical lenses). CO2 Snow should not be confused with liquid CO2, supercritical CO2, or pelletized dry ice. CO2 Snow is the generation of micron to sub-micron crystals of CO2 formed as a result of CO2’s enthalpy properties as modified by venturi or adiabatic nozzle geometries supplied by a pressurized gas or liquid CO2 source. The cleaning mechanisms can be characterized as momentum transfer displacement and mild organic solvation.

2. Via personal communication. Beth Lipman’s desire to illuminate the work preferentially was followed after she was consulted by a conservator regarding the long-term preservation risks of the request. Following acquisition of Bancketje the artist’s response was recorded in the curatorial files, conservation files, and SAAM’s collection database.

3. The CO2 snow unit at the SAAM Conservation Lab is a dual gas unit by Applied Surface Technologies of New Providence, New Jersey. The unit has gas-fed CO2 snow generation with simultaneous dry nitrogen (N2) blanket gas capabilities. The nitrogen gas acts to displace water in the ambient atmosphere allowing more efficient CO2 crystal formation.

REFERENCES


SOURCES OF MATERIALS

Dual Gas Carbon Dioxide Snow Gun
Applied Surface Technologies
15 Hawthorne Drive
New Providence, NJ 07974
(908) 464-6675
Kimwipes EX-L, Small and Large
   Erie Cotton
   1112 Bacon Street
   Erie PA, 16511
   (814) 459-6644

Triton XL-80N
   From Lunder Conservation Center Lab supply stock
   This product no longer commercially available

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“…IF THE ROOM IS STEADY THE CAPULA SHALL ROCK….” (REYES 2007)

STEEL, PLASTIC, AND THE PUBLIC: THE LIFE AND CARE OF CAPULA XVI AND XVII IN THE SEATTLE ART MUSEUM OLYMPIC SCULPTURE PARK PAVILION

LIZ BROWN

ABSTRACT

*Capula XVI* and *XVII*, created by Pedro Reyes as part of an international series, are an intriguing exploration of utopian space and architecture. The large suspended steel armatures, wrapped by Mexican basket weavers with vinyl cordage, invite audiences to explore the space both within and without the light-filled areas while swinging gently. Reyes’ interest extends beyond the creation of his artwork to their future existence and has created an interesting conservation opportunity.

These two *Capula* were designed for the Seattle Art Museum’s new Olympic Sculpture Park Pavilion in 2006. Reyes’ work with a fabricator to design strong plastic cordage with good light stability has been successful in previous installations. However, in a busy sculpture park with exuberant children, the pieces were exposed to unforeseen stresses. As a result the cords broke frequently, necessitating weekly maintenance. Reyes consulted with the weavers and designed a new tying system, which he relayed to the conservators. Other areas of breakage were solved with new melting techniques and adhesives. After a group of lively teenagers caused a weld to break and one *Capula* to fall, Reyes redesigned the hanging points. The impermanence of plastic and the interactive nature of the pieces raise questions that have created a rewarding conversation between artist, conservator, and fabricator.

1. INTRODUCTION

While pursuing ideas of utopian space, Pedro Reyes was inspired by the drawings of basic life forms by Ernst Haenckel. The resulting series of *Capula* explore ideas of a cocoon, capsule, and capillary. They are designed considering ideas such as the evolutionary processes whereby, as people evolved from apes and lost their outer coating of hair they developed other protective means including animal skins, clothes, furniture, and buildings. Reyes proposes that although people often like and find order in square things, we like round, soft shapes close to the body. Reyes’ *Capula* function like an enclosure but still are soft enough to lie in. To provide a better understanding of the artworks the artist provided the following:

<table>
<thead>
<tr>
<th>Capula Manifesto</th>
<th>the capula shall be round</th>
</tr>
</thead>
<tbody>
<tr>
<td>If a room has square walls,</td>
<td>the capula shall be round</td>
</tr>
<tr>
<td>If a room divides the inside from the outside,</td>
<td>the capula shall be permeable</td>
</tr>
<tr>
<td>If a room is grounded,</td>
<td>the capula shall hover</td>
</tr>
<tr>
<td>If a room has walls that block the light,</td>
<td>the capula shall radiate the light.</td>
</tr>
<tr>
<td>If a room creates a fixed field of vision,</td>
<td>the capula shall be kinetic.</td>
</tr>
<tr>
<td>If a room needs furniture,</td>
<td>the capula shall be a surface that bends itself into furniture</td>
</tr>
<tr>
<td>If a room is an ensemble</td>
<td>the capula shall be a continuum.</td>
</tr>
<tr>
<td>If a room hides from the view,</td>
<td>the capula allows a glimpse</td>
</tr>
<tr>
<td>If a room is steady,</td>
<td>the capula shall rock.</td>
</tr>
<tr>
<td>If a room is rigid,</td>
<td>the capula shall be elastic.</td>
</tr>
</tbody>
</table>

Fig. 1. Capula Manifesto by Pedro Reyes (Reyes 2007)
Capula XVI and XVII were designed for a pavilion located in the southeast corner of the Seattle Art Museum’s (SAM) Olympic Sculpture Park, which opened in January 2007. The large glass walls of the pavilion afford a view over the water and sculpture park, which was designed to be a “park without walls” and blend seamlessly with the city. The pavilion functions as a public space for events and to house a café. As the building is not climate controlled and there is a large amount of light, the space functions primarily as an environment for temporary installations. Capula XVI and XVII were the first of the Capula series to be installed in a public space as a part of a permanent museum collection.

2. FABRICATION

Capula XVI and XVII were fabricated in Mexico under Pedro Reyes’ supervision. The steel frames of the two artworks are constructed in eight sections of welded 304 stainless steel. Flanges are welded to the sides of the sections enabling the pieces to be bolted together after they were woven (fig. 5).

Mexican basket weavers wove the frames in a circular pattern with multicolored polyvinyl chloride (PVC) plastic cordage (3/8 inch diameter). Coming from a background in architecture, Reyes has a strong interest in both the form and function of his works and he chooses his materials accordingly. He noted early in the development of the Capula installed in Miami and Mexico that the vibrant colors of the cords had the potential to fade in sunlight. Therefore he worked closely with plastic manufacture Jorge Akele to include more stable pigments, dyes, and UV inhibitors. To assist SAM conservation in understanding the plastic, Reyes provided Mr. Akele’s contact information. Akele related (translation by Marta Pinto-
Llorca) that the plastic is a PVC polymer with 30% bis(2-ethylhexyl)phthalate (DEPH) plasticizer, fillers, and heat and light stabilizers added. As he procures the base resin from another distributor more specific information is still being investigated (Akele 2007).

The starts of the woven cords were secured to the frames with an adhesive, described by Reyes as similar to super glue (cyanoacrylate) in the United States. The cord was then wrapped a few times over this end before it was passed along to the next rung in the frame, and then wrapped around this bar several times. New cord lengths were added by melting the ends together with a cigarette lighter and snipping away the excess with scissors. At the end of a section, the last several inches were wrapped around the steel bar and secured in place with the same cyanoacrylate adhesive.

After the artworks were shipped to Seattle, the sections were bolted together and hung with steel cables from beams in the ceiling. Reyes carefully chose the hang points, working with art installers on site in order to allow the correct amount of movement when one is inside.

Fig. 3. Weaving of a Capula. Copyright Pedro Reyes. (Photograph by Pedro Reyes)
Fig. 4. Installation of *Capula XVI* and *XVII* (2007.3 and 2007.4). Copyright Pedro Reyes. (Photograph by Liz Brown) Copyright Pedro Reyes. (Photograph by Nicholas Dorman)

Fig. 5. Detail of bolt flanges on *Capula XVI*. (2007.3) Copyright Pedro Reyes. (Photograph by Liz Brown)
3. ARTIST INTERVIEW

Before the installation opened, SAM Conservation interviewed Reyes regarding his thoughts on the care of the two Capula. He indicated that the artwork was conceived as a piece with which people interact. It should not be kept away from people in order to protect it. If a part became damaged it should be repaired, much like one would re-cane a chair in one’s house. Another analogy he gave to illustrate his concept was a Japanese fountain where the stone structure remains but the bamboo pipes are replaced as needed. He also related that although the concept is that the piece is used, the evidence of use, for example soiling, is not appropriate. In his words, “I would prefer the piece not exist than be displayed in bad condition” (Reyes 2006).

To better understand the weaving process, and thus its repair, conservation worked with Reyes during the installation so he could demonstrate how the plastic cords are wrapped and secured. He provided extra cordage for repairs and indicated that he would relay the resin specifications so more could be fabricated in the future if he is not available. However for the current installation, as the colors are extremely important to him, Reyes asked to be contacted when replacement cordage was required so he could inspect the colors from the manufacturer. Some of the long-term issues with plasticized PVC in collections such as plasticizer migration and PVC degradation were circumvented by accepting the impermanence of the PVC cords and providing a solution.

4. CHALLENGES POSED BY THE INSTALLATION

Reyes’ previous Capula have been installed successfully in private galleries, homes, and as temporary exhibits in museums. However as part of a permanent collection, in a setting that is often seen by the public as more of a park than a museum, a new set of challenges was introduced for the first time. As the pavilion in which the Capula were installed also serves as a café and a site for events, the environment is often very different from the quiet serenity created by most museums and galleries. Although there were calm days when people sat quietly contemplating their environment, frequently they were also full of children of all ages climbing, hanging, and swinging from the plastic cords.

This popularity caused a number of concerns. One of the first was the safety of the children. As the Capula were not designed to be a children’s swing set, they were not necessarily safe to be used as such. The popular practice of parents encouraging their children to scale the cords and stick their heads through the steel holes for photographs had frightening implications. There were also a few occasions when children fell out onto the hard concrete floor below. The second difficulty caused by the enthusiastic use was the wear to the artworks themselves. As people climbed, hung, and pulled on the cords they became stretched and many broke.

5. SIGNAGE AND SAFETY

The museum staff was hesitant to add signage when the sculpture park first opened, as it believed that placing limits on the Capula interactions would compromise the concept of the artwork. However, after the extent of the damage and risk to the public was observed, it became apparent that some guidelines were necessary. In order to preserve the intent of the artwork, conservation staff worked with Reyes to develop appropriate wording for signs. Signage was introduced asking people to treat the Capula gently and not to climb on the artworks. The
number of people in each Capula was limited to four at a time and parents were asked not to leave their children unattended. Requiring people to remove their shoes made a significant difference in the amount of soiling. This posting was successful in reducing some of the wildness. However, summer weekends remained problematic, since in the excitement the signs were largely ignored. When possible, a guard or volunteer was posted with the pieces to encourage respectful explorations of the artworks.

In addition to signs, rubber mats were placed under Capula after consultation with Reyes. There were concerns that this would encourage people to view the artwork as a children’s play area, however as children were falling out and becoming hurt, discrete black rubber mats were determined to be the best compromise.

![Image of damage to Capula XVI (2007.3). Copyright Pedro Reyes. (Photograph by Liz Brown)](image)

6. PVC CORD REPAIR

The large number of cord breaks, approximately 10 per week, necessitated new systems to be developed for repair as the original weaving technique proved impractical. Additionally the super glue securing the ends was failing rapidly. The adhesive failure was discovered to be an issue during installation and as a short-term solution Reyes asked that zip ties be used to secure the ends until a more permanent system could be found.
6.1 MECHANICAL REPAIR OF UNRAVELING CORDS

In order to develop a method for repairing the cords compatible with the original weaving technique, Reyes consulted with the weavers he worked with in Mexico City. They devised a mechanical system which he recorded and sent to SAM as an instructional video. The start of the technique was similar to the original weaving system for splicing in new cords as a new length of cord was melted to the original with a lighter and then woven the distance necessary for the repair. The end however, instead of being wrapped around and adhered with super glue, was secured mechanically by weaving it along a bar in the steel frame over and under the cords creating a strong mechanical bond.

This method was successful in a number of areas, particularly on the floors of the artwork, and by pulling the ends around to the bottom the repairs were well hidden. This was important, as the public enjoyed discovering innovative knots with any cordage available to them. By securing the ends in this manner it was not necessary to re-weave entire sections or rely on adhesives when a cord broke. The ease of the system facilitated frequent repairs which was important in order to avoid adjacent sections collapsing into areas of loss. Additionally, the mechanical technique allowed areas to be reversed easily should they re-break.

Fig. 7. Still from Reyes Instruction Video 1. Copyright Pedro Reyes. (Photograph by Liz Brown)

Fig. 8. Still from Reyes Instruction Video 2. Copyright Pedro Reyes. (Photograph by Liz Brown)

Fig. 9. Still from Reyes Instruction Video 3. Copyright Pedro Reyes. (Photograph by Liz Brown)

Fig. 10. Unraveling section of Capula XVI (2007.3). Copyright Pedro Reyes. (Photograph by Liz Brown)

Fig. 11. Repaired section of Capula XVI (2007.3). Copyright Pedro Reyes. (Photograph by Liz Brown)
6.2 SPLICING IN NEW CORDS WITH HEAT

Another system was necessary for breaks to the sides of the *Capula* where the cords met the steel rods at steep angles. In these areas the cords tended to pull up and over the cords next to them, especially as they became stretched with wear. When a repair cord was introduced under it, the problem was exacerbated (fig. 12). Furthermore, it appears that the weavers recognized this difficulty and attempted to secure the ties in some areas with super glue, thereby making it difficult to introduce replacement ties below.

After some experimentation with various jigs, it was found that new sections could be spliced into the original cords, eliminating the need to secure the ends under adjacent cords. For these splices, the original cords were cut back a few inches and a new length of cord was melted to one end with a cigarette lighter. When cool, the other end of the replacement cord was secured with a setscrew into one end of a brass jig and the other end of the original cord secured in the other side of the jig, the two ends overlapping slightly in the center. The pieces were then heated and pushed together (figs. 13-15). A small butane torch produced better results than the cigarette lighter for this particular application. Although the flame is hotter than a typical lighter, the flame can be fine-tuned and directed which reduced the heating on the cords above it. Ceramic fiber felt was wrapped around the adjacent cords to further protect them from the heat.

A drawback of this approach was the difficulty of execution. The cord melted somewhat unpredictably, with only a slight excess of heat causing blackening of the cord. There was also a short effective working time of only a few seconds. Frequently, multiple attempts were required before the correct tension and strong weld was achieved.
6.3 SECURING WRAPPED ENDS WITH A HEATED SPATULA

The ends of the cords wrapped around the steel bars and temporarily secured with zip ties also presented a challenge, as they often did not end near a location that would enable them to be secured as described in the first section. To reduce the tension on the super glue join holding them in place, tests were performed to determine if the ends could be melted to adjacent wraps. A small heated micro-spatula pressed over and between the wraps of the cords successfully melted the two together producing a very strong join. With Reyes’ permission, as the zip ties slipped off, the areas were welded together.

Securing the ends in this manner reduced much of the peel failure, a weakness of cyanoacrylates, and thus the overall failure rate was reduced significantly. However, this is not ideal given that heat has been shown to accelerate the degradation of PVC. Solvent melting was also tested. N-methyl-2-pyrrolidone successfully fused adjacent cords together, however this system was not used as it was a slow and posed a potential health problem due to the close proximity of the public.
7. ADHESIVES FOR PVC CORDS

The heated spatula technique worked well to keep the ends from unraveling, however an adhesive was still necessary to prevent the melted section from spinning and loosening on the steel rod (fig. 19). When selecting an adhesive for this project one of the most important qualities was a rapid cure. It was often necessary to repair the pieces while the space was open to the public and children (and adults) waited impatiently to regain access. A strong bond and good impact resistance were also extremely important. However, conversely, it was also necessary for the adhesive to release relatively easily for repair when adjacent cords broke requiring the area to be rewoven. Due to the need for weekly repair, a long cumbersome method of reversing the adhesive would not be practical. Furthermore, using high toxicity solvents was impractical for reasons mentioned previously.

![Unsecured welded section of cordage](image)

Fig. 19. Unsecured welded section of cordage. (2007.3) Copyright Pedro Reyes. (Photograph by Liz Brown)

7.1 TEST PARAMETERS

As this piece is just one out of many in a very busy exhibit schedule with a staff of two conservators between three SAM sites, it was not possible to do thorough analytical testing of a large variety of adhesives at this time. However, a few were rapidly tested in mockups. The adhesives chosen for testing were: Loctite Super Glue (ethyl cyanoacrylate), Scotch-Weld CA7 (methyl cyanoacrylate poly(methyl methacrylate)), Scotch-Weld CA100 (ethyl CA poly(methyl methacrylate)), two blends from GluStitch (50/50 butyl/octyl CA, 70/30 butyl/octyl) Scotch-Grip 1099 (acrylonitrile-butadiene, phenolic resin), and Scotch Grip 4474 (PVC and polyurethane).

The methyl and ethyl cyanoacrylates (CAs) were selected for testing as the fabricator used them for the other artworks and found them to be the most effective for this application.
Additionally the CAs have many advantages for this application. They are fast setting, bond well to PVC and stainless steel, and do not require mixing. However there are also numerous disadvantages. These include brittleness, poor peel and impact strength, poor gap filling, and loss of adhesion, particularly in contact with moisture (Down 2001), which is necessary to clean the Capula. In addition, formaldehyde is produced during degradation of the adhesive. Scotch-Weld CA7 and CA100 were selected as they are industrial grade adhesives designed for good impact resistance and the Loctite as a commercially available comparison. The two butyl/octyl cyanoacrylates were selected for testing as medical studies have shown that the longer chain polymers are more flexible and appear to potentially degrade more slowly (Down and Kaminska 2006). The two Scotch-Grips were tested as they are designed to provide strong flexible bonds with PVC and metals and as a comparison with the CAs.

7.2 TEST METHOD

The test cords and steel rods were prepared by degreasing with acetone. The PVC surfaces were not lightly sanded as recommended by manufacturers, as the ties twisted during the wrapping process. Adhesive was applied to the steel and PVC cords as they were wound around the stainless steel rods. The system was allowed to set for 15 minutes and pulled off subjectively observing the strength of the bond. Three tests were done for each adhesive.

7.3 ADHESIVE TEST RESULTS

The Scotch-Weld CA7 and the Scotch-Weld CA100 provided extremely strong bonds, CA7 being the strongest. These findings were consistent with 3M ASTM-D-1002 testing (3M 2004), although were somewhat surprising as the CA100 was designed to have better gap filling abilities with its significantly higher percentage of PMMA. However, they were brittle and could be peeled back mechanically. The Loctite formed a comparably weak and even more brittle bond. The Scotch-Grip 1099 and 4475 produced the strongest most flexible bond of all tested; however, both had cure times that were too long to be practical in this application. Furthermore, after the full cure time, it was very difficult to reverse these bonds.

The butyl/octyl CA mixtures were interesting. They all released more readily and had longer set times than the CA7. However, as expected they did appear to produce slightly more flexible bonds.

<table>
<thead>
<tr>
<th>Adhesive</th>
<th>Resin</th>
<th>Set time</th>
<th>Strength (a)</th>
<th>Flexibility (b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scotch-Grip 4475</td>
<td>Polyurethane, PVC</td>
<td>24 hours</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Scotch-Weld CA7</td>
<td>Methyl cyanoacrylate poly(methyl methacrylate)</td>
<td>30 seconds</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Scotch-Grip 1099</td>
<td>Acrylonitrile-butadiene, phenolic resin</td>
<td>40 minutes</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>GlueStitch GBO73SM</td>
<td>7:3 Butyl cyanoacrylate: Octyl cyanoacrylate</td>
<td>~1 minute</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>GlueStitch GBO55SR</td>
<td>1:1 Butyl cyanoacrylate: Octyl cyanoacrylate</td>
<td>~1 minute</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Scotch-Weld CA100</td>
<td>ethyl cyanoacrylate poly(methyl methacrylate)</td>
<td>70 seconds</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Loctite Super Glue</td>
<td>ethyl cyanoacrylate</td>
<td>30 seconds</td>
<td>7</td>
<td>7</td>
</tr>
</tbody>
</table>
7.4 ADHESIVE SELECTION

For this application the Scotch-Weld CA7 was chosen for its strength, ease of use and reversibility. Long-term testing still needs to be done and ideally a more stable adhesive would be used. Although studies have shown the addition of 15% PMMAs increases the tensile strength both at room and higher temperatures (Samantha et al. 2000), Down’s finding indicating that the pure ethyl CAs and butyl CAs may degrade more slowly in acidic environments (Down and Kaminska 2006) suggests that if the PVC produces an acidic environment as it degrades, the addition of the PMMA may not be ideal. Additionally being a methyl CA is less than ideal as it is the shortest length and thus potentially the least stable of all tested. However in the end, a very rapid and immediate strong bond proved invaluable. After a year of display, the repairs have held although the PVC cords show signs of degradation.

If time allows, adhesive testing will continue in the event that it is necessary to completely reweave the Capula in the future. If testing proves that the butyl/octyl mixture loses its adhesion to PVC less rapidly than the CA7, the longer chain polymers may be a better solution.
Fig. 22. Detail of broken weld of bolt flange. (2007.4) Copyright Pedro Reyes. (Photograph by Liz Brown)

Fig. 23. Cracked weld on hang point. (2007.3) Copyright Pedro Reyes. (Photograph by Liz Brown)
8. STEEL FRAME

After approximately six months of display, an issue with the steel frame was discovered by some exuberant youths. While on a school trip, eight teenagers climbed into one of the Capula and swung it violently. This resulted in one of the welds breaking and the piece falling to the floor. Fortunately, no one was hurt.

Although the artworks were examined for condition on installation, because they are works of art the welds were not subject to the inspections and regulations necessary for construction or playground equipment. After the piece fell, the welds were re-examined and several cracks were discovered to be forming on other hang points as well as the flanges of the bolted plates. Two of the bolt plates had broken entirely through. Engineers consulted suggested that all the hang points be re-welded.

Reyes was contacted and felt strongly that the pieces should be made safe. He suggested all the welds be reinforced and sent designs depicting the method by which he would like the hang points reinforced. To repair the artwork, conservation worked with Drew Middlebrooks, a Seattle welder, fabricator and artist. The pieces were moved to Middlebrooks’ facilities and before welding, a team of conservation staff documented and labeled the pieces, unbolted sections and unwrapped the cordage a short distance from the areas to be welded. The sections were then re-assembled before welding to prevent any of the flanges from warping out of alignment. Middlebrooks TIG-welded the sights and cleaned the new welds. The Capula were then disassembled again for re-wrapping and transport. As the hang points had worn a significant distance through the carabiners in the previous five months, new, low-carbon steel carabiners were installed with the artworks by SAM art preparators.

In retrospect, when considering how this incident might have been avoided, one is confronted with the debate between public safety and preserving the original artwork. Typically the welds are considered an important component of the artwork if executed by the artist. Altering or removing the artist’s welds could be considered removing the artist’s hand from the piece. One could extend this concept to the artist’s fabricators and assistants. However, the museum also has a responsibility to the public who will assume that an artwork in a public space is safe.

Fig. 24. Middlebrooks welding Capula XVI (2007.3). Copyright Pedro Reyes. (Photograph by Christian French)

Fig. 25. Detail of new welds (2007.3). Copyright Pedro Reyes. (Photograph by Liz Brown)
9. UNSOLVED QUESTIONS

Although many interesting repair methods were discovered working with Reyes, several concerns remain. As the plastic became stretched and loose, the cords collapsed inward and large gaps opened between sections. These were not only visually problematic but a potential safety problem as children’s legs slipped through. Additionally, over time as the number of repairs grew the system became bulky with all the cord-ends woven along the steel framework. Extreme use caused the cords to twist around and the repairs that were hidden below became visible on top. Furthermore, during the year and a half display there were visual changes in the cords. The white and yellow cords, although partly simply soiled, showed visible signs of PVC degradation, turning yellow to brown in areas. Colors such as the pink were also visibly fading.

When Reyes was shown the images of the Capula floors he decided that he would like to design a new floor. He envisioned the new floor to be a grid pattern with smaller spaces between the rungs. After a year and a half the artworks were de-installed for another exhibition. This allowed time to contemplate the questions raised by the creation of a new floor: by changing the floor, to what extent is the museum actually commissioning a new piece? What becomes of the original floors?

When the Capula get re-hung, if new floors are not fabricated the original ones will need to be rewoven. Reyes stated in his first interview that they could be rewoven by anyone as it is the concept and the space that is created that is important. However, would the public feel the same about a piece that was woven by a conservator? In recent conversations Reyes relayed that he would like to remain involved in the process since he often decides on a new color scheme, like new wallpaper. It has become clear in this project that an ongoing relationship beyond the initial interview is extremely important to allow him to react to conditions as they arise.
Fig. 28. Collapsed areas of floor of Capula XVII. (2007.4) Copyright Pedro Reyes. (Photograph by Liz Brown)

Fig. 29. Detail of floor of Capula XVII. (2007.4) Copyright Pedro Reyes. (Photograph by Liz Brown)
10. CONCLUSION

Like many contemporary artworks, the *Capula* present a number of challenges though their use of modern materials and exploration of the boundaries of art. Collaborations between artist, fabricators, weavers and conservators allowed solutions for many of the concerns to be uncovered. These include weaving new sections of cord, melting techniques, and the use of adhesives. Some challenges appear to remain inherent such as the PVC cord’s loss of elasticity. Other issues may present themselves as the piece ages, such as the potential reaction between the stainless steel and acids produced during the degradation of the PVC and plasticizers (Shashoua 2001; Williams 2002).

Working though the challenges of these artworks has been successful and a pleasure as Reyes remains interested and involved in the process. An important issue highlighted in this process is the extent to which a conservator ought to be involved in and thus affect the creative process. Early in discussions, when the plastic cords began to fail, Reyes commented that he was considering using a coated metal wire for future pieces. Obviously this would change the piece considerably. But on a smaller scale, if new PVC cords are fabricated in the future should conservation be involved with the plastic and adhesive selection? For example if PVC is used, should they suggest a plasticizer with molecular weight of more than 400 as recommended by some for decreased migration (Stark et al. 2005)? Where to find the line becomes highly subjective. On a similar note, when interviewing an artist who recently installed an artwork in the same location, he indicated that he was thankful he was not told of the potentially wild atmosphere in the pavilion during the conception phase as it may have had a limiting effect on his artwork.
ACKNOWLEDGEMENTS

The author would like to thank Pedro Reyes for making this project so interesting with his ongoing enthusiasm and support, and without whom none of it would be possible. Additionally invaluable were steel fabricators Drew Middlebrooks and Larry Tate, SAM mount maker Scott Hartley, and SAM staff Nicholas Dorman, Sarah Kleiner, Susan Lewandowski, Tim Marsden, Chris French, and Marta Pinto-Llorca.

REFERENCES


Akele, J. 2007. Email communication.


—– 2006. Personal communication. Seattle Art Museum, Seattle, WA.


