

**(01) Review of Shipping Containers as Storage Options for Cultural Properties and Suggested Low-Cost Solutions for their Improvement, Phase I**

*Geneva J. Griswold and Ayesha Fuentes, third year students, UCLA/ Getty Program on the Conservation of Archaeological and Ethnographic Objects*

Metal shipping containers are often used for short and long-term storage of cultural materials and archives in post-disaster remediation, as well as in areas with limited permanent storage solutions. While shipping containers are widely available and inexpensive, their lack of climate control may catalyze deterioration unless modified. This study seeks to develop guidelines for the preparation, installation, and maintenance of metal shipping containers to be used as storage facilities. These guidelines are based on the extended monitoring of several such containers *in situ*, literature review, consultation, and the results of a survey of cultural heritage professionals with experience using these containers in a variety of storage contexts. Proposals for future container prototyping - to be developed based on the results of this initial research - prioritize the development of an efficient, low-cost, low-tech protocol for optimizing the performance of shipping containers as storage facilities.

Case studies and anecdotal evidence cite the use of unsealed and non-insulated shipping containers as post-disaster storage solutions; however, the containers have been noted to cause more damage than was previously present, due to moisture infiltration, temperature fluctuation, pest infestation, or lack of security. A literature review of previous research reveals a significant lack of published data on this topic. As such, this project particularly seeks to build upon Ted Ling's shipping container trial for records storage (2002), by identifying materials and methods for use in storing other collection types in diverse climate zones.

During this study's first phase, the stability of shipping containers' interior conditions were assessed by monitoring temperature and relative humidity over time in two differing climatic locations: Venice, CA and Bremerton, WA. The results of this monitoring regime will be presented in relation to weather and climatic conditions from these areas, and interpreted for insight on the relative stability of these spaces. Additionally, this data set will serve as the control against which the insulating capacity of materials will be assessed. This paper will also present the results of a survey conducted to evaluate conservators' and allied professionals' experiences with the use of shipping containers, perspectives on the containers' shortcomings and strengths, as well as their priorities for improvement. In coupling the survey results and consultation with conservation resources such as Timothy Padfield's *Humidity buffering of building interiors by absorbent materials* (2011), we seek to identify common, inexpensive materials most effective in stabilizing the interior environment, both for short or long-term use.

The project's next phase seeks to realize an inexpensive and technologically accessible option for communities to better maintain their cultural materials and to provide a risk assessment-based guideline for creating storage solutions that is legible to both conservators and non-specialists alike. Future research will

include materials testing and further experiments, including the use of buffering materials (e.g. cardboard, Styrofoam) as insulating layers, solutions for increased ventilation, exterior structures or tarpaulins, painted exteriors, and other modifications. We intend to present this research to the AIC community during its first phase in order to solicit feedback and suggestions so as to guide further study.

**(02) RTI in Paper Conservation: A Review of Current Practices and Applications**

*Angela Campbell, Assistant Conservator, and Lisa Conte, Assistant Paper Conservator, at the Sherman Fairchild Center for Works on Paper and Photograph Conservation, The Metropolitan Museum of Art*

The careful study of the surface topography of a work of art on paper is a critical component to understanding and protecting the object as a whole. Routinely, conservators have relied on multiple raking light images to glean detailed visual information about the surface of both the support and the medium/media on its surface. But with the development, in 2001, of Reflectance Transformation Imaging (RTI) by Cultural Heritage Imaging (CHI), a non-profit organization based in San Francisco, paper conservators have been better able to digitally capture and analyze the subtle three-dimensionality of paper-based objects. RTI involves capturing 30-50 images of an object, all with the same light source (for example, a remote flash) positioned at a different angle for each individual image. Using the software built by CHI, the series of images are then compiled and enhanced to generate a detailed three-dimensional recording of the object, which can provide visual data about the object which is not apparent under normal light or by a single angle of raking light.

Despite the significant potential of this technology for the documentation and analysis of paper-based objects, it has not been uniformly embraced and implemented by paper conservation labs. This poster presents an overview of the technique's usefulness and will address what types of documentation projects it best supports. Focusing on objects in the Metropolitan Museum of Art's collection that were documented using RTI technology, we will highlight specific instances where RTI has proven beneficial. The documented works in the Metropolitan Museum's collection were selected for their diverse topographies and include an 18th-century French blackwork print, a 19th-century Surimono woodcut print, and a 20th-century American screenprint as well as several objects with painted surfaces. With this research, we hope to provide conservators a broad understanding of how this technology can influence conservation practices and be of use to our field.

### **(03) The Role of Temperature on the Loss of Physical and Optical Properties of Newsprint: An Assessment of Deacidification and Subzero Freezer Storage for the Long-Term Preservation of Newspapers in their Original Form**

*Henry Wilhelm, co-founder and director of research at Wilhelm Imaging Research, Inc.; John Baty, Assistant Research Professor and Heritage Science for Conservation Scientist, Johns Hopkins University; and Andrew Han, Materials Science and Engineering Student, Johns Hopkins University*

Many cultural heritage papers are composed of groundwood and other high yield pulps, and it is important to develop a better understanding of their permanence properties and the treatments and storage conditions necessary for their preservation. A Canadian study undertaken between 1994 and 1997 largely disproved the hypothesis that lignin, on its own, promotes the mechanical degradation of paper, and accordingly in 2000 a National Standard of Canada for permanent paper was approved, specifying no upper limit on lignin content when optical properties are not an issue. When optical properties are important, the standard specifies a maximum of 1% lignin, in accord with the ANSI/NISO Z39.48 standard, because the supporting research had affirmed the hypothesis that lignin content promotes discoloration during aging, even in the absence of light. However, significant questions remain on the role of lignin in paper aging, including the compatibility of lignin-containing papers with deacidification treatments.

Rather than consider the preservation of papers composed of high-yield pulps as a whole, the present study was designed to contribute to our broader understanding by focusing on newsprint, and the options available to preserve newspapers in their original form. This involves a study of the loss of physical and optical properties as a function of temperature, and the benefits afforded by deacidification.

Representative samples of newsprint were taken from issues of *The New York Times* in the Wilhelm Imaging Research/Smithsonian newspaper preservation collection and subjected to accelerated multi-temperature Arrhenius tests outlined in “ISO 18936:2012, Imaging Materials – Processed Colour Photographs – Methods for Measuring Thermal Stability.” Arrhenius tests enable the extrapolation of changes in optical and physical properties over a wide range of temperatures (e.g., ambient room temperature, refrigerated temperatures, and subzero freezer temperatures). Because newspapers contain both text and monochrome and color images, it is appropriate to evaluate them using an imaging standard. Moreover, since ISO 18936 calls for 50% RH, it is in generally in accord with the TAPPI T 544 humid aging standard, with the exception that multiple temperatures are used. Additionally, these tests can be performed side-by-side with the ASTM D6819-02 sealed vessel standard, but again employing several temperatures. Yellowing and other discoloration of the papers at each temperature was measured in the near-UV and visible spectrum, and physical deterioration and weakening of the papers was evaluated using “TAPPI Test Method T 511 om-08, Folding Endurance of Paper (MIT Tester)” and “TAPPI

Test Method T 414 om-98, Internal Tearing Resistance of Paper (Elmendorf-Type Method).” In addition, molecular weight analysis using gel permeation chromatography was conducted.

Samples of deacidified newsprint were also included in the study, both to evaluate the efficacy of such treatments with newspapers stored at ambient room temperatures and to compare the cost-benefits of non-aqueous deacidification vs. cold storage.

With the advent of the Internet and the widespread adoption of computers and mobile smartphones and tablets, the worldwide distribution of news has rapidly shifted away from the traditional newspaper. The newspaper industry is in a state of precipitous decline, the more than 500-year history of this decisively important form of communication is coming to an end, and the physical artifact that we know as an unbound, folded paper newspaper printed on inherently low-stability newsprint is vanishing. It is therefore important that representative selections of newspapers in every country in the world be preserved in their original form.

This research is a joint effort of Wilhelm Imaging Research, Inc. and the Center for the Image in Grinnell, Iowa; and Heritage Science for Conservation, the Department of Conservation and Preservation – the Sheridan Libraries and University Museums, Johns Hopkins University, Baltimore, Maryland.

### **(04) From Pen to Press to Paper— McCutcheon’s Political Cartoons and How They Were Printed**

*Allison Holcomb, Conservation Fellow, Northwestern University Library*

The drawings of John T. McCutcheon, a Chicago area cartoonist, were translated from pen and ink to print using the commercial technology developed over the course of the 19th century. McCutcheon’s cartoons, drawn between 1889 and 1949, were published and republished in a range of newspapers, books, and periodicals through a variety of different methods. His work as a graphic artist serves to highlight the overlooked art of reproducing illustrations for relief printing in the wake of wood engraving.

Northwestern University Library is home to more than 400 of McCutcheon’s original drawings. Examination of them during a survey and rehousing project allowed close documentation of the materials and the way in which they were used. With these works as a starting point it is possible to trace the steps from drawing, to the production of a photographic relief plate and duplication. Marks of the processes used are evident in the construction and deterioration of the drawings themselves and the characteristics of the final prints.

Most of the drawings were for publication in newspapers which were printed cheaply and quickly. They would have been executed first as photographic relief etchings. These swift, undetailed drawings make use of dense, black, matte ink on dimensionally stable illustration board adhering to the precepts of contemporary instruction manuals. The bold nature of a drawing with little reliance on detail lent itself to the multiplication of plates by the stereotype process which often created imperfect replicas or obliterated finer elements.

Some drawings are marked with exes through blank spaces and instructions to use pre-made dot patterns to fill areas of the

drawings in the final illustration. The evidence shows a disregard for the original drawing as art object and a clear trend towards the functionality of the materials and the way in which they were used. Other drawings by McCutcheon were executed with more care on textured paper with dry media, creating the illusion of gradations in tone without the use of halftone screens.

This poster will illustrate the technology behind the printing methods used, highlighting the evidence in both McCutcheon's original drawings and the final prints.

### **(05) Preserving Decorative Metalwork at the Legislative Assembly of Ontario**

*Fiona Graham, MAC, CAPC, CAHP, Goldsmith Borgal & Company Ltd. Architects*

The Legislative Assembly of Ontario is the seat of government for the province of Ontario, Canada. The 1893 Richardsonian Romanesque building occupies a symbolic and central position in downtown Toronto. At 450,000 square feet and five stories, it is brimming with fine finishes including murals, wood veneer, marble, stained glass, brass, bronze and painted iron. Decorative metalwork includes interior and exterior railings, light fixtures and staircases. As with all pre-modern public buildings, these elements were originally maintained by an army of cleaners. A janitorial crew of four currently handles the work.

This particular project began as a typical contract to a heritage architect to investigate the heritage value of the decorative metalwork, to assess the condition of the metalwork, and to make recommendations for any repair or restoration work. In this instance, the architectural firm charged its in-house architectural historian and conservator with the task. Several large-scale conservation treatment projects were identified but most condition issues were minor and deemed to be the result of inappropriate maintenance practices. The primary recommendation for preserving the decorative metalwork was for a conservator to develop a maintenance manual and to train the janitorial staff in how to best clean the various types of metalwork.

In keeping with the author's philosophy on preventive conservation, preserving the majority of the metalwork was not a matter of doing something extra, but rather a different way of doing what was already being done. Using the right products in the right way, and only when necessary, would save time and energy as well as improving preservation of the original material. It would, in short, be sustainable. What might not be sustainable or ethical would be to continue the practice of waiting until the condition had worsened to an unacceptable state and then placing the heritage element on a list of conservation projects to be contracted out when the necessarily substantial monies became available. The Legislative Assembly appreciated the desirability of preservation through proper maintenance. Nevertheless, putting this approach into practice could prove difficult in a large organization where heritage preservation is carried out by contractors on a project-by-project basis, and is administratively entirely separate from the functional work of housekeeping. The key could well be the personal pride the cleaners take in their work.

Two years have passed since the cleaners received training

and detailed instructions on how and when to clean different metal elements. The conservator is now evaluating the results of these efforts, hoping to show that this simple preservation plan is indeed sustainable.

### **(06) The Development of an Aqueous Gel Testing Procedure for the Removal of Inorganic Salt Crusts**

*Annelies van Loon, Laura Eva Hartman, Andrew Mellon Paintings Conservation Fellow, Metropolitan Museum of Art, Julia van den Burg, Carol Pottasch, Ralph Haswell*

With the closing of the Royal Picture Gallery Mauritshuis for expansion and renovation, the opportunity was taken to study and treat the decorative ceiling and chimney paintings by Antonio Giovanni Pellegrini (1675-1741) located in the *Golden Room* of the Mauritshuis. During treatment of the Pellegrini paintings a visually disturbing, grey surface haze was noticed beneath the varnish, which became more pronounced and disfiguring after the varnish was removed; appearing as if the paintings were covered with a grey/brown veil. In order to determine the nature of the haze, SEM-EDX, FTIR, and DT-MS analyses were carried out in collaboration with the laboratories of Shell Nederland. Results indicated that a complex inorganic salt crust layer had formed on the surface of the paintings, most likely a result of past environmental conditions when the paintings were still in an unvarnished state, and when the galleries were heated by coal stoves. Based on analysis, the major elements of the crust layer on the ceiling paintings are likely present in the form of lead (II) sulfate and potassium sulfate (or a mixed salt), with the addition of calcium oxalate.

As this layer significantly altered the artists' original intent – Pellegrini is known for his use of bright pastel colors that were now completely disguised by the grey veil – its removal was greatly desirable. This paper explores testing of aqueous gels in order to determine a safe cleaning procedure for the removal of the inorganic salt crusts on the surfaces of the Pellegrini paintings. It specifically addresses the methodology of testing, which involved the use of test panels as well as both empirical testing and chemical analysis to evaluate the efficiency of the cleaning gels and their effect on the original paint surface. It also addresses how this research enabled us to come to a better understanding of the salt crust and the underlying original paint, and ultimately make better-informed treatment decisions during the conservation treatment of the Pellegrini paintings.

### **(07) Adhesive Smackdown: Consolidating a Synthetic Leather Wrestling Costume**

*Alison Castaneda, Conservator, Textile Conservation Workshop*

Of all the materials left for the conservator by the modern age, synthetic leather is perhaps the most multifaceted. It can be found in high-end designer wear, beanbag chairs, chemical labs and thrift stores. Equally thought of as humane, tacky, advanced and passé, the only thing certain about it is that it has evolved greatly since its inception. Despite advances in technology, however, its innate vices

guarantee it will make regular appearances in conservation labs.

Polyurethane (PUR) is one of the most commonly used materials for modern synthetic leather, and is inherently flawed. Oxygen, light, and moisture all contribute to its decay within decades of production. Between 2002 and 2006 the Netherlands Institute for Cultural Heritage conducted the PUR Research Project, studying the manufacture, use, degradation and conservation of polyurethane foam. This study is the basis of Thea van Oosten's book, *PUR Facts: Conservation of Polyurethane Foam in Art and Design*. Although the study concentrated on its use in sculpture, variations on the tested treatments could be applied to the textile field because of the foam-like physical structure of polyurethane synthetic leathers.

The centerpiece of this poster will be a garment sent by World Wrestling Entertainment (WWE) to the Textile Conservation Workshop. It served as ring entrance gear for now Hall of Famer, Shawn Michaels. It is a highly theatrical garment, replete with mirrors, chains and crosses. The synthetic leather was powdering and flaking badly with very limited amounts of the polyurethane "skin layer" remaining on the nylon knit substrate. When considering which adhesives could be used to consolidate the garment, the following parameters were used: the adhesive had to be strong enough to withstand minimal handling while retaining the original flexibility and sheen of the textile. It had to be able to nebulize well, as the ultrasonic nebulizer was deemed the best delivery method to fully penetrate the flakes without moving them around. Lastly, it was preferable that it be soluble in either water or minimally toxic solvents. Considering these factors, as well as which adhesives had been found successful in the PUR sculpture treatments outlined in *PUR Facts*, the following five adhesives were selected for trial: Ethulose, Gelatin, B72, Plextol B500 and Impranil DLV. Mock-ups were created in order to test these adhesives for suitability. Detached flakes taken from the bottom of the transport box were placed on samples of newly purchased nylon knits and adhered with different concentrations of the five selected adhesives. Only B72 and Impranil DLV adhered the heavy flakes to an acceptable degree and of the two, Impranil DLV left the nylon substrate more flexible. These results, combined with the excellent recommendations it received in *PUR Facts*, led to Impranil DLV being used to consolidate the wrestling costume. After consolidation, the PUR synthetic leather skin layer was successfully re-adhered to the nylon substrate with minimal to no change in sheen or flexibility. Although the costume cannot be displayed on a mannequin, a customized storage box allows it to be safely viewed and studied.

### **(08) Study and Treatment of Coastal Alaskan Native Kayak Models at the Peabody Museum of Archaeology and Ethnology, Harvard University**

*Judy Jungels, Assistant Conservator, the Peabody Museum of Archaeology and Ethnology, Harvard University*

The Harvard Peabody Museum, Cambridge, Massachusetts, and the Alutiiq Museum and Archaeological Repository, Kodiak, Alaska, recently collaborated to study and conserve several

nineteenth-century full-sized skin-covered kayaks and over one hundred associated Alaska Native ethnographic objects. This two-year project was partially funded through a grant from the Save America's Treasures Program and included a public-interactive conservation workspace located in one of the museum's galleries. The project allowed the rare opportunity to fully study objects from the Alaska Native collections in the Peabody Museum and to consult with Alutiiq colleagues to build knowledge of Alaska Native technologies. Material analysis using X-ray fluorescence (XRF), matrix assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-ToF-MS) and polarized light microscopy enabled better understanding of the technology of these objects. As part of this project, the museum's collection of twenty small skin-covered kayak models from various Alaska Native groups were studied and conserved. Historical and technical information on the kayak models was gathered through research into the museum's archives, discussion with Alaska Native consultants, a review of current literature, and material analysis. This poster discusses the collection and donor history, cultural affiliation, materials and technology, and preservation of these kayak models.

