ABSTRACTS
2009

The American Institute for Conservation of Historic & Artistic Works (AIC) is the national membership organization supporting conservation professionals in preserving cultural heritage by establishing and upholding professional standards, promoting research and publications, providing educational opportunities, and fostering the exchange of knowledge among conservators, allied professionals, and the public. The Foundation of the American Institute for Conservation (FAIC) supports the preservation of cultural materials through education and research initiatives for conservation and allied professionals. FAIC advocates public appreciation of conservation and the primary role it plays in increasing understanding of our global cultural heritage.

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AIC
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CONSERVATION 1.0: BEFORE THE 21ST CENTURY

Joyce Hill Stoner, Professor, Winterthur/UD Program in Art Conservation and Director, Preservation Studies Doctoral Program

The landscape of the profession of conservation changed dramatically especially in the last quarter of the 20th century. The patterns of progress in the U.S. were a reflection of what was happening internationally. The Staatliche Museen in Berlin established a laboratory in 1888, and the British Museum followed suit in 1921. The Fogg Technical Laboratory in Cambridge, Massachusetts was operating by 1928 and published the first technical journal, from 1932 to 1942. The first international conference on conservation was held in Rome in 1930. The International Institute for Conservation of Historic and Artistic Works was founded in London in 1950, and the "American Group" of the IIC met for the first time in 1960. The IIC-AG adopted the first standards of practice and code of ethics for conservation in 1963 and 1967. Training programs began in London in 1934, Vienna in 1936, Munich in 1938, Rome in 1943, and New York in 1960.

In the 1960s, conservation graduate students had few conservation-related books to purchase, few professional groups to join or conferences to attend, and limited knowledge of solvent toxicities or approaches to preventive conservation. Scientific investigation was focused most successfully on inorganic materials: metals, pigments, glass, and ceramics. Beginning in the 1970s, conservation literature, conferences and professional organizations, training programs, specialties, philosophical approaches and techniques, regional and museum conservation departments, and related scientific instrumentation and research multiplied exponentially.

A "minimalist" movement increased attention to preventive conservation, and more conservators became high-level collaborators rather than the basement "fix-it" guys or nay-sayers. In 1974, leading practitioners of paintings conservation, the historically high-profile specialty, declared a moratorium on the traditional techniques of lining. A menu of alternative adhesives and techniques rapidly followed along with a list of new approaches to the removal of unwanted coatings. Paper conservators re-examined bleaching and flattening. Procedures once carried out with bravado—the transferring of panel paintings, the removal of frescoes from their original walls, or the removal of original wood from furniture during restoration—were soon considered unacceptable. Rules have flexed. Native Americans are encouraged to dance in their traditional costumes housed within a museum; artists may repaint their now-faded outdoor murals themselves with the advice of scientists, paint manufacturers, and conservators and the consent of developers and politicians. Conservators, who were once lonely advocates for materials and their long-term survival, now must look at preservation in a much larger arena.

The post-1975 conservator may work with scientists to understand the strengths and limitations of a vast array of possibilities for instrumental analysis, can collaborate with curators, art historians, archivists, archaeologists, architects, or artists, and understands a vocabulary of technology and connoisseurship which may range from the contents of a shipwreck to Indian miniature paintings. By the end of the twentieth century, conservators were also expected to understand integrated pest management, HVAC systems, light levels, and permissible exposure limits and be able to speak articulately to foundation heads or reporters from *Sixty Minutes.* George Stout's "three-legged stool" has become at least a twelve-legged settee. (NOTE: in the talk, special attention will be paid to our U.S. pioneer conservators whom we have recently lost.)

THE CONSERVATION OF *JUANQINZHAI*, THE STUDIO OF EXHAUSTION FROM DILIGENT SERVICE, AS A PROTOTYPE FOR ARCHITECTURAL CONSERVATION PROJECTS IN THE FORBIDDEN CITY, BEIJING

T.K. McClintock, Director of Studio TKM Conservation of Fine Art and Historic works on Paper and Chief Technical Advisor to the World Monuments Fund on the Conservation of Juanqinzhai; John Stubbs, Vice President of Field Projects, World Monuments Fund, New York, and Adjunct Associate Professor, Graduate Program in Historic Preservation, Columbia University, New York; Liu Chang, Country Representative for China, World Monuments Fund, and Associate Professor, School of architecture, Tsinghua University, Beijing; Wang Shiwei, Deputy Director of the Historic Architecture Department, Palace Museum, Beijing; Cao Jinglou, former Deputy Director of the Conservation Science and Technology Department, Palace Museum, Beijing

The Qianlong Garden Complex (*Ningshougong*), was constructed in the northeast corner of the Forbidden City over five years (1771-75) under the direct supervision of the Qianlong Emperor (born 1711, reigned 1736-95), who was renowned for his patronage of the fine and decorative arts. Twenty-seven structures surround four courtyards, of which *Juanqinzhai*, the Studio of Exhaustion from Diligent Service, is located in the most northern and private courtyard. It is a nine bay post and beam tier structure (*Tailiang*) with masonry infill walls, four bays of which comprise a two story theater and the other five bays of which comprise a group of private rooms on two floors that surround an entry court. The interior is distinguished in these two locations by the fully encompassing but distinct design schemes and by the rarity of the materials used for their decoration. The theater is renowned in particular for the trompe l'oeil mural paintings that cover the entire wall and ceiling surfaces that were executed in tempera on silk by Wang Youxue under the supervision of Lang Shining (Giuseppe Castiglione 1688-1766). The other surfaces in the theater are decorated with polychrome and faux-bamboo painted finishes, lacquer and gold leaf. The entry court is distinguished by naturalistic scenes and geometric patterns created from veneers of

assorted hardwoods, dyed bamboo, inner skin, and jade. Many of these fragile surface treatments are the last surviving original examples of their type in the Forbidden City.

The conservation departments of the Palace Museum (Forbidden City) have enormous collective expertise in diverse specialties, including historic architecture and paintings on silk and paper, however a request was made to the World Monuments Fund for assistance in planning and executing a project that would reflect current international standards and practices of conservation. This involved locating craftsmen familiar with the unusual materials found, comparing methods of practice between Chinese and western conservators to identify how traditional practices could be executed, revived or varied to meet both modern conservation criteria for stability of materials, reversibility, and documentation of procedures as well as the laws and guidelines pertaining to the preservation of Chinese heritage sites. While the project was originally conceived to address conservation of the trompe l'oeil murals (by their removal, studio treatment, and remounting), it was understood that conservation of the building was equally important because of its function as an enveloping protective structure and because of the quality and rarity of the surviving original decorative finishes. Therefore, the conservation was organized to focus on the architectural structure, mural painting, interior painted finishes, interior veneers, and textiles. Projects were also directed at developing an interpretation program that would minimize the impact of visitor traffic on the structure and contents, introducing low-voltage lighting, and improving the interior environment by introducing a discreet air handling system to filter the air and mitigate the extremes of the temperature and relative humidity. With the success of the cooperative arrangement of the project, which lasted over six years and involved numerous specialists from within and outside China, the conservation of *Juanqinzhai* was identified as a prototype for the entire Qianlong Garden complex over the next decade. The presentation will focus on the specific conservation strategies and procedures used as well as the insights gained about communication, project management, and tailoring different working traditions to a project that called for innovative solutions.

"FINGERPRINTING" OBJECTS AS PROTECTION AGAINST ILLEGAL TRAFFICKING

W. Wei, Netherlands Institute for Cultural Heritage, Amsterdam, The Netherlands

Throughout history, illicit trafficking of objects has robbed many countries of significant parts of their cultural heritage. Recent controversies surrounding the provenance of objects found in major museums around the world has cast new light on this centuries-old problem. Illicit trafficking continues to be a major problem to this day, with many objects stolen from archaeological sites and museums which lie unprotected in war zones such as Afghanistan and Iraq, mysteriously appearing in antique shops and shows around the (western) world. Thousands of lesser known objects of equal cultural and historical value are also waiting to be found, listed, for example, on the Art Loss Register, the ICOM Red List, and/or Interpol's "Stolen Works of Art" CD-ROM. However, this is just the tip of the iceberg.

One of the main problems in fighting the illegal trafficking of objects is their irrefutable identification. History has shown that (digital) photographs, written descriptions and provenances, and identification markings and stickers have always been open to dispute. Besides that, most adhesives and markers leave some sort of permanent trace on an object. There is thus a pressing need for a method to identify objects unequivocally.

A promising solution for this problem has been developed in the so-called "FING-ART-PRINT" project funded by the European Community, see www.fingartprint.org. A methodology has been developed to take a "fingerprint" of an object which is unique for that object. This involves measuring the micro-roughness (topography) of one or more selected (proprietary) areas (for example, 1 cm^2) of the (painted) surface of an object, this on a scale of micrometers. At that scale, which is less than the size of a pigment particle, such information is unique to the object, and is, in fact, the "signature" of its maker. (Note that this is not the actual fingerprint of the maker.) It would thus be virtually impossible to forge the fingerprint on a micrometer scale assuming that a forger even knew where the fingerprint was taken. A series of case studies on museum objects has shown that unique fingerprints can be taking objects such as paintings, metal and ceramic sculpture, and wooden objects. It is also possible to automatically relocate the fingerprint, as would be necessary for identification, for example, at a customs station. Under certain conditions, printed paper and photographic materials can also be identified.

Such a fingerprint will be extremely useful, for example, in a "passport" for objects, which could be required by international law for the import/export, sale/purchase of objects of cultural heritage. An international network against illegal trafficking is being organised for developing such a passport, but more importantly, to coordinate international laws and law enforcement against trafficking, as well as to educate governments, cultural heritage institutes, and the general public about the serious implications of illegal trafficking in cultural heritage.

ANALYSIS OF THE CAPABILITIES OF A PRACTICAL MULTI-SPECTRAL IMAGING CAMERA FOR THE STUDY OF MODERN PAINTINGS: CASE STUDIES FROM THE MOMA COLLECTION, NEW YORK.

Jane McCree, Jim Coddington, and Dr Christina Young

Multi-spectral imaging is an emerging technology that offers great potential for non-invasive investigations within the field of conservation. Existing multi-spectral systems are diverse in their capabilities, where absolute spectral accuracy often has to be balanced against speed, cost and practical usability. A new multi-spectral imaging system, using a standard commercial digital camera, has been designed by Rochester Institute of Technology for the Museum of Modern Art (MoMA), New York. The camera makes use of commercially available components and has a spectral range of 340-1100nm, giving sensitivity in the UV, visible and near infra-red regions of the electromagnetic spectrum. This system offers an alternative to the more complex, high maintenance, imaging spectrometer based systems and was developed to provide conservators with a cost effective system that balanced, spectral accuracy with practical usability within a studio rather than laboratory environment.

This study explores how well this relatively simple, practical system could be integrated as a useful tool in a working conservation department. The overall performance of the multi-spectral imaging system is evaluated by assessing the practical application of the camera and the colourmetric accuracy of the system compared with others within the same spectral range. The study also explored its use for the technical examination of modern paintings.

The results show that this system could be used routinely by conservators to achieve controlled, reproducible colour accurate images, providing a valuable tool for the documentation of paintings to monitor colour and structural change in paintings. Whilst absolute colourmetric accuracy was not achievable, the system significantly improves on the accuracy of standard digital photography, currently used to routinely document paintings.

The potential of multi-spectral imaging is that it provides an innovative approach to understanding works of art, which, in conjunction with other analytical tools can aid our interpretation of works of art. To test the capabilities of the system, modern abstract paintings were chosen as they often present a challenge to traditional examination techniques. The advantages and limitations of the system are evaluated using the results from painted test boards and case studies. The case studies from the MoMA collection include works by Mark Rothko, Jackson Pollock and Lyubov Popova.

Overall the multi-spectral images generated from the system offer great flexibility and broaden the possibilities for technical analysis by allowing pixel-by-pixel comparisons of images from different regions of the spectrum. Specifically pigment identification and separation to clarify painterly technique were investigated. The multi-spectral images were used individually for useful comparisons or together in image sets for spectral analysis. The application of remote sensing analytical techniques using IDRISI Andes software, in conjunction with spectral and XRF data, have shown promising results for characterizing pixels both spatially and spectrally. These methods of analysis have shown great potential for the study of materials and techniques and reveal new findings not discernable by more traditional methods of analysis.

INTEGRATING ADVANCED IMAGING TECHNOLOGIES TO CONSERVATION – CHALLENGES AND SUCCESSES

Fenella G. France, Library of Congress;
Michael B. Toth, R B Toth Associates

The integration of new technologies to the field of conservation requires significant adaptation to the rapid changes of a dynamic technology environment, while addressing the very real challenges and consequences of applying new knowledge. The translation of hyperspectral imaging from a sophisticated, high cost system to an advanced digital imaging conservation work tool demonstrates a successful transfer of high technology to the world of cultural heritage. This offers enhanced value as a useful application when integrated with effective work processes and support to become an everyday technique. The effective application of new technologies to conservation depends on how they are integrated into the everyday work processes, methods and current systems. Given the historical and cultural significance of the objects, conservation is a necessarily risk-adverse field, where the latest technology can only be effective if the study methods, risk assessments, and research response cycles can be faster and more flexible. The real challenge for successful translation of new technologies for preservation is the integration and impact of people and processes.

Historically, hyperspectral imaging systems have been used as a powerful tool for non-contact or remote sensing of molecular chemical information of material composition. Fields ranging from agriculture, pharmaceuticals, polymer and material science, forensics, and global warfare have exploited this technology. Hyperspectral imaging measures nanometer bandwidths, often contiguous wavelengths, of the visible and non-visible spectrum – from ultraviolet, through visible to infrared – and can detect variance at any wavelength or combination of wavelengths, while multi-spectral imaging uses just a few wavelength bands, which are distinctly separate from each other. The resulting images collected may be digitally combined with or subtracted from each other to form images for precise analysis. This has the advantage of characterizing, discriminating between similar compounds, identifying and possibly quantifying materials present in the document.

The utilization of hyperspectral and other advanced imaging techniques comprises the non-destructive and non-invasive characterization of objects with integrated

data management of the resulting large volumes of digital images and data. The successful application of these advanced digital imaging techniques as a standard conservation laboratory research tool involves their integration with other spectral analyses and non-destructive testing techniques to complement and enhance component analysis. The accurate determination of parameters associated with substrate and media without sampling is critical to the assessment and preservation of many international items of cultural heritage. Key to this utilization of large amounts of data is the linkage of the image collection and processing with an extensive descriptive capture of spatial metadata to ensure registration with future images, and "scriptospatial" tagging of key points on the images – the equivalent of a global positioning system for documents.

The real challenge for effective and timely technology transfer is the need to guarantee that risk to the object will be decreased. Historically, the reverse has often been true, with time disproving applications of new chemicals, treatments and methods that have jeopardized objects. Consequently the conservation community is now a late adopter of technology. Successful integration of advanced imaging techniques into conservation requires addressing the inevitably slow risk management cycle into the field and developing effective and streamlined work processes, IT infrastructure, and metadata and data collection systems to truly make this a valuable conservation tool.

REFLECTANCE TRANSFORMATION IMAGING: A NEW CONSERVATION TOOL FOR EXAMINATION AND DOCUMENTATION.

Philip Klausmeyer, Andrew W. Mellon Conservator in Science and Paintings Conservation, Worcester Art Museum; Rita Albertson, Chief Conservator, Worcester Art Museum; Winifred Murray, Samuel H. Kress Fellow in Paintings Conservation, Worcester Art Museum; Carla Schroer, Director, Cultural Heritage Imaging; Mark Mudge, President, Cultural Heritage Imaging

Recent studies have demonstrated that Reflectance Transformation Imaging (RTI) is an effective conservation tool for robust documentation, surface examination and interpretive study of cultural heritage materials. RTI is an image-based representation of the appearance of a surface under varying lighting directions. The acquired data contains information about an object's 3D shape and surface properties. This information is used to build dynamic, interactive digital representations capable of mathematical enhancement and being rendered in a variety of ways to disclose features that are difficult or impossible to see through direct physical examination.

RTI brings significant advantages to conservation activities. These advantages include: scientifically trustworthy information, non-contact acquisition of data, clear representation of 3D shape characteristics through RTI enhancement functions, no data loss due to shadows and specular highlights, high resolution sample densities up to 20,500 per square millimeter, simple and achievable image creation processing pipeline, and easy online communication. RTI also presents curators and conservators with new means by which to share information with scholars and the public in a highly interactive manner that enriches the viewing experience.

In 2006-08, the Worcester Art Museum collaborated with Cultural Heritage Imaging, a non-profit organization based in San Francisco, to develop an RTI unit tailored specifically for the needs of the Museum. Funded by the Andrew W. Mellon Foundation, the project included the design and fabrication of a novel and portable RTI instrument for use with a wide range of works of varying size and scale, including objects, paintings and works of art on paper. A number of discoveries providing new information about works were made, and applications for this new technology continue to be explored.

THE USE OF HIGH THROUGHPUT TESTING SYSTEMS FOR THE RAPID SCREENING OF POTENTIALLY USEFUL CLEANING FORMULATIONS FOR THE REMOVAL OF SURFACE DIRT FROM ACRYLIC EMULSION PAINTS

Melinda H. Keefe, The Dow Chemical Company, Midland, MI; Alan Phenix, Getty Conservation Institute, Los Angeles, CA; Thomas J. S. Learner, Getty Conservation Institute, Los Angeles, CA; Bronwyn A. Ormsby, Tate, London, UK; Keith Harris, The Dow Chemical Company, Midland, MI; Greg F. Meyers, The Dow Chemical Company, Midland, MI; Linda A. Moore, The Dow Chemical Company, Midland, MI; Carl W. Reinhardt, The Dow Chemical Company, Midland, MI; Chengli Zu, The Dow Chemical Company, Midland, MI

The efficacy for dirt removal of both aqueous and organic solvent based cleaning systems can be dramatically altered by small quantities of surfactants, wetting agents, chelating agents, enzymes, pH buffers, and other additives. The direct result of adding these materials to a cleaning system is hard to predict due to synergistic effects amongst the various components. In order to determine the optimum cleaning formulation for removing surface dirt from a specific material, huge numbers of empirical tests would be necessary. High throughput (HTP) testing is an emerging automated technology developed in the industrial sector that can rapidly screen large numbers of cleaning formulations so that the effects of subtle variations in their composition can be more precisely quantified. Different automated systems are capable of measuring a variety of optical, chemical and physical properties of the test substrate (here soiled artists' acrylic paints), and predictive models can then be used to identify potentially useful cleaning candidates for more rigorous performance testing and validation.

Although HTP could be applied to any type of substrate, in this paper we describe its use to rapidly screen cleaning

formulations (aqueous and aliphatic hydrocarbon solvent systems containing surfactants and other ingredients) intended to remove surface dirt from acrylic emulsion paints, with the inclusion of raw materials novel to the conservation field. The technology used includes robots to prepare and dispense dirt and cleaning formulations, clean soiled paints, and measure color data. Automated atomic force microscopy (AFM) methods were employed to monitor topographical changes (from height images) and compositional changes (inferred from phase images) to paint surfaces before and after dirt removal. In addition, Desorption Electrospray Ionization (DESI) was used to characterize species present at the film surface before and after cleaning. These tools allowed for the rapid evaluation of the cleaning efficacy (i.e. removal of dirt) and degree of risk (i.e. potential substrate damage) of approximately 100 cleaning solutions to a number of brands of acrylic emulsion paint soiled with two different artificial dirt formulations. This work was conducted at The Dow Chemical Company, in collaboration with the Getty Conservation Institute and Tate.

THE TOLEDO MUSEUM OF ART GOES GREEN

Suzanne Hargrove

Faced with daunting energy costs, the Toledo Museum of Art explored alternative energy sources to save energy and generate power for the museums heating ventilation and air conditioning systems (HVAC).

In the museum's historic 1912 Beaux-Arts main building combined heat and power (CHP) technologies were explored. The CHP technology augments the existing HVAC systems to save energy. Taking advantage of grant opportunities from the Ohio Department of Development's Office of Energy Effieiency (OEE) and by securing additional low-interest loan funding, the museum installed four 60-kW natural gas-fired microturbines in 2004. The four microturbines function as boilers that create electricity as a by product. They supplement the museum's conventional heating system consisting of multiple duct loops that move hot water and air throughout the museum to control the environment for the museum collections. In 2008 the museum received another grant from the Ohio Department of Development to install an array of solar panels on a portion of the roof. The panels will generate 101 kW of peak power on sunny days to meet 1/5th of the museums energy needs. This talk will review the funding, installation and energy savings generated by each project.

MENOKIN, HOME OF FRANCIS LIGHTFOOT LEE, SIGNER OF THE DECLARATION OF INDEPENDENCE: 18TH CENTURY BUILDING, 20TH CENTURY RUIN, 21ST CENTURY CONSERVATION

John G. Lee, Artisan Conservator, Annapolis, MD; Charles A. Phillips, AIC-PA, AIA, Conservator Architect, Winston-Salem, NC; Richard Wolbers, Conservator, Conservation Scientist, Winterthur, DE; Tim Macfarlane, Structural Engineer, Dewhurst Macfarlane Partners, London, UK; Ellen Hagsten, Architectural Conservator, Annapolis, MD; Sarah Pope, Executive Director of The Menokin Foundation

How attempting to stabilize and interpret a ruin led to a rejection of all but the basic tenets of conservation. A different approach that relies on many traditions but few if any direct methods or materials emerged. This Conservation 2.0 of ruins required a complex, integrated rethinking of just about everything from deteriorated wooden artifacts to masonry stabilization; to museum environments; to the design of vitrenes/display cases (large enough for a house); to the integration of passive geo-thermal and active photovoltaics; to the Coordination and integration of Archaeologists, ecologists, and structural glass engineers into the working conservation team; to the Design of Protheses for structural loss compensation – requiring no loss of extant original surfaces and minimal loss of total fabric; but especially to "writing the book" on structural testing and evaluation of deteriorated and conserved structural artifacts returned to or continued in service. New solutions that continued to beg the question of "Why not?" were the only path forward.

The presentation will be in three parts focusing on Masonry, Wooden Structure, and the Glass display case:

Masonry Stabilization/Conservation

Ellen Hagsten, Conservator, Traditional and Sustainable Building

From moving and re-aligning displaced wall sections to re-attachment of finish plasters and stuccoes, modern lime sand grouts, adhesives, and fills meet the necessary structural requirements while being easily removed and 100% compatible with the historic materials.

Conserved Wooden Timber Structural Analysis

John Lee, Artisan Conservator, John Greenwalt Lee, Co.

A testing approach for new consolidants for wooden artifacts leads to an elegant integration of carbon-fiber and glass as protheses for wooden structural members. Since there are no books or tables on the capacity of a partially rotted and splintered truss member with a glass prothesis; a relatively simple system for testing structural artifacts was developed to verify their conserved capacity to function allowing them to be put safely back in service. This goes into more detail about the integration of a variety of conserved members into a structural system although the individual elements will not be ignored.

The Glass House: Integration, Interpretation, and Greening

Tim Macfarlane, Structural Engineer, Dewhurst Macfarlane and Partners

Development of a glass enclosure/display case/interpretive device that functions as infill [surface and structure] for the missing portions of the building envelope while utilizing ground temperature air circulated by photovoltaic powered fans to temper the interior environment provides a unique opportunity to learn from the past and develop methods and systems of construction that are informing the most modern construction of the 21st century.

To wrap up the team will discuss building the team which is what Conservation 2.0 is all about.

BIOTECHNOLOGY FOR CONSERVATION: PUTTING KNOWLEDGE TRANSFERS TO WORK

John Scott, Conservator of Art and Architecture, New York Conservation Foundation

Discovery research and technology development for major industries is enabling new adaptations for conservation of cultural heritage materials. A scientific context is presented for consideration of biotechnology for applications in conservation. Qualitative aspects of methods already in use or under development are described.

Reduction, oxidation and chelation chemistries are fundamental not only to traditional aqueous cleaning and finishing, but also to newer biotechnological cleaning and finishing methods. Yet underlying processes are unfamiliar to most end users. Relevant science, developing conservation biotechnology, reporting from a basic survey of relevant research, patent and marketing literature, and from a basic survey of conservation literature, are discussed.

Potentially useful microbes and their externally oriented metabolisms involving reduction, oxidation, or chelation mechanisms are presented. Some microbes derive life process energy in oxidizing or reducing water-soluble ions including copper, iron, sulfates, etc. Some microbes alter their local ecologies by sequestering ions incompatible with their life. In care of heritage materials, such biochemical mechanisms may prove useful to remove metal or metal oxides from surfaces, to remove other mineral encrustations or stains, to redeposit mineral into eroded matrices, or for similar effects

Current applications of these mechanisms are illustrated, first the source technologies in mining and other industries. Potentially valuable applications under development for conservation of cultural heritage are critiqued.

Sulfate–reducing bacteria and biosource chelators are

also considered very effective in removing rusts from metal equipment and artifacts, with little or none of the collateral corrosion effects caused by traditional acidic derusting methods. Refining of patinas on metal items can proceed without using even the least aggressive traditional chemical or abrasive media. Biotechnology applications for stone and other materials are described.

Post treatment stability of treated objects, and issues of ill effects over the long term completes the presentation. A basic bibliography (printed and online sources) to guide readers into the literature and technology is provided.

Case studies are presented during the cumulative questions and answers session.

CONSERVATION OF THE WORLD'S LARGEST PAINTING? THE EXTERIOR OF THE NATIONAL BUILDING MUSEUM RECONSIDERED

Richard Wolbers, Associate Professor, Art Conservation Department, University Of Delaware

Conservation Of A 90,000 Sq. ft. Painting—The Building Museum in Washington, DC [huge red brick building with red terra cotta dressings and a cream terra cotta bas relief band] was blanching white and some projecting areas had lost mortar from unprotected joints. Every time it was cleaned it got whiter. The theory was that it had been cleaned with hydrofluoric acid in the 1980s (despite the lack of any documentation) and was now efflorescing. A 6 figure study ensued. Still, every treatment made it whiter. Regardless, it was put out to bid.

The contractor finding that the specified treatment did not work called John Lee for assistance to figure out what they were doing wrong. A quick scraping of the white area was analyzed for the salts and did not reveal any significant amount. Wolbers analyzed a brick under florescence microscopy revealing an organic binder holding red pigment well into the pores. This coating was on all six sides of the brick. It had been dipped in red paint and wiped it off changing the appearance from good quality brick to high quality pressed brick approaching terra cotta with a very uniform color, which was what had been specified - early procurement fraud?

Regardless the problem was now painting conservation not masonry cleaning. The clear coating used to restore the optical surface and red appearance comes from the cosmetic industry and has many years of residing on faces not to mention excellent results from accelerated failure tests. It is easy to remove but does not break down in the way traditional clear coatings fail. Obviously this is a condensation of a complex project that required rethinking and a new approach to painting conservation on a mammoth scale.

CONSERVATION OF THE METROPOLITAN MUSEUM'S SPANISH CEILING: RESEARCH, TREATMENT, AND INSTALLATION

Melanie Brussat, Assistant Conservator, Miguel Garcia, Assistant Conservator, Timothy Hayes, Associate Conservator, Stephanie Massaux, Assistant Conservator, Batyah Shtrum, Assistant Conservator, Metropolitan Musem of Art, New York

A large Islamic-style Spanish ceiling, composed of painted and gilded wooden panels and geometric strapwork, was donated to the Metropolitan Museum by the Hearst Foundation in 1956. The ceiling was installed in the Islamic Art gallery in the 1970s. The de-installation of the ceiling in 2004, for a major construction project, has allowed the architectural work of art to be studied and more closely understood.

Four months were dedicated for research and minor conservation treatment upon de-installation. A13-month in-depth project, employing five objects conservators, includes research in the areas of provenance, manufacturing techniques, scientific analysis, and conservation treatment protocols, revealing information related to the ceiling's original appearance and the later restoration campaigns.

The ceiling was augmented considerably in a 19th/20th century restoration campaign. Boards and beams from the original structure were relocated and reused wherever possible and original components had been reassembled changing the entire shape of the structure, possibly from a five-faceted profile to one with three facets and a much shallower grade.

Several areas of strapwork were moved and augmented to connect to the original composition also changing the geometric patterns. Original Islamic woodwork is mathematically coherent, however these changes led to a geometric design lacking symmetry. This design flaw led to the previous assumption that the ceiling was of provincial manufacture.

In conjunction with the Curatorial Department of Islamic Art, the team considered a variety of conservation treatments and visual compensation possibilities. The first phase of the treatment focused on cleaning and stabilizing the wooden panels and decorative surfaces. A nebulizer was used to tackle the more difficult matte paint surfaces. The second phase focused on visual integration. Being a pastiche, the goal is to harmonize the original with the restorations, allowing the Spanish Ceiling to shine as an architectural object amidst the textiles it is meant to complement.

CLEANING HISTORIC BUILDING INTERIORS: THE QUESTION OF RESIDUE USING ARTE MUNDIT® CLEANING PASTE

Erica V. Morasset, Architectural Conservator, Building Conservation Associates in New York; Adriana Rizzo, Assistant Research Scientist, Department of Scientific Research, The Metropolitan Museum of Art, New York; Julie Arslanoglu, Department of Scientific Research, The Metropolitan Museum of Art, New York; George Wheeler, Director of Conservation in the Historic Preservation Program, Columbia University, and Research Scientist, Metropolitan Museum of Art

Arte Mundit® cleaning paste has been increasingly used for cleaning stone building interiors. Significant advantages to this latex rubber-based product are the ease of application, removal and disposal of the cured latex film after use. Arte Mundit® is generally effective but the long-term effects of possible residues have been understudied. An investigation was conducted to establish whether Arte Mundit® leaves residues, if the residue varies with the type of stone and whether the residue has an effect on the stone.

Granite, Berea sandstone, Indiana limestone, Tennessee marble, travertine, and Texas cream limestone were treated with Arte Mundit® and washed with water after the film was removed. Each sample was examined by optical microscopy, ultraviolet (UV) light and by measuring capillary uptake before and after treatment. Surface scrapings from treated stones were tested for the presence of residual latex by Evolved Gas Analysis (EGA), a technique in which a material is simultaneously thermally desorbed from the substrate and analyzed by a mass spectrometer. The presence of residue on the surface of the stone was assessed by comparison of desorption profiles from treated and untreated stone and cured Arte Mundit®. The presence of absorbed electrolytes before and after treatment was measured using conductivity.

EGA analysis is a powerful technique to assess the presence of latex residues, even in cases where optical and UV examination failed to detect them. The EGA results indicate that latex residues are present in the stone, and the amount of residue is dependent on the topography and porosity of the surface, with Berea Sandstone, travertine and Texas cream limestone being the most affected. In addition, the results of this study confirm that treatment of a substrate with Arte Mundit® does not increase the presence of absorbed electrolytes within the stone.

PILOT CONSERVATION TREATMENTS OF THE CARRARA MARBLE CAPITALS OF THE PHILADELPHIA MERCHANTS' EXCHANGE, INDEPENDENCE NATIONAL HISTORICAL PARK

Lauren R. Hall, Conservator, Building Conservation Associates, Inc., New York City; Frank Matero, Professor of Architecture and Chair of the Graduate Program in Historic Preservation, University of Pennsylvania

William Strickland's Philadelphia Merchants' Exchange Building is notable for its architectural design including colossal order colonnades with fluted shafts of Pennsylvania marble surmounted by Carrara marble capitals of the Composite order. Carved in Italy and signed by their craftsmen, the capitals represent some of the most exceptional sculpted architectural features in the country. The capitals are in an elevated state of deterioration and immanent loss.

The material and the carved geometry of the capitals render them highly susceptible to atmospheric weathering and sulfation. The formation of a gypsum crust threatens the structural integrity of the marble, increasing water-solubility and a different thermal expansion coefficient exerting stress on calcite grains. The encrusted surface has maintained the detail of the carved design, but beneath the crust, the bulk of the material is completely disaggregated, losing inter-granular cohesion and detaching from the core of the stone.

Performance and compatibility of successive treatments are carefully considered in laboratory investigations prior to execution in situ. Stabilization of the gypsum crust is achieved with barium hydroxide, cleaning techniques including laser, chemical, and micro-abrasion using a polyurethane sponge media were employed. Hydroxylating Conversion Treatment (HCT) preceded the application of Conservare OH100 to consolidate the friable stone. Micro-pinning with alumina ceramic pins seated in a viscous solution of Acryloid® B-72 thickened with marble dust was employed. Voids were filled with a mortar formulation using Natural Hydraulic Lime. This paper reports on the current state of knowledge on combination treatments of soiled sulfated marble and the results of comparative treatment trials using an integrated approach of new and traditional methods on the Merchant's Exchange representative pilot column capital.