FURTHER READING


**SOURCES OF MATERIALS**

Ceramic fiber felt  
Seattle Pottery Supply  
35 S Hanford Street  
Seattle, WA 98134

Loctite Brush On Super Glue  
Home Depot  
2701 Utah Avenue South  
Seattle, WA 98134

N-butyl cyanoacrylate/2-octyl cyanoacrylate  
GluStitch Inc.  
103A -1574 Gulf Road Point  
Roberts WA, 98281
Scotch-Grip 1099, Scotch-Grip 4475, Scotch-Weld CA7, and Scotch-Weld CA100
3M Adhesives
3M Center, Building 21-1W-10, 900 Bush Avenue
St. Paul, MN 55144-1000

Turbo Torch
Home Depot
2701 Utah Avenue South
Seattle, WA 98134

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BECOMING A CHIEF OF OBJECTS

ANNE DE BUCK

ABSTRACT

The installation artwork *Voorstelling* (1997) by the Japanese-Dutch artist Suchan Kinoshita consists of two connected rooms. A performer, referred to by the artist as the Chief of Objects, inhabits one of the rooms and manipulates the numerous objects Kinoshita put in both spaces. This installation is part of the collection of the Ghent Museum of Contemporary Art. To date it was only put up for display in close collaboration with the artist. Combining elements of a performance, a complex display of objects, and an interactive environment, *Voorstelling* challenges the museum in more than one way. This paper presents the co-operation that took place between the museum and the artist in order to allow the museum to deal with this work in the future, even without Kinoshita being present.

The goal was to develop guidelines and procedures for the future presentation of the work and its conservation – and when necessary the duplication and replacement of the installation and the objects. Although the aspect of randomness plays an important role in the performance, it was also necessary to create a performance-score for the Chief of Objects.

Being able to work together with the artist may seem to turn this research into a walk in the park, but quite a few out of the box, or rather, out of the conservation discipline solutions were needed to reach our goal. Putting neither the artist’s nor the museum’s interests in first place, but rather focusing on the artwork was one of the key elements. With this in mind both parties succeeded in securing *Voorstelling* for the future. We would like to put forward the methods and approach used in this research as solutions for the conservation of similar installations and for working together with contemporary artists.

1. INTRODUCTION

The kinds of creative collaborations that conservators engage in come in many different forms. It is clear that the challenges we all encounter in our disciplines urge us to be both open-minded and creative. An example of such a challenge was the conservation of the installation artwork *Voorstelling* by the Japanese-Dutch artist Suchan Kinoshita, owned by the Ghent Museum of Contemporary Art (SMAK).

The research on *Voorstelling* was carried out within the framework of the project *Inside Installations*. This project ran from 2004 until 2007 and focused on, as the name suggests, installation art, and more specifically the preservation and re-installation of contemporary installation art. With the support of the European Community, this project was set up by six institutions that were all confronted with the same issues: how to deal with the conservation of installation art. The goal was to create guidelines for safeguarding installations for future generations, and to find solutions or methods for how to deal with this diverse art form. A thorough investigation was set up around topics such as documentation, preservation, artist participation, theory and semantics, and knowledge management and information exchange. These themes were incorporated into the research of several case studies on artworks owned by the participating museums and institutions.

Installation art is very diverse. This is confirmed by recent art history. The word installation has been used to describe art ranging from the early 'enhanced' paintings by Picasso, to Dadaist sculptures, to room-sized multimedia works by Allan Kaprow. In literature, one will find installation as a synonym for such diverse concepts as environment, assemblage, or in situ work.
It is relatively easy to agree on characteristics for categories such as painting or sculpture. Defining installation art would probably postpone lunch quite a bit. The easiest solution would be to come up with a negative definition: installation art is not painting and not sculpture.

This lack of definition is not necessarily a problem, but it is probably part of the reason why there are no conservators trained for the category of installation art. These artworks consist of new and unique combination of elements and materials. The fact that they have little common ground, and we rarely have “category knowledge” to fall back on, urges us to think outside the box and apply a bottom up approach in nearly all of the cases. This was clearly the case with Kinoshita's Voorstelling.

2. ABOUT THE ARTWORK

The installation artwork Voorstelling combines elements of a performance, a complex display of objects and an interactive display. It was made in 1997 for the exhibition Entr’act 9 in Van Abbemuseum, in Eindhoven, the Netherlands. Afterwards it was bought by SMAK, which showed this installation in its opening exhibition in 1999.

The installation is set up in a museum. It consists of a closed space that is divided into two equally large parts or rooms. Because of the way the installation is set up in the museum galleries, the visitors do not always immediately see the connection between the two rooms. In the wall between those rooms there is an opening – a window. Both rooms are open to the public through doors. In one of the two areas, wooden benches have been arranged, from which little program books have been hung. In Kinoshita's terminology this is the Visitors Room. The other room contains objects and is where the performer is found. Kinoshita refers to this performer as the Chief of Objects, hence the room is called the Chief of Objects’ Room. During the performance the Chief of Objects interacts with the objects and controls light and sound devices. The performance was never carried out by the artist herself – she always looked for someone else to be her Chief of Objects.¹

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¹ The performance was never carried out by the artist herself – she always looked for someone else to be her Chief of Objects.

Fig. 1. Exterior view of the installation (Photograph by SMAK)

Fig. 2. The Visitors Room (Photograph by SMAK)
The title of the work suggests a theater performance – the Dutch word *voorstelling* means performance. Elements of the installation – the benches, the curtains – strengthen this link. But in contrast to a theater performance, this work – and the performance within it – has no clear beginning or end, and the role of the audience (or ‘visitors’) remains undefined.

While the installation was acquired by the museum, staff was still heavily dependent on the artist to put it up for display. It was a close collaboration, but we needed to know how to deal with this artwork in the future, even without the artist being present.

The goal was to achieve guidelines for the future presentation of the work and the conservation of the installation. Three elements were researched: the space, the objects and the performance. This research took place in a ‘real life’ setting: *Voorstelling* was installed in the museum galleries during the end of 2005 and the beginning of 2006. This setting gave us the possibility to investigate how to deal with the museum visitors. We had to know how to deal with them, their presence, and their interactions with the artwork. During the research it was important to keep in mind that the information and the knowledge we were about to gather was intended for different audiences: the museum in general, the conservation department, and the performer.

### 3. RESEARCH TOPICS

#### 3.1 SPACE

The first step in the re-installation process was the construction of the closed space, which contains the Visitors Room and the Chief of Objects’ Room. At this stage, we already had close contact with the artist because we were wondering which of the previous set-ups was the best. The Van Abbe Museum had previously built the rooms, and the artist simply used the existing space to create her new artwork. For the artist, these two rooms functioned as two separate exhibition spaces and the public had to walk around through the museum to get to the other side.

In 1999, when SMAK first showed its new acquisition, they just copied the Van Abbe presentation: the same measurements were used to build the room. The biggest difference was that the space stood on its own in a large hall and did not connect with the museum architecture itself. Through interviewing Kinoshita, it became clear she did not like this isolated situation.
Through these talks it became clear for the first time that the artist thought it was important to relate to the architecture of the museum. Solutions for managing the given space with a view to future re-installations were collected. The instructions given by the artist for the re-installation of the rooms were followed closely in 2005. Existing museum walls were used and some new walls were built to complete the form.

The floor plan became smaller. This had consequences for the position of the objects in the rooms. Together with Kinoshita all objects were arranged and some of them in a slightly different way compared to two previous installations.

The space itself and the displays in the rooms were precisely documented through plans, photographs and a video registration. Construction materials used were listed. This documentation will help us with coming installations of Voorstelling: the creating of the space, the rooms, and the arrangement and position of the objects. The guidelines make it possible to adjust the layout to different measurements. This means the museum staff no longer has to copy older set-ups; through these guidelines they achieved more liberty.

3.2 OBJECTS

The objects, part of this installation artwork, are made from all kinds of materials, using different techniques. Some objects have particular visual and sound effects.

The use of all objects by the Chief of Objects during the performance has an influence on the preservation strategy. Objects can break down faster through this manipulation. Using the objects is crucial for the meaning of the artwork, so subjects such as duplication, reproduction, and restoration were discussed in conversation with Kinoshita.

All objects were catalogued. A description was made for every object, a photograph was taken, its condition was determined, it was measured and the position in the installation space was fixed. Some of the artwork’s objects have specific light or sound characteristics. The light and sound levels were measured.

Together with the artist, preservation and presentation guidelines for every object have been established. Some objects could be replaced; others could be reproduced or restored. A few examples:

The coffee maker is a good example of replacement. Kinoshita bought this yellow-brown coffee maker in a second hand shop (fig. 5): for her it is important that objects carry a history.

![Fig. 5. The coffee maker (Photograph by SMAK)
During the performance, the *Chief of Objects* makes actual coffee with this machine. It produces a particular rattling sound caused by calcification. If the old one must be replaced, the conservator would also have to make sure this characteristic is present because it has an important “sound” role in the performance. Because of the history aspect this coffee maker cannot be replaced with a brand new one.

The PUR curtain illustrates reproduction. This curtain consists of polyurethane sprayed in a certain pattern. During the performance it travels around the room hanging on a rail. From time to time, it bumps against another object or visitor, and it is not unusual for pieces to break off. Kinoshita explained and showed us how to make such curtains. Together with the artist an instructional video has been made. The tools for production are kept in the material archive of the conservation department.

![Fig. 6. The PUR curtain in the installation (Photograph by SMAK)](image)

Fig. 6. The PUR curtain in the installation (Photograph by SMAK)

![Fig. 7. The reproduction of the PUR curtain (Photograph by SMAK)](image)

Fig. 7. The reproduction of the PUR curtain (Photograph by SMAK)
Some parts are so unique, restoration is still the answer. This is the case for the water-oil clock, an hourglass filled with salad-oil and water. This object, assembled by the artist, had been broken by a visitor during a previous exhibition. The two parts of glass are glued together with a reversible adhesive. The time mechanism can be reproduced by calculating the ratio of oil to water in the clock.

![Fig. 8. The water-oil clock broken in two (Photograph by SMAK)](image1)

![Fig. 9. The water-oil clock after restoration (Photograph by SMAK)](image2)
The role of the public also had an influence on the preservation strategy. There is an interaction allowed but only up to a certain level: visitors can walk around the two rooms. But as a visitor it is tempting to manipulate objects, certainly when you see the performer doing the same. Kinoshita allowed the visitors to sit on the benches, but objects in the Chief of Objects’ Room could not be touched – only the Chief of Objects has permission. Guidelines were set up as to how the Chief of Objects should deal with this kind of visitor. He or she can point out that the objects are not to be moved, and the performer has the permission to secure things, when necessary.

3.3 PERFORMANCE

The performance is an important part of the artwork. Since the performance should be carried out by the Chief of Objects every time the artwork is on display, a thorough investigation was needed on how to deal with it.

Each time in the past, Kinoshita personally coached the Chief of Objects. In 1999 some notes about the performances were drawn up; this was called the “score.” However, the actions were not fully documented, there was lack of information, and the structure of the performance was unclear. This score was exposed in the artwork on a music stand.

It was obvious that the score was very limited and unclear without further explanation from the artist.

The first step of the solution was for the structure to be sorted out. An adaptable system was set up, keeping the opening hours of the museum in mind. This structure is adaptable, so when the artwork is exhibited in another museum they can adjust it to their opening hours.

Another difficulty was the role of randomness in the performance. According to the artist, the performance does not have a beginning or an end; an opening or closure. How should one interpret this, knowing the goal is to create something to enable the re-performances? The artist herself came up with the solution: the score was replaced by a card game. The cards are divided into the following themes: objects, light and sound. The Chief of Objects pulls a certain number of cards from these different groups and makes combinations. In this way the aspect of randomness is preserved: the chance of drawing exactly the same cards twice is very small. Each card displays one action that has to be carried out. The complexity and the richness of the performance were hereby preserved.

Fig. 10. The card game (Photograph by SMAK)
The scheduling and the card game were already big improvements, but we also needed information on how to carry out the different actions. By interviewing the artist, a lot of information on how to fulfill these actions has been gathered. She also showed us, in the installation itself, how to deal with certain aspects. These observations were very instructive. Furthermore, she taught the Chief of Objects how to manipulate objects in particular. The performer took a lot of notes. By then, he knew what the content of every action was. Based on this material he did several test runs. This way of working made it possible to find gaps in the information.

By this point, the performances had been documented with word and image. The knowledge and information about this artwork accumulated. The next step in the research process was to create a manual for the performance. The main objective was to create a reference document for the performer that listed all instructions and contained general guidelines. A vocabulary needed to be established: the artist had given specific names to objects such as broad case, doll-beast, etc. The manual had to have a low learning curve. Other requirements were that the manual had to be task oriented, it had to have a balance between general and detailed information, and it had to be easy to read. The manual should be modular, so it would be extendable in the future.

This document differs from the conservation file, in which everything is described in a rather technical way. The performance manual is more practical, focuses on the execution and is linked to the card game.

Traditional manual types were examined. A script or screenplay was not a suitable option. The performance has way too many actions and it is hard to deal with the aspect of randomness in a script. The instructional video is a good reference medium, but creating an instructional video was seen as impossible. Once again, it is hard to capture the aspect of randomness and recording all possible actions would be very time consuming.

The technical manual seemed the most suitable, and fit the proposed criteria. The difference between the performance manual and the usual technical manual lies in the goal. A technical manual has a clear goal, for instance: install your DVD-player and make it work. Our
manual for the performance does not have such clear objectives; it is more a listing and explanation of all possible actions.

To give you an idea of how the manual was constructed, we can look at its table of contents. It all starts with a general introduction - in this part we make the future performer aware of what the installation consists of. That is followed by the ‘Structure of the performance’ in which the play and still phases are explained. The third chapter discusses the card game, its function, types of cards and rules. The fourth chapter, ‘Actions,’ is the main part of the manual; for every object and its possible action, a chart with a description was made. This is followed by a rehearsal plan and the appendices. In these appendices, all cards of the game are listed and explained; it is excellent reference material and can be easy consulted when one has forgotten something.

As previously stated, a chart for every object and its action was made. All charts were made using the same template. This was based on the method called Information Mapping. Characteristic elements are: the title, the marked keywords, the use of limited amounts of text between lines, and the “step action table.” In this “step action table” every action is described in different steps, so it is easy to understand, to perform and to memorize.

4. CONCLUSION

The collaboration between SMAK and the artist Suchan Kinoshita was very successful. As researchers of contemporary art, we sometimes have the opportunity to work together with the artist on the conservation of his or her artwork. This way we can glean information first hand. We can acquire a direct answer to specific questions concerning conservation and management aspects of an artwork. Not only do we have an opportunity to pose questions concerning the work of art, materials, techniques, and guidelines for display, but there is also the possibility of observing the creative process.

This case was selected knowing the willingness of the artist to cooperate. It is clear that without her cooperation, without the possibility of collaboration, it would be very hard to achieve
a satisfying result. But it is important to stress this was not a collaboration in the creation process, but rather a collaboration in the reconstruction of the creation process, so that we had a clear understanding of all aspects of the installation. It is not unimaginable that a collaborating artist would try to redo or update his or her work. This was not the case with Suchan Kinoshita; the historic dimension was clear to all involved. On the other hand, the distance in time between the creation and documentation can make it easier for the artist to take a more objective stance, if that is possible at all.

This kind of collaboration is not always easy. It is important you have clear goals from the start. For this case study, we wanted to be able to deal with this artwork in the future without Kinoshita being present. Both parties understood the importance. The artist and the museum kept the artwork Voorstelling as the main focus and this is how we succeeded.

If you have to work with an artist, take the following aspects into consideration: be well prepared, and do a lot of research in advance so you know what the artist’s work is about. Otherwise these meetings will be very overwhelming and you will lose focus.

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NOTE

1. The artist listed some selection criteria, which are included in the manual: “The Chief of Objects can be either a man or a woman. His or her age is not important. He or she preferably has a background in the artistic or cultural sciences, or in scenography. An artist can also take on the role. Actors do not fit the profile.” The number of performers selected would depend on length of exhibition - on this no specifics are included in the manual.

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COLLABORATIVE CONSERVATION OF THE CHARLES HUBBARD NATURAL HISTORY DIORAMAS

RON HARVEY AND NINA ROTH-WELLS

ABSTRACT

This paper will address the treatment of natural history dioramas in the L.C. Bates Museum in Hinckley, Maine. The collection has been exhibited in its present building since 1911 as a teaching museum for the residents/students of the Good Will-Hinckley Home for Boys and Girls. The L.C. Bates Museum houses a unique collection of natural history and fine art within an historic structure. The dioramas were created by painter/naturalist Charles Hubbard to illustrate the mammalian and avian species of Maine. The treatment of the dioramas followed a holistic approach and was carried out through collaboration of the objects and painting conservators. As the dioramas had never been treated before, the treatment goal was to retain the specimens and early 20th-century interpretation while repairing damages, updating lighting systems, and retrofitting cases to reduce infiltration of dust and create more stable environmental conditions.

1. HISTORICAL BACKGROUND

The L.C. Bates Museum is situated in rural Maine on the campus of the Good Will-Hinckley Home for Boys and Girls. The Good Will-Hinckley Home for Boys was founded by the Rev. George Hinckley in 1889 as a home for needy boys. Today Good Will-Hinckley continues to provide services for children, both boys and girls.

The museum was designed in 1903 by the architect William R. Miller, a Maine native who was very fond of the Romanesque style. The museum building was originally the manual training school, however, it was converted to a museum in the 1920s when Lewis Carleton Bates paid for building improvements and museum exhibits. Rev. Hinckley’s personal collections formed the basis for the museum collection. His main areas of interest were natural history and rural culture, which he felt complemented the mission of Good Will-Hinckley.

Fig. 1. Exterior of L. C. Bates Museum (Photograph by authors)
In 1912, American impressionist Charles Hubbard was commissioned to design a logo for the Good Will-Hinckley Home. Hubbard designed the roundel, which is in essence a pictorial representation of Rev. Hinckley’s six main principles of child rearing: Home, Education, Discipline, Industry, Recreation, and Religion. The relationship between Hubbard and Hinckley continued, and in 1915 Hubbard traveled to Good Will-Hinckley where he and Hinckley discussed plans for a museum.

By the 1920s, the museum planning was underway and Hinckley commissioned Hubbard to design the natural history dioramas for the L.C. Bates Museum. There are 32 dioramas that depict the flora, fauna, and scenery of Maine. Additionally, there is one diorama with a hyena and the pyramids of Egypt in the background.

Like many impressionists, Hubbard painted *en plein air*. He traveled around the state of Maine and painted sketches for what was to become the backgrounds to the dioramas. Hubbard was also an avid photographer and he photographed each location so that the background scenes could be reconstructed with accuracy once he had returned to the studio.

The museum is modeled on a late 19th century cabinet of curiosities, and the museum remains much as it was to this day. Because of this philosophy, the dioramas have not been reinterpreted to fit scientific advances in the understanding of natural history, therefore they are among the oldest and best-preserved dioramas in New England.

The conservation of the natural history dioramas at the L.C. Bates Museum began as the result of an Institute for Museum and Library Services (IMLS) funded Conservation Assessment in 1999-2000. The assessment identified the dioramas as high conservation priorities as well as historically important components of the museum. The dioramas were designed, constructed, and installed by Charles Hubbard, an American impressionist artist. Mr. Hubbard selected taxidermy mounts from the collection and incorporated them into environmental settings with painted backgrounds of known locations within Maine. With the exception of the spotted hyena, all of the dioramas reflect the natural habitat, flora, and fauna of diverse locations within the state.
The IMLS Conservation Project grant funded in 2001-2002 supported the conservation of the first group of bird dioramas within the museum. The purpose of the project was to address the identified issues that threatened the dioramas. These issues included internal incandescent lighting, high light levels within the dioramas, dust and debris that had accumulated within the dioramas due to gaps between the wood frames holding the glass, the lack of proper coverings at the tops of the cases, and damage from decades past insect infestation. Another problem that threatened the preservation of the dioramas was the necessity to open the cases to change interior lighting. Changing the lights required removing the wood frame and glass to access the interior of the dioramas. In addition, due to the presence of arsenic associated with the historic taxidermy mounts, a handling protocol was established (appendix 1).

An earlier test on isolated mounts within the L.C. Bates Museum undertaken by Tuckerbrook Conservation detected a range of toxic materials and heavy metal poisons that had been used when preparing natural history mounts. The testing identified the presence of arsenic
as the most consistently used material during the preparation of the taxidermy mounts. Prior to beginning any work with the diorama interiors, each mount was tested for the presence of any toxic materials that would have been used on 19th and 20th century taxidermy mounts. A modification for using the Merckoquant Arsenic Test Kit provided by Catherine Hawks appears in appendix 1.

2. TREATMENT

The dioramas’ background paintings were in good condition with minor areas in need of treatment. However, the mounts have suffered from long-term exposure to light and past insect infestation. Our treatment plan focused on intervention and developing a preventive care and maintenance model in which the dioramas could be treated in situ.

2.1 TREATMENT OF PAINTED BACKGROUNDS

The backgrounds of the dioramas were painted on a thick cellulose-based support similar to artist’s board. In most of the dioramas the supports of the painted backgrounds were stable and in good condition. Exceptions to this could be seen on five dioramas that are against exterior walls. In these cases, temperature and humidity fluctuations from the adjacent exterior masonry wall had caused warping in the cardboard support panels. The treatment of warped panels with the specimens in situ required creative thinking to design a support that allowed safe access to the panels without threatening the artifacts or the conservator.

Treatment of the diorama backgrounds with stable supports was considerably easier. Once the glass in the front of the case was removed, the painted surface was examined closely in raking light to ensure there were no areas of insecure or flaking paint. Occasionally, flaking paint was discovered near nail heads used to attach the painted backgrounds to the case. When necessary, tiny flakes were consolidated with 5% Paraloid B-72 in xylene. The next step was to dry brush and vacuum the painted surface to remove any particulate matter. The paintings were in remarkably good condition. They were not varnished, so discoloration of a surface coating was not a problem. Furthermore, they had been in cases resulting in very little surface grime. When necessary, visual integration was undertaken by first isolating adjacent paint layers with Golden MSA matte varnish (brush applied), followed by filling with Modostuc, a commercial water-activated fill material consisting of a calcium carbonate base material with small amounts of barium sulfate and a polyvinyl acetate copolymer binder. After the fills had set, they were inpainted with Golden Acrylic paint to blend with original surfaces.

2.2 CLEANING PROTOCOL

A protocol was established for the cleaning of the interior of the dioramas and the cleaning and rearrangement of the feathers, fur, glass eyes, legs, feet, and bases of the mounts. Due to the complexity of the dioramas, the shallow interiors, and the fragility of the leaves and plant material, it was determined that all cleaning would occur without removing items. The cleaning consisted of removing surface dust by mechanical means, that is, dry-brush dusting of surfaces with a natural fiber brush (Hake and assorted small artist brushes) and capturing the raised dust with a variable-speed Nilfisk HEPA vacuum. The nozzle of the vacuum tube was covered with a section of nylon stocking to capture any loose or detached elements of the mounts. The interior ground cover elements, such as leaves, tree branches, trunks, stones and plant material, were cleaned using this technique. The mounts were not removed from the
dioramas and were dry brushed and HEPA vacuum cleaned in place. The hyena mount was the exception to cleaning in place.

The glass eyes of the mounts develop a heavy accumulation of dust that clouds and dulls their appearance and affects the aesthetics of the mounts. Cleaning the glass eyes required the use of cotton micro swabs dampened with distilled water or ethanol to thoroughly remove the surface accretions. Care was taken to reduce the impact of solvents and water on toned areas around eyes and any exposed skin or hide elements. Bamboo skewers, tweezers, and micro spatulas were used to separate, realign, and preen the mounts after dry cleaning.

![Fig. 6. Cleaning seagull mounts (Photograph by authors)](image)

2.3 TREATMENT OF MOUNTS

Some of the mounts within the mammal dioramas required conservation treatment. A primary example would be the fox family, a pair of adults with two kits. The insect damage of the adult male mount included loss of fur along the back of the mount as well as the complete loss of fur on the tail. Replacement of the missing fur was accomplished by first mapping the areas of loss using 0.5 mil polyester sheeting (Mylar) and a Sharpie marker. The mapped losses were cut out of the Mylar and used as templates. A faux raccoon fur was purchased to test the fur replacement process. The faux raccoon fur was identified as an acrylic fiber with cloth backing, and was cut to size using the Mylar maps. The faux fur was trimmed to the length of the original fur adjacent to the replacement areas. The faux fur was toned using a cold encaustic paint. To make this paint, a small amount of Victory microcrystalline wax (3-5%) was added to mineral
spirits and mixed at room temperature. The wax acted as the toning medium and dry pigments were added until the desired color was achieved. The wax-pigment toning system was brush-applied to the faux fur and allowed to dry. After drying, the tinted fur was teased using a sharpened bamboo skewer as well as a small stippling brush to separate the fur and provide a more natural appearance. The tinted faux fur was placed in the areas of fur loss on the hide of the mount and held in place using size 0 stainless steel insect pins. The perimeter of the faux fur was blended into the original fur using a sharpened bamboo skewer and a synthetic fan brush. This process was continued until all of the fur losses were completed. The missing tail was replaced using a commercially tanned fox tail that had been treated with a commercial taxidermy insect deterrent, Protex Mount Care. Protex Mount Care contains di-N-alkyl dimethylammonium chloride, N-alkyl dimethylbenzylammonium chloride that has disinfectant and microbial inhibitor properties. The tail was placed over the original wire support and held in place by applying a 20% solution of Paraloid B-72 in acetone to the underside of the tail hide and wrapping the hide over the wire support. The tail would mimic the original placement of the tail and provide the full, bushy quality that was missing from the damaged mount.

2.4 MODIFICATION OF DIORAMA CASES
The easiest issue to address was the design and construction of rigid top “roofs” for the dioramas. The tops were constructed using medium density overlay (MDO) plywood with pine bracing, and with the interior facing and edges covered with a heat-set aluminized polyethylene and polypropylene barrier foil (Marvelseal 470). The exterior perimeter of the MDO plywood had applied pine moldings stained to mimic the original cabinetry of the cases. The museum contracted with a local cabinetmaker to fabricate the tops for the cases, and students working
under the supervision of the museum director applied the laminate to the interior surfaces and edges of the custom-cut MDO plywood. A layer of fabric-grade Tyvek was installed between the MDO plywood and the original top of the cabinet to further reduce the infiltration of dust. The Tyvek was secured in place along the interior wood framing using Monel rust-resistant staples.

The gaps and openings noted where the interior surfaces of the wood-framed glass fronts and the pine interior frames meet allowed the infiltration of dust and airborne particulate into the dioramas. A silicone, pressure-sensitive acrylic adhesive backed gasket (Strip-N-Stick Silicone Rubber gasket 200A) was applied to the face of the interior frame to contact the surface of the wood framed glass panels and reduce or eliminate particulate infiltration into the dioramas.