### **(09) Evaluating and Choosing Sheer Overlays**

*Camille Myers Breeze, Director and Chief Conservator, Museum Textile Services*

Textile conservators have employed sheer overlays for stabilization and preventative conservation since the early days of our field. An overlay is a sheer material placed on the object's surface with the goal of protecting the object and/or changing the object's appearance. The benefit of a sheer overlay is that it can provide immediate stabilization, as well as preventative protection, and is easily reversible, except when applied using an adhesive. As such, it is one of the first treatment tasks that interns at Museum Textile Services learn. In an effort to create a standard protocol for evaluating and selecting sheer overlays, I created a Sheer Overlay Score Card based on the three main categories of sheer fabrics listed in Chapter VI of the Textiles section of the AIC Collaborative Knowledge Base (AIC Wiki): nylon net, silk crepeline, and polyester sheers (e.g. Stabiltex®). The Sheer Overlay Score Card allows our staff to weigh the relative pros and cons of each sheer material based on sets of variable and non-variable factors. Its functionality was tested at the Campbell Center for Historic Preservation Studies, where I teach a class called "Textile Stabilization Using Sheer Overlays," and was found to be useful for students at all levels. With increased understanding and competency in choosing and using sheer overlays, conservation technicians and collections-care specialists are able to achieve an advanced knowledge of this skill. This interactive poster will allow viewers to touch samples of many sheer overlay materials, vote for the material they most often use, tell us where they find these sometimes-evasive materials, and take away a copy of the Sheer Overlay Score Card.

## **(10) Verdigris Pigment Properties and Degradation Studies: Part I**

Lynn B. Brostoff, Senior Scientist and the Analytical Services Liaison, Preservation Research & Testing Division, the Library of Congress; Cynthia Connelly Ryan, and Alessandra Gambardella

Until about the 19th century, the synthetic green pigment called verdigris offered artists an important alternative to the use of malachite, a natural copper mineral, or the use of mixtures of blues and yellows. Verdigris could be made from a plethora of recipes that date as far back as antiquity and basically consist of the corrosion of copper metal with acetic acid derived from vinegar, wine, or other fermented substances. True verdigris is thus a copper(II) acetate salt, although different recipes result in a range of compounds that may be categorized as either basic or neutral copper acetates, along with contaminant salts such as basic copper chlorides [Scott, Taniguchi, Koset, *Reviews in Conservation* (2001)]. Experiments with verdigris synthesis and paint media mixtures by numerous authors and professionals have shown that verdigris pigment has a range of associated colors, from bright teal-blue to dark green [Kuhn, *Artists' Pigments* Vol. 2, 1993]. Differences in water of hydration in copper acetate salt(s) is likely to play an important role in these color variations, although this has not been established. While the fresh pigment is crystalline and fairly straightforward to characterize by X-ray diffraction (XRD), Raman spectroscopy, and thermal analysis [Scott et al. 2001; de la Roja, Baonza, San Andres, *Spectrochimica Acta Part A*, 2007, Musumeci, Frost, *Spectrochimica Acta Part A*, 2007], it tends to lose crystallinity and otherwise react upon exposure to different environments. For example, it is often remarked that a color change from blue to green occurs in air in the first month after manufacture. Verdigris can also alter to a muddy green-brown over time. Exposure to high heat, including from artificial aging conditions or a 785 nm laser, can cause decomposition of verdigris to black CuO or other compounds, which can complicate studies using these conditions. The causes of these color changes have not been systematically studied nor defined in terms of natural aging mechanisms in media other than oil.

Regardless of its make-up, after several centuries *in situ* on a work of art, aged verdigris is often difficult to analyze due to loss of crystallinity and, as been hypothesized, possible reaction with the binding medium [Banik et al., *Mikrochimica Acta I* 1981, Scott et al., *Studies in Conservation*, 2001]. As a result, identification of verdigris is often based solely on the presence of copper and lack of detection of other pigments, as well as the commonly evidenced copper-induced paper degradation in book illustrations and maps. Verdigris was also often mixed with yellow pigments, which further complicates its identification.

This paper presents initial results of a Library of Congress study that seeks to define chemical properties and transformations of verdigris pigment as they occur in environments pertinent to their occurrence on paper-based artifacts. In particular, the study aims to clarify stages of chemical alteration in verdigris pigment in different environments, including exposure to light, heat, humidity, pH, and gum arabic and proteinaceous media or coatings, before the compounds become amorphous and discolored. This paper will present analytical results obtained from both experimental and historical samples of verdigris by XRD, Raman, and UV-Vis analysis.

## **(11) Transformation of Personal Grooming Tools into Paper Perforating Pens**

Grace Owen-Weiss, Associate Conservator for Book and Paper, The New York Public Library, Barbara Goldsmith Preservation Division

Conservators commonly use needles and scalpels to cut intricate shapes from paper for filling losses in paper artifacts. This method is slow and often stressful on the hands. The Crayola Cutter, sold as a toy for children, uses a wand fitted with a retractable needle to perforate paper, so that it can be pulled apart without the use of scissors. Some conservators have adopted it for cutting fills. The concept of the cutter is ingenious. In practice, however, its lack of power and awkward design prevent it from being considered a serious tool. The quest began to find a hand-held power tool that produces similar results without any of the issues. A design for a device seen on the Internet, made by prison inmates, came surprisingly close. It is a home-made tattoo gun, created by fitting a sewing needle to the shaft of a battery-powered spin toothbrush. The spin toothbrush actually operates in a linear motion, in that when a needle is attached to the shaft, it can punch a series of holes in paper, as the Crayola Cutter does. In fact, toothbrush tattoo guns are available for purchase over the Internet. They are fitted with a professional grade tattoo needle and are marketed to breeders for tattooing identification numbers inside the ears of show animals. Unfortunately, both toothbrush devices proved too bulky to hold comfortably in the hand and manipulate. Modifying a smaller, more ergonomically designed appliance became the next logical step. Personal grooming tools such as nose, ear, and facial hair trimmers were selected because they are small, powerful and many operate in a linear motion. The grooming tools of choice, each powered by an AA or AAA battery, can be modified using parts from a mechanical pencil, and a sewing needle. Two versions, the larger for heavier weight papers, have been designed and built. The paper perforating tool, with a cloth-covered Neoprene pad (mouse pad) used as a cutting base, handles like a pen. It can be used effortlessly to draw a series of small holes in a fluid motion. The perforated line is then pulled apart to create a feathered edge. The beauty of these tools is that they can be used on a variety of paper thicknesses. The poster will provide illustrated instructions on how to make two perforating pens from two models of trimmers presently on the market, and offers suggestions on how to use them in conservation treatments.

## **(12) Recent ASHRAE Standards and Research on Gaseous Phase Air Filtration with Applications for Conservation Environments**

William Lull, President, Garrison/Lull Inc.

In the past few years, ASHRAE has promulgated standards and completed research that concerns gaseous contamination and control, with direct bearing on how heating, ventilation and air-conditioning (HVAC) systems can help meet the goals for conservation environments. This paper reviews these published standards and research for how they are of value in creating better control over gaseous contaminants to protect collections.

ASHRAE Standards 145.1 and 145.2 provide a standard method for testing gas-phase filtration on most target gases for improved collections environments. Standard 145.1 is a method of testing granular media, while 145.2 tests whole filtration assemblies. Unfortunately, using these standards requires specification of the gases involved, and each have compromises in their methodology. The paper discusses how to make effective use of these standards in application.

ASHRAE Research Project 1557 tests six typical media types against four typical contaminant gases: ozone, formaldehyde, nitrogen dioxide, and toluene, using a Standard 145.1 test assembly. However, RP1557 tests at different concentrations and with a different basis of run time. Most media manufacturers test their products at very high concentrations, several parts per million (PPM), when the typical application for their media is in the low parts per billion (PPB) level. RP1557 is specifically designed to compare media performance at high and low inlet concentrations. In this way the traditional method of performance testing with high PPM concentrations can be verified against low PPB concentrations more commonly found in applications.

However, perhaps the most interesting part of RP1557 is the very consistent testing of the representative samples against the four challenge gases. This gives an objective side-by-side comparison of the performance of media, with some surprising results. Much of the conventional thinking about how to best filter the air for offending gases to protect collections needs to be revisited.

### **(13) Evaluation of Consolidants for Leather with Red Rot: The Search for a Natural Material Alternative**

*Caitlin Mahony, third year graduate student, the UCLA/Getty Program in Archaeological and Ethnographic Conservation; and Ellen Pearlstein, Associate Professor, University of California*

Inspired by an interest in finding both a natural material alternative as well as a successful treatment approach to powdering leather surfaces on a Native American object, a comparative study of two novel treatment materials and two established consolidants for leather with red rot was undertaken this past year as part of a Master's thesis for the UCLA/Getty Conservation Program. Natural material consolidants have been demonstrated to be preferred by tribal members for use on materials other than leather. One of the materials tested as a potential consolidant was *neri*, an aqueous mucilage most commonly extracted from the roots of the *aibika* plant that is used in the traditional production of Japanese paper. The other material selected was chitosan, the main derivative of the natural polymer chitin, which has recently been applied in treatments of archaeological silk and paper. The performance of these potential materials as leather consolidants was compared against the performance of established modified organic consolidants, i.e. mixtures of Cellugel and Klucel G with the acrylic wax SC6000. The study focused on evaluating each material's consolidation performance, the visual and physical changes observed on the leather, and the chemical stability of the consolidant following heat and light aging. Although *neri* proved to have excellent chemical stability, it is not recommended

for leather due to unavoidable water content and unsatisfactory working properties. Though chitosan had no adverse effects towards the appearance and feel of the leather, it is not recommended as a consolidant until further research is conducted on its chemical stability. The Klucel G with SC6000 mixture had great application properties but the wax component is questionable due to the opacity change of the aged wax. Cellugel demonstrated the most desirable properties in performance and chemical stability; therefore it was selected as the consolidant for the treatment on the Native American object. Experimental results indicate that the natural materials evaluated may be recommended as alternatives to synthetic consolidants following additional research.

### **(14) An Investigation of Painted Wood Shields from 3rd Century Dura-Europos**

*Anne Turner Gunnison, Assistant Conservator of Objects, Yale University Art Gallery; and Irma Passeri, Associate Conservator of Paintings, Yale University Art Gallery*

The Yale University Art Gallery has in its collections three painted wood shields, excavated in 1934 at the Hellenistic, Parthian, and Roman site of Dura-Europos, in present day Syria. Dated to about 256 AD, the shields serve as extraordinarily rare examples of ancient painting techniques on wood supports, depicting what have been previously identified as a warrior god, and scenes from the Trojan War and the Amazonomachy. While a 1941 review in the *American Journal of Philology* of the 1939 publication *The Excavations at Dura-Europos: Preliminary Report of the Seventh and Eight Seasons of Work* projected that these shields "will take an important place in the history of ancient art," there has been little to no study of these significant finds.

Initial investigation of the three shields indicated that a comprehensive study would elucidate invaluable information about panel painting techniques used in the ancient world. Through visual examination, high-resolution infrared and UV photography, as well as x-radiography, preparatory layers, fragments of textile and plant fibers glued directly to the support and possible underdrawing were identified, and the wood substrate better understood. Objectives of a first phase of further study include: analyzing and identifying the materials present, including pigments, preparatory layer, binding medium, adhesives, textile and plant fibers, as well as the types of wood used to construct the shields; finding evidence for construction techniques, preparation of the wood support, and historic context and use; and reading the contemporary written treatises on painting and comparing the data collected to the materials cited in these sources. The shields were treated in the field post-excavation. Most significantly, the surfaces were consolidated with PVA, as indicated in treatment and analytical records from 1935. Currently the shields are in a variety of conditions, with the painted and preparatory layers the most fragile and prone to loss. Planning conservation treatment in consultation with curators and scientists and treating the shields as necessary to preserve these delicate surfaces is a priority.

Because archaeological wood, and more specifically painted wood, rarely survives, these shields serve as exciting research possibilities for the advancement of understanding painting practices from the ancient Roman world.

## **(15) Uncovered and Unconventional: Preserving Works on Paper and Photographs on Open Display**

*Nina Quabeck, Paper Conservator, Kunstsammlung Nordrhein-Westfalen*

Prior to the mid-20th century, works on paper and photographs were traditionally presented in the relative protection of a frame or showcase. The past fifty years, however, brought about a great change in the way art was conceived, created, and presented. Today, artists often choose to expand the boundaries of materials and formats. Consequently, enclosed display is frequently not an option for modern and contemporary works on paper and photographs.

The preservation issues of uncovered works on paper were first researched as part of the author's Samuel H. Kress Fellowship which was carried out at the Fine Arts Museums of San Francisco in 2007 to 2008. As part of the study, a general survey involving specialists caring for modern and contemporary collections in the US and Europe was conducted. The collection of the host institution was scrutinized for works on paper intended for open display and several of those examples were examined, re-housed or treated in the museum's paper lab.

Further examples of unconventional works on paper and photographs were encountered since the author's return to the Kunstsammlung Nordrhein-Westfalen, in Düsseldorf, Germany, in 2008.

As a final case study, the Wolfgang Tillmans exhibition held most recently at the Kunstsammlung, incorporated not only a mass of uncovered chromogenic prints, but also a number of large-format inkjet prints. In this project, the combination of the object's requirements with artist's and curator's wishes challenged traditional paper conservation practices. An exhibition consisting almost entirely of works requiring open display put us on the front lines in this battle to develop preservation strategies for these fragile objects and changed everyone's expectations for the installation, display and maintenance of an exhibition.

## **(16) Earthquake Mitigation: Adapting the Collections for Seismic Activity at The University of British Columbia Museum of Anthropology**

*Stephanie Johnson, Master's candidate in Arts Management, University of Oregon; Ida Pohoriljakova, Emerging Object Conservator*

During the summer of 2013, Collections Management Intern Stephanie Johnson and Conservation Intern Ida Pohoriljakova at the University of British Columbia Museum of Anthropology collaborated on an earthquake mitigation project in collections storage. The project was presented to them as a joint effort between the two disciplines with the aim of improving the safety of the collections. The project took place in an area of the Museum of Anthropology's (MOA) Three Dimensional Storage that houses Chinese ceramics. These improvements are a continuation of the Renewal Project, a grant-enabled initiative that resulted in a significant transformation to the entire museum, including completely

new collections storage areas. The goal of the earthquake mitigation project was to create a new housing that would significantly improve the outcome in the event of an earthquake. The task at hand was to establish an economical and systematic strategy for storage that will continue to be incorporated throughout the entire collection of three-dimensional objects.

Prior to the implementation of the mitigation project, the Chinese ceramics were stored in compactor shelving units without adequate support. The storage materials primarily consisted of acid-free tissue paper, pillows, snakes, and Coroplast® boxes. While these materials are suitable for storage, they would not provide sufficient support in the case of an earthquake. The project required the use of a method that was cost, time, and resource effective. As a result of these pre-requisites, off-cut scrap materials from other museum projects were recycled for this task. An original design of a grid system created from Blueboard, Plastazote® foam, and Hollinger Metal Edge trays for small and medium-sized objects and Coroplast® boxes for large objects was adopted. Consequently, this design provided a flexible and adjustable solution that secured objects from jostling as in an earthquake. In all, one unit, which holds 150 objects on seven removable trays and five shelves, was rehoused.

The outcome of the initiative produced an accessible, flexible, secure and aesthetically pleasing storage solution. In five weeks' time, a creative method that fulfilled the needs of both collections management and conservation was achieved from initial problem-solving to implementation. Collaboration between the two departments provided the opportunity for knowledge-exchange with the common objective of preserving the collection. It is believed that the success of this project rests on this partnership.

## **(17) The Key to Sustaining Conservation: Student Leadership & Community Outreach**

*Louise S. Beck, Kate L.M. Becker, Miriam Orsini, and Leslie Stephens, Master's candidates in Conservation for Archaeology and Museums, Institute of Archaeology, University College London*

Conservation as a profession requires collaboration amongst heritage professionals and community members, an interaction which is often exemplified in a university setting. The unique combination of students, professors, university collections, and strong communities allows for sustainable collaborations and beneficial outreach experiences. When conservation derives from a place of mutual advancement, the outcome is not only material preservation, but the beginning of a relationship which will help to guarantee the sustainability of the collection and the conservation profession. This scenario was the foundation of a collaborative project undertaken at University College London in the spring of 2013. Four previously damaged glass radiography tubes and valves from the University's Medical Physics collection were identified by the curator as at risk of loss and/or further damage if not conserved. However, related objects already existed within the collection in a more complete form, leaving scarce resources for the conservation of those in poor condition. Thus, the ideal solution was to involve the UCL conservation students in the treatment. Four students were selected to conserve

the objects and use them as part of their assessed coursework. The unique opportunity offered by peers treating a similar group of objects allowed us to share the experience with the general public through a blog, thereby showcasing conservation methodology and techniques. The benefit of public outreach lay in increasing awareness of conservation and informing the public about the inherent individuality of treating objects. In writing the blog posts, the students themselves were able to collaborate and discuss treatments, verbalizing the process of prioritization and the interplay of values in an informative manner that illuminated the conservation decision making process. The partnership produced stabilized and legible objects, advanced the education of conservation students, and engaged a wider London community. Maximizing the number of shareholders involved in conservation projects ensures not only the professions' sustainability but also the sustainability of the conservation action itself. The project provides a model for future collaborations which extends beyond the sphere of university training programs.

### **(18) Conservation of a 17th-Century Chinese Painting by Ding Yungpeng at the Missionary Ethnological Museum in the Vatican Museums**

*Minah Song, Senior Paper Conservator, and Marianne de Bovis, NEA Fellow in Paper Conservation, Conservation Center for Art and Historic Artifacts*

This paper describes the conservation treatment of the 17th-century Chinese painting *Lohan riding an ox* by Ding Yungpeng (active 1584–1638) from the Missionary Ethnological Museum in the Vatican Museums. The treatment was carried out in 2011 by Minah Song while on a fellowship funded by the William Penn Foundation at the American Academy in Rome and Marianne de Bovis, an intern at the museum at that time. The paper also provides an overview of the Museum's Asian collections.

The unique Asian collections at the Missionary and Ethnological Museum are not well known to art historians and conservation professionals. The collections were created in 1925, after a special exhibition of numerous art works and curio, sent by the Missionary Congregations from outside of Europe. Some artifacts were eventually returned but some remained at the museum and became a part of the museum's permanent collection.