TREATMENT AND TECHNICAL STUDY OF A 1934 PAINTED ROOM BY MILLARD SHEETS

Linnaea E. Saunders, Conservator of Paintings, Los Angeles, California

This painted dining room in a Hollywood house was executed by Millard Sheets early in his career. Sheets was an important figure in early southern California art world. A noted watercolorist, painter, muralist, mosaic artist, and architecture and interior designer, arts administrator, and perhaps most importantly, teacher, Sheets' career spanned 1920s to 1980s. Sheets was also a nationally known figure who completed a number of commissions throughout the country, perhaps most notably, the Library tower mural at Notre Dame University, affectionately known as "Touchdown Jesus".

Sheets' career and the painted dining room are placed in cultural context, while the materials and techniques of the painting and the artist's revision to the composition and color palette are discussed. The painting is well preserved although passages have been reworked, perhaps by the artist, to address past water and heat damage. Information from archival sources as well as media analysis of the paint including the two different phases of the work is included

Treatment concerns are discussed including choice of cleaning methods, selective cleaning of repainting, choice and application of varnish, and method of reintegrating large areas originally covered by architectural elements. Because the painting was executed in both wall paint and traditional artist's oil colors, as well as interlayers used during reworking, cleaning solutions were modified to address solubility concerns. Varnishing needed to address evening out the oil wall paint with minimal increase in gloss. Reintegration of the overdoor passages needed to create a seamless transition to the flat color of the wall paint.

This talk provides a peek into a rarely seen decorative scheme that reflects the cultural context of Los Angeles in its early heyday, by an artist whose national recognition is growing.

CONCRETE REPAIRS AND COATINGS FOR FRANK LLOYD WRIGHT'S SOLOMON R. GUGGENHEIM MUSEUM

Glenn Boornazian, Amanda Thomas Trienens, Norman R. Weiss, Integrated Conservation Resources, Inc.

Wright's Guggenheim Museum, completed in 1959, is among the best known buildings in the world. Materials for the repair and re-coating of the Museum's curved exterior walls of spray-applied concrete (gunite) required particular attention.

The color history, based on microscopic examination of specimens was undertaken prior to stripping of the 2 mm of accumulated coatings permitting a full examination of problematic exterior conditions, primarily cracks, losses and failed repairs. An understanding of the building's ageing and its seasonal behavior was developed through a program of crack monitoring and investigation of core samples, along with probes to confirm the complex configuration of reinforcing steel.

A complex research project was coordinated with six major producers of crack fillers, patching compounds and coatings for concrete. These were applied to small panels replicating the original gunite and exposed to water spraying, thermal shock, freeze/thaw, UV radiation, and water vapor transmission was determined for coatings. Adhesion and color were measured before and after the accelerated weathering, using tape testing and reflectance spectrophotometry.

The better product systems were studied on a larger scale at several locations on the building. After two rounds and some laboratory follow-up one manufacturer was selected for the work.

The work at the Guggenheim presents a new approach to conservation of a modern building through the elaborate collaboration of several different disciplines and rigorous laboratory testing and in situ evaluation by Integrated Conservation Resources. The foundation of the research was established by mechanical testing (compressive strength, coefficient of thermal expansion, and water absorption), crack monitoring, and petrography from several specialists, upon which the selection of repair materials, development of a replicated substrate, testing program and repair designs were based. The exhaustive elimination process of the six manufacturers' products is a unique technique to conservation goals.

UNILATERAL NUCLEAR MAGNETIC RESONANCE STUDIES OF OIL STAINS ON PAPER

Eleonora Del Federico, Department of Mathematics and Science, Pratt Institute; Silvia Centeno, Department of Scientific Research, Metropolitan Museum of Art; Cyndi O'Hern, Department of Mathematics and Science, Pratt Institute; Penelope Currier, Department of Mathematics and Science, Pratt Institute; Denise Stockman, Conservation Department, New York Public Library; Victoria Russell, Chemistry Department, New York University; Lindsey Tyne, Department of Mathematics and Science, Pratt Institute; Jacob Newman, Chemistry Department, New York University; Alexej Jerschow, Chemistry Department, New York University

Oil stains can be transferred to artworks on paper through handling or close contact with an oily object or media. Sometimes it is not desirable to reduce these stains because they represent historical evidence, or are adjacent to sensitive media. When the stains are visually disruptive or the damage is recent, however, it is important to know the safest and most effective treatment options.

Unilateral Nuclear Magnetic Resonance Spectroscopy (NMR) is a novel technique that allows the measurement of NMR relaxation and diffusion parameters directly on the paper surface. NMR relaxation parameters T_1 and T_2 can be correlated to molecular size and motion and therefore they can be used to monitor the presence of large and small molecules present in the paper matrix and how these change with aging, paper type and the action of treatment. In this work we have applied unilateral NMR on a sample population prepared with five types of paper, ten different oils with iodine index ranging from 90-180 and three approaches to aging. T_2 relaxation measurements were collected and correlated to paper type, iodine index, cross-linking degree and treatment.

The potential of unilateral NMR as a tool to determine effective treatment procedures for oils stains on works of art on paper will be discussed.

USING TYCORE BOARD AS MOUNTING PANEL FOR OVERSIZED CHARCOAL DRAWING

Fei Wen Tsai, Associate Professor, Graduate Institute of Conservation of Cultural Relics, Tainan National University of the Arts, Taiwan

The oversized charcoal drawing "Passers-by on the Square", by Taiwanese artist Ching Jung Chen was donated to the Kaohsiung Museum of Fine Art. This drawing, approximately 339 cms in width and 230 cms in height, had previously been folded. It was also torn and had been repaired with tape. Treatments, such as consolidation, tape removal, humidification and flattening, were carried out to stabilize the piece. Due to its enormous size, it was impossible for the museum to store this drawing in flat format. The alternative was designed and executed using three pieces of Tycore® board as backing panel. The boards were hinged with Japanese paper and then glued together into one large piece. The backing panel was then pasted onto layers of bast-fiber papers. The drawing, with paper-strip extensions, was then mounted onto the panel. After framing, it is store vertically and secured onto a wire frame. This paper will describe the procedures of the whole project and the challenges encountered during its execution.

A TECHNICAL STUDY OF A RELATIVELY UNKNOWN PRINTING PROCESS: MIXOGRAFIA®

Chail Norton, Assistant Paper Conservator, Los Angeles County Museum of Art

This paper is a summary of a project undertaken to investigate the materials, manufacture, and subsequent treatment options for a collection of prints produced using the Mixografia® process. The Mixografia® printing method when compared to traditional techniques such as etchings, woodcuts, or lithographs, is very unusual. The originators of this process still hold the patent; thus, little is known about the materials and mechanism used to create these works.

To understand the development of this printing method, an art historical survey was conducted on the originating artist, Rufino Tamayo, and the printing studio, Mixografia® Workshop; as well as the owner Luis Remba. Information on the events leading up to the collaboration and conception of the process have been well documented, but specifics information on the actual printing process and materials used were limited. The descriptions provided by the Mixografia® Workshop raised more questions than were answered.

A technical investigation was conducted to determine details regarding the manufacture of these prints. During this study some of the materials associated in making these works of art were identified, and a reconstruction of the printing process was devised.

NEW DIRECTIONS IN THE NON-DESTRUCTIVE ANALYSIS OF WATERCOLORS BY JOHN MARIN

Cyntia Karnes, Paper Conservator, Library of Congress; John Delaney, Senior Imaging Scientist, Lisha Glinsman, Conservation Scientist, Paola Ricciardi, Samuel H. Kress Fellow, and Mathieu Thoury, Charles E. Culpeper Fellow, Scientific Research Department, National Gallery of Art, Washington D.C.

The authors will discuss the application of newly developed analytical techniques to characterize colorants in eighteen watercolors by the American modernist artist John Marin, painted between 1895 and 1929.

This presentation will elaborate on the technical

examination of Marin's watercolors presented at the AIC meeting in 2005, which focused on the artist's evolving palette, influenced by prevailing color theories and corresponding developments in optical science. Preliminary analysis for that study, using air-path X-Ray fluorescence spectroscopy, color spectroscopy, infrared reflectography, and visual examination with ultraviolet radiation, will here be integrated with data obtained from relatively newer technologies now being developed for the analysis of works on paper, such as X-Ray fluorescence spectroscopy using a helium flush and imaging spectrometry.

The qualitative evaluation of colorant responses to ultraviolet and infrared radiation in the previous study have been superseded by hyperspectral and fluorescence emission imaging techniques that gather narrow band reflectance and luminescence data, allowing resolution of colorants with similar spectral behaviors, the discrimination of colorants in mixtures, and their spatial distribution across a work. XRF employing a helium flush has the advantage over air-path XRF in that it eliminates spectral noise and identifies atomic weight elements below potassium, enabling the characterization of mordants and fillers used in the manufacture of watercolors.

These new analysis techniques not only offer the promise of a considerably richer understanding of John Marin's color palette as his technical abilities matured, but may also provide a template of options for colorant analysis on art and historic artifacts where sampling is not permitted.

HYPERSPECTRAL IMAGING FOR MONITORING OF AGING PROCESSES IN ARCHIVAL DOCUMENTS

R. Padoan, National Archives of the Netherlands; M.E. Klein, Art Innovation; G. de Bruin, National Archives of the Netherlands; B. J. Aalderink, Art Innovation; Th. A. G. Steemers, National Archives of the Netherlands

Hyperspectral imaging is an optical remote sensing technique which is already used in a number of research fields, such as Earth observation and medicine, where often direct contact with the analysed object or partial sampling is not possible. In the last decades outstanding improvements in this technique have made possible a faster and more accurate acquisition of information from hyperspectral data. The recent developing of relative low price hyperspectral imagers has also allowed the use of the great potential of this analysis system for applications in the world of cultural heritage due to its non-invasive character and high capacity to simultaneously acquire a large amount of spectral and spatial information.

The Nationaal Archief (National Archives of the Netherlands) is currently conducting an applicability study of this technique towards the use of a specifically designed machine for the hyperspectral analysis of archival materials, with the main focus on the monitoring of aging processes. In order to compare the same recorded area in different time periods and allow the identification of aging process, even after short times of exhibition, high efforts have been invested in the improving of the accuracy and precision of the recording apparatus. Within the research program, data is taken in consideration from both original documents (naturally aged) and specially prepared samples (artificially aged). In this way the behaviour of a large number of materials (paper, parchment, leather, cotton, linen, inks, pigments, adhesives and photographic material), when exposed to different types of conservation treatments and aging conditions, can be analysed and compared. The result of this study is expected to indicate the range of applications of hyperspectral imaging and its usefulness as an aid in assessing the condition of documents before, during and after conservation treatments, exhibitions and storage periods.

AN EXAMINATION OF ANOXIC COLOR FADING FOR SELECTED GOUACHES, WATERCOLORS AND TEXTILES

Vincent Beltran, Assistant Scientist, Getty Conservation Institute

As a part of its Museum Lighting initiative, the Getty Conservation Institute explored the effects of anoxia on color fading for a wide range of colorants. Expanding upon the limited sample sets of previous research, this study attempts to further quantify the benefit and disadvantage of display in the absence of oxygen.

Following an experiment examining light-induced color fading of pigments and natural history specimens, the subsequent set focused on samples of selected gouaches, watercolors, and textiles. In addition, samples of fluorescent highlighters, ISO blue wool cards, and other fugitive pigments were included.

Samples were housed in two hermetically-sealed cases, one with an air atmosphere and the other containing less than 50 ppm of oxygen. Irradiated under a bank of MR-16 halogen lamps, temperature and relative humidity were tightly controlled by internal radiator plates connected to constant water temperature baths. The air and anoxia sets (121 samples each) were exposed for ~17.5 million lux-hours.

ΔE values (2000 calculation) were determined for each sample by pre- and post-exposure spectrophotometric analysis. The range of ΔE values observed for the air sample set ranged from 0.2 to 55, while that of the anoxia set exhibited a narrower range from 0.2 to 30. Comparing the ratio of ΔE_{Air}:ΔE_{Anoxia} for each sample, the vast majority displayed values above 1 (indicating less fading in the absence of oxygen than in air) and most of these samples showed ratios above 2 (fading in air was 2x greater than anoxic fading). However, a number of samples had ratios below 1, indicating enhanced fading in anoxia – these samples were mostly fugitive pigments, though included were gouache samples fluorescent yellow (ratio of 0.67, ~1.5x more fading in anoxia) and orange lake light (0.91) and textile samples

reseda luteola on wool (0.94) and laccifer lacca on silk (0.94).

SACRED LEAVES: THE CONSERVATION AND EXHIBITION OF EARLY BUDDHIST MANUSCRIPTS ON PALM LEAVES

Yana van Dyke, Associate Conservator at the Sherman Fairchild Center for Works of Art on Paper, Metropolitan Museum of Art

During the summer of 2007, a collection numbering over a thousand leaves of rare and important Indian paintings on palm leaf and paper were rediscovered during a renovation and storage relocation project within the Metropolitan Museum of Art's Asian Art Department. The first exhibition, in a series of permanent collection rotations, focuses on a remarkable group of early palm leaves that cite the Buddhist Sutra of The Perfection of Wisdom in Eight Thousand Lines (Ashtasahashrika Prajnaparamita). Almost all of the illustrated manuscripts that are known today that were produced in northeast India and Nepal in the eleventh and twelfth centuries cite this text. Aside from the wall paintings in the cave temples such as those found in Ajanta, The Metropolitan's palm-leaf folios represent the earliest surviving examples of Indian painting.

The paper will explain the initial assessment, examination, triage approaches, museum collection management responsibilities, along with technical analysis, conservation solutions, and preservation options. By their very nature, these small scale, vulnerable and portable, early manuscripts of palm leaf present a multitude of difficult conservation and preservation situations. Historic evolution of the structure, the sacred ceremonial functionality and utility of the manuscript traditions, and technical background, material composition, support preparation, painting techniques, pigment analysis, condition assessment, and inherent deterioration mechanisms of both the support and media will be examined and described. Conservation treatment materials and procedures such as structural stabilization of the aged palm leaf, including ethical considerations in compensation and reintegration of design, mounting, housing, display and storage; topics pertaining to the care and understanding of these early Indian paintings on palm leaf will be discussed in detail.

SENSITIVITIES OF MODERN DIGITAL PRINTS TO ABRASION DAMAGE

Douglas Nishimura, Senior Research Scientist, Gene Salesin, Research Assistant, Jessica Scott, Daniel Burge, Research Scientist, Peter Adelstein, Research Scientist, James Reilly, Director, Image Permanence Institute, Rochester Institute of Technology

The objective of this project was to determine the resistance of various digitally printed materials (photographs, documents, ephemera, etc.) to abrasive forces. The data from the testing of the digitally printed materials was compared to results from prints made by traditional processes in order to provide institutional staff with benchmark experience for the housing and handling of digitally printed materials. Results were obtained with inkjet, electrophotographic, and direct dye thermal transfer (dye sub) prints as well as prints produced on digital presses. In addition to determining the abrasion resistance of various digital print technologies, the abrasiveness of several common enclosures materials (envelope paper, polyester film, and interleave tissue) were tested to establish whether these would be equally suitable for housing digital prints. Prints were also tested against the reverse side of the same print paper to represent the effects of storing prints unseparated in stacks. Results indicated that there are a variety of resistances to abrasion within a mixed collection of digitally printed materials. This applied regardless of the type of enclosure material used. This suggests that great care will be needed for the handling and storage of many modern printed objects.

DIGITAL SURROGATES: A NEW TECHNIQUE FOR LOSS COMPENSATION OF GRAPHIC WORKS ON PAPER

Adam Novak, Craigen W. Bowen Fellow in Paper Conservation at the Straus Center for Conservation, Harvard Art Museum

Historically and presently, restorers and conservators engaging in loss compensation have used fine hand skills to recreate convincing design elements in addition to paper color and texture, and these techniques have been documented and taught. In contrast, the focus of this paper is the use of digital surrogates as an alternative for loss compensation of graphic works using digital images and high quality printers. By employing this method, the lost design is reconstituted without compromising the artist's original intent.

The process of producing a digital surrogate will be explained using a case study of a recent treatment of Jacques Callot's The Siege of La Rochelle, a monumental print from sixteen plates. While producing a facsimile image might seem relatively simple, there are several details in production that can be adjusted to produce a high quality surrogate. Using digital images from a complete print for the reproduction, two methods of production were identified: 1) printing the appropriate design on a paper similar in quality to the original, or 2) printing the illusion of paper texture, color and design on a high quality inkjet optimized paper. This paper will focus the techniques used for the final digital surrogate, with discussion of image capture, digital manipulation, paper selection and surface coatings.

CHARACTERISTICS OF BLOCK-PRINTED BOOKS IN THE EDO PERIOD (1603-1867) OF JAPAN

Kazuko Hioki, Conservation Librarian, University of Kentucky

Printed texts of the Edo period were almost exclusively produced by woodblock printing, printed on Japanese paper and bound in side-stitched binding with Japanese paper covers. While the binding style was relatively simple and seemed less diverse than Western bindings, wide variations were observed in the cover decorations as well as the dimension of the books. One of the major characteristics of print culture during the Edo period was that, as a result of the flourishing commercial publishing industry, books became a popular commodity. Over 10,000 titles were published, and millions of copies were circulated among the population. To appeal to customers, the physical appearance, such as book shape and cover decoration became important. Book dimensions and material composition were determined by their cost and by market competition. The physical traits of Edo books became associated with certain genres of writing.

This presentation focuses on the physical characteristics of books and bookbinding, including book formats, binding materials, and cover decoration of the time. It also discusses various genres along with specific physical traits that distinguish them. This talk is based on the study which will be published in the forthcoming 2008 issue of the Paper Conservator.

MATERIAL JAPONISME IN AMERICAN ART, 1876-1925

Rebecca Capua, Andrew W. Mellon Conservation Fellow, Sherman Fairchild Center for the Conservation of Works on Paper, Metropolitan Museum of Art

Much has been written about Japonisme in America and Europe in terms of an aesthetic affinity, but comparatively little has been written about the use of actual Japanese materials by Western artists. American Japonisme cannot be understood as an isolated phenomenon occurring within the realm of fine art; at the same time that travelers such as Edward Sylvester Morse were building the great American collections of Japanese art, key civic events such as the 1876 Centennial Exhibition were introducing the general American public to the arts and industries of Japan. Also at this time, increasingly sophisticated educational theories drew on Japanese materials and technique as a basis for arts education in public schools, representing a shift in American understanding of childhood development. As the focus of this paper is on materials (as opposed to style or aesthetic) the wider context of cultural commodities comes into play much more significantly than it would in a purely art historical discussion of Japonisme. This is an important link that describes the relationship between culture at large and the material choices of artists who have their own particular concerns.

This paper will examine the works on paper of artists such as Arthur Wesley Dow, Arthur B. Davies, Bertha Lum, and John La Farge who used Japanese materials such as papers, brushes, and media, handling the specific working properties of the materials in different ways (either by using them traditionally, adaptively, or innovatively). The paper brings together several different avenues of research, including ongoing analytical research on the materials themselves (as examined or sampled from the works on paper or historical samples), an examination of artists' techniques and their attitudes toward the use of these materials, and a discussion of the history and availability of Japanese materials to American artists in the late nineteenth and early twentieth centuries.

EFFECT OF AQUEOUS TREATMENTS ON 19TH CENTURY IRON-GALL INK DOCUMENTS PART 2: ARTIFICIAL AGING BY HEAT, HUMIDITY, AND LIGHT

S. Tse, Senior Conservation Scientist, Canadian Conservation Institute; Dr. D. Goltz, Associate Professor, Chemistry Department, University of Winnipeg; Dr. G. Young, Senior Conservation Scientist, Canadian Conservation Institute; S. Guild, Paper Conservator, Canadian Conservation Institute; V. Orlandini, Paper Conservator; M. Trojan-Bedynski, Senior Paper Conservator, Library and Archives Canada, Gatineau Preservation Centre

The efficacy of iron gall ink treatments are often tested on model papers and laboratory prepared inks in order to control the variables during experimentation. Evaluating these treatments on originals helps identify unforeseen problems and confirm their effectiveness. The calcium phytate (Ca-phy)-calcium bicarbonate ($Ca(HCO_3)_2$) treatment was consistently found to be effective in protecting model papers and inks during artificial aging. This study uses original inked documents that are typically found in Canadian archives, and compares the effect of the Ca-phy-$Ca(HCO_3)_2$ treatment to deacidification with $Ca(HCO_3)_2$ and magnesium bicarbonate ($Mg(HCO_3)_2$), paper simmering, and other modified phytate treatments.

Five original 19th century iron gall ink documents, donated by a Québec archive, were subjected to 18 separate treatments. The results after treatment, before artificial aging, were previously reported.

The effectiveness of eight of 18 treatments was further tested after exposure to heat and humidity, high intensity light, and elevated humidity at room temperature. Changes were evaluated against unaged or untreated controls. Methods of evaluation include hyperspectral imaging, color measurement, pH, bathophenthroline test and microfade testing. This paper will include findings from all the results except for microfade testing.

Visible hyperspectral imaging was carried out using a

Nuance™ Imaging system with a liquid crystal tunable filter (LCTF). Single wavelength images were collected from 420 to 720 nm at 10 nm intervals using both ultraviolet (365nm) and visible light sources, located at 45° relative to the camera and the paper. The usefulness of hyperspectral imaging and image analyses techniques to evaluate the effect of aqueous treatments will be highlighted.

Heat aging results confirmed the effectiveness of phytate-bicarbonate treatments. High humidity did not cause mould growth on phytate treated samples. Continuous exposure to fluorescent lights (without UV filter) caused fading of the papers and some fading of the inks.

WHERE ARCHIVAL AND FINE ART CONSERVATION MEET: APPLYING IRON GALL INK ANTIOXIDANT AND DEACIDIFICATION TREATMENTS TO CORROSIVE COPPER WATERCOLORS

Crystal Maitland, Paper Conservator, Johns Hopkins University

Iron gall ink inherently accelerates both acid hydrolysis and oxidation of cellulose. Stabilization of ink-on-paper artifacts must therefore address both deacidification and application of antioxidants (chelating agents, radical scavengers or peroxide decomposers). Calcium phytate (CaP), a chelating agent for iron(II) ions, is coupled with calcium bicarbonate (CaB) deacidification in an effective treatment for corrosive iron gall inks; however, this treatment must be applied aqueously and does not address the corrosion caused by other transition metal ions present in the inks. A new treatment, involving peroxide decomposer tetra-butyl ammonium bromide (TBAB) coupled with deacidification, is emerging in the literature. TBAB is advantageous as it is not metal specific, and can be applied non-aqueously.

The effects of antioxidants have been well studied for use in archival conservation, but their use in fine art conservation has not been fully investigated. This research examined the effects of antioxidant treatments on metal gall inks and associated media found in fine art on paper. Ideally the fine art media could be safe during treatment, and perhaps even stabilized by the antioxidants. Two common copper-containing "problem" pigments (verdigris and azurite) were studied in a watercolor medium alongside samples of two laboratory prepared inks (pure iron gall ink and a mixed iron-copper gall ink). Accelerated aging allowed monitoring of the treatments over time. Results showed that all treatments produced initial color changes in all four media. Under the studied aging conditions, verdigris stability was not greatly increased, but neither was it decreased relative to the untreated control. Generally, however, treatment enhanced the stability of the two inks and the azurite watercolors.

A DISCUSSION OF THE CONSERVATION OF "SS-HYGIENE INSTITUT" DOCUMENTS IN THE ARCHIVES OF THE AUSCHWITZ-BIRKENAU STATE MUSEUM

Beate Kozub, PhD student at Viadrina European University in Frankfurt/Oder, Germany

The Archives of the Auschwitz – Birkenau Stade Museum in Poland is a repository of materials mainly related to the history of Auschwitz Concentration Camp. It contains 3 to 5% of all the paperwork related to the activity of the concentration camp as the Nazis destroyed most of the documents prior to the liberation of the camp. Some documents had also been transferred to Germany earlier where they were lost. Upon the liberation of the camp by the Soviet Union on 27th January 1945 some documents were taken to the USSR where they remain in Russian archives to this day.

A three-year project was started in January 2008 with the goal of conserving the complete collection of 40,000 documents in the Archives. The project is carried out in co-operation with and funded by Bundesland Nordrhein-Westfalen, Germany. The contents of the files are typical for 20th century records from the period during and after the National Socialist regime.

The main conservation problem is related to the aniline dyes in the inks used to write and stamp camp documents. Up until now more then 70 different inks have been found. Treatment requires minimizing the risks to the inks while stabilizing the damaged paper documents. The paper will discuss the examination, condition, triage and treatment of the documents in such a manner as to fulfill the project goals.

PLACE IN WALES: RECONSTRUCTING DRAWINGS FROM A SKETCHBOOK BY FRANCIS PLACE

Emily O'Reilly, Senior Paper Conservator, National Museum of Wales

Amgueddfa Cymru - National Museum of Wales holds 18 works on paper by Francis Place (1647–1728). During routine conservation it became apparent that ten of the drawings were from the same sketchbook. These ten drawings form an important part of the collection as they are the earliest images of Wales carried out on the spot (dated 1678). Place was a gentleman amateur artist who was one of the earliest English artists to specialize in landscape.

On the removal of two secondary supports, drawings were discovered on the verso enabling some order of the drawings in the sketchbook to be established. Research revealed amongst other facts that a second sketchbook from the tour also survives.

Perhaps the most fascinating information to be revealed during the project were the annotations and marks that Place

used. Pages fold over to join up with the landscape on the verso; ink crosses on the edge of a double page spread join up with sketches on the verso to extend the panorama further. These intriguing, subtle marks are an insight into Places' working techniques and his use of a sketchbook, transforming it from a simple drawing surface into an instrument to convey space.

From this new research it will now be possible using the manipulation of digital images to 'recreate' the sketchbook and view the panoramas as Place saw them. Through the Museums website and Gallery interactive, access to the drawings will now be possible that could never be achieved on a Gallery wall or in a study room.

SIZING IN 19TH CENTURY BOOK PAPERS

Morgan S. Jones, Associate Conservator, Cathleen A. Baker, Senior Paper Conservator, and Shannon Zachary, Head of the Department of Preservation and Conservation, University of Michigan Library

Recent research into nineteenth-century machine papermaking processes reveals that gelatin surface sizing for book papers was phased out during the early years of the machine as the internal size, alum-rosin, gained use. In this preliminary investigation, the authors tested for gelatin (protein) using Biuret and ninhydrin reagents. A total of sixty American-imprint books—five from each decade (1790 to 1910)—were tested. Protein is present in a large majority of book papers from the 1790s through the 1830s, but from 1840 to 1910, only a small minority of papers tested positive. These results seem to support the premise that gelatin sizing decreased with the growing use of alum-rosin. A test for starch was also carried out, and its presence was found in a few book papers starting in the 1830s, rising to a presence in a majority from 1880 on. This finding confirms the addition of starch to alum-rosin sizing into the beater (engine) as reported in contemporary papermaking recipes. The testing procedures were modified from standard ones: notably, the ninhydrin-treated sample was not heated, but allowed to develop color (if positive) over a couple of hours.

TREATMENT OF PERSIAN LACQUER BINDINGS

Katherine Beaty, Book Conservator, Harvard College Library, Harvard University

Persian lacquer work is a method of decorative painting on a prepared surface and involves the use of shellac. From the 14th century onward a variety of decorative objects were lacquered in the Persian speaking world, most commonly pen boxes, mirror cases, and bookbindings.

The production of a Persian lacquered bookbinding is a laborious process. Layers of ground are applied by brush on the pasteboard substrate, followed by a coating of shellac. After the design is laid out, the painting is blocked out in layers of opaque paint consisting of pigments bound with animal glue. Intricate details are painted on these blocks of color. Upon completion of the painting, the entire surface is coated with shellac. Any gilding or metallic decoration is laid into this tacky shellac. The piece is finished when a smooth homogenous surface is attained after repeated applications of shellac interspersed with sanding.

The nature and construction of these materials creates many challenges for the conservator. Because the underlying structure is often misunderstood, many traditional paintings, objects, and book conservation techniques could be detrimental to the delicate painted surface. This presentation will share preliminary observations and analytical findings concerning the structure and materials used to produce Persian lacquer objects, chiefly bookbindings, and share a number of treatment approaches for the various damages associated with Persian lacquer bookbindings

ELECTRONIC MEDIA

INTERACTIVE MULTIMEDIA ON CD-ROM: EXPERIMENTS WITH RISK ASSESSMENT

Mona Jimenez, Associate Arts Professor/Associate Director, Moving Image Archiving and Preservation Program (MIAP), New York University

In this talk, the author will discuss collection and item level assessments of interactive multimedia produced during the 1980s and 1990s and stored on CD-ROMs. The works include educational titles as well as art works such as Laurie Anderson's *Puppet Motel*, and typically incorporate hyperlinked text, image, audio and video files arranged through what is commonly referred to as authoring software. To understand the works and the contexts in which they were produced and viewed, one must view the works in their "native" environment. Viewing works in later environments can lead to incorrect assumptions in such basic areas as boundaries of a work, its behaviors, functionality, timing and visual/aural qualities. However, creating a work's software and hardware environment is easier said than done. Also, information about a work's technical needs may be minimal. Decoding a work's component parts and determining their relative value and condition is also challenging. However, the author will share lessons learned in diagnosing risks to the works, finding strategies for assessment, and determining the feasibility of migration or emulation. The goal is to identify titles within a collection that can realistically be maintained, and to suggest decision-making models that will lead to prioritization and to preservation workflows. Analysis of these early multimedia titles may also inform the conservation of more current examples of multimedia and networked art. The findings are the result of the examination of multimedia titles held in the Avery Fisher Center for Music and Media in the Elmer Holmes Bobst Library at New York University, as part of research within the Moving Image Archiving and Preservation Program.

CHARACTERIZING OPTICAL DISC LONGEVITY

Christopher S. Coughlin, Research Chemist, Michele H. Youket, Preservation Specialist, Library of Congress, Preservation Research and Testing Division (Presented by Fenella France, Research Chemist, Library of Congress, Preservation Research and Testing Division)

Since they are not subject to the same wear and tear as other recorded media, optical discs have long had a strong appeal for preservation conscious institutions. Additionally, considerable "born digital" material is created by people authoring their own CDs and DVDs. We have been engaged in ongoing research into the longevity of optical discs including CD-ROM/Audio, CD-R, DVD-R and DVD-RW. We will report the results of accelerated aging studies performed in collaboration with the National Institute of Standards and Technology. While almost all discs showed predicted longevity greater than five years, our results indicate that most CD products tested showed a high probability of prolonged lifetime relative to their DVD counterparts. This may result from the fact that for a given aging-induced flaw size, more bits are affected on a DVD than a CD. The results of physical and chemical examinations of the failed discs will also be reported.

FORGING THE FUTURE USING WEB 2.0 CATALOGING TECHNIQUES

Michael Katchen, Senior Archivist, Franklin Furnace Archive, Inc.

Interactive trends of Web 2.0 have the potential to revolutionize descriptive cataloging and conservation. New opportunities exist for description and sharing by combining innovative folksonomy techniques with traditional taxonomy procedures. By merging the two in a complimentary manner, it is possible to create a hybrid model for both cataloging and vocabulary. This combination approach has the ability to produce richer, more complex, and more useful records. Franklin Furnace is a member of a multi-organizational initiative titled: "Forging the Future" which is developing this concept and a corresponding suite of tools. One of the tools is the publicly accessible "VocabWiki" which was designed for the dynamic creation of "collabulary" (collaborative vocabulary) to describe New Media. The initiative's overall approach is unique in that is uses terms from the VocabWiki to describe past, present, and future states of New Media artwork.

SUSTAINING DIGITAL SYSTEM ENVIRONMENTS BY VIRTUALIZATION: CONSIDERATIONS ON THE PRESERVATION OF COMPUTER AND INTERNET-BASED ARTWORKS

Tabea Lurk, M.A., Bern University of the Arts, AktiveArchive

This talk is based on current approaches to preserving computer- and especially network-based art. It will present interim results of the Swiss media research group AktiveArchive. In order to sustain cultural values, especially those that are encoded in the artists' software and the artistic configurations of computer programs, established technical applications are applied to specific conservatory requirements. As an example, the use of virtualization shall be discussed. Virtualization can serve as one important element in a series of possible actions. It presents a meaningful transfer method for sustaining born digital artifacts that are processed dynamically and that rely on a specific system environment. Reverting to virtualization means to think about isolating the artwork and work-relevant components from the original host and porting them to a so-called virtual machine. In contrast to trans-coding operations this suggests a lossless

migration. No code conversion takes place. The crucial point is to identify the artwork among the technical configuration of programs and related software elements. This procedure can become complex - especially in the case of net art. Internet-based artworks are dissolved by their nature. They are distributed among different machines. While the artwork's host is in general a web-server, the piece appears on a client. Often the included elements rely on different system requirements. In addition Internet-based artworks can include searching processes, which address external web-services and communicate with variable data providers. The displayed content is therefore continuously changing. After a short introduction on core elements and basic communication structures the presentation will explain how far we tend to enhance technological knowledge by introducing parameters that can sustain consistent values in the preservation records. Beside virtualization we want to refer on the Netart Router - a novel tool which is tested currently in our research lab.