2.5 LIGHTING

Interior lighting was next addressed with the goal to lower light levels, reduce or eliminate any heat buildup in the case, reduce the need to enter the case to change out light bulbs, and provide a light system that would be free of any ultraviolet radiation. Many of the cases had existing interior lighting consisting of knob and tube with ceramic or metal fixtures, incandescent light bulbs, and milk glass shades. Discussions with the director resulted in the decision to leave the original lighting in place, but attempt to use a single bulb approach to illuminate the diorama interior.

The first seven cases in the Audubon Room were initially illuminated using an acrylic fiber-optic lighting system (NOUVIR) in which the light source (driver) was mounted on top of the diorama case and out of the line of sight of the viewer. The advantage to this system was the ability to provide light through the acrylic fibers into a clear bulb that had been modified to accommodate the acrylic fibers and have the appearance of a single bulb. Although this approach did meet the goal of providing illumination through an existing, though modified, light fixture, it did not provide adequate light to meet the viewers’ needs. In a second attempt, acrylic fiber-optic lighting was introduced through gaps in the ceiling at the front of the diorama. Fixtures were attached to the interior face of the framing and aimed to provide adequate lighting to meet visitors’ needs as well as conservation standards for natural history collections: 50 lux or 5 footcandles as recommended by Garry Thomson. The staff can change the bulbs in the illuminators without accessing the interior of the dioramas. A motion-activated sensor that would turn the diorama case lighting on as visitors were approaching the entrance to the Audubon Room controlled this lighting system. The use of the motion-activated system will further protect the mounts and organic interior elements from prolonged light exposure, therefore providing greater preservation of the fragile collections.

The second phase of diorama conservation supported by the award of an IMLS Conservation Project grant involved a bank of shallow cases with bird mounts, minimal ground cover, and Hubbard-painted backgrounds. The cleaning protocol established with the first group of bird dioramas was implemented on the second group of dioramas. At the request of the museum director, the lighting for this group of dioramas was a glass fiber-optic lighting system manufactured by LSI. The museum director’s decision was driven by the reported longevity of glass versus acrylic fiber-optics and her investigation into the LSI system. The conservator installed the glass fiber-optic lighting through the top of the diorama caps and into the dioramas through gaps and openings that were present in the original construction. Brass rod mounts were fabricated to direct the ends of the fiber optic bundles and illuminate the interiors of the shallow dioramas. The shallow depths of the dioramas accommodated the point source illumination, however, there were some areas that fell into shadow within some of the dioramas. The new
lighting within the dioramas met conservation standards for illumination for the preservation of the specimens. A motion-activated sensor switch to reduce long-term exposure to light as well as to reduce energy consumption controlled the glass fiber-optic lighting system.

A third round of IMLS funding provided for the conservation of the last group of bird dioramas in the Audubon Room. The established protocol for the cleaning of the interiors and mounts was followed, as was the construction and placement of the caps and reproduction moldings. The museum director, Deborah Staber, attended a New England Museum Association Annual Conference and took a workshop on museum lighting. The development and use of light emitting diodes (LED) in systems termed LIA (LED Illumination Assembly) as lighting sources in a museum setting has been investigated by Richard Kerschner, Director of Preservation and Conservation at the Shelburne Museum, Vermont. Kerschner presented a workshop on his lighting research and use at Shelburne during the New England Museum Association Annual Conference in 2004. At the request of the museum director and after investigation by the conservator, yet another system of interior lighting was installed to address lighting of the shallow dioramas. A test was undertaken using a 12 in. strip of the 4000K LIA LED placed in a 16 in. square acrylic cube with a HOBO Pro datalogger. A second logger was placed outside the case and the LIA was activated by a timer and run for eight hours a day. At the end of two weeks, the data from the two loggers was compared and a 1°F rise was detected in the interior temperature throughout the day. The amount of heat generated by this system of LED lighting would not adversely affect the interior temperature (or relative humidity) within the diorama cases.

The LED lighting manufactured by Prolume is available in a range of color temperatures (3200 and 4000K), spacing of LED “bulbs” (1 in., ½ in., etc.), beam spreads (20° and 40°), and unit lengths, as each strip is custom made. The strips of LEDs can be easily installed in the case using nylon cable clips or custom fabricated brass mounts. Various lengths, pitch of lights and consistent color temperature provided an even illumination within the shallow dioramas. The longevity of the LED system (13-year guarantee), the decrease in energy consumption to drive the lighting, the consistent color temperature of the lighting, the light levels in the diorama and the lack of ultraviolet or infrared light will provide long-term preservation of the mounts and background paintings and will reduce the necessity of opening the dioramas for lighting maintenance. The drivers (transformers) for the LED lighting was located on top of the diorama cases to allow ease of access as well as replacement of the transformers when needed.

The remainder of the dioramas (mammals), with the exception of the single, large diorama (caribou, black bear family, white-tailed deer, etc.) have been lit using 4000K LEDs for the background paintings. The foreground and mounts have been illuminated using 3200K LEDs to complement the warmer colors. The difference in lighting is most noticeable when photographing the dioramas using digital photography. Newer LED lighting at 3000K has been used in relamping exhibit cases in the museum.

3. CASE STUDY: HYENA DIORAMA

The spotted hyena mount required extensive conservation intervention. The 19th century mount prepared by Ward’s Natural Science Establishment, Rochester, NY had suffered from past insect infestation resulting in the loss of hide along the underside of the body. In addition, excessive damp resulted in the deterioration of the internal threaded iron rods in the legs used to support
and mount the hyena to an oak base. The deteriorated metal rods expanded in the plaster that formed the legs of the hyena resulting in a split of the hide along old seams.

![Fig. 8. Hyena diorama (Photograph by authors)](image)

The mount was initially cleaned of surface dust and particulate by dry brushing with a natural fiber artist brush and the particulate was captured using a Nilfisk M80, variable-speed HEPA vacuum. The loose plaster fill material was photographed and then vacuum cleaned. The failing rusting iron rods were cut and removed. Each leg was measured and sections of 316 stainless steel 3/8 in. threaded rod were cut to extend up into the leg and overlap the original iron rod, replacing the deteriorated sections. Several inches of the exposed old rods were given a brush application of an epoxy (System Three T-88) to act as a separator and to seal the surface of the iron rod. After curing, the new rods lapped several inches of the old iron rods and were attached to the old iron rods using a structural epoxy adhesive (System Three T-88).

The openings at the legs and damage to the feet were repaired by filling gaps in the plaster with a water-based cellulose fill material (Modostuc) with the addition of 10% alpha-cellulose powder for strength. Large gaps were initially filled with a sculpted section of expanded polyethylene foam (Ethafoam) and then the gaps were filled with the Modostuc and alpha-cellulose. The feet and legs were shaped into correct form and held in place using plumbers’ Teflon tape (non-adhesive) until set. The hide was realigned and reattached using water-based flexible polyvinyl acetate adhesive (Jade 403) and a strong, medium-weight 100% Kozo Japanese tissue (Kizukishi) to bridge gaps. The paper was attached to the interior edges of the hide with a dilute Jade 403 solution and was aligned at the seam with the other edge of the hide. The remaining edge of the Kozo paper was given a light application of the dilute Jade adhesive and then worked behind the hide to form a bridge. The hide was held in place using sections of a nylon stocking wrapped around the exterior of the leg until the hide repair dried. This was repeated until all four of the legs were repaired.
The damaged underbelly of the hyena had been eaten by insects in the past and the hide loss exposed the string and fiber understructure associated with the original taxidermy. The strings were realigned and tucked in to hold them in place. Strips of the Japanese paper were attached along the inner edge of the hide surrounding the area of loss using Jade 403 adhesive thinned with distilled water. The exposed area of the mount support was faced with a single layer of the Kozo paper and held in place with Jade 403 adhesive thinned with distilled water. The paper covering was gently tamped in place over the mount support to form a protective covering and was attached to the perimeter paper using the thinned Jade adhesive. The paper was held in place using stainless steel pins until the adhesive dried. The Japanese paper repair covered the exposed inner mount and provided a stable surface on which to attach the faux fur.

A synthetic (modacrylic) fur was chosen that was similar in hair size though it was white in color. A template of the missing fur area was made and was used to shape the faux fur. The fur was trimmed using an electric trim shaver to adjust the length of the hair to more closely match the length of the original fur on the hyena. The faux fur fill was toned using the wax/solvent/dry pigment technique and allowed to dry. The faux fur was glued in place over the paper facing using Jade 403 and held in place using stainless steel pins until dry. The pins were removed and the faux hair was brushed using a fan tip brush to align the faux fur with the original fur. Toning was adjusted using the wax/solvent/dry pigment system to more effectively blend the fill with original fur color.
Areas of hair loss from past insect damage noted throughout the body of the hyena were toned to reduce their visibility. Toning was undertaken using gouache applied with a fine artist brush to areas of exposed hide. The areas of color loss (cracks) around the eyes were also toned using gouache. The small losses on the nose of the hyena were toned using gouache to blend with surrounding surfaces.

The fur of the mammal was realigned using the point of a bamboo skewer and various artist brushes. The glass eyes were examined and found to be stable within the mount. The eyes of the mount were cleaned using distilled water applied with cotton-tipped applicators and allowed to air dry. The completed hyena was attached to a new mount using stainless steel washers and nuts.

The original wood flooring of the diorama was covered with a multi-layer laminate (Marvelseal 470) to reduce future moisture migration into the diorama. Any openings along the interior perimeter of the diorama were sealed using expanded polyethylene rod (Backer Rod). The sand was reinstalled on the deck of the diorama and the hyena was installed in the diorama.

One 60 in. section of the 3400K LEDs with 1 in. separation was installed on the inside surface above the window of the diorama to illuminate the case. A silicone, pressure-sensitive acrylic adhesive backed gasket (Strip-N-Stick silicone rubber gasket 200A) was applied to the face of the wood frame to contact the interior surface of the glass panels and reduce or eliminate particulate infiltration into the diorama.
4. CONCLUSION

The variety of issues associated with the care and handling of natural history specimens, the complexity of conserving both natural and artificial materials included in the Hubbard Dioramas, and the unique and historic visual content of the dioramas made them both a challenge and a joy to conserve. The success of this project is a result of the collaboration of two conservators working in difficult and challenging circumstances to address the conservation of these unique and historically significant dioramas.

APPENDIX. USING THE MERCKOQUANT ARSENIC TEST KIT

The Merckoquant (EM Quant) Arsenic Test Kit is designed to detect the presence of arsenic (3+ or 5+ valance states) in water, soil extracts, pharmaceuticals, prepared biological materials, and liquid foods. The kit is designed to detect trivalent or pentavalent arsenic by converting the arsenic to arsine gas. This is accomplished by adding zinc dust (Reagent 1) to the samples, then hydrochloric acid (Reagent 2). The reaction between the metal and the acid generates hydrogen gas that combines with arsenic in the samples to produce arsenic trihydride (arsine, AsH₃), a very toxic, colorless gas with an odor of garlic (consequently, it is important to do the test with closed caps and to do it in a well ventilated area).

The arsine gas reacts with the treated portion of the test strip to produce a color change that is said to be indicative of the concentration of the arsenic present in the sample. The treated portion of the strip contains mercury bromide, which reacts with the arsine to form a colored compound.

Always wear a lab coat or a rubber lab apron, safety goggles, and heavyweight nitrile gloves while doing the tests. Conduct the tests in a fume cabinet or in a well-ventilated area. Never attempt to test more than 10 samples at a time.

Take samples using cotton-tipped swabs dampened very lightly with deionized water. Roll one side of the swab gently on the surface of the object/specimen, over as much area as possible. When dealing with taxidermy mounts and animal skins, concentrate on the areas around the eyes, nose, mouth, ears, ventral suture (if present), base of tail, and bottom of feet. Collect samples from each object/specimen on at least three swabs.

Always conduct the tests using a negative control – a fresh cotton swab tip dampened with deionized water. As long as there is no discoloration of the test strip over this swab, the results for the actual samples should be valid.

The test has been modified by Catherine Hawks:

• Using disposable styrene vials with snap caps as test vials (5 or 7 dram). The snap caps are slit to accommodate the test strips that are part of the kit, so that the test area of the strips extends into the headspace of the vials. Once the reagents have been added, the cap is immediately placed on the vial.
• Cutting the tips of the swabs and placing the tips in individual test vials.
• Adding few drops of a 1M or 1N potassium hydroxide solution to the swab tips in the vials to help dissolve the samples.
• NOT diluting the samples with water.
• Adding reagents in smaller quantities than indicated in the instructions. Usually ½ scoops of the Reagent 1 and 3 drops or so of Reagent 2 will suffice.
While the strips purportedly give a quantitative indication, the concentration is largely irrelevant for most museum objects. Arsenic salts were never applied evenly on these objects and the concentration in the sample is an artifact of the sampling procedure rather than a reflection of the overall concentration of arsenic on the objects. Consequently, the test results should be regarded as simply positive or negative for arsenic. If test results are equivocal (it is uncertain whether there has been a color change on the test strips for at least two of the three test samples), repeat the tests with fresh samples.

When the tests are completed, push the test strips down into the vials, collect the used vials in a sealed, heavyweight, zip top, plastic bag. The bag can be disposed of in ordinary trash because the amount of arsenic involved in 10 or fewer samples does not constitute hazardous waste (at least, based on testing to date), and because the potassium hydroxide helps to neutralize the acid.

SOURCES OF MATERIALS

Alpha cellulose powder  
Sigma  
P.O. Box 14508  
St. Louis, MO 63178

Backer Rod  
Thermwell Products Co., Inc.  
Mahwah, NJ 07430

Dry pigments  
Kremer Pigments Inc.  
228 Elizabeth Street  
New York, NY 10012

Golden Artist Acrylic Paints, MSA varnish  
Golden Artist Colors, Inc.  
New Berlin, NY 13411

Gouache  
Winsor & Newton  
London, England HA3 5RH

Grizzly craft fur #676-1654  
Joanne Fabrics

Kizukishi paper  
Andrews/Nelson/Whitehead  
31-10 48th Street  
Long Island City, NY 11101
LED: LIA & RIAs
   ProLume Inc.
   525 Fan Hill Road
   Monroe, CT 06468

Merckoquant (EM Quant) Arsenic Test Kit

Modostuc
   Peregrine Brushes & Tools
   41 N. Center, P.O. Box 200
   Wellsville, UT 84339

Paraloid B-72, Jade 403, Marvelseal 470
   University Products, Inc.
   517 Main Street, P.O. Box 101
   Holyoke, MA 01041-0101

Protex Mount Care
   Knoblochs
   1850 Dogwood Street
   Louisville, CO 80027

Strip-N-Stick Silicone Rubber gasket (200A)
   Greene Rubber Co. Inc.
   20 Cross Street
   Woburn, MA 01801-5606

Stainless steel insect pins
   Bioquip
   2321 Gladwick Street
   Rancho Dominguez, CA 90220

T-88 structural epoxy
   System Three Resins, Inc.
   3500 West Valley Highway North, Suite 105
   Auburn, WA 98001

Tyvek 1422A
   University Products, Inc.
   517 Main Street, P.O. Box 101
   Holyoke, MA 01041-0101
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TWO CONSERVATORS, A WHOLE LOT OF WALLPAPER
AND A ROOM WITH A VIEW – SCENIC RESPITE OR
RECIPE FOR DISASTER?

MICHAELA Z. NEIRO

ABSTRACT

Working with different personalities and getting along with others are aspects of the conservation profession that are ever present and seldom discussed. Conservators are a unique breed and have a great deal in common simply due to career choice, but considering the amount of creativity in the profession, it is reasonable to expect that two people faced with the same problem might approach it in different ways, especially if they are from different disciplines, different experience levels, and different countries. Throw into the conversation a curator with 40 years at the institution in question, a site manager who wants the house looking good for frequent photo shoots, and house guides who have been telling the public the same story for 10 years, and you have a decision-making process for a project with the potential to become completely unmanageable. The collaborative process can also lead to innovation, and an interdisciplinary approach provides learning opportunities for all concerned.

This paper will discuss this decision making process and the subsequent treatment of extremely damaged and degraded wallpaper with water sensitive pigments, which involved the successful use of cyclododecane as both a barrier layer and a facing adhesive.

1. CONTEXT OF THE CONSERVATION

1.1 THE HISTORIC HOUSE AND THE WALLPAPER

During the summer of 2007, treatment of 100 square feet of historic wallpaper in situ was undertaken by the Historic New England (formerly SPNEA) conservation staff in an effort to maintain the intended appearance of the historic interior, prevent further damage and loss to the paper, solve adhesion problems, improve the poor appearance and condition of the paper, and increase its longevity for the future. The treatment was conducted by the associate conservator at Historic New England, who is an objects conservator, and by a Mellon fellow who studied historic interiors in the Netherlands. Constraints of time, space, location and experience molded this project, but in the end creative, collaborative, and successful results.

Fig. 1. Beauport – The Sleeper-McCann house
(Photograph by Michaela Neiro)

Fig. 2. The Central Hall before treatment
(Photograph by Michaela Neiro)
Beauport, a sprawling marvel of a house literally on the cliffs of Eastern Point in Gloucester, Massachusetts, was built as a summer retreat by interior decorator Henry Davis Sleeper (fig. 1). Building began in 1907 in the style of a small Queen Anne cottage. Sleeper expanded it by continually adding rooms until his untimely death in 1934. One of the later-added rooms was the Central Hall - as its name suggests, a main thoroughfare between the rooms at Beauport (fig. 2). The condition of the wallpaper in this room had been a source of embarrassment for Historic New England for many years but there was no easy answer to improve its appearance.

The Chinoiserie wallpaper was likely hung around 1929 when the Central Hall was completed and dates approximately to that period. The wallpaper depicts a repeating pattern of Chinese figures, phoenix, hummingbirds, and exotic flora. Chinoiserie wallpapers were inspired by 18th-century Chinese hand-painted wallpapers and silk hangings. The Chinoiserie style was very popular at the turn of the century and lower quality papers such as this were used in Europe and America to satisfy demand. The paper is machine made, identified by the brittleness and brown color of the acidic wood pulp paper and the lack of horizontal seams common with handmade paper sheets. The wallpaper is printed in approximately 20 colors on ungrounded paper. The wallpaper has a roll width of 18 5/8 inches with a vertical repeat of 30 1/4 inches and there are no additional borders.

1.2 CONSERVATION CONSIDERATIONS

There are several factors that contributed to the poor condition and, therefore, appearance of the paper. The paper was darkened and embrittled over time, caused by the oxidation of the acidic wood pulp paper. As the paste dried and shrank over the years, delamination from the walls became widespread, as did tears and losses. The losses were especially unsightly since the paper was applied without a lining, and the rough, white plaster wall showed through. Additional loses were created by silverfish living in the dark, damp hall (fig. 3).

Fig. 3. The Chinoiserie wallpaper showing losses and dark stains (Photograph by Michaela Neiro)
Because the wallpaper was severely damaged, degraded and disfigured, the decision of whether to treat, replicate, or replace the wallpaper was a difficult one involving several people and several factors. With only a furniture conservator and objects conservator on staff (and they only for the past seven years), Historic New England has long debated the issue of how to deal with deteriorating wallpaper. Lacking the knowledge and training to handle large wallpaper treatments, and often without funding, projects such as this idled. Unlike paintings which can be sent out to a contract conservator one at a time, it is virtually impossible to treat only a portion of a room’s wallpaper. Eight years ago, treatment for this paper was outlined by a local wallpaper conservator, but the cost was prohibitive. Reproduction of the wallpaper was considered but would not only have been very expensive due to the 20 colors present, but would have resulted in a paper that looked too new in relation to all the other objects and furnishings in the house. A third option recently discussed by curators was digital reproduction. The advancements in this process are great, but it still requires excellent photography, reworking of the digital files to improve the paper's appearance, and, finally, printing. This too would be quite expensive and brings up the question of what then to do with the original?

2. DEVELOPMENT OF THE TREATMENT

2.1 TESTS AND MOCK-UPS

In 2006, the conservation department hired a post-graduate fellow named Judith Bohan who specialized in the treatment of historic interiors, particularly wallpaper. During the summer of 2007, a window of time opened for the conservation department to consider taking on the conservation of the wallpaper. In early spring, a 6 x 8 inch section that was mostly detached already was removed from a discrete location between a door and the ceiling for testing. It was quickly realized that the pigments, especially red, were water sensitive and that polyvinyl acetate (likely Elmer’s Glue, first marketed by Bordens in 1947) had been used in some areas to re-adhere loose bits. The areas with the PVAC were very difficult to remove dry and came off only with great effort and in small pieces. Water, and, where there was PVAC, water and ethanol, had to be used to remove the paper, therefore a barrier for the water sensitive pigments would be needed as well as a facing to hold together the small pieces.

The small sample was taken back to the lab to test cleaning methods, water barriers, and facing methods and materials. Cleaning methods such as contact washing with damp blotter paper on both sides, spraying with ethanol and water, and float washing in a bath on Hollytex for 5, 10, and 15 minutes were attempted. It was quickly realized that float washing would not be an option for several reasons: the pigments were too sensitive, the paper was too delicate, and the pieces were too small to wash individually. Although little visible change in appearance was made by any cleaning method, there was a significant improvement in the flexibility of the wallpaper, and yellow deterioration products were clearly being rinsed out.

2.2 TESTING CYCLODODECANNE AS A WATER BARRIER AND FACING ADHESIVE

A water barrier was needed, and it had to be something that would hold a facing on during removal, that could be used while the house was open for tours, and that wouldn’t slow down the treatment significantly. Mock-ups using water-sensitive paint on thin paper were made to test barriers paired with facing adhesives. Materials tested were gelatin, methylcellulose, Aquazol 200, Laropal K80, Paraloid B-67 in mineral spirits, and cyclododecane, each used with
Japanese paper, rayon paper, Hollytex and Mylar. Cyclododecane and Hollytex proved to be the best combination of workability, reversibility, and functionality. The material cyclododecane is a cyclic alkane, and looks like a waxy crystal (Brückle et al. 1999). It melts clear and can be brushed on through the Hollytex. The most useful feature of this material is that it sublimes after a few days, so no solvents would have to be used in the historic house to remove it.

3. IN SITU TREATMENT BEGINS

3.1 REMOVAL OF THE WALLPAPER AND PREPARATION OF THE WALL

Starting work on Monday when the house was closed for tours, the goal for the day was to remove the wallpaper, repair cracks in the wall with lightweight spackle, and apply a pre-cut piece of cotton canvas on the wall. The purpose of the canvas was to provide a buffer between the plaster wall and the cleaned wallpaper, create a flat smooth surface for reapplication, and provide a substrate to enable the removal of the conserved wallpaper if needed. Removing the wallpaper was by far the most difficult, stressful part of the treatment. The first step in preparing to remove the wallpaper was to make a tracing on Mylar of the panel, indicating major shapes, tears, and edges of the wallpaper. This was essential for accurately repairing and reattaching the wallpaper. Hollytex was taped to the painted molding directly above the panel using low-tack blue painter's tape. The cyclododecane was applied over large areas using two-inch chip brushes. Using a heat gun, the crystals were melted in glass jars and quickly brushed through the Hollytex, allowing it to penetrate the wallpaper (fig. 4). The cyclododecane solidified quickly, therefore it had to be frequently re-melted. Heating the cyclododecane in this manner did create potent fumes but they were very localized and dissipated quickly. Information on the health risks of cyclododecane is not available, but the room was well ventilated and exposure was limited. After the facing was applied on an entire section, the wallpaper was removed by sliding 16-inch-long Teflon spatulas specially made for this treatment between the wall and the faced wallpaper (fig. 5). Where PVAC was encountered, the wallpaper easily tore into small bits (0.5 x 0.5 inch to 6.0 x 6.0 inch sections), so in these areas, smaller, finer metal palette knives were used to remove the wallpaper. In many areas it was necessary to remove a thin portion of the plaster wall along with the PVAC and the wallpaper in order to remove the wallpaper section as intact as possible. Unfortunately the facing did not always hold these small pieces together, the result being a puzzle of small pieces.

After a discrete section was removed from the wall and placed face-down on the Mylar tracing, it was moved in cardboard folders to a small enclosed porch on site. Having to work around the hourly tours of the house, the goal was to re-hang each section by Friday so the Central Hall was kept as intact as possible during tours. On the small porch, the wallpaper was cleaned, pieced together, and lined with Japanese paper. Although the view from this cement room was beautiful, the physically demanding yet delicate task was a daunting one.
Fig. 4. Applying melted cyclododecane by brush (Photograph by Judith Bohan)

Fig. 5. Removal of the wallpaper with facing using a Teflon spatula (Photograph by Judith Bohan)
3.2 CLEANING THE ORIGINAL PAPER

Damp rayon paper was placed on the verso of the wallpaper to clean the paper by capillary action. This was fairly successful in removing yellow degradation products. Even though the dry wallpaper didn’t appear much lighter in color, it was noticeably stronger, more even in tone, and more flexible. While the paper was wet from the contact cleaning, the verso was scraped of the residual wheat starch paste, PVAC, and plaster removed with the paper in areas of previous repair. The PVAC came off the verso with much less difficulty after this prolonged wetting.

3.3 TEAR REPAIR

After cleaning the back, the wallpaper was flipped over to begin the tear repair portion of the treatment. Before-treatment photos were crucial at this stage to guide the correct placement of the small pieces. Using Zen Shofu wheat starch paste and thin strips of Japanese tissue on the verso, pieces were pasted together. A tacking iron and blotter paper were used to speed the drying of the wheat starch paste and inhibit tide lines (figs. 6-7). Due to the quantity of wheat starch paste used in this treatment, tests were conducted to determine the feasibility of using the significantly less expensive paste, Aytex-P. These were quite successful, but it was felt that the more refined Zen Shofu paste performed slightly better during the tear repair portion of the treatment. It was decided to only use the Zen Shofu paste exclusively during tear repairs.

3.4 REASSEMBLING AND LINING THE WALLPAPER

At the reassembly stage, only two days had passed since the application of the cyclododecane. With the Hollytex facing still in place, it was difficult to piece the paper back together. Therefore, the cyclododecane was melted with a tacking iron using a Mylar interleaf in order to remove the Hollytex without damaging the pigments. This saturated the paper with cyclododecane, but also sped up its sublimation. Cool temperatures and restricted airflow inhibit the sublimation of the material. Once large sections were assembled, the Mylar tracing was essential in facilitating the registration of the separate wallpaper sheets and fragments.