The conservation practice in the Missionary and Ethnological Museum focuses on preventive conservation; thus, the treatment is usually limited and the funding is outsourced. Certain projects, however, are occasionally chosen and funded by donors, so more extensive treatment can be performed. *Lohan riding an ox* by Ding Yungpeng—one the most famous painters of Buddhist subjects during late Ming Dynasty (1368–1644)—was one of these projects. The painting was executed with Chinese ink and gouache on a primary fabric support of a mixture of cotton and linen. The painting was lined with two layers of brown paper. Scientific analysis was done using infrared spectrometry and microscopic analysis for identification of fibers of the painting support and lining support, and the lining adhesive. The treatment included

lining removal, consolidation of red paint, washing and lining.

The conservation treatment of this painting represents an interesting case, illustrating how conservation professionals with different backgrounds approach each step of treatment. Each step of conservation treatment of the painting was carried out after discussion among conservators. The project was also challenging in terms of balancing between principles of conservation at the museum, dictated by the limited budget and materials, and general conservation practice of Asian materials.

### **(19) Applying New Techniques on a Traditional Adhesive for Book Conservation**

*Marjan Anvari, Manuscript Conservator; Roozbeh Mafi, PhD Candidate Chemical Engineering Department McMaster University*

Eremurus is a reversible plant-based adhesive which easily dissolves in water with an acceptable flexibility, strength, stability over a long period of time, good aging characteristics and does not cause shrinkage on paper. Moreover, due to the absence of organic solvents using this natural adhesive does not affect the cellulosic substrate. These wonderful characteristics attracted traditional conservators not to reject using this adhesive over many years. Using an adhesive which mimics the properties of the original glue is another reason of preferring the use of natural adhesives over the synthetic ones. A major disadvantage of using Eremurus glue is that it forms dark amber stains on paper after drying due to its impurities.

Purification of Eremurus, according to a procedure has been already employed for naturally occurring polysaccharides, successfully led to a clear, gel like glue which can be used in conservation of books and cellulose based materials. The purified Eremurus glue showed enhanced adhesion to cellulosic materials without showing any discoloration in the substrate or the bonding film and improved flexibility. It can be a promising, strong adhesive which does not release any organic solvents and has a very good compatibility with cellulosic substrates.

### **(20) Documentary Heritage Conservation in Mexico: A Perspective on the XXI Century**

*Diana Noemi Velázquez Padilla; Thalía Velasco Castelán; Tania Estrada Valadez; Marie Vander Meeren; Jeniffer Arlett Ponce Fernández*

In Mexico, the preservation of documentary heritage is a culturally important area due to the large number of properties and their historical value. Yet, little government support is given to this task, as Federal resources are allocated to other political issues. This is the context in which CNCPC (National Coordination for Cultural Property Conservation) documentary heritage conservators perform their work.

Given the need of a comprehensive panorama of the documentary heritage, a National Plan of Documentary Heritage Conservation is going to be implemented in 2014, which will define and implement the conservation policy guidelines.

Furthermore, conservators have come to rely on the following principles with increasing certainty:

- Instead of following models developed in other countries, we strive to find our own strategies that are adequate to the particular problems of our socio-economic context, as well as optimizing the use of accessible materials and resources that are more compatible with our heritage.

- Prioritize preventive conservation. In addition to being ethically preferable, it is a more efficient medium and long term strategy, compared to expensive, short range projects. When dealing with deteriorated and restored property, it is essential to design conservation plans. In the Santa Maria Acapulco project, where church property was severely damaged by fire, the training of community members was instrumental in establishing new conservation measures for the restored goods.

- It is necessary to develop networks with local, regional and international institutions to exchange experiences and knowledge. This also aims to counter the centralization of institutions in Mexico. In addition, our country can continue to be an important bridge between institutions and professionals from different countries. A case in point is the ICCROM – LATAM course, which has been held in Mexico for restorers of all Central and South America.

- One fundamental preventive conservation strategy is raising awareness on the heritage value at different levels: from the appropriation of assets by the community to academic research. Often, the usage needs clash with the conservation measures imposed by a specialist, but it becomes important to respect the dynamics of use that give meaning to the properties. For the stabilization project of choir books from the National Museum of Viceroyalty, minimal intervention of the books was made, but the most important step was the digitalization of the heritage for its dissemination and to protect it from manipulation, which is difficult because of its size.

## **(21) Reflections on the Conservation of the Choir Books Collection of the National Museum of Viceroyalty (Tepetzotlán, Mexico)**

*Tania Estrada Valadez, Assistant Conservator and Restorer in Graphic Documents, Graphic Documents Department, National Coordination for the Conservation of Cultural Heritage, Mexico City; and Diana Noemí Velázquez Padilla, Conservator in Private Practice, Mexico City*

The collection of 92 choir books of the National Museum of Viceroyalty is one of the largest and most important in Mexico, because of their rarity, manufacture and cultural-historical values.

Although it is known that they are rare and therefore valuable, it was not until 2012 that the National Coordination for the Conservation of Cultural Heritage (CNCPC) of the National Institute of Anthropology and History (INAH), started to work on a in a two stage plan conservation project.

The poster includes some considerations around the decision-making in this project, which is a crucial moment where we contemplate the values, context and the extent and amount of books in the collection, as well as the use they have today.

Consequently, sometimes these considerations could be a restriction on the management and acquirement of financial

resources instead of being a practical tool. Besides, although nowadays there are more specialists in this area, the lack of personal related to the amount of collections that needs conservation or stabilization is another problem.

The criteria used to develop the project of stabilization were based on two main aspects: the actual use of the collection as researching sources or museum objects and the minimal intervention.

Thus, some questions we made ourselves were: should we have to restore books instead of preserve them to keep the evidence that shows manufacture and history data? Which are the values that prevail for this kind of books? Which are the ways to disseminate them for their best understanding and assessment?

From this perspective, there's one last question: Under which foundation it is constructed the decision-making? If we attend and prioritize only on the analysis of the intangible and tangible aspects, then the object has the last decision.

## **(22) Conserving Tape In, Around, and Under Paintings: Recent Case Studies from Modern and Contemporary Paintings Collection at the American Art Museum**

*Jessica Ford, Winterthur Graduate Intern; Tiarna Doherty, Chief of Conservation; and Amber Kerr, Paintings Conservator, Lunder Conservation Center, Smithsonian American Art Museum*

Tape is commonly used by modern and contemporary artists in the painting process and in the final presentation of their work. In the painting process tape is most commonly used to help delineate forms and allow for the artist to create a hard edge. Conservators are often able to discern where this was done. In some cases tape serves to adhere collage elements and may be a collage element itself on a painted surface. In addition, tape may be found which was applied in order to serve as a temporary repair, by the artist or someone else, on a work of art. Painters also use different forms of tape to cover tacking edges and create a clean edge to their work. All of these uses of tape present unique challenges in conservation treatments.

At the American Art Museum conservators have recently explored different approaches to conserving tape as part of treating a number of 20th-century paintings. Conversations with artists and curators have helped inform treatment. Recent treatments have included consolidating and restoring areas of lost tape; addressing paint loss associated with tape applied as an underlayer; and removing tape from paintings.

Paintings presented include Michael Goldberg's *Sardines* (1955), which has two types of tape that play a prominent role in the composition. Masking tape was partially covered with subsequent paint layers, and the tape delaminated and curled away from the surface in some areas in response. Filament tape was applied on top of the paint, and it has discolored and become brittle with vulnerable edges.

Freddy Rodriguez's *Amor Africano* (1974) is a painting where tape was left under some of the borders of the artwork. The tape was used in a traditional way associated with hard-edge abstract painters; however, Rodriguez was criticized for this practice

when he returned to his native Dominican Republic from New York in 1976 as proof that he didn't know how to paint. Paint is now delaminating from the underlying tape layer at the edges of the work.

Arturo Rodriguez's *Sin Título* (1998) has black tape covering the tacking margins and on the edges of the display surface that was applied by the artist as a framing device. Handling caused areas of loss, delamination and distortion to the tape.

The thought processes behind each treatment approach for these examples of tape in, around, and under 20th-century paintings are shared to encourage discussion and to provide a reference for similar situations encountered by conservators.

### **(23) Contemporary Analog and Digital Color Photographic Prints: Dye and Pigment Print Process Descriptors, Naming Conventions, Dating, and Permanence Characteristics**

*Henry Wilhelm, Co-founder and Director of Research, Wilhelm Imaging Research, Inc.*

Drawing on many years of research associated with *The Wilhelm Analog and Digital Color Print Materials Reference Collection – 1971 to 2014*, this paper describes the wide range of color print processes that comprise the modern era of color photography which began in 1935 with Kodak's introduction of Kodachrome transparency film and the companion Kodak Minicolor print process announced in 1941, both of which utilized images composed of cyan, magenta, and yellow dyes formed by a process known as chromogenic development using external couplers. These products were followed by a large number of color transparency and color negative film and print systems from Kodak, Agfa, Ansco, GAF, Fuji, Konica, 3M, Ferrania, and others. Photographers, galleries, and museums have variously referred to color prints made by these dye image processes as: Type C Prints; Type R Prints; Chromogenic Prints; Color Coupler Prints; Silver-Halide Prints; Lightjet Prints; Lambda Prints; Digital Type C Prints; Digital C Prints; Digital Chromogenic Prints; Duratrans; Digital Duratrans; and brand-associated names such as Ektacolor Prints; Kodak Prints; Crystal Archive Prints; Fujiflex Prints; Duraflex Prints; Endura Transparency Display Material; and so forth. In recent years, many of these print materials could be exposed with an enlarger or contact printed in an "analog" fashion, and the same print material could also be digitally imaged with scanning RGB laser or LED light sources (which can also produce monochrome images on color papers), further adding to the confusion about what the prints should properly be called. Face-mounting to acrylic sheet, lamination, and various types of print coatings have further complicated the naming situation.

Likewise, dye image prints made by the silver-dye-bleach process and dye-imbibition prints have been described using a variety of names, some brand-associated and some with names describing the image formation process.

Digital inkjet processes began entering the photography market in 1991, with dye image prints made on a wide variety of papers by Nash Editions and others using Iris Graphics Printers. A

few years later, affordable desktop and large-format inkjet printers were introduced by Epson, Hewlett-Packard, and Canon, which were soon followed by Brother, Kodak, Agfa, HP-Scitex, Mutoh, Mimaki, Roland, EFI-Vutek, Durst, swissQprint, Canon-Oce, Fuji, Noritsu, and other manufacturers. Inkjet printers with improved stability pigment inks came into the market in 1998 and by 2006 most professional and fine art photographic prints were being made with pigment inks, often with printers utilizing six, eight, ten, or even twelve inks. Water-base aqueous pigment inks were later supplemented by solvent-based inks, UV-curable inks, dye-sublimation inks (used with a transfer process for both prints on fabrics and on treated aluminum-base "Metal Prints"), and aqueous Latex inks. Unlike earlier color print processes, inkjet prints can be made on a very wide variety of substrates, including cotton-fiber fine art papers, RC photo-base papers, plastic supports, and fabrics. UV-curable ink prints can be made with rigid panels, including large sheets of acrylic plastic, aluminum, glass, plywood, and other materials.

In part because the inks and supports used to make inkjet prints are supplied as separate parts of the printmaking process, there are essentially an unlimited number of combinations of inks and supports, which has in turn greatly complicated the description, dating, and naming of these prints.

This paper proposes a simplified list of process descriptions and naming conventions that reconcile usage by photographers, museums and galleries, and the manufacturing industries. The proposed naming conventions distinguish between prints with images made with dyes and those made with pigments. Lists of non-recommended (but commonly used) names are also given. The permanence characteristics of the various processes and guidelines for their preservation are discussed.

### **(24) Disaster Response Ten Miles out to Sea**

*Nina Roth Wells, Founder, Nina A. Roth-Wells LLC; and Lauren R. Lewis, Paintings Conservator in Private Practice*

Monhegan Island, located 10 miles off the coast of Maine, has been a haven for both weekend painters and famous artists for over 100 years. The Monhegan Museum (founded in 1962) has a fine collection of artwork by artists such as Robert Henri, Andrew and Jamie Wyeth, Rockwell Kent, George Bellows and Edward Hopper, as well as many objects related to the history and culture of the island. The museum, which is only open to the public in summer months, faces many challenges, including keeping gallery spaces and storage vaults safe for the works, dealing with unpredictable weather and the difficulty of getting professional assistance to the museum when needed.

Labor Day weekend 2013 brought stormy weather to Maine. Lightning struck the top of Lighthouse Hill on Monhegan, where the museum is located. Although the museum was spared a direct hit, the strike wrought havoc with the electrical systems on the island and caused the museum's fire suppression system to deploy. The system was a state of the art waterless DuPont FM200 system, and the museum was assured that the material released was completely volatile. Unfortunately, when the gas was deployed, corrosion products from the iron pipes were dispersed throughout the galleries and offices, coating everything with a

fine dust of iron particles.

This paper will describe the disaster response of two intrepid painting conservators on the coast of Maine. We will discuss the challenges of working onsite, commuting by ferry and working on the harsh island environment. We will discuss the materials and techniques used to treat the 35 paintings in the gallery. Finally we discuss chemical analysis of the particulate matter sampled from the paintings at various stages of cleaning. These samples should help us to evaluate the efficacy of both the dry and aqueous cleaning methods used during the project.

## **(25) Preservation Scientific Reference Sample Collections: Sustainable Assessment of Collection Materials Deterioration**

*Penella G. France, Chief of the Preservation Research and Testing Division, Library of Congress*

The development of a reference database of scientific samples in the Preservation Research and Testing Division (PRTD) at the Library of Congress has been an ongoing development to create a web-accessible shared scientific sample collection for addressing collection management challenges. The physical collection known as the “Center for Library Analytical Scientific Samples” (CLASS) includes a range of heritage materials: paper, parchment, fibers, pigments, colorants, modern media (compact discs, magnetic tapes, lacquer discs), and fugitive media (twentieth century inks and pens), with the range of materials expanding. These samples comprise not only original sample materials, but both naturally and accelerated aged materials, where accelerated samples are aged for longer consecutive periods of time, but at conditions much closer to ambient. The samples created establish a matrix of aging scenarios enabling a range of degradation mechanisms (temperature, relative humidity, light, pollutants, treatments) to be assessed and analyzed from exposure to controlled environmental and treatment parameters. Scientific reference samples are tested (generally) non-invasively on a range on instrumentation so complementary data pertaining to the same sample can be generated. Instrumentation includes but is not restricted to; spectral imaging, Raman and Fourier infrared spectroscopy, X-ray diffraction, UV-VIS spectrometry, scanning electron microscopy (SEM), gas-chromatography – mass spectrometry (GC-MS), direct analysis in real time (DART) mass spectrometry and ion chromatography (to name the most common analytical methods).

The associated digital data files “Center for Library Analytical Scientific Samples – Digital” (CLASS-D) expand the utility of non-destructive scientific analyses for cultural heritage research, yielding enhanced preservation data and greater access to structured research data. The creation of the online presence expands the capability of this initiative, with the digital component allowing international access and sharing. To support archiving of digital products with consistent quality, PRTD has established standard workflows for data management. The primary goal of CLASS-D was to encourage interaction between and ease of use of data. To test the CLASS-D database, a prototype was completed using example entries from the reference sample collection with representative example scientific analyses. These included both

sample and analysis records; where a sample was designed as a record of a research sample, and an analysis record was designed to correspond to a single instance of a test or analysis. Further data collection on a range of materials an instrumentation types was included in the prototype.

To date a large portion of the extensive physical collection data has been transferred to the CLASS-D database. Based on the prototype, some changes were made to the data model and application. It was apparent that the analysis record needed to be simplified to accommodate a single analysis or a group of related analyses of a single type. Each analysis record needed to have a single structured archive of data files associated with it that complied with strict standards for structure and content. A tool was also needed to ensure that the database could accept bulk uploads of XML data for large data sets. Significant discussions were held with users and potential users both internal and external to the Library, including scientists, conservators, curators, researchers and information specialists. Discussions with colleagues underlined the need to support standardized capture of preservation research data in order to enable better collaboration, sharing of data and best use of resources in the current economic environment. The initiative towards standardization of scientific research data collection will assist sustainability of collections care and management, and advance our knowledge of complex environmental degradation mechanisms.

## **(26) Undoing the New: Conservation of 21st Dynasty Egyptian Coffins and Impact of unsustainable treatments in the 20th century**

*Elsbeth Geldhof, Owner, Blue Tortoise Conservation; Jessica Hensel; Casey Mallinckrodt, third-year Intern, the UCLA/Getty Program in the Conservation of Archaeological and Ethnographic Materials; and Jonathan Gratton*

After their discovery and excavation in 1893, several mummy coffin sets of the Bab el-Gasus corpus, comprised of fifteen objects, were given to the Rijksmuseum van Oudheden, Leiden, the Netherlands, among seventeen international institutions. The polychrome mummy coffin sets originally belonged to Priests and Chantresses of Amun, in the Deir el-Bahari area during the 21st Dynasty.

Since arrival in the museum, many coffins, lids and mummy boards have had up to four different restoration phases. Incompatible materials introduced as fills, adhesives, and coverings have caused problems far beyond the inherent deterioration of the 3,000 year-old materials with the result that most of these objects ended in storage, un-exhibited, for at least sixty years.

Conservation treatment carried out on three of the artifacts exemplify unsustainable 19th and 20th century interventions, the complex resulting damage, and the strategies that were undertaken in this project to mitigate the damage and secure the objects.

The Vatican Coffin Project is a collaboration between the Vatican Museums, the Louvre, and the Rijksmuseum van Oudheden that investigates and preserves the Bab el-Gasus coffin sets in a coherent and sustainable way. At the Rijksmuseum van Oudheden, research commenced in 2011, but actual treatment

was initially limited to five months in Summer 2013 and took place in front of the public as part of an exhibition, requiring careful prioritization of phased treatments.

In this presentation three treatments will be described that exemplify the damaging impact of non-sustainable and undocumented practices, how those interventions directed decision-making in the current conservation campaign, and the solutions that were chosen.

The complex and highly intervening restoration history of the objects, was directive in choosing a high standard of reversibility of the materials added as well as any new active conservation performed. As examples, we choose our treatment of a shattered mummy board with giant wax fills, an outer coffin lid with three different fill materials covering large areas of original surface, and objects suffering from flaking paint due to unsympathetic impregnation of cracks in the wood supports.

These treatments provide examples of the impacts of non-sustainable interventions, the decision-making process, and the conservation solutions that reduce damage, secure the objects and allow them to return to exhibition.

