

President's Letter

Catherine Coueignoux

Hello WAAC!

Our outgoing president, Katie Holbrow, has passed the baton to me, and I am looking forward to taking on the role this year. Katie certainly has set the bar high, as those of you who attended the annual meeting in San Francisco know.

It was my very first WAAC meeting, and I came away feeling invigorated by the WAAC conservation community. The talks were stimulating, diverse, and relevant; the atmosphere was

friendly and laid-back—not your typical ‘conference’ at all. How lucky we are that this meeting is annual and that in just a few months we will have another opportunity to gather together and share our experiences of the past year.

Before tantalizing you with a preview of the next meeting, I want to thank outgoing WAAC board members and welcome new ones. First of all, much appreciation is due to Katie for being such an excellent, organized, and practical president. Our two outgoing members-at-large, Liz Homberger and Susi Friend, were hugely helpful when it came to planning the annual meeting. We are fortunate that Susi will stay on as a permanent, non-voting member of the board. Thanks are also due to last year’s nominating committee, Jodie Utter and Sarah Kleiner, for helping with the election.

We are pleased to welcome three new board members. Teresa Moreno of the Arizona State Museum will be our Vice President this year and President next year. Two new MALs have signed on: Claire Barry of the Kimbell Art Museum and Sarah Melching of the Denver Art Museum. I am very much looking forward to working with them and to making the upcoming annual meeting worthy of WAAC.

The 2015 meeting will be held from Wednesday, September 30 through Friday, October 2 (with other events happening earlier that week) at the Asilomar Conference Grounds in Monterey Bay, CA. The timing isn’t a coincidence—this is a vacation destination and ideal for a long weekend with the family!

I recently visited Asilomar on a reconnoitering trip, and I cannot say enough about it. Some of you many remember that a WAAC conference was actually held at this very place about fifteen years ago. The grounds are literally on the beach—the sound of the waves and sweet salty air will lull you to sleep at night.

The Monterey Aquarium is nearby, as is lovely Carmel-by-the-Sea and the famous 17-mile drive along the Pacific Coast which runs right by the famous Pebble Beach. There is hiking and biking and surfing, whale watching and wine tasting, as well as historic houses and museums. Most importantly, the Asilomar breakfast muffins are to die for! There will be WAAC-organized trips to some of these places, but lots more to do for those who decide to stick around afterward. The conference’s theme of local history and conservation will tie the program to the location and make for a really special experience.

To stay for a moment on a local topic, many of you are probably aware of the vandalism that has taken place in national parks across the West. A quick Google search will update anyone who missed this story. The safe removal of this graffiti is an important issue that concerns all of us, not only as conservators but also as members of the earth. WAAC is investigating ways to unite those who are interested in contributing to a solution, as well as to discuss treatment options. Watch this space.

It will be an exciting year, and I’m honored to experience it alongside all of you.

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Alaska

Helen Alten secured an NEH Preservation Assistance Grant for an environmental assessment on the Sheldon Museum in Haines, to be performed by **Ernest Conrad**. In January the museum begins an architectural assessment for structural upgrades. She is completing an NEH Sustaining Cultural Heritage Collections grant for a new compactor storage unit. The additions of the new compactor storage will convert the museum's lower gallery into a large storage and research space designed to accommodate the incoming Alaska Indian Arts collection, which fills in gaps left by repatriations to the nearby Tlingit village of Klukwan.

Ellen Carrlee has been preparing objects for the new Alaska State Museum's inaugural exhibits with help this summer from paintings conservator **Gwen Manthey**, natural history conservator **Fran Ritchie**, and UCLA/Getty graduate conservation intern **Tom McClintock**. She also presented information about the museum's move process at the WAAC meeting in San Francisco, consulted on a Charlie James (Kwakwaka'wakw) totem pole at the University of New Mexico, and participated in a bear gut processing workshop with **Sven Haakanson Jr.** at the Burke Museum in Seattle.

Scott Carrlee did a CAP survey at the Maxine and Jessie Whitney Museum in Valdez.