Once all the original wallpaper pieces from a discrete section of wall had been tacked together, the wallpaper was lined with a large sheet of Japanese paper. The Japanese paper was cut in advance from a roll to fit the section of wallpaper being treated, and toned with thinned acrylic paints to match the background color of the wallpaper. The toned Japanese paper was brushed with Aytex-P that had previously been cooked, cooled, sieved and thinned, and then was adhered to the verso of the repaired wallpaper. The lining paper was pounded using a Japanese Nazehabe brush to improve adhesion. After applying the lining, the wallpaper was dried between wool felts (fig.8).
Fig. 6. Assembling small sections of wallpaper using wheat starch paste and Japanese tissue strips (Photograph by Michaela Neiro)

Fig. 7. Japanese tissue “band-aids” on the verso (Photograph by Michaela Neiro)
3.5 REHANGING THE TREATED PAPER

The following day, the paper was ready to be re-hung. A section of toned Japanese tissue was applied on top of the previously-attached canvas with wheat starch paste to encourage better bonding with the wallpaper (fig. 9). The cleaned, repaired, and lined wallpaper was pasted with a 50/50 mixture of wheat starch paste and methyl cellulose for easier positioning. The Mylar tracing was used to support the lined, pasted wallpaper section and lift it into place. Once positioned, paint rollers and the Japanese pounding brush were used to firmly adhere the wallpaper in its original place. The Mylar was removed and the wallpaper was blotted with paper towels to wipe off excess paste. After the wheat starch paper was dry and the wallpaper flat, areas of loss were compensated using pastel pencils to continue the lines of the pattern.
4. CONCLUSION

All in all, the two conservators wrote out 121 steps to the treatment. Agreeing on these steps and their relative importance versus time pressures was not always easy, nor was working side by side in a little room all day, or in the way of tour guides and house visitors. No matter how well you get along in a lab working on your own projects, site work is completely different. Factor in different disciplines, nationalities, and training, and conflicts were bound to arise. With all the challenges this treatment offered, in the end it was a resounding success. The wallpaper is now flat, firmly adhered to the wall, losses are filled, and the danger of further loss is greatly mitigated. The treatment of the first floor of paper took approximately 800 hours and was completed for one fifth the cost of the contract estimate, based on hourly wages, travel costs, and materials.

The key to this treatment was the innovative use of cyclododecane as a water barrier and facing adhesive. Surprisingly, the cyclododecane took much longer to sublimate than expected. Several reasons for this could be the thickness in which it was applied, the cool air in the house, the lack of air circulation around the cyclododecane, or simply that the author had never used the material in that great a quantity before and therefore did not know what to expect. Since water was used at several stages in the treatment, it was an advantage to have the cyclododecane remain, but its bulkiness and resistance to adhesives caused other problems. Cyclododecane is a unique material that, with further use and research, has great potential in the field of conservation.

ACKNOWLEDGEMENTS

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NOTE

1. Elmer’s was originally part of the Borden® Company, which introduced the first consumer white glue in 1947. It is a PVAC adhesive.

REFERENCES


Elmer’s Glue. [www.elmers.com](http://www.elmers.com) (accessed 08/13/2012)
SOURCES OF MATERIALS

Zen Shofu, Aytex-P, methyl cellulose, Hollytex, Mylar
   Talas
   568 Broadway
   New York, NY, 10012
   (212) 219-0770
   www.talasonline.com/

Cyclododecane
   Kremer Pigments Inc.
   228 Elizabeth St.
   New York, NY 10012
   (212) 219-2394
   www.kremerpigments.com

Sekishu extra thick Japanese paper, Rayon paper thick roll, Noribake paste brush, Naezake
   pounding brush
   Hiromi Paper International
   2525 Michigan Ave. G9
   Santa Monica, CA 90404
   (310) 998-0098
   www.hiromipaper.com

Golden Acrylic Paints
   Golden Artist Colors, Inc.
   New Berlin, NY 13411
   (607) 847-6154
   www.goldenpaints.com

DAP Lightweight spackle
   Local hardware store

Pastel pencils
   Local art supply store

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BITTEN BY THE BUG: THE INTEGRATED PEST MANAGEMENT WORKING GROUP’S COLLABORATIVE APPROACH TO PROVIDING IPM RESOURCES FOR THE MUSEUM COMMUNITY

RACHAEL PERKINS ARENSTEIN, NEIL DUNCAN, LISA ELKIN, RICHARD MONK, AND CHRIS NORRIS

ABSTRACT

An effective integrated pest management program requires the involvement of staff throughout an institution, including conservators, collection managers, facilities staff, and administrators. These individuals all have important roles to play but due to other priorities they may not have the time necessary to fully implement and operate their integrated pest management program. This was the guiding principle behind the formation of the Integrated Pest Management Working Group, an ad hoc collaboration of conservators, collection managers, pest management professionals, and others from the United States and abroad.

This group does not teach integrated pest management, as participants are expected to already be familiar with general integrated pest management principles. Instead, the Integrated Pest Management Working Group focuses on providing resources to make it easier for the broader museum community to develop and implement their own integrated pest management programs. The goal of the Group is to promote and facilitate good integrated pest management practices and collaboration at the personal and institutional levels through the development and online distribution of training materials and other resources.

A brief history will be presented on the creation of the group, from a simple collaboration on a single computer program by two institutions, to a large group with over 60 members from the United States, Canada, and Europe, and an annual meeting that attracts 25-30 participants each year. This presentation will describe some of the initiatives being pursued by the group and available on the website www.museumpests.net, including the developing online resources for collections care personnel to use in identifying real or potential threats to their collections; assessing the need for integrated pest management databases; developing training resources, both printed and electronic, for museum staff with pest management responsibilities; and compiling best practices documents and information regarding various treatment methods.

Additionally, the paper will also examine the challenges created by the loose, ad hoc organizational structure, the distance between collaborators, and the lack of dedicated staff time in keeping such collaboration moving forward so that each institution need not “reinvent the wheel.”

1. INTRODUCTION

Heritage Preservation’s Heritage Health Index 2005 survey found that the most urgent preservation need at US collecting institutions is environmental control which, for the purposes of their project, encompassed temperature, relative humidity, light, pollutants, and pest control. In a breakdown that examined the needs of museum and historical societies that together account for 22% of the 4.8 billion collections items in the United States, approximately 75% of these institutions require an integrated pest management program with 20% of that being an urgent need.

Those numbers aren’t all that surprising. Anyone who has tried to implement or carry out an integrated pest management program is aware that it is a time consuming task and therefore easy to switch to a back burner in favor of more pressing or easily accomplished projects. What is surprising is that, as a profession, conservators have not yet adequately helped address this need better. Rather than addressing challenges in discipline specific groups like objects, paintings, and paper, as is done at the American Institute for Conservation annual meeting, the Heritage Health Index survey confirmed that the best way to protect collections is by focusing on
preventive conservation which benefits from cross-discipline collaboration. This is particularly true with projects such as environmental and pest monitoring, which often must be done institution-wide to maximize their efficiency and efficacy. These types of projects require collaboration that must be creatively conceived and executed.

The ongoing effort of the Integrated Pest Management Working Group, known as the IPM-WG, to collaboratively address the needs of collection holding institutions’ integrated pest management projects is examined here with the goals of: introducing AIC members to the resources currently available on the group’s website, [www.museumpests.net](http://www.museumpests.net), convincing conservators to join the group and loan their time and talents to the cause, and presenting the IPM-WG’s efforts as a model for other cross-discipline preservation projects.

2. WHAT IS INTEGRATED PEST MANAGEMENT (IPM)?

IPM is a strategy that emphasizes prevention and minimizes the use of toxic chemicals to manage and eliminate pests. A functional IPM plan works to reduce the possibility of pests accessing collections, monitors levels of pest activity, and, if necessary, deals with remedial treatment. The downside to IPM is that it is time consuming and, like some other preventive care projects, it can be hard to put a price tag on the benefits of the time expenditures. However, as pesticides and fumigants are increasingly limited for institutional use, a reasonable IPM plan is really the only viable option for preventing infestations in collections.

3. HISTORY OF THE IPM-WG

3.1 INITIAL COLLABORATION

The seeds of the IPM-WG began out of straightforward bi-institutional collaboration based on a desire not to reinvent the wheel while working on integrated pest management issues for the Move Project at the National Museum of the American Indian (NMAI) in 2001. During the Move Project, as well as now, the institution had a firm commitment to good pest management practices. However, the purpose of the work in the NMAI’s Bronx Research Branch (RB) facility was to move the collection out, so while preventive measures such as pest or environmental monitoring were conducted, it was with an eye on the clock, as every staff hour spent on those tasks were ones not spent on the core mission (fig. 1). The collection assistant who carried out the pest monitoring had already moved from a paper based recording system for tracking her pest data to an Excel spreadsheet. But, other than a statistical breakdown of pests each month, there was little she could do with the data (fig. 2). NMAI staff members remembered that colleagues at the American Museum of Natural History (AMNH) had created a particularly good Access database that not only allowed them to record their pest captures and present the data in graphical form (fig. 3), but also to map them on a floor plan, giving them a visual perspective that was particularly useful in identifying hotspots of pest activity in the building (fig. 4).

In a meeting with the creators of the AMNH Pest Manager Database, Neil Duncan, Chris Norris, Lisa Kronthal Elkin, and George Ramos, NMAI Research Branch staff offered to supply information on how to use bar codes and scanning technology to speed data entry if AMNH would share their database and allow it to be modified for NMAI’s needs (fig. 5). There was a steep learning curve in adapting their program but, several months after the first meeting, NMAI was able to use the database at the RB facility.
Fig. 1. Monitoring for pests during the NMAI move (Photograph by Rachael Perkins Arenstein)

Fig. 2. Evolution of data recording during the NMAI move (Photograph by Rachael Perkins Arenstein)

Fig. 3. Screen captures of the AMNH Pest Manager Database data entry and floor plan screens

Fig. 4. Screen captures of floor plan and graphical outputs from the AMNH Pest Manager Database

Fig. 5. Barcodes and scanners in use at NMAI to speed data entry on pest names and trap numbers (Photograph by Rachael Perkins Arenstein)
Ultimately, though, the question was, did using the Pest Manager Database save time in completing pest-monitoring tasks? Discounting the time spent setting up the program and researching the contribution of scannable barcodes (not inconsequential expenditures), using the program was found to save time, dropping bimonthly monitoring times to from 19 to 16 hours. Once scannable barcode labels for the insect traps were introduced, monitoring times dropped to about 10 hours. Use of the program also increased the quality of the data and so the project was considered a success (fig. 6).

### Monitoring Times

- **19 hours without database** (bimonthly collection)
- **16 hours with database** (bimonthly collection)
- **10 hours with database and scanning** (monthly collection)

![Monitoring Times](image)

Fig. 6. Identification of pests at NMAI (Photograph by Rachael Perkins Arenstein)

### 3.2 WIDENING THE COLLABORATIVE SCOPE

During one of the AMNH-NMAI meetings, the idea of having an IPM “think tank” was discussed. The goal was to begin communication with some of the other colleagues known to be working in this area, such as Richard Monk, a collection manager at the Museum of Texas Tech University and Tom Strang of the Canadian Conservation Institute (CCI). In 2002, the AMNH staff arranged the first meeting with staff from all these institutions present and one important addition – Leon Zak of Zak Software. Leon is the lead programmer for the Rochester Institute of Technology’s (RIT) Image Permanence Institute’s (IPI) Climate Notebook software and his presence was supported by IPI after their director Jim Reilly was convinced of the relationship between environmental conditions and pest activity.

Discussion during this initial meeting focused on development of databases with potential for mapping pest activity, identification of essential data fields for databases, and the need to survey the community regarding IPM activities and needs. Shortly after this one-day meeting the group’s first product was created, courtesy of Leon: a listserv for IPM related topics now known as the Pestlist. At its conception the list was a way for the 11 members present at that first meeting to communicate. Now, six years later, this e-mail list has over 600 subscribers and serves as a venue for discussion of IPM, pest treatment and insect identification issues. This gives people immediate access to experts like David Pinniger or the staff of Insect Limited to help with their issues.

It is important to point out that at this initial meeting, only three of the 11 members were conservators. The rest were collection managers, administrators, a conservation scientist, and the programmer. This was an essential element of the group’s success, as it is for the success of an...
effective integrated pest management program, which requires the involvement of staff throughout an institution.

Two years later Richard Monk moved from Texas Tech to take up the position of curatorial associate of mammalogy at AMNH and revived the idea of the pest group. Invitations were sent to the preservation community via the Conservation DistList and the Natural History Collections listserve, NHCOLL-L, and in February 2005, with 19 people in attendance, the second meeting was begun with a self-imposed mandate to assist the museum community with IPM issues. Participants were present from the following institutions: American Museum of Natural History; Smithsonian Institution - National Museum of the American Indian; Museum of Fine Arts, Boston; Peabody Museum of Archaeology and Ethnology, Harvard University; Yale Peabody Museum of Natural History; Milwaukee Public Museum; Canadian Conservation Institute; Swedish Museum of Natural History; Insects Limited; and Zak Software.

There were several things done during this second meeting that set the stage for a constructive process to follow. First, while the meeting was open to the public, it was made clear from the beginning that the agenda would not include teaching basic IPM principles. Early participants were people who had existing IPM programs or pest management experience and were willing to help the broader community develop and implement their own IPM programs. The impetus for most of these people, other than altruism, was a desire to gain from what others had already done and hopefully achieve a product that would be impossible alone.

One of the first orders of business was to determine what we hoped to accomplish. After bandying around many ideas, a basic mission statement was agreed upon.

The goal of the group is to promote and facilitate good IPM practices and collaboration between staff and institutions through development and online distribution of training materials and other resources.

The AMNH staff who arranged the meeting had put a lot of thought into coming up with ideas – but, from the beginning, most decisions were made democratically. The group discussed a ‘starter’ list of possible topics to which additions and refinements were made. The list included the following topics:

- Software for Mapping and Monitoring
- Data Collection
- Rapid Processing
- Identification Aids
- Standards & Best Practices
- Treatment
- Education/Dissemination
- IPM Website

Participants then listed their first three choices of topics for discussion. The top three choices based on the votes were Standards & Best Practices, Data Collection, and Identification Aids. These formed the initial subgroups. Each subgroup broke out and met to establish goals, and members of the group left with short, medium, and long-term assignments.

There was a discussion at the end of the meeting about allying with an established preservation organization, but there was consensus that it was best at this point to remain an unaffiliated, ad hoc group. The AMNH Division of Vertebrate Zoology, however, did give a
commitment to host a yearly meeting of the working group, and so a meeting date for 2006 was set.

Shortly after this second meeting, three new products were completed. The first was the formation of a website, www.museumpests.net, as a place to make the Working Group’s information available to each other and to the wider community (fig. 7).

![Fig. 7. Screen capture of www.museumpests.net homepage as of May, 2008](image1)

The second was a release of a pest management database called Zpest, developed by Leon Zak. This free, downloadable program organizes pest observation data and presents it in graph and/or report format. The format is based on the basic field suggestions created by the Data Collection group. This program is basic but can be used by institutions of all sizes that are looking to do more than just record pest monitoring captures on a spreadsheet (fig. 8).

![Fig. 8. Screen capture of Z-Pest database developed by the Zak Software and the Integrated Pest Management Working Group available on www.museumpests.net](image2)
The third product was the IPM Questionnaire, which was used to survey the preservation/museum community to learn more about what others’ concerns were. The 30 questions covered information on the respondents and their institutions, and their current monitoring, pest identification, and data analysis needs. Since then, the data from the approximately 100 respondents has been used to ensure that the work of the IPM-WG subgroups is addressing the needs of the community (fig. 9).

![Fig. 9. Screen capture of the IPM-WG Questionnaire used to guide the group’s work](image)

In February 2006, the third meeting of the IPM-WG was held and was attended by 25 individuals representing the following institutions: American Museum of Natural History; Smithsonian Institution - The National Museum of the American Indian; National Museum of Natural History; Museum Support Center; Historic New England - Society for the Preservation of New England Antiquities; Peabody Museum of Archaeology and Ethnology, Harvard University; Yale Peabody Museum of Natural History; U.S. Army Heritage and Education Center; Canadian Museum of Nature; Museum of Fine Arts, Boston; Natural History Museum, London; Insects Limited; Steritech; and Zak Software.

Obviously, not everyone from the 2005 meeting was able to attend, but there were enough returning members to ensure continuity and new members to bring energy. In addition to the various institutions, participants came from Insects Limited and Steritech, pest control companies that serve the museum community and were interested in learning more about museum IPM needs. The IPM-WG has been particularly grateful for the continued support of Insects Limited, where general manager Pat Kelley has not only been an active member of the IPM-WG but has also donated demo materials and some funds to cover coffee breaks for the annual meetings.

In 2006, two additional subgroups were added: Treatments and Web Resources. The format of the two-day meetings was, by now, established. The group would meet as a whole for introductions, a review of past activities, and the goals for the present meeting. Then participants would break out into subgroup sessions. The groups would reconvene at the end of the day to review accomplishments and assignments as a whole. Because some participants were only able
to get travel funding if they ‘presented’ their work, people were encouraged to give presentations during the coffee breaks over the two days to describe efforts in their home institutions (fig. 10).

The Web Resources group was the only one that included everyone to ensure coordination across subgroups and because, ultimately, the website was the vehicle for all of the groups’ work. At this time, a portion of the website was password-protected so that WG participants could post documents in progress. Wiki pages were added to the Working Group’s password-protected portion of the site. Wiki pages (like those on Wikipedia) allow people to add, remove, edit, and change content in an accessible format. This was designed as a tool to allow subgroup members to communicate efficiently. Some groups used them effectively; others preferred to communicate the old fashioned way - using e-mail.

The fourth meeting in 2007 involved participants from two institutions (Denver Museum of Nature and Science and the Lower East Side Tenement Museum) in addition to the returning 2006 participants. Several former participants who were not able to attend the meeting continued to contribute remotely or by designating someone else from their institution. The authors of this paper continued to organize the meeting and the website, but in an effort to emphasize the non-hierarchical nature of the organization, adopted the term “local organizing committee” rather than “leadership.” While these individuals were initially the chairs for the all the subgroups, by 2007 the positions had been turned over to others and other volunteers were sought as new subgroups were created. The goal was not only to avoid burnout and spread the workload, but also to empower the group. Chairs were told to use the questionnaire to guide their work but were given full authority to decide with their members their own goals and assignments. It was explicitly stated that subgroup chairs would have enough to do in delegating and organizing the
workload, and should not feel that they had to produce product as well. It was emphasized that the tasks of the IPM-WG would fall low on the “To Do” list when people returned to their institutions, and that some deadlines would be missed. When that happened, the subgroup chairs would have to reassess, reassign tasks if necessary, and keep the local group informed on their progress.

By this time it was clearer who in the group would actually complete their promised contributions, and when tasks would have to be revised or reassigned. The local group also became a bit more realistic about what work would be actually completed during the year. Assignments that people could do on their own, e.g. writing case studies, collecting documents, and creating bibliographies were often successfully completed, but collaborative efforts, such as vetting products, were best done face to face at the meetings. By this point, the established subgroups spent less time in determining what products they wanted to work on, and the meeting’s schedule was reformatted to provide the groups time to actually sit and carry out some of the necessary work then and there.

The group at the 2008 meeting included an even wider range of institutions, adding libraries and archives as well as smaller historical societies. Participants represented the following institutions: American Museum of Natural History; Smithsonian Institution - National Museum of the American Indian; Smithsonian Institution - Museum Support Center; Harvard University Herbaria; Sterling Memorial Library, Yale University; U.S. Army Heritage and Education Center; Historic New England - Society for the Preservation of New England Antiquities; Canadian Museum of Nature; Natural History Museum, London; Denver Museum of Nature and Science; Lower East Side Tenement Museum; Museum of Fine Arts, Boston; Baltimore Museum of Art; Upstate History Alliance; Insects Limited; and Zak Software. The presence of the libraries and smaller institutions forced the group to think about broadening the goals and focus so that the website could serve the needs of a wider audience if it is made more appealing and accessible.

4. THE SUBGROUPS AND PROJECT STATUS

What follows is an overview of the goals of each IPM-WG subgroup and a status report as of Fall 2008.

4.1 IDENTIFICATION AIDS SUBGROUP

The number one desire from our questionnaire respondents was for online identification resources. So the ID Aids subgroup’s medium-term goal, which is rapidly nearing completion, is a series of printable fact sheets. The group first developed a template, and since then has begun to collect data and images on the top offenders as voted on by respondents to our questionnaire. Those pests include:

- American Cockroach *Periplaneta americana*
- Black Larder Beetle *Dermestes ater*
- Brownbanded Cockroach *Supella longipalpa*
- Casemaking Clothes Moth *Tinea pellionella*
- Cigarette Beetle *Lasioderma serricorne*
- Drugstore Beetle *Stegobium paniceum*
- Firebrat *Thermobia domestica*
- German Cockroach *Blattella germanica*
• Hide Beetle *Dermestes maculatus*
• Larder Beetle *Dermestes lardarius*
• Odd Beetle *Thylodrias contractus*
• Oriental Cockroach *Blatta orientalis*
• Silverfish *Lepisma saccharina*
• Vodka Beetle *Attagenus smirnovi*
• Warehouse Beetle *Trogoderma variabile*
• Webbing Clothes Moth *Tineola bisselliella*
• White Shouldered House Moth *Endrosis sarcitrella*

The first series of these sheets should be available in the fall of 2008, but prototypes are currently on the website (fig. 11). The long-term goal is a searchable, text and image database for identification available through the website. The subgroup is still seeking high quality images of pests on traps as well as damage from specific pests, and if there is anyone who is willing to share their images they can contact the subgroup chair whose contact information is available on [www.museumpests.net](http://www.museumpests.net). In a recent, exciting collaboration, Gregory Smith, who teaches the preventive conservation class at the Buffalo State College Art Conservation program, has assigned students to complete research for some of the unassigned pests. Their work will be vetted by the IPM-WG’s entomologists. This has provided the students with a practical academic exercise and hopefully provided the IPM-WG with enthusiastic foot soldiers with access to extensive library resources.

![Fig. 11. Pest Identification sheets developed by the IPM-WG and available on www.museumpests.net](http://www.museumpests.net)
4.2 STANDARDS AND BEST PRACTICES SUBGROUP

The Standards and Best Practices subgroup focused in on two main goals. First, to collect, vet and post IPM-related material that the group thought exemplified best practices. Over 40 examples of policies, procedures, and other related documents were chosen for placement on the www.museumpests.net Resources page (fig. 12). 2008 saw the completion of the next stage, production of templates for developing policy and procedure documents. The templates contain lists of headers and information or questions that the institution should address for each section. The goal is for institutions to write their own policy and procedure documents using the templates as a guide and the other documents as examples. Another useful tool on the website is the ‘grid’ which is helpful in understanding what arguments might effectively make the case for IPM at different levels within an institution (fig. 13).

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**Fig. 12.** Documents created by IPM-WG participants for the Standards & Best Practices subgroup and available on www.museumpests.net

**Fig. 13.** The Standards & Best Practices subgroup Grid document that identifies the various institutional stakeholders in an IPM plan and available on www.museumpests.net
4.3 DATA COLLECTION SUBGROUP

The goals of the Data Collection subgroup are to help institutions organize their IPM data, and, if possible, speed data entry. In addition to the ZPest database program mentioned above, there is an annotated list of IPM database fields for people interested in developing their own database. Also available on the site is a forum where people can share their database with others and evaluate the pros and cons of different programs (fig. 14).

![Z-Pest Database](image1)

Fig. 14. Screen capture and documents of products created by IPM-WG participants for the Data Collection subgroup available on [www.museumpests.net](http://www.museumpests.net)

4.4 TREATMENT SUBGROUP

The work of the Treatment subgroup has focused on creating summary fact sheets with a standardized format so museum staff can determine whether physical, chemical or modified atmosphere treatments would be right for their collections. These are further illustrated by case studies written by participants. These, too, have a standardized format allowing for easy comparison (fig. 15).

![Treatment fact sheets and case studies](image2)

Fig. 15. Screen capture and documents of products created by IPM-WG participants for the Treatment subgroup available on [www.museumpests.net](http://www.museumpests.net)
4.5 VISUALIZATION SUBGROUP

In 2007, due to popular demand, the Visualization subgroup was started. The group is tasked with identifying programs such as geographical information systems, or GIS, that allow for mapping and visualization of pest activity. Some institutions have found this an invaluable resource for identifying pest problems in their buildings. Ultimately, the work of this subgroup will be combined with the work of the Data Collection group (fig. 16).

Fig. 16. Screen captures of products created by IPM-WG participants for the Visualization subgroup available on www.museumpests.net

4.6 WEB RESOURCES SUBGROUP

The goal of the Web Resources subgroup is to help make www.museumpests.net the best entry portal for IPM information on the Internet. On the site’s Resources page there is a comprehensive bibliography, as well as links to various IPM-related web resources that members have found useful (fig. 17). There are training PowerPoint presentations for download and announcements of other useful IPM-related classes and activities (fig. 18). Collaborations have begun with the ICOM Ethnographic Group Pesticide Project. For the most part, the groups have completed or are nearing completion on their medium-term goals, and are closing in on their long-term ones.

Fig. 17. Screen captures of products created by IPM-WG participants for the Data Collection subgroup available on www.museumpests.net
5. TIPS

Participants in the IPM-WG eventually started to see this group as a model for cross-institutional and cross-discipline collaboration, and this paper was presented with the hope that some of these suggestions might be helpful to other groups or projects.

- Draw on expertise of all stakeholders - One of the strengths of the IPM-WG is that it draws from the experiences and expertise of a wide range of individuals and institutions, and can truly be seen as a community led and supported process. The group has representatives of almost all the stakeholders involved, and participants with certain forms of expertise were actively recruited when necessary. The exception is that are no facility managers participating, which will hopefully be rectified in the future.

- Open to the community - While the group is open to all, making it clear that IPM wouldn’t be “taught” and that participants would be leaving with assignments encouraged motivated participants. Interns or Fellows were allowed to participate with the understanding that assigned tasks could take up to 20 hours throughout the year, and that it was expected that supervisors be supportive and ultimately responsible for honoring those commitments. There is no cost to attending the meeting, but individuals and their institutions cover their own travel and accommodation expenses.

- Flexible organizational structure - Although AMNH has generously hosted the meetings, the IPM-WG is not affiliated with any particular institution or professional society, which has afforded it a flexible structure. The reality, though, is that the early organization of the group and continued work running the meetings has been facilitated by our cohesive core local committee.

- Transparent work process - Throughout the process, the group’s goals have been practical – to develop tools and resources that can be downloaded and used by any institution. The
Recruit good leadership - It is essential to assign leadership roles strategically. There were times when people were reasonably hesitant to take new assignments onto already heavily laden plates. Subgroup leadership has been excellent, in particular the contributions of Emily Kaplan of NMAI and Pat Kelley of Insects Limited.

Set realistic goals and show progress - To keep people motivated, e-mail updates are used to publicize progress, when groups complete goals and assignments, and when new material is posted to the website. The repeated updating of our short and medium goals shows that participants are chipping away at long-term objectives and keeps the momentum going. There is no desire to be overly demanding of volunteers and it is recognized that group deadlines will be missed, but numerous missed deadlines without any comment leads participants to feel that the work wasn’t really needed or necessary. Subgroup chairs occasionally need to be heavies to make sure that people know that their contributions are needed.