ARCHIVAL VIDEO FILES: WHEN IS COMPRESSION ACCEPTABLE?

Angelo Sacerdote, Preservation Program Manager, Bay Area Video Coalition (BAVC)

File size is a major factor in the economics of any digital reformatting project. Falling prices of storage have rendered the question of compression moot for audio (WAV) and image files (TIFF), but video still remains an expensive problem. Most newer high quality digital video files are compressed and therefore have much smaller file sizes than uncompressed video captured from analog sources. Compression may add artifacts that will forever alter the new "master" recording. Will the cost of storage fall enough to render this question moot as well, or does it make sense to consider visually lossless forms of video compression. The author will share the results of a study conducted with the Dance Heritage Coalition to help offer guidance on this question.

FROM SINGULARITY TO MULTIPLICITY: AN ETHNOGRAPHIC RESEARCH INTO VERSIONS, VARIATIONS, AND EDITIONS IN MUSEUM PRACTICES

Vivian van Saaze, PhD candidate, Maastricht University / Netherlands Institute for Cultural Heritage (ICN)

In conservation literature it is often argued that with contemporary artworks, and especially with time-based media art production, the concept of originality as singular has become obsolete or at least highly problematic. Specific language is employed aiming to discriminate between the original and its reproductions, multiples, copies, variations, versions, replica's, editions or emulated works of art. A selection of case studies shows that, despite the increase of multiplicity, the repertoire of singularity in museum practices is still particularly persistent. This paper explores how this repertoire of singularity is manufactured and reinforced in day to day practices through actors such as photographs, space, loan agreements, wall labels, artist's statements, artist's assistants, and specific choices of vocabulary. How can we understand the co-existence of singular and multiple repertoires in museum practice? And what does is mean for an art work to be more than one?

THE CONSERVATION OF TIME-BASED ART: PRACTICAL APPLICATIONS IN A MUSEUM SETTING

Jeff Martin, Conservation Research Fellow, The Hirshhorn Museum and Sculpture Garden

The Hirshhorn Museum and Sculpture Garden in Washington, DC holds a rapidly-growing collection of time-based art: single-channel videos, film projections, multiple-screen installations, and born-digital works. These artworks present unique challenges to conservators and registrars, and require a degree of specialized knowledge not often found in an art-museum setting. Yet the Hirshhorn, like nearly every other art museum in the world, does not have a fulltime conservator dedicated to media art. As a way of exploring these issues, the Hirshhorn turned to a post-graduate research fellow, whose training was not in fine art conservation but in film and video preservation and documentary production. This paper will discuss the ways in which these areas of expertise, sometimes overlooked in discussions of conserving media art, can be integrated into the conservation lab by adopting the field's traditional ethics and practices. The paper will also detail the policies and procedures developed at the Hirshhorn for the acquisition, cataloging, and conservation of time-based media. The goal of this work was not to reinvent the workflow within the collection management department, but to adapt that existing workflow to accommodate the special needs of time-based works.

TIME-BASED MEDIA CONSERVATION PROGRAM AT MOMA

Glenn Wharton, Time-Based Media Conservator, Museum of Modern Art

This presentation will provide an overview of the conservation program being developed for time-based media at MoMA. Although the collection was established in the 1970s, a position for conserving the video and digital collections was not established until 2007. Basic policies and procedures are now in place for media migration, equipment management, and storage of digital works with associated metadata. New forms of documentation are employed, such as artist interviews to capture installation variability. Time-based media conservation also requires new forms of collaboration

within and outside the museum. A cross-departmental team called the Media Working Group meets regularly to discuss acquisitions, exhibitions, and conservation. MoMA also works collaboratively with other institutions to develop common practice for this emerging field. Several case studies will be presented to illustrate how these procedures come into play.

DEVELOPING A DIGITAL COLLECTIONS CONSERVATION REPOSITORY AT MOMA

Barbra Mack, Portfolio Manager, Information Technology Services, New York University

This presentation will focus on MoMA's evolving program for the conservation of digital collections. After conducting a preliminary survey of the digital media preservation practices that are emerging for libraries and archives, MoMA established short- and long-term strategies for its own digital collections. The presentation will use a case study of an artwork recently acquired by MoMA to illustrate some of the details of these strategies, and how MoMA's program fits within larger currents in the field. The presentation will also take a few minutes to highlight some as-yet-to-be-resolved issues that MoMA identified, which the conservation field and other related disciplines could begin to collectively tackle in an effort to extend digital collections conservation practices.

PRESERVATION OF INTERACTIVE INSTALLATIONS FROM THE LATE 1960S–AT THE INSTANCE OF THE ARTIST/ENGINEER COLLABORATION E.A.T. (EXPERIMENTS IN ART AND TECHNOLOGY)

Christine Frohnert, Conservator for Contemporary Art, Modern Materials and Media, Cranmer Art Conservation

Artists have always carefully pursued the technologies of their time to incorporate them into their artworks. Given the current persuasiveness of technology, it is no surprise that modern materials and media became increasingly important tools in the artist's studio practice. Conservators have always assumed that preservation of the evidence of the past to conserve for future generations is our primary responsibility, but that assumption is being put to a hard test by works of art that include electric/electronic components and modern materials. Consequently, the preservation of artworks containing these components is of increasing concern to the art conservation profession, not only in terms of the long-term storage of information, but also regarding the preservation of the works of art themselves and their artistic intent. Conservators have to implement new conservation strategies and techniques to meet the challenge to preserve those artworks and their contemporary materials and technologies for future generations. Therefore, the documentation, preservation and conservation of the objects with their 'state of the art' technology and their time specific dynamics will be discussed. The presentation will start with a short overview of artworks incorporating electric and electronic components as well as new materials in works of US American Art. The roots go back to the 1960's, when artists and engineers started to collaborate and will be addressed at the instance of the pioneering group E.A.T. (Experiments in Art and Technology). Today, these early technology-based artworks created at that time are relatively little known, primarily as a result of the complexities of preserving, displaying and properly maintaining them. Some technological components have become outmoded/obsolete or even lost. A case study on the preservation of Jean Dupuy's 'Heart Beats Dust' from 1968, will be presented, revealing the fine line between conservation and re-creation.

INTRODUCTION TO THE EUROPEAN PROJECT "INSIDE INSTALLATIONS: PRESERVATION AND PRESENTATION OF INSTALLATION ART"

Vivian van Saaze, PhD candidate, Maastricht University / Netherlands Institute for Cultural Heritage (ICN) (Presenting on behalf of Tatja Scholte, Scientist /Program Manager, Netherlands Institute for Cultural Heritage (ICN), Conservation Research Department)

This presentation will introduce the ground breaking multi-national research project "Inside Installations: Preservation and Presentation of Installation Art" (www.inside-installations.org). During a three year period (from 2004 to 2007), twenty-four museums and institutions explored the care and administration of an art form that is challenging the prevailing views of conservation. Over 30 complex installations, many with media components, were selected as case studies and were re-installed, investigated, and documented. Experience was shared and partners collaborated to develop good practice on five research topics: preservation strategies; artists' participation; documentation and archiving; theory and semantics; and networking (knowledge management and information exchange). This presentation will discuss the main research questions, the aim of the project, and how it was organized. In addition, the relationships between the project and the International network for the Conservation of Contemporary Art (INCCA) will be explained.

FABRIZIO PLESSI'S "LIQUID TIME II" AT ZKM CENTER FOR ART AND MEDIA: PRESERVATION AND PRESENTATION OF A LARGE-SCALE KINETIC VIDEO SCULPTURE

Fenna Yola Tykwer, Master Conservation, ZKM Center for Art and Media Karlsruhe, Germany; Thomas Zirlewagen, Master Conservation, Zurich, Switzerland

The case study of Fabrizio Plessi's "Liquid Time II" was part of the three-year research project "Inside Installations: Preservation and Presentation of Installation Art". In 2004 "Liquid Time II," a large-scale kinetic sculpture with video components, went on exhibition at ZKM for a period of two years. In conjunction with the exhibition, extensive documentation of the artwork was carried out, including video recordings, 3-D visualization, and an installation manual. During this long-term presentation, a number of conservation problems arose caused by mechanical impact and wear and tear to the electronic equipment. As a result, a maintenance plan and further solutions for preservation had to be found to protect and preserve unstable technical components. This two-part lecture offers insights into the decision-making processes and the main conservation issues. Thomas Zirlewagen will provide a short introduction of the artwork and its exhibition history and will describe the key components and their mode of operation, such as kinetic and electronic functions. In the second part, Fenna Yola Tykwer provides an introduction to the hardware components of "Liquid Time II", explaining the different types of video systems and the technical features of this special video signal. The central focus is on the question: which video version of the artwork is the most authentic one? Furthermore, two different considerations for the long-term preservation of the video system will be presented.

TO EMULATE OR NOT: CASE STUDY "REVOLUTION, A MONUMENT FOR THE TELEVISION REVOLUTION" BY JEFFREY SHAW, 1990

Gaby Wijers, Collectie, Nederlands Instituut voor Mediakunst, Montevideo/Time Based Arts, Amsterdam

The focus of this preservation case study by NIMk and ICN, in the scope of the project "Inside Installations: Preservation and Presentation of Installation Art", was to establish what was important for the preservation of this computer-based interactive installation and how emulation can be used as a preservation strategy. In this installation, the spectator pushes a bar attached to a steel column with a built-in monitor. When it is pushed in a forward position, 180 images of historical revolutions are presented on the monitor. A fast turn will result in a vague blur of images. Pulling backwards, the image of a millstone appears. 'Revolution' can be divided in two different parts: the sculpture (the column, the pushing bar etc.) and the electronics. The technology used is over 15 years old and within the next 10 years one of the components of 'Revolution' (an analogue rotation sensor, an 8086 XT PC, a Sony DLP1500 Laserdisc player and a handmade sample player/interface box) will probably breakdown beyond repair. The PC or laserdisc player may be replaced but the handmade hardware that interfaces audio and sensor data cannot be rebuilt. There is no schematic diagram and no documentation whatsoever. If this installation is to be shown to the public later, the current hardware must be replaced. Preservation of the original components is only a temporary solution; therefore, emulation was explored as a long-term strategy. In addition to in-depth documentation, installation instructions and an artist interview, a precise description of hard- and software, function, and user interaction was made. The content was secured digitally and many aspects of the behavior of the installation were measured and described. To test the validity of this description, an emulation was made in pure data.

GARY HILL'S "SUSPENSION OF DISBELIEF (FOR MARINE):" DOCUMENTATION STRATEGIES FOR TIME-BASED MEDIA

Gwynne Ryan, Assistant Objects Conservator, Museum of Fine Arts, Boston; Jeff Martin, Conservation Research Fellow, the Hirshhorn Museum and Sculpture Garden

Gary Hill's "Suspension of Disbelief (for Marine)" is a major work by a seminal media artist and, like all time-based works, faces complex preservation challenges. These challenges are exacerbated by the fact that the work is co-owned (by the Hirshhorn Museum and Sculpture Garden and the San Francisco Museum of Modern Art), has undergone both a technological retrofit (from laserdisc playback to DVD) and a major structural repair, and utilizes nearly-obsolete playback technology (black-and-white CRT monitors). This paper will examine the documentation that has been generated over the course of the work's life and evaluate this documentation for its relative usefulness in four areas: acquisition, installation, conservation, and loans. The paper will detail the creation of a master conservation document for the work, and will also discuss its documentation in relation to existing initiatives in this area.

RECONSTRUCTING A SIMULATION: ANT FARM AND T.R. UTHCO'S "THE ETERNAL FRAME"

Glenn R. Phillips, Senior Project Specialist and Consulting Curator, Department of Contemporary Programs and Research, Getty Research Institute

Using the J. Paul Getty Museum's recent reconstruction of the 1976 sculpture and video installation "The Eternal Frame" as a case study, this presentation will examine issues surrounding the reconstruction of installation works from archival and photographic evidence. As art of the recent past becomes more and more historicized, there will be increasing interest in re-staging or recreating examples of ephemeral projects. Since most of these projects involve building something new rather than working with an original object, it is likely that many projects will be undertaken outside the stewardship of conservators, being supervised instead by curators and artists or estates. Because of this, it is more important than ever to ensure that the ethics underpinning conservation work become familiar and pervasive within contemporary curatorial practice.

OBJECTS

THE FACULTE "BROADCAST:" A NEW MULTI-MEDIA TOOL FOR CONSERVATORS

Candis Griggs Hakim and Mather Hakim, Griggs Conservation, San Francisco, CA

This talk will introduce a new multi-media communication tool for conservators, the Faculte "broadcast". This web-based software allows the user to create a seamless, narrated, online presentation with any combination of images, voice, text, video, documents, and power points. It allows a conservator or museum professional to easily and precisely describe and highlight condition aspects, conservation options, treatment progress, and more with their clients, lenders, curators, and so on. The software is simple to use and is entirely web-based, precluding the need for cumbersome downloads and emails, hazy faxes, and slow or expensive mailings. Several examples of the software's use in conservation will be presented here.

ARCHAEOLOGICAL METALS STORAGE AT THE SCIENCE MUSEUM OF MINNESOTA

Gretchen Anderson, Conservator, Science Museum of Minnesota, St. Paul, MN

There are times when a low tech solution to a problem is the best way to go. At the Science Museum of Minnesota, we have experimented with passive climate control for archaeological metals. We have developed a storage system that is economical and holds the desired relative humidity, at the same time providing researchers easy access. All of this and more by simply adapting existing storage drawers. Details and plans will be provided.

CLEANING FEATHER BONNETS

Nancy Fonicello, Ancient Artways Studio, Wilsall, MT

A quick method for effectively cleaning sooty and soiled feather bonnets and other feathered objects in museum environments that have limited laboratory facilities.

BLOW IT OFF: MOVING BEYOND COMPRESSED AIR WITH CARBON DIOXIDE (CO_2) SNOW

L. H. (Hugh) Shockey, Jr, Object Conservator, Lunder Conservation Center, Smithsonian American Art Museum, Washington, D.C.

Carbon dioxide (CO_2) snow cleaning is an emerging technology that has advanced significantly in recent years making it an affordable and consumer-friendly surface cleaning method. The technology has been tested and used in critical cleaning applications, such as the removal of surface contamination during production of silicon microchip wafers and precision optical lenses. The application of CO_2 Snow cleaning in conservation has been limited.

Robert Morris' molded plastic sculpture *Model*, 1967 was requested for loan from the Smithsonian American Art Museum's collection. During examination of the work a disfiguring whitish surface haze was readily visible. After careful consideration, CO_2 snow cleaning was chosen as the treatment method to address the surface condition. During the course of treatment CO_2 snow proved to be an effective and efficient method of reducing the appearance of the disfiguring haze without bringing solvent or aqueous cleaning systems to the surface.

The theory, technology, and equipment of CO_2 snow cleaning will be presented along with the method and results from treatment of Robert Morris' *Model*, 1967. CO_2 snow cleaning may provide a useful tool for the conservator's tool box with the potential to address cleaning problems and ongoing maintenance of objects with sensitive surfaces.

MINIATURIZED COLD ATMOSPHERIC PLASMA FOR IMPROVING THE ADHESION PROPERTIES OF PLASTICS IN MODERN ART

Anna Comiotto, Lecturer, Berne University of Applied Sciences, University of the Arts, Department of Conservation and Restoration, Specialization Modern Materials and Media, Berne, Switzerland

Some plastics in works of modern and contemporary art, in particular non-polar polymers like poly(ethylene) and poly(propylene), are known to have insufficient adhesion properties. Due to a lack of surface polarity, they are difficult to wet, their adhesive bonds have limited tensile strength and applied coatings do not possess enough mechanical resilience. As a consequence, durable conservation and restoration treatments (e.g. paint layer consolidation, bonding or retouching) are not applicable. To improve the adhesion properties of non-polar plastics, a pre-treatment is necessary to fit the polymer surface with an artificial polarity. Plasma, also referred to as the fourth state of matter, provides an opportunity to change the chemical composition of non-

polar polymer surfaces. This high-energy ionized gas can create polar chemical groups in polymer surfaces, thereby enhancing their surface polarity. In order to overcome adhesion problems during conservation and restoration treatments on non-polar plastics, within a 2-year research project, a plasma-pen was developed. The plasma can be operated without vacuum at atmospheric pressure, has a sphere of action in the millimetre-range and is tailored to the application on heat sensitive plastics. In this paper, the setup of the developed plasma equipment is described and examination results concerning the effectiveness of this pre-treatment for enhancing the wettability, bondability and coatability of polyethylene (PE), polypropylene (PP) and polystyrene (PS) are presented. Furthermore, experiments for reducing the thermal load during the pre-treatment of heat-sensitive plastics are specified. The effectiveness of this new tool has been proved by bonding PE and PP with the acrylic resin Acryloid B-72, whereas the extent of adhesion improvement was quantified by performing tensile shear tests. Changes in coatability were examined in pull-off tests, carried out on gouache-painted PE and PS. For a better understanding of the caused chemical changes, treated and untreated polymer-surfaces were examined by water contact angle measurements and chemically characterized by infrared spectrometric measurements (FTIR-ATR). The developed plasma-pen seems to be a promising tool in order to overcome adhesion problems during conservation and restoration treatments on non-polar plastics in modern and contempory art. After pre-treatment the strength of all tested adhesive bonds was significantly enhanced. The applied gouache coatings also gained a considerable mechanical resilience; therefore the application of reversible retouchings on hydrophobic plastic surfaces becomes possible. It must be noted, that an important chemical mechanism during plasma treatment is surface-oxidation. Therefore undesirable side effects on the long-term aging properties of the pre-treated polymers, especially concerning their oxidative stability, have to be excluded. First studies considering changes in oxidation stability are in progress and presented here. The aim of these further investigations is to assure a minimal intervention into the artwork's materiality.

KISS AND TELL: THE CONSERVATION OF LIPSTICK-BASED WORK BY RACHEL LACHOWICZ

Elizabeth Homberger, Assistant Conservator, Natural History Museum of Los Angeles County, Los Angeles, CA; Carl Patterson, Director of Conservation, Denver Art Museum, Denver, CO

The recent reinstallation of two lipstick-based sculptural works by artist Rachel Lachowicz, *One Month Late* and *Untitled (Lipstick Urinals)*, provided conservators at the Denver Art Museum a unique opportunity to develop a holistic approach to the works' preservation and installation. This included collaboration with the artist in order to document her techniques and intent, as well as research and materials analysis in order to understand lipstick deterioration mechanisms. This paper will describe the research, treatment, and preventive conservation recommendations for preserving an actively deteriorating and ultimately ephemeral material, and, in doing so, provide information to further the study of the conservation of contemporary art composed of non-art materials.

DISROBING: RESEARCH AND PREVENTIVE CONSERVATION OF PAINTED HIDE ROBES AT THE ETHNOLOGICAL MUSEUM, NATIONAL MUSEUMS BERLIN, GERMANY

Anne Turner Gunnison, MSc in Conservation for Archaeology and Museums, Institute of Archaeology, University College London; Helene Tello, Object Conservator for South- and North American Collections, Department of American Ethnology, Ethnological Museum at the National Museums Berlin, Peter Bolz, Curator for North American Collections, Department of American Ethnology, Ethnological Museum at the National Museums Berlin; Nancy Fonicello, Conservator, Ancient Artways Studio, Wilsall, MT

The North American collections at the Ethnological Museum in Berlin, Germany include a selection of eighteen painted bison and cattle hide robes. Within this collection are seven rare and early examples of bison robes, collected in the 1830s by Prince Maximilian zu Wied on his travels along the Upper Missouri River. Due to their size, the robes present a challenge for the museum to store, exhibit, document, examine, and conserve. For almost twenty years, fourteen of the robes were inappropriately stored, hung from trouser hangers clamped along their edges, in a case with limited access. This method of storage made it difficult to examine the objects for ethnological and conservation research.

An extensive preventive conservation project was undertaken to re-house the robes horizontally on trays, in a purpose-built storage unit. The robes were documented and condition checked. The project also incorporated an in-depth study of a Piegan (Blackfoot) robe collected by Prince Maximilian. This study included identifying the dyes and pigments used in the quillwork and painted iconography, using HPLC and FTIR. Experiments in dyeing quills with native dye material and using these dyes as paint on tanned bison hide were also undertaken.

As pesticide contamination is a prevalent problem in the Ethnological Museum collections, it was decided to identify and quantify the possible chemicals, including chlorine containing compounds like DDT, lindane or PCP and/or heavy metal compounds like mercury(II)-chloride or arsenic trioxide, used on this robe, as well as two others, using GC/MS and ICP/MS. Mercury was found at extremely high levels; this will present enormous problems when these

objects are handled and studied. Current and future work must be carried out under strict protocol, including the use of suitable personal protective clothing.

IT TAKES GUTS

Kelly McHugh, Conservator, National Museum of the American Indian; Kim Cullen Cobb, Conservator, National Museum of Natural History; Michele Austin-Dennehy, Conservator, National Museum of Natural History; Landis Smith, Conservator, National Museum of Natural History, Suitland, MD

The Smithsonian Institution's (SI) National Museum of Natural History and the National Museum of the American Indian are presently involved in a joint loan of approximately 600 objects to the Anchorage museum of History and Culture. These objects are part of a project entitled, "Living Our Cultures", created by the SI's Arctic Studies Center, which will be housed in the new wing of the Anchorage Museum. The premise behind this loan is to increase Alaskan access, knowledge, and use of the SI collections, primarily by Native Alaskans. The loan for these objects is slated for a 12-year duration; however, there will be continual SI object rotation well into the future.

The regional focus of this project provides a distinct opportunity for SI conservators to concentrate, for an extended period of time, on the diverse materials, technologies and histories offered by these artifacts. Eleven cultural groups located throughout Alaska are represented in the exhibit. Currently, we are working on the treatment and preparation of selected objects from the Bering Sea cultures. The dependency on marine mammals for survival is illustrated in the number of artifacts made from the inner and outer skins of whales, seals, walruses, and sea lions. While there is a significant amount of information regarding outer skins, the conservation literature on inner skins is limited.

The unusual properties of gutskin can be somewhat intimidating to conservators working outside the Arctic region, who do not treat it on a regular basis. The opportunity to utilize two large comparative institutional collections, while having access to curators working with Arctic collections, marine mammal biologists, Native Alaskan consultants, contemporary gutskin artists, and conservation scientists prompted us to undertake a comprehensive study of this material in order increase our understanding and inform our treatment decisions. This paper will report on results of our investigation and will hopefully stimulate a cooperative and expanded study with other conservators and artists working with this amazing material.

EXAMINATION OF AN EGYPTIAN CORN MUMMY

Meg Loew Craft, Senior Objects Conservator, Walters Art Museum, Baltimore, MD

For the installation of the Renaissance Chamber of Wonders completed in 2005 and for Mummified, a show opening at the Walters Art Museum in November 2008, a small Egyptian corn mummy was examined and prepared for exhibition. The corn mummy dates from the Late Period, 685-520 B.C. The corn mummy does not contain an animal or human, but is a bundle in the shape of a human mummy made of sand or clay and seeds that is then wrapped in linen bandages. A wax mask of a crowned Osiris was positioned over the "head." The corn mummy was placed in a painted wooden coffin with miniature wax figures representing the four sons of Horus. The corn mummy was used as an offering at festivals and sometimes in burials in association with rebirth and resurrection.

The composition of the corn mummy is complex and analysis was undertaken to identify the materials. FTIR was used to examine the wax mask and a black coating applied over the mummy. XRF was used to identify the pigments on the wax mask and wood coffin. A computed tomography (CT) scan was undertaken at the University of Maryland Department of Medicine to look at the interior of the mummy, its condition and for any amulets that might have been included. The results will be reported and their consequences for treatment and display requirements.

CONSERVATION AT KAMAN KALEHÖYÜK

Alice Boccia Peterakis, Director of Conservation, Kaman Kalehoyuk Excavation, Japanese Institute of Anatolian Archaeology, Turkey

Several research projects that have been carried out in the Conservation Laboratory of the Kaman Kalehöyük excavation in Turkey since 1992 will be presented. Results from 2 projects dealing with the conservation treatment and stabilization of archaeological iron and bronze will be summarized. The new facilities at the site forming an international center for the study of Anatolian archaeology, sponsored by the Japanese Institute of Anatolian Archaeology, will be viewed. Plans for the future of conservation at Kaman Kalehöyük include a renewed annual conservation student internship program, a workshop in 2010 and a conference in 2011 for archaeological conservators.

TECHNOLOGY AS A TOOL FOR ARCHAEOLOGICAL RESEARCH AND ARTIFACT CONSERVATION

Gretchen Anderson, Conservator, and Giovanna Fregni, Conservation Intern, Science Museum of Minnesota, St. Paul, MN

Advances in image and analysis technology have been an immense benefit to the field of museum conservation. X-Ray Refractrometry (XRF), 3D imaging and industrial X-ray/CT scans all provide data through non-destructive and non-invasive analysis.

Recent research at the Science Museum of Minnesota utilized equipment including the Bodelin Proscope HR, the Leica Stereo Explorer, the Next Engine Desktop 3D Scanner and CT scans provided by Northstar Imaging, Inc.. This technology not only provides the conservator with needed analysis of composition and detailed images of surface structure, but equipment such as the Next Engine scanner can create 3 dimensional images of an artifact that can be viewed from a variety of angles and measured without further handling of the artifact. This technology creates virtual duplicates that can be shared, measured and studied by other institutions, thus providing larger data samples for researchers and information for conservators without subjecting artifacts to risks through repeated handling.

CONNECTING MATERIALS SCIENCE AND ENGINEERING WITH ARCHAEOLOGICAL CONSERVATION

Paul Mardikian, Head Conservator, Dr. Stephanie Crette, Research Scientist, Dr. Michael Drews, Director, Nestor Gonzalez, Research Engineer, Johanna Rivero, Assistant Conservator, Claire Tindal, Conservation Intern, Clemson Conservation Center, School of Material Science and Engineering, Clemson University

Innovative thought and scientific exploration are two of the most important tenets embodied by artifact conservation. At the same time, our profession requires extreme caution when implementing new products, techniques, and protocols on non-renewable cultural materials. It is now well accepted that a subtle blending of materials science and conservation may facilitate and establish a negotiation between these two potentially conflicting philosophies. Particularly in the field of archaeological conservation, one has very little hope to make significant progress without the support of a materials science component. It was this reality, as well as the vast conservation challenges presented by the H.L. Hunley Project, that prompted the formation of Clemson Conservation Center in South Carolina. The stabilization of compromised metals and waterlogged organic materials, especially those subjected to wet marine environments for long periods of time, are two common difficulties faced by professionals in the discipline. Several techniques adapted from other applications – one for metals and the other for organics – have been evaluated and successfully applied to the stabilization of archaeological artifacts. These techniques, employing tunable and environmentally responsible solvents, have not only produced stable artifacts thus far, but have also trimmed treatment times down to only a fraction of their previous values. This session will discuss both the subcritical treatment of iron and supercritical treatment of waterlogged cork, as well as the invaluable collaborative process that has greatly contributed to their development.

THE LASER CLEANING OF ANNA HYATT HUNTINGTON'S ALUMINUM SCULPTURE "THE TORCH BEARERS"

Michael Barrett, Applications Engineer, Quantel USA, Bozeman Montana; Andrew Baxter, President, Bronze et al, Richmond Virginia; Mark Lewis, Conservator, Chrysler Museum of Art, Norfolk, Virginia; Scott Nolley, Chief Conservator, Fine Art Conservation of Virginia, Richmond, Virginia

A prolific and innovative American sculptor, Anna Hyatt Huntington (1876-1973) was noted for her large equestrian statues. With her husband, Archer Huntington, the artist helped found 20 museums and wildlife preserves as well as America's first sculpture garden, Brookgreen Gardens in South Carolina.

The second cast of Anna Hyatt Huntington's *The Torch Bearers*, the artist's sculptural symbol of Enlightenment ideals and the effort required for their preservation, was gifted to the city of Norfolk Virginia in 1956. In the letter offering the large multi-figure work to Norfolk, Huntington cited her late husband's long affiliation with Hampton Roads and that his father Collis P. Huntington had founded the Newport News Shipbuilding and Drydock Company.

Fabricated from an aluminum alloy, located outdoors in close proximity to coal yards, industrial facilities, and shipyards and located a few hundred feet from the brackish tidal inlets of the city, the sculpture, cast in this highly reactive metal, had succumbed to continuous exposure in this aggressive environment. The once luminous, "lunar" luster of the sculpture's burnished surface had overtime acquired a substantial accumulation of chemically complex corrosion products that obscured delicate surface detail and tool marks typical to this artist's work. It was considered necessary to reduce these accumulations - layers of substantial thickness that threatened the long-term stability of the form and that remained largely unaffected by reasonable and traditional techniques for surface treatment of the soft aluminum casting.

A Quantel™ Nd:YAG Q-switched laser (Laserblast 60) was employed in the effective and controlled reduction of the layers of corrosion products with considerable success. This presentation will provide a brief historical overview of the artist's aluminum castings and laser technology as it has been employed in the treatment of metal sculpture, a short explanation of the unique reactivity and complex corrosion

chemistry of aluminum when employed as an outdoor sculpture material and the specific methods development and treatment procedures carried out on this particular work.

INNOVATIONS IN EDDY CURRENT ANALYSIS OF METALS FOR HERITAGE PRESERVATION

Curtis Desselles, Northwestern State University of Louisiana; Mary F. Striegel and Jason Church, National Center for Preservation Technology and Training, Natchitoches, LA

In an era of economic uncertainty research laboratories can rarely afford the latest and best instrumentation. Older technologies can be resurrected and improved upon to meet their needs. The use of "eddy currents"—induced currents in metals produced by a coil—has been a valuable tool in the study of defects in metals for over 50 years. In 1999, the National Center for Preservation Technology and Training (NCPTT) funded a study of gilded objects at the Freer Gallery of Art. The study evaluated the use of eddy currents analysis as a means of non-destructive testing of gilded museum objects.

The Freer study used off-the-shelf probes and instruments, created reference test samples, and tested actual museum objects. Blythe McCarthy, project leader, stated "We are excited by the results we have found so far and plan to continue research in several areas". Building on these studies, NCPTT set out to evaluate additional uses for eddy currents within historic preservation. This paper will illustrate that a sensitive handheld metal tester can be constructed for less than $200.00 with commercially comparable features. Possible applications include recovery of marks and serial numbers on museum objects and archaeological artifacts, identification of defects in metals, measurement of surface thickness of gilding and plating, and investigation of corrosion properties.

In the summer of 2008, a handheld metal tester was constructed to investigate the feasibility of producing an economical yet sensitive instrument that could measure eddy currents in ferrous and non-ferrous metals. The instrument circuit is based on five functional units. The input signal is a one megahertz square wave. The tank circuit—a coil and a capacitor—resonates at a frequency of one megahertz. A voltage divider is used to filter and lower the voltage to an acceptable level. The resulting voltage (0-5 volts) is converted by an analog to digital converter circuit (ADC). The digital output of the ADC circuit is displayed graphically and referenced to a database of known samples.

Test results indicated that metals with defects and marks could easily be detected. The recovery of serial numbers and hallmarks on corroded museum objects was successful in the field and laboratory. The measurement of gilding and plating was equal to that of commercial eddy current instrumentation. The handheld metal tester holds much promise and it is economically valuable for research laboratories on a tight budget. This paper should challenge the scientific community to reuse old technology and increase basic research and development.

BIOTECHNOLOGY FOR OBJECTS CONSERVATION

John Scott, President and Conservator of Art and Architecture, New York Conservation Foundation, Inc., New York, NY

As usual, discovery research and technology development for major industries is enabling new adaptations for conservation of cultural heritage materials. A scientific context is presented for consideration of biotechnology for applications in conservation. Qualitative aspects of methods already in use or under development are described and illustrated. Colleagues are encouraged to undertake new research and development.

Reduction, oxidation and chelation chemistries are fundamental not only to traditional aqueous cleaning and finishing, but also to newer biotechnological cleaning and finishing methods. Yet underlying processes are unfamiliar to most end users. I describe relevant science, and developing conservation biotechnology, reporting from a basic survey of relevant research, patent and marketing literature, and from a basic survey of conservation literature, and I describe and illustrate applied tests and test cases.

I briefly describe potentially useful microbes and their externally oriented metabolisms involving reduction, oxidation, or chelation mechanisms. Some microbes derive life process energy in oxidizing or reducing water-soluble ions including copper, iron, sulfates, etc. Some microbes alter their local ecologies by sequestering ions incompatible with their life. In care of heritage materials, such biochemical mechanisms may prove useful to remove metal or metal oxides from surfaces, to remove other mineral encrustations or stains, to redeposit mineral into eroded matrices, or for similar effects

I then describe and illustrate current practical applications of these mechanisms, first the source technologies in mining and other industries. I describe, illustrate and critique a few potentially valuable applications already in use or under development for conservation of cultural heritage.

In copper, iron and gold mining, ores are pulverized and mixed with aqueous slurries of bacteria, i.e., sulfate-reducing bacteria. In the wet paste, bacteria reduce or partly reduce ore minerals, making metal easier to win. The paste is then wash-processed to separate reaction products for further refining. Post-process biochemical residues are considered ecologically much safer than traditional tailings rich in cyanide and other eco-poisons.