Sarah Owens finished curating an exhibit, *It's All Material*. The exhibit celebrates craftsmanship and promotes a deeper appreciation for the resources, inventiveness, time, and skill required to make museum-quality objects. The exhibition features more than 100 objects from the Anchorage Museum's collection; videos of contemporary artists demonstrating how they select and work with raw materials; a HD microscope for a close-up view of raw materials; and touch samples. For the duration of the exhibit Sarah is participating in the Conservator's Corner, where visitors can get a behind-the-scenes look at conservation in action and learn how a conservator applies knowledge of materials and scientific methods to care for the museum's collection.

This past year the Anchorage Museum launched a new initiative, which includes increasing access to collections. In support of this, **Monica Shah** along with the Arctic Studies Center has launched a new program, Artist in Collections. The program connects emerging Alaska Native artists to collections as a resource for research and study for advancing development as an artist, to strengthen the relationship between Alaska Native artists and the museums by increasing their accessibility to museum staff and collections, and to expand outreach to Alaska Native communities.

In July and November, Monica worked with performance artist Allison Warden and mask maker Brian Walker. In addition, Sarah and Monica are participating in the third Materials Traditions residency, which brings together artists and conservators and focuses on traditional arts and technologies. With the program, indigenous artists work to document, teach, and celebrate traditional design and perpetuate endangered Alaska Native arts. Artists who work with gut are joined by conservators Sarah, Monica, **Kelly McHugh**, and **Michelle Austin-Dennehy**.

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Arizona

Linda Morris is conserving more than forty documents, including a United States Post Office document (a handwritten contract with Butterfield Stage Coach Lines from St. Louis to San Francisco), U.S. Presidential engravings, signatures, letters, and autographs from three different collectors. There is even a humorous one written by Maurice Sendak to his dry cleaner, apologizing for not paying his bill on time. It states, "but what can you expect from a 'wild thing'?" Sendak even drew an illustration of Max in his wolf suit. Linda is also working on a 1778 portrait painting and a variety of other projects.

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Internet

Articles and most columns from past issues of WAAC Newsletter are available on-line at the WAAC website, a part of CoOL (Conservation OnLine) <http://cool.conservation-us.org/waac/>.

Deadline

Contributions for the January Newsletter should be received by the Editor before **August 15, 2014**.

Western Association for Art Conservation

The Western Association for Art Conservation (formerly, the Western Association of Art Conservators), also known as **WAAC**, was founded in 1974 to bring together conservators practicing in the western United States to exchange ideas, information, and regional news, and to discuss national and international matters of common interest.

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Regional News, continued

Brynn Bender and **Dana Senge** busily wrapped up the funding year by treating collections for exhibition in National Park Service parks and newly recovered items from various archeological sites. Brynn continued work with the Hopi Tribe to survey newly donated items with the portable X-ray Fluorescence to identify the presence of heavy metals. Dana has been collaborating with curators, mount-makers, and photographers on new exhibits at Aztec Ruins National Monument and Tonto National Monument.

Maggie Hill-Kipling, **Bailey Kinsky**, and **Rachel Childers** worked on treating prehistoric textiles and ceramics from Tonto National Monument. The lab staff has worked hard over the years to be an integral player in the establishment of an extensive exhibit rotation plan for the beautiful collection of prehistoric textiles. **Audrey Harrison** is working on treatments for the ethnographic collections of Grand Teton National Park.

Martha Winslow Grimm helped the Heard Museum with uniforms and other sports regalia as the museum prepared for the Dec. 19th opening of an exhibit on American Indian athletes. Martha continues organizing Angels Projects for Costume Society of America with the 2015 event scheduled for the Heritage Museum in Seguin, Texas.