Take good minutes - A final practical piece of advice is to take careful minutes at meetings. On a number of occasions when participants dropped out at the eleventh hour or when groups transitioned their leadership, having detailed and complete minutes allowed the local committee to guide the subgroups back on track and get new leaders up and running.

6. CONCLUSION

The main project for 2009 is to identify how funding can be secured to improve the website. Much is already asked of participants, so raising money through fees was thought inappropriate. Grant applications were considered unrealistic given the group’s limited resources and the large amount of work for what was considered to be a small amount of money. At this point, the group has identified sponsorship of the website (not of the actual working group) as the most viable option for raising money. While advertising on the website is undesirable, it was hoped that a sponsorship page with links to supporting groups, institutions, and select commercial vendors whose interests align with the IPM-WG would be an option.

There have been many moments in this process when the local committee has thought of phasing out the project, but then something will happen; a mention by a colleague of how useful some of the materials are, or chancing upon an online link to www.museumpests.net that gives us the boost needed to keep forging ahead. There has been planning, though, for an “exit strategy.” It is hoped that most of the initial long-term goals will be completed in the next few years and so the question of what to do then is frequently revisited. At the point when the site is considered for the most part complete and only requires periodic updating, it should be handed off to an organization to host, but at this point it is not clear who that might be. Choosing organizations like the AIC would be seen as precluding non-conservators who make up the majority of the group. Choosing the Society for the Preservation of Natural History Collections (SPNHC) would seem to preclude art museums, libraries and archives, and the American
Association of Museums (AAM) seems to lack a place where this would fit in their structure. The reality is that as long as an organization will keep the site available, it wouldn’t actually preclude use by anyone, but the perception that this is only for certain groups has been a problem for IPM-WG members. Determining what organization might best exemplify the IPM-WG’s interdisciplinary approach and deal with the broadest concerns of all stakeholders at collecting institutions is in progress.

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SAVING GRAND CANYON RIVER RUNNING HISTORY

BRYNN BENDER

ABSTRACT

Modern adventurers have been traveling through the Grand Canyon on the Colorado River since 1869. The Grand Canyon National Park Museum collection contains 18 boats that have made historic journeys on this amazing river from 1909 to 1965. The history of running such an important river is captured in this collection. This article will include an overview of the National Park Service’s project to preserve and exhibit these boats. The project has been a highlight for the park and the river running community. It has involved numerous volunteers, river runners, architects, historians, and park staff over the past five years. Overall, the boats are in good structural condition but their surfaces were damaged from outdoor storage conditions. Getting the boats into appropriate storage posed interesting challenges due to their size and public interest. Treatments of the four oldest wooden boats have been undertaken over the past four years. Condition problems thus far have involved dirt, staining, excessive linseed oil, unstable paint, torn and distorted canvas, and corrosion. Stabilization of these large boats required multi-disciplinary techniques. Future treatments include cleaning and stabilizing a rubberized canvas on a kayak, a painted polyethylene raft, a homemade fiberglass kayak, oxidized gel-coated fiberglass jet boats, and two jet propulsion systems and three motors. An inflation support for a large WWII rubber raft must also be located.

1. INTRODUCTION

A collection of historic boats is finally getting the attention they deserve to tell the story of running an incredible river. The Colorado River runs 277 miles through one of the greatest natural wonders in the world, the Grand Canyon. Nowhere along the river are the waters more violent and majestic than through this park where the river drops 2,000 feet within the park’s boundaries. It has proved a real canyon-carving machine. The Grand Canyon was formed 5-6 million years ago by a handful of major geologic events, such as tectonic plate movement, water, and wind erosion. It has close to 2 billion year-old rock at the lowest visible level along the river.

There is a Native American story of a Hopi man who traveled down the river in a dug out cottonwood tree, to the sea where he learned about the Snake god and the ceremonies and songs that were necessary for bringing rain to his people. In the 1800s, the canyon was one of the last unexplored territories in the US. In 1869, John Wesley Powell, war veteran and geologist, mail ordered wooden boats from Chicago to attempt a trip through this area. He was successful and proved that the river went through here from Colorado to the Gulf of California. A western white man had never done it. Powell named formations along the way and named this place the Grand Canyon. By the 1880s sightseeing groups arrived and in 1919 it was declared a National Park. Before the introduction of the 1950s rubber raft, which allowed for safer travel down the river, fewer than 100 people faced the rapids and lived to tell the tale.
2. HISTORY

The Grand Canyon National Park Museum collection contains 20 boats that have made historic journeys on the Colorado River from 1909-1963. There are wooden boats, plastic boats, a motorboat, metal boats, fiberglass jet boats, kayaks, and canoes. These boats span the various design styles that tried to get it right, some successful and some not.

<table>
<thead>
<tr>
<th>Boat name</th>
<th>User</th>
<th>Significant date</th>
<th>Primary material</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stone</strong></td>
<td>Julius Stone</td>
<td>1909</td>
<td>Wood</td>
</tr>
<tr>
<td><strong>Defiance</strong></td>
<td>Ellsworth Kolb</td>
<td>1911</td>
<td>Wood</td>
</tr>
<tr>
<td><strong>Edith</strong></td>
<td>Emery Kolb</td>
<td>1911</td>
<td>Wood</td>
</tr>
<tr>
<td><strong>Ross Wheeler</strong></td>
<td>Charlie Russell/Bert Loper</td>
<td>1915</td>
<td>Metal</td>
</tr>
<tr>
<td><strong>Glen</strong></td>
<td>U.S. Geological Survey</td>
<td>1921-1923</td>
<td>Wood</td>
</tr>
<tr>
<td><strong>Canoe, canvas-3</strong></td>
<td>David D. Rust</td>
<td>1920's</td>
<td>Canvas</td>
</tr>
<tr>
<td><strong>WEN</strong></td>
<td>Norm Nevills</td>
<td>1938</td>
<td>Wood</td>
</tr>
<tr>
<td><strong>Mexican Hat</strong></td>
<td>Norm Nevills, Don Harris</td>
<td>1938</td>
<td>Wood</td>
</tr>
<tr>
<td><strong>Escalante kayak</strong></td>
<td>Alexander &quot;Zee&quot; Grant</td>
<td>1941</td>
<td>Canvas and wood</td>
</tr>
<tr>
<td><strong>Esmeralda II</strong></td>
<td>Ed Hudson, JP Riggs, Doc Marston</td>
<td>1949</td>
<td>Wood</td>
</tr>
<tr>
<td><strong>Woman of the River</strong></td>
<td>Georgie White</td>
<td>1954</td>
<td>Neoprene</td>
</tr>
<tr>
<td><strong>Gem</strong></td>
<td>Stephen “Moulty” Fulmer</td>
<td>1950's</td>
<td>Wood</td>
</tr>
<tr>
<td><strong>Jet Boat - Wee Red</strong></td>
<td>Bill Hamilton, Jon Hamilton, Guy Mannering, Phil Smith</td>
<td>1960</td>
<td>Fiberglass</td>
</tr>
<tr>
<td><strong>Jet Boat - Dock</strong></td>
<td>Bill Hamilton, Jon Hamilton, Guy Mannering, Phil Smith</td>
<td>1960</td>
<td>Fiberglass</td>
</tr>
<tr>
<td><strong>Fiberglass Kayak</strong></td>
<td>Walter Kirshbaum</td>
<td>1960</td>
<td>Fiberglass</td>
</tr>
<tr>
<td><strong>Music Temple</strong></td>
<td>P.T. Reilly and Martin Litton</td>
<td>1962</td>
<td>Wood</td>
</tr>
<tr>
<td><strong>Sport Yak II</strong></td>
<td>Dock Marston</td>
<td>1963</td>
<td>Plastic</td>
</tr>
</tbody>
</table>

Fig. 1. Colorado River at horseshoe bend (Photograph by Brynn Bender)
The *Stone* boat of 1909 was the first time a vacationer had hired a guide to go down the river just for fun. Nathaniel Galloway designed this boat; he had traveled down the river before on hunting trips. He came up with the design ideas for a wooden boat that have stood the test of time on this river. Previous boats were large, long and difficult to control in the intense rapids of the Colorado. He designed a narrow, shallow one-man boat. It was flat bottomed, with watertight compartments. It was light so it could be maneuvered in rapids that were filled with boulders. Galloway also started rowing the boat backwards, with stern first, to slow down and for better control.

![The Kolb brothers with the *Edith* and the *Defiance* boats in 1911](Photograph courtesy of Grand Canyon NP collections)

Ellsworth and Emery Kolb used boats named the *Edith* and the *Defiance* to create the first motion picture of running the rapids in 1911. The Kolbs then ran this film four times a day for 65 years in their photo studio on the south rim. It is said to be the longest run of any motion picture. The *Ross Wheeler* of 1915 is a metal boat that sits just off the river. It is only accessible via the river or the end of the seven-mile long South Bass trail. It was stolen by two men who wanted to make a movie on the river. However, the trip proved extremely difficult as they had to hike out a few times for supplies, two other boats sank, and they were so battered and bruised that they gave up on the trip and abandoned the boat on the very spot it sits today. It is a wonderful exhibit for the river running community, but of course comes with conservation issues. The *WEN* boat of 1938 marked the beginning of commercial companies running trips for the public and started a three-generation family business that is going strong today. The first kayak traveled down the river in 1941. It is a foldboat with a rubberized canvas stretched over a collapsible wooden frame.

By 1948, river runners wanted to try to run a motorboat down and then up the river. They made it down in the *Esmeralda II* in four and a half days for the first ever downstream motoring. They then started upstream but the boat became so badly beat up they abandoned it. A year later it was found, repaired and taken downstream. Rubber rafts were introduced onto the river in the 1950s and enabled large groups to be toured down the river, but often times not safely. The *Georgie Woman of the River* raft is one of these early craft. In 1963, a group of four...
bathtub-shaped sport yak boats were taken down the river to photograph the extreme low river conditions after the gates were closed at newly constructed Glen Canyon Dam. They used smaller crafts to maneuver through rapids at the low water levels.

In 1960, some enterprising New Zealanders brought their jet thrust propulsion system to the Colorado River. It was developed in New Zealand for motoring up whitewater rivers. They wanted to run down and then up the river. During the trip, one boat sank but the *Wee Red* made it up and back, the only boat ever to do so. It took all day and three different drivers to get through the largest rapid on the river, Lava Falls.

In 1962, some people wanted to get back to the dignity and grace of the wooden boat so they adapted a boat called a dory commonly used in Oregon. They made it taller, more watertight, and stronger. The *Music Temple* is the first dory to have run the river. Dories are still used on the river but the most popular today is the inflatable raft.
The collection of boats grew at the park over many years through donations. Nine were placed in an open courtyard for display in the 1960s and there they sat for over 40 years, neglected due to budgetary constraints. With interest from concerned boat lovers and a newly appointed cultural resources manager, preservation efforts began in 2003. The boat lovers came from the existing river running community including boat enthusiasts, admirers, expedition companies and families of the historic people that were involved with these boats. As conservators dedicated to the parks in the Rocky Mountain region, the lab was called to perform a condition survey. This survey eventually enabled the park to acquire funds from the National Park Service and the river running community to stabilize all 20 boats. The lab started the ball rolling right away using this fan club to get the boats out of the courtyard and inside for storage, thorough examinations, and stabilization so they can be displayed again in the future. During the move the lab replaced their custom-made cradle mounts. The project gathered good press in the area with regional newspaper articles. The community really grabbed hold of the project. Construction drawings were made by an architect to document the design. This was a priority for the boating community. The drawings helped incredibly with boat terminology for conservation treatment documentation.

3. CONDITIONS AND TREATMENTS

While in the courtyard, the boats suffered a lot of surface damage but luckily they were in great structural condition. The park museum staff began first with dry cleaning the three oldest wooden boats using a brush and vacuum. The boats were extremely dirty with loose dust, dirt, lint, and plant debris.

![Dry cleaning the wooden boats](image)

Fig. 5. Dry cleaning the wooden boats (Photograph by M. Quinn)

The wooden boats were poorly coated with linseed oil in the 1960s as a preservation attempt. To start the reduction of oil, one of the volunteers picked off lint and hairs that had stuck to the semi-hard oil. This was just on the sides closest to the walls. The oil that
accumulated as drips was removed by shaving with a scalpel. Drips formed everywhere they could.

Two of the oldest boats had extensive tears to their canvas covered decks. One section had a severely torn and distorted tear. Humidification and flattening to realign allowed the area to be set in place with heat set BEVA film and muslin.

![Before (left) and after (right) treatment of the canvas deck on the Stone boat](Photographs by Brynn Bender)

Paint stability was an issue due to the outside storage with sun, wind, air conditioner exhaust, and runoff of water. There was staining from close proximity to an air conditioner. Painted wood surfaces were cleaned using warm water where possible. A 15% (w/v) solution of Golden MSA varnish (an iso-butyl and n-butyl methacrylate mixture) in pure gum turpentine was then used to consolidate the paint layer using an airbrush. This consolidant was chosen for its flexibility with changes in temperature and humidity, adhesive strength and ease of application.

Wet cleaning was performed on the canvas decks and painted wood to remove years of loose dirt. In some cases only warm water was used. In other cases warm water was used, followed by a 3% (w/v) triammonium citrate mixture of citric acid in deionized water set to a pH of 6-8 using ammonium hydroxide, followed by a water rinse. The chelating action of the cleaning mixture picked up the dirt well on the painted canvas decks. Contrast became visible in the paint layers showing paint loss due to wear and tear on the river.

Severe flaking paint existed on a wooden hatch lid. The paint was set down with a hot spatula, cleaned with warm water, and adhered in place using 15% (w/v) Paraloid B-72 in acetone applied with a syringe and a brush.

Metals on all the boats have minor corrosion and an irregular coating of oil. They were cleaned mechanically using bamboo skewers and with cotton swabs of acetone. This was followed with the application of a coating of microcrystalline wax in Stoddard solvent.

On one boat, the 1938 Wen, the linseed oil had gathered dirt and yellowed. We removed the dirt layer using the same 3% triammonium citrate solution followed by a water rinse. The cockpit was particularly thick with a well-adhered layer of dirt. The oil layer was then removed by swelling with warm water compresses followed by removing with acetone or ethanol depending on the sensitivity of the underlying paint. The results were great, exposing original white and green colors.
4. CONCLUSION

We are still deciding on treatment for some boats, like the 1915 *Ross Wheeler* that is still on the river. It is such a cultural landmark for boat tours that the park is reluctant to remove it. However, more recently, items from the boat have gone missing and graffiti has occurred. When visiting it in 2004, we discovered an inflatable raft stashed inside, boulders pushing in the bottom, and corrosion on the floor. So this is an ongoing process to balance our wishes to helicopter it out of the river with the community’s wishes. Future plans involve getting the *WEN* boat on exhibit at the visitor’s center, more treatments, including two boats at a river history museum in Utah, and filling the WWII inflatable neoprene raft with polystyrene beads. It has been wonderful to witness the attachment the community has to this collection and their strong desire to promote the history of their river running culture.

ACKNOWLEDGEMENTS


FURTHER READING


Fig. 8. *Ross Wheeler* boat on Colorado River, 2004 (Photograph by Brynn Bender)

**SOURCES OF MATERIALS**

Citric acid, monohydrate, reagent grade (C7129-1KG)  
Sigma-Aldrich  
3300 S. Second Street  
St. Louis, MO 63118  
(800) 325-8070.

Golden MSA varnish (iso-butyl and n-butyl methacrylate mixture) gloss in turpentine (No. 7730), pure gum turpentine  
Dick Blick Art Materials  
PO Box 1267  
Galesburg, IL 61402  
(800) 447-8192

Paraloid B-72, Microcrystalline wax  
Talas  
20 West 20th Street  
New York, NY 10011  
(212) 219-0770
BRYNN BENDER Senior Conservator, National Park Service, Intermountain Region Museum Services Program, 255 N. Commerce Park Loop, Tucson, AZ 85745, (520) 791-6430. E-mail: brynn_bender@nps.gov
AN EVALUATION OF POTENTIAL ADHESIVES FOR MARBLE REPAIR

MERSEDEH JORJANI, GEORGE WHEELER, CAROLYN RICCARDELLI, WINSTON O. SOBOYEJO, AND NIMA RAHBAR

ABSTRACT
A collaboration among conservators, conservation scientists, and material scientists has yielded interesting results in evaluating adhesives for the reassembly of marble fragments. Understanding the properties of adhesives in this context is essential for their optimal use. Two such properties – interfacial fracture toughness and bond line width – were examined. This project aims to aid conservators in making informed decisions in choosing adhesives by comparing the performance of thermoplastic and thermosetting resins commonly used in marble repair. The interfacial fracture toughness of Brazil-nut specimens is determined using tensile splitting tests. The following eight adhesive systems were used: Paraloid B-72, Paraloid B-48N, a 3:1 mix of Paraloid B-72 and B-48N, Hxtal NYL-1, Epotek 301-2, Akepox 2000, Marmorkitt 1000, and a Paraloid B-72/Epotek 301-2 sandwich.

One hypothesis tested in this study is that thermoplastic resins could be used as structural adhesives for marble repair. The goal of using such adhesives is to provide reversibility while maintaining adequate strength of the joint. Results indicate that from the perspective of interfacial toughness, several thermoplastic systems are viable for marble repair.

Another important property, adhesive bond width, is also determined. For each adhesive, the bond width is compared to values previously published in conservation literature. These data are then used to assess the correlation between bond widths and interfacial toughness of the various adhesives.

1. INTRODUCTION
Adhesives are widely used in repairing marble objects and architectural ornaments. Few scholarly articles (Koob 1986; Down 1996; Podany et al. 2001) in the conservation literature address the difficulties faced by conservators when choosing an adhesive for marble repair. Understanding the properties of adhesives used in these contexts is essential for their optimal use. This paper aims to add to the information on this subject and aid conservators in making more informed decisions when selecting adhesives.

The samples for this study, generally referred to as Brazil-nut specimens, consist of Carrara marble disks created from two semicircular specimens bonded together with one of the eight thermoplastic or thermosetting adhesives chosen for the study. Using these samples, interfacial fracture toughness was determined using tensile splitting tests. Interfacial fracture toughness is defined as the ability of a material containing a crack to resist fracture. In this study, it specifically refers to the resistance of the interface between marble and adhesive to decohesion. Interfacial fracture toughness is generally accepted in the fracture mechanics community as a more accurate, quantitative, and reliable than interfacial strength as it takes into consideration additional parameters including stress state, flaw size, and specimen geometry. (Kuhl and Qu 2000). Fracture mechanics “relates the crack length, the material’s inherent resistance to crack growth, and the stress at which the crack propagates. Hence, fracture mechanics can be used to address the prescribed parameters in this work by estimating the interfacial fracture toughness to analyze the interfaces between a range of restoration adhesives and marbles used to restore sculptures and historical objects” (Rahbar et al 2010, 4939).

Adhesive bond widths were also determined for each adhesive and are compared to values previously published in conservation literature.
One hypothesis tested in this study is that thermoplastic resins can be used as structural adhesives for marble repair. The goal of using thermoplastic adhesives is to provide reversibility while maintaining adequate strength of the joint. Of equal importance, but beyond the scope of this paper, are the creep and fatigue characteristics of joints created with thermoplastic resins.

2. ADHESIVES USED IN CURRENT STUDY

Four classes of adhesives were used in the current study: acrylics, polyvinyl acetalts, epoxies, and polyesters. The majority of the adhesives tested in this study are for indoor use only.

2.1 ACRYLIC RESINS

The use of acrylic resins in conservation has been common since the 1950s, when Lucite 44, a polybutyl methacrylate, was used as a varnish for oil paintings (Horie 1987). Their popularity in the past 50 years has not waned, and it is likely that they will remain in use provided they “fulfil all criteria for present day conservation” (Robson 1992). Acrylic resins used in conservation normally fall into two families–acrylates and methacrylates. The glass transition temperature (T\text{g}) of methacrylates is higher than that of the acrylates, and copolymers with the desired T\text{g} can be made by varying the percentage of each monomer in the final mix (Horie 1987). Two such acrylic copolymers, Paraloid B-72 and Paraloid B-48N manufactured by Rohm & Haas, as well as a 3:1 mix (by volume) of Paraloid B-72/Paraloid B-48N, were tested in this study. Paraloid B-72 is a copolymer of ethyl methacrylate/methyl acrylate with a T\text{g} of 40°C (Horie 1987). The popularity of this resin in conservation has led to its use as a coating, consolidant, and adhesive. For this study, a 40 wt% solution of Paraloid B-72 was prepared in an acetone/ethanol (10:1 by weight) solvent solution.

Paraloid B-48N is a copolymer of methyl methacrylate and butyl acrylate with a T\text{g} 50°C (Horie 1987). It is often used as a protective film for canvas paintings and metal. As with the Paraloid B-72, a 40 wt% solution of Paraloid B-48N was prepared in an acetone/ethanol (10:1 by weight) solvent solution.

The 3:1 ratio (by volume) of B-72/B-48N was based on the recommendation of Conservator Donna Strahan at the Metropolitan Museum of Art, who had used it as an adhesive for marble in archaeological contexts. Indeed, the mix should give an adhesive with a higher T\text{g} than using Paraloid B-72 on its own, as Paraloid B-72’s relatively low T\text{g} is often of concern to conservators due to possible cold-flow issues.

2.2 EPOXY RESINS

Epoxy resin systems consist of two parts: an epoxide component that reacts with a hardener. Diglycidyl ether of bisphenol A (DGEBA) is normally the epoxide component, while the hardeners are often aliphatic amines and amides. Epoxy resins normally shrink about 5% during hardening. They have been used widely for glass, stone and wood (Horie 1987). Epotek 301-2, Hxtal NYL-1, and Akepox 2000 were used in this study in accordance with manufacturer’s instructions.

2.3 POLYESTER RESINS

There are many polyester resin products on the market for stone repair with a wide range of viscosities. Polyesters are also two-part systems, in which an initiator is mixed with a resin pre-polymer containing a reactive monomer, normally styrene. The polymerization first results in
a gel, and then a hard solid. The working time (12–20 minutes at room temperature) can be regulated by adjusting the amount of initiator used. Some amount of shrinkage is involved in the polymerization process that likely continues for months (Hoarie 1987).

The use of polyesters in conservation began shortly after their introduction to the market in the 1940s, and they have been used as consolidants and fillers for wood, as well as adhesives and consolidants for stone. While polyesters cannot be dissolved in organic solvents, they can be removed after swelling (Horie 1987). The polyester resin tested in this study was Marmorkitt 1000.

3. EXPERIMENTAL

3.1 INTRODUCTION

This project involved the use of the adhesives listed in the previous section to adhere samples of Carrara marble, making the so-called Brazil-nut sandwich fracture specimens (figs. 1, 2). The glued samples were then subjected to tensile splitting to determine the interfacial toughness based on a modified standard ASTM D3967-95a (ASTM 1995). Experiments using Brazil-nut specimens for the testing of interfacial toughness were first designed and employed in 1990, and the use of this specific type of sample is essential to the testing method (Wang and Suo 1990). Since then, this type of testing has been used in assessing adhesive performance in microelectronic devices and electronic packages (Kuhl and Qu 2000). No reference was found for using this type of testing for adhesives in conservation. The interfacial fracture toughness is measured over a range of mode mixities, from pure tension to pure shear, by varying the angle between the direction of the applied load, P, and the long axis of the flaw. This angle is referred to as $\theta$. The load at which fracture occurred was recorded, as was the type of failure, i.e. its occurrence in the marble or in the adhesive line.

In addition, the width of each adhesive bond line was measured and compared to previously published standards in conservation literature (Bradley 1984; Podany et al. 2001) for adhesive bond widths. These data were used to determine a possible correlation between bond widths and interfacial toughness.

![Fig. 1. Brazil-nut specimen with adhesive layer, where P is the applied tensile load and $\theta$ is the loading angle. Both measurements are used to calculate the crack tip phase angle, $\psi$. (Wang and Suo 1990)](image-url)
3.2 SAMPLE PREPARATION

For every adhesive, 50 samples were prepared: 25 with smooth bonding surfaces and 25 with fractured bonding surfaces (fig. 2). The final samples were cylinders with a diameter of 24 mm and a height of 8 mm, with an elliptical hole in the center measuring 6.4 mm x 3 mm. This elliptical hole provides each sample with a uniform flaw of defined dimensions, orientation, and location. In this way, subsequent tensile testing of the samples would not measure the inevitable flaws that would be present in a material such as marble, but would in fact measure the performance of the adhesive. In these terms, the flaw acts as an equalizing factor for a heterogeneous material like marble.

An important step in the sample preparation was the use of abrasive water-jet machining (AWJM) technology for the shaping of the initial cylinders that were used to make the final samples. This technology uses water at high pressure (400–1400 MPa), mixed with an abrasive to cut a variety of materials. The desired shape is programmed into a computer that controls the cutting machine. This type of machining is considerably cleaner and more efficient than other cutting processes. Among the many advantages of AWJM are the minimum wetting of the working surface, the ability to start cutting from any point, minimal heat production and minimal burring (Kalpakjian and Schmid 2006).

3.2.1 Fractured Surface Samples

For the fractured surface samples, cores incorporating the elliptical hole were cut from the original Carrara slab using AWJM. The dimensions of these initial cores were 24 mm in diameter and 19 mm in height.

In order to have consistent fractured surfaces for gluing, each core was then subjected to incrementally increasing pressure using an Instron 4201 Table Top Electromechanical Test System operated by the author, and located at the Metropolitan Museum of Art. Enough pressure was applied to make a clean break across the diameter, with the break bisecting the elliptical hole’s length. The pressure was applied parallel to the long axis of the elliptical hole, and the presence of the flaw aided with controlling the direction of the fracture. The machine’s metal plate surfaces were each fitted with a plastic lid, which decreased the damage and pulverization at the meeting point between stone and metal. Using this system, fractures from one sample to the next were uniform, a requisite for having consistent results in the testing phase (fig. 2b).
preparation for the adhesive, each surface was lightly cleaned using a synthetic sable 10 mm brush in order to rid the face of residual marble dust and debris, and blotted with acetone.

3.2.2 Smooth Surface Samples
In order to make the smooth surface samples, the abrasive water jet technology was used to cut half-cores from the original piece of marble, each with half of the elliptical flaw (fig. 2a); the assembly of two of these half cylinders then resulted in a full cylinder. In preparation for the adhesive layer, each surface was lightly cleaned using a sable/synthetic 10 mm brush in order to rid the face of marble dust and debris, and wiped clean with acetone.