Sulfate–reducing bacteria and biosource chelators are also considered very effective in removing rusts from metal equipment and artifacts, with little or none of the collateral corrosion effects caused by traditional acidic derusting methods. For instance biochemical cleaning of life-critical diving hardware is permitted, although non-biochemical ammoniacal and mineral acid or alkaline cleaners are not

permitted. Refining of patinas on metal items can proceed without using even the least aggressive traditional chemical or abrasive media, and sometimes without the need for hot or cold repatination. I also describe other biotechnology applications for cultural heritage in stone and other materials.

I address post treatment stability of treated objects, and issues of ill effects over the long term.

I include a basic bibliography (printed and online sources) to guide readers into the literature and technology.

JOINT SESSION: PAINTINGS AND RESEARCH AND TECHNICAL STUDIES

THE EFFECT OF ACCELERATED AGING AND PIGMENT INTERACTION ON ANTIGENIC DETECTION OF PROTEINACEOUS BINDING MEDIA USING AN IMPROVED PROTOCOL FOR ENZYME-LINKED IMMUNOSORBENT ASSAYS

Philip A. Klausmeyer, Andrew W. Mellon Conservator in Paintings and Conservation Science, Worcester Art Museum; Rita P. Albertson, Chief Conservator, Worcester Art Museum; Birgit Strähle, Samuel H. Kress Fellow in Paintings Conservation, Worcester Art Museum; Robert T. Woodland, Associate Professor of Molecular Genetics and Microbiology, University of Massachusetts Medical School; Madelyn R. Schmidt, Assistant Professor of Molecular Genetics and Microbiology, University of Massachusetts Medical School

Immunological methods of analysis hold great potential for applications within art conservation. In particular, the method of enzyme-linked immunosorbent assay (ELISA) has begun to emerge as a valuable complement, or in some instances an alternative, to well established analytical methods such as GC/MS and FTIR. Until recently, the reliability of ELISA to detect target molecules as they exist in art materials and the effects that aging and pigment interaction have on their antigenic properties received little attention. This present study evaluates the ability of several antibodies to recognize specific proteins within various proteinaceous binding media before and after aging including: egg-based, collagen-based, and milk-based preparations from a variety of species, as well as selected carbohydrates with glycoprotein components such as gum arabic, gum tragacanth, ghatti gum, and cherry gum. Extensive investigations involving mock-ups of traditional paint formulations were conducted to evaluate the impact on antigenic detection following increased exposure to heat and light. In addition, the potential inhibitory effects of 21 different pigments on protein detection were compared. Results from series dilution assays of paint samples suggest that ELISA is indeed a robust and highly sensitive method for analysis of pigmented art materials. Despite findings that indicate accelerated aging, in particular photo-degradation, decreases detection sensitivity, the technique exhibits extremely sensitive detection limits for aged paint samples ranging from less than 1 ng to 2 μg, of paint depending on the type of protein-pigment combination analyzed. The present study also offers an improved ELISA protocol that integrates a signal amplification involving biotinylated secondary antibodies and streptavidin alkaline phosphatase, a technique previously unused in the field. Brief descriptions of a few case studies that employ the improved protocol are included to illustrate the usefulness of the technique and to encourage future research into immunologically-based methods.

OPTIMIZATION OF INFRARED REFLECTOGRAPHY

John. K. Delaney, Andrew W. Mellon Senior Imaging Scientist, Scientific Research Department, Conservation, National Gallery of Art, Washington, DC

Infrared reflectography (IRR) utilizes the decrease in optical scattering and absorbance of paints in the infrared to render visible preparatory sketches and paint changes. Advances in application methods and instrumentation offer conservators a wide array of choices. In this paper a review of the IRR phenomena, cameras and methods will be given to help conservators optimize instrumentation and methods for their specific applications.

The optimization is determined from spectral reflectance measurements of artist materials as well as optical modeling and measurements of the various cameras available (Si CCD, InGaAs, PtSi and InSb). The reflectance spectra from 350 to 2500 nm of the artist materials (paints, grounds and underdrawing material) and test panels help to determine the best spectral region to image a given paint-underdrawing-ground combination as well as the required spectral sensitivity camera. IRR examples showing the level of improved clarity obtained by limiting the spectral band (i.e, 1100 to 1400 nm versus 1500 to 2000 nm) will be given. Detailed modeling and measurements of image sharpness (limiting resolution and modulation transfer function) of various camera and camera lenses with and without spectral filters are also given. Results of controlled sharpening, based on measured modulation transfer function, show level improvements possible by image processing. Experimental results of recent studies into using multi-spectral (3 spectral bands), and hyperspectral (100 spectral bands) infrared cameras are given and show promise to provide further improved visualization of preparatory and paint changes for challenging paintings. By using optimized working methods, spectral filters and post capture image processing good IRR are possible with a variety of cameras.

COMPUTER VISION AND COMPUTER GRAPHICS FOR ART HISTORIANS AND CONSERVATORS: NEW TECHNIQUES, NEW DIRECTIONS

David G. Stork, Chief Scientist, Ricoh Innovations and Consulting Professor, Stanford University

Computer vision is the discipline seeking to make computers "see" or interpret images and in the past few years its methods have been applied to problems in the history and conservation of art. These methods go far beyond mere imaging of art to allow art scholars to analyze visual information too subtle or complex for even visually sophisticated experts. Examples include:

- Wavelet analysis of brush strokes of van Gogh and Perugino, for authentication and conservation.
- Computer correlation analysis of brick work in

Jan van der Heyden's "View" to search for evidence of counterproofing.

• Removal of successive layers of brush strokes in digital photographs of paintings, for instance van Gogh's Self portrait with grey felt hat, to reveal the intermediate stages in the development of the work.

• Dewarping of images depicted in convex mirrors in realist art such as van Eyck's "The Arnolfini Portrait" to reveal new views into the tableau and to reveal artists' working methods.

Computer graphics models of painters' studios allow scholars to simulating "what if" scenarios and reveal artists's working methods. Examples include:

• Scholars can adjust the location of illuminants in computer models of Georges de la Tour's "Christ in the Carpenter's Shop,"Vermeer's "Girl with a Pearl Earring" and Caravaggio's "The Calling of St. Matthew" to determine the number and location of illuminants.

• Computer graphics models of the tableau in Velàzquez's "Las Meninas" as well as the viewer's space allow scholars to "fly through" the space to find sightlines and explore the effects of changing the height of the painting on the museum wall and of viewing positions.

This paper will present some of these new methods, the assumptions underlying their applicability, their strengths and weaknesses, and how they have shed light on questions in history and conservation of art.

ADVANCES IN COMPUTER-ASSISTED CANVAS EXAMINATION: THREAD COUNTING ALGORITHMS

C. Richard Johnson, Jr., Professor, School of Electrical and Computer Engineering, Cornell University; Ella Hendriks, Head, Conservation Department, Van Gogh Museum; Petria Noble, Head Paintings Conservator, Conservation Department, Royal Picture Gallery Mauritshuis; Michiel Franken, Curator of Rembrandt and Rembrandt School, Rijksbureau voor Kunsthistorische Documentatie

Since manual thread counting is tedious, and sometimes beyond the scope of the human eye, techniques developed in the field of computer-based image processing offer new tools to conservators. When processing a scanned image of a painting, the computer can call on a wealth of digital signal processing algorithms to assist in image analysis. One such task is the problem of thread counting from x-ray images of paintings. From the pattern of intensity values exhibited by the x-ray, various signal processing algorithms, such as a Fourier transform, can be applied to infer the nominal period of light to dark and back to light fluctuation exhibited in moving along the centerline of a thread from one crossing thread to the next. The use of such a new tool for thread counting is illustrated in two ongoing canvas examination case studies, one of a seventeenth-century painting the "Saul and David" by Rembrandt and/or studio (Mauritshuis inv. nr. 621) and the other of a nineteenth-century painting "The Bedroom" by Vincent van Gogh (Van Gogh Museum inv. nr. S47 V/1962).

The computer-assisted thread counting scheme produces a much larger archive of thread count data, including meta-data, than can be accumulated in the same time period of examination by traditional manual methods. A computer-based, spot-specific, data archive can also exploit the computer for enhanced visualization, for example by mapping color-coded spot counts onto the x-ray image. This tool has revealed areas of modestly higher (previously undetected) weave density in both case studies that more fully characterize the respective canvases. Standardization of the use of this tool across artists, periods, and museums is also discussed.

THE USE OF SPECTRAL IMAGING AS AN ANALYTICAL TOOL FOR ART CONSERVATION

Roy S. Berns, Richard S. Hunter Professor, Rochester Institute of Technology; Dr. Yonghui Zhao, Color Imaging Scientist, Xerox Corporation; Lawrence A. Taplin, Color Scientist, Rochester Institute of Technology; James Coddington, Agnes Gund Chief Conservator, Museum of Modern Art; Chris McGlinchey, Sally and Michael Gordon Conservation Scientist, Museum of Modern Art ; Dr. Ana Martins, Conservation Scientist, Museum of Modern Art

During the 1970's and early 1980's, visible reflection spectrophotometry was introduced as an analytical tool for art conservation by pioneers W. D. Wright and R. M. Johnston-Feller. During the 1990's, this was extended to imaging where from five to 31 spectral bands were captured using a monochrome sensor and either absorption or interference filters. Initially, the imaging goal was improved color accuracy. With time, the goal expanded to include obtaining spectral data. In our research, we have used an RGB color-filter array sensor with its NIR blocking filter removed and two optimized absorption filters used sequentially, resulting in a pair of RGB images. Through a learning-based calibration, visible spectra are estimated at each pixel. Such a system has cost and resolution advantages. We have used this system for pigment identification, pigment selection for restorative inpainting, pigment mapping (decomposing a work of art into its constituents), lighting design, and digital rejuvenation where images are simulated where pigments that have undergone undesirable color changes (e.g., fading or darkening) are replaced with chromatically stable pigments. This system and these applications will be described in this paper. In particular, we will focus on the analysis of Vincent Van Gogh's *The Starry Night* [Saint Rémy, June 1889; oil on canvas, 29 x 36 1/4" (73.7 x 92.1 cm); acquired through the Lillie P. Bliss Bequest.].

A LOST PAINTING BY VINCENT VAN GOGH VISUALIZED BY SYNCHROTRON RADIATION BASED XRF ELEMENTAL MAPPING

Joris Dik, Associate Professor, Delft University of Technology; Koen Janssens, Universiteit Antwerpen, Antwerp, Belgium; Geert van der Snickt, Universiteit Antwerpen, Antwerp, Belgium; Luuk van der Loeff, Conservator, Kröller-Müller Museum, the Netherlands; Karen Rickers, Deutsches Elektronen-Synchrotron (DESY); Marine Cotte, European Synchrotron Radation Facility (ESRF), Grenoble, France

Vincent van Gogh is best known for his vivid colours, his vibrant painting style and his short, but highly productive career. His productivity is even higher than generally realized, because the artist would often re-use the support of an abandoned painting and paint a new or modified composition on top. These hidden paintings offer a unique and intimate insight into the genesis of his works. Yet, current museum-based imaging tools are unable to properly visualize many of these hidden images. Here, we present the first-time use of Synchrotron radiation based X-ray Fluorescence mapping, applied to visualize a woman's head hidden under the work Patch of Grass by Van Gogh. We recorded decimetre-scale, X-ray fluorescence intensity maps, reflecting the distribution of specific elements in the paint layers. In doing so we succeeded in visualizing the hidden face with unprecedented detail. In particular, the distribution of Hg and Sb in the red and light tones respectively, enabled an approximate colour reconstruction of the flesh tones in the hidden face. This reconstruction proved to be the missing link for the comparison of the hidden face with Van Gogh's known paintings. This approach opens up new vistas in the nondestructive study of hidden paint layers, which applies to the oeuvre of Van Gogh in particular and to Old Master Paintings in general.

PAINTINGS

SIMPLY WHITE - A STUDY OF ROBERT RYMAN'S DIVERSE PAINTING MATERIALS

Rachel Rivenc, Research Lab Associate, Contemporary Art Research, Getty Conservation Institute; Thomas Learner, Senior Scientist, Head of Contemporary Art Research, Getty Conservation Institute; Francesca Esmay, Conservator, Dia Art Foundation; Carol Stringari, Chief Conservator, Solomon R. Guggenheim Museum; Julie Barten, Conservator, Collections and Exhibitions, Solomon R. Guggenheim Museum

Robert Ryman (born in 1930) started to paint his white paintings in the mid 1950s. Within the confines of such an apparently reductive palette, it is interesting to find that he has experimented with almost every conceivable type of paint media, including: oil, polyvinyl acetate, acrylic, casein, gouache and enamel, along with a wide variety of supports. Not surprisingly, his paintings show an enormous variety of finish, gloss, transparency and surface texture. Robert Storr wrote in 1993: "from the outset, Ryman's painterly 'approach' – a favorite word – simply consisted of seeing how his tools and raw materials would behave. Each mark, area, or textural incident tested the characteristics of the pigment, the surface, the brush, or all three simultaneously". Samples from many of Ryman's key works from the collections of the Dia Art Foundation, the Solomon R. Guggenheim Museum, and the artist have been examined and analyzed, focusing mainly on the binding media and support. The analytical study of Ryman's materials, complemented by interviews with the artist, not only gives an invaluable insight into the artist's creative processes, but also provides an excellent test for the analytical methods themselves – given the wide range of media that are potentially present. The combination of the extremely limited pigment range and the high diversity of binding media presents conservators and conservation scientists with a unique opportunity to monitor and compare the handling, aesthetic and ageing properties of a wide range of modern binding media.

A CLOSER LOOK: CONDITION ISSUES IN ABSTRACT EXPRESSIONIST GROUND LAYERS

Dawn Rogala, Postgraduate Fellow, Museum Conservation Institute, Smithsonian Institution; Susan Lake, Director of Collections Management and Chief Conservator, Hirshhorn Museum and Sculpture Garden; Christopher Maines, Conservation Scientist, National Gallery of Art; Marion Mecklenburg, Senior Research Scientist, Museum Conservation Institute

In 2007, the Hirshhorn Museum and Sculpture Garden, Smithsonian Institution, completed an inventory and condition survey of their paintings collection. Of the approximately 4,600 paintings surveyed, a pattern of condition issues surfaced within their mid-century holdings. In collaboration with the Museum Conservation Institute, Smithsonian Institution, a research fellowship was created to take a closer look at the situation.

This research focuses on works from the Abstract Expressionist school, and includes paintings in the HMSG collection by New York artists Willem de Kooning, Hans Hofmann, Franz Kline, and Jackson Pollock, as well as contemporaneous works by European artists Karel Appel and Antonio Saura. Artists were chosen based on similarities in technique and palette (in comparison with stain painting, for example), and the potential for shared information regarding materials. Individual paintings were chosen for the study group based on similarities in condition issues.

Examination of the study group paintings revealed two distinct types of damage: 1) widespread blind cleavage of the cadmium colors, with thin layers of ground attached to lifting paint, and 2) overall, disruptive cracking of black paint, with no associated cleavage. Zinc was detected in all the damaged areas during preliminary *in situ* XRF analysis.

Samples from several works were then examined using microscopy and SEM-EDS, which confirmed high levels of zinc in white paints throughout the study group paintings. In areas of damage, a zinc white layer lay beneath a cadmium color, or a carbon-based black. Py-GC-MS analysis of zinc white paints from the study group indicated unusual levels of unsaturated fatty acids.

The unique response of drying oils to zinc oxide significantly alters the drying processes of paints containing high levels of zinc, resulting in unusually stiff and brittle paint layers. Do the two distinct types of paint failure found in the Hirshhorn's Abstract Expressionist works reflect the comparative strengths of the colored paint layers when attached to a stiff and brittle zinc paint layer? What role is played by the use of a commercial zinc white oil paint in lieu of a traditional ground layer?

This talk will detail the analyses performed on the study group paintings, as well as the comparative analyses of paints from the mechanics study collection at the Museum Conservation Institute. Mechanics testing of representative paints was also performed, and will be included. The implications of this phenomenon will be discussed.

PAINTINGS FROM THE CLYFFORD STILL COLLECTION: CONSERVATION CONCERNS, PHILOSOPHICAL APPROACH, AND TREATMENT STRATEGIES

Barbara A. Ramsay, Director of Conservation Services, ARTEX Fine Art Services

At the 2008 AIC Meeting in Denver, an introduction to the life and work of the American Abstract Expressionist painter, Clyfford Still, was presented along with a glimpse into the artist's little known paintings of the 1930s through 1950s. Still's mysterious art collection and the various conservation efforts that have been centered around it over time were

described. Many of the oil paintings from the Clyfford Still Estate have been undergoing examination and treatment in the ARTEX Conservation Laboratory since 2004.

In this presentation, specific conservation concerns and some of the challenges inherent in preserving these complex modern paintings will be elaborated upon. The conservation philosophy that has been adopted by the team of conservators at ARTEX will be discussed. Most of the paintings examined to date appear to be in astonishingly good physical condition, but those with conservation problems have required treatment of various kinds. Specific examples of conservation treatment will be presented, for example, the reduction of pronounced planar deformation of the previously rolled cotton duck canvases; mounting of the paintings (many oversized canvases) onto stretchers; local consolidation of lifting, flaking, and/or powdery paint (often matte, weakly bound oil paint); and lessening of the appearance of disfiguring surface grime, debris, or paint efflorescence. Our approach will be presented in terms of resolving issues such as: which of the multiple fold lines should be used for mounting of the paintings on stretchers; whether or not to remove, reduce, or otherwise treat severely reticulated and discolored varnishes applied by the artist; whether or not to enhance the saturation of very matte paint according to instructions provided by the artist; whether or not to infill and inpaint losses in these hitherto untouched paintings and, if so, to what extent; and how to best protect these paintings during handling, storage, and travel.

NO-ADHESIVE MEND AND CAST SPRAY-PAINT – A TREATMENT OF A TEAR ON AN ED RUSCHA PAINTING

Kinga Piotrowska, Painting Conservator, Amman+Estabrook Conservation Associates

Combining the artist's technique, and the function of the artwork in a private collection as well as the dramatic damage it was subject to, the painting required an approach that led to a result usually obtained with traditional methods, while avoiding entirely their typical technical impact. Alternatives had to be proposed for structural and esthetic procedures.

An accident resulted in a stair-shaped tear, accompanied by distortion with weave dislodgement, frayed tear edges and paint loss in the area. In the structural phase of the treatment, the goal was to avoid using adhesive, while restoring the integrity of the canvas as painting support. In the esthetic part of the treatment, the challenge consisted of re-creating the uniform, spray-paint quality while working with an extremely absorbent surface.

The treatment was conducted in three phases. Firstly, very prolonged manipulation of the tear edges using various pulling systems and weight was meant to re-align the weave and to bring the tear edges to meet. Secondly the mending of the tear was done in stages of reweaving the threads and simultaneously securing the mend stability, re-connecting individual threads, and introducing a system of Goretex® sutures into the entire area. Ultimately, the in-painting was executed by "manufacturing" droplets of acrylic paint and medium, which were adhered onto the area of the loss.

The goals of the treatment were met within the technical constraints, and without compromising the visual aspect of the painting. New materials, and an alternative application of products known for some time, resulted in a successful treatment of a major problem on a contemporary painting.

THE EMERGENCE OF BRAZILIAN ABSTRACTION AND THE CONSERVATION OF THE LEIRNER COLLECTION AT THE MUSEUM OF FINE ARTS, HOUSTON

Maite Leal, Associate Conservator, Paintings, and Erica E. James, Assistant Conservator, Paintings, Museum of Fine Arts, Houston

In 2007, the Museum of Fine Arts, Houston acquired the Adolphe Leirner Collection of Brazilian Constructive Art. This collection of 98 works of art represent a cross-section of an era of tremendous innovation, the mid-twentieth century in Sao Paolo and Rio de Janeiro. Lygia Clark, Helio Oiticia are among the important artists from this era. These artists believed in abstract forms that were universally accessible. As they developed their art, the artists experimented with new techniques and materials, with movement within the art and interaction with the spectator. These goals were articulated in the Concrete and Neo-Concrete movements, clearly stated in the Neo-Concrete Manifesto of 1959. These movements represented a new aesthetic that moved from strictly rationalist thought to reflect utopian, humanitarian ideals in a time of political uncertainty.

It is during this highly-charged atmosphere, that the Leirner collection was created. The artists were not only experimenting with new forms, they were also experimenting with non-traditional materials. In some cases they were formulating their own paints. We expect that certain commercial materials, such as alkyd and nitrocellulose paints, will be identified in these works. Through understanding the artwork and the context in which it was created, we hope to gain a greater understanding of the deliberate choices in materials made by the artists represented in the collection. This understanding will help to identify appropriate caretaking measures and conservation treatment.

AMERICAN PAINTERS AND VARNISHING: BRITISH, GERMAN, AND FRENCH CONNECTIONS

Lance Mayer, Conservator, and Gay Myers, Conservator, Lyman Allen Museum

Eighteenth- and nineteenth-century American painters were familiar with British, German, and French publications on technique, but they also traveled to Europe and took notes that give insights into both American and European varnishing practices.

For instance, when John Singleton Copley arrived in Britain in the mid-1770s he described the differences between the mastic varnishes that British painters used and the sandarac/alcohol varnish that he had used in Boston. Copley also reported that Benjamin West used a retouching varnish that contained spermaceti. (Gilbert Stuart, who worked with West in London, was later said to have had a particular aversion to retouching varnish because it might turn yellow. Stuart was also "loath to varnish" the white parts of his paintings lest they discolor.)

Thomas Sully visited Britain twice and took notes on British painters' techniques. He was especially interested in the question of overall toning, which he believed was done by both contemporaneous British painters and by the Old Masters. Sully and other Americans wrote lengthy manuscripts that document both European practices and more independent American experimentation with varnishes as unusual as gum tragacanth and animal fat.

By the middle of the nineteenth century, French and German materials were becoming better known in America. For example, Soehnée's retouching varnish (based on shellac) was used in America by about 1850-52, and was recommended as a final varnish toward the end of the nineteenth century. This probably connects with the trend toward thinner varnishes in the second half of the nineteenth century, documented not only in books and periodicals but in a disagreement between John Singer Sargent and Frank Duveneck in 1881 on the proper thickness and gloss of a varnish. Matte varnishes – sometimes based on wax – were mentioned as early as 1890, and with greater frequency by the 1920s.

THE CHANGING FACES OF EVA CALLIMACHI CARTAGI–A PORTRAIT BY HENRI FANTIN LATOUR

Devi Ormond, Paintings Conservator, Van Gogh Museum; Julie Arslanoglu, Associate Research Scientist, The Metropolitan Museum of Art

The Portrait of Eva Callimachi Cartagi (1881) by Henri Fantin-Latour, is a feature work of the Kröller-Müller Museum collection in the Netherlands. In 2005 it arrived at the Getty Museum for possible conservation treatment. Such was the extent of the damage of the painting that it was considered to be a portrait without a face.

As part of the Getty Conservation Guest Scholar Program, a collaborative effort was made between the Kröller-Müller Museum, the Paintings Conservation Department of the Getty Museum and The Getty Conservation Institute to ascertain whether or not the portrait could, through scientific examination, art historical research and conservation treatment, be restored in order to render the sitter's face readable.

The disfigurement to the face was caused by extensive drying cracks resulting in several drastic past conservation campaigns that may have exacerbated rather than solved the problem. These former treatments allowed for the changing nature of practical methods and of ethics within the field of conservation to be brought into discussion.

In an attempt to gain a better understanding of what may have caused this defacement, research into 19th century artist's manuals and recent studies into the techniques of contemporary painters were consulted. Scientific analyses provided valuable results that allowed for a deeper insight into the materials used and applied by Fantin-Latour. This, coupled with the array and diverse documentary evidence, proved to be fundamental both in the understanding of what this painting had experienced during its life time and in the decision making process with regards to its recent conservation.

This paper aims to provide a chronological outline of how Fantin's *Portrait of Eva Callimachi Cartagi* visibly changed from the 20 years after it was painted up until the present day.

SOME OBSERVATIONS ON THE DYNAMIC MECHANICAL PROPERTIES AND GLASS TRANSITION TEMPERATURE (T_g) OF ARTISTS' OIL PAINTS AND SOME CONSERVATION MATERIALS

Alan Phenix, Scientist, Getty Conservation Institute; Thomas Learner, Senior Scientist, Head of Contemporary Art Research, Getty Conservation Institute; Michael Schilling, Senior Scientist, Getty Conservation Institute; Rachel Rivenc, Research Lab Associate, Contemporary Art Research, Getty Conservation Institute

In recent work by our group the technique of Dynamic Mechanical Thermal Analysis (DMA or DMTA) has been used to investigate the dynamic mechanical properties and glass transition temperatures of a range of artists' oil paints: proprietary and laboratory-made; freshly cured and artificially aged. That study showed that, depending on formulation and age, the glass transition temperature (T_g) of the artists' oil paints varied over quite a considerable range, from well below zero °C to up to 40°C. Some paints (those with T_gs below about 20-25°C) were in their rubbery-leathery condition at ambient room temperature, whilst others were well into the glassy state at room temperature. Changes in T_g due to curing and ageing could be monitored quite sensitively by DMA.

The work presented seeks to build on this earlier study by exploring in more depth the potential of DMA, and other related techniques of thermal analysis, to investigate the physical properties of artists' paints and some conservation materials. Particular issues which are being investigated include:

- the softening of artists' oil paints due to immersion in organic solvents and aqueous liquids;
- variations in the mechanical properties of artists' oil paints caused by environmental humidity;
- comparison of glass transition temperature (T_g) values obtained by different methods of thermal analysis: Dynamic Mechanical Analysis (DMA), Thermomechanical Analysis (TMA), Thermogravimetry (TGA) and Differential Scanning Calorimetry (DSC);
- Glass transition temperature (T_g) values of some common conservation materials, especially acrylic and PVAc polymer dispersions;
- The influence of casting solvent on the mechanical properties and T_g of polymer resin films, in particular Paraloid™ B72.

A DELIGHTFUL RESTORATION: THE *TURKISH SMOKING ROOM*, VICTORIA MANSION

Gianfranco Pocobene, Director, Gianfranco Pocobene Studio, Inc.; Lauren Cox, Paintings Conservation Fellow, Straus Center for Conservation, Harvard Art Museum; Richard Wolbers, Associate Professor, Art Conservation Program, University of Delaware

This paper describes the conservation and restoration of the *Turkish Smoking Room*, Victoria Mansion, Portland, Maine. Built as a summer home by Ruggles Morse (a proprietor of luxury hotels in New Orleans) between 1858 and 1860 the Victoria Mansion is the finest existing example of residential design from the pre-Civil War era in America. The original interiors, amongst the most sophisticated and lavish of their time, exemplify the highest aesthetic aspirations in architecture and interior. Built in the Italian villa style, the mansion features interior creations by Gustave Herter, founder of the New York City design firm of Herter Brothers. The Victoria Mansion is the earliest known Herter commission and the only one that remains largely intact. More than ninety percent of the original contents survive, including furniture from the Herter workshops, wall paintings, carpets, lighting fixtures, stained glass, paintings and decorative arts.

The *Turkish Smoking Room* is the first documented smoking room in a private American residence and is decorated with Islamic inspired motifs. Along with the other interior wall decorations, the *Turkish Smoking Room* was created by the artist and decorator Giuseppe Guidicini and assistants. Executed in distemper paints and gilt accents, the wall and ceiling surfaces were consolidated, surface cleaned to remove heavy soot deposits and finally, missing design elements were in-painted and re-instated. Extensive cross-sectional analysis characterized the materials and painting techniques and informed treatment procedures. The presentation will illustrate the notable effects of the cleaning the painted surfaces and re-instatement of gold leaf patterns.

MODERNISM ON THE OHIO RIVER: HISTORY, ANALYSIS, AND CONSERVATION OF SAUL STEINBERG'S *MURAL OF CINCINNATI*

Stephen Bonadies, Chief Conservator and Deputy Director for Collections Management, Virginia Museum of Fine Arts; Wendy Partridge, Associate Paintings Conservator, Intermuseum Conservation Association

In 1947 the artist and illustrator Saul Steinberg received a significant mural commission for the soon to be constructed Terrace Plaza Hotel in Cincinnati. He was asked by John J. Emery, president of Thomas Emery's Sons and developer of this new modernist hotel, to paint a 10' x 80' mural for the main restaurant – the Skyline Room. Emery also commissioned a mural by Joan Miró and a mobile by Alexander Calder for his new hotel designed by Skidmore, Owings & Merrill. The *Mural of Cincinnati* is one of Steinberg's masterpieces, a spatially complex, witty, and joyous view of the city on the Ohio River.

When the Terrace Plaza was sold in 1965 to Conrad Hilton, the Steinberg, Miró, and Calder pieces were donated to the Cincinnati Art Museum. The history and conservation of the Miró mural was presented last year at the Denver meeting by Frederick Wallace and Per Knutas. The Steinberg mural was on view at the museum until the early 1980s when it was moved to storage due to a renovation project. Long popular with the museum's public, the visually compromised mural underwent a major conservation treatment campaign in 2006-2007 supported by a Save America's Treasures grant and timed to coincide with a traveling Steinberg retrospective organized by the Frances Lehman Loeb Center at Vassar College.

This talk will discuss art historical and analytical information about the creation of the mural and Steinberg's working methods uncovered during the course of the project, a second major collaboration between the Cincinnati Art Museum and the ICA. The talk will also address the choices made during the challenging conservation treatment and explore decisions about the mounting and presentation of the large, multi-section mural.

XRF ANALYSIS OF HISTORICAL PAPER IN OPEN BOOKS

Tim Barrett, Research Scientist, University of Iowa, Center for the Book; Robert Shannon, Application Physicist, Bruker AXS; Jennifer Wade, Research Scientist, Library of Congress

XRF analysis of historical paper is made difficult by usually low concentrations of our key elements of interest; Al, K, S, Mg, Fe, Cu and Ca. Quantitative analysis is made more difficult by the wide variation in thickness and density of historical paper specimens. We developed a technique to correct for the variation in paper thickness and density by placing a thin film impregnated with Cr and Br behind the paper specimen. Variations in Cr and Br signal strength and backscatter in a selected region of the spectrum allowed us to generate a 'thickness/density' value that became part of the final calibration. We constructed a special Plexiglas accessory and mounted it to a Bruker handheld instrument to position the Cr/Br thin film in the same location behind paper specimens during calibration and analysis of unknowns.

Using this technique, our calibration allows us to estimate ppm concentrations of K, S, Ca, and Fe with a precision of +/- 20% at a 90% confidence level when concentrations are close to 1000ppm. Precision improves at higher concentrations and is poorer at lower concentrations. Elemental variation must also be considered, as precision is generally better with Ca, due to its high concentration. Fe was present in the calibration specimens in a narrower range making the accuracy outside of this range poorer. The precision for S is not as good as for K due to instrument sensitivity. We believe this level of precision is adequate for documenting trends in the concentrations of alum (potassium aluminum sulfate), Ca compounds, and Fe in hundreds of specimens over the centuries, or for documenting the average concentrations in large collections. However, additional research is necessary before this technique can be used to monitor changes in single artifacts during aqueous treatment.

OBSERVATIONS ON ON-SITE ANALYSIS OF RENAISSANCE BRONZES USING PORTABLE X-RAY FLUORESCENCE SPECTROMETRY

Dylan Smith, Robert H. Smith Research Conservator, Department of Objects Conservation/Department of Sculpture, National Gallery of Art, Washington, DC

In 2006, the Department of Objects Conservation at the National Gallery of Art acquired a Keymaster (now Bruker) Tracer III-V hand-held x-ray fluorescence (XRF) spectrometer. The primary application has been analysis of alloys in Renaissance bronzes, particularly on-site examinations performed in churches and other museum collections. Early testing indicated that the Tracer, as provided, would not provide reliable quantitative analyses for many historical alloys. Starting from the manufacturer's calibration, a custom calibration was developed which would be suitable for assessment of the wide range of alloys found in Renaissance bronzes. Most critical to this process was the incorporation of additional copper alloy standards. Testing of this initial custom calibration at the National Gallery provided quantitative results comparable to those obtained using the more established laboratory-based spectrometers.

Experience with the spectrometer during subsequent research travel has led to reevaluation of the custom calibration and further refinement of working methods. On-site analysis of less typical Renaissance alloys under non-ideal conditions revealed certain weaknesses in the calibration and limitations of the Tracer. These observations have ultimately led to a more robust and reliable calibration. Difficulties on-site have also motivated changes in planning and working strategies to obtain more consistent and dependable data. Three case studies will be presented: analysis of bronzes by Giovanni Bologna on exhibition in Vienna; examination of works by Jacopo Sansovino in San Marco, Venice; and investigation of bronzes by Andrea Briosco (known as Riccio) in the Santo, Padua.