## **(27) Untitled Project: A Cross-Disciplinary Investigation of JODI's *Untitled Game***

*Lisa Adang, MA candidate, Bard Graduate Center in Decorative Arts, Design History and Material Culture, Conservation Fellow at Rhizome, New Museum*

The Belgian-Dutch artist duo JODI have long been appreciated for their pioneering browser-based artworks that exploit the materiality of the internet as an artistic medium. A less explored aspect of their practice is software modification through which they transform commercial game software by way of alterations to its code. Guided by the attempt to understand JODI's artistic intent, this investigation looks closely at specific changes the artists enacted to the original code of *Quake*, and frames the resultant modifications formally through analysis of the code and its corresponding graphical and interactive elements in *Untitled Game* (1996-2001).

Moving out from this highly concentrated mode of observation, this investigation also seeks to record the researcher's procedure in observing and documenting *Untitled Game*. This includes a discussion of the forensic tools used for this purpose, and an exploration of emulation as a strategy for experiencing obsolesced software, including detailed qualitative comparisons of various access strategies. It considers how the use of emulation applications changes interaction with "legacy" software and reframes such artistic content within an additional technical apparatus.

It is concluded that the use of an emulator to experience *Untitled Game* is in-line with JODI's vision for the piece, especially because of its inherent reliance on participant-side technology. In this way, the artists accept a multiplicity of viewing conditions through their free distribution of the software, downloadable at [www.untitled-game.org](http://www.untitled-game.org). The un-updated (obsolete) software, technologically linked to an older operating system, necessitates an extended access strategy such as emulation to experience the work. Thus, the procedure undertaken in this investigation communes with JODI's own working methods, running parallel to their process of creation through its shared emphasis on code.

## **(28) Disaster Recovery and Sustainable Choices—Cologne City Archive: Five Years after the Collapse, Which Decisions for the Future?**

*Marion Verborg, Paper Conservator and Lab Manager, Cologne City Archive*

After the collapse of the Historical Archive of the City of Cologne in March 2009, around 95% of the archival material was salvageable. About 30 shelf kilometres of numerous important collections of records representing historical continuity lay among tons of sand and rubble on the afternoon of the 3rd of March 2009. The archive housed 1,000-year-old records documenting regional and national history, among those about 65,000 charters on paper and parchment, and close to 2,000 manuscripts. The building in Cologne-downtown contained original manuscripts of, among others, Albertus Magnus, Napoleon Bonaparte, Jacques Offenbach, Giuseppe Verdi, Karl Marx, Heinrich Böll and Konrad Adenauer.

The entirety of these unique and non-reproducible historical accounts needs to be identified, re-registered, re-organized, conserved, and preserved immediately for future generations. The salvaging procedure and primary care operations were both successfully completed in August of 2011. During this step, an estimated 15% were slightly damaged, while 50% sustained medium damage and 35% were heavily deteriorated. Damages vary from small scratches on paper or parchment to huge holes in entire books.

We are currently developing and improving conservation and preservation measures in a temporary off-site building established after the disaster. At present, a team of more than 45 conservation technicians and 20 conservators work on these projects. Other institutions are involved in varied partnerships as well.

One of these projects is the treatment of the 3,000 metres of archive material collected in a wet condition and cleaned of dirt and ground soil at a rinsing station after the collapse. These documents were frozen and are currently stored at -26°C in a freeze storage unit near Cologne. Vacuum freeze dried units are currently used in varied places in Germany. Once dried, the documents are put through the cleaning process carried out on site.

Typical daily projects include: identification, registration, condition report, conservation dry surface cleaning (phase including dry surface cleaning, metal pieces removal, copy of unstable materials, removal of plastic materials, etc.), quality control, categorization (depending of possibility of direct or indirect use), digitization, and rehousing. These are the main steps in the recovery process. The process is still evolving, using feedback from co-workers to improve our system and make better decisions regarding sustainability and collection care. In our case, the term "conservation" describes a course of action that, considering the need of treating very large amounts of material and the need to prevent further damage, does not aim to restore aesthetic appearance, but aims to stabilise documents so that they can go back into use, be it in their original or in digital format.

Another project is the unmounting, dry surface cleaning, minor repair and remounting on conservation quality material of the middle-age charters on parchment. Taking advantage of other institutions' experience with mounting of parchments, we

developed a housing process to improve preservation on a very long term basis.

Many other projects are also created on site, among others un-mounting and cleaning of large format books and photo conservation. Insect monitoring and climate control are our priority as well.

Coordination of all these projects is challenging, and requires some non-conservation specific skills, communication of which is of primary importance. Every choice must be the result of a balance between budget options, material/time availabilities, and effective management of personnel.

### **(29) Study of pH-Sensitive and Reversible Aqueous Acrylic Coatings for Cultural Heritage**

*Amanda J. Norbutus, Postdoctoral Fellow in the Department of Chemistry, Villanova University*

Transparent coatings can provide additional stability and protection to outdoor heritage, such as historic buildings, public murals, and sculptures. Recent tightening of VOC (volatile organic content) regulations in the United States have limited the variety of coatings permitted for outside application and preservation use and impacted the use of solvents during conservation treatments. Coatings that are applied with the use of organic solvents, such as mineral spirits acrylics, may be “grandfathered in” for use by government officials, as was the case as the 2011 restoration of Michael Webb’s St. James Church. Older solvent-based coating systems require the application of additional solvent to remove the aged, brittle, or physically degraded surface coatings, which can present a roadblock to receiving a VOC-exemption when conservation of cultural heritage is performed outside. VOC exemptions are gradually becoming more difficult to obtain and are often issued on a per treatment basis. The development and study of aqueous-based coating systems is in direct response to the increasing demanding path for approval of organic-coating systems on conservation work sites.

pH-sensitive ethyl-methylmethacrylate and methyl-methacrylate co-polymers from the medical coating industry are combined with different ratios of plasticizers and UV protective additives to create stable, non-yellowing, reversible coatings. The coating can be applied in a slightly basic aqueous solution and then can be removed using an aqueous solution within the pH sensitivity range. The manipulation of copolymer concentration and other additives result in a range of pH sensitivity (pH 5.0–7.5) that may prove useful as a sacrificial or protective coating for artworks, particularly outdoor public murals that require coating renewal every 10–15 years.

### **(30) Prioritizing Treatment in Collections Conservation Using Shared Resources**

*Jennifer Hain Teper, Head of Conservation Department, University Library at the University of Illinois at Urbana-Champaign*

Library preservation and conservation programs are at the precipice of transformation – with the increasing availability of digitized content, as well as the development of shared print repositories,

our perceived obligation to the preservation of individual print copies at an institutional level is shifting to a more shared model – but how is this influencing our day to day practices? This poster presents the data collected from a 2012 survey of preservation and conservation programs in academic and research libraries in North America and interprets that data to show how the availability of digital surrogates, libraries’ increasing consideration of shared print holdings, and the perceived value of scarcely held content are all influencing selection for the conservation treatment of general collections. It will also touch on the successes and failures of a pilot currently underway at the University of Illinois at Urbana-Champaign’s University Library to apply these data to incoming repairs from our general collections in order to better prioritize limited resources.

### **(31) More than Meets the Eye: Eularian Video Magnification Applications for Conservation Research**

*Karen L. Pavelka, Lecturer, School of Information; Lorrie Dong, Doctoral Candidate, School of Information; Artimis Harbert, Michael Nugent, Benjamin Philbrook, and Elizabeth Seiple, Masters Candidates, School of Information; Sarah Hunter, Masters Candidate, School of Architecture; all at The University of Texas at Austin*

Eularian Video Magnification (EVM), a technique and tool developed by The Massachusetts Institute of Technology Computer Science and Artificial Intelligence Laboratory and Quanta Research Cambridge, Inc., allows researchers to view movements that are not visible with the naked human eye. Through EVM, researchers can apply spatial decomposition and temporal filtering to video sequences to amplify subtle variations in the signal. EVM was developed for non-invasive medical monitoring (e.g., determining pulse rates and respiratory motion), but may have some useful and exciting applications in conservation.

Although paper can often appear to be unmoving, we know that paper fibers respond to changes in relative humidity, resulting in movement and stress across the sheet and the cockled pattern that appears on aged papers is reflective of this movement. But a sheet of paper does not necessarily behave predictably or evenly across its surface and those differences are hidden from human sight. EVM offers an innovative way to monitor the physical changes that happen to materials over relatively short spans of time.

In a preliminary evaluation of EVM use for paper conservation, the authors have applied the online EVM tool to study the movement of various types of paper in response to changes in relative humidity. Using high-definition video in conjunction with EVM, the researchers were able to capture subtle movements across sheets of several types of paper, working first with highly responsive papers like glassine, and then focusing on the more subtle movements of handmade papers. Furthermore, they experimented with the different video processing variables in order to exaggerate both temporal and spatial aspects of the video. As a result, the authors were able to see with various degrees of success the sometimes surprising patterns that emerged in the materials. This paper will present the results of the study to date, as well as offer best practices for using EVM, and explore other possible applications.

### **(32) Pulp Addiction: The Use of Dry Cast Pulp for Seamless Repairs in Works on Paper**

*Debra Evans, Head of Paper Conservation at the Fine Arts Museums of San Francisco; Victoria Binder, associate conservator in paper conservation department at the Fine Arts Museums of San Francisco*

Filling losses with wet pulp is a tried and true paper conservation operation, which involves reprocessing existing paper into a slurry in a blender. Leftover wet pulp is typically stored in jars or poured into a lump to dry, for future use. At the Legion of Honor, paper conservators have instead cast pulp into a collection of small sheets of paper, creating a visual library of paper tones. This reprocessed paper is easier to shape and is more “carve-able.” Once made it is an excellent product to have on hand for immediate use.

Dry cast pulp repairs do not require wetting of the object and can be easily removed. Using a library of dry cast pulp, seamless repairs can be done more quickly than traditional shaped repairs. The result is usually far superior. This poster will depict how dry cast pulp can be easily used to fill losses, make more “invisible” mends, and camouflage dirty tears and stains.

### **(33) Cast Pulp Paper—An Alternative to Traditional Repair Materials for Infills in Book and Paper Conservation**

*Renate Mesmer, Eric Weinmann Head of Conservation at the Folger Shakespeare Library; Jennifer Evers, book and paper conservator, advanced intern at the Folger Shakespeare Library.*

Cast pulp paper can be a viable alternative to traditional repair materials such as long-fibered Hanji or Washi papers or wet paper pulp. Asian papers can be too strong as an infill material, too transparent, and may unsuccessfully match the characteristics of a handmade Western paper. However, wet paper pulp is rarely an option when working on bound or water-sensitive materials.

Cast pulp paper repairs are often more aesthetically pleasing, especially when adhered to wove papers. The pulp can be made from a variety of materials, such as linen and cotton handmade paper. The paper is beaten in a blender and then cast with a modified deckle box or on a suction table. Cast pulp paper can easily be shaped to the outline of a loss by using a waterbrush, and further refined with a scalpel or sanding stick. An infill can also be pre-cast in the shape of a loss, making the repair more efficient when treating multiple leaves exhibiting the same area of damage.

This poster will show how cast pulp paper can easily be produced in a conservation lab using inexpensive materials and standard equipment, and will demonstrate the results of this technique.

### **(34) Conservation Documentation with Digital Mapping**

*Kisook Suh, Assistant Conservator, Department of Textile Conservation, The Metropolitan Museum of Art*

Like other types of information relating to artwork in museums,

conservation documentation is at present in transition from analogue to digital format. This paper will discuss current issues relating to the digitization of conservation documentation, focusing in particular on pictorial information used in textile conservation. Digital photography in high resolution has been used successfully to record far more information than the previously available photography by showing artwork at the level of actual scale, often magnified to microstructure. However, even highly developed digital photography cannot replace diagrams that selectively render crucial information about the condition or treatment of artwork. Many of the technical limitations that conventional diagrams have can be overcome by adopting digital mapping technique.

Conservation documentation of textiles involves different levels of information: from microscopic images of fibers to overall images; from the treatment of stabilizing a single yarn to supporting an entire oversized textile. More advanced tools are required to visually record different scales of conservation work. In particular, various levels of treatment information are difficult to be integrated with conventional diagrams. In place of drawing diagrams to map details on printed images, digital mapping programs can be used more efficiently for conservation treatment documentation. Digital mapping can be achieved as precisely as mapping the treatment of a single element of an oversized textile on a true-to-size scale high-resolution image.

Digital techniques not only have allowed us to have conservation documentation in digital format, but also have improved the quality of information that the documentation presents. Then there is always the question of “How much documentation is worth doing?” While aiming to perform the best practices in a given situation, of course with compromise, conservators find the significance of conservation documentation in the broad meaning of sustainable conservation practice. Because no conservation treatment is meant to be totally final, comprehensive documentation clearly will play a critical role in allowing conservation practice to be more “sustainable” or continue to grow in the future.

### **(35) Chinese Polychrome Lacquered Wood Vessels from the Asian Art Museum: a Technical Study**

*Amy Y. Tjong, Project Conservator, Katherine A. Holbrow, Head of Conservation, and Mark Fenn, Associate Head and Objects Conservator, Asian Art Museum*

A group of Chinese lacquered wood objects, characterized by bands of alternating colors, have been stylistically dated to the Song through the Qing dynasties (960 CE-1911 CE) by historians. This material was examined using a range of analytical and imaging techniques including visual and microscopic examination, x-radiography, XRF analysis, ultraviolet and infrared imaging for a comprehensive catalog. The research results presented here focus on some of the unique technical features seen in certain identified types.

The AAM owns a diverse collection of lacquer ware that includes examples of rare, virtuoso and well-preserved specimens

of little known lacquer types, and carved polychrome lacquer is unusually well represented. While some technical information is available on objects decorated with lacquer, carved polychrome lacquer in particular remains far from understood for several reasons. First, art historical literature and curatorial opinion have struggled to define carved polychrome lacquer as a stylistic group. Second, carved polychrome lacquer is one of the more complex lacquer techniques to master, requiring the utmost in skill and precision by craftsmen.

This study of carved polychrome lacquer, carried out in conjunction with a museum research catalog of Chinese lacquer-ware, offered the opportunity to contribute additional information to the corpus of lacquer studies. A goal of the research was to use imaging and instrumental analysis to survey this large group of lacquerware and identify unique construction details among the different types.

### **(36) Garlic on Dutch Copper Plate Paintings from the 16th to 17th Centuries**

*Nicole Schmidt, Student, Buffalo State College class of 2014; Corina Rogge, Andrew W. Mellon Research Scientist, Museum of Fine Arts, Houston and the Menil Collection*

Artists' treatises from the 16th and 17th centuries recommend the application of crushed garlic or garlic juice onto the copper plate as a preliminary treatment before beginning to paint. While art historians often cite these treatises, no analytical work has positively identified garlic in historic oil paintings on copper or established what role garlic may have played to warrant its recommendation. The objective of this research is twofold: to determine a suitable method for identifying garlic within a painting and to investigate possible reasons behind its use. Mockups of copper oil paintings (with or without garlic ground layers) were made utilizing pure pigments in linseed oil and either aged naturally or subjected to one month of artificial aging at 80°C and 60% RH. Fourier transform infrared spectroscopy (FTIR), staining, and pyrolysis gas chromatography mass spectrometry (py-GC-MS) were used to test for the presence of garlic. Preliminary results show that FTIR and staining of cross sections are ineffective at identifying garlic, but py-GC-MS analysis reveals the presence of 2,5-dimethylfuran, a carbohydrate marker compound present in fresh garlic juice, in fresh or aged garlic juice on copper, and in the natural and artificially aged paint samples on garlic ground. We propose that this species could serve as a marker for the presence of garlic in historic copper plate paintings. No differences in paint adhesion between aged mockups with or without garlic were noted, but we observed differences in pigment stability between these samples. Smalt, a pigment sensitive to oxidative discoloration, turns brown within a relatively short period of time when painted out on bare copper, but shows a lesser amount of discoloration with the garlic ground layer, suggesting that one reason for the use of garlic may have been to protect sensitive pigments.

### **(37) Consolidant Application for Polyurethane Ester Foam: The Treatment of a Headset from NASA's Skylab Missions**

*Marci Ann Jefcoat, Pre-program Student; Lauren Anne Horelick, Objects Conservator, National Air and Space Museum; Nicole Little, Physical Scientist, the Smithsonian Institution's Museum Conservation Institute; Jennifer Levasseur, Museum Specialist, Department of Space History, National Air and Space Museum*

Polyurethane (PUR) foam is found as a component of many composite artifacts in the National Air and Space Museum (NASM) collection. We find PUR foam on head-sets, flight helmets, aircraft seat cushions, and as instrument packing material. PUR foam is highly susceptible to degradation, and when it begins to deteriorate can transform into a fragile crumbly powder. This type of deterioration causes severe material loss and disrupts the interpretation of the artifacts' intended use, and often results in the complete loss of the artifact.

The most comprehensive studies in conservation to date illustrate the successful use of either Impranol® DLV/1 for PUR ether foams, and aminopropylmethyl-diethoxysilane (AMDES) as a consolidant for PUR esters. However, these studies focus on fine art collections and do not concern themselves with technical or scientific material culture artifacts. Additionally, the studies focus on nebulization or immersion application techniques. Immersion is not a viable option for the types of composite artifacts containing PUR foam in the NASM collection. In our research we found that initial attempts at nebulization only deposited either a thin film or a thick layer of consolidant onto the surface of the foam, leaving the untreated interior soft and crumbly. The need to identify a workable application technique for PUR foam consolidants became relevant when the NASM conservation lab was presented with a collection of headsets from the Skylab era (c. 1970's). Each of the headsets have PUR foam ear cushions in varying states of deterioration.

This poster will present a case study for the treatment of one Skylab era headset with deteriorating PUR ester foam. To consolidate the fragile foam of this composite artifact it was necessary to determine the maximum thickness of the foam to be treated, followed by identifying the best methods to ensure that only the foam was consolidated with the Impranol® DLV/1. This poster will illustrate the series of experiments carried out on samples of PUR foam from the NASM collection dating to approximately the same era as the PUR foam on the Skylab headsets. These experiments ultimately helped to determine the best treatment methodology, which was then used to treat the headset.