3.3 APPLICATION OF ADHESIVE
After preparing the smooth and fractured surfaces, the adhesive was applied to the samples. For each adhesive, a new synthetic sable 10 mm brush was dipped into the container holding the solution. Excess adhesive was brushed away against the rim of the container. The adhesive was then brushed on the surface of the half cylinder along its length with two passes, covering the surface of the marble. The adhesive-saturated half cylinder was then attached to its respective dry half. Excess adhesive was removed mechanically or with acetone.

For application of the layers comprising the Paraloid B-72/Epotek 301-2 sandwich, a layer of Paraloid B-72 (10 wt% in acetone) solution was applied with a brush to each half cylinder along its length, covering the surface of the marble. This barrier coat was then cured at room temperature for fourteen days. After the curing period, the Epotek 301-2 layer was applied to a half cylinder. The adhesive-saturated half cylinder was then attached to its respective dry half.

3.4 CLAMPING AND CURING OF ADHESIVE
One of the first steps in developing the sample preparation protocol was the identification of the optimal pressure needed for maximum adhesion. This was done empirically: an even layer of a Paraloid B-72 solution (40 wt% in 10:1 acetone and ethanol) was applied to two 1 in. cubes of marble. Using an Instron 4201, pressures of 300, 700, and 1400 kPa were then applied in order to observe the effect on adhesion. At 300 kPa, the adhesive layer was thick, making the two pieces of marble slide off one another and impeding adhesion. At 1400 kPa, almost all the adhesive was squeezed out of the joint, resulting in a dry joint with no adhesion. At 700 kPa, there was enough adhesive, but not a thick layer that would obstruct adhesion; 700 kPa was subsequently identified as the optimal pressure at which to cure the samples.

To maintain even pressure across the sample sets, a clamping system was designed, consisting of two pieces of plywood measuring 41 cm x 2.54 cm x 2 cm, nuts, and bolts (fig. 3). The holes for the bolts were drilled 7 cm from one another, and each clamp system held a total of ten cylinders. Once the glued samples were placed in the clamping system, the nuts and bolts were tightened to approximately 700 kPa using a torque wrench. This pressure value was converted into torque units, Newton meter (N·m), by considering the length of the torque wrench handle, the pitch of the screws used in the system, the clamping area dimensions, and the force necessary per screw to exert 700 kPa (Semat 1958; Hurd 2005). Each bolt was tightened to 6 N·m.

After tightening the six bolts to 6 N·m, the glued cylinders were allowed to cure under pressure for 7–30 days depending on the adhesive (thermosetting versus thermoplastic). The cores were then cut to their final height of 8 mm using a Struers Accutom-50 precision saw. Each
Cylinder yielded two samples to be used in interfacial fracture testing. It should be noted that the samples continued curing after they were unclamped until they were subjected to tensile testing. The adhesives cured for an average of three to four months before testing.

![Photograph of clamping system](image)

**Fig. 3. Clamping system devised for the curing of glued cylinders using plywood, nuts and bolts (Photograph by authors)**

### 3.5 SPECIMEN TESTING

After sample preparation was complete, tensile tests were conducted by the authors using an Instron 8281 dual-column mechanical analyzer controlled with a proprietary data acquisition software application. The instrument is located in the Department of Mechanical and Aerospace Engineering at Princeton University. The applied tensile load, \( P \), was increased at a rate of 0.005 mm/sec for each loading angle, \( \theta \) (fig. 1), until complete fracture occurred. The critical load at which fracture occurred for each loading angle was recorded. There were 10 specimens in each sample set; each specimen was placed in the machine at one of 5 different loading angles. The first two specimens were placed into the machine with the elliptical hole at 3° from vertical (the loading angle \( \theta \)). The remaining specimen pairs in each sample set were tested at 8°, 13°, 18°, and 27°.

After the experimental data were recorded, the loading angle \( \theta \) and the corresponding critical load were converted to crack-tip phase angle, \( \psi \) (see Atkinson et al. 1982). Based on these, the corresponding fracture energy, \( G \), was then established. The interfacial fracture toughness curve was generated by plotting the fracture energy, \( G \), versus the crack-tip phase angle, \( \psi \) (fig. 4). These curves were then used to characterise the interfacial fracture toughness of adhesive/marble interfaces (Wang and Suo 1990).

Bond line widths for each specimen type were also recorded using 2.5 mm samples that were produced as a by-product of slicing during sample preparation. These samples were acid-etched and stained using an alizarin-HCl solution (1 g alizarin in 100 mL of 10% HCl solution) in order to have a better contrast between the marble and the adhesive layer. The samples were then examined at a magnification of 175x using a Keyence VH-500 series digital microscope (fig. 5).

Using the microscope’s measuring feature, 50 measurements were taken with an approximate distance of 0.02 mm between each measurement. Using the data, the range of widths, the average width and the average deviation were determined (table 1).
Fig. 4. Interfacial fracture toughness curves: a) marble matrix, b) marble matrix curve overlaid on Paraloid B-72 curve (prepared as described in Section 2.1), c) marble matrix curve with Epotek 301-2 curve, d) marble matrix curve with 3:1 B-72:B-48N blend curve (prepared as described in Section 2.1).

Fig. 5. Bond dimensions at 175x magnification. a) two smooth surfaces without an adhesive, b) two fractured surfaces without an adhesive, c) Paraloid B-48N in a fractured joint, d) Paraloid B-72/Epotek 301-2 sandwich in a fractured joint. (Photographs by authors)
Table 1. Average bond line measurements in µm (average +/- standard deviation)

<table>
<thead>
<tr>
<th>Adhesive</th>
<th>Smooth</th>
<th>Fractured</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry join (no adhesive)</td>
<td>20.89 +/- 1.79</td>
<td>22.87 +/- 3.64</td>
</tr>
<tr>
<td>40 g B-48N, 54 g acetone, 6 g EtOH</td>
<td>31.83 +/- 5.79</td>
<td>21.94 +/- 4.86</td>
</tr>
<tr>
<td>40 g B-72, 54 g acetone, 6 g EtOH</td>
<td>28.07 +/- 4.13</td>
<td>39.20 +/- 4.96</td>
</tr>
<tr>
<td>3:1 (by volume) mix B-72/B-48N</td>
<td>23.00 +/- 2.77</td>
<td>41.26 +/- 13.41</td>
</tr>
<tr>
<td>10g Mowital B60HH, 40 g EtOH</td>
<td>26.20 +/- 3.49</td>
<td>30.13 +/- 5.34</td>
</tr>
<tr>
<td>Hxtal NYL-1</td>
<td>30.81 +/- 3.42</td>
<td>44.29 +/- 10.29</td>
</tr>
<tr>
<td>Epotek 301-2</td>
<td>28.89 +/- 4.41</td>
<td>48.44 +/- 5.99</td>
</tr>
<tr>
<td>Akemi Akepox 2000</td>
<td>46.16 +/- 5.72</td>
<td>37.91 +/- 6.08</td>
</tr>
<tr>
<td>Marmorkitt 1000</td>
<td>38.40 +/- 2.65</td>
<td>56.47 +/- 7.39</td>
</tr>
<tr>
<td>B-72/Epotek sandwich</td>
<td>29.01 +/- 3.98</td>
<td>58.06 +/- 5.97</td>
</tr>
</tbody>
</table>

4. RESULTS AND DISCUSSION

4.1 INTERFACIAL TOUGHNESS

Several interfacial fracture toughness curves will be used in this section to illustrate points of discussion. In general, interfacial toughness is higher in the fractured samples compared to the smooth samples. The higher fracture energies in the fractured-surface specimens are not surprising and are probably a result of the overall increased surface area of contact in the fractured samples. Over the range of the phase angles measured, Paraloid B-48N exhibits the lowest interfacial toughness for both the smooth and fractured surfaces. Akepox 2000 showed the highest fracture energy on fractured surfaces while Epotek 301-2 was the toughest on smooth surfaces. For all adhesives on both surfaces, the interfacial fracture toughness increases with increased crack-tip phase angle, $\psi$. Marble on its own, tested as the control, was a stronger material than most of the adhesives tested (fig. 4a). It is also important to note the large scatter observed in the data. This scatter increased with increasing phase load angle, a phenomenon typical of interfacial fracture toughness data (Thurston and Zehnder 1993).

On the whole, the thermosetting adhesives were higher in fracture toughness than the thermoplastic adhesives. However, the performance range of the two types was similar, with both types falling between 2–10 J/m². Interesting results were observed for Epotek 301-2 (fig. 4c) and Hxtal NYL-1, both of which are low-viscosity epoxies. They each exhibited high fracture energies at the lowest phase angle in the fractured specimens, while Hxtal NYL-1 also showed the same trend in the smooth samples. This behavior might be caused by the absorption of the two epoxies into the stone (a halo of epoxy adjacent to the adhesive line was noted when making the samples) and in essence consolidating the stone near the adhesive line. Interesting results were also seen with the Paraloid B-72/Paraloid B-48N mix (fig. 4d). The fracture toughness curve closely followed that of marble matrix.

The fracture patterns were also observed and recorded. The three patterns are illustrated schematically in figure 6. Type 1 failure was in the adhesive line while Type 2 failure was a crack in the marble parallel to the adhesive line. Type 1 was rare and found only in thermoplastic resins. Type 2 failure was observed mainly at low compression angles, notably in Hxtal NYL-1 and Akepox 2000—both thermosetting adhesives.
By far the most prevalent failure type observed was Type 3, with the failure initiating at the upper left part of the sample, continuing through the elliptical hole and terminating at lower right part of the sample. This type of failure was seen in fractured and smooth samples with all types of adhesives and at various compression angles, and indicates that as a group these adhesives are strong enough to join marble.

4.2 BOND LINE WIDTH MEASUREMENTS

The average bond thicknesses for the various adhesives are presented in table 1. Bradley (1984, 24) gave the figure of 30 µm as the lower limit of a bond width. Bradley observes that a joint smaller than 30 µm can result in “adhesive starvation,” but no mention is made of bond widths thicker than 30 µm. Podany et al. (2001, 24) mentioned the bond thickness of 100–300 µm as being commonly accepted. Bond lines thinner or thicker than this indicated range were said to have too many voids, causing weaknesses in the adhesive layer. However, considering an object with numerous joints being reassembled, a bond width of 200 µm seems thick enough to cause a perceptible displacement at the end of assembly. The smooth surface adhesive bonds studied here measured on average between 26 µm and 46 µm. All are invariably smaller than the range stated by Podany et al.; the largest bond width for the smooth surface, at 46 µm, was seen in the Akemi Akepox 2000. The largest bond width overall was observed in the fractured Paraloid B-72/Epotek 301-2 sandwich, at 58 µm.

Seven of nine adhesive layers were found to be thicker in the fractured samples than in the smooth samples. In order to rule out the nature of the break as a deciding factor in this inconsistency, two dry joints (one smooth and one fractured) were placed in the clamping system under 700 kPa and examined under the microscope in order to measure the width of the breaks before the gluing process. The smooth surfaces were separated by an average gap of 21 µm, while the fractured surfaces were separated by an average gap of 23 µm. The difference of 2 µm between the two types of samples therefore does not explain the discrepancy between the widths of the two surfaces once the adhesive is applied (reaching a maximum average difference of almost 30 µm in the Paraloid B-72/Epotek 301-2 composite system).

Paraloid B-72 (smooth) and Epotek 301-2 (smooth) had very similar bond thicknesses at 28.07 µm and 28.89 µm, respectively. If the two were compared using bond thicknesses as the only variable, one would think their fracture energies would be similar. However, the fracture energy of Epotek 301-2 (average fracture energy 7 J/m² at the highest $\psi$) is higher than that of Paraloid B-72 (average fracture energy 4 J/m² at the highest $\psi$). Evidently, the type of adhesive in this case was more relevant to fracture toughness than to bond thickness. To fully comprehend the relation between bond thickness and fracture toughness, future research should consider the application of different adhesive thicknesses before tensile splitting.
5. CONCLUSION

A primary aim of this project was to establish a step-by-step method for adhesive testing for stone. The ability to make uniform samples and thus have consistent data among all sample sets was the most important aspect of the protocol. Key aspects in having consistent samples involved the use of AWJM, a uniform clamping system for all samples, and the determination of optimal pressure for curing the samples. This sample preparation protocol proved extremely functional when making uniform Carrara marble samples and should be tested with other types of stone to assess its effectiveness.

When considering at the performance of the eight adhesive systems, it can be concluded that all are strong enough for use on Carrara marble, as the majority of the failures were observed in the marble rather than the adhesive line. The similar performance of thermosetting and thermoplastic adhesives was a surprising result, as the initial assumption was that the thermosetting would be much tougher than the thermoplastic adhesives. Therefore, other properties such as reversibility can be used as a determinant when choosing an adhesive.

The fracture patterns observed for the adhesives were all similar, with the majority of the breaks in the marble and not at the adhesive line. The conventional wisdom in conservation is to use an adhesive that is not as strong as the matrix. That convention needs to be re-examined, since even the thermoplastic adhesives could be considered by these standards to be too strong for marble repair.

This paper is a first step in compiling practical data on marble adhesives for use in conservation. Ideally, the same protocol can be used on other types of stone in order to expand knowledge of adhesive performance on a range of matrices. This research involved a limited range of adhesives; more should be tested to have a more complete picture and a deeper understanding of adhesives used in marble repair.

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SOURCES OF MATERIALS

Abrasive Water Jet Machining
Hydro-Cutter, Inc.
1177 Stafford Street
N. Oxford, MA 01537
(508) 892-7481
www.hydro-cutter.com

Paraloid B-72, Paraloid B-48N, Hxtal NYL-1
Talas
330 Morgan Avenue
Brooklyn, NY 11211

Akemi Akepox 2000, Akemi Marmorkitt 1000
Stone Boss
26-04 Borough Place
Woodside, NY 11377

Epo-Tek 301-2
Epoxy Technology, Inc.
14 Fortune Drive
Billerica, MA 01821
(978) 667-3805

Carrara marble
ABC Stone
234 Banker Street
Brooklyn, NY 11222

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FROM MARBLE TO MUSSELS: A SIMILAR TREATMENT APPROACH TO DISSIMILAR MATERIALS

JUDY OZONE AND ABIGAIL MACK

ABSTRACT

The conservation treatments devised for two important sculptures in the collection of the National Gallery of Art were found to be unexpectedly similar in approach and choice of materials, despite the fact that each sculpture is substantively different from the other in terms of materials and methods of fabrication, as well as in artistic motivation and conception.

Damage to a 1786 marble portrait by Jean-Antoine Houdon rendered the sculpture so physically compromised that even the most careful handling in the course of treatment could cause further damage. The construction of the mixed media Panneau de Moules by Marcel Broodthaers had weakened in the forty years since its creation in 1966; thousands of mussel shells held together by polyester resin were tenuously attached to a desiccated particleboard support. The physical configuration of damage in each object presented logistical challenges that made developing an effective yet safe treatment especially difficult.

1. INTRODUCTION

The sculpture collection at the National Gallery of Art is built around Western European and American works that date from the 14th century to the present day. From enduring bronze statuettes of the Renaissance to transitory conceptual works of the late 20th century, the collection embodies the shift from traditional to non-traditional materials and techniques as well as the evolving role of art within Western culture.

Two important objects in the collection that epitomize such diversity presented the Object Conservation Department with two separate and thought-provoking treatment challenges. The first work, a traditional marble portrait by Jean-Antoine Houdon of Giuseppe Balsamo, is signed and dated 1786.1 Balsamo was more famously known as “Count Cagliostro,” the notorious figure who was involved in the legendary necklace swindle of Marie Antoinette.2 The second object is a modern composite work of mussel shells and resin mounded on particleboard, titled Panneau de Moules, which was created in 1966 by the Belgian poet, filmmaker, and artist Marcel Broodthaers. Materially and conceptually, the enigmatic mussel panel, with its mundane and ephemeral components is the antithesis of the solid, laboriously carved sculpture by Houdon.3

At first (and even second) glance, these objects have very little in common (fig. 1). Composed of vastly different materials and made nearly 200 years apart, each was created for a different purpose and represents a wholly different era in art history. The Houdon bust was commissioned to honor Cagliostro at the height of his popularity, before he was exposed as a criminal and charlatan. By contrast, Broodthaers used his work to challenge the mind more than the eye, often using everyday objects that defied cultural status. The culmination of this concept came in a 1972 exhibition in which every object carried the label, “This is not a work of art”.

The critical condition of each sculpture led the authors to devise individual treatments that ultimately united the objects in unexpected ways. Their initial similarity was simply that the structure of each object was so weakened that neither could be exhibited without a comprehensive and potentially intrusive treatment that might significantly alter its appearance. Though conservation treatment of the Broodthaers followed that of the Houdon by over a year,
the results from the material tests and the procedural concepts developed for the marble treatment were entirely appropriate for the mussels treatment. The complete condition and treatment details of each object are not included here; this report will focus instead on their similarities.

Fig. 1. (left) Jean-Antoine Houdon, Giuseppe Balsamo, Comte di Cagliostro. Collection of the National Gallery of Art (1952.5.103). (right) Marcel Broodthaers, Panneau de Moules Collection of the National Gallery of Art (2005.36.1). (Photographs by Lee Ewing)

2. CONDITION OF GIUSEPPE BALSAMO, COMTE DI CAGLIOSTRO, BY JEAN-ANTOINE HOUDON

The Houdon marble was severely damaged when it fell from a lift during transport within the museum. The top-heavy sculpture landed head first onto a concrete floor, resulting in fragmented and crushed marble, as well as a series of deep cracks and fissures. The most serious damage emanated from the point of impact at the top of the head. A deep and wide crack bisected the head - from the front neck, across the right side of the face, and down to the collar at the back - such that each end of the crack was only inches away from the other within the neck. This primary crack measured 20 inches in length (51 cm) (fig. 2).

The resulting crack was also over 1.0 mm at its widest point, and tapered off through most of its length into a network of hairline fissures that branched up to 10 cm away from the main crack. What made this crack even more troublesome was that, in addition to its substantial width, the marble had sprung, that is, the stone’s inherent internal stresses were released, creating a permanently stepped and misaligned surface. This misalignment was especially apparent across the right eye (fig. 3).

An additional problem was that the sculpture did not break apart enough. Had it split completely apart, it might have been easier to apply adhesive or to pin the sections together. It was the potential depth of this primary crack that most compromised the sculpture’s overall stability and created the question of how to ensure sufficient penetration of an adhesive. At the top of the head, the crack measured as much as 3 inches deep.
Fig. 2. Detail of damage: Houdon, Giuseppe Balsamo (Photograph by Abigail Mack)

Fig. 3. Detail of damage through right eye: Houdon, Giuseppe Balsamo (Photograph by Abigail Mack)
Fig. 4. Detail of surface loss: Marcel Broodthaers, Panneau de Moules (Photograph by Judy Ozone)

Fig. 5. Detail at of resin separation at panel edge: Marcel Broodthaers, Panneau de Moules (Photograph by Judy Ozone)
3. CONDITION OF *PANNEAU DE MOULES*, BY MARCEL BROODTHAERS

The fragile condition of the Broodthaers work was evident immediately when the object arrived at the museum for purchase consideration. Taped along the inside edges of the packing crate were little packets of detached mussel shells. Many of the shells were broken, lost, or actively separating from its particleboard backing (fig. 4). More seriously, the friable particleboard was prone to flexing and was inadequate to support the weight of the thousands of shells held together in a matrix of clear and tinted polyester resin, all of which is meant to be viewed vertically. Between the shells, it was apparent that the resin was not a continuous film. Also visible were remnants of old paint on the board, along with leaves and other detritus among the shells, which gave evidence to the swift and spontaneous application of shells on a recycled board. The many detached and insecure shells as well as gaps along the edge of the panel called attention to the fact that both the resin and particleboard had shrunk appreciably (and at different rates) in the 40 years since the piece was made, and raised serious concerns about the overall structural integrity of the work (fig. 5).

Even with careful handling, the board would flex and the movement of the shell/resin conglomeration was audible. While there was no way to know where the resin was separated from the support, or even how much was still attached, it was clear that the entire assemblage had the potential to loosen and eventually delaminate. The challenge was to devise a way to re-establish a structural bond at the interface between the resin and board in spite of the fact that the interface was buried beneath five inches of shells and the areas of weakness were not visible.

4. SIMILAR TREATMENT CONSIDERATIONS AND APPROACHES

Each sculpture had problematic physical damage that limited the choice of treatment procedures and materials. The very fragile condition and gross structural instability of both objects meant that even the most judicious handling during treatment was an opportunity for increased damage. Complicating matters for each object was that access to the unstable areas was severely limited, and therefore limited the treatment materials and methods that could be used.

At one end of the treatment spectrum is the choice to do nothing. Should the Houdon bust be chalked up as a loss and put into storage forever? If the Broodthaers panel could not be installed vertically on a wall (as the artist intended) without the continual loss of mussel shells, should it be exhibited at all? At the other end, the ultimate goal for each treatment is to ensure that the object is stable enough for long-term exhibition or for travel on loan. After many conversations between curators, conservators, and administrators, the decision was to fully treat each object, acknowledging that a certain amount of creativity and likely irreversibility in the treatment process would be required to respond to each object’s physical constraints. Despite efforts to anticipate the steps of treatment, the very fragile condition of both works required constant re-evaluation and the flexibility to change course if needed.

5. TREATMENT OF THE HOUDON MARBLE

The marble’s physical condition was so tenuous that every effort had to be made to prevent magnifying the damage. To prevent loss, the fragments were contained *in situ* with squares of non-woven tissue and wheat starch paste; the head was then wrapped with cotton cloth to prevent movement of the weakened marble. A wooden cradle lined with foam custom-cut to the
sculpture’s contours was fabricated to secure the sculpture during treatment (fig. 6). It should be noted that the marble weighs over 300 pounds, and the cradle was designed so the immobilized sculpture could be turned over in order to access the full circumference of the crack.

Before the primary crack could be treated, the crushed marble and extensive fissure network had to be consolidated. The goal was to find an adhesive that had sufficient cohesive strength to connect the fissures and viscosity low enough to flow through the relatively dense matrix, yet not saturate or darken the marble. A group of low viscosity adhesives was compared for strength and saturation by combining alternative solvents and various resin concentrations that were tested on samples of Carrara marble. The chosen combination proved to be a low concentration of Paraloid B-72 dissolved in di-ethyl benzene (DEB), which was applied by brush.

To increase the penetration and distribution of the resin throughout the marble matrix, the entire consolidation procedure was done in a DEB fume-saturated chamber, after which the marble was kept in isolation in the spray booth for over six weeks to allow for the slow dissipation of solvent (fig. 7).

Once the fissure networks were consolidated, the challenge was to identify the most viable structural adhesive for the primary crack. As revealed by x-radiography, only 6 inches of intact marble separated the new network of cracks through the head and neck, from an old vertical crack that runs from the center of the bust, up through the ruffle of the shirt. The ideal adhesive would have to satisfy three conditions: 1) have a low viscosity in order to penetrate the full extent of the crack; 2) be strong enough to hold the sprung halves together; 3) fill the void created when the marble distorted.

The extremely limited access along the length of the crack required the use of an adhesive with the lowest possible viscosity in order to reach into the depths of the crack. For this reason, Hxtal NYL-1 epoxy was chosen following considerable testing. In order to avoid staining the surface, medical syringes were used to inject the epoxy deep into the crack. Because the crack traversed the entire head, any application of adhesive from one side would likely flow out through the other. To contain the flowing epoxy as it was introduced into ports at the front of the head, the crack at the crown was dammed with a wax-resin mixture (fig. 8). The same procedure was used when the sculpture was turned onto its back.

To control its movement within the marble, the Hxtal epoxy was applied in small increments and allowed to cure in successive stages until the built up layers of epoxy could be seen within the crack (fig. 9). The last half-inch of the gap was underfilled with the slightly more viscous Akepox 5000 epoxy which has less creep, more body, and could also serve as a gap filler. With the primary crack stabilized, the remaining gap was filled level with the sculptural surface using the same wax-resin mixture as was used to dam the crack, tinted to match the adjacent marble surface (fig. 10).
Fig. 6. Wooden cradle for Houdon marble (Photograph by Abigail Mack)

Fig. 7. Fume chamber for marble consolidation (Photograph by Judy Ozone)
Fig. 8. Applying wax-resin dam material around injection ports (Photograph by Judy Ozone)

Fig. 9. Injection of epoxy into crack (Photograph by Abigail Mack)
6. TREATMENT OF THE BROODTHAERS PANEL

Immediately after acquisition, a request was made for loan of *Panneau de Moules* to an outside exhibition, provided the work could be successfully treated. Thus, the treatment plan for the mussel panel had to go one step further and take into account its transport by truck. With the knowledge that the work would be traveling, conservators were impelled to devise a comprehensive treatment that would integrate the need for structural stability, minimal aesthetic impact, and ease of handling.

The initial, though not insignificant step, was to clean away years of accumulated dust and dirt. Historically the panel had been hung from all four sides, so every conceivable surface was covered with dust, giving the panel an overall grey appearance. In the course of cleaning, the full extent of the work’s instability became apparent, as did the still brilliant colored resin that Broodthaers used to fill the shells (fig. 11). A reference system was devised to ensure accurate documentation and to track treatment progress. The mussel panel was laid on a temporary support board to which was attached a low wooden upright along each side. Lightweight string was woven around the uprights to create a 64-section grid suspended over the surface of the mussels (fig. 12).

The shrinkage gaps between the resin and support board presented the same access problems as were found in the damaged marble, such that nothing other than a low viscosity adhesive would flow into the constricted spaces. The choice of Hxtal NYL-1 epoxy for this treatment was based on the test results from the marble treatment, the benefits being water-thin viscosity, low rate of yellowing, and high cohesive strength.
Using powerful illumination, areas were located where the support board was visible between the mounds of mussels. These potential injection ports were temporarily marked with bamboo skewers. The use of disposable syringes that worked so well in the Houdon treatment proved to be the best epoxy delivery system for the Broodthaers panel as well. For this treatment, the syringes were modified to form a hybrid of the syringe body fitted with a wide and flexible plastic pipette tip (fig. 13a). The goal of the treatment was to create a web of consolidant, with the expectation that the epoxy would flow over, around, and hopefully underneath the existing resin (fig. 13b). As with the marble treatment, the use of a free flowing adhesive required damming the edges of the panel prior to its application. To create this barrier, more viscous epoxies were first injected along the edges and allowed to set.
With the edges securely dammed, each of four sides of the object was propped up sequentially so that as the Hxtal epoxy was introduced, it would flow toward the center (fig 14). The epoxy was applied until sufficient epoxy “fingers” met or overlapped, as determined by inserting a skewer to see how far the wet epoxy had reached. After each application, the epoxy was allowed to cure fully for two days before the object was turned. Written and photographic documentation was critical to monitor the location of each injection port, the succession in which epoxy was injected from each side, and the direction and extent of adhesive flow (fig. 15).