A NEW PORTABLE XRD/XRF INSTRUMENT FOR THE STUDY OF WORKS OF ART

Giacomo Chiari, Chief Scientist, Getty Conservation Institute, Los Angeles; Philippe Sarrazin, InXitu.inc, Mountain View

Non-invasive procedures do not require object sampling. However, they often require transporting the object to the instrument, with significant risks of accidental damage, high insurance cost or impossibility to analyze immovable heritage. Non-invasive, portable instruments that can be taken to the object are therefore highly favored.

A small portable X-Ray Diffraction/Fluorescence instrument (X-Duetto) was jointly developed by the authors. Configured in reflection geometry, it permits analysis of flat or convex surfaces such as mural and easel paintings, salt efflorescence, statues and manuscripts. Obviously for XRD the material has to be crystalline. The instrument head (less than 7 kg in weight) is precisely adjusted at a distance of 2 mm from the surface, using a sturdy tripod, an X-Y-Z stage and laser alignment guides. The positioning is delicate since for XRD the sample needs to be in the focusing plane. A fine X-ray beam, produced by a copper tube and miniature slits illuminates the object at 10° incidence. A 2D CCD detector collects the X-rays scattered in an angular range of 20 to 50° 2θ, and the energy discrimination enables simultaneous XRD and XRF measurements. A power and control unit, packaged in a separate rugged case, includes Li-ion batteries for autonomous operation in the field, a miniature computer for control of the instrument, and a wifi access point for remote operation and data download from any laptop PC. The two units can easily be transported to any remote site.

Usable XRD patterns can be obtained in as little as 5

minutes. The XRF data collected on the same spot can help the phase identification by XRD, especially for quick measurements. X-Duetto has been tested on a variety of samples, including paintings, stone and bronze sculptures, and a red shroud mummy. The most significant case studies will be presented.

WHEN CAN WE RELY ON A HAND-HELD XRF? A CASE STUDY OF GLASS, GLAZE AND METAL COMPOSITIONS FROM GENGHIS KHAN'S BLACK BANNER MILITARY CAMP, KARAKHORAM

Lesley D. Frame, PhD Candidate, Heritage Conservation Science Program, Materials Science and Engineering Department, University of Arizona; Pamela B. Vandiver, Professor, Heritage Conservation Science Program, Materials Science and Engineering Department, University of Arizona; J. Israel Favela, Graduate Student, Heritage Conservation Science Program, Materials Science and Engineering Department, University of Arizona; Meili Yang, Graduate Student, Heritage Conservation Science Program, Materials Science and Engineering Department, University of Arizona

Recent investigation of a variety of objects from Genghis Khan's Black Banner Military Camp in Mongolia has provided insight into the possibilities of using hand-held XRF to examine compositional differences in glass technology. Established in 1220 C.E. and destroyed by fire in 1388 C.E., this camp lies south of the capital at Karakoram and shows remarkable site preservation due to the short rainy season and severe cold. The objects analyzed were selected from the hundreds of surface finds at the site, and they include two Song Dynasty coins, glass beads, glass vessel fragments, tiles, and potsherds. This discussion focuses on (1) the glass and glaze technology as shown by compositional analyses using XRF and SEM-EDS, and (2) the composition of the Song Dynasty coins as compared to published compositions of similar coins from various Chinese contexts.

The XRF measurements were performed with a Niton XLi on the weathered surfaces of the artifacts, and the EDS measurements were taken on polished or fresh fracture surfaces with a Hitachi S-3400N SEM equipped with a Thermo SDD X-ray detector. By employing both hand-held XRF as well as SEM-EDS to examine the composition of these artifacts, we were able to compare the results of these methods. It was found that the use of hand-held XRF is adequate for objects with this degree of preservation when examining broad compositional trends, but compositional variation and low-concentration elements are difficult or impossible to discern.

The glass technology was found to consist of both a local technology, represented by the glazes and glass vessels, and a foreign technology, represented by the glass beads that are similar to the beads of Afghanistan, Iran, and the Eastern Mediterranean. The coins were not characteristic of other examples of Song Dynasty coins, which typically contain higher amounts of lead.

HANDHELD XRF ANALYSIS OF WRITTEN MATERIAL FROM THE UNITED STATES HOLOCAUST MEMORIAL MUSEUM ARCHIVES

Lynn Brostoff, Research Chemist, Preservation Research and Testing Division, Library of Congress; Jennifer Wade, Research Scientist, Preservation Research and Testing Division, Library of Congress; Jane Klinger, Chief Conservator, United States Holocaust Memorial Museum

This paper describes the use of handheld X-ray fluorescence (XRF) as a tool in the initial examination and analysis of inks. The United States Holocaust Memorial Museum (USHMM) is one of the largest repositories of artifacts and records relating to the Holocaust period. Included in the collections are many materials that were produced clandestinely while authors were in concentration camps, ghettos, or in hiding. Of particular interest are personal diaries and cookbooks, which reflect events of the Holocaust, everyday life, and culture and traditions that victims sought to record. Visual inspection of artifacts suggests that in some cases, inks appear to undergo changes that may reflect the author's condition, as well as the increasing difficulty of obtaining writing media. Anecdotal evidence indicates that as writing and drawing materials became scarce, commercial products were diluted or mixed to extend their useful life; home-made mixtures were also produced with available materials. The composition of the inks and writing materials is therefore of interest in terms of both historical and information content. Furthermore, in order to develop sound conservation treatment protocols for the Holocaust artifacts, it is important to understand the nature of the writing media.

Three contemporary and geographically-related objects were chosen for initial study, including: 1) a censored postcard sent by a prisoner from Therezanstadt, a camp in former Czechoslovakia; 2) a cookbook written by female inmates of Therezanstadt; and 3) a series of diaries by Otto Wolf, a Jewish teenager who was hiding in the forests of the former Czechoslovakia from about 1942-1944. The preliminary investigation focused on use of a Bruker Tracer III-IV handheld XRF spectrometer as an *in situ* screening tool to qualitatively examine ink compositions. The XRF beam settings for most spectra were 15 kV, 25 μA, a 1 mil Ti filter, and vacuum pumping. In this way, the instrument was optimized for analysis of ink on paper, i.e., for relatively thin substrates and films, and for elements between aluminum (Al) iron and (Fe), but including magnesium (Mg), nickel (Ni) and copper (Cu). When elements above Cu were suspected to be present, the instrument was run at 40 kV, 7 μA, and with a Cu-Ti-Al filter. The study shows how elemental information from XRF can aid ink classification, provide clues to the

identity and source of the writing materials within one or multiple objects, and also guide decisions about further directions for analytical study and conservation treatment.

A STATISTICAL COMPARISON OF RANDOM ERROR IN XRF INSTRUMENTS

David R. Smith, Associate Conservation Scientist, Arizona State Museum, University of Arizona, Tucson, Arizona

As the applications of handheld XRF equipment in the conservation of works of art increases, there is a continuing need to understand the fundamental meaning of the measurements that are being made. In addition the continuing development of the handheld XRF equipment has resulted in improvements in instruments. There is a need to compare the results from older radioactive source instruments with the results from the newer x-ray tube instruments. This need is driven by the changing availability of the instruments and the need to build on earlier studies.

Instrument studies at the Arizona State Museum Laboratory presenting the results of comparison testing of three instruments to develop an understanding of the random error associated with the instruments and with the spatial analysis of samples will be presented. The subject of the study is a glass beaded object that allows for repeat analyses to compare instruments. The instruments that were studied were the Niton® 753 cadmium source instrument, the Niton® x-ray tube instrument and the Bruker ® x-ray tube instrument. The results obtained and the associated error will be compared for each instrument. In addition the results of the measurements of multiple different areas of the same sample will be used to develop an understanding of the underlying reasons for the error

STRATIGRAPHY OF WALL PAINTINGS BY THE NMR MOUSE

Eleonora del Federico, Victoria Boardman, Licio Isolani, Pratt Institute, Brooklyn, New York; Bernhard Blümich, Agnes Haber, Maria Baias, Federico Casanova, Institute of Technical and Macromolecular Chemistry, RWTH Aachen University, Germany

Nuclear Magnetic Resonance (NMR) [1] is a phenomenon well known in clinical diagnostics and chemical analysis. Due to large superconducting magnets, the equipment is heavy, and the analysis is conducted at the site of the instrument. With the development of small mobile NMR sensors and spectrometers [2], a wide variety of new investigations becomes possible, as the analysis can now be conducted at the site of the object. The NMR-MOUSE is a mobile and open, single-sided sensor with a sensitive volume located a given distance away from the sensor [3]. This sensor has been employed to characterize moisture content and porosity of building materials including wall paintings, and it has been used to monitor wetting and drying cycles of materials exposed to moisture. In particular, surface modifications by coatings can be assessed. Depth profiles through layered materials acquired at different times after exposure to surface moisture reveal the moisture propagation into the material and the barrier properties of the interfaces between different layers. On a laboratory specimen it has been demonstrated that the NMR-MOUSE is a suitable tool to reconstruct details of hidden secco paintings covered underneath an imprimatura of up to 10 mm depth. Results on the measurements performed on a historical Italian building during the summer of 2008 will be presented

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VISIBLE AND NEAR INFRARED HYPERSPECTRAL IMAGING OF HISTORICAL DOCUMENTS

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Hyperspectral imaging combines digital imaging with spectroscopy. Images are collected over a range of wavelengths with reasonably high resolution (10 nm or less). The result is a 2-dimensional spatial image with spectral information in a third dimension. Data is stored as a single file (image cube) which allows the researcher to view single wavelength images of historical documents.

For our work two Nuance imaging systems were used. Both cameras were equipped with charge coupled device detectors and liquid crystal tunable filters for wavelength selection. The visible camera acquired images from 420 to 720 nm at 10 nm intervals and the near IR camera was capable of acquired images from 650 to 1100 nm at 10 nm intervals. Spectral information was obtained in reflectance mode by placing a light source at a 45° angle relative to the object and the imaging camera.

In one project, properties of ink migration were studies in two historical treaties that were housed in the Preservation Centre (Library and Archives Canada). Visible imaging was useful for assessing the degree of iron ink migration as well

as ink diffusion from a decorative red ink (eosine). A second project focused on the evaluation and assessment of stains in other historical documents (Haggadah). Wine stains have a much higher absorbance at shorter wavelengths (420 nm) than longer wavelengths and therefore, single wavelength images can be powerful tools for determining the degree of staining on a given surface. Hyperspectral imaging of iron gall inks that have undergone aqueous stabilization treatments were also assessed using visible hyperspectral imaging. Both ultraviolet (365 nm) and visible light sources provided useful reflectance images for examining iron gall ink that had been exposed to elevated heat, humidity and ultraviolet light.

THE EFFECT OF ENVIRONMENTAL DETERIOGENS ON THE ELISA ANALYSIS OF ORGANIC MEDIA USED IN WALL PAINTINGS

Joy Mazurek, Associate Scientist, Getty Conservation Institute; Jennifer Porter, Mellon Fellow, Conservation Research, Los Angeles County Museum of Art

Over the last fifty years, enzyme linked immunosorbent assay (ELISA) has been sporadically investigated in conservation for the analysis of organic media in works of art. Recently, a full protocol for the analysis of four of the most common binding media (animal glue, egg, casein, plant gums) was developed by scientists at the Getty Conservation Institute. While ELISA is able to identify classes of proteins within mixtures, is relatively inexpensive, does not require sophisticated instrumentation, and has been successfully used in the analysis of many works of art, it can yield false negatives. This means that it fails to detect the presence of media where more established methods of organic analysis such as GC-MS succeed. Therefore, before ELISA can be accepted as a reliable method of organic analysis for the conservation field, the possible causes of false negatives need to be systematically explored.

Though many parameters remain to be examined, recent analysis has suggested that environmental deteriogens may be key causes of false negative results in the ELISA analysis of wall painting samples. The current study focused on the effects of two common environmental causes of deterioration in wall paintings, light exposure and fluctuating relative humidity. Samples of four typical binders (whole egg, animal glue, gum arabic and casein) were chosen for exposure to both light and cycled humidity separately, and analyzed using ELISA. The results of the tests clearly show that immunological activity, and therefore ELISA detection, is adversely affected by environmental deteriogens, clarifying one possible cause of false negatives, and suggesting that certain types of samples might be more appropriate for immunoanalysis than others. The results also point the way for further research in the development of ELISA as a reliable method of organic analysis.

POLYNOMIAL TEXTURE MAPPING (PTM): ADAPTATION TO THE MICROSCOPE

Giacomo Chiari, Chief Scientist, Getty Conservation Institute, Los Angeles

PTM is a technique wildly applied to document details of a surface texture. One takes many pictures (30-50) with a steady camera and light coming from different directions. Raking light illumination is particularly useful to enhance texture. The programs needed can be freely downloaded from Hewlet Packard Laboratories (www.hpl.hp.com). The images are combined so that by moving the mouse on the screen, one can change the light direction on the object. A dynamic view of the surface is obtained, to be compared with the one produced after change has occurred (aging, varnish removal, consolidation treatments etc.).

The light direction for each picture needs to be precisely specified. Different approaches have been applied, all giving excellent results, but sometimes resulting in cumbersome gadgetry. Typically, the light source is fixed to a support, movable or having a large number of light positions. A less precise but more practical solution is to insert a shiny ball in the picture field and to calculate the light directions from the position of the spot reflected from the ball. This process can easily be carried out in the field, even in full daylight. The hardware is reduced to a camera on a stand, a flashlight synchronized with the camera, and a shiny ball of the proper dimensions compared to the object to be documented.

PTM can also be carried out using a microscope. The size of the ball must of course be very small to occupy a fraction of the picture only. The tip of fine ball-point pens would do it. The microscope can be mounted on a turntable and the light positioned at the proper angles. Examples using free hand positioning of the flash (or just a torch light) will be presented for mural paintings, stuccoes, rock art and mosaics, together with microscope applications.

EVALUATION OF PROCION MX, DYLON COLD WATER DYES, AND COLORHUE INSTANT SET SILK DYES FOR USE IN TEXTILE CONSERVATION

Yoonjo Lee, Andrew W. Mellon Fellow, Frank Preusser, Senior Research Scientist, Terry Schaeffer, Chemical Hygiene Officer, Charlotte Eng, Associate Research Scientist, Los Angeles County Museum of Art

Three commercially available dyes were tested for their ability to meet the performance standards of Lanaset and Solophenyl dyes familiar to most textile conservators. Procion MX, Dylon Cold Water Dyes, and Colorhue Instant Set Silk Dyes were chosen for their cost-effectiveness, ease of use and low toxicity. Procion MX and Dylon Cold Water Dyes were also chosen for their ability to dye both cotton and silk fibers. Red, blue and yellow dyes of each product

with the exception of the appropriate Dylon Cold Water red dye, which was not available at the time, were used to dye samples cut from Testfabrics cotton and silk samples according to the manufacturers' instructions. The samples were tested for acid off-gassing, washfastness and lightfastness. Each sample was tested first for off-gassing using IPI-acid detection strips in direct contact with the samples. Samples were then tested with a micro-fading tester before and after immersion washing with Orvus surfactant. The color was also measured before and after washing with a handheld abridged spectrophotometer (Minolta- 2600d). All samples passed the IPI acid and washfastness test. The results from the micro-fading tests suggest that the Colorhue Instant Set Silk Dyes had poor lightfastness qualities. Many of the other samples were moderately stable to stable as compared to ISO blue wool standards. Some dye textile combinations responded atypically to the fading tests. They will require further testing by long-term exposure of samples to gallery light conditions. The light-fastness of all samples benefited from washing with suitable surfactant.

THE ARCHAIC MARK CODEX: A COLLABORATIVE STUDY IN AUTHENTICATION

Joseph G. Barabe, Senior Research Microscopist, McCrone Associates; Christine McCarthy, Former Head of Conservation, University of Chicago Library Special Collections; Currently Chief Conservator, Yale University Library; Margaret M. Mitchell, Professor of New Testament and Early Christian Literature, University of Chicago Divinity School; Abigail B. Quandt, Head of Book and Paper Conservation, The Walters Art Museum

If authentic, an illuminated manuscript known as "Archaic Mark" held by the University of Chicago would be an important witness to the earliest text of The Gospel according to Mark. This small, possibly 14th century codex, which came to scholars' attention in the 1930s, is closer than any known manuscript to the text of Vaticanus, a major fourth century manuscript of the Greek Bible.

From early in its history, there were doubts, not only about the precise dating of the codex, but also its authenticity. A number of earlier, partial studies (e.g. Orna, 1989) supported those doubts. For this reason, it was decided that a thorough chemical analysis of all the physical features of the codex should be performed to settle the matter definitively. To this end, a codicological study of the manuscript was performed by Abigail Quandt, and microscopic and chemical analyses of the materials were conducted at McCrone. Also, portions of parchment from non-image and non-textual areas were taken for radiocarbon dating.

Analysis of the materials definitively indicated the presence of materials not available in the 14th century, but consistent with the late 19th or early 20th centuries. The collaboration between scholar, conservator and scientist proved to be especially fortuitous, bringing clear answers to questions of long duration.

TEXTILES

AN ALTERNATE APPROACH FOR CARPET CLEANING

Deborah Lee Trupin, Textile Conservator, New York State Office of Parks, Recreation and Historic Preservation

A large, heavy, wool pile on cotton warp and weft carpet from Mrs. Mills's boudoir (office) at Staatsburgh State Historic Site had red dye-bleeding stains from a previous non-conservation cleaning and was heavily soiled from old coal soot. As the boudoir is being restored, the carpet needed cleaning. Because of the earlier bleeding and the weight of the carpet, I was not willing to wet-clean it.

After discussions with a specialized carpet cleaner about collaborating on this project did not prove fruitful, I called Cristina Carr at The Metropolitan Museum, thinking that she might have ideas for a cleaner who might be more cooperative. Instead, she referred me to Tina Kane, who works at The Metropolitan Museum and has her own textile conservation practice, specializing in tapestries and rugs. Tina described a cleaning method using the Bissell "Big Green Clean Machine" that she had used for similar projects. She said she had learned about the machine and its conservation applications from Ronnee Barnett, a conservator in private practice in the Hudson Valley, and Nancy Britton, upholstery conservator at The Metropolitan Museum. I asked Tina to come to Peebles Island to try this tool and her techniques with us. Much to my surprise and pleasure, we found this to be a rather successful treatment for the carpet.

The "Big Green Clean Machine" is a wet/dry vacuum that was marketed to consumers for home floor, rug, and upholstery cleaning. Although the machine is no longer made, it can be purchased used. Its use in conservation is a slight variation on the home methods. It is essentially an alternative to, or variation of, other non-immersion and/or suction cleaning techniques used by textile conservators. While not appropriate for every object, "Big Green Clean Machine" may prove useful for other conservators. This "tip" presentation (10-15 minutes) will describe and illustrate the techniques used.

DIGITIZATION VIDEO OF CHINESE LAST EMPIRE DRESS CODE

Dr. Shu Hwa Lin, Assistant Professor, University of Hawai'i, Manoa

This project involves the production of an educational documentary DVD entitled, *Threads of Majesty: Tapestry and Embroidery for Ranking Qing Dynasty Officials*. This DVD will display Chinese textiles from the Q'ing Dynasty, which have been donated to the University of Hawai'i at Manoa and talk about their significance in terms of rank and symbolism. This DVD will demonstrate how complex the dress of the Qing Dynasty was by giving the viewers a visual presentation of the different garments that were worn. This DVD will also explain the different symbols, motifs, color patterns, and textile techniques, and how they can be interpreted to give us a better understanding about the important themes, beliefs, and ways of life during this time. This documentary will result in increased understanding and appreciation of this part of Chinese history. The reason behind preserving these artifacts in DVD form is because of their age and condition. These artifacts were brought to Hawai'i at least one hundred years ago and have suffered noticeable deterioration due to the humid climate of Hawai'i. The production of this DVD will preserve these artifacts in their current condition which will allow people to view, study and learn about them for many years to come.

USE OF GEL POULTICES FOR ADHESIVE REMOVAL

Maya Naunton, Assistant Conservator, Textile Conservation, The Metropolitan Museum of Art

Extracting adhesive residue, especially if it has to be done in a localized manner, is an ongoing challenge in textile conservation. Because textiles are composed of porous fibers, usually twisted into yarns, the adhesive becomes deposited not only on the surface of the object, but in all the interstices, making it difficult to remove.

Poultices, which work by dissolving (or softening) the adhesive and then drawing it out of the textile, have been used to address this problem before. However, poultice residues on the object always remain a concern. Recently, some paper conservators have been working with poultices that have Jell-O-like consistency and that prompted me to experiment with this approach on textiles, using methyl cellulose as the absorbent material.

In this technique, methyl cellulose is mixed with water to obtain the desired consistency. The pH of the resulting gel (around 6, as measured by pH strips) can be altered, at will, with addition of buffering agents. The poultice can be used as is, or other active ingredients, such as solvents, can be added. The dampness of the gel can also be varied by using more or less water and/or other solvents.

The poultice, when ready to be used, is spread on a smooth surface, such as a sheet of Plexiglas. It can then be cut to shape and removed in a thin sheet.

The gel can be used directly on the object or a barrier can be placed between the poultice and the object. To date, use of this poultice resulted in substantial adhesive residue reduction, as determined by examination under microscope.

APPLICATION OF DIGITAL IMAGE CORRELATION TO TAPESTRY AND TEXTILE CONDITION ASSESSMENT

Williams, H.R., Dulieu-Barton, J.M., Chambers, A.R., School of Engineering Sciences, University of Southampton, United Kingdom; Lennard, F, Eastop, D., Textile Conservation Centre, University of Southampton, United Kingdom

Tapestries and large wall hangings are subject to stress imposed by their own weight during prolonged periods of display, with the effects of mechanical strain yet to be widely studied.

The primary aim of this research is to develop a non-destructive technique for quantifying this mechanical strain before any deleterious effects to the tapestry are visible. Although damage related to long-term display is almost inevitable, the development of a monitoring system would inform decision-making about conservation interventions as well as enhancing understanding of the effects of environmental changes.

Current experimental work applies whole-field non-contact strain measurement techniques to tapestries. The data gathered allows the relationship of material properties and behaviour at the micro-scale (fibres and yarns) to be compared with the behaviour of a tapestry as a whole, and also allows comparisons with more widely understood "engineering materials". The data will be used to develop a tapestry degradation model.

The technique used is Digital Image Correlation which uses digital images to create a three-dimensional model of a surface, from which mechanical strain can be extracted. The technique has been verified to ensure it gives accurate and precise measurements of displacement and strain by applying the procedure to engineering materials, specifically single-ply woven glass fibre composites, and a representative woven material.

Using a specially designed loading rig, tapestry specimens are monitored to study the effect of loading upon the weave structure and discontinuities that commonly feature in historic tapestries, such as slits and weft thread joins.

The system is innovative, adaptable and it is envisaged that it will also be capable of evaluating and quantifying the performance of any conservation treatments that a historical textile may undergo.

THIRTY YEARS OF MICROSCOPE IMAGING TECHNOLOGIES FOR EXAMINATION AND DOCUMENTATION OF TEXTILES IN THE TEXTILE CONSERVATION DEPARTMENT, THE METROPOLITAN MUSEUM OF ART

Elena Phipps, Senior Museum Conservator, and Min Sun Hwang, Assistant Conservator, The Metropolitan Museum of Art

Macro- and micro-scale images (from 0.5-1000x) are critical for the documentation, study and conservation of the textiles. Since 1978 when the Textile Conservation Department, under the direction of Nobuko Kajitani purchased its first video camera for the lab's stereo-zoom microscope, the constant search for the appropriate tools for examination, capture and storage of images has been a continuous endeavor.

Previously, 35mm camera attachments to microscopes were cumbersome and infrequently used. However, color slides and black and white film taken during the 1960s and 70s remain today as part of the permanent record, unlike some of the intermediary video and digital formats used since then. (This paper will not address the archiving of these materials, but notes the critical impermanence of digital media as a whole, and the urgent need for addressing this in the field.)

With these evolving technologies, the struggle to define the requirements and expectations of new and composite systems for a working conservation lab is a challenge. Applications range from identification of materials (fibers, yarn composition), documentation of weave structure and other technical characteristics, characterization of surface soils and fabric composition features and treatment activity: these all require not only different levels of magnification but also different sets of equipment to accommodate various working heights, viewing methods and capture devices.

The paper will focus on the evolution and development of systems for examining textiles that incorporated film, video and digital imaging technologies in the context of the department's efforts to create and improve methods for the examination, documentation and preservation of the Museum's textile collection.

UPDATE: DETERGENTS AND AQUEOUS CLEANING OF TEXTILES

Mary W. Ballard, Senior Textiles Conservator, Smithsonian Museum Conservation Institute

The European Union has curtailed the use of nonyl phenyl ethoxylates. In the United States, octyl phenyl ethoxylates have also been questioned for their safety to humans and for their waste products. Yet the search for substitutions have led to cleaning agents designed for metal, glass, and nonabsorbent plastics in specialized industrial settings: dairies and breweries. How did we get so far afield?

How effective are these products? The current study will review the current legislation and examine the efficacy of potential choices, nonionic and anionic.

THE CLEANING OF AN 18TH CENTURY FINGER WOVEN WOOL SASH: A PRACTICAL TWIST ON COMMON WET CLEANING METHODS

Catalina Hernandez, Andrew W. Mellon Conservation Fellow and Susan Heald, Senior Textile Conservator, Smithsonian Institution's National Museum of the American Indian

During the 2007 North American Textile Conservation Conference (NATCC) in Washington DC, Richard Wolbers, paintings conservator at the University of Delaware, presented the workshop "Aqueous Cleaning Methods." Part I of the workshop emphasized the benefits of using buffers to control pH, chelating agents to chemically bind metal ions in the soil components, and salt to match the conductivity level of the textile being treated as a potentially more efficient and safer method for soil removal than the use of a surfactant solution alone. Based on this methodology, an 18th century wool finger-woven sash from the Great Lakes region was wet-cleaned at the National Museum of the American Indian's conservation lab. It had heavy soiling from long-term exhibition and degraded fibers that were too fragile to be submerged in a wash bath. After careful consideration it was determined that an aqueous cleaning solution containing a pH adjusted citric acid chelating agent, followed by a sodium chloride salt solution sprayed and blotted from the textile for rinsing, would provide a safer and more controllable method of soil removal than the traditional submersion in a surfactant bath followed by several rinses. The treatment resulted in substantial soil reduction, a brighter appearance, and an improved hand – which had been gritty and stiff prior to wet cleaning. This paper will describe the aspects that were taken into consideration before, during and after the treatment process and the techniques and materials used.

REMOVAL OF SOME OLD RESINS FROM ANCIENT PILE TEXTILES, APPLIED STUDY ON A TURKISH RUG

Dr. Mohamed Marouf, Assistant Professor, Sohag University, Faculty of Arts Conservation Dept., Egypt; M. Saber, Textiles Conservator, Egyptian Museum in Cairo, Egypt

Natural resins such as animal glue, casein, starch, gum Arabic, gelatin, beeswax, paraffin wax and shellac can often be found on old textiles in the form of adhesives. Also, man-made resins such as cellulose nitrate, polyvinyl alcohol, polyvinyl butyral, polyvinyl acetate, and polyacrylates are used for many purposes in the conservation of archaeological textiles as a consolidates, adhesives, supports, display and storage materials. All these resins have many physical and chemical changes many years after application on textile, or even after a short time according to the type of resin, the application method, and the surrounding environmental conditions e.g. (light, temperature, air pollution, and relative humidity). Also, the chemical and physical changes depend on the molecular structure of these resins, absorbed photons energy and chemical/physical effects of the added materials. These changes can occur in several forms such as rigidity, shrinkage, brittleness, and yellowing, due to decrease of the flexibility, tensile strength properties, and increase of the acidic or alkaline effects on the treated textiles due to their aged condition.

This paper relates the studies done on the degradation aspects of textiles previously treated with resins (natural and synthetic). Of special interest were the support layers of pile textiles such as rugs. An applied analysis of the most important Turkish rugs at Al Gazera Museum in Cairo, involved the use of X-ray fluorescence (XRF) with scanning electron microscopy (SEM). These methods were used to obtain good diagnostics results and interpretations for all degradation aspects. In addition, this study examined suitable methods to remove the support layers from the rug. The experimental and applied study achieved several important results to determine which solvents can be used to remove old unsuitable from old textiles.

DESIGNING WORKSPACES

Patricia Ewer, Textile Conservator, Textile Objects Conservation, Minneapolis, Minnesota

In line with AIC Annual Meeting Theme of *Conservation 2.0–New Directions* I suggested that the Textile Specialty Group address the topic of new conservation labs and storage. We have been very fortunate that many conservation departments have recently acquired new work spaces. This is a topic that is very timely as there is much interest within AIC membership for this type of information, and I am pleased at the response my colleagues gave to this subject by submitting a number of excellent papers.

I had the opportunity of creating or enhancing an existing a conservation lab/workroom in designated areas while working at Biltmore House, a challenge in an historic structure. At one point during my tenure at Biltmore Company I was charged with researching the costs of a purpose built structure to house collections storage, a collections processing center and all the conservation labs. This is where my interest began on this topic. I spent a year doing this research and amassed a great body of information. It was a great experience to think you could design the "ideal."

Then before I started at Midwest Art Conservation Center they were in the planning stages for a new conservation facility and I was able to design the space there within the limits of the physical space we were being offered.

We have a lot of models for storage, but how do we "design" our workspaces? What are our references? I will

show models of related workspaces as an introduction to this discussion. There will be six papers on the topic, followed by a panel discussion to answer more questions. Some of these labs are no longer "new" so an evaluation of the design after time will be informative.

TEXTILE CONSERVATION TREATMENTS IN A NEW SPACE

Harold Mailand, Director, Textile Conservation Services, Indianapolis, Indiana

After 21 years of treating textiles and costumes in the lower level of my live/work space, new contractual agreements forced a move. The perfect space had been sought for years: 2,500 square feet, skylights, 14 feet high walls, no interior walls or columns, and secure yet accessible. Sometimes the solution is not a dream fulfilled but a practical space hidden in plain sight. Both passion and deadlines can be partners for change.

In October 2007 an oddly shaped space of about 900 square feet was found two blocks away. After extensive changes to water and HVAC systems; resurfacing walls; adding 14 feet long storage shelves; designing a staff/guest service area; and hanging inspirational textiles; the space was up and going with the emphasis on mobility and change. I could now leap into the air and not hit my head.

The following 12 months allowed for the successful treatment of seven tapestries, a pro football jersey, five shattered silk costumes, a severely damaged flag, eight Katrina-damaged embroideries, a Native American wearing blanket, and the documentation of a private collection. This "perfect" space brought together four part-time technicians and two summer interns to work together on a 24-7 basis. Meanwhile I could return to my old lab to organize years of records, write lectures, and pursue research.

THE LIBRARY OF CONGRESS: RENOVATING THE PRESERVATION RESEARCH AND TESTING DIVISION

Fenella G. France, PhD MBA, Research Chemist, Preservation Research and Testing Division, Library of Congress

The Library of Congress Preservation Research and Testing Division is currently undergoing major laboratory renovations. The two main laboratories G52 and SB27 comprise the Chemical and Physical Testing and Optical Laboratories respectively and are being upgraded, remodeled and expanded in instrumentation to address the preservation needs of the Library collection. Close collaboration with the Facilities, Design and Construction Department as well as the Architect of the Capitol have been required to meet stringent safety and building requirements for laboratories in a building where this is an activity different to the norm. The Library of Congress has a large and diverse collection of over 130 million items ranging from balloon cloths to modern media and this scale of objects and object types challenges the capacity of any laboratory in both size and complexity. The essential materials science studies of this range of composite materials has led to the final planned space of approximately 9000 square feet that allows an extensive range of research capabilities, specialized conditioned room and reference collection space. The issues and challenges faced during this renovation process will be discussed.

NEW LAB SPACE, NEW DE YOUNG

Sarah Gates, Head of Textile Conservation, and Beth Szuhay, Textile Conservator, Fine Arts Museums of San Francisco, de Young Museum

The new de Young Museum in San Francisco, California, reopened October 5, 2005. Included is an almost 3000 square foot textile conservation lab with separate dry, wet and dye rooms. The growing permanent collection is comprised of 13,000 textiles including costumes, monumental European tapestries and carpets. This paper will review the questions asked and decisions made about the lab space in regards to the needs of the collection. This paper will also discuss the positives and negatives of the resulting space after more than ten years of research, negotiation and compromises.

TRADING PLACES: THE NEW GABRIELLA AND LEO BERANEK TEXTILE CONSERVATION LABORATORY AT THE MUSEUM OF FINE ARTS, BOSTON

Meredith Montague, Conservator, Museum of Fine Arts, Boston

In June 2005, the MFA textile conservation staff moved into renovated laboratory facilities in spaces previously utilized by the Museum's Main Library. The move, which included relocation of textile storage, curatorial offices and study room, was part of a master plan that would empty the entire east wing of the Museum in preparation for demolition and construction of a new wing for American art. Planning for the new facilities took place intermittently over a five year period concurrent with a full schedule of exhibition programming.