### **(38) Map It Out: Visualising Data For Sustainable Collections Management At The National Archives UK**

*Sarah VanSnick, Preservation Manager, The National Archives UK; Kostas Ntanos, Head of Conservation Research and Development, The National Archives, London*

To facilitate truly sustainable choices in collections management an in-depth understanding of the collection, storage areas,

display facilities and access level are essential. For large collections this requires the gathering and interpretation of large quantities of data. In recent years the Collection Care Department at The National Archives UK (TNA) has developed thematic data maps that present visually some of our large sources of data about our collection and storage environment. These visual tools have permitted TNA to suggest and implement improvements that are both better for the collection and sustainable.

Environmental mapping of TNA's storage was achieved using paper-based isoperms to illustrate environmental conditions in a single map. Creating the maps monthly clearly illustrated the seasonal cycle of TNA's main storage area. This information was key to informing subsequent projects and the development of our new seasonally adjusted set point schedule. This schedule provides an improved environment for the storage of the collection and delivers substantial energy savings over the traditional use of constant set points for the HVAC system throughout the year.

TNA has also created maps that link a number of different data sets to storage locations by shelf number. 'Collection maps' which colour-code material types across storage, are important evidence for exploring the possibility of zoning the collection according to material type and allow tighter environmental control for more vulnerable parts of the collection, for example photographic materials. The map has been instrumental in establishing a dedicated area for photographic collections operating at cooler and drier conditions.

This mapping tool was successfully used to illustrate the number of deliveries to our reading rooms from each shelf in storage and documented where our most popular records were stored. These maps will now inform changes to our storage cleaning regime. Knowing which areas host more activity will allow TNA to concentrate its cleaning in those areas resulting in a more efficient and effective cleaning programme.

Conservation professionals and the institutions they work for collect data routinely, but mapping offers the ability to look at the data differently. By harvesting, using and presenting data in innovative ways, TNA has been able to make sustainable collections management decisions as a result.

### **(39) The Humming Bird 2: Using Fosshape as an Alternative Backing for Fiber Art Sculpture**

*Marissa Stevenson, Jason Depriest, Suzanne Hargrove, Toledo Museum of Art*

Fosshape is a common material used in the costume and theater industry. It is a nonwoven fabric made of low melting synthetic polyester fiber that can be manipulated into a permanent form when exposed to heat (200°F range). Fosshape will conform to an underlying surface to create a firm custom fit support that can be sewn in place. In 2009, the Textile Museum in Washington, D.C. utilized Fosshape to construct invisible costume mounting structures (Amnéus and Miles, JAIC 2012). At the Toledo Museum of Art, Fosshape was considered as a possible support for The Hummingbird 2, a hemp and sisal wall sculpture by Magdalena Abakanowicz. The sculpture consists of a three-dimensional woven panel with four vertical slit openings. Additional knotted

and wrapped forms create large three dimensional surfaces that come from the back through a center opening. The sculpture's top and bottom contain cut pile wefts that are looped into the warp to create a hair like surface appearance. Consequently the artwork has wide ranging undulating peaks and valleys. The original mounting structure consisted of a simple wood frame which was tacked to the weaving with ½" staples in four areas at the top and did not provide adequate support. The extreme irregular surface planes and attached wood frame created support and mounting issues. Fosshape was considered an ideal textile friendly (or textile compatible) material as an auxiliary rigid support for both the sculpture and its existing wood frame.

First a mockup was designed to insure the procedure would work. Based on its success, a cast model was created of the back of The Hummingbird 2 by placing it face down on an appropriately padded support with an isolating layer of Dartek, a transparent cast nylon film that is free of surface coatings and plasticizers. Plaster bandages were applied to make the model. Once set the plaster model was used to construct the Fosshape. A sheet of Fosshape was cut to fit the model with an additional 6" allowance. It was then manipulated to fit the model using a Rowenta Superpress 050 steamer and tacking iron. The steam process was started at the center working to the edges so the Fosshape would shrink consistently to fit the cast.

Sandbag weights were applied after heating to reinforce the shape. Additional strips of Fosshape were added where needed for extra support. The Hummingbird 2 was then suspended between two supports so the front and back were both accessible. The molded Fosshape panel was then fitted to the back of the wood frame and artwork. Transmitted light was used to trace the vertical openings and outlines of The Hummingbird 2 onto the Fosshape. The Fosshape was removed and these areas were cut out. The edges of the cut openings were covered with orange cotton archival fabric and sewn to the Fosshape so that the material was not visible.

The molded Fosshape was sewn to The Hummingbird 2 using four rows of vertical basting stitches (approximately ½" in length, 2 ½" apart) with 100% cotton 100m Gutermann thread while the sculpture was suspended for access to the front and back. The Fosshape was also attached to the wood frame with screws. Finally the excess Fosshape was trimmed off along the wood frame. (Should this process be done again, a barrier layer such as fine 100% polyester or muslin would be used between the Fosshape and the artwork as the Fosshape has a textured surface.)

Through this process Fosshape has proved to be a viable resource to conservators as it has potential to be utilized in a variety of circumstances as a custom support structure. This material can be utilized to create supports for treatment as well as structures for mounting and storage. Fosshape is an easily manipulated material that is not only cost effective but a firm, supportive alternative to traditional backing and mounting.

### **(40) The Digital Portfolio in the Conservation Field**

*The Emerging Conservation Professionals Network*

## **(41) The Use of Cyclododecane as a Temporary Fixative for Loose Surface Media on Paper to Allow Mechanical Conservation Treatments**

*Marie-Lou Beauchamp, Paper Conservation Student, Queen's University*

Cyclododecane (C<sub>12</sub>H<sub>24</sub>) has been used in the field of conservation for almost two decades. In the paper speciality, its use has mainly been oriented towards its properties to act as a temporary fixative for aqueous treatment of soluble media. In artefact conservation, cyclododecane is mostly used to secure fragile artefacts during movement and transportation. This study proposes to use cyclododecane spray as a temporary fixative for loose surface media, like pastel, to secure the pigments during mechanical conservation treatment on the verso of the object. The application of cyclododecane may allow the conservator to perform treatments like mechanical backing removal, surface cleaning and flattening under light weight. Samples will be created by applying pastel on paper and then applying a coating of cyclododecane. Then, the samples will be submitted to a smudge test, based on the ASTM Standard Test Method for Determination of Abrasion and Smudge Resistance of Images Produced from Business Copy Products. After sublimation of the cyclododecane, assessment of the change in colour and glossiness will be made with colorimeter and glossmeter. UV photography and reflected photography will be used to detect any smudging, abrasion or pigment transfer from the sample during the test. It is expected that a film of cyclododecane applied on the media would protect it from disruption, smudging, smearing and crushing during test. Since the conditions of experiment would place a greater stress on the samples than a conservator would normally put on an object during treatment, the hypothesis is that a commercial cyclododecane spray can act as a temporary fixative to perform mechanical treatments on pastels drawings.

## **(42) Multispectral and Computational Imaging Methods for Documentation of a 19th Century British Landscape Painting**

*Taylor Bennett, Intern, Digital Diagnostic Specialist, Kept Art Restoration, San Jose, CA; Ken Boydston, President, MegaVision, Inc., Santa Barbara, CA; William A. Christens-Barry, Ph.D., Principal Scientist, Equipoise Imaging, LLC., Ellicott City, MD*

This poster presents the application of multispectral imaging and computational imaging methods, including Reflectance Transformation Imaging (RTI) and photogrammetry, to document a 19th century British painting of the Giudecca Canal and Santa Maria della Salute in Venice, Italy (920 millimeters [mm] x 1,020 mm or 36 inches x 50 inches). These imaging techniques were chosen with consideration for the long-term preservation and reuse of the data using well-documented, open-source standards. They have been adopted by conservation departments at several major museums and used for such open scholarship projects as the Archimedes Palimpsest Project (<http://archimedespalimpsest.org/about/>) and the Antikythera Mechanism Research Project (<http://www.antikythera-mechanism.gr/>). Rapid developments of computational photography methods and improvements in digital imaging equipment have made these techniques highly portable, available to independent conservators, and applicable to cultural heritage *in situ*, outside of an institutional research setting. These methods provide a detailed digital data set documenting the condition of the painting and forming a basis for further analysis and scholarship regarding the artist's technique and use of materials.

Multispectral and computational image sequences were captured in an overlapping mosaic pattern to obtain a ground sample resolution ranging from approximately 350–500 pixels per inch (ppi) over the entire painting surface, and up to approximately 2,000 ppi for some details, resulting in over 120 gigabytes of raw images. Multispectral reflectance images of the painting were captured in twelve discrete wavebands ranging from approximately 350 to 1,000 nanometers (nm), including one ultraviolet (UV), six visible, and five near-infrared (NIR) wavebands. Fluorescence images were captured using UV and blue excitation wavelengths in conjunction with emission filters, and visible-range images were captured using both bidirectional and unidirectional lighting to provide additional textural information. The spectral imaging system consists of two lighting arrays with individual light-emitting diodes (LEDs) for each waveband, a camera with a 50-megapixel monochrome charge-coupled device (CCD) sensor, and a custom 120-mm focal length lens designed to maintain focus over the range of wavelengths for precise image registration. Controlling the wavelengths of the light source reduces the potential for photochemical damage to the subject and allows better image resolution than is possible using the alternate method of using a broad-spectrum light source and placing filters on the camera lens. The absence of a color filter array on the sensor allows the reflectance and fluorescence data for each waveband to be registered and compared, per-pixel, without introducing errors from the demosaicing process common to most color (RGB) digital cameras. The individual wavebands can be viewed and analyzed individually or in combination, for example, to allow accurate color rendition, reveal areas of damage and subsequent repairs, and help distinguish original from later pigments.

RTI obtains surface shape information from a sequence of typically 30–50 images captured while varying the direction of the light source in a hemispherical pattern. The sequence of images is computationally processed to calculate the direction of the normal vector perpendicular to a plane tangent to the surface at each pixel. The resulting RTI file can be viewed using software that allows the viewer to virtually manipulate the light direction on a computer monitor, and also provides a variety of algorithms to change the reflectance properties of the surface to make fine textural details (for example, brushstrokes, impasto, and craquelure) more visible. The data collected for an RTI sequence can be reprocessed as newer software tools become available. The open-source software used for this project includes RTIBuilder and RTIViewer, available from Cultural Heritage Imaging (<http://culturalheritageimaging.org>).

RTI obtains surface shape information from a sequence of typically 30–50 images captured while varying the direction of the light source in a hemispherical pattern. The sequence of images is computationally processed to calculate the direction of the normal vector perpendicular to a plane tangent to the surface at each pixel. The resulting RTI file can be viewed using software that allows the viewer to virtually manipulate the light direction on a computer monitor, and also provides a variety of algorithms to change the reflectance properties of the surface to make fine textural details (for example, brushstrokes, impasto, and craquelure) more visible. The data collected for an RTI sequence can be reprocessed as newer software tools become available. The open-source software used for this project includes RTIBuilder and RTIViewer, available from Cultural Heritage Imaging (<http://culturalheritageimaging.org>).

### (43) Conservation of a 17th Century Baroque Oil Painting as a Collaborative Research and Instructional Tool

Kristen Watts, Department of Chemistry, Villanova University; Emily Wroczynski, Winterthur/University of Delaware Program in Art Conservation; Maggie Bearden, Pre-program student/Undergraduate degree in Art Conservation, University of Delaware; Amanda Norbutus, Department of Chemistry, Villanova University; Kristin Deghetali, PhD Program in Preservation Studies, University of Delaware; Anthony Lagalante, Department of Chemistry, Villanova University

The opportunity to conduct *in situ* analysis in tandem with ongoing conservation efforts does not frequently present itself, especially in conjunction with educational outreach. *The Presentation of David to King Saul after Slaying Goliath* (12' x 19', oil on canvas), a 17th century oil painting attributed to Baroque master Pietro da Cortona, originally hung in Nemi Castle outside of Rome until the mid-20th century. During World War II, the painting was exposed to the elements after a bomb damaged the roof of the castle. In the 1950s, Princess Eugena Ruspoli donated the painting to Villanova University. After an initial restoration campaign in 1956, the painting has reverted to its pre-restoration state. The current conservation campaign will seek to restore the painting and understand the failure of the 1950s restoration.

A two-year campaign to restore the painting has begun at the university incorporating both technology and methodologies that were unavailable during the previous conservation campaign. Villanova University is using this project to provide an educational opportunity regarding art conservation and history to its students and the surrounding community. An interdisciplinary team composed of a private paintings conservator, two conservation interns, and members of the Villanova chemistry and art history departments are acting as collaborators. The conservation effort will be performed in an open forum, in a room dedicated partially to the painting and partially as a common area for the students at Villanova where they will be able to study and observe the conservation team as they work on the painting. Members of the Villanova chemistry department specializing in preservation science and analytical chemistry are conducting research (utilizing XRF, SEM-EDX, DESI-MS, etc) into the artist's original materials and as to why the degradation after the 1956 restoration campaign occurred so rapidly. At the same time, Art historians at Villanova are investigating the history of the painting and the artist. All team members will blog throughout the project using a variety of social media (Twitter, Facebook, Instagram, YouTube, etc.) to engage the public and promote awareness about the painting. Regularly scheduled tours of the painting will be given during treatment hours with panels highlighting key aspects as to the conservation research currently underway.

This painting will be utilized in many classes on Villanova's campus, providing an opportunity for liberal arts students to see chemistry in a non-traditional way, and for chemistry students to see a practical application of science to the arts. This includes public demonstrations of XRF as a tool to monitor the cleaning of the painting by examining the levels of zinc present on the surface from previous overpaint. This poster will highlight the various avenues of public outreach involved in the conservation project of *David and Goliath*.

### (44) History Unfolded: Conservation Treatment and Housing of 18th-Century Printed Paper Fans

Annie Wilker, Paper Conservator, The Huntington Library, Art Collections, and Botanical Gardens

Thirty-three folding paper fans were recently acquired by the Huntington Library's department of early printed books. These fans, all produced by fan manufacturers in England during the second half of the 18th-century, share characteristics with bound collection—they contain significant amounts of printed text, represent a convenient method of storing reference information, and are three-dimensional, composite objects that were intended to be handled. The purpose of this poster is to describe the production, condition, treatment, and housing of these fans.

Paper fans from the 18th-century were mass-produced and ephemeral in nature, allowing people from all levels of society to keep up with rapidly changing trends at little expense. Much more than fashion accessories, however, these fans serve as documents that shed light on the social and political history of the period. Their printed text often functioned as memory aids and included almanacs, song lyrics, dance steps, rules for parlor games, and the details of current and past events.

In the Huntington's collection, the most typical fan design consists of a semi-circular leaf constructed from two sheets of thin, antique laid paper mounted to plain wooden sticks. The leaf generally includes line or stipple engraving with a strip of metallic foil along the top edge. More elaborate fans feature leaves with hand coloring and sticks of bone embellished with paint or faux jewels.

Few paper fans from this period have survived, but those represented in the Huntington's collection are in stable condition. However, the inherent stress of opening and closing the fans has presumably caused tears along folds and some flaking of paint media; significant staining exists where wood sticks are in contact with paper. Other issues include corrosion of metallic foils, the likely presence of mildew, and extensive previous repairs which interfere with the mechanical action of the folding fans.

Treatment of the fans was complicated by the folded nature of their supports and by the need to limit moisture to prevent warping, bleeding, and corrosion. Paint consolidation, non-aqueous mending, tape removal, and mildew reduction were completed as appropriate. Various housing options were then considered. While an open position could lead to warping of the sticks and flattening of the leaf, a closed storage position requires additional mechanical stress for viewing. Because the fans are structurally stable and have been digitized to reduce handling, the decision was made to store them closed in custom-made housings. Conservation treatment of the printed paper fans stabilized them for future use, while a closed storage position protects the objects, saves staff time, and reduces necessary storage space.

## **(45) Roy Lichtenstein's Time Magazine Cover of Robert F. Kennedy: His Working Method**

*Rosemary Fallon, Paper Conservator, Smithsonian's National Portrait Gallery*

The Smithsonian National Portrait Gallery (NPG) holds approximately 2000 objects of original art created for reproduction on the covers of Time magazine. In 1968 Time commissioned pop artist, Roy Lichtenstein to do two covers at the same time: an image of Robert F. Kennedy (RFK) during his presidential campaign and the other, a smoking gun, for a feature story on gun violence. Mr. Lichtenstein rarely accepted commissions or did portraits but RFK had mobilized the anti-war movement with his campaign and the artist admired his energy. Mr. Lichtenstein accepted the magazine commissions although he thought the process a bit too commercial. This amused him because some critics thought his art work too commercial. RFK appeared on the May 24, 1968 cover and was assassinated a few weeks later. Ironically the image of the gun ran on the cover shortly after.

The color film overlays created for the RFK cover were selected by Portrait Gallery Chief Curator, Brandon Fortune and Curator of Prints and Drawings, Wendy Wick Reaves for their exhibition, Face Value scheduled to open in April 2014. This selection prompted further examination of the preparatory drawings and associated materials for the magazine cover. The Lichtenstein Foundation did not have detailed information about the drawings for this work and was interested in documenting all associated materials. While meeting together with Avis Berman, researcher for the Lichtenstein Foundation, Jim Barber, NPG Curator of the Time Collection, and Wendy Wick Reaves, NPG Curator of Prints and Drawings, the group began to piece together the artist's process for creating this compelling image of Robert Kennedy but questions remained and required more research.

This poster will address the artist's process and materials used to create the magazine cover with images and text. The artist's method was similar to the way he approached his paintings whereby the drawings described the final design for the art work. Lichtenstein began with photographs of Kennedy and then worked out the design in a series of black and white preparatory drawings, photo reproductions, photographs and collage. There is one, black and white key drawing on illustration board and four, black and white overlay drawings on translucent paper executed in felt tip markers over graphite pencil, some with brushed, matte paint and collage elements. The key drawing was reproduced and served as the underlay image for the overlay drawings created for each separate color. The sixth object is a collage, mock-up of two photographs with hand applied color and a sample of Lichtenstein's printed dot paper. The four color film separations (cyan, magenta, yellow and black) were created from the drawings for each color plate. In 1989 Time magazine asked Lichtenstein to make a color lithograph of the final design for the NPG possibly due to the instability of the materials of the film overlays, the only extant example of the final design other than the magazine.