With the front of the work successfully consolidated, the panel was turned upright and placed in a temporary vertical wooden frame to gain access to the reverse (fig. 16a). This was necessary to accomplish three steps: 1) remove the existing inadequate hanging device (small metal rings attached with short screws) and an aluminum X-shaped brace from the back of the particleboard (fig. 16b); 2) consolidate the entire back of the porous particleboard; 3) attach a rigid support that would inhibit flexing and incorporate a new hanging method.

A new support made of aluminum honeycomb panel was designed to both stabilize the work of art and to facilitate handling and installation. The ¾-inch thick aluminum honeycomb panel was chosen because its lightweight construction could provide support and rigidity to the fragile particleboard without adding appreciable weight to an already heavy object. The panel was made slightly smaller in dimension than the work of art so that it is less apparent to the viewer (fig. 17).

Because the particleboard panel was too porous and friable to hold the new aluminum support by mechanical means alone, a structural epoxy was used to secure the honeycomb panel to the back of the object. After the epoxy cured, screws were attached through the back of the aluminum panel to provide additional security (fig. 18). Attached to the back of the new support panel are three sets of aluminum Z-cleats: one for hanging and two for lifting by means of removable handles (fig. 19a). The removable handles were designed so that art handlers would never have to touch the face or the sides of the object, and to distribute the weight of the object during installation (fig. 19b).
Fig. 14. Panel on slant during epoxy application (Photograph by Abigail Mack)

Fig. 15. Annotated photograph showing location of epoxy injection ports, order of application, direction and extent of flow (Graphic by Abigail Mack)
Fig. 16a. Securing art work into temporary wooden frame (Photograph by Judy Ozone)

Fig. 16b. Extant aluminum brace on back of Panneau de Moules (Photograph by Judy Ozone)

Fig. 17. Back of Panneau de Moules (left) and attachment face of aluminum honeycomb (right). (Photograph by Judy Ozone)
Fig. 18. Securing aluminum panel to back of Panneau de Moules, after adhesive application
(Photograph by Judy Ozone)

Fig. 19a. Mock-up of Z-cleat design for back of honeycomb panel
(Constructed and photographed by Andrew Krieger)

Fig. 19b. Art handlers lifting newly treated Panneau de Moules by means of lifting handles
(Photograph by Judy Ozone)
7. CONCLUSION

The treatments of two seemingly incongruous works of art were brought together by their like limitations. Having previously tested a wide range of adhesives, adapted various tools, and worked out handling logistics for the marble treatment, the authors were able to apply much of the same methodology in the treatment of the composite mussel panel, executed more than a year later. These extensive though ultimately successful treatments made it possible to install two works that otherwise would have been considered too fragile or disfigured to be exhibited (figs. 20 and 21).

ACKNOWLEDGEMENTS

Both treatments required collaboration from numerous departments within the museum, the work of many hands, and more than a little choreography. These treatments would not have succeeded without our talented colleagues: Steve Wilcox, Senior Frame Conservator; Hugh Phibbs, Head of Matting and Framing; Andrew Krieger, Senior Art Handler, all from the National Gallery of Art, as well as Van Wood, of Smallcorp, who fabricated the aluminum panel.
NOTES

1. Jean-Antoine Houdon, Giuseppe Balsamo, Comte di Cagliostro (1786), marble. Collection of the National Gallery of Art (1952.5.103); dimensions: 62.9 x 58.9 x 34.3 cm.

2. According to popular theory, Cagliostro rose from poverty by assuming a false lineage; he is believed to be the Sicilian petty criminal, Giuseppe Balsamo. This bust was carved during the height of Cagliostro’s popularity in Paris just before a legendary and notorious necklace swindle involving Marie Antoinette and one of her admirers, Cardinal Rohan. It is believed that Cardinal Rohan commissioned Houdon to create the bust.

3. Marcel Broodthaers, Panneau de Moules (1966), mussel shells, resin, wooden particleboard, paint. Collection of the National Gallery of Art (2005.36.1); dimensions: 115.8 x 123.1 x 12.8 cm.

4. In 1972, Broodthaers installed Musée d’Art Moderne, Département des Aigles, Section des Figures at the Städtische Kunsthalle Düsseldorf, one of a series of exhibitions in his Musée d’Art Moderne project, a conceptual museum that appeared in numerous locations between 1968 and 1972. Every object in the exhibition bore a label, “This is not a work of art,” in various languages.

5. Adhesives tested included: Paraloid B-72 (ethyl methacrylate and methyl acrylate copolymer), Butvar B-98 (polyvinyl butyral), Hxtal NYL-1 epoxy, isinglass, Rhoplex AC33 (acrylic copolymer emulsion).

6. The wax-resin fill material contains poly (vinyl acetate), Irganox, and ethylene acrylic acid copolymer.

REFERENCES


SOURCES OF MATERIALS

Paraloid B-72 resin (ethyl methacrylate and methyl acrylate copolymer)
 Manufactured by Rohm and Haas North America
 100 Independence Mall West
 Philadelphia, PA 19106
 (800) 967-7704
Akepox 5000 (flowing) epoxy resin; Akepox 5010 (knife grade) epoxy resin  
Manufactured by Akemi, Nürnberg, Germany; available from:  
INNOCHEM  
4030 Pleasantdale Road, Suite F  
Doraville, GA 30340  
(877) GO-AKEMI

Aluminum honeycomb panel (designed by NGA staff and fabricated by Smallcorp)  
SmallCorp  
19 Butternut Street  
Greenfield, MA 01301  
(800) 392-9500 (US only); (413) 772-0889

Disposable polyethylene transfer pipets  
Fisher Scientific  
300 Industry Drive  
Pittsburgh, PA 15275  
(800) 766-7000

Disposable syringes  
BD Syringe, Luer-Lok  
Manufactured by Becton, Dickinson and Company  
1 Becton Drive  
Franklin Lakes, NJ USA 07417  
(201) 847-6800

Hxtal NYL-1 epoxy resin, available from:  
Talas, 330 Morgan Avenue  
Brooklyn NY 11211  
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COLLABORATIVE WORK TOWARDS THE PRESERVATION OF SPRUCE ROOT BASKETRY AS A LIVING TRADITION

MOLLY GLEESON AND SAMANTHA SPRINGER

ABSTRACT

During the summer of 2007, interns Samantha Springer and Molly Gleeson, Native Alaskan weavers Janice Criswell and Teri Rofkar, and conservator Ellen Carlee worked to preserve Haida and Tlingit spruce root baskets in the collections of the Alaska State Museums. A major focus of this project was to encourage collaboration between the conservators and Native weavers. By focusing on a specific type of basketry the interns were able to allow this collaboration to direct the process of preserving the baskets. Additionally, their work was enhanced by collaborating with each other and other museum professionals daily about treatment solutions and techniques, as well as by interacting with Native demonstrators, the local community, and the surrounding southeastern Alaskan environment.

The interns’ major responsibility was the treatment of several Haida and Tlingit spruce root baskets. To understand the materials, technologies, and properties of these baskets more fully, they worked with Native weavers to learn gathering, processing, and weaving of the spruce roots. Besides these more concrete concepts, they also gained an understanding of the weavers’ relationship to the materials, the baskets, and the environment. The weavers made regular appearances in the lab to discuss the history of the baskets in the collection and previous and current treatment techniques and approaches. Through this interaction, the interns developed a greater responsibility and ownership of the information that they acquired and a desire to ensure that it is passed on in an accurate and respectful manner.

The interaction between weavers, conservators, other museum professionals, and the public took preservation of the baskets beyond the confines of an eight-week internship in the conservation lab and helped to bring these baskets, their traditions, and their stories into the community. Such interactions encourage preservation efforts to progress beyond project-driven collaboration towards a more organic collaborative process of conservation.

1. INTRODUCTION

The Alaska State Museums (ASM) in Juneau and Sitka contain superior examples of Native Alaskan spruce root basketry. While these types of baskets are valued worldwide, they are particularly meaningful to contemporary weavers in southeast Alaska. Native weavers have a history of working with the ASM in a variety of capacities. The ASM has continued a relationship with these weavers in an attempt to involve them in the conservation of baskets in these collections. During the summer of 2007, Ellen Carlee, ASM conservator, offered two graduate conservation internships to work on Tlingit and Haida spruce root baskets and experience the benefits of this type of collaborative work. The authors were the fortunate students to participate in this project. Originally, the project had two main goals: to conserve Haida and Tlingit baskets in the collections and to encourage a partnership with the weavers. However, the collaborative spirit extended beyond the interns working with the weavers to learning from each other, other professional museum staff, and the local community.

The ASM consists of the Alaska State Museum in Juneau and the Sheldon Jackson Museum (SJM) in Sitka. These cities are located in southeastern Alaska, in the heart of the Tlingit and Haida cultural homeland. This area is abundant with Sitka spruce trees, whose roots have supplied the raw weaving materials for the people who have lived on this land for thousands of years.

At the Alaska State Museum in Juneau, work was carried out in the conservation lab under Ellen’s supervision. The interns also regularly interacted with other museum staff, including the curator of collections, Steve Henrikson and Scott Carlee, a conservator and the curator of museum services at ASM. Outside the lab, the interns worked with Janice Criswell, a Haida and
Tlingit weaver (fig. 1). Jan provided instructions on how to collect, process, and weave with spruce roots. She also visited the conservation lab periodically to comment on baskets in the museum’s collection. In Sitka, the interns continued learning to weave with Teri Rofkar, a Tlingit weaver, and worked on several baskets in the Sheldon Jackson Museum (fig. 2). Teri also visited the museum to examine baskets in storage and to discuss treatments. In the museum, work was carried out under the supervision of the curator, Rosemary Carlton. To provide public outreach, the interns carried out as much of the treatments in the gallery as possible (fig. 3).
Working in a public area gave the interns an opportunity to explain conservation to visitors and also to interact on a regular basis with the Native artist demonstrators who also worked in the galleries. The small size of the museums provided opportunities to interact frequently with museum staff in addition to the weavers. The interns also spent a lot of time working side-by-side, which provided a venue to discuss treatment issues as they came up and brainstorm solutions continuously. Devoting the entire summer to a single material and type of object allowed the interns to become familiar with different aspects of the spruce root weaving technology, common features of Tlingit and Haida baskets, and common condition problems. Based on shared knowledge, experiences, and ideas, treatments were adapted for each basket.

Carrying out this work in Juneau and Sitka gave the interns the opportunity to witness the commitment and determination of the community to preserve the local cultural traditions. It was a privilege to be included in these vital communities, and to be a part of this project that was about more than just conserving baskets, but preserving a cultural tradition and bringing conservation beyond the museum environment.

Fig. 3. The interns at work and chatting with visitors in the gallery of the Sheldon Jackson Museum (Photograph by Germán Parra)

2. WORKING WITH THE WEAVERS

The possibility of working with Native weavers, not only learning traditional weaving methods, but also consulting on treatments, was one of the major draws for the interns to go to Alaska. Their first interaction with the weavers was going out to collect roots with Jan and her root-digging partner Mary Lou King. Mary Lou is a noted environmental activist and active member of the local weaving community.

Traditionally, roots were harvested in the spring after the ground thaws, but before the summer sap runs through the roots. One reason for this practice is that the bark is more easily
removed during this time. In addition, roots must be harvested from trees of a certain age to produce the types and sizes of roots used for weaving. Trees that grow in sandy soil produce long, straight runners close to the surface making the roots easier to find and collect. In this instance, the interns had the opportunity to go digging on a sandy island behind Mary Lou’s home.

After finding a good spot, roots are found by pulling surface moss away to reveal the distinct orange color of the spruce roots’ bark. Once a root is found that is of desired size and close to the surface, one lifts the moss from above the root (fig. 4). The root is then loosened from the sandy soil with a hooked tool. Long, straight roots are best, as they are the easiest to weave. When the root forks into two, has a kink, or starts to change drastically in diameter, it is cut from the ground and wound into a coil. Before finishing for the day, Jan said it was important to thank the trees for their generosity. The time spent collecting roots that day was determined by the tide, as it was only possible to get to the island while the water was low. It was this type of constriction that revealed the importance of being familiar with the environment.

The next step is processing, which includes roasting, peeling off the bark, and rinsing in water. To roast the roots, they are coiled, placed directly in an open fire, and rotated with a stick to heat them evenly (fig. 5). The steam created from the natural moisture within the roots bursts open the bark making it easier to remove. The reasons behind roasting are not completely understood. The weavers suggested that roasting is used to prevent discoloration and premature aging or to ‘sterilize’ the roots from fungus and insects, and that it has been part of the process for generations. In addition, Ellen recalled that some weavers believe the roasting makes the wood denser and stronger. After roasting, to remove the charred bark, the root is pulled through an eena, or a wooden stick with a slit (fig. 6).

The two sides of the stick can be squeezed together with one hand to get the right pressure while the root is pulled through the opening with the other. Afterwards, the roots are rinsed in Alaskan rainwater, which contains little contaminants or chemicals that might discolor the roots.

The last step before weaving is splitting the roots. Spruce roots have a slightly hourglass shaped cross section with opposing root hairs on either side of the narrow section (fig. 7). First, the root is split in half down the middle of the narrowest diameter and through the root hairs (depending on one’s skill, of course). Then, each half is split again and again until the desired thickness is achieved, somewhere between 1-2 mm. The outer side of the root with the smooth epidermis is used for the wefts and the inner sections for the warps. To split the root, an initial incision is made with a small knife. One split end is held in the mouth, the other split end is held in the right hand, and the unsplit root is held in the left hand. This arrangement allows tension to be created so that the root can be split evenly down the center. It was evident that this part of the root preparation process took years of practice to perfect.

Once the roots are split and ready to be woven, they are coiled and dried. When they are needed for a basket, they are soaked in water until they are flexible enough for weaving. During the interns’ five weeks in Juneau, they worked with Jan and Mary Lou to each weave a small basket. While many of the spruce root collection, preparation and weaving techniques are well documented in Sharon Busby’s *Spruce root basketry of the Haida and Tlingit* (2003), these experiences were a critical aspect of understanding the materials and techniques of spruce root baskets.
Fig. 4. Pulling away the moss to reveal the spruce roots. Here the roots appear in an ‘x’ shape. The top root has an undesirable kink. (Photograph by authors)

Fig. 5. Roasting the roots over an open fire (Photograph by Seth Pauley)
Fig. 6. Removing bark from the root by pulling through an eena. The purple gloves are cotton gardening gloves, NOT nitrile (Photograph by Seth Pauley)

Fig. 7. Cross-section of a Sitka spruce root (Drawing by Teri Rofkar)
The interns each learned to weave in a different style, one Tlingit and the other Haida. Learning both styles helped them to understand the subtle differences between the twined structures (figs. 8, 9). For example, Tlingit baskets are woven right side up in a clockwise direction. This creates a “jog down” from left to right when there is a transition in design elements, while Haida baskets are woven upside down in a counterclockwise direction creating a “jog up” between design elements. In addition, Haida weavers often used a form to help keep the warps of the basket straight during weaving. A difference in decoration is that Tlingit baskets have false embroidery or wrapped weft decoration, while Haida baskets do not. Traditionally, maidenhair fern stem and grasses were used for these decorative elements. Learning from two different weavers revealed that even within the Tlingit weaving style there are differences in each weaver’s method, such as how to add new warps or wefts and whether one uses single or double warps.

Spending time with Jan and Teri and learning from them not only taught the interns about the materials, but it also instilled a sense of responsibility to fully include them in the preservation of their culture. This motivated the interns to write a paper together with the weavers for the 2008 15th Triennial ICOM-CC meeting in New Delhi, not just as a translation, but as a true collaboration. The process was challenging for everyone. For the interns, as the main editors of the paper, it was a delicate balance between taking control and allowing the weavers’ voices to come through. In the end they did very little to change the weavers’ words, but more to guide them to elaborate on topics that the conservation community would be interested in, as well as to suggest places to cut back to keep within our strict word count. An unexpected outcome of having the weavers express themselves on paper was that it clarified certain ideas that were particularly important to them. They both spoke at length about the connection they felt to several 4-5,000 year-old archaeological baskets found in the area. They expressed concern about the baskets’ stabilization so that others could also see them.

The interns were anxious to share their experiences from that summer with the conservation community, but were also sensitive to the fact that much of this information was traditional knowledge that has been passed down within the weaving community, and may not have been theirs to share. Writing the paper with the weavers was a way for the interns to ensure they had been given permission to pass this information along to others. This experience also allowed the interns to learn what they might be able to offer to the weaving community. Both Teri and Peter Corey, the previous curator at the Sheldon Jackson Museum, expressed how difficult it was to distinguish different types of plant materials from one another on old baskets by visual examination alone. For example, there is concern that horsetail root might be routinely mistaken for maidenhair fern stem. The interns explained microscopy techniques to them that can be used to characterize these materials and it was encouraging to think that conservators could help to give information back to the weavers about their past.

Weaving baskets together created a fertile space for the transmission of knowledge, one that only exists when people sit together with their hands busy and their minds wandering. It was then that the weavers shared their feelings and thoughts about baskets, weaving, and the past. Jan talked about how even the baskets they made that summer have a history. Their history started with the creation of the island and the growth of the spruce trees. The history of the baskets will continue on in these women and through collaboration with them.
Fig. 8. Tlingit start (Photograph by authors)

Fig. 9. Haida start (Photograph by authors)
3. WORKING IN THE MUSEUMS

At both museums, the interns examined baskets with Jan and Teri and with the curators Steve Henrikson and Rosemary Carlton. Spending time with these experts familiarized the interns with the baskets, their cultural significance, and their significance to the museum collections. In addition to looking at baskets in these collections, baskets were examined at the Sitka National Historical Park with curator Sue Thorson.

Looking at these baskets, discussions ensued about their traditional uses and how this might be related to their current condition. In these conversations, Jan always cautioned against jumping to conclusions. For example, baskets with irregularities in their weave at first suggested the work of an inexperienced weaver. But Jan offered other ideas; reminding the interns of all of the irregular roots that they found when they were out gathering with her, and how a basket might look if those twisted roots were the only ones that could be found that season.

Looking at baskets in museum storage revealed a range of repairs, both traditional and non-traditional. Traditional Native repairs generally consisted of making the basket functional again. Later, as baskets were sold for tourist trade, repairs were carried out to maintain aesthetic integrity. The later museum repairs ranged from losses filled with sections cut from other baskets, mechanical repairs with thread, and various types of paper and adhesive repairs. Some looked similar to the types of repairs that are commonly used to mend baskets in conservation labs today. Looking at these older repairs allowed the interns to think more critically about how to approach treatments. As they examined the baskets with Jan and Teri, they asked the weavers how they felt about the repairs overall, the materials used, and the final aesthetic. Generally, while the weavers appreciated the visual integration of conservation treatments, for them, stabilization was enough, a preference seemingly prompted by a desire to not lose any more of their past. The weavers seemed most concerned about the stabilization of the archaeological basketry fragments. These “old ones” as Teri liked to call them, were an inspiration for their own work and really linked Jan and Teri to their ancestors. The weavers also seemed hesitant to touch and handle the damaged baskets. The interns realized that stabilization is not only beneficial to preservation, but also accessibility.

At both museums, the interns examined and treated several baskets. The treatments included cleaning, reshaping, stabilization, loss compensation, and toning fills. The treatment proposals and ultimate treatment decisions were determined collaboratively with Ellen, the curators, weavers, and other museum staff. Several of the baskets required reshaping to facilitate further examination, study and interpretation, as well as preparation for further repairs and loss compensation. For example, one Tlingit basket had upside-down, Y-shaped creases which were evidence of the traditional method of folding and storing baskets, indicating the basket was made for use rather than the tourist trade. In addition, the shape was distorted from more recent damage that undermined its structural integrity in areas. In this case, it was important to restore the original shape of the basket, but maintain the evidence of use (figs. 10, 11). Reshaping also allowed for proper cleaning and adequate stabilization. However, before reshaping could be carried out, it was important to understand how the basket was traditionally folded and then decide how this information should be preserved.
Fig. 10. Tlingit basket (ASM 2008-18-1) before treatment with upside down Y-shaped crease emphasized with white lines (Photograph by authors)

Fig. 11. Tlingit basket (ASM 2008-18-1) after treatment (Photograph by authors)
A Tlingit oval lidded basket at the Sheldon Jackson Museum required extensive reshaping. It was significantly distorted from its original shape – the rim and side walls were deformed into an oval shape 90 degrees to the original axis (fig. 12). Due to this deformation, the lid of the basket sits on the rim perpendicular to its original orientation. The two-part rim of the body was also significantly altered, almost completely obscuring the false embroidery on the exterior of the basket in this area.

Teri felt certain that the false embroidery design around the rim of the basket should match the design along the bottom edge. Due to the misshapen condition, however, the basket was difficult to understand. It was agreed that an initial reshaping and documentation of the obscured false embroidery design would help make this basket more comprehensible to the weavers and other researchers (fig. 13).

All reshaping treatments were carried out using a humidification chamber with a mixture of water and ethanol. The ethanol was added to inhibit mold growth. Afterwards, if necessary, further reshaping was carried out using local humidification with Gore-Tex, a waterproof, breathable material made from polytetrafluoroethylene (PTFE), damp blotter paper, and Mylar polyester film. The treatments were completed by creating internal forms for the baskets made of materials including soft-structure Tyvek, a spun-bonded, high-density polyethylene non-woven fabric, and Ethafoam polyethylene foam (fig. 14).

After reshaping, many baskets required extensive repairs and loss compensation. Many of the repairs were carried out using twisted strands of Japanese tissue paper fibers and wheat starch paste, a technique described in the publication, The Conservation of Artifacts Made from Plant Materials (Florian et al. 1990) (fig. 15).

Several baskets also required loss compensation, for both stabilization and aesthetic reasons. The interns found that they had more room for creativity in developing techniques for loss compensation than they did for tear repair, and each experimented with different materials and techniques. By the end of the internship period, they developed several fill methods, which could be applied to many baskets, with modifications depending on the needs of each individual basket. For example, one Tlingit basket had a loss on the rim (fig. 16). A technique was developed for filling the loss to imitate the surrounding spruce root elements, as well as to provide strength and maintain flexibility. The fill was made by creating a plaited structure using blotter paper wrapped with Japanese tissue paper for the warps, and folded Japanese tissue paper for the wefts (fig. 17). This plaited structure was then attached to the basket using wheat starch paste. Twisted strands of Japanese tissue paper were used to strengthen the connection. Small wads of Japanese tissue paper and wheat starch paste were then applied to replicate the twined texture (fig. 18). A thinner strip of folded Japanese tissue paper was used to imitate the false embroidery along the rim. All of the repairs were toned using watercolor paints (fig. 19).
Fig. 12. Tlingit oval lidded basket (SJM I-A-631) before treatment (Photograph by authors)

Fig. 13. Tlingit oval lidded basket (SJM I-A-631) after treatment (Photograph by authors)
Fig. 14. SJM I-A-631 after treatment with internal form made from Ethafoam and Tyvek (Photograph by authors)

Fig. 15. Twisted Japanese tissue paper repairs on a Tlingit basket (ASM 2006-18-2) during treatment (Photograph by authors)
Fig. 16. A Tlingit basket (ASM 2006-18-1) before loss compensation with detail of loss area (Photograph by authors)

Fig. 17. The loss area on basket ASM 2006-18-1 during treatment (Photograph by authors)
Fig. 18. Detail of the loss compensation on ASM 2006-18-1 after treatment, exterior view (Photograph by authors)

Fig. 19. Detail of the loss compensation on ASM 2006-18-1 after treatment, interior view (Photograph by authors)
Another technique was developed to compensate the large losses around the base of a severely damaged Haida basket that required fills strong enough to hold the weight of the basket walls without placing any more stress on the surrounding broken spruce roots (fig. 20). After initial experimentation with the technique described above, it became apparent that this solution would not provide enough support and involved too many separate pieces that would be difficult and cumbersome to work with to create such large fills. Additionally, the size and location of the losses required the use of a temporary mount during treatment that restricted access to the interior. This led to the investigation of making a mold of the basket surface or sacrificial basket fragment, and then casting a replica for the loss area, based on a technique described in the CCI Notes “A Replication Technique for Damaged Basketry” by Barclay (1989). Testing this idea involved many conversations with the ASM exhibit designer, Paul Gardiner, who suggested molding and casting materials and methods. Unfortunately, with the available materials and time, this option was not possible.

Finally, the fill was made using several materials, including twisted Japanese paper fibers, cotton gauze, Japanese tissue paper, and paper pulp made from blotter paper. To start, long, twisted strands of Japanese tissue were sandwiched and adhered between two pieces of gauze with Jade 403. The gauze was then backed by a piece of Japanese tissue paper. The gauze and Japanese tissue paper sandwich was laid into the loss, gauze-side out, and the twisted paper strands were adhered to the exterior of the basket with wheat starch paste. Then, a mixture of paper pulp in wheat starch paste and Jade 403 was applied to the exterior of the fill, which provided the final strength and bulk (fig. 21). The paper pulp mixture was textured during application, while it was still wet, to resemble the surrounding weave structure.

Once the paper pulp was dry, it was fairly strong and still had some flexibility. All of the repairs were toned using watercolor paints (fig. 22). Developing these two initial treatments served as a solid foundation for the subsequent treatments.
Fig. 21. A detail of the loss compensation with molded paper pulp before toning on ASM II-B-493 (basket is inverted for treatment) (Photograph by authors)

Fig. 22. ASM II-B-493 after treatment, with internal form made from Ethafoam and Tyvek (Photograph by authors)
4. CONCLUSION

Collaboration is not a new concept for conservators; they regularly work in tandem with curators, other conservators, registrars, mount makers, and artists. And like much conservation work, the success of this project was dependent on many interactions. The interns gained knowledge by working with each other and drawing on past experiences and varied educations. They also had the opportunity to consult with other museum professionals, Native artists, and to interpret their work to the general public. Being surrounded by the Alaskan wilderness was also a means of enriching their understanding of basketry and Native traditions.

The most prominent collaboration of the internship described in this article was that between the conservation interns and the Native weavers, Janice Criswell and Teri Rofkar. As weavers and conservators work to preserve Native American cultural heritage, they learn from each other. Native artists can gain insight through scientific examination, and conservators can improve their work by learning about materials, weaving techniques, and their history and significance. For conservators, this hands-on experience is imperative to develop a deeper understanding and feeling for the work. With such knowledge and collaborative discussions, conservators can better propose, develop, and carry out treatments in a way that safeguards the object’s inherent knowledge and significance, as well as respects the wishes of the object’s primary stakeholders – which also connect to the object’s significance. Joining weavers in the forest to gather roots, feeling the outer bark strip away leaving a slick, strong inner root, smelling the soil and the freshly cooked roots, conservators can be closer to the natural source of the baskets and begin to appreciate the strength and beauty of new roots as a weaving material. Splitting roots into warps and wefts and weaving with Alaska Native weavers, conservators enter the circle of ancient weavers. By connecting deeply with the process of making these objects, a conservator’s work becomes less about doing repairs and more about respect between and among weavers of all nations, past and present.