Having occupied the space for three years, an informative critique of the lab will be detailed. With the perspective of time and a working knowledge of the facility; the design, planning, and implementation of the laboratory will be presented.

TEXTILE CONSERVATION DEPARTMENT AT THE METROPOLITAN MUSEUM OF ART

Florica Zaharia, Conservator in Charge, The Department of Textile Conservation, The Metropolitan Museum of Art

The proposed paper will present the Metropolitan Museum's Textile Conservation laboratory – its facilities and its professional practices.

The Textile Conservation Department at the Metropolitan Museum of Art responds to the needs of conservation, preservation, display, and technical studies of the Museum's core collection of over 36,000 textiles belonging to twelve curatorial departments. Eighteen professionals – permanent staff members, and also volunteers, fellows and interns – make up the department, which is housed in a 9,400-square-foot lab specially designed with state-of-art facilities to accommodate the great variety of projects for which it is required.

The Department has a long history of well established professional standards, achieved by working with one of the most comprehensive textile collections in the world, and founded on the experience and knowledge of the staff based on continuous research as well as long practice.

The presentation will include a virtual tour of the lab, showing the various areas where particular types of work are done – such as technical analyses, treatment, and cleaning; an overview of current projects and practices; and an outline of present challenges such as shortage of space, the search for new conservation materials, upgrading and absorbing the new technology, and managing the steadily growing database.

INHERITING THE NEW LAB

Beth McLaughlin, Senior Textile Conservator, Midwest Art Conservation Center

It's always exciting to get a new lab, even if you weren't directly involved in its creation. You truly appreciate the effort someone put forth unknowingly for your benefit: electrical outlets located every three to six feet on the wall and hanging from the ceiling, two new exhaust trunks, clean surfaces, fresh paint, and new storage cabinets to house tools and supplies. There is new equipment to be purchased and installed. The placement of most new acquisitions is at the conservator's discretion. It's all very exciting.

I was extremely fortunate to know well and trust the person who was planning the new textile lab at MACC. She purged old supplies and materials and whittled away at legacy projects before moving into the new temporary space. I literally strolled in and worked the first three months as the new Senior Textile Conservator in a space shared by the director, business manager, a textile preparator (that works for another organization), and a part-time pre-program conservation intern. It was a great way to get to know folks and to gain an understanding and appreciation of this regional lab housed within a museum.

The less exciting part, however, is interpreting what others planned versus what was actually built and installed. A conservator's interpretation of a floor plan is different than that of a contractor or a facilities administrator. This also entails receiving equipment that was selected by facilities staff who did not think to consult the conservator prior to making purchases – for example, a washer and dryer. And the list goes on. In addition, the new space is rented to the organization by the museum. We are all just guests here.

OUT OF THE BOX: NEW COSTUME AND TEXTILE STORAGE AT THE PHILADELPHIA MUSEUM OF ART

Sara Reiter, Conservator of Costume and Textiles, Philadelphia Museum of Art; Linda Gottfried, Director of Museum Products, Borroughs Corporation

In 2008 the 30,000 piece Costume and Textile Collection of the Philadelphia Museum of Art moved from an overcrowded 30 year old storeroom to a new facility in the Hamilton Center for Costume and Textiles in the recently opened Ruth and Raymond Perelman Building. The new storage space occupies 7,600 square feet and utilizes 12' high compacting powder coated steel storage cases. Working together, the staff conservators from PMA, Borroughs engineers, and project manager Kevin O'Brien of O'Brien Business Systems, developed a *textile specific* storage system that protects the collection from water, light and dust and provides greater visibility and access to the collection at a significant cost savings from traditional closed storage cabinets. The principle innovations of the system are: an angled roofline and water shield that protect the collection in the event of a sprinkler discharge; an interlocking closing system that inhibits light and dust penetration; and interior components designed specifically for textiles.

ASSESSING WATERLOGGED TEXTILE RECOVERED FROM THE CIVIL WAR SUBMARINE H.L.HUNLEY

Johanna Rivera, Conservator, and Paul Mardikian, Senior Conservator, Clemson Conservation Center, Clemson University

Due to environmental constraints, shipwrecks rarely produce artifacts containing textile components, and only under extraordinary circumstances are large fragments recovered. The unique presence of fabric within the *H.L. Hunley*, a 19th century Confederate submarine lost in 1864 with a crew of 8 on board, provides an interesting case-study. During the excavation of the iron-hulled submarine in 2001, 2002 and 2003, archaeologists and conservators removed 11 tons of sediment and hundreds of artifacts. Among those artifacts discovered were textiles associated with the remains of the sailors within the vessel. While marine

bacteria inflicted limited damage on protein fibers such as silk or wool, very little cotton remained. Due to the nature of the site and the deteriorated condition of the fabrics still present, conservators determined that the safest manner in which to proceed would be to remove the sediments through block-lifts and continue excavations in the lab. Once safely transferred, each block was documented with digital x-ray technology and several were sent for Computed Tomography (CT) analysis. The blocks were stored in water maintained at 4°C until excavations resumed. In order to excavate each block individually, conservator's implemented an immersion technique, whereby textile remnants could be safely manipulated and unfolded. This system permitted the safe removal of associated artifacts and skeletal remains. Textile samples were also retained for analytical and testing purposes. New equipment recently acquired by the Clemson Conservation Center including the Hitachi S-3700N Ultra Large Chamber Variable Pressure scanning electron microscope (SEM), will be employed for further, in-depth textile analysis. The cleaning and stabilization issues will be presented and discussed as well as the long term preservation of this textile collection.

A PANEL DISCUSSION OF THE PRESERVATION AND CARE OF BLACK, BROWN & BLACK MUD-DYED SILKS FROM SOUTHEAST CHINA AND SOUTHEAST ASIA

Dr. Shu Hwa Lin, Assistant Professor, University of Hawai'i, Manoa; Dr. Abby Lillethun, Associate Professor, Montclair State University Dr. Margaret Ordoñez, Professor, University of Rhode Island

This discussion panel will present guidelines for handling, storing, and cleaning bi-colored black and brown silk textiles called jiāo-chou and xiang-yun-shā (a.k.a. black gummed silk, Canton silk, cloud perfumed silk, gambiered silk) from southeast China and other Southeast Asian black silks coated with mud. Samples include contemporary boutique and one-hundred-year-old textiles and garments. Dyeing with ji-liang starch juice makes the bi-colored silks stiffer than the black ones, some of which are quite drapable. Due to the mud-caked surface of the yarns, these silks are vulnerable to abrasion and creasing, therefore, they require special handling and storage. The panel will discuss experiments for reducing creases, soil, and mold.

The presenters will provide a brief history, economic value, and explanation of coloration and finish. They will explain the characteristics of the textiles—chemical composition and permeability to light, air, and water. Little known in the West until recent boutique designer interest, these textiles express cultural identities associated with specific geographic locales in southern China (Guangdong province) and Southeast Asian (Thailand and Vietnam) where both indigenous people and immigrant Chinese took advantage of the available appropriate mud. Beyond monetary value, they were imbued with beliefs, such as benefits to health and well being.

VACUUMING TEXTILES–A NEW KIND OF COST BENEFIT ANALYSIS

Elizabeth C. Shuster, 3rd year intern, WUDPAC (Winterthur/ University of Delaware Program in Art Conservation) and Smithsonian Museum Conservation Institute; Supervisor: Mary Ballard, Senior Textiles Conservator, Smithsonian Museum Conservation Institute

The term "gently vacuumed" is often taken for granted by textile conservators, but there are so many variables involved in the process of vacuuming textiles that it is difficult to assess what "gentle" vacuuming really is and whether or not we are achieving it. Textile conservators generally note the model and setting of the vacuum and the attachments they use, but this information offers little in terms of the efficiency of their cleaning efforts and/or the actual forces exerted on the textile. The most important factor to consider is the hand of the individual wielding the vacuum. As an intern at the Museum Conservation Institute, I was inspired by a cursory study of this subject by my mentor, Senior Textile Conservator, Mary Ballard, who employed instruments used to measure suction strength (manometer) and air flow (anemometer) to assess the conservation vacuuming campaigns. For this subsequent study, more extensive data were compiled at various vacuum settings, with various attachments, at various distances and angles from the textile surface. Although by no means conclusive, the aggregate data suggest there are predictable and demonstrable trends that may be extrapolated to specific recommendations for more standardized methods of gentle and effective vacuuming.

WOODEN ARTIFACTS

SHOP CONSIDERATIONS: EPOXY—CARBON FIBER, UTILITY AND RETREATABILITY

William Ralston, Ralston Furniture Reproductions, Cooperstown, NY; Robert H. Monroe, Gougeon Bros., Bay City, MI

When repairing furniture that is still in use, structural integrity must be a top priority. During more than three decades of work I have found several cases where carbon fiber reinforced epoxy has advantages over other methods. Epoxy/carbon fiber repairs can be less invasive, more structurally sound, and often as retreatable as traditional methods. By using a reversible barrier between the epoxy and the object, such treatments can be completely reversible.

Carbon fiber reinforced epoxy has two important attributes: It is extremely high in tensile strength and its strength and stiffness allow it to be used in unobtrusive amounts. Unlike fasteners, it distributes loads over a large area, reducing or eliminating stress points. Epoxy/carbon fiber can be superior to other methods in a variety of structural situations: broken joints, broken wood, and failed repairs.

An example of reinforcing a broken joint is the leg/column joint on a pedestal table where the legs have splayed out. A strip of carbon fiber joining the leg to the column added strength and mitigates against future joint failure. Carbon fiber to reinforce a break in the wood itself was used on the leg of a pedestal table that had broken across the short grain. A strip of carbon fiber reinforced epoxy applied to the underside of the leg uses the tensile strength of the fiber to strengthen the leg. Carbon fiber can also be used as a reinforcing band around a weak spot caused by a previous repair. For example, on a Windsor hoop back chair a short piece had been scarfed to the broken end of the hoop. The scarf was too short to have any strength. Rather than removing more of the original hoop to make a proper scarf, the scarf was re-glued with hide glue and banded with carbon fiber.

REDUCTION OF LOSS IN STRUCTURAL WOODEN ELEMENTS THROUGH PLATE GLASS, CARBON FIBER AND UNUSUAL ADHESIVES AND CONSOLIDANTS IN THE CONTEXT OF THE MENOKIN RUIN

John G. Lee, Artisan Conservator, Annapolis, MD; Charles A. Phillips, AIC-PA, AIA, Conservator Architect, Winston-Salem, NC; Richard Wolbers, Conservator, Conservation Scientist, Winterthur, DE; Tim Macfarlane, Structural Engineer, Dewhurst Macfarlane Partners, London, UK; Ellen Hagsten, Architectural Conservator, Annapolis, MD; Sarah Pope, Executive Director of The Menokin Foundation

The conservation of a significant ruin evolved into reconsidering the whole premise of conserving a ruin, as well as new approaches to all of the usual conservation issues associated with a large complex, multi-material artifact left out in the weather. The results involved testing new consolidants for wooden artifacts along with the elegant integration of carbon-fiber and glass as protheses (MOMA, eat your heart out!) for wooden structural members allowing them to be placed back in service, the development of a glass enclosure/display case/interpretive device that only provides infill (surface and structure) for the missing portions of the building envelope while utilizing ground temperature air circulated by photovoltaic powered fans to temper the interior environment; but particularly how a relatively simple system for testing structural artifacts to verify their conserved capacity to function was developed since there are no books or tables on the capacity of a partially rotted and splintered truss member with a glass prothesis. And finally building the team, which is what Conservation 2.0 is all about.

While this presentation focuses on the wooden aspects of the ruin conservation, there will be a more complete discussion of the whole project in the Architectural Specialty Group session.

PS: Menokin, a National Landmark, was the 1771 Virginia home of Francis Lightfoot Lee, signer of the Declaration of Independence.

WATERLOGGED WOOD FROM THE USS *MONITOR*: A NEW DIRECTION FOR RESEARCH AND COLLABORATION

Susanne Grieve, The Mariners Museum, Newport News, VA; Farideh Jalilehvand, University of Calgary, Calgary, Alberta, Canada; Robert Blanchette, Joel Jurgens, University of Minnesota, St Paul, MN; Todd Plaia, Institute of Maritime History, Kensington, MD; Dave Emerson, Bigelow Laboratory for Ocean Sciences, West Boothbay Harbor, ME

The preservation of the waterlogged wood excavated from the USS *Monitor*, one of the first Civil War ironclads constructed, provided opportunities for conservators to work with wood chemists and microbiologists to examine the effects and retreatment of sulfur deteriorated wood as well as methods of stabilization for untreated wood. The *Monitor*, constructed in 1862, sank after a year in service while being towed during a hurricane. In collaboration between the United States Navy and the National Oceanic and Atmospheric Administration (NOAA), artifacts were excavated from the wreck site lying in 250 feet of water. While the *Monitor* is mostly constructed of iron, there are several hundred artifacts that are composed of various species of wood. Wooden components treated in 1990 are beginning to show signs of sulfur deterioration similar to the Swedish warship *Vasa*. In order to determine the most appropriate method for retreatment and to prevent deterioration from occurring in recently excavated objects, The Mariners' Museum has collaborated with related scientific fields to analyze samples from the wreck site.

A METHOD OF ACOUSTIC DETECTION OF WOOD-BORING INSECT LARVAE

Emmanuel Maurin, Laboratoire de Recherche des Monuments Historiques, France; Dominique de Reyer, Laboratoire d'acoustique musicale (UMR Culture-CNRS), France

Detection of the presence of activity of plant-eating insect larvae is indispensable for the selection of a plan of action for the treatment of infested wooden structures or furniture. Craft Inadec developed a prototype detector capable of diagnosing on site the presence of termites. Insufficiently sensitive, the systems of acoustic detection available on the market are not adapted to detect *Anobium punctatum* and *Lyctus brunneus*, the woodboring beetles which are most often found in infested furniture.

Work over the past seven years has achieved the following: the definition and acquisition of a true insect acoustic signal; the study of the acoustic signals emitted by the larvae of the xylophages being researched; the study of different systems for the treatment of the signal; the development of a useful system in real cases for recording the area of activity; and different levels of recording were tested by LRMH to obtain a "true" signal.

The next stage of research must include: a definition of the limits of detection of the apparatus; further analysis of the data by experts in insect infestations and comparison with other, more classic methods of detection, in order to develop rules of interpretation which can be integrated into a logical approach to detecting and treating insect infestations; and the integration of these rules into an approach that is useful in real situations.

It will be possible to envisage the creation of an enterprise with a dedicated, portable apparatus, which is simple to use, which can be used in a systematic way in the field to both promptly detect infestations, and monitor against them over the long term

NEW EVIDENCE FOR THE USE OF IMPORTED RAW MATERIALS IN 17TH CENTURY JAPANESE EXPORT WARE

Arlen Heginbotham, The J. Paul Getty Museum, Los Angeles, CA; Herant Khanjian, The Getty Conservation Institute, Los Angeles, CA; Michael Schilling, The Getty Conservation Institute, Los Angeles, CA

The J. Paul Getty Museum's collection includes pieces of 18th century French furniture incorporating panels of Asian lacquer. Surrounding the Asian panels, the French craftsmen imitated the lacquer surfaces with their own pigments and varnishes. In preparing catalogs of the French furniture collections, Getty Museum conservators collaborated with scientists from the Getty Conservation Institute (GCI) on an analytical research program focused on these extraordinary objects. The program has developed a methodology for sampling and analysis of the organic components of Asian lacquer and their European imitations with improved sensitivity and precision over existing techniques. The primary analytical methods used have been pyrolysis-gas chromatography-mass spectrometry (py-GC-MS) and Fourier transform infrared spectroscopy (FTIR).

The new research indicates the use of imported raw materials in 17th C Japanese export lacquerware. Normally, all Japanese lacquer is assumed to have been made using raw lacquer tapped from trees of the species *Rhus verniciflua* . The results of our research provide evidence that the Japanese lacquer on at least three objects in the Getty's collections was made using raw lacquer from *Melanorrhoea usitata*, a tree native to Thailand and Burma. A likely explanation for this unexpected finding is that the Japanese craftsmen producing lacquerware for export in the 17th century were, for reasons of economy, importing raw lacquer from Dutch trading posts in Burma and Siam. 17th century trade records of the Dutch East India Company (VOC) support this interpretation. In addition, one example of Japanese export lacquer in the collection contains dammar resin. Dammar is harvested from trees native to Indonesia, the finest quality coming from Batavia. The largest and most important Dutch trading post in Asia was in Batavia. This suggests that the Dutch were

trading in dammar within Asia more than a century before its introduction to the West as an artist's material.

HISTORY AND TECHNOLOGY: GEORGE WASHINGTON'S FRAME

William Adair, Gilding Conservator, Gold Leaf Studios, Washington, DC

A "Palace Frame" with engraving, given to George Washington by Louis XVI, is remarkably still in the collection of the Mount Vernon Ladies Association. This paper will briefly outline the historical significance of this genre of politically inspired gifts and describe the minimal conservation approach desired for objects of great historical significance. Time has taken its toll on the object in many ways that is typical of all frames, previous campaigns of regilding, impact damage resulting in loss of ornament, insect damage, gesso loss, and benign neglect, will be briefly outlined.

Solutions of previous(1985) and current suggested conservation (2008) intervention will be described in detail. In addition, future preservation suggestions will be outlined, as these are always essential to the long term care of gilt artifacts in all collections.

Replication of the frame is also being undertaken using 3-D scanning technology. In the future, this technology (developed by NASA) will an essential tool for preservation of any culturally significant and unique object.

AS THE CAROUSEL TURNS: NEW WAYS OF REMOVING AGED GREASE AND OIL FROM SHELBURNE MUSEUM'S DENTZEL CAROUSEL

Nancie Ravenel, Shelburne Museum, Shelburne, VT; Rachel Penniman, Cleveland Museum of Art, Cleveland, OH; Laura Brill, Kress Fellow, Shelburne Museum, Shelburne, VT; Richard Wolbers, Art Conservation Department, University of Delaware, Newark, DE

Although removal of linseed oil applied as maintenance to painted animals on the Shelburne Museum's 1902 Dentzel carousel has been a regular occurrence in the conservation lab, the department had yet to address the other decorative elements of the carousel. These included painted wood panels which had been coated with linseed oil like the menagerie, and paintings on canvas which had been splattered by grease and lubricating oil from the carousel engine. Machine oil splattered on the back of canvases had worked its way through paint and varnish layers on the paintings, resulting in dark splotches in the images. Storage materials for the panels stained with oil indicated that despite being over 50 years old, the oil had not fully cross-linked. In addition to the grease and lubricating oil, the paintings were unevenly coated with an apparent yellowed spar varnish similar to what had been found on the carousel animals.

As part of a 2007 grant from the Institute of Museum and Library Services, Richard Wolbers consulted on removing the grease and machine oil from the panels. After testing solvents, solvent gels, and solvent gel poultices, Wolbers introduced Pemulen TR-2, a polymeric emulsifier to the range of cleaning agents. A water-soluble polymer, Pemulen forms stable oil-in-water emulsions without other surfactants. Product literature for Pemulen indicates that linseed oil, mineral oil, tung oil and tallow have been successfully emulsified with 0.4% or less Pemulen TR-2.

This paper will describe a variety of cleaning gels and emulsions prepared using Pemulen TR-2 that have been found useful after testing in removing linseed oil, grease and yellowed spar varnish from the painted surfaces of the carousel. Advantages and disadvantages of these agents will be compared to aqueous and solvent gels used in the past to remove linseed oil from the painted wood elements.

INSPIRED BY THE FRENCH AMERICAN PARTNERSHIP: THE CONSERVATION OF LOUIS MAJORELLE FURNITURE AT THE VIRGINIA MUSEUM OF FINE ARTS

Kathy Gillis, Sculpture and Decorative Arts Conservation, Virginia Museum of Fine Arts, Richmond, VA

In April of 2006 the French Ébéniste-Restauratrice, Anna Østrup, came to the Virginia Museum of Fine Arts in Richmond, Virginia with the sponsorship of the French-American Partnership program organized by the Wooden Artifacts Group and funded by the Florence Gould Foundation. Anna's expertise is in Art Nouveau Furniture and she was invited to examine, study, and advise on the condition and preservation of the Art Nouveau Furniture in the Sydney and Frances Lewis Collection of Decorative Arts at the Virginia Museum of Fine Arts. Seventeen pieces of furniture in the VMFA collection are the work of Louis Majorelle, or attributed to him, including a complete Bedroom Suite, dating from the first decade of the 20th Century. The Suite includes a bed, armoire, two nightstands, two sidechairs, and two armchairs.

While all of the Majorelle furniture at VMFA was examined with Anna and microscopy samples collected and analyzed for the project, the bed in the Bedroom Suite stood out as an example of Majorelle's work that appeared to have undergone some substantial alteration since its original design and fabrication. This prompted a more intense study of the VMFA bed and other beds of similar design by Majorelle, leading to the undertaking of a conservation project that would address these issues. Were it not for Anna's visit and the opportunity to closely examine these pieces with her expertise, this project would not have come to light. Thanks to the benefits of the international exchange between conservators provided by the French-American Partnership,

the understanding of Majorelle's work, the furniture in the Lewis Collection, and the ability to correctly represent the artist's intent in the Bedroom Suite has been realized.

A MINIMALLY INTRUSIVE UPHOLSTERY METHOD FOR AN OVERSTUFFED VICTORIAN CHAIR

Donald C. Williams, Conservator, and Michele Pagan, Conservator, Museum Conservation Institute, Smithsonian Institution

The object is a piece of study furniture held by the Smithsonian Institution for educational and teaching purposes, a mid-late Victorian upholstered arm chair with diamond-back tufting. As received in the Furniture Conservation Studio, the chair was primarily a wooden frame with remnants of the previous upholstery including jute webbing and tied springs. The goal of the project was to recreate the complete overstuffed upholstery original to this piece, including the diamond-tufting, making it totally removable at the same time.

The major treatment innovation introduced for this chair, produced by the furniture conservator, was the creation of a fitted Epoxy/fabric composite shell upon which the additional layers of upholstery, including trim and tacks, were to be attached. That is, the wooden frame of this piece is totally encapsulated within a "clamshell" of 2 pieces of Epoxy-stiffened canvas, to which all additional layers are stitched, glued, or otherwise adhered.

The contribution by the textile conservator consisted of making a custom-shaped "mattress" of a seat, within which the original springs are still found. Much as a mattress is completely removable upholstery for a bed frame; this custom-shaped seat functions like a mattress, and completely eliminated the rigid wire forming the front edge, previously stapled to the chair frame.

An additional challenge of this work was making the diamond-back tufting stable, and yet completely removable and fully sittable. The experience of the textile conservator, in handling fabric layers, enabled this skill to be sufficiently transferred to this new arena of minimally intrusive upholstery.

The final product of this treatment is already in progress; creation of a detailed illustrated instructional manual presenting this treatment technology for the benefit of conservation and upholstery practitioners facing similar challenges.

GLOBE CHAIR, ADHESION AND COHESION: AN INTERIOR PROBLEM

Nigel Bamforth, Senior Furniture Conservator, and Dana Melchar, Furniture Conservator, V&A Museum, London

The second half of the twentieth century saw extensive development of materials such as plastics, fibreglass and foam for use in furniture. The Globe chair (Circ. 12-1969), also known as the Ball chair, was designed by Finnish designer Eero Aarnio and exemplifies the use of these materials. It was acquired directly from the manufacturer, Asko Furniture Manufacturing Company, by the Victoria and Albert Museum in 1969.

Now, several decades after manufacture, many of the modern materials used in the Globe chair have changed in their appearance and properties, requiring radical treatment to enable the chair to be displayed in a state representing the designer's intent for the V&A exhibition *Cold War Modern: Design 1945-70.* While the glass-fibre reinforced polyester shell had remained stable with the external gel-coat suffering only minor abrasions, the appearance within the shell had changed dramatically. The interior fabric hung limply rather than maintaining the crisp profile intended by Aarnio. The adhesive applied between the cover textile and foam under-upholstery had failed, leaving the textile unsupported, especially on the top interior of the shell where the textile hung down.

As the foam still maintains some flexibility when compressed and has not degraded into a powdery dust, we decided to retain the foam and consider a treatment that might increase its longevity. Whilst being aware that the textile would outlive the foam indefinitely, we wished to enable future re-treatment and the eventual removal of degraded foam while retaining the show cover.

The result of our treatment was a clean, crisp profile on the interior of the shell. The original materials have been kept, the shell's interior profile has been restored and the treatment executed anticipates the eventuality of the foam's degradation and replacement while retaining the original show cover textile.

THE BLACK THAT NEVER WAS: DECODING COLOR IN THE MARQUETRY OF J. F. OEBEN

Arlen Heginbotham, J. Paul Getty Museum, Los Angeles, CA; Clara von Engelhardt, Furniture Conservator, Leipzig, Germany

The J. Paul Getty Museum's collection of French furniture includes an important mechanical table with a floral marquetry top by Jean Françcois Oeben (70.DA.84) as well as a pair of corner cupboards with marquetry panels attributed to Oeben, both produced in the middle of the 18th century. As is characteristic of the work of Oeben, many of the leaves and stems in the floral compositions are rendered in a dark, nearly black wood. In catalogs and scholarly publications

about Oeben, this dark wood has variously been described as 'ebony,' 'dark stained wood,' or 'black wood.' As part of the systematic study associated with preparing catalogs of the French furniture collections, Getty Museum conservators collaborated with scientists from the Getty Conservation Institute (GCI) to study these and other related objects with the goal of understanding the original color of this dark wood.

Initially, microscopic wood identification determined that the dark wood in the mechanical table is holly, a naturally white wood. X-ray fluorescence spectroscopy (XRF) then demonstrated that the dark wood contains extremely high levels of iron. The presence of a yellow dye (young fustic; *rhus cotinus*) in the wood was established by high pressure liquid chromatography (HP-LC) and confirmed by UV-visible reflectance spectroscopy. A search of the 18th century literature on dye recipes for wood and textiles identified a sub category of recipes for 'bottle greens' or 'olive greens' that correlates well with the current analytical results. These recipes call for dying with yellow dye in conjunction with an iron sulfate mordant. Test batches of holly dyed in this manner yielded a range of muted greens that are probably representative of the original leaves and stems in the marquetry of Oeben. Accelerated aging of the test samples confirmed that they darken with exposure to light.

CLEARING THE IMAGE: A QUANTITATIVE ANALYSIS OF HISTORICAL DOCUMENTS USING HYPERSPECTRAL MEASUREMENTS

B.J. Aalderink, Art Innovation BV; Marvin E. Klein, Art Innovation BV; R. Padoan, Nationaal Archief, The Netherlands; G. de Bruin, Nationaal Archief, The Netherlands; Th. A. G. Steemers, Nationaal Archief, The Netherlands

Hyperspectral imaging (HSI) is a non-destructive technique that is already well-established in a number of fields such as agricultural and environmental studies and defense, however, it has entered the world of art and historic document conservation only fairly recently. HSI refers to the recording of tens or even hundreds of digital images of an object, each one taken at a different spectral light band. Typically, HSI covers not only the visible, but also the near-ultraviolet and near-infrared spectral range. The conventional approach for analyzing this multitude of images is to use standard image processing software to visually compare the images on the computer screen and possibly apply relatively simple, intuitive enhancement functions. While it can be quite successful in helping to distinguish between different materials and to enhance faint or even invisible features such as in palimpsests, this approach has its limits. Since this qualitative approach essentially relies on the capabilities of human vision, it is subjective, and the results are not always reproducible. The sheer amount of hyperspectral image data and the general limitations and peculiarities of human vision often prevent an effective exploitation of the data.

In this contribution we discuss the working principles and applications of advanced numerical hyperspectral image processing techniques applied to the analysis of historical documents. Powerful computer algorithms for spectral feature extraction and classification allow one to detect even very subtle correlations in the hyperspectral data which cannot be detected with conventional visual comparison. Such algorithms can provide reproducible, quantitative results that enable a comparison of different objects or of the same object measured at different times, so that it becomes possible to establish data bases and to measure the influences of treatments or aging.

In order to be able to most successfully apply such advanced numerical processing, the recorded measurement data has to be calibrated, i.e. it has to be basically independent of the specific optical properties of the used instrument itself. In a cooperation of the *Nationaal Archief* (National Archives of the Netherlands) and the company Art Innovation the quantitative hyperspectral imager (QHSI) was developed for the analysis of historical documents. Each measurement with the instrument provides 70 spectral images (wavelength range 365 – 1100 nm), each with 4 megapixel resolution on an object area of 125mm × 125mm. Due to meticulous calibration, a hyperspectral dataset contains for each pixel an entire, accurate spectral reflectance curve. Spectral feature extraction techniques based on algorithms such as the so-called "spectral distance similarity" algorithm are used to distill from the pixel spectral curves the information required for example to distinguish ink types. The distributions of different inks on a document can be visualized using false-color presentations of the numerical results, which can also be used for further statistical analysis. This particular application of distinguishing ink types is not only very useful for historical research addressing the authorship and age of text parts. It can also be of great importance for an effective application of conservation treatments for example by helping to distinguish the notorious iron gall ink from other, less aggressive, ink types.

THE ROLE OF STATIC CHARGE IN DIRT ACCUMULATION ON PAINTED SURFACES

Jamie Abbott, Undergraduate Summer Research Fellow, Buffalo State College; Dr. Gregory Dale Smith, Andrew W. Mellon Assistant Professor of Conservation Science, Buffalo State College

The tendency of acrylic paintings to collect dust is often ascribed to their "plastic" nature, meaning that they should behave as electrical insulators, becoming static charged and attracting dust particles to their surface. This theory was tested by measuring the surface resistivity and static charge capacity of numerous pigmented acrylic paints and comparing those results to identical experiments on similarly pigmented paint media and varnished paints. The samples studied included artist paints (acrylic dispersion, oil, alkyd, casein, and PVA dispersion), conservation colors (Golden MSA acrylic solution and Golden PVA solution), experimental acrylic dispersion paints (anti-static and variable hardness) as well as varnished oils (dammar and Regalrez 1094) and varnished acrylic dispersion paints (Golden MSA and Golden polymer). The experiments were performed at several relative humidities spanning 14% to 75% RH. The anecdotal evidence for increased dirt accumulation rates for acrylic paintings relative to other paint media was tested by conducting an accelerated dust accumulation experiment on painted and varnished paint mock-ups. The dirtiness of the samples was assessed using loss of gloss and particle counting experiments. The alternative possibility that differences in dirt accumulation could be correlated simply to the softness of the paint film surface was further investigated by measuring the glass transition temperature (T_g) of the media and varnishes and comparing those values to the previously mentioned measures of dirt accumulation. Based on these results, it is concluded that static charge on paintings is unlikely to be a concern for dirt accumulation, especially at moderate to high RH where almost all paints behave as static dissipating materials. Paints based on n-butyl methacrylate (Golden Conservation Colors and ostensibly Magna solution acrylics) as well some varnishes were found to be insulating even at high humidity levels, although charge retention for most of these materials is short lived. Moreover, harder paint surfaces, such as the MSA acrylic

solution paints, are less likely to trap dirt, and so they are easily brushed or wiped clean of any accumulated particles. The use of harder latex emulsions or the application of harder varnishes onto the surface of softer paints is perhaps warranted to reduce dirt accumulation and entrapment of dirt in soft acrylic emulsion paint media.

INTERPRETING THE *KINGSBURY GIRLS*: A NAIVE 19TH CENTURY PORTRAIT ATTRIBUTED TO SUSAN CATHERINE MOORE WATERS

Cynthia M. Albertson, Paintings Conservation Intern at the Museum of Modern Art, Buffalo State College Art Conservation Department; James Hamm, Professor of Paintings Conservation, Buffalo State College Art Conservation Department

This poster presents the historical research, materials analysis, and conservation treatment of the *Kingsbury Girls*, a mid-nineteenth century oil on canvas double portrait attributed to Susan Catherine Moore Waters. Genealogical research of the sitters and artist helped to place the picture in historical context. Various material analyses were conducted to interpret the condition of the painting and help define the artist's working methods. Analytical and investigative equipment, such as Fourier-transform infrared spectroscopy, x-ray fluorescence spectroscopy, and optical microscopy were utilized, as well as digital x-ray radiography which provided images of the picture in a fraction of the time. In addition, examination and comparison of several of Waters' paintings was conducted using a newly developed infrared-sensitive web camera to view underdrawings in the paintings without removing them from their exhibition space. All of the analyses proved instrumental in conserving the Kingsbury Girls, strengthening the attribution to Waters and ultimately preparing the painting for exhibition at the Tioga Point Museum.

A NEW VARIATION ON BOARD SLOTTING

Angela M. Andres, Conservation Technician, New York University Libraries

This presentation is based on the article, "A New Variation on Board Slotting," published in the Spring 2008 issue of the online journal *The Bonefolder*. Board slotting creates a strong board reattachment for many books; however, books with significant losses in the spine material require additional structural compensation and aesthetic integration. An adapted board slotting technique that addresses this specific concern is described here.