## **(46) Life Cycle Assessments of Museum Loans and Exhibitions: Four Case Studies at the Museum Fine Arts, Boston**

*The Sustainability Committee, The American Institute for Conservation (Geneva Griswold, Betsy Haude, Christian Hernandez, Sarah Nunberg; Robin Ohern, Denise Stockman, Melissa Tedone, Jia-Sun Tsang); Sarah Nunberg, The Objects Conservation Studio, LLC; Pamela Hatchfield, Robert P. and Carol T. Henderson Head of Objects Conservation at the Museum of Fine Arts, Boston; Matthew Eckelman, Assistant Professor in the Department of Civil and Environmental Engineering of Northeastern University*

The American Institute for Conservation of Historic and Artistic Works (AIC) and the Museum Fine Arts, Boston (MFA) commissioned Northeastern University (NEU) environmental engineering students under the direction of Dr. Matthew Eckelman to study the environmental and economic impact of museum loan and exhibition practices. This project grew from discussions concerning the potential benefits and risks of changes in climate guidelines for museum loans. Further consideration of loan activities led to examination of not only electricity used for environmental control, but also the materials and energy required to transport art for loans and prepare gallery space for exhibitions. Treatment materials were also examined, beginning a systematic evaluation of the environmental impact of the resins we use. Since the 1990s, industry has used the life cycle assessment (LCA) tool to evaluate actions, economic impact, inefficient energy use and waste management. Once hotspots are identified, libraries, museums, private practitioners, archives and heritage institutions can effectively work towards environmental, economic and socially sustainable goals when caring for collections.

Four LCAs were commissioned for this project. LCA 1 compared efficiencies of the cost and life cycle of halogen lamps with light emitting diode (LED) lamps in a single MFA gallery. This study concluded that in addition to long term cost savings, LED use results in lower environmental impact, lower eco-toxicity and fewer human health indicators than halogen lamps. LCA 2 considered the materials and environmental impact related to loan preparation and shipment to two different venues. Plexiglas™ vitrines, gallery lighting and climate controls were responsible for approximately one third of the carbon emissions from the exhibition preparation phase. Crate and Plexiglas™ reuse as few as four times would significantly lower the loan carbon impact. However, the highest environmental impact of all loan phases proved to be the carbon foot print of the courier who travels two round trips for every one object round trip and has more than three times the impact of the art transport. LCA 3 addressed cost and energy savings resulting from the temporary shutdown (coasting) of air handling equipment for one newly constructed gallery at the MFA. The study found that turning off the air handling systems for 12 hours nightly achieved a 21% (daily) reduction in cost and electricity use. LCA 4 compared silane stone consolidant with Acryloid B-72 in a 1:1 acetone/ethanol solution, and Acryloid B-72 in xylene for treatment of a Romanesque church façade in the MFA collection. The study considered the ecotoxicity, human toxicity, acidification, and global warming potential of each system and concluded that silane use results in a significantly

higher impact in every category, even recommending the B72/xylene system over the silanes.

LCA is a useful tool, dependent on the practitioner's knowledge and the consumer's commitment to sustainable work habits and lifestyle. Studying the impact of our actions will allow us to make educated decisions and consequently achieve more sustainable, responsible best practices.

#### **(47) Multispectral Imaging (MSI) with a Modified Monochrome DSLR Camera**

*Jiuan Jiuan Chen, Assistant Professor; Dan Kushel, Emeritus SUNY Distinguished Teaching Professor; Graduate students: Amanda Chu; Ellen Davis; Jena Hirshbein; Jennifer Johnson; Zachary Long; Colleen O'Shea; Dawn Planas; Erica Shuler; Liz Sorokin; and Christina Taylor, Art Conservation Department, Buffalo State College*

UV-vis-IR modified single-lens reflex cameras (DSLRs) have been used by conservators and museum photographers to record the reflective response of artifacts in UVA, visible light, and near IR. The sensors in these cameras are modified by the removal of the IR blocking and anti-aliasing filters allowing for imaging in these three spectral regions with the use of appropriate lens filtration. In these cameras, the sensor's RGB color filter array (CFA) is left in place to permit standard color photography. The CFA, however, makes it impossible for the camera to record the precise spectral response of each pixel site because each pixel is covered by a red, blue or green filter.

The removal of the CFA, in conjunction with appropriate lens filtration (or subject illumination) to control the specific wavelengths reaching the sensor, will permit the camera to record the actual spectral response of the subject's surface as recorded by each pixel. An additional advantage of a modified monochrome camera is improved imaging in the UVA and NIR because the CFA attenuates in these regions. Imaging is improved most significantly in the UVA region because the blue and green CFA filters and the pixel microlenses (removed with the CFA) absorb UVA strongly.

The MSI system at the Art Conservation Department at Buffalo State College employs a monochrome Canon EOS Rebel T3i (600D) DSLR camera modified by Maxmax.com. With its supplied Canon EOS Utility software, easy and convenient computer image capture control is permitted. For MSI work, the camera is used with a Coastal Optics UV-VIS-IR Apo 60mm Macro Nikon-mount lens with a Rayqual Nikon-to-Canon-EOS adapter. The lens is apochromatic from 315nm to 1100nm and thus requires no focus adjustment when imaging outside the visible region. This is extremely advantageous since this eliminates the image size changes that occur with focus shifts thus making perfect registration easy to achieve when stacking image sets or creating false-color images.

A set of fourteen Andover narrow bandpass filters is used to control the wavelength range reaching the lens. (Visible and IR filters are 10nm bandwidth; UVA filter is 25nm bandwidth.) The set consists of 25mm diameter filters with peak transmission wavelengths of: 365, 400, 450, 500, 550, 600, 650, 700, 750, 800, 850, 900, 950, and 1000 nanometers.

The filters are mounted in a computer controlled Finger Lakes

Instrumentation CFW-3-20 20-slot motorized filter wheel. The camera lens is positioned closely behind the filter slot opening to minimize vignetting.

The poster will describe and illustrate this MSI system. MSI images of various artifacts and false-color images made from selected MSI images will be presented along with commentary on how these images augment our understanding of the artifacts.

#### **(48) Moulds on Photographic Techniques and Maps Stored: A Case of Study**

*Sofia Borrego, Chief of the Preventive Conservation Laboratory / Researcher and Preservation Specialist, National Archive of the Republic of Cuba and Alian Molina*

Filamentous fungi—so called “mould”—are important agents of biodeterioration in documentary heritage stored in archives, libraries and museums. Fungi are able to live at low water activities; they are perfectly adapted to indoor environments and thrive in microclimatic niches caused by condensation, lack of ventilation or water retention by hygroscopic materials. Fungi spoil valuable documents mechanically, chemically, degradation of organic components and aesthetically. For these reasons, the aims of this research were to isolate the fungi on different photographic techniques and maps from XIX century, to identify the principal fungal genera and species and to determine the metabolic characteristics of the fungal strains detected to degrade the different compounds which composed the documents analyzed. For this study six photographic techniques and four maps without evidence of fungal affectation were analyzed. The photographic techniques were two tobacco leaves engraved, one poplar leaf engraved, one ferrotype, one glass negative and one photo in paper with albumin emulsion. The maps were two in paper support and two in textile support. The samples were performed from 1 cm<sup>2</sup> of surfaces of each document with sterile and wet swabs. The swabs were immersed in 1 mL of sterile distilled water and serial dilutions were made. The dilutions selected were inoculated on Petri dishes containing Malt Agar to isolate the fungi. The dishes were incubated and the fungal strains grown were isolated and identified. The cellulolytic, proteolytic and amylolytic activities and the production of acids and pigments of the fungal isolates were qualitatively determined. The different techniques of photos and maps are stored at low temperatures and relative humidity (about 21°C and 51%). They are kept clean and preserved in the furniture and in appropriate wrappers. However, the concentration of the fungi on photos ranged between 101 - 103 CFU/cm<sup>2</sup> besides on maps the concentration ranged between 101 and 102 CFU/cm<sup>2</sup>. The predominant fungal genera on the all documents were *Aspergillus*, *Penicillium*, *Cladosporium*, *Eurotium* and yeast genera *Candida* was detected too. The 100% of the fungal strains isolated were capable of degrading cellulose and excrete acids. The protein and starch were degraded by 70% of the strains and some pigments were excreted by 50% of them. These results demonstrated that fungi are present on the documentaries materials even if they are clean and in good conservation conditions, so if the temperature and relative humidity increase sharply and remain high for several days the biodeterioration of these documents could start.

## **(49) Oil on Paper: New Challenges for Two Specialties**

*María Soledad Correa, Paper Conservator, Centro Nacional de Conservación y Restauración, Recoleta, Chile*

Conservators of the Painting and Paper Conservation Laboratories from the Centro Nacional de Conservación y Restauración de Chile (CNCR) were faced for the first time with the challenge of treating two oil paintings on paper. Each specialty contributed their own expertise and experience. A multidisciplinary team (a conservation chemist, a photographer, and representatives from the owner institutions) headed by conservators from the two specialties, was assembled. The objective was to investigate the material properties of the objects, their historical context, their value, their uses, and the owners' and specialists' expectations. With the information gathered, intervention criteria and areas of study were established according to the needs of each particular case.

The oil painting *Portrait of Pilar Garfias del Fierro* painted by Raymond Monvoisin in 1844, is part of the permanent exhibition of the Museo Histórico Nacional (MHN) and was admitted to CNCR as medium size oil on canvas. During the identification process, it was discovered that the support was made of paper hidden under a protective layer of fabric attached to the back of the paper. The specialists were forced to consider specific issues posed by this technique. Given the lack of experience of the painting conservators with paper, the paper conservators were asked to collaborate, and a bibliographical search on the topic was carried out. Unfortunately the results were limited and inconclusive. This is the scenario in which the working team had to begin the intervention.

The structural stability of the object and the appropriate aesthetic reading of the image were compromised by the severe damage. The painting showed brittle support, severe distortions of the surface, missing areas, tears, inappropriate inpaintings, and a yellowish varnish. During the treatment many difficulties were faced, which led to a need to perform invasive treatments that had previously been dismissed.

During the development of the final stage of treatment, the Museo Nacional de Bellas Artes (MNBA) requested from the CNCR an urgent intervention for a small sized oil on paper, *Dido y Eneas*, painted by Ernst Kirchbach. After spending years in storage and with no attached historical information, this work was selected for exhibition in the near future. The painting showed surface dirt, significant missing areas, support distortions and a yellowish varnish. The experience with the *Portrait of Pilar Garfias del Fierro* became a fundamental starting point to meet this new challenge, which resulted in a different and successful treatment proposal.

The poor and outdated bibliographic information available and the unsuccessful attempts to contact professionals that had faced similar experiences, proved to be a major constraint in the development of the treatment. These issues are the main reason we wish to disseminate information on our experiences. We seek to encourage discussion and to provide support for those who face similar challenges.

## **(50) Changing Habits: From the Fumigation Chamber to IPM Practice**

*Ana Carolina Delgado Vieira, Research Specialist, Conservation & Restoration Area, Museu de Arqueologia e Etnologia – Universidade de São Paulo*

In September 2012 the Conservation Laboratory staff of the Museu de Arqueologia e Etnologia (MAE / USP) in Sao Paulo, Brazil identified an initial moth infestation (*Tinea murariella* Staudinger, 1859) in the ethnographic collection. This unfortunate circumstance, despite the serious consequences, has opened a scenario of various "new" possibilities within the institution.

Like many others museums, the MAE / USP still owns a fumigation chamber acquired many years ago. This chamber until recently had been operated by museum staff using hazardous chemicals such as methyl bromide, ethylene oxide, carbon tetrachloride and phosphine. Despite of daily battles against insects, the museum staff was hesitant to stop using pesticides to rely on Integrated Pest Management principles.

However, in long ongoing discussions, the museum conservators were able to demonstrate that maintaining this practice would continue to cause considerable damage to the staff, the environment and the collection. Therefore, it would be legitimate to say, that this severe moth infestation was the primary catalyst to finally abolish toxic chemicals and look for alternative disinfection methods.

This poster describes the evolution from toxic to non-toxic pest control by means of anoxia nitrogen treatment. In addition to this recent approach, we report on how the institution is taking its first steps towards the implementation of an Integrated Pest Management Program to ensure the safeguarding of its collection.

## **(51) Conservation Challenges: The Art Museum of the Banco de la Republica of Colombia Reinstallation Project**

*Ingrid Frederick, Preventive Conservator, Banco De La Republica, Bogota, Colombia*

The Art Museum of the Banco de la República of Colombia houses the most important public collection of modern and contemporary art of the country.

It was created in 1957, and today contains close to 5,000 artworks. The project of re-installation of the Permanent Collection, which currently exhibits near to 800 artworks in 2735 square meters, started three years ago and was opened at the end of June past.

This project implied a series of conservation challenges, which have been addressed since the planning of the project, both during and after its completion. It includes the criteria and decision-making processes, which have been reconsidered in order to ensure the preservation and enjoyment of these works exhibited to the public.

This presentation intends to show the experience of the re-installation of the museum galleries from the conservation perspective, and the implications in the negotiation of priorities among the curatorial and museography needs and intentions.

First, the number of works on exhibit tripled compared to the previous installation of the permanent collection; as a result, a great number of artworks needed to be prepared in order to “bring them to light”; in addition other works, already on exhibit, had to be revised and once again prepared. Furthermore, in regards to a number of special works, new exhibition ideas had to be reinvented or created, in order to mount them to walls and showcases. All these new requirements went along with the curatorial intentions of communication towards the public, which demanded “new” ways of looking at already-known artworks, in relation to the variety of techniques, materials and time period.

Another factor that implied a challenge in terms of conservation was the re-design of the exhibition spaces, which required the environmental conditions assessment and control of new areas and showcases.

In addition, the responses of conservation were transformed according to the inevitable changes occurred between the planning period and the real installation process, where the limited time and resource factors put to the test our capacity of reaction in diverse scenarios. Finally, we plan to present the challenges of after the installation giving the nature of this project.

## **(52) Tzauhtli, the ideal textile adhesive? A Natural Alternative to Adhesives used in Textile Restoration**

*Lilian García-Alonso, Professor and Materials Analyst, National School of Conservation ENCRyM; Lorena Román, Senior Textile Conservator, INAH; Rodrigo Buentello, Materials Professor at the National School of Conservation ENCRyM; Alejandra Corona, Professor of Textiles, National School of Conservation ENCRyM*

Tzauhtli is a pre-Hispanic adhesive obtained from the mucilage contained in orchid bulbs. This was used in the center of Mesoamerica in the creation of feather mosaics, and later, during the colonial period as a binder for the production of corn stalk pulp used in making light figures of Christ, musical instruments and edible sugar figures.

Currently, working with Tzauhtli is almost unheard of, partly due to the complexity of the extraction of the material and also because the orchids that contain the mucilage are increasingly difficult to obtain and are often protected to prevent exploitation and possible extinction.

In 2002 in the textile conservation seminar and workshop at the ENCRyM, the senior conservator Lorena Román Torres worked on the conservation of a very significant feather mosaic from XVI century, the Cristo Salvador del Mundo from the National Museum of Viceroyalty. During the research process for the preservation of the piece, it was learned that the adhesive used in its creation was the orchid mucilage known as Tzauhtli. It was then found that despite the age of the piece and its natural aging process at all levels the adhesive remained unaltered. Through this, it was also discovered that the Tzauhtli was a natural and reversible adhesive, colorless, innocuous, non-toxic and due to its characteristics, compatible with natural fibers.

Lorena Román and her team continued to study the adhesive properties of Tzauhtli, and in recent years, remarkable progress

has been made: various species of orchids have been grown for extraction of mucilage and various methods of extraction have been performed. This year we have conducted tests such as spectrophotometry, hydrogen potential measurement, density, viscosity, surface tension, weathering, solubility, tensile strength, accelerated aging and yellowing tests, all these efforts to test the quality of the adhesive and to determine whether the Tzauhtli today can become the ideal alternative for the conservation of textiles, especially for highly deteriorated silks.

For the first time this poster presents for the first time to conservation specialists with the results of the tests carried out on the *Prosthechea citrina* adhesive applied to samples of silk. These complex and complete tests are rarely performed on an adhesive of this nature with the goal of identifying the best qualities of Tzauhtli as an adhesive for conservation. In addition, this study promotes the care and cultivation of the orchids and is intended to initiate collaboration with people dedicated to the growing of *Prosthechea citrina*. Through this cooperation, we will promote the use of organic materials for conservation and initiate a research with of other orchid species in combination with other materials for the Tzauhtli to be used in conservation of other materials such as wood, most textiles, paper and more.

## **(53) Collection Management against the Clock**

*Norma Juliana Jimenez, Conservator and Museologist, Museo De La Independencia – Casa Del Florero, Bogotá, Colombia*

The Museum of Independence – Casa del Florero is a museum that focuses on the time of the Independence of Colombia, mainly from the second half of the 18th century until the present. The museum is located in the main square of Bogota, next to the President's Palace, the Major's Office, the Congress, the Palace of Justice, the Cathedral and several other public offices of the country. Some of the main topics of the museum are: Contexts of the independence from Spain, social actors involved in the independence, history of the house, consequences and legacies of this social movements, among others. Apart from that, there are at least three temporary exhibitions every year dealing with different themes that are related with the concepts of independence and citizenship.

The museum was created in 1960 by the Colombian Academy of History and donations from other museums and private collectors. Today, the museum's collection contains around 4,470 pieces (mainly historic documents, paintings, sculptures, drawings, photography, furniture and textiles).

The museum is located in a colonial house (recently restored) and some additions made in 1960 for the creation of the museum (more exhibition rooms and a garden).

For the commemoration of the bicentennial of the independence of Colombia, the museum was completely renovated; the building was restored, as well as the whole exhibition concept and design.

The renovation project was initially formulated for an 18 month period (including all preventive actions required to properly conserve the collection), but due to several bureaucratic, economical and political problems, the time was reduced to 3 months.

During this short time, we had to document the entire collection for the registrar (photographs, conservation status, general maintenance of all parts and conservation actions on some parts etc.), design and order manufacture of all the boxes and special conservation units for the move and storage of the collection during the renovation, and finally, pack everything to move to a remote location that fulfilled all conservation and security requirements.

I want to share my experience during this difficult process, highlighting all the quick and practical conservation decisions that had to be made in record time in order to move all the collection before they started the renovation work on the house. I would like to point out the problems, things to be avoided, remedial processes and recommendations for future projects of the same characteristics.