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REFERENCES


FURTHER READING


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CONSERVATORS WITHOUT BORDERS: AN INTERNATIONAL ARCHAEOLOGICAL CONSERVATION AND OUTREACH INITIATIVE

MELINA SMIRNIOU, CHRISTIE POHL, AND DOMINICA D’ARCANGELO

ABSTRACT

Conservators Without Borders is a volunteer program that provides support to archaeological projects where insufficient funding does not allow for conservation activity. Priority is given to sites in countries where finds are in need of urgent attention, either during or post-excavation. Other objectives of the initiative include outreach to local communities, developing sustainable methods of conservation, collaboration with archaeologists, and training students, volunteers and interested community members. In 2007, Conservators Without Borders was awarded a sum of money by University College London Futures to carry out two pilot seasons in 2007 and 2008. University College London Futures, funded by alumni, staff and friends, awards grants to members of the University College London community for non-research initiatives.

This paper describes two collaborative projects undertaken by Conservators Without Borders in 2007. During the first project, Conservators Without Borders worked alongside archaeologists from the Kythera Island Project on the island of Kythera in Greece. A collection of Minoan, Classical and Roman artifacts were subject to fluctuating environmental conditions and the circumstances worsened following a severe earthquake in 2006. The second project took place in Jordan in cooperation with the country’s Department of Antiquities and involved treating objects from museum collections in Umm Qais, Jarash, Karak, Petra, Irbid and Amman.

Both projects have provided Conservators Without Borders with valuable opportunities to raise the profile of archaeological conservation through close interaction with archaeologists, museum professionals, government officials and students. Helping to build long-term sustainable conservation programs in areas where there is enthusiasm for conservation is rewarding for Conservators Without Borders conservators and stakeholders alike. Conservators Without Borders will return to Greece and Jordan in 2008 for additional conservation work and to build on the foundations laid through the initial outreach and training sessions.

1. BACKGROUND

As post-graduate conservation students at University College London’s (UCL) Institute of Archaeology in 2006, Melina Smirniou, Christie Pohl and Dominica D’Arcangelo together identified a need for increased conservation input on archaeological sites. Devising an international volunteer initiative called Conservators Without Borders (CWB), the founding members looked at ways in which conservators could become more actively involved in archaeological projects through improved communication and the implementation of dynamic approaches to information exchange.1

In 2007 a grant was awarded to CWB by UCL Futures, funded by alumni, staff and friends to award grants to members of the UCL community for non-research initiatives and projects. This paper introduces CWB and describes two collaborative projects undertaken by the initiative in 2007. The first project took place on the Greek island of Kythera and the second at six locations in Jordan. Both projects are distinctly different from each other but provide examples of how conservators can add value to archaeological sites and programs. These case studies also highlight some of the key considerations and challenges involved in the successful collaborations.

CWB is a volunteer initiative which focuses resources on sites and regions which lack funding for professional conservators and conservation materials, but whose stakeholders have demonstrated an interest and enthusiasm for conserving their tangible heritage.
primary strands to the activities: practical conservation, education and outreach. One of the
guiding principles of CWB’s work is to cooperate with archaeologists, heritage professionals,
local communities and students to build sustainable preventive conservation programs. The
initiative also aims to work closely with conservation students to contribute to their training by
giving them experience with conservation in the context of archaeological sites. Through the
 provision of outreach, education and training, communities become better equipped to
understand conservation needs and have an increased ability to participate in conservation
activities.

CWB’s practical work consists of administering first aid conservation on newly or post-
excavated unstable objects and helping to improve artifacts’ packaging in storage. With limited
resources, CWB aims to make a lasting impact in a short period of time by restricting complex
remedial conservation treatments to the most urgent cases. Individual object treatments can be
time consuming and the goal is to treat and stabilize as much material as possible in a 2-3 week
fieldwork session. The focus of CWB’s training program is to demonstrate how to minimize
damage through preventive conservation techniques rather than to repair damage after it has
occurred.

2. ON-SITE CONSERVATION

In conservation literature, there is broad recognition that involving conservators early in the
excavation process is the key to sustainable collection care; however, there is often a gap
between theory and practice. Cronyn writes in *The Elements of Archaeological Conservation* that
collaboration between conservators and all who have an interest in the excavated archive “is the
only ethical approach” because without successful communication, information and time are
wasted (Cronyn 1990, 10). Archaeological conservators working on-site quickly recognize that
their remedial and preventive conservation skills are valuable and necessary assets. Effective
cooperation with specialists and archaeologists can ensure that fragile objects are lifted intact and
as much information as possible is recovered. Conservators also have the ability to advise on
adequate storage that optimizes an object or collections’ use for all research and public-facing
needs.

Although the tide is slowly changing, very few archaeological projects have the ability or
resources to include conservation from the beginning (Sease 1999). ICCROM’s former Director-
General, Nicholas Stanley Price argued over 10 years ago that standards of conservation in the
field have not improved at the same rate as excavation and the presence of conservation on-site is
a rarely achieved ideal (Price 1995). In the early 21st century, despite some progress, many
conservators would still agree with these statements.

Why does the situation persist in which conservators remain underrepresented on
archaeological sites? There are many reasons for this, including funding short-falls, a lack of
understanding about long-term benefits of on-site conservation, and a lack of regulation by host
countries. These are interrelated issues and often are the result of fundamentally complex
political and economic considerations. CWB believes that one way of addressing the situation is
by increasing the comprehension of conservation aims and objectives amongst all archaeological
site stakeholders through effective communication. Higher visibility of the profession gained
through communication ensures that conservation is a resource that is appropriately budgeted for
in the project planning stage when it can have the greatest positive effect. In addition, if
governments or other funding bodies also prioritize the long-term use of objects and regulate in
favor of conservation provision, conservators would cease to be a ‘nice-to-have’ add-on to archaeological excavations and would figure into the core team at a preliminary stage. Raising the profile of conservation is not the only way, but one way of successfully informing decision makers and influencing how they spend their money.

CWB is helping to raise the profile of conservation. By targeting under-funded sites that are rich in educational and outreach potential, CWB volunteers can add value to collections while empowering archaeologists, students and other stakeholders to positively engage with conservation. However, with this multi-faceted objective come practical and communication challenges that must be overcome.

3. PRACTICAL CHALLENGES

On-site conservation poses a range of challenges for conservators. Often, storage environments are uncontrolled, fluctuating and collections may have been neglected for long periods of time. There is often a high demand on handling the collections with a constant turnover of students and researchers requiring access to them. In addition, in some countries, it is difficult or impossible to obtain conservation-grade materials which are the most appropriate for long-term storage.

After assessing the stability of objects and conditions in both Greece and Jordan, CWB determined that there were requirements for remedial and preventive activities. Although CWB had a glimpse of the issues posed by the condition of the collections prior to travelling, it was not until arriving on-site that the team could accurately gauge the risks to the collections and implement appropriate solutions. CWB’s primary assets are conservators’ willingness and ability to be extremely flexible with on-site strategies. As well as prioritizing work flow quickly, solutions were found which work well within the project time-frame and the host’s capabilities.

Training museum staff accounts for around 40% of CWB’s work and, again, it is important for conservators to gauge trainees’ skills in order to put together effective training sessions and sustainable conservation solutions. CWB primarily focuses on-site training around preventive conservation; however, in some contexts, it has been appropriate and necessary to discuss basic remedial treatments.

To deal with the issues surrounding packaging, CWB aims to provide adequate conservation-grade materials for careful repackaging. Conservators have also taken samples of conservation materials and consulted with local professionals to find out if similar stock can be obtained locally. Going forward, CWB must evaluate the sustainability of providing conservation-grade materials versus sourcing materials in the host country.

4. COMMUNICATION CHALLENGES

In addition to practical challenges, there are also communication challenges. Effective communication can be difficult where there is a language barrier. In addition, the sites to which CWB has been invited may have political structures and histories which volunteers have to effectively negotiate without causing offence or misunderstandings with the other individuals or groups involved in a project. Although CWB team members strive to understand the local project and situation prior to travelling, they are aware that upon arriving there may be political issues or legacies which may affect their work flow. Most importantly, the initiative aims to inform and cooperate with archaeologists and local communities which can be most easily accomplished where a bond of trust is established.
CWB is looking at ways of how best to deal with language issues. The dominant operating language is English, but we are looking to involve volunteer conservators who can offer intermediary language skills. This will help with communication both ways and demonstrate a commitment to mutual understanding.

CWB has experienced an openness and appreciation of participants in the training and information sessions. CWB does not exist to criticize past treatments or conditions, but assists in looking forward and preserving collections for future use. This approach can diffuse potentially sensitive political conditions by depersonalizing any advice and promoting collaboration in the search for workable solutions.

5. THE FIRST CWB MISSION IN KYTHERA, GREECE

The first CWB project took place on the island of Kythera, Greece for three weeks in June and July 2007. Kythera – 280 sq. km in area – is situated between the southern tip of the Peloponnese and the island of Crete.

The island has a very rich archaeological heritage resulting from 7,000 years of continuous occupation, which spans the late Neolithic, Bronze Age, Iron Age, Roman, Byzantine, Venetian, Ottoman and Modern Greek periods (Bevan and Connoly 2004).

In the 1960s, the British School at Athens, led by Nicholas Coldstream and George Huxley, excavated at the coastal site of Kastri, concentrating on the Early Bronze Age layers and the Minoan presence on the island. Apart from Minoan finds, the archaeological material also includes artifacts from Classical, Hellenistic, and Roman periods and the collection is mainly comprised of pottery sherds, ceramic, metal, stone and glass small finds. The material had been stored at the Kythera Archaeological Museum in its original packaging since the 1960s excavations. The storeroom has no environmental control and the temperature and humidity levels fluctuate throughout the year. The inappropriate micro and macro environmental conditions resulted in the deterioration of the objects. In 2006, a severe earthquake which measured 7.2 on the Richter scale hit the island, and the museum was deemed structurally unsafe. The archaeological material was then moved to the current storage facility for the Kythera Island Project (KIP). KIP is a project that involved a four-year (1998-2001) intensive field archaeological survey of the island, and since 2001, a close study of the collected artifacts. KIP is co-directed by Cyprian Broodbank of University College London (UCL) and Evangelia Kiriatzi of the British School at Athens.

The two directors invited CWB to work on the collection because of the observed deterioration of the objects. The original small finds packaging included paper bags, cigarette cases, biscuit tins, and small paper boxes with sheep’s wool; all were stored with larger ceramic vessels in open wooden crates filled with hay and straw. This organic material resulted in pest infestation, and some of the ceramic and glass sherds had shattered upon contact with one another as a result of the poor original packaging. Many of the metal objects – iron, copper alloys, and lead – were actively deteriorating.

A three-person CWB team travelled to Kythera, which included Christie Pohl, Melina Smirniou and student volunteer Saray Naidorf from the MSc conservation program at UCL’s Institute of Archaeology. The team worked with the directors of KIP to prioritize artifacts for CWB to treat during the 2007 season. Together it was decided to first treat and stabilize the most vulnerable and fragile objects, and then re-house the small finds which specialists frequently access. The final task involved reconstructing and repacking the pottery from the Early Bronze
The two teams collaborated, worked together and learned one from the other in an interdisciplinary approach. This two-way communication worked effectively; the archaeologists extended their understanding of conservation processes and CWB team members managed to implement a workflow system utilizing the available resources.

The team cleaned the small finds, mechanically removed active corrosion in order to stabilize the metals, consolidated flaking glass surfaces, reconstructed some of the pottery, replaced the old storage material with new conservation-grade packaging, and relocated the collection into air-tight containers or polyethylene bags, as appropriate. This packing method created a stable micro-environment which will prevent further damage. New identification tags and labels were made that included the finds number, type of material, description, place and year excavated. The newly packaged objects were then re-housed in plastic crates with closed lids. Before and after photographs were taken, and all of the work and treatments were documented and left with the KIP directors.

Figs. 1a, 1b. Examples of the original packaging (Photographs by authors)

Figs. 2a, 2b. CWB replaced the old storage material with conservation-grade packaging (Photographs by authors)
The team also collaborated with researchers who visit the site every summer to study the material. The new packaging was tested to see whether the collection was easily accessible with minimal handling, and it was enthusiastically received by the visiting researchers. By exposing researchers, archaeologists and specialists that visit the site to preventive measures, CWB also managed to raise the conservation awareness of the collection’s stakeholders.

The museum’s seasonal employees visited the working site and gave information to the team regarding the collection and the status of the museum. The team gave hands-on demonstrations and training sessions on best conservation practices, preventive conservation, appropriate packaging and storage methods, and how to handle fragile archaeological materials. Although these sessions were short, an initial outreach to the museum staff started to develop, raising users’ interest in and awareness of preventive conservation.

The biggest challenge during the project was overcoming the bureaucratic administrative museum structure and local politics in order to reach the local community. CWB realized that trust can be built through establishing a long-term relationship. During this first season in Kythera, the team managed to launch an initial communication channel with the local authorities and aims to collaborate with these officials to develop sustainable archaeological conservation on the site. Sustainability, or the capability to maintain preventive conservation practices with available local resources, is key to the long-term preservation of collections. Building trust is an on-going effort and this process takes time. CWB will continue to develop relations with the museum and local authorities through transparency and openness.

During the 2007 season, a total of 582 ceramic, metal, glass and stone objects were stabilized and re-housed in conservation-appropriate storage and packaging conditions. Remedial treatments involved mechanical cleaning, consolidation and reconstruction. The original storage conditions included a range of organic materials such as wood chips and straw. These materials had led to pest infestation and further damage occurred to many of the small finds during a significant earthquake in 2006. CWB eliminated all the organic storage materials and replaced them with conservation-grade packaging materials. An initial outreach effort was established during the project, aiming to promote best conservation practices and sustainability. A continuous dialogue with all the stakeholders involved was also encouraged. CWB is planning to strengthen these relationships as well as provide conservation support to the archaeological collection again during the 2008 season.

6. THE SECOND CWB MISSION IN JORDAN

CWB began to discuss a collaborative mission with Jordan’s Department of Antiquities (DoA) in the spring of 2007. A need was identified to treat post-excavated material in storage, involving objects from the National Archaeological Museum in Amman and five different museum collections associated with the DoA: the Umm Qais Archaeological Museum, the Dar As-Saraya Museum in Irbid, the Jarash Archaeological Museum, the Al-Karak Antiquities Museum and the Petra Archaeological Museum. A mission in Jordan allowed for the fulfillment of several other CWB objectives, including working with local museum employees and archaeologists, conducting training sessions with individuals on both preventive and practical conservation techniques, visiting several museums and storage facilities and extending additional outreach through a public lecture and practical demonstration at the DoA Headquarters in Amman. In these sessions topics such as proper handling and appropriate storage conditions for various materials were discussed; appropriate packaging techniques; how to create a stable micro-
environment when a controlled store-room is not feasible, as well as consolidation and stabilization techniques for glass, ceramics, and metals. The 2007 team included Christie Pohl, Melina Smirniou and Amy Drago, a volunteer professional conservator.

Jordan’s archaeological sites and material culture are extremely diverse and the antiquities (Palaeolithic (700,000 BC) through the Ottoman period (early 20th century)) represent a long history across multiple civilizations (Department of Antiquities 2007b). The following background information on the six sites and museum collections provides a platform for a discussion of CWB’s 2007 work.

Archaeological surveys indicate that Umm Qais (Gadara), in northern Jordan, was occupied as early as the 7th century BC. Strategically located, Umm Qais was surrounded by a number of key trading routes connecting Syria and Palestine and was also one of the ancient Greco-Roman cities of the Decapolis. The local archaeological museum was originally the Ottoman governor's house (Ministry of Tourism and Antiquities 2003) and the Umm Qais collection includes a range of archaeological objects, mosaics and statuary.

The city of Jarash, also in Northern Jordan, has an unbroken chain of human occupation that dates back more than 6,500 years; however, its golden age came under Roman rule and Jarash is one of the best preserved Roman towns in the world. Modern Jarash lies directly east of the Roman settlement and the archaeological museum features artifacts found during excavations, including ceramics, glass, coins, metal objects, statuary and sarcophagi.
Fig. 4. The archaeological site of Jarash (Photograph by authors)

Fig. 5. A view of the Karak Castle (Photograph by authors)
Karak has been inhabited since at least the Iron Age and was an important city for the Moabites. Its greatest importance was during the Crusader and Ayyubid periods and these groups were responsible for building the 12th century castle that overlooks the city (Massadeh 2007). The Karak Archaeological Museum was established inside the old castle and the collection dates from the Neolithic to the late Islamic period. The museum houses remains of skeletons and pottery from the Iron Age, Byzantine glass vessels and inscriptions, and Roman and Nabataean coins, ceramics, and metal objects (Department of Antiquities 2007a).

The Petra region in southern Jordan was inhabited by settled communities as early as 7,000 BC. The Nabateans took over from the Edomites in the 6th century BC and were engaged in caravaneering (Ministry of Tourism and Antiquities 2007). These peoples prospered and dominated the region’s trade routes and built the ancient city of Petra, a series of architectural tombs, façades and theatres carved into multi-colored sandstone. Petra is Jordan’s most famous archaeological site and the Petra Nabatean Museum shows examples of Neolithic food processing, Edomite pottery, Nabataean sculpture, jewelry, lamps, bronze statuettes, terracotta figurines, pottery, and coins.

Within the boundaries of Jordan’s Irbid Governorate, the complete spectrum of cultural periods exist, from the early Stone Age through the Ottoman period (Department of Antiquities 2007b). The Dar As-Saraya Museum is housed in an original castle built by the Ottomans during
the mid-19th century and the museum is comprised of seven halls. The Ancient, Classical and Islamic periods are outlined, with additional halls devoted to metal finds, sculpture and mosaics.

The National Archaeological Museum in Amman has a collection of antiquities from all of the archaeological sites in the country, ranging in date from the Palaeolithic to the 15th century AD. The museum features exhibits of the Dead Sea Scrolls and presents ancient items of daily life such as pottery, glass, flint and metal tools, in addition to monumental inscriptions and statuary.

The CWB team travelled to Jordan in October and November 2007 for a three-week project. The main base was a dig house on the archaeological site in Jarash, but the team also spent three days working in Petra at the Petra Archaeological Park Headquarters. Both of these locations provided ample space for setting up a basic workspace with the team’s conservation supplies and tools. The approach to the work on each collection was initially focused on preventive conservation measures, including packing techniques using conservation-grade materials, advice on environmental conditions for different materials and creating controlled micro-environments for archaeological metals. Important health and safety measures were also discussed with each group of participants. There were approximately five to six participants per group and one group for each of the six locations CWB visited. The primary materials treated from each of the six museum collections included copper-alloy and glass artifacts as these (together with ceramics) are the most commonly excavated objects in the region and the most unstable due to improper storage conditions. The daily schedule started with a four-hour training session with employees and archaeologists from each museum. The CWB team then carried out additional conservation treatments in the evening.

Figs. 7a, 7b. Copper-alloy object from the Irbid Museum; before and after treatment (Photographs by authors)
After covering minimal intervention, appropriate preventive conservation techniques and best practices, the team members discussed and demonstrated basic chemical and mechanical cleaning for copper alloy objects. CWB’s microscope allowed the museum employees and archaeologists to view an object much more closely and to use it as a tool for removing active corrosion from bronzes. If time allowed, CWB also described methods for consolidating a fragile glass vessel, preserving a weathered surface, and the approach to reconstructing fragmentary objects. The latter gave the participants an idea of the more complex practical treatments used in conservation, and demonstrating more interventive techniques gave the training session
participants a more well-rounded understanding of conservation methods and processes. The primary aim was to pass on skills to the trainees that could be utilized to better preserve artifacts and collections. By demonstrating more complex conservation work, CWB communicated the necessity of formal training for many of the treatments and the importance of consulting a conservator for involved remedial work such as reconstruction, repairs, gap fillings, etc. Along with before and after photographs of each of the objects, CWB also left each museum with a detailed record of each treatment, material guidelines, health and safety considerations, and sources for acquiring conservation supplies.

In addition to the practical work and training sessions, CWB had the opportunity to visit several of Jordan’s museums and on-site storage facilities. This gave the team the opportunity to examine the display case conditions and evaluate the long-term storage environments. CWB made several recommendations for further safeguarding the collections, advised on environmental conditions, and suggested the use of materials such as silica gel to control fluctuating humidity levels in the absence of an environmental control system. The suitability of display-case materials (e.g. textiles) was also discussed, particularly for cases containing metal objects.

The Department of Antiquities arranged for CWB to give a lecture at the Amman Headquarters, followed by a hands-on practical demonstration of packing techniques, mechanical cleaning of active corrosion using a scalpel and microscope, and the stabilization of corroded archaeological glass. The lecture covered the main principles of conservation and preventive measures that were relevant to Jordan’s antiquities. The team also described CWB’s objectives and work to date in Greece and Jordan. Both the lecture and practical demonstration gave CWB additional exposure, and the program was attended by heritage specialists, students, archaeologists and museum curators from across the country.

Overall, the first CWB mission in Jordan was deemed successful by the CWB volunteers, the museum staff who participated in the training sessions, and Jordan’s Department of Antiquities. Approximately 200 glass, copper alloy, iron, stone and ceramic objects were stabilized and re-housed from the six collections. The outreach activities gave the participants an introduction to valuable and achievable preventive conservation measures. The CWB team members found the initiative to be a rewarding experience as a result of sharing conservation knowledge and skills, while learning and developing their own practical and communication skills. The graciousness, enthusiasm and appreciation of all the participants played a crucial role in the accomplishments of the initiative, and establishing a sense of trust was a significant and constant element of the projects. Reciprocal relations, particularly with tangible benefits for the countries and participants involved, are fundamental to CWB’s mission and are a crucial ingredient for negotiations and successful, international archaeological collaborations.

Over the course of the three weeks, there were several key considerations and challenges that emerged as likely factors in future CWB projects. One aspect of any fieldwork project is the limited duration and the need to complete a great deal of work in a short, concentrated time-span. Time management was a very important part of CWB’s work in Jordan. The workload had to be evaluated on the spot with each collection, since the team did not have an indication of how much material needed treatment (and to what degree) ahead of time. With six collections to work on and three to eight people present for each training session, it was of utmost importance to balance the outreach element of the project with treating and stabilizing as many of the objects as possible. The finite morning outreach sessions allowed the CWB conservators to complete additional treatments in the evenings. The Jordan initiative gave the team the opportunity to fine-
tune their ability to evaluate the needs of a collection very quickly. Sustainability was a primary consideration for CWB while making suggestions for change and improvements that the museums and outreach participants could realistically achieve. More specifically, the CWB conservators’ aim was to hand over the project at the end of their stay to the museum or store employees and these individuals could then continue the work and perhaps even show other regional museums appropriate preventive conservation practices.

Fig. 11. Christie Pohl with Sate Massadeh from Karak (Photograph by authors)

Fig. 12. The store room of the Petra Archaeological Museum (Photograph by authors)
Showing how to create a controlled micro-environment for metal artifacts using silica gel and Tupperware containers (which are inexpensive and widely available in Jordan), is a good example of how CWB helped the museum employees and archaeologists understand how to stabilize the condition of their stored collections.

Besides evaluating the needs of the objects, it was necessary to evaluate the ability of the training session participants in a short amount of time and tailor the outreach to accommodate those without any conservation experience as well as those who already had some theoretical knowledge and practical skills. CWB recommended several of the museum employees and archaeologists for further conservation training, as there may be an opportunity for this in the future, facilitated by the Department of Antiquities. Another challenge of the outreach component is finding a balance between teaching enough to make an impact and not giving the impression that complex remedial treatments should be attempted without consulting a professional conservator. Mechanically over-cleaning metals and the removal of corrosion layers on archaeological glass are two examples of the dangers of further damage that can occur to objects without proper and thorough explanations of these conservation techniques.

One of the concerns with an international initiative like CWB is the potential for difficulties due to the language barrier and how this may impact communication during the project. However, with the 2007 projects in both Greece and Jordan, language differences did not prove to be problematic or inhibit effective communication. So far, a CWB team member has been able to speak the native language, those we have worked with speak English very well, or there has been an individual in the training session that can assist with translating. Since much of the outreach work is based on visual and hands-on demonstrations, a lot can be successfully communicated without language. But CWB team members are also willing to study some language basics for the regions they travel to and will actively try to recruit multi-lingual volunteers to help facilitate a successful overall experience.

Throughout the Jordan initiative, and with any project in a foreign country, cultural sensitivity and respect for different beliefs and values is extremely important. CWB aims to open a dialogue on conservation issues and does not believe that there is one ‘right way’ to conserve collections. CWB’s objective in Jordan was to identify how the team could best assist with some of the issues and challenges in caring for Jordan’s antiquities, not to direct or take over. By sharing conservation knowledge, local people have an opportunity to improve conditions in order to sustain collections for the long term.

7. CONCLUSION

The 2007 mission in Jordan contrasted with the project in Kythera in several ways. The latter was on a smaller scale and focused on one collection in one storage facility. The Jordan initiative had a larger emphasis on outreach and training; the ability to consult on museum displays and storage conditions was also a significant component. Both projects allowed CWB to establish relations with governmental departments. In Jordan, CWB additionally met and built trust between individuals from six different museums. There is great potential for a long-term relationship with contacts in Jordan and Greece as a result of the 2007 projects. KIP has invited CWB to return in 2008 and a second mission in Jordan is planned for the fall of 2008.

Based on our projects in 2007, CWB firmly believes that communication and interdisciplinary working are fundamental to raising the profile of conservation. In addition, CWB provides opportunities for conservators to respond to real concerns and problems with
practical, feasible solutions. All communication should be two-way; conservators have an important role to listen carefully to localized needs before formulating preventive conservation suggestions such as proper handling, packing and storage, use of conservation-grade materials, pest management, as well as health and safety guidelines. CWB’s activities demonstrate that amongst the sites visited, there is a real openness, willingness to learn and appreciation for the information exchange on offer.

Fig. 13. CWB giving a lecture at Jordan’s Department of Antiquities (Photograph by authors)

Fig. 14. Metal objects from the Karak Museum (Photograph by authors)
Figs. 15–17. Working together with museum employees (Photographs by authors)

Fig. 18. Lina Bakkar of the Dar As-Saraya Museum in Irbid (Photograph by authors)
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NOTE

1. At the time of publication, Conservators Without Borders (CWB) is no longer operating under that name. With the same aims and objectives, the original founders have broadened the organisation’s scope and changed its name to Heritage Without Borders (HWB). HWB builds capacity in heritage skills; supports heritage projects in situations of poverty, and following conflict and disaster; and provides valuable work experience for students and professionals in the heritage sector. For more information, see the website: www.heritagewithoutborders.org. In August 2012, Heritage Without Borders registered as a charitable company in the United Kingdom. HWB is an independent charity, but is based at the Institute of Archaeology, University College London, 31-34 Gordon Square, London, WC1H 0PY, UK.

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