When the Barbara Goldsmith Book and Paper Conservation Laboratory at New York University Libraries acquired a Peachey Board Slotting Machine, Jeff Peachey, the machine's designer and manufacturer, trained full-time staff (Conservation Librarian Laura McCann and Conservation Technicians Lou DiGennaro and Angela Andres) to operate the machine, demonstrated finishing techniques for slotted books, and suggested readings for further study. With its strong board attachment and relative speed of execution, board slotting provided a practical alternative to standard rebacking.

In selecting candidates for board slotting, we focused on 19th and 20th century circulating books with detached boards and partially or completely missing spine material. These volumes benefited from the secure reattachment of their boards through board slotting, but the absence of original spine material, particularly the head and tail caps, left the spine exposed and vulnerable. In addition, the result lacked the aesthetic integration of a slotted volume with its original spine material replaced. After some experimentation I devised a way to treat these books, combining elements of board slotting and traditional rebacking to create a strong board attachment, new spine material, and reconstructed head and tail caps that offer aesthetic compensation for the lost spine material. Unlike most board slotting treatments, this technique requires the machine-milled slot to extend all the way through the ends of the boards, which may result in the loss of a small amount of original material; for this reason, this treatment may not be suitable for some volumes.

By combining board slotting and rebacking, this adapted technique makes use of the best qualities of each treatment when applied to books with detached boards and missing spine material. First and most importantly, this method creates a very sturdy and durable board attachment. Second, it is fast, usually taking no longer than a standard reback. Additionally, there is no need to lift leather or cloth from the boards, which saves time and minimizes disturbance to the covering material. Finally, the reconstructed spine provides added protection for the text block and unifies the appearance of the finished volume. This poster will feature a step-by-step description of this technique, illustrated with drawings and photographs and accompanied by sample volumes at various stages of the treatment.

LETTERPRESS COPYING BOOKS: PRESERVATION AND CONSERVATION IMPLICATIONS

Beth Antoine, Candidate, M.S.I.S/C.A.S Conservation, Kilgarlin Center for the Preservation of the Cultural Record, School of Information, University of Texas at Austin

Letterpress copying books can be found in most archival collections in the Western world. They contain a vast amount of information relating to the history of our culture, and many are quickly deteriorating to the point that records are being lost. Copying books often contain the only extant version of a document as the originals were routinely discarded or lost. Copying book paper and ink formulations were developed to have certain properties that optimized the copying process. The addition of gums and sugars, for

example, encourages the ink to move from the original to the copying paper, while the lack of size and the translucence of the paper allow the writing to be read from the verso of the leaf. Because the inks and papers used are unique to copying books, their preservation needs are likewise unique. This study explores the preservation and conservation implications of these important and fascinating records.

This study investigates the current conditions and preservation needs of copying books in archival collections, and current conservation practices and storage issues related to copying books. Methodology includes a survey of the copying books in the collection of the Center for American History at the University of Texas at Austin and a questionnaire submitted to various professional archive and conservation list-serves. Treatment options were investigated after assessment of the results of both surveys. A selection of copying books from the Center for American History collection were examined, tested, and treated. Recommendations for storage, handling, and treatment are presented.

The results of the questionnaire illustrated a great need for research into best practices for treatment, storage and handling, and duplication of these materials. There was great variety in current practices highlighting the lack of standards, and many archivists are unclear about appropriate preservation plans for copying book collections. Through a relatively high response rate and many detailed comments, the respondents communicated a feeling of both urgency and enthusiasm in the field for research in this area.

Eight copying books were selected from the collection of the Center for American History for examination and treatment. The books exhibit a wide variety of conditions and were chosen to represent the range of possible conditions of letterpress copying books, including iron gall ink corrosion, embrittlement, and faint text. They consist of similar materials; namely, thin un-sized machine-made tissue paper, iron gall and aniline copying inks, and various half-leather and cloth case bindings. After extensive research and testing, appropriate treatments were determined for each book.

Various lining, mending, humidification and flattening, and aqueous treatments were performed in order to allow the safe handling of the fragile paper. The composition of the copying papers creates special challenges for conservation treatment. The inclusion of sugars, glycerin, and other humectants causes the paper to become quite sticky and difficult to handle, especially when wet, yet, the papers did not readily adhere to the solvent-set or heat-set lining tissues. The results of the treatments are presented and the most effective treatment procedures are described. The most effective lining method involved Lascaux 498 HV coated tengujo tissue misted with ethanol and boned down with a Teflon folder while inside a silicone-release Mylar sandwich.

HANDLING OF EAST ASIAN SCROLLS

Catherine Badot-Costello, Book Conservator in the University Library, Weissman Preservation Center, Harvard University Library

Pictorial art and calligraphy mounted as scrolls demand careful handling and viewing practices. The mounted scroll is a complex laminate structure engineered to support and protect the artwork. With their unique components of silk and paper, metal and wood, scrolls are meant to be unrolled, viewed for short periods of time, rolled, then wrapped and stored in a protective box.

Scrolls are subject to damage from improper handling, inadequate storage, and exposure to harmful environmental conditions. Preventive measures, in the form of condition assessments, recommendations for handling, and exhibition and storage, will protect scrolls from further damage.

The following guidelines for handling collections of East Asian scrolls were created by Harvard University Library's Weissman Preservation Center. They include text with technical illustrations, digital images, and video available on www.preserve.harvard.edu. The guidelines were created by a conservator for members of the Harvard community interested in the theory and practice of the preservation of library and archival materials. They are available to a broader audience of faculty, students, and other institutions with scrolls in their collections, in the form of downloadable PDFs in color or black and white. The video may be viewed on a laptop or other viewing device as a helpful tool.

If a scroll appears to be damaged, it is best to seek the assistance of a conservator. When examining any object, it is important to prepare a clean flat surface free of sharp implements, liquids, or pens. Clean smooth weights are needed to support the scroll while unrolling. Hands must be clean and free of jewelry. Dirt and perspiration can stain paper, silk, lacquer, and metal. Because of the complexities of the scroll format, it is recommended that two people be present to handle a hanging scroll or hand scroll.

The guidelines describe in words and imagery the structure of hanging scrolls and hand scrolls, as well as how to hang, roll, tie, and secure the scroll in its box. The handling of fragile scrolls and practical storage issues using western archival materials are addressed.

A laptop and handheld device will be present to demonstrate the video at the Poster/Author session.

EFFECTS OF AGING VERDIGRIS IN ARTIST PREPARED PAINT, PART 2

Megan Berkey, Graduate Student, Art Conservation Department, Buffalo State College; Dr. Aaron Shugar, Assistant Professor in Conservation Science, Art Conservation Department, Buffalo State College; Katrina Bartlett, Graduate Student, Art Conservation Department, Buffalo State College

Verdigris (copper acetate) is known to discolor and darken with time in various artists' media. Previous research was conducted to observe changes in the optical property and morphology of the pigment in freshly prepared, naturally aged and artificially aged samples. Verdigris pigment samples were dispersed in three common artists' media: egg tempera, watercolor vehicle (gum arabic), and linseed oil. In addition, a control sample of verdigris dispersed in water and ethanol was also employed. All samples were observed, analyzed, and documented. The present research (using the same media and aging parameters previously established in part one) further analyzed pigment samples through the use of colorimetry, Fourier transform infrared spectroscopy (FTIR), x-ray diffraction (XRD), and Raman spectroscopy to establish variations and changes in chemical composition and crystallinity that verdigris pigment undergoes as it ages in various artists' media.

THE REMOVAL OF LEATHER DRESSING FROM PAPER

Brenna Campbell, Kress Fellow in Rare Book Conservation, Thaw Conservation Center, The Morgan Library & Museum

Traditionally, the preservation of leather bound books included the regular application of "leather dressing," a mixture of fats, waxes, and other ingredients designed to keep the leather supple and resistant to moisture. This process of furbishing and conditioning the leather was typically undertaken in concert with wet or dry surface cleaning of the binding.

In the past twenty years, however, conservators have become increasingly aware of the potentially detrimental effects of leather dressing. While the routine application of dressing to leather bound books has fallen out of favor, many previously treated volumes are suffering from bloom, formation of corrosion products around metal furniture, and perhaps most problematically, staining of the textblock. This staining occurs when the leather dressing penetrates through the leather and spine linings into the textblock, causing discoloration and damage to the paper.

The history and typical formulae of leather dressings will be reviewed, and a variety of techniques for reduction and/or removal of leather dressing stains will be evaluated. Local and immersion treatments will be employed and will include the use of solvents, surfactants, bleaches, and enzymes. The effectiveness of each treatment will be measured using colorimetry, as well as visual and tactile evaluation. A case study of a treatment during a fellowship at The Morgan Library & Museum will also be discussed.

UNIVERSITY OF DELAWARE ART CONSERVATION UNDERGRADUATE EDUCATION 2.0

Vicki Cassman, Director of the Material Culture Preservation Program, University of Delaware; Jae Gutierrez, Interim Coordinator, Winterthur/University of Delaware Program in Art Conservation; Debra Hess Norris, Provost for Graduate and Professional Education & Chair, Art Conservation Department, University of Delaware

The Art Conservation Department of the University of Delaware is revising its undergraduate curriculum to meet the needs of a changing field and to better prepare students for graduate school. Undergraduate students face tough admissions challenges for existing conservation graduate schools and there are now three undergraduate conservation programs to choose from in the United States. In recent years through an assessment process we have made changes to our undergraduate program. We have also chosen to streamline undergraduate education by eliminating the two concentrations (pre-graduate study and collections care) to create one major: Material Culture Preservation. It is also clear that as science becomes ever more important in the field it is imperative that our students can do more than say they have taken two years of chemistry; they must also be able to use that knowledge. Therefore, we have provided students with a capstone-like applied chemistry elective. In addition, the Material Culture Preservation Major has a solid preventive conservation curriculum, a selection of traditional studios and a required capstone course. The three-legged stool model with art history/anthropology/history, science, and studio courses has been expanded to be a four-legged stool with stronger components of ethics and practice. Undergraduate students are required to undertake two internships and we hope to encourage practicing conservators to mentor undergraduates and contact us with any and all projects, both paid and unpaid, for preprogram interns.

A CUT ABOVE: THE CRAYOLA CUTTER AS CONSERVATION TOOL

Lisa Conte, Graduate Student, Conservation Center, Institute of Fine Arts, New York University; Lisa Nelson, Graduate Student, Conservation Center, Institute of Fine Arts, New York University; Katherine Sanderson, Graduate Student, Conservation Center, Institute of Fine Arts, New York University; Eliza Spaulding, Graduate Student, Conservation Center, Institute of Fine Arts, New York University

The field of conservation often benefits from the identification of mainstream products that are applied to conservation practice. This poster introduces the "Crayola

Cutter" to the paper conservation community as a valuable tool for creating fills, inlays, and hinges.

The Crayola Cutter is a product marketed for children, designed to make it easier to cut out complex shapes from a sheet of paper. It takes the form of a stylus with a pulsating needle at the tip, thus transforming the action of cutting paper with a blade or scissors into one more akin to drawing by perforating the paper. Depending on the speed with which the cutter is drawn across the surface of a sheet of paper, the nature of the paper, and the hardness of the cutting surface, it can achieve results ranging from a soft, feathered edge for a hinge to a precisely crafted fill or inlay.

The product was tested using materials found in a typical conservation laboratory. Three variables were considered: paper type, cutting surface and shape. The instrument's usefulness and limitations were determined by cutting a variety of shapes and sizes, using a wide range of papers and cutting surfaces. The instrument was then compared to traditional tools used for creating fills, inlays, and hinges (e.g. scissors, X-ACTO knife, scalpel, needle, water and brush). Factors considered in the comparison were the ability to achieve a similar result, and the relative ease and amount of time it took to reach that outcome.

This poster presents the findings of these tests and presents the Crayola Cutter as an effective new tool for the paper conservator.

CASSEL COLLECTION: CONSERVATION, DIGITIZATION, AND THE REEVALUATION OF EARLIER RESTORATION TECHNIQUES

Danielle Creech, Assistant Conservator, Etherington Conservation Services –Midwest

From 2006 to 2008 Etherington Conservation Services – Midwest undertook an extensive rare book conservation project for Earlham College's Lily Library Archives and the Bethany Theological Seminary. The project included many religious texts from the 16th to 19th century that had been subjected to severe water damage and crude restoration efforts in the past. This poster will juxtapose the techniques and materials used in these previous restoration efforts with the restoration and digitization work performed by ECS - Midwest, focusing on three particular volumes. All digitization work was captured on a Kirtas APT Bookscan 1200 and processed into uncompressed TIFFs at native dpi.

Hauspotill (1569), a volume in a contemporary vellum binding, featured hand-painted woodcuts throughout. This volume had been previously repaired with heavy western paper and hide glue. These mends obscured text and provided breaking points that caused further damage to the pages. In the current restoration project, the old mends were soaked off and replaced with Japanese tissue and wheat paste mends that allowed full text visibility and page flexibility. The woodcuts were digitized in color and provided for display by the Lily Library Archives.

Opera Omnia Theologica (1681), a volume bound in contemporary calf, lacked the front board and spine. This volume had a paper-covered replacement board and a poorly executed "new" leather spine. The replacement board was wholly dissimilar in thickness and shape to the beveled wooden back board. During the recent restoration, a new board was created from laminated binder's board, beveled and shaped to match the original. The volume was rebacked with calf that extends over this new board. The leather was blind tooled and toned with acrylics to match the remaining original board. The title page and frontispiece were digitized in color for display by the Lily Library Archives.

Bericht Uber Eine Reise (1829) was a small volume bound in half calf with marbled paper over boards. This volume had been vandalized, resulting in a title page pasted over with newsprint letters and a textblock lacking pages iii-xvi and 1-6. Earlham College secured photocopies of these missing pages through interlibrary loan. By digitizing the photocopies, we were able to digitally repair and de-skew the text, removing library marks and marginalia. We were further able to process the images into folios and print facsimile pages on western handmade paper of a similar tone and weight as the remaining leaves.

APPLICATION OF IMAGING SPECTROSCOPY TO THE STUDY OF ILLUMINATED MANUSCRIPTS.

John Delaney, Andrew W. Mellon Senior Imaging Scientist, National Gallery of Art, Washington DC; Michelle Facini, Paper Conservator, National Gallery of Art, Washington DC; Lisha Deming Glinsman, Conservation Scientist National Gallery of Art, Washington DC; Mathieu Thoury, Charles E. Culpeper Conservation Science Fellow, National Gallery of Art, Washington DC.

This poster summarizes the results of imaging spectroscopy and fiber diffuse reflectance spectroscopy to identify and map the primary pigments on a leaf attributed to the workshop of Pacino di Bonaguida titled, *Christ in Majesty with Twelve Apostles* (c.1320). Imaging spectroscopy, the collection of numerous images in narrow spectral bands, has the potential to be a useful in-situ tool for the study of works of art on paper. Specifically, reflectance and luminescence images in the visible to the near infrared were acquired using a high sensitivity, low noise, Si CCD camera outfitted with narrow band filters. High spectral resolution diffuse reflectance spectra, covering the visible to infrared (350 to 2500 nm) were obtained using a fiber optic spectrometry.

Initial comparison of the spectral images and reflectance spectra data show that the following pigments were primarily used: azurite for the blue background, lead tin yellow, red lead, a red dye, and a mixture of lead tin yellow and azurite for the green. Assignment of the red dye comes from both the reflectance spectra and the observed luminescence images.

Comparison of these results with X-ray fluorescence reveals good agreement. In general, these results are similar to Raman spectra and X-ray diffraction data obtained from two leaves attributed to Pacino di Bonaquida acquired by scientists at the Getty Conservation Institute and presented at the Eighth Biennial Conference of the Infrared and Raman Users Group. The opportunity to compare and contrast other artworks attributed to Pacino di Bonaguida expands our understanding of his working methods and also provides a fuller context to study his color palette. Furthermore, slight irregularities or unusual trace elements revealed during analysis may prove to be a unique identifier for the artist's work.

CONSERVATION AND TECHNICAL DOCUMENTION IN DIGITAL FORM: AN INTER-INSTITUTIONAL RESEARCH RESOURCE ON PAINTINGS BY REMBRANDT

Wietske Donkersloot, Mellon Fellow, Netherlands Institute for Art History (RKD), The Hague, The Netherlands; Edwin Buijsen, Head of Collections, Royal Picture Gallery Mauritshuis, The Hague, The Netherlands; Michiel Franken, Curator of Technical Documentation, Netherlands Institute for Art History (RKD), The Hague, The Netherlands; Petria Noble, Head of Paintings Conservation, Royal Picture Gallery Mauritshuis, The Hague, The Netherlands; Sytske Weidema, Project Assistant, Netherlands Institute for Art History (RKD), The Hague, The Netherlands

This poster aims at presenting the structure and functionality of the *The Rembrandt Database* (working title), a database currently in development at the Netherlands Institute for Art History (RKD) and the Royal Picture Gallery Mauritshuis in The Hague (The Netherlands), with support of the Andrew W. Mellon Foundation in New York.

The RKD, one of the leading art historical information centers in the world, and the Mauritshuis, which houses one of the most important collections of 17th-century Dutch paintings, are collaborating on a Mellon Pilot Project aimed at advancing the fields of conservation and art history by developing a Rembrandt research resource that will make conservation and technical documentation electronically accessible. For this project, which started in March 2008, the already existing RKD databases are being adapted and expanded into a multi-lingual information network in which conservation and technical documentation, scientific data and art historical information will be integrated for dissemination at different levels of interpretation. Functionalities such as zooming, image comparisons and explanatory texts are being incorporated in the user interface. Another important aspect of the project is the long-term sustainable storage of high resolution digital files.

The pilot project focuses on a test group of nineteen paintings, by or (formerly) attributed to Rembrandt in the collection of the Mauritshuis. In the last ten years the most important works from this group, including Rembrandt's *Anatomy Lesson of Dr Nicolaes Tulp* (1632), *Homer* (1663) and the late *Self portrait* (1669), have been treated and thoroughly investigated with a range of technologies generating new discoveries and insights, as well as a wealth of documentation and analytical data. The database will also include all paint cross sections from the Rembrandt paintings (images and searchable text files). This material, together with older, existing analog conservation and technical documentation, augmented with documentation from the Rembrandt Research Project archives, will be digitized and made available online to professional colleagues and the public.

The goal is to create a system capable of storing and presenting conservation and technical documentation of paintings by Rembrandt from various museums and institutions internationally. During the pilot project, a selection of Rembrandt paintings from other important collections (including The Metropolitan Museum of Art in New York and The National Gallery, London) will also be incorporated, thus laying the basis for an exhaustive, ever-changing and growing research resource on Rembrandt that can serve as an independent, collaborative, inter-institutional research tool. All information in the database will be presented in English, as well as in the national language of the contributing institution.

The pilot project is part of a larger Mellon initiative to create new digital assets that can readily interface with those of other institutions, and to foster international collaboration and sharing of expertise.

This poster presentation at AIC Los Angeles is the first presentation of the project to the conservation community at large. The team hopes to make this project more widely known and to get feedback on its proposed structure, content and functionalities.

EMERGING CONSERVATION PROFESSIONALS NETWORK: EMERGING CONSERVATORS USING EMERGING TECHNOLOGIES

Sherry N. DeFreece Emery, MS, Senior Architectural Historian and Conservator, URS Corporation; Laura Brill, Kress Fellow, Shelburne Museum; Anne M. Simon, Graduate Student, Department of Chemistry, University of Arizona

AIC's Emerging Conservation Professionals Network (ECPN) was launched in 2007 with the purpose of serving AIC members who have been in the field for up to five years, current graduate students, as well as those who are looking to enter the profession. ECPN is taking full advantage of new technologies to encourage connections between conservators and share information. These include social networking tools such as Ning and Facebook, as well as broader developments in AIC, such as the new website and outreach presentation.

Emerging conservation professionals are very likely to be familiar with new technology and feel comfortable using

digital photodocumentation, web-based research, and new materials and techniques. But while they may be very up to date on conservation literature and information, they also know that they don't have all the answers.

While new technologies bring many advantages and opportunities, in some situations there is still no substitute for personal interaction. One of the objectives of the group is to establish an effective mentorship program which utilizes both high- and low-tech methods. Emerging conservation professionals will be paired with an appropriate mentor based on a variety of criteria, and will be able to connect to them via email, phone, social network, or in person. Mentees will benefit from the experience and guidance of the mentor, while the mentor will benefit from being connected to the next generation of conservators and learn about new trends in conservation.

ENVIRONMENTAL DEGRADATION VS. ARTISTIC INTENTION: THE DARKENING OF RED LEAD PIGMENT ON JAPANESE PRINTS

Christina Finlayson, Art Conservation Department, SUNY-Buffalo State College; Aaron Shugar, Assistant Professor, Conservation Science, Art Conservation Department, SUNY-Buffalo State College; Judith Walsh, Associate Professor, Paper Conservation, Art Conservation Department, SUNY-Buffalo State College

The blackening of lead pigments on works of art due to hydrogen sulfide exposure has been well documented. In particular, Japanese woodblock prints display instances of lead discoloration that can be attributed to environmental conditions. However there are examples where a silvery discoloration appears to be a patina desired by the artist. This research revisits earlier work on the subject conducted by Judith Walsh, *et al.* (1997), but in addition, it will attempt to reconstruct possible traditional methods for creating the surface patina. Samples will be printed with red lead dispersed in water and mixed with rice starch paste. Half of the samples will be overprinted with a 5% acetic acid solution and placed in a chamber containing sodium sulfide and sulfuric acid to produce hydrogen sulfide; the others will be overprinted with rice vinegar and exposed to hydrogen sulfide vapors produced with a variety of period-appropriate materials. The morphology, chemistry, and crystallinity of the resulting lead sulfide will be observed and compared using polarized light microscopy, SEM, and XRD. It is expected that alternative techniques for producing the lead patina will have unique qualities that will help differentiate it from red lead blackened using laboratory reagents.

Walsh, J., Berrie, B., and Palmer M. (1997) "The Connoisseurship Problem of Discoloured Lead Pigments in Japanese Woodblock Prints" in: *IPC Conference Papers London 1997* pp. 118-136.

AFRICAN BEADED OBJECTS: CHARACTERIZING CONSERVATION ISSUES AND TESTING AND DEVELOPING CLEANING TREATMENTS

Maria Fusco, Kress Fellow, Smithsonian Institution, National Museum of African Art; Stephen P. Mellor, Chief Conservator, Smithsonian Institution, National Museum of African Art; Robert J. Speakman, Head of Technical Services, Smithsonian Institution, Museum Conservation Institute

This poster presents research currently in progress at the Smithsonian Institution's National Museum of African Art (NMAfA) and Museum Conservation Institute concerning the conservation of African beaded objects. The main goals of the project are to characterize the soiling and deterioration issues of a segment of ethnographic art not well represented in the conservation literature and to study the appropriateness and effectiveness of common yet sometimes debated cleaning treatments of beaded ethnographic objects, here as they relate to African items. The study aims to take into account substrate and component materials beyond the beaded elements and to also utilize instrumental analyses which will allow for further development of research conducted by other institutions with the beaded art of other cultures. A survey is being undertaken of collection items at the NMAfA as well as other significant African collections in North America; the distinguishing features of these objects' soiling patterns and deterioration are being analyzed physically and chemically. The results of the chemical analyses will be used to inform, test, and develop the variety of cleaning treatments currently used.

APPROPRIATENESS OF WET CLEANING TECHNIQUES FOR INKJET PRINTS

Tessa Gadomski, Undergraduate Student, University of Delaware; Jennifer Jae Gutierrez, Interim Coordinator, Winterthur/University of Delaware Program in Art Conservation, University of Delaware

This poster summarizes research conducted during the fall 2008 semester as part of an undergraduate senior thesis project at the University of Delaware. Research goals for the project included establishing protocol for future cleaning tests of inkjet materials, discovering if wet cleaning is a possibility for fine art inkjet prints, and evaluating whether or not different types of inkjet paper alter how the ink is affected by wet cleaning.

Various wet cleaning methods were researched and tested in the Department of Art Conservation's photographic materials conservation laboratory under the supervision of Jae Gutierrez and Debra Hess Norris. The appropriateness of traditional photograph wet cleaning techniques for the surface cleaning of fine art inkjet prints is discussed.

Due to limited time and resources, the amount of research conducted was fairly small. The inkjet print materials tested

were Epson Ultra Premium Photo Paper Luster and Ilford Galerie Gold Fibre Silk paper with Epson K3 Ultrachrome ink. These materials were chosen because they have a high probability of appearing in fine art collections. A target including ten color swatches, a small image, and four checkered boxes in different colors was printed on both paper types and used for testing. Reasoning behind the organization of the target and the choice of colors used will be discussed in detail. An Epson Stylus Pro 4800 printer was used to create the targets.

Several wet cleaning techniques, including spot testing and immersion were investigated. Measurement of color shift, dye migration, and surface sheen were used to evaluate the samples. Color shift was measured quantitatively using colorimetry. Dye migration and surface sheen was measured qualitatively. Measurement of samples was conducted before and after wet cleaning. Possible reasons behind any changes observed in the target are discussed, and the appropriateness of wet cleaning techniques is evaluated.

EXHIBITING AND PREPARING FOR THE FUTURE TREATMENT OF CONTEMPORARY MOVIE POSTERS

Erin K. Jue, Andrew W. Mellon Fellow, Paper Conservation, Los Angeles County Museum of Art; Jennifer Kim, Conservator, The Academy of Motion Picture Arts and Sciences, Margaret Herrick Library; Lucia Bay, Conservation Technician, The Academy of Motion Picture Arts and Sciences, Margaret Herrick Library

The Academy of Motion Picture Arts and Sciences' Margaret Herrick Library collects a wide range of materials that document film as both an art form and an industry. The collection spans cinema from its infancy to movies currently in production. Included in the library's holdings are over 40,000 posters. Approximately 8% of these holdings contain double-sided imagery, are printed on coated papers, and use unspecified printing technologies.

The media and supports of these new posters have proven to be more sensitive to moisture and solvents in comparison to older posters. The exhibition of the works has been complicated by the fact that traditional adhesives used for hinging in paper conservation do not adequately adhere to the surfaces of these highly glossed prints.

While these double-sided posters are currently in good condition, it is expected that the objects will eventually require conservation treatment; therefore, knowledge of their materials and methods of manufacture is necessary. As such, the authors have begun a project to research these new materials by collecting information from various local printing firms and surveying the collection to identify the printing media and supports.

Various adhesives and mounting methods, both traditional and non-traditional, are currently being examined for use with these works. At this time, the main foci of the project are to report the data gathered from the poster printers, find compatible adhesives for the objects, and develop acceptable methods for exhibition framing.

AQUAZOL AS A HEAT-SET ADHESIVE FOR TEXTILE CONSERVATION TREATMENTS

Katherine Lechuga, MSIS Candidate, CAS Candidate in Conservation, The University of Texas at Austin, School of Information, Kilgarlin Center for Preservation of the Cultural Record

Consolidating shattered silk has been a long-standing difficulty in textile conservation due to the fact that most embrittled silk cannot withstand the stress of mechanical consolidation achieved through hand stitching. The most traditional option has been to use an adhesive treatment, which can be problematic since the drape of the textile is almost certainly affected.

A search of the conservation literature on adhesive treatments for textiles showed that many adhesive treatments could adversely affect the drape of cloth and sometimes required the use of organic solvents to reverse their application. Aquazol, Poly(2-ethyl-2-oxazoline), a synthetic, water-soluble adhesive often used in painting conservation, was chosen for experiments due to its physical properties of easy reversibility, water solubility, thermoplasticity, and retention of flexibility. Aquazol is available in four molecular weights: Aquazol 5 (MW 5,000), Aquazol 50 (MW 50,000), Aquazol 200 (MW 200,000) and Aquazol 500 (MW 500,000).

In this study, only Aquazol 50, 200, and 500 were tested. The viscosity and adhesion strength increase with the molecular weight, which can be advantageous depending on the adhesion strength required for a given treatment. Aqueous solutions of all three molecular weights were mixed in varying concentrations and tested to determine which would provide sufficient adhesion strength while retaining maximum flexibility. The support fabrics used were silk habutai, silk crepeline, and nylon net. A test treatment was carried out on a teal green silk chiffon beaded dress from the 1920s. The dress exhibited areas of severe loss and shattering at the upper bodice area.

Aquazol was easily reactivated by very low temperatures and provided sufficient bond strength to consolidate shattered silk. In addition, it was extremely easy to reverse and clear using water, so mends could be removed with very minimal risk to the textile artifact. However, it was also discovered that during exposure in high humidity situations (approximately 75% RH), Aquazol did penetrate and stain fabrics.

This poster will illustrate the experimental procedures and materials used in fabricating Aquazol coated and consolidated fabrics. The sample treatment will be illustrated, demonstrating the versatility and potential usefulness of Aquazol as a consolidant for shattered silk.

THE ROLE OF THE EXHIBITIONS CONSERVATOR IN TOURING EXHIBITIONS AT THE MUSEUM OF FINE ARTS, BOSTON

Laura Lipcsei, Assistant Objects Conservator, Museum of Fine Arts, Boston

The production and promotion of large-scale traveling exhibitions are a reality in today's museums. Whether revenue driven, motivated by educational outreach or storage relief, traveling exhibition and loan programs have increasingly become part of many museums' agendas. As collections have begun to be used in novel ways, the traveling exhibitions conservator has, in turn, taken on a new role as facilitator in the process, creating an evolving specialty in the field of art conservation.

In recent years, the touring exhibitions and loans conservator at the Museum of Fine Arts, Boston, has increasingly been called to assume the role of project manager. The traveling exhibition conservator today works with curators at the point of object selection, with registrars and exhibitions managers to communicate with venues on a wide variety of issues and concerns, with collections care specialists and packers for the coordination, handling, packing, movement and installation of objects, and working as an ambassador or liaison on behalf of the home institution while working at the host site.

As a result of such new-found uses of collections, challenges arise. With increased pressure to support the Museum's mandate to share its collections, the conservator is often placed in a difficult position. Given that increased travel and handling of ancient artifacts has the potential for major impact on the physical and chemical stability of the objects, the conservator is faced with an ethical dilemma when making recommendations about whether "to lend or not to lend." Other challenges can originate from the host venue. Unanticipated problems, such as, a host's inability to maintain standard museum environmental conditions, venues with less experienced staff or insufficient resources, changes to pre-established exhibition layouts or instances where new casework must be built all serve as significant challenges in the preparation of traveling exhibitions and the installation process.

This paper will describe the history and development of the traveling exhibitions and loans of ancient works of art at the Museum of Fine Arts, Boston: long-term loans to the Dallas Museum of Art and San Antonio Museum of Art; the international loan program with the MFA's sister institution in Nagoya, Japan; and two ongoing touring exhibitions from the ancient collections traveling to venues across North America. This presentation will illustrate the conservator's role in bringing the Museum's traveling exhibit from inception to fruition. Case studies will be presented together with information streamlining the process to face some of the challenges mentioned above. Developments in computer software databases, such as The Museum System (TMS), digital photography and the use of computer software such as Adobe Bridge, Photoshop, and Excel have facilitated the process. The use of easy-to-read documents, such as checklists for site visits, clear recommendations for host venues on acceptable environmental parameters and material guidelines for display case construction will be presented.

A BASE OF XRF REFERENCE SPECTRA TO SUPPORT THE IDENTIFICATION OF INORGANIC PIGMENTS

Ana Martins, Associate Research Scientist, The Museum of Modern Art; Chris McGlinchey, Sally and Michael Gordon Conservation Scientist, The Museum of Modern Art; Kristen Patterson, Conservation Student, Institute of Fine Arts, Conservation Center, New York University; Kristin Robinson, Conservation Student, Institute of Fine Arts, Conservation Center, New York University; Hannelore Roemich, Associate Professor of Conservation Science, Institute of Fine Arts, Conservation Center, New York University; Alan McSherry, Senior Software Engineer, Stepping Stone Software Ltd., Dublin, Ireland

X-ray fluorescence (XRF) spectroscopy is widely used as a non-destructive technique for the identification and sometimes quantification of chemical elements in a wide range of materials. Development of energy-dispersive spectrometers has led to the commercialization of handheld and reasonably priced instruments that allow in situ investigations of metals, glass, ceramics, stone, written material, and paintings for the detection of elements with atomic number as low as 12 (magnesium).

XRF spectroscopy performed with this category of instruments can assist the identification of inorganic pigments in paints, as long as they are composed of detectable elements. However, the XRF spectrum of a painted area does not necessarily provide unambiguous information regarding the true identity of the pigments. For example two pigments, or two mixtures of pigments, with the same color or not, may share the same key detectable elements and thus cannot be distinguished. Also due to the penetration of the x-rays, this technique is not only sensitive to the elements at the surface, but can detect elements down to the ground preparation of a painting. On the other hand, the sensitivity of this type of instruments is such that not only the expected elements according to the chemical formulae of the pigments will be detected, but also impurities that derived from the production process as well as the mineral origin of the materials used in their preparation.