In short, I want to share the best practices followed by the museum even at times when time and reality go against ideal procedures, effectiveness and even common sense.

### **(54) Analysis of Decay Rates of Paper Samples Naturally Exposed in Library Environments in a Subtropical Location**

*Eduardo Krüger, Associate Professor, Technological University of Paraná; and Clara Fritoli*

Several environmental factors affect paper degradation. Air temperature and relative humidity are among the most important. Under inadequately controlled environmental conditions they can trigger biological, chemical, and physical processes which can accelerate degradation. The goal of this study was to investigate how different cyclical (24 hour cycles) and seasonal variations in air temperature and relative humidity affect paper degradation; it also tried to determine which climatic conditions contribute to greater rates of degradation. In the study, two types of paper were exposed to different natural microclimate conditions, indoors and outdoors, at two university libraries. One of the libraries is located in Curitiba, Brazil (25° 30' S, 49° 20' W, 910m above mean sea level) and the other is located in Caiobá, Brazil (25° 49' 03" S, 48° 32' 34" W, on the sea coast). The period of natural aging was 24 months (July 2010 - July 2012), with a mid-term data collection. Microclimate data were recorded at 1 hour intervals, with data loggers. The paper samples were placed in ventilated acrylic boxes (41x41x16cm, 4mm thickness). The acrylic had a UV filter coating (to control light exposure) and the box was provided with charcoal filters (to control exposure to pollutants). The rationale was to limit the environmental impact on the paper samples almost exclusively to air temperature and relative humidity. The box was used indoors and outdoors; the outdoors box was placed in a Stevenson screen, as used in standard meteorological stations. The theoretical indices PI (Permanence Index) and TWPI (Time Weighted Preservation Index), which quantify the effects of temperature and relative humidity on paper life expectancy were used for comparison with observed degradation rates in the lab. For this, chemical tests were performed to measure viscosity and pH. The results of the chemical tests correlated well with the theoretical TWPI predictions.

### **(55) Small Island Realities: The Good, the Bad and the Ugly of Conservation and Collections Management Practices in Barbados**

*Nerys Rudder, Collections Manager (Self Employed)/ Object Conservation Student, the Blue Road Art and Design Consultancy, Barbados / Cardiff University, United Kingdom, St. Andrew, Barbados*

This poster will highlight the environmental, economic and social costs and benefits of practicing interventive and preventive conservation and collections management in the Caribbean with real world examples highlighted in Barbados.

Small island developing states have particular needs, restrictions and social obligations that may not be applicable to larger countries. Lack of funding and research and networking opportunities, as well as locality and shipping costs all impact on collection management practice. Identifying, communicating and addressing these issues not only assists practitioners within these regions but also helps to contextually place these concerns for the profession as a whole. Subjects to be addressed will include:

- Lack of maintenance programmes for outdoor sculpture and the knock-on financial affects (The bronze statues of Karl Broodhagen)
- Effect of elevated light, rh and temperature and the costs of controlled environments (Air conditioned stores versus cross ventilation)
- Obtaining archival material for treatment and storage (Cost effective medium term storage of paintings)
- The consequences of pests infestations and chemical deterrents (Non-existent COSHH and Health and Safety in the Caribbean)
- Benefits of social media and public education programmes (the National Art Gallery Project Education programme)
- Local supplies and practices that cut down on transport/energy/economic costs (Macgyver conservation that cuts costs but not corners).

### **(56) Preventive Conservation of Ensembles: Moorish Pavilion and Collections at Fundação Oswaldo Cruz**

*Carla Maria Teixeira Coelho, Architect, Fundação Oswaldo Cruz, Rio de Janeiro, Brazil*

Fundação Oswaldo Cruz (Fiocruz) is an institution linked to Brazil's Health Ministry, created in 1900 with the goal of fighting the great problems in the Brazilian public health care system. Its headquarters are located in the neighbourhood of Manguinhos, in the north zone of Rio de Janeiro.

The Moorish Pavilion, headquarters of Fiocruz, was built between 1905 and 1918 to house the activities of the institution (laboratories, library, museum and offices). Listed by Instituto do Patrimônio Histórico e Artístico Nacional as a Brazilian architecture treasure, the building follows the trend of architectural composition of the late 19th and early 20th century in Brazil - Eclecticism - revealing influences of Moorish architecture. It is

located high on the slopes of the terrain of the institution, next to Guanabara Bay and to Avenida Brasil – pathway that receives daily a very large number of vehicles crossing the city. The city of Rio de Janeiro has a tropical climate, with averages around 80% of relative humidity and temperature of 24°C.

The building houses important collections, such as the Rare Books Section of the Biomedical Sciences Library (about 40.000 volumes of works in the areas of natural history, biological sciences, medicine and public health, published between the 17th and 20th centuries); the Entomological Collection (approximately 5 million insects collected since 1901 by the first scientists of the institution); and part of the Museological Collection (laboratory equipment and scientific objects). The combination of the building and the collections housed in it make for an interesting example for reflection on how to act to improve the conditions of the set in a balanced manner, arising from a concern for the coexistence of historic structures and the artifacts within them as defined by the New Orleans Charter.

In the 1990s, a chilled water air conditioning system was installed in part of the building. Fifteen years after deinstallation of the HVAC system a preliminary assessment indicated conservation problems in the building and the collections, and human comfort issues. In order to improve the preventive strategies related to the conservation of the ensemble, and to support the renewal of the HVAC system, a multidisciplinary team carried out a conservation assessment of the building and the collections. The work was based on the methodology developed by the Getty Conservation Institute and previously used in other Brazilian institutions, which proposes an integrated analysis of the macroclimate, the building, the collections and organizational aspects influencing their preservation.

The research included the development of diagnostic conservation of the building and collections, environmental monitoring and assessment of areas of custody holdings and the establishment of conservation strategies. This work aims to present the results of this research and its consequences. The information collected is being used to support sustainable actions regarding the building and the collections, such as the development of a preventive conservation plan; and the design of a new HVAC system, less intrusive to the building and appropriate for the collections.

## **(57) Conservation of Special Collections - Ludwig von Mises Library, Guatemala**

*Marisol Zuniga Lau, Collections Coordinator, Ludwig von Mises Library, Guatemala City, Guatemala*

The Ludwig von Mises Library at the Universidad Francisco Marroquín in Guatemala City has a special collections room named José Cecilio de el Valle. The collections are available to students, teachers and researchers, and national and foreign visitors upon written request. Those who consult the collections must comply with the regulations of the library; the materials may be viewed exclusively inside the collections room, where backpacks, bags, briefcases, meals, drinks, pens, notebooks are not allowed, and with paper and pencil for notes provided by staff. Photocopying and flash photography are not permitted. The person in charge of the room accompanies patrons entering to

consult materials at all times.

The following collections that were donated to the library from the families of important people are available for viewing in the collections room:

- José Cecilio del Valle collection: Contains 1,800 published books dating from the 16th to the 19th century. Included are the main liberal economists, classics, books about law, religion, literature, social sciences, in English, Spanish, French, Latin, Greek, and Italian. Each volume is important both for its content and for the beauty of the bindings of the time, the illustrations and the typographic arts employed in printing. The Lexicon Graecolatinum of Coradum Gefnerum and Arnoldum, Arlenius, is the oldest in this collection, dated 1548. A copy of the first Universal Encyclopedia of Denis Diderot and Jean ALEMBERT, 1782-1783 is also part of this collection.
- William H. Hutt collection: Hutt was a very important, Neo-Keynesian economist. His collection contains 543 books, including writings by Keynes, and most of the books have his own annotations.
- Carlos W. Elmenhorst collection: Elmenhorst was a collector of maps and books of travelers by Mesoamerica. The collection consists of 593 books. The maps are displayed on exhibition in the library. The collection includes books of cartography, geography, history and stories of voyages of exploration in the Mesoamerican region.

In consideration of the age of books and its historical value, special measures have been taken to conserve them. The room is designed for storing these collections with special shelves and doors that allow the air circulation in the collections. There is also air conditioning and continuous monitoring of the humidity and temperature. We applied preventive conservation to very damaged books housing them inside acid-free boxes. All the materials that were use are designed for conservation. Every year we receive advice from specialists, who work for the restoration and care of the collections of ancient books.

In 2008, the library launched an agreement with the Internet Archive. We are in the process of digitizing the books about Guatemala and Central America history. The oldest book that has been digitized dates to 1619. Currently the digitized books are available to researchers, students and anyone who wants to consult the materials on the site [www.archive.org](http://www.archive.org).

## **(58) Investigation into Microclimates within Storage Boxes of Archival Records**

*Hannah Clare, Conservation Manager – Research & Development, The National Archives, UK; Rachel Farmer, Trainee Preventive Conservator, the Heritage Lottery Fund's 'Skills for the Future' Programme; Kostas Ntanos, Conservation Science Manager, The National Archives (UK)*

The National Archives (TNA) is the official archives of the UK government. It holds almost 1000 years of recorded history at its site in Kew, London. The collection is stored in 15 repositories, the three main ones are in the 1978 building referred to as Q1; 12 are in the 1996 Q2 building. The larger Q1 repositories are comprised of open plan areas of approximately 6500 square meters

each. The environment in this space is controlled by a vast air conditioning (HVAC) system which is both complicated and increasingly costly to operate and maintain.

As part of the move towards sustainable heritage management The National Archives has switched its environmental control to a pattern following seasonal drift. This allows the humidity and temperature set points within the repositories to increase in summer and decrease in winter, which has resulted in significant reduction in the amount of energy needed to control the repository environment. As part of this change it was decided that more investigation into the microclimates within the storage boxes was needed to ensure that the humidity levels were still acceptable. Previous experiments had raised concerns that the hysteresis effect combined with fluctuations in humidity could lead to a slow increase in humidity within the boxes.

This project aimed to investigate whether ambient RH fluctuating above the set point, gradually drives the RH inside boxes higher, which will have implications in the implementation of seasonally adjusted set points.

Boxes containing sample archive material and data loggers were placed inside an environmental chamber and the humidity increased and decreased according to a predetermined pattern to establish how the microclimate inside the boxes reacted. The first experiment examined the result of RH rising by 20% for 48h and returning to set point for 48h before repeating the cycle. In the second experiment an oscillating pattern of RH that overall followed the annual seasonal drift was applied. The third RH pattern fluctuated between various points cycling between long periods at a high humidity and shorter periods at a lower humidity. The boxes were tested individually and then stacked tightly together to mimic their condition on the shelves in the repository.

This project is on-going and part of a wider programme of work at The National Archives, which aims to improve preservation environments in storage, whilst meeting Government sustainability targets. This poster will report on the findings of the initial 3 cycles of experiments, which will influence the focus of future investigation. The project was undertaken by a 'Skills for the Future' Preventive Conservation Trainee. The 'Skills for the Future' programme is funded by the Heritage Lottery Fund, a UK funding body, and lasted for 18 months based at The National Archives and The Tate.

### **(59) The Restoration of a Roman Urn with Free Running Erbium: YAG Laser, at 2.94µm: Science in the Service of Art**

*Adele DeCruz, Professor, Duke University; Alessia Andreotti, Researcher, University of Pisa, Italy*

The cleaning of a Roman funerary urn, 67-100 CE: Acquired by the St. Louis Art Museum in 1922, and never exhibited because of the intractable encrustation on the surface of the marble was sent to the conservation laboratory at Duke University for cleaning with the free running Erbium: YAG laser at 2.94µm. During the testing it was discovered that the encrustation was a combination of organic materials, which over the millennia had transformed to oxalates.

The Roman Cinerary urn was incrustated with an intractable layer of calcite that covered the decorative area of the body of the marble surface. None of the traditional conservation methods for cleaning the surface was effective in removing the dark crystal structure.

In a number of areas located over the surface of the urn, round or oval black fungi nests had eaten in to the marble. Laser ablation was able to remove these nests and follow into the stone to remove the embedded fungi. A bright white flash of black-body light occurred during the ablation process that is a reaction to Er:YAG laser ablation of the thick cell wall of the fungi, which are comprised of long chain polysaccharides that are made up of many C-OH bonds

A literature review of Roman burial customs gave an indication that the encrustation on the marble surface was caused by the oxidation of organic materials that were applied to the surface of the urn on the anniversary of the death of the person whose ashes were interred in the urn. The intent of these rituals was to assure abundance in the afterlife.

The Er:YAG laser at 2.94µm in the mid-infrared corresponds to a strong absorption peak in the infrared spectra of OH- or NH-containing organic molecules. The energy of photons at this wavelength excites bond vibrational stretching mode. Any substance containing a high concentration of -OH bonds at its surface has a strong affinity for photons at 2.94µm, and confines the absorption of these photons to a surface depth of no more than a few microns. An object's organic contaminant, which either contains the --OH bonds or has been treated with a thin liquid film (water, alcohol, -NH) immediately before lasing, acts as a stain of relatively high concentration and very high absorption, providing a natural barrier to energy penetration into underlying layers. Laser ablation offers a gradual, homogeneous, cleaning which enables the conservator to complete the cleaning using mild solvent mixture, which in themselves are not effective in removing the encrusted materials.

Raman, Scanning Electron Microscope, Gas Chromatographic Mass Spectrometric, Emission Spectroscopy are analytic techniques used to identify the degraded materials as well as marble structure.

### **(60) Mitigating and Containing Damage during Emergency Clean-up: Protocols, Guidelines, Standards and Regulations**

*Karen H. Kahn, Art and Environmental Restoration Consultant*

Last fall, Hurricane Sandy hit the East Coast with devastating effects. Not only did it destroy lives and livelihoods of people who lived and worked in its path, it destroyed or severely damaged buildings and their contents, including valuable art and collectables. Millions were uninsured or under-insured for the damage which ensued. Hurricane Sandy had particular impact on the New York City art community: its galleries, museums, private collectors and artists. Owners and occupants of damaged properties, and volunteer helpers, were faced with the daunting task of salvage and recovery.

While art organizations, foundations, restorers, museums, and patrons of the arts rallied to support the art community, offering

space where art could be stored, stabilized, evaluated and cleaned, few knew where to begin, the guidelines to follow, the hazards that would likely be present and the steps needed to be taken to avoid harmful exposures and the significant risk of cross-contamination to areas outside of the damage. Potential contaminants in buildings which have experienced floods are mold, lead and asbestos found on interior building materials and pesticides where crawls paces and basements have been impacted. Objects of art in flooded buildings may also contain a variety of harmful chemicals which, when in contact with water, may create potential hazards to salvage and recovery teams, and to the restorers of the art who are unaware and uninformed of their potential hazardous exposures.

Guidelines published by public and private agencies related to disaster clean-up are oversimplified, often misleading and uninformative; they do not adequately address the hazards of the emergency response, nor the danger that removal, transport and storage of impacted property will contaminate otherwise clean environments and unknowingly expose people to microbial and chemical hazards.

This paper will take a critical look at the guidelines available to owners, insurers, volunteers, art conservators/restorers and contractors involved in the clean-up of disasters from agencies such as FEMA, the Red Cross and Studio Protector. These guidelines will be compared to industry standards of care for mitigation and restoration of flooded buildings published by the International Institute for Cleaning and Restoration Certification (S500 and S520) and regulations of NIOSH and OSHA.

An immediate hands-on approach to salvaging buildings and works of art may be unavoidable in the aftermath of a disaster, but those involved in such activities should still be able to identify the types of materials likely to be hazardous, know the basics of handling contaminated materials and the minimum precautions which need to be taken to protect art, building structures and human health.

State of the art guidelines and protocols should be in place to provide adequate assurance that restoration of buildings and works of art proceed in such a way as to better mitigate and contain contaminants during disaster clean-up. An essential first step to developing informed guidelines and protocols is by understanding the strengths and deficiencies of the available published reference materials.

## **(61) The IMAT: A New Performance Tool for Heat Transfer and Innovative Applications for Art Conservation**

*Nina Olsson, Nina Olsson Art Conservation, LLC, Portland, OR; Tomas Markevicius, Tomas Markevicius Restoration Center, Vilnius, Lithuania; Kate Seymour, Head of Education, Stichting Restauratie Atelier Limburg, Rue Ceramique, Maastricht, Netherlands; Laura Amorosi, Via del Moro, Florence, Italy; Lorenzo Conti, Borgo delgi Albizi, Florence, Italy; Erika Borovikovaite, Chief Conservator, Lietuvos Dailės muziejus - P. Gudyno Restauravimo Centras, Rūdninkų g. 8, Vilnius, Lithuania; Helmut Meyer, CEO, THM Nano, In der Follmühle, Odenthal, Germany; Rocco Furferi, Assistant Professor,*

*Department of Industrial Engineering, University of Florence, Italy*

The creation of new improved conservation materials and sophisticated instrumentation is of fundamental importance in the advancement of the best practices in the field of art conservation. Yet the tools currently available to conservators for heat transfer, an essential element for success in most structural treatments of paintings, works on paper, textiles and other cultural heritage assets, has remained relatively unchanged in recent decades.

The Intelligent Mobile Multipurpose Accurate Thermo-Electrical Device (IMAT) Research Project (2011–2014), now at mid term, responds to this oversight, filling a critical gap in the conservator's toolbox for an instrument that provides accuracy, selectivity and portability when application of heat is required.

The IMAT Project has advanced cutting edge technology of carbon nanotubes while designing a series of innovative, state-of-the-art precision instruments for mild heating, designed specifically for art conservation, in the form of ultra thin profile, lightweight, flexible, transparent and breathable mats. The heat source in the laminated mats is a carbon nanotube film, custom-designed to perform within the conservation field's operational parameters by nanotechnologists in the project consortium. The mats are driven by a programmable mobile touch screen console, also custom designed by the project, that gives the operator unprecedented control over the temperature and heating cycle, and allows the conservator to achieve a more nuanced and customized heating treatment that corresponds better to the current demands of our field. Although the IMAT is designed to provide uniquely uniform and steady heat up to the temperatures customarily required to activate thermoplastic conservation materials, of particular interest is the unsurpassed accuracy of the device at low temperature ranges (75°–125°F/24°–52°C), opening new possibilities in treatment methodology. Breathable mats have been designed to permit the migration of vapors and airflow so often used in combination with mild heating in treatments.

The portability and low energy consumption make the IMAT an ideal multi-use instrument for work both in the field and in the laboratory, indispensable for *in situ* treatment, treatment of large-scale works, work in locations with limited power capability, in areas of limited access or in emergency response conditions. In addition, an important goal of the project is to provide a performance tool that is also cost accessible.