Despite the potential complexity of XRF spectra interpretation for paintings, the intricacy of all the above-mentioned contributions may actually represent one of the key attributes of this technique for the identification and discrimination of pigments.

In order to interpret a spectrum obtained for a particular painting, it is necessary to know beforehand the expected

representative chemical elements for the largest set of possibly relevant pigments. The purpose of this project is therefore to build a web supported database of XRF reference spectra for inorganic pigments and their interpretation, to assist their identification. This poster will present the progress in the development of the database and its functionalities.

A TECHNICAL ANALYSIS OF HOPI KACHINA DOLLS AT THE ARIZONA STATE MUSEUM

Meghan McFarlane, Third-Year Conservation Intern, Winterthur/University of Delaware

Kachina dolls are among the most collected and recognized objects created by the Hopi people of Northern Arizona. These colorful figures are carved in the likeness of supernatural beings that form an integral part of Hopi religious beliefs. Kachina dolls are traditionally carved by men and given to girls and young women during special ceremonies. There are over 300 distinct Kachinas, each representing an object, animal, person, or place. The earliest Kachina dolls were carved from a single piece of wood and decorated with earth pigments. With time, and the influence of outside materials and collectors, Kachinas developed into multi-part, composite objects. The aesthetic evolution of Kachina dolls has been documented by numerous sources; however, no scientific technical studies have been published on Kachina doll materials and techniques to date. The present study uses new and old technologies available to conservators to characterize the materials present on a diverse selection of Kachina dolls owned by the Arizona State Museum. These techniques include the use of Fourier transform infrared spectroscopy and handheld x-ray fluorescence spectroscopy, as well as long-established methods including microscopy, x-ray radiography, and microchemical spot tests. Through the use of novel and recognized analytical methods, new insights can be made into this historic collection.

THE SAMPLING OF ARCHAEOLOGICAL METALS FOR LEAD ISOTOPE ANALYSIS USING ETHYLENEDIAMINETETRAACETIC ACID– A "MINIMALLY DESTRUCTIVE" ALTERNATIVE

Vanessa Muros, Staff Research Associate, University of California, Los Angeles /Getty Conservation Program; Joseph Lehner, Graduate student, Cotsen Institute of Archaeology, University of California, Los Angeles; Alma Bardho, Laboratory Assistant, Faculty of Natural Science, University of Tirana

Conservators, scientists and archaeologists often struggle with the issue of sampling archaeological and historic objects for research and analytical purposes. In many cases, destructive sampling, requiring one to take a solid sample from an object, is required for a variety of techniques to answer questions on technology, provenience, and deterioration issues. Lead (Pb) isotope studies of archaeological metals that are used to find the ore source from which the metallic artifact was made often requires a small piece of an object to be taken in order to perform the analysis. Equipment such as laser-ablation inductively coupled mass spectrometry (LA-ICPMS) has minimized the amount of solid sample required to just a few microns. However, for archaeological metals which are covered in layers of corrosion a solid sample is still often taken to provide an uncorroded polished metal surface on which to perform the analysis.

An alternative sampling method has been investigated using ethylenediaminetetraacetic acid (EDTA), which extracts lead directly from the object for analysis. In order to perform the extraction, the object is soaked in a solution of EDTA and the Pb rich solution is then analyzed using time of flight inductively coupled mass spectrometry (TOF-ICP-MS) to determine the isotopic ratios present. In the archaeological literature success has been reported using this technique for the sourcing of majolica in the American Southwest and lead and silver objects in Pakistan. The authors in these cases report no macroscopic alteration to the artifacts after soaking in the EDTA solution. However, no study has been undertaken to determine whether the extraction technique alters the surface or appearance of the object in any way when examined under magnification.

Preliminary work was conducted by the authors in order to determine whether or not this sampling technique could effectively be used for sourcing leaded archaeological bronzes, in addition to silver and lead artifacts, from Anatolia and Albania. During the EDTA sampling process, the objects were examined both before and after soaking using a binocular microscope (7-45x). Using objects with relatively smooth corroded surfaces to allow for easier identification of surface changes, no pitting or alteration to the surfaces was observed. Objects that were only partially immersed in EDTA due to their size also did not show any surface differences between the soaked and unsoaked areas.

These preliminary results seem to indicate that no observable change can be seen at a low magnification when objects are soaked in a low concentration solution (0.05%) of EDTA. Therefore, it is possible that EDTA extraction may be a "minimally destructive" method that could be used to sample objects for Pb isotope studies. However, more work needs to be undertaken to determine what surface changes or alterations to the object may be occurring during sampling, since it is clear that material is being extracted out of the metallic artifacts. It is the hope of the authors that this initial field study will prompt other researchers to continue to look into this sampling method, which shows some promise as an alternative method of sampling metallic artifacts to traditional destructive sampling.

APPLICATION OF UV/VNIR DIGITAL PHOTOGRAPHY AND COMPOSITE FALSE-COLOR IMAGING IN FIELD ARCHAEOLOGICAL CONSERVATION INVESTIGATIONS

Cuong Nguyen, Pre-program Intern, Objects Conservation, Museum of Fine Arts, Boston; Ioanna Kakoulli, PhD, Professor, Archaelogical Materials Science & Conservation, UCLA Materials Science and Engineering Department with joint appointment in the UCLA/Getty Conservation Program; Maria Cecilia Lozada, PhD, Adjunct Professor of Anthropology, University of Chicago

This project explores the potential of digital ultraviolet, visible/near infrared (UV/VNIR) photography in field archaeological conservation investigations as a diagnostic tool to assist non-invasive surface morphological characterization and identification of constituent materials and alteration artifacts of archaeological objects. The research aimed at optimizing the conditions for in situ field UV/VNIR photography using commercially available digital camera systems and user-friendly software for image post-processing to develop trichromatic composite false-color images. The case-studies investigated focused on the examination of human remains and other pre-Columbian archaeological materials at the Tarapaca Valley in Chile.

In this project, the Fujifilm IS-1 camera, a standard tripod, two 150 watt halogen flood lights, and three ultraviolet LED handheld flashlights (with emission in the long ultraviolet range) were used. Photography was performed in a static system of bracketing, offering a preferred still set in different exposures at specific wavelengths. MaxMax NIR long pass filters were used at 715 nm, 780 nm, 815 nm, and 1000 nm, while the MaxMax UVR and X-Nite BP1 were combined in ultraviolet-induced photography. MaxMax X-Nite CC1 was used to capture images in the visible region, and color corrected using the QP cards on a calibrated LCD notebook.

Monochromatic images were combined through color channel arrangements to produce trichromatic false-color images. These new composites were able to enhance surface characteristics and to produce false-color topographic maps underlining weathering in life and/or post mortem effects of the human remains rendering more obvious surface soiling and other deposits, bacterial growth, and burns.

COMPUTER IMAGING ANALYSES OF BRICK PATTERNS IN PAINTINGS BY JAN VAN DER HEYDEN (1637-1712)

Petria Noble, Head of Paintings Conservation, Royal Picture Gallery Mauritshuis; David G. Stork, Computer Scientist, Ricoh Innovations; Sean Meador, Department of Computer Science, Stanford University

Jan van der Heyden, engineer, inventor and painter, lived and worked in Amsterdam between 1637 and 1712. As a painter, he is chiefly known for his city- and landscapes that are depicted with compelling realism. Van der Heyden developed a highly characteristic and effective manner of adding hundreds of tiny bricks that serve to heighten the illusion of reality in his paintings. This unique feature appears to be present throughout his entire oeuvre. An intriguing question is how the patterns were created. In 1721, just nine years after the artist's death, the biographer Arnold Houbraken speculated on this aspect of Van der Heyden's art in his *De groote schouburgh der Nederlandtsche konstschilders en schilderessen*:

"...He painted every little stone in the buildings so minutely that one could clearly see the mortar in the grooves in the foreground, as well as the background... In truth, it is still believed that he had a special trick, or had invented a means whereby, to all who understand the use of the brush, he could accomplish things that seem impossible with the customary ways of painting." (1753, 2nd ed., Vol. 3, 81)

Microscopic examination of several paintings, including 'View of the Oudezijds Voorburgwal with the Oude Kerk' ca. 1670, reveals that the light paint used for the brick mortar (a mixture of lead white and yellow earth) does not appear to be painted with a brush. The paint stands in sharp ridges; in other places the paint is very fluid with peculiar raised dots of paint suggesting the lines were pressed in some fashion, rather than painted, on the paint surface. In many paintings the brick patterns are applied in two colors, first in a fluid dark paint for the shadows, then slightly above or below, and to the left or the right in a light paint for the mortar. It has been proposed that a counter proofing printing technique was used to create the patterns where a wet print or part of a wet print was carefully positioned face down on the painting. In the case of the light and dark lines, this would be achieved by two consecutive applications of the identical pattern in a different paint. If, indeed a number of 'brick templates' were used for this purpose, we would expect to find repeated patterns in different parts of the painting or in different paintings as the print/s were shifted from place to place or painting to painting.

Since visual search for repeated patterns within a painting is beyond the scope of the human eye, computer imaging analysis, specifically digital cross-correlation, is being applied in collaboration with computer scientists. The first step has been to isolate the various areas of brick patterns in a high-resolution image of the painting. In order to compare the shapes and width of the lines, a morphological filter was used to create an image where the mortar lines are of equal

thickness. The next step was cross-correlation of these images to search for repeated patterns. While our preliminary results show no significant regions of cross-correlation that would indicate multiple re-use of counter proofing, it does not rule out the single use of a master print.

To our knowledge, this is the first use of digital pattern recognition to look for repeated patterns in a work of art in order to answer an intriguing question regarding an artist's painting technique. A subsequent step in this research will be to carry out inter cross-correlation analysis of other paintings by Jan van der Heyden. Reconstructions of the brick patterns involving various printing techniques are also planned.

MODERN MATERIALS, SPECIAL NEEDS: THE DUAL CHALLENGE OF INHERENT VICE AND PREVIOUS TREATMENT IN A SPECIAL COLLECTIONS PAPERBACK

Sarah Norris, MSIS, CAS Candidate, Kilgarlin Center, University of Texas

As many 20th century library materials begin to transition from general collections to special collections status, they move correspondingly into new realms of conservation thinking. These items have often been subject to past preservation strategies that appear aggressive by today's standards. Conservators treating these items must now face a dual challenge: working with the inherent vices of modern materials and construction; and mitigating the often harmful effects of previous preservation efforts. These were the difficulties that shaped the treatment of *El Gobierno del Uruguay*, a 1919 special collections paperback held by the Benson Latin American Collection at the University of Texas at Austin. This loosely-sewn paper case book had previously been drilled and laced into acidic pamphlet boards, its paper cover removed and adhered to the front pamphlet board. A treatment was designed to reverse this invasive preservation strategy and return the item closer to its original state. The result is an item that retains its original modern structure and design limitations, but is stabilized for library storage and researcher use.

This poster examines the problematic features of the paperback's construction and provides a comparison of the past and present methodologies used to address them. Emphasis is placed on the significance of preserving modern structures, many of which already represent bygone production methods. This presentation also aims to stimulate thought and discussion about the shift in preservation philosophies from a focus on utility and strength to a focus on the integrity of the item.

LOW-COST INFRARED IMAGING USING A 'NIGHT VISION' WEBCAM

Elizabeth Nunan, Graduate Student, Art Conservation Department, Buffalo State College; Dan Kushel, State University of New York Distinguished Teaching Professor, Technical Examination and Documentation, Art Conservation Department, Buffalo State College; Dr. Gregory Dale Smith, Andrew W. Mellon Assistant Professor in Conservation Science, Art Conservation Department, Buffalo State College

Various near infrared (NIR) imaging devices and techniques have been used for the examination of underdrawings in paintings and the characterization of losses and damages under restoration layers. The most common inspection devices for these applications are infrared vidicon cameras, or solid state imagers such as indium gallium arsenide, indium antimonide, or mercury cadmium telluride devices. However, these technologies are expensive, bulky, and complicated, which has limited their application by private conservators, smaller institutions, and curators. For less than 1% of the cost of a vidicon system, a NIR-sensitive digital web camera (webcam) can be easily adapted for use as an extremely inexpensive, portable, and simple infrared examination tool for artwork that also allows for convenient capture of infrared images on-the-fly. The webcam's NIR sensitivity is limited as compared to that of the other systems (1000nm maximum vs. 1700 to 2200nm), but does match that of infrared film and standard digital cameras modified for IR photography. The use of such a device for reflected and transmitted infrared examination and for the observation of infrared luminescence is demonstrated and a careful comparison is made of its performance relative to a vidicon system.

NATURALLY AGED VARNISH SAMPLES FROM THE 1994 CANADIAN CONSERVATION INSTITUTE WORKSHOP, "VARNISHES: AUTHENTICITY AND PERMANENCE"

Michael O'Malley, Paintings Conservator, Centre de Conservation du Québec

In September 1994, the Canadian Conservation Institute hosted a professional training workshop entitled "Vanishes: Authenticity and Permanence." The purpose of the workshop was to compare the characteristics and handling properties of different varnish formulations used on paintings by artists and conservators.

During the course of this two-day workshop, each participant created a large set of varnish test panels to keep and study. The panels consisted of pre-primed artists' boards that were subsequently coated with various paint media. While most of the boards were also primed with an additional layer of lead white oil paint as a substrate for the varnish samples, other background colors (either oil- or acrylic-based)

were also applied, including black, brown, red, and blue. Newer varnishes and/or proprietary commercial varnishes were then brushed onto the panels in thin strips alongside older 19th century varnishes, which were recreated from published recipes in artists' manuals.

Some of these samples were brought to the Centre de Conservation du Québec (CCQ) in 1994. They were mounted on a wall in the paintings lab adjacent to a north facing window and left to age for over a decade. Fifteen years later seemed an appropriate moment to take a closer look and evaluate the appearance and performance of the varnishes.

The panels have aged in a controlled environment similar to museum conditions in a northern climate. The light is a mixture of daylight and fluorescent lighting. It would have been highly instructive to see how the panels would have aged in an environment containing an appreciable amount of UV radiation. However, UV is filtered in the CCQ paintings lab and generally does not surpass 50 microwatts per lumen.

The varnish samples were applied by hand in thin layers to replicate bench practice. While no attempt was made to standardize how the varnishes were applied, all the sample areas were well delineated and identified. However, the hand application procedure may have resulted in slight variations. Accordingly, the observations presented in this poster are subjective and anecdotal, as opposed to quantitative scientific findings. They do, however, reflect the consensus of several conservators in the CCQ paintings lab.

We noted the degree of yellowing, the saturation, the homogeneity of surface gloss, the effect of the hindered amine light stabilizer Tinuvin 292, the performance of the varnishes on oil and acrylic paint layers, and their solubility in mild solvents. Photographs further illustrate differences in the appearance of the samples.

There were several surprises and some disappointments. This poster presents a brief summary of the salient observations. It will be very interesting to chart the changes in these varnishes over the next 15 years and beyond.

SALOME BY FABRIZIO BOSCHI (1572-1642): DISCOVERED AND TREATED

Louise M. Orsini, Conservation Intern, The Walters Art Museum & Winterthur/University of Delaware Program in Art Conservation

A painting of *Herodias Presenting Salome with the Head of John the Baptist* came to the Winterthur/University of Delaware Program in Art Conservation via the program's monthly clinic which offers free consultations to the public. The painting appeared to be an Italian work from the 17th or 18th century. Little was known of the painting's provenance except that the owner's father acquired it in America circa 1920. Subsequent analysis and art-historical research found that the painting was not only an Italian work, but also an oil sketch (bozzetto) by the accomplished 17th-century Florentine artist Fabrizio Boschi (1572-1642). Analytical techniques utilized in the dating of the piece included cross-section microscopy, scanning electron microscopy-energy dispersive spectroscopy, x-ray fluorescence spectroscopy, and polarized light microscopy.

These findings were used in forming a treatment plan which took into account the age of the work and its treatment history, which included a 19th-century restoration. The presence of a floating signature (added above a 19th-century varnish layer), source unknown, presented an ethical dilemma. Should the floating signature be left in place for future researchers or should it be removed in order to minimize its visual impact on the work? With reference to past treatments of works by Frans Hals involving a similar dilemma, a compromise was reached. The floating signature "Rossi" was left intact, documented, isolated, and carefully inpainted out.

THE INVESTIGATION OF CYCLODODECANE'S EFFECT ON CARBON-14 DATING OF ARCHAEOLOGICAL MATERIALS

Christie M. Pohl, Assistant Conservator, Peabody Museum of Archaeology and Ethnology, Harvard University; Greg Hodgins, Research Scientist and Professor of Anthropology, NSF Accelerator Mass Spectrometry Facility, University of Arizona; Robert J. Speakman, Physical Scientist and Head of Technical Studies, Smithsonian's Museum Conservation Institute; Harriet F. Beaubien, Senior Objects Conservator and Head of Conservation, Smithsonian's Museum Conservation Institute

Cyclododecane (CDD), a cyclic hydrocarbon (C12H24) and volatile binding medium, has been tested and utilized in the field of conservation since the 1990s. It has been employed as a consolidant, release agent, and barrier layer on a variety of substrates including ceramics, stained glass, textiles, paper, wall paintings, and sculptures. It sublimates slowly under ambient conditions, and this property makes it an appealing alternative to conventional (non-subliming) organic consolidants because it alleviates the need for physical or chemical handling when removal becomes necessary. However, current understanding of CDD's affect on organic archaeological substrates is limited. For example, if sublimation is incomplete, what are its affects on future chemical and isotopic studies of treated materials? This study investigated CDD's impact on the carbon-14 dating of CDD-treated archaeological materials using accelerator mass spectrometry. The study also investigated compositional aspects of CDD using Fourier transform Raman spectroscopy, x-ray fluorescence spectroscopy, and gas chromatography-mass spectrometry. The carbon-14 content of two conservation-grade and two laboratory-grade CDD samples was determined. All were radiocarbon-free, indicating that the chemical is synthesized from petroleum-derived, rather than modern hydrocarbon sources. Radiocarbon dates obtained from modern and archaeological gourd rinds, both of known age, either untreated or cycled through CDD application and

sublimation, were found to be identical. The conclusion is that CDD treatment of artifacts does not preclude subsequent radiocarbon dating. While the study does not demonstrate that CDD residues are absent from CDD-treated artifacts, it showed that the stringent sample cleaning protocols specifically designed to remove both burial and laboratory contaminants were sufficient for any residues that might be present.

THE VARIOUS SCHOOLS OF ARCHITECTURE IN NEPAL

Bharat Raj Rawat, Chief Museologist, National Museum of Nepal, Kathmandu

Nepal, although primarily a Hindu country, is inhabited by people of different religions. After the Hindus, Buddhists are the second largest group in the country. In Nepalese architecture, the influence of both Hindu and Buddhist philosophy can be seen widely. Nepalese Hindu architecture is best characterized by its various Hindu temples and monasteries. The Shikhar style of temple is built using stone with mud or lime mortar and terracotta. In this style of architecture, there are three or four levels of plinths that make up each temple. In the case of brick Shikhar temples, the doors and beams are made of wooden members. Multi-roofed temples, known as Nepalese-style temples, are very common in Nepal and frequently made of one, three, or five stories. The walls are made of brick, while the windows, doors, pillars, and roof are all made of wood. After planking, the roof is also covered with soil and tiles. Occasionally, copper-sheets that are sometimes gilded have been used in place of the soil and tiles. Stupas are also common in Nepal. They are dome-shaped and generally made of brick, plastered with mortar, and white-washed with lime. Secular architecture consists of a variety of buildings such as palaces and are often constructed of similar materials including brick and wood with mud and tile roofs.

There are a variety of conservation issues surrounding architecture of this type. Since large quantities of wood have been used in Nepalese architecture, termites can easily damage the wooden members causing the structure to collapse. Salt formation is another problem in the case of stone and terracotta temples. The salts are removed by poulticing with paper pulp and continuously checking for the presence of salts with a 5% silver nitrate solution. The copper sheets are subject to corrosion due to atmospheric pollutants. In areas where plants are a problem, different herbicides are used. The plants are removed so that these areas can be conserved. Insects on the wooden members are controlled using suitable insecticides. If the damage is extensive, the wooden members are removed and replaced. During the conservation of these monuments, a thorough examination is carried out with extensive documentation.

A PRELIMINARY INVESTIGATION INTO THE SURFACE CHARACTERISTICS OF PAINT AND THE IMPLICATIONS FOR RESTORATION

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This study presents an initial investigation into the surface characteristics of the uppermost paint layer of paintings--the finished final paint surface. The primary focus is on how to characterize differences in surface morphology between intact and damaged paint. This will allow a better understanding of how small local disruptions (primarily abrasion) at the very surface of otherwise intact paint affect the overall visual impression of a painting. To what extent does surface abrasion or the additive effect of small areas of surface abrasion interfere with our reading of the picture?

When viewing a painting, a broad spectrum of the surface phenomenon contribute to our perception. These include natural aging such as color fading and shifts, discolored varnish, cracks, restorations, etc. This study focuses only on the surface characteristics of the uppermost surface of the original paint layer. To fully understand the phenomenon, differences between an intact upper surface of a paint layer and the lower areas of the same layer are examined using a variety of visual and analytical techniques including digital photography, colorimetric studies, roughness measurements (confocal white light profilometry) and microscopic observation (both stereoscopic and scanning electron microscopy). Means are sought to record subtle visual differences and to qualify and/or quantify them with the goal of using this information in restoration strategies. Gross abrasion that exposes distinctly different lower paint layers are not a concern.

The implications of this research can affect decisions made in the restoration of paintings. Opinions often differ as to what is seen in a painting. Differences as to how the composition holds together or works with regards to overall balance and/or perspective are often reduced to individual subjective evaluation. However, as a collection of visual effects, even subtle disturbances to the surface alter a picture's appearance. Identifying how the damaged surface of what on first appearance may seem to be an intact solid paint layer differs from an otherwise undamaged paint layer can objectify the visual effect of surface phenomenon. This can have a direct effect in understanding why we see what we see and, in turn, the direction of a painting restoration.

General restoration of paintings includes the restoration of missing paint in order to reestablish the original, albeit aged, appearance of the composition. Controversy as to what extent restoration can or should be carried out can be found in almost every discussion on the subject. While retouching actual paint loss, including lost glaze layers and abraded paint that exposes underlying color, is widely accepted in the practice of paintings restoration, retouching or toning to

restore only the damaged surface of otherwise intact paint is more often questioned. Understanding what constitutes the surface of a painting and how it is altered can aid in understanding to what extent subtle damage plays a role in the actual appearance of a painting and add insight into treatment options.

FISHING FOR AN ALTERNATIVE TO THE TRADITIONAL SOURCE OF ISINGLASS: PRELIMINARY INVESTIGATIONS

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Isinglass has become a generally accepted tool in Western conservation as an adhesive and consolidant. Isinglass is a natural polymer consisting of collagen and having relatively low viscosity, high-tack properties, and low gellation temperature, which distinguish it from traditional animal glues and synthetic adhesives. These unique properties have made it an indispensable tool for a variety of paper and paintings conservation treatments.

Isinglass is traditionally produced from the inner membrane of the Russian beluga sturgeon. However, due to dwindling sturgeon populations in the Caspian and Black Seas, an alternative to the traditionally Russian produced adhesive is necessary.

This study provides an overview of various traditional methods of producing isinglass. Potential replacements for traditional Russian sturgeon will be explored, focusing on the availability of sturgeon in the United States. Isinglass will be prepared in a variety of processes, utilizing American farm-raised white sturgeon. Fourier transform infrared spectroscopy will be used to compare laboratory prepared and traditional isinglass samples. Differential calorimetry will document and compare phase transitions of the samples. Additional traditional analytical methods will measure key adhesive properties such as pH, molecular weight, and gelling properties.

These results will be compared with the available published data. A determination will be made as to the feasibility of replacing traditional Russian isinglass with more easily obtainable alternatives.

PHOTOGRAPHIC IMAGING OF INFRARED LUMINESCENCE INDUCED BY VISIBLE LIGHT IN ARTIST MATERIALS

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Photographic imaging of infrared radiation (IR) is frequently practiced by conservators during examination of artwork. Another method of IR examination is the documentation of infrared luminescence induced by the absorption of relatively intense visible light. This technique requires filtration of the illumination source to eliminate infrared and filtration on the camera to eliminate visible light and transmit IR. While a routine technique in forensic laboratories where facilities are available and procedures standardized, its use has been limited in conservation because of the difficulty of initial setup, the slow response of infrared film to the low intensity of the luminescence emissions, and the difficulty in assessing and determining exposure and focus because of the required film processing. Digital cameras modified for infrared work, however, provide greater sensitivity to the low intensity luminescence because they do not exhibit reciprocity failure; they also provide instant feedback facilitating the assessment of exposure and focus. Thus, the recent transition to digital photography in the conservation laboratory now makes infrared luminescence a viable examination method.

Using infrared luminescence techniques, this study surveys the luminescence properties of a variety of colored materials including pigments, dyes, wood, and glass samples. Investigation will include photographing the samples with a Fujifilm FinePix S3 Pro UVIR digital SLR camera, which is capable of imaging infrared radiation to 1000 nm. Further investigation will include inspecting and documenting the samples with an infrared vidicon camera capable of imaging to 2000 nm. Samples that exhibit luminescence will be analyzed using spectroscopy to determine excitation-emission spectra. With this information, it is hoped that excitation sources and detection methods for the documenting of IR luminescence of the surveyed materials can be optimized.

A COMPARATIVE INVESTIGATION OF LINED LINEN AS A BOOK COVERING MATERIAL

Dr. Melissa Tedone, Conservation Intern, University of Illinois at Urbana-Champaign

Book conservation exists at the intersection of craftsmanship traditions and scientific methodology, which lends the field richness and diversity, but also means that treatment decisions are often made in a gray area where intuition and habit merge with research and quantifiable data. While traditional approaches continue to be a valuable resource, it would serve us well as conservation professionals occasionally to re-examine and challenge the assumptions that underlie our use of common materials and methodologies, in order to move the field forward on solid footing. To this end, a comparative investigation of common approaches to lining linen as a book repair material was conducted at the University of Illinois at Urbana-Champaign. Brian Baird and Mick Letourneaux's 1994 article, "Treatment 305: A Collections Conservation Approach to Rebinding" describes the use of lined linen as a covering material for tightback repairs, and draws upon Bill Minter's seminal article, "The Use of Linen as a Book Covering Material" (1985), which recommends a covering material of unlined linen sized with wheat starch paste/methylcellulose. Lined linen offers greater opacity and heft than unlined, particularly for shaping over spines, and has become a widespread choice as a board-covering material. However, approaches to lining linen vary just as widely. Seeking to make an informed choice of lining method, the author made up a series of sample squares using common lining materials and adhesive mixtures, in order to compare their behavioral properties.

Sample squares of 12 cm^2 airplane linen were lined and sized with Japanese mulberry or Western machine-made tissue ("lens tissue") and a range of adhesive mixtures, including equal measures of wheat starch paste/PVA (polyvinyl acetate), wheat starch paste/methylcellulose, and PVA/methylcellulose. Half of these samples were dried in open air on Mylar (polyester film), as described in Minter's 1985 article, and half of the samples were partially dried and then calendared in a standing press, according to Baird & Letourneaux's 1994 article. The resulting samples were handled and surveyed by 15 conservation professionals and student conservation technicians, who rated each sample's texture, flexibility, malleability, and shape retention on a scale of 1 to 3. While the survey results admittedly provide "soft" data, a sufficient amount of this subjective data was collected that the results can be quantified. Clear trends favored two samples over the others. While opinions were divided on whether a smoother or coarser final texture was most desirable, participants overwhelmingly preferred lens tissue over mulberry as a lining material. The most-preferred linen sample (favored by 70% of survey participants) was lined with lens tissue and a 1:1 mixture of wheat starch paste/PVA, then calendared smooth. The second most preferred sample was lined with lens tissue and a 1:1 mix of PVA/methylcellulose, then air-dried on Mylar.

MEDIATING COMMUNITY RELATIONS THROUGH ART CONSERVATION

Katelyn Uehling, student, University of Delaware

Many enjoy visual art for the art's sake. But when art becomes a representation of social activism, it can undertake a whole new meaning for the artist, contributors, and community. This project aims to document the preservation history of the Community Remembrance Project, a joint effort by the University of Delaware's Art Department and the Center for Material Culture Studies begun in 2004 to recognize and honor the cultural roots of the New London Road African American Community in Newark, Delaware. More specifically the initial direction was to conserve a mosaic monument in Newark which was erected to "Honor, Respect, and Remember" the community, an important component of the original Community Remembrance Project. Unfortunately, the three-year-old monument is already deteriorating beyond repair due to inherent vice. The status of the monument requires a new direction, which is to implement state historical markers at important locations within the community. The project will also produce a pamphlet containing oral history quotes and pictures to layout a walking tour of the New London Road Community with explanations of the important buildings. This will simultaneously commemorate the community and educate the university students about an important part of Newark's history and current population. Information about both the community and the Community Remembrance Project provide a better understanding of the community identity, which will be translated into the text of both the historical markers and the pamphlet.

The importance of establishing a community identity makes preservation of oral histories, or documented historical information gathered from the community members, a key component of this project. Existing oral histories from the first Community Remembrance Project were read and new oral histories continue to be conducted. Texts and online sources about the community, the project, and general African American history in the twentieth century were also utilized. This information provides insight into the often strained relationship between the University of Delaware and the community, as well as the degree of success of the original monument at strengthening this relationship. The documents, pictures, and digital files that are being compiled from this community will also be preserved in the Special Collections of the University of Delaware Library. The conservation emphasis of this project and the careful planning needed for the historical marker application process are essential and highly symbolic to the success of race relations within a community.

TECHNICAL INVESTIGATION OF SHEA BUTTER-CONTAINING FORAWA VESSELS FROM GHANA

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A number of Ghanaian metal vessels, currently housed in the Fowler Museum of Cultural History at the University of California, Los Angeles, were investigated with regard to their manufacture and deterioration. Technical examination revealed that all vessels were manufactured from skillfully hammered brass sheets, and purpose-built for storing shea butter, a multi-purpose substance derived from shea nuts. Most vessels still contain remnants of shea butter, which has now become discolored from being stored in the vessels: while shea butter extracted using native methods is off-white to yellow, the vessel remains have taken on different shades of green. Typically, such discoloration is caused by diffusion of metal ions into the organic substance, and spectroscopic analysis (X-ray diffraction, infrared and mass spectroscopy) of the discolored shea butter provided evidence of such interactions in the sampled material. The present study discusses how and under what conditions metallo-organic complexes between shea butter and copper and zinc ions are formed, and whether the formation of such complexes is likely to harm the brass surface of the vessels.

REMOVE IT OR LOSE IT! REMOVAL OF THE FORWARD AND AFT BALLAST TANK PUMPS AND THE STRATEGIC PLANNING FOR THE LONG-TERM PRESERVATION OF THE H.L. HUNLEY SUBMARINE

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The H.L. Hunley, an American Civil War era submarine that sank in 1864 and was recovered from the ocean in 2000, is both an artifact and also a self-contained archaeological site. The project encompasses over 17-tons of archaeological material including the iron submarine itself, human remains, sediment, and a variety of artifacts associated with the eight crew members. The long-term preservation of the H.L. Hunley is currently being undertaken at the Warren Lasch Lab/Clemson University Conservation Center in Charleston, South Carolina. In response to the complexity of this task, a conservation plan was developed by conservators and submitted to the U.S. Navy in 2006 with the intent to stabilize the submarine with minimal risk while preserving its technical integrity. Although keeping the original fabric of the submarine as intact as possible is an important stated goal, the excavation of the interior compartment and the preparation of the hull for stabilization necessitate some degree of disassembly. The forward and aft ballast tank pumps illustrate some of the practical and ethical challenges faced while developing this conservation plan. The pumps, which are riveted to the hull, are composite artifacts made of cast iron, wrought iron, copper alloys, and rubber with complex internal voids that can inhibit chloride diffusion during treatment. The only opportunity to maintain long-term stability is to disassemble and treat each piece of the pump assembly separately; otherwise, chloride salts would persist and contribute to further degradation. While still attached to the hull, however, x-ray radiography could not be performed on the pumps, making their disassembly in situ risky. Weighing ethical considerations, the conservation plan determined the best option was to remove the pumps from the hull if possible, but the removal of the pumps also required the additional removal of two keel blocks. The pumps and keel blocks are critically important elements of the submarine's architecture and their removal required the expertise of an engineer to perform a finite element analysis in order to assess the effect of their removal on the stability of the hull. After two years of careful planning, the pumps were safely removed from the hull. They are currently receiving appropriate conservation treatment, which involves thorough analysis and documentation of the internal mechanisms, disassembly, treatment, and eventually reassembly. Specific challenges, ethical considerations, and professional collaboration required to successfully execute this critical phase of the conservation plan were accomplished through strategic planning that was continually adapted to the individual needs and circumstances of a project with such scope.

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