The core of the project's consortium is formed by art conservators, who have been involved during the design, development and field-testing phases so as to gain the best insight into design improvements, to optimize the range of potential applications of the IMAT and to formulate new conservation methodology associated with the new technology. The paper will include case studies of innovative applications of the IMAT in treatments by the consortium's field-testing partners.

Several examples of the IMAT will be available for conference participants to review in person.

## **(62) Conservation Treatment of Large Books with Colored Illustrations; Or, Can We Wait For The Magic Bullet?**

*Bill Minter, Book Conservator in Private Practice*

Books with fine art illustrations are the ultimate challenge for the book conservator. Some books, such as Audubon's *Birds of America*, are routinely disbound and the plates are housed individually for preservation. Other books with illustrations and related text must however remain intact. As the paper and the bindings in these volumes continue to deteriorate, there is a need to preserve all of the materials in a sound manner. This is the case with John Gould's 1837 set of the *Birds of Europe*. For this book, the structural problems were addressed in a unique manner with a new cloth inner hinge secured with thread in the form of a staple; additionally a set of special lightweight boxes were constructed to rehouse these large and heavy leather volumes. The real question, however, is a consideration of near-future treatment to slow the deterioration of the paper in these magnificent volumes: from a casual observation, the paper is already getting brittle. Treatment options will be considered and discussed.

## **(63) Recovery and Discovery: A New Look at an Old Pot**

*Katie Belton, Pre-Program Intern, Arizona State Museum; Dr. Werner Zimmt, Museum Fellow, and Dr. Nancy Odegaard, Lead Conservator, Conservation Laboratory, Arizona State Museum*

Pothunters in the Southwest have a long history of pillaging archaeological sites in search of treasure. In the process, it is not uncommon for pots to break and the pieces to be crudely reassembled with adhesives. Reassembly often results in left over rubber bands and staining from tape residues. Frequently, these artifacts end up in boxes as record-less sherds and partially reconstructed vessels. This project began with one box provided by the Arizona State Attorney General's office where it had been intended for use in a law enforcement sting, or a carefully planned operation involving deception.

This poster illustrates the conservation treatment of an indented, corrugated Mogollon jar, which arrived in a box with 128 sherds at various stages of reassembly. The sherds were completely covered with masking tape and excess polyvinyl acetate emulsion adhesive (probably Elmer's white glue). The vessel, dating between 1150 and 1300 CE, comes from an ephemeral period in northern Mogollon culture when large, brownware vessels with all-over indented corrugation were characteristic. These vessels vanish from the archeological record by 1400, and we have yet to understand why.

The conservation treatment began with removal of the masking tape. Volunteers worked to carefully remove the upper layers of tape using tweezers. With some of the sherds revealed, several were selected to study their magnetism, to distinguish among sherds belonging to the main pot and those from different vessels. Analysis using FTIR was performed to further characterize the tape residue that had severely stained the ceramic, as well as to characterize the adhesive that was generously used to reconstruct portions of the vessel. Solvents were selected to remove the residues. Finally, the vessel was reconstructed.

## **(64) New Approaches in Comprehensive Mold Remediation & Recovery**

*Elise Yvonne Rousseau, Principal Conservator Textiles, Historic Objects & Decorative Arts, Art Conservation de Rigueur et Anoxia Abatement Solutions*

This poster will follow several extensive treatment case studies of 17th & 18th c. Baroque and Rococo Italian Furniture, Decorative Arts, and Painting collections to exemplify how conservators can identify and recognize when active fungal-microbial, bacterial-microorganism and concomitant pest infestations are occurring. Collections today are ever more under the threat of Climate Change with seasonal temperature and humidity spikes and associated events such as floods, hurricanes, and wild fires. What are the specific protocols for the implementation of disaster preparedness, remediation and recovery of contaminated collections and storage facilities. How to approach contamination in mixed storage collections. New practical and efficient strategies in conservation science approaches and treatment recommendations for successful remediation and recovery, necessary materials and supplies will be explained in thoughtful detail.

Beginning with a basic fundamental outline of what bioaerosols, fungi, bacteria, mycotoxins, volatile organic compounds and microbial microorganisms are, and how they affect indoor environments? What are the potential hazards and consequences impacting various collections, materials and human health from direct contact, handling and treating objects? Delineating protocols for personal protection equipment, so that both staff and volunteers can protect their respiratory and pulmonary health. Identifying the particular species strain is an important initial step.

Discussing options for methods of accurate testing and sampling, such as ATP bioluminescence rapid hygiene swabbing, petri dish culturing, tape lifting and airborne sampling for colony forming unit counts (CFU's). The resulting lab data from the mycelium, hyphae and spore counts can accurately identified harmful molds species, such as: *Aspergillus*, *Alternaria*, *Cladosporium*, *Penicillium*, and *Stachybotrys*. Understanding the biological science of mycelium branching, germination and spore blooming cycles is imperative to prevent reinfestation or cross contamination.

How to stage quarantine and isolation work spaces that segregate dirty to clean treatment operations. Establishing the "New and Next Generation" appropriate baselines for dehumidifying, dehydration, dry vacuum flash freezing, CO2 anoxia oxygen deprivation tenting, non-contaminant transfer hepavacuuming procedures, surface cleaning, antiseptic disinfecting solutions for topical surface cleaning and clean storage encapsulation. Also, what are the least invasive treatment procedures for drying and blotting.

Materials and supplies needed to carry out remediation and recovery, or how to decide which "used" storage materials can be salvaged, or must be discarded. What precautions must be taken to prevent infestation from exacerbating, or worse, spreading to other objects in the collections, storage and exhibits. How not to take the contamination home with you!

Mold, microbial microorganisms and pests must be addressed as contaminants, a contagion that has the potential for ongoing damaging life-cycles widespread throughout collections. Handling

any seemingly minor situation properly is imperative, so as not to wind up with an expensive emergency to clean up later. Appropriate treatment programs for effective assurance that mold/mycelium cellular structures have fractured and cannot reproduce is a mandate to be followed in a most exacting manner. Preventative conservation planning cost little in comparison to the expense of disaster recovery and potential health hazards that will ensue from a fungal infestation passively allowed to proliferate.

### **(65) Photoshop® Assisted Spectroscopy – An Economical and Non-Destructive Method for Tracking Color Shift**

*Kristi Wright, Contract Conservator, National Library of Medicine, National Institutes of Health Department of Health and Human Services; Holly Herro, Conservator, National Library of Medicine, National Institutes of Health Department of Health and Human Services*

Color shift in fugitive media and media substrates is a conservation concern across several disciplines. Established methods for predicting the degree to which a medium is sensitive in a given environment may require expensive equipment and cause damage to the object being tested. As the result of a multi-phase study to (a) determine the chemistry of ballpoint pen ink; (b) identify the extent of ballpoint pen ink color shift as a result of light damage and oxidation; and (c) safely re-house the original research of the National Institutes of Health's first Nobel Laureate Dr. Marshall Nirenberg, the conservation staff at the National Library of Medicine have developed Photoshop® Assisted Spectroscopy.

Photoshop® Assisted Spectroscopy is a non-destructive method for tracking color shift using only a scanner and an image processing program such as Adobe Photoshop®. It is a relatively simple method that could potentially be incorporated into conservation documentation and digitization procedures across disciplines. While it does not predict color shift on an object, it assists in monitoring and provides valuable condition information to collection custodians. When properly executed, this method can detect color shift before it becomes visible to the human eye. The poster will demonstrate the Photoshop® Assisted Spectroscopy methodology and provide a summary of how the methodology was used to determine an appropriate re-housing environment for Dr. Nirenberg's research.

### **(66) Infrared Fluorescence Analyses of Louise Herreshoff's Paintings in Relation to CdS Degradation Issues**

*Samuel Florescu, Riley Hampsch, Erich S. Uffelman, Patricia A. Hobbs, Jennifer L. Mass*

Cadmium yellow (cadmium sulfide, CdS) degradation is a significant problem causing conservation and treatment issues in turn-of-the-twentieth-century paintings by such notable artists as Henri Matisse, Edvard Munch, and Georges Seurat. These issues include fading, discoloration, flaking, and spalling of the affected paint layers.

Louise Herreshoff Eaton (1876-1967) was an American

painter who was receiving commissions by the age of nineteen and continued working until 1928, when the death of her Aunt Lizzie caused her to abruptly stop painting. Herreshoff studied art in Providence, RI, with Mary C. Wheeler and then travelled to Europe to make the grand tour. She studied painting in Paris, first under Wheeler, and then under Raphael Collin. She also studied under Jean-Paul Laurens at the Ladies Academy of the Julian. By her mid-twenties, her paintings were accepted for international exhibition in both the Paris Salon (1900 and 1903) and at the National Academy of Design (1900) in New York. Her paintings, nearly all of which are in the University Collections of Art and History at Washington and Lee University, were rediscovered by the world at large in a 1976 exhibit at the Corcoran Gallery of Art in Washington, DC.

Because she quit painting precipitously and subsequently stored her paintings in her attic, her paintings present unusual condition issues. Many of her paintings have been exposed to far less light during their lifetimes than those created by Henri Matisse and his early modernist contemporaries. Consequently Herreshoff's colors are, for the most part, still bold and vivid. However, due to poor humidity and temperature control for several decades, and due to some aspects of her technique, several of the paintings are exhibiting significant paint adhesion problems (including flaking, spalling, and cracking). Given that many of the paintings need conservation treatment, and given W&L's participation in the international team of scholars led by Dr. Jennifer Mass (spearheaded by the Barnes Foundation, the Lenfest Foundation, the Winterthur Museum, and the University of Delaware) who are studying cadmium yellow photo-oxidative degradation, the Herreshoff paintings have become increasingly interesting in terms of their state of preservation relative to paintings by Matisse, Van Gogh, Munch, and others. Thus, we have already reported a study of the paintings by portable X-ray Fluorescence Spectroscopy (pXRF) in Applied Physics A.

Here, we report preliminary studies of the Herreshoff paintings employing UV-induced IR fluorescence. This methodology is simple to execute, because all that is needed is a source of UV illumination at approximately 365 nm, and a digital camera with its IR-blocking filter removed and a visible light-blocking filter attached. The poster will correlate CdS-containing regions of the paintings determined by pXRF with the UV-induced IR fluorescence work to attempt to show possible qualitative pigment degradation status in the fluorescence intensity, as has been proposed by Van der Snickt et al. The Lenfest Foundation has been crucial in supporting the multi-institutional collaborations involved in this work and in encouraging undergraduate participation in the projects.

### **(67) Hand-colored Photographs: History, Identification and Research**

*Janka Križanová, Research Scholar in Photograph Conservation, The Metropolitan Museum of Art*

When first introduced in 1839, the daguerreotype process was admired for its definition, clarity and beauty, but it was also criticized for its lack of color. The Swiss painter, printer and daguerreotypist Johan Baptist Isenring introduced the first hand-colored daguerreotypes in 1841. From this early date in the history to the 1960's, many new monochrome photographic processes were introduced. When color photography became the dominant photographic medium in

the 1960's, hand coloring of monochrome photographs diminished to become a method of image modification used by only a few photographers. After their first introduction, each of these monochrome processes (salted paper, albumen, collodion, gelatin, platinum, and so on) were made available in hand-colored or overpainted forms. That satisfied, at least partially, the desire of a photography-loving public to have color in photographs. Many major photograph studios employed full-time or part-time colorists, and coloring of photographs become an important part of the photograph industry. Photographic supply houses started to offer coloring sets, and a number of photograph coloring guidebooks, manuals and articles were published in the photographic literature. Techniques of color application differed between photographic processes and coloring media also changed from natural pigments and dyes to fugitive aniline colors to modern and highly stable organic pigments and dyes. As a result of all these changes in photographic processes and coloring materials, many of today's Slovakian museum photograph collections contain a certain number hand-colored photographs that are usually stored and exhibited together with other photographs, but that may have very different light stability compared with standard monochrome images. To develop a modern methodology for long-term storage, exhibition and conservation treatment of hand-colored photographs, we have to be able to identify not only the underlying photographic process, but also the chemical nature of colorants and binders used.

One part of non-destructive research involves closer examination of 19th and 20th century hand-colored photographs. Non-destructive XRF and FTIR analysis reveals the composition of applied coloring media. Augmenting this investigation of the photographs themselves is the cataloging, examination and analysis of original 19th and 20th century coloring sets. Reference sets were created using historic coloring pallets on different photographic processes for analytical comparison with original hand colored photographs. These sets were created under the supervision of Dusan Stulik in the laboratories of the Getty Conservation Institute.

### **(68) A Lesson Learned from Lucy: An Alternate Format for the Loan Condition Report**

*Ronald Harvey, Conservator/Principal, Tuckerbrook Conservation LLC; Dr. Nancy Odegaard, Dr. Vicki Cassman, Sofia I. Barron*

Lucy, also known as AL 288-1, included several hundred pieces of bone representing about 40% of the skeleton of a female *Australopithecus afarensis* that was discovered in 1974 at Hadar in the Awash Valley of Ethiopia. The complex fossil comprised of 76 individual pieces was the star of a recent 5-year traveling exhibit. The fossil elements required condition documentation at every venue. Information that could be easily, efficiently, and accurately, compared by the conservator, registrar and collection specialist was needed prior to each installation and de-installation as well as during packing and unpacking.

It was obvious during the original assessment that the cumbersome and interpretative nature of traditional written documentation would limit an accurate assessment of each element in the collection due to the complexity of language and allowance of time.

High resolution digital photographs, taken during the first assessment, followed by annotations consisting of key words and color coded lines to highlight details of condition were added to the digital photographs using Photoshop. When used for condition reporting, the photographs, viewed on a laptop, provided views of the individual fossil annotated elements. Zoom capability was used to review details that were of particular concern.

### **(69) Thermally and Photochemically Re-Workable Epoxy Adhesives for Use in Artifact Repair**

*Elyse M. Canosa, Materials Science and Engineering Department; Kevin M. Frederick, Materials Science and Engineering Department; Douglas A. Loy, Materials Science and Engineering Department and Department of Chemistry and Biochemistry; Pamela Vandiver, Materials Science and Engineering Department; and Nancy Odegaard, Materials Science and Engineering Department and Arizona State Museum; all at The University of Arizona*

Polymeric adhesives such as acrylics and epoxies are commonly used for the reconstruction and repair of ceramic and glass artifacts. Currently used epoxies have superior strength but are non-reversible after they have cured, making any important structural artifact corrections impossible. We have therefore tailored two separate epoxies. One is reversible by administering heat and the other by ultra violet light, transforming the cured epoxy from the solid to the liquid state so that it can be removed without adverse effects. This quality of reversibility utilizes the desirable mechanical properties of epoxies and adapts them to benefit the conservation community as a new application. The purpose of this project is to study the chemical, mechanical, and working properties of such epoxies specifically in relation to their use on artifacts.

Our approach was to incorporate Diels-Alder thermal weak-links or coumarin dimer photochemical weak-links into epoxy resin. At a given temperature or given wavelength, these weak links sever to convert a solid epoxy into liquid, a process which can be reversed to form a solid epoxy again. Such bonds provide the potential for re-workability and removal if necessary. The cured epoxies were tested for mechanical tensile strength using an MTS Criterion Electromechanical testing system and the ASTM D1002-10 standard. Chemical properties of the epoxies were fully characterized via NMR, ATR-FTIR spectroscopy, HR-MS spectroscopy, TGA, and MDSC analysis, and the curing properties optimized using four commercial hardeners. All ceramic substrates were characterized prior to epoxy application using xeroradiography, SEM, water contact angle analysis, and boiling water analysis (ASTM C20-00, 2010) to understand porosity, pore distribution, and wetting abilities. We investigated the practical properties of these thermally re-workable epoxy adhesives for use on glass and ceramic artifacts by collaborating with conservators at the Arizona State Museum and reworking cured epoxy material. Through such tests we were able to show that these adhesives can be easily re-worked and act as a useful new tool for object conservation.

## **(70) Criteria for Preservation Assessment of a Heritage Site on Cerro Nevado Island, Antarctica**

*Gabriela Ammirati, J.B. Ambrosetti Ethnographic Museum, School of Philosophy and Literature, Buenos Aires University, Buenos Aires, Argentina*

The goal of this work is to present an integral approach to the evaluation of the preservation state of a heritage site as part of a bigger context (geographical, environmental, historical, etc.).

In this framework, the author presents the tasks performed to determine the conservation status of the hut used by the Swedish expedition led by Otto Nordenskjöld in early 1902 until late 1903, located at Cerro Nevado Island, in the Antarctic Continent.

This cabin was brought disassembled by the expedition members, and was reassembled at the site in order to function as a shelter during the investigations. Later, it was abandoned. Since 1979, Argentina, with support from Sweden, became involved in the preservation, restoration and maintenance of this heritage site

In January and February of 2013, an evaluation was made of the conservation state of this hut, based on theoretical and methodological criteria that contemplate that a heritage site, in this case an immovable heritage asset, cannot be taken as a single entity, isolated or static.

In principle it should be noted that the object of our study has a history of original use and another of historical subsequent uses. Once this object has been studied, it will be possible to understand the changes that may have had suffer through time, changes that could manifest themselves in the preservation state.

These changes may be due to human interventions made during the original use, the interventions made after use, or the modern preservation and restoration works.

In this analysis we have considered use of this site at the present time and in the future. This use and its consequences must be taken in consideration during future preservation activities.

Another topic to be considered is the construction materials and the manufacture techniques of the heritage asset. It should put the focus of the study in the deterioration state of this materials and the manufacture, to determine what problems could derive of at the present time and in the future, and how it could affect the preservation of the asset.

Finally, it is of great importance to contextualize this heritage with the environment where is located. It is necessary to understand the surrounding environment, how it affects the preservation state now, and how this environment can change in the short, medium and long term; ultimately how the changes will influence the state of the cultural heritage in time.

It is important to stress that these analytical approaches, although can be taken separately, are interrelated and complementary.

The preservation state evaluation of a cultural heritage asset based on this theoretical approach will firstly be able to provide more trustworthy data, taking into account the multiplicity of possible deterioration causes—in the past, present and future. Secondly, it will help establish solutions for the present dilemmas, based in criteria derived of broad spectrum observations.