The Arizona State Museum was awarded an NEH Saving Cultural Heritage Collections grant for planning the renovation of the museum's photographic collections storage area. **Teresa Moreno**, the primary investigator, and **Jannelle Weakley**, ASM curator and co-investigator, teamed up with preservation environment specialists **Jeremy Linden** and **Chris Cameron** from the Image Permanence Institute to launch a new environmental monitoring program as part of the planning process. Teresa completed the condition assessment of twenty photogravures from the Edward S. Curtis portfolios, *The North American Indian*. This selection includes images of Havasupai, Walapai, Hopi, and Zuni people, and is the third installation in a three-part exhibition entitled *Curtis Reframed: The Arizona Portfolios*.

In October, in collaboration with BACC, Teresa taught a one-day workshop in Tempe on the care of metals object as part of the Focus on Collections Care Workshop series. She will teach additional workshops in 2015 as the series continues. She collaborated with native artist Kay Walkingstick at the Heard Museum in Phoenix on the treatment of Walkingstick's wax painting entitled *Cardinal Points*, which is going on loan from the Heard to NMAI. Teresa continues her work and research on the conservation of American Indian silver jewelry.

Nancy Odegaard is on sabbatical through June 2015 and has been traveling. She attended a meeting with conservators in the Christchurch area of New Zealand in September organized by **Sasha Stollman**. After presenting papers at the ICOM-CC meetings in Melbourne she began a tour of Vietnam, Cambodia, and Thailand and was fortunate to meet with conservators at the National Museum in Phenom Pen and Queen Sirikit Museum of Textiles in Bangkok. Nancy has been awarded an Honorary Professorship at the University College in London and will be in residence there in April 2015.

Gina Watkinson continues to coordinate the daily activities of the ASM Preservation Division, as well as assist and provide support to conservation lab students, interns, and volunteers on various projects. Gina worked on out-going loans to various institutions within Arizona and assisted Nancy with packing nearly one-hundred small objects for return to the University of Alaska Museum of the North.

Gina and **Brunella Santarelli**, doctoral candidate in the heritage conservation science program at the UA, are working to thoroughly inventory the conservation lab's chemical stock in preparation for the new-year. Brunella has also been engaged in a pine pitch aging experiment to explore the degradation mechanisms of pitch coated baskets in ASM's collections.

Skyler Jenkins, ASM conservation intern, continues to diligently assemble a Jeddito plain ceramic vessel found and collected during a survey at the Rock Art Ranch Field School in 2014. She is also working on the excavation of a block-lifted textile with Nancy.

Pre-program conservation intern **Rachel Childers** volunteered in the ASM lab during the fall semester. She assisted Teresa with various projects including: photo-documentation

Regional News, continued

of objects, mounting of Navajo textiles for display; creating a hinge-free shim mat for a photogravure printed on Japanese tissue, and various tasks associated with the ASM basketry project. She begins a six month internship in the paper conservation lab at the Williamstown Art Conservation Center in January.

Crista Pack completed her FAIC Samuel H. Kress Conservation Fellowship working on the ASM basketry project. She started a new job as objects conservator at the Missouri History Museum. Before she left ASM in the fall she revised the museum's integrated pest management protocol, which Skyler and Gina have carried on implementing monthly.

Madeleine Neiman graduated from the UCLA/Getty master's program and completed her third-year internship at ASM. While at ASM, Madeleine treated a variety of archaeological and ethnographic objects. She completed the treatment of a Tlingit rattle-top basket, and she worked with Nancy on the treatment of a Lakota winter coat from the Heard Museum. Madeline is now the Samuel H. Kress Fellow at the Kelsey Museum of Archaeology, Ann Arbor, MI.

ASM was also recently awarded an IMLS Museums for America grant to support the treatment of 320 ethnological baskets in the museum's Save America's Treasure collection. This initiative is part of ASM's ongoing basketry project. As part of this project **Marilen Pool** continues to organize and upgrade the storage for the Archaeological Perishable collections. She will continue to work on the project into the treatment phase. In her private practice Marilen is currently conserving several ceramic pieces.

ASM welcomed back **Christina Bisulca!** Christina earned her PhD in the Heritage Conservation Science program at the University of Arizona in August. Meanwhile, for the past ten months she has been working in the Preservation Research and Testing Division at the Library of Congress. She has now returned to ASM to work on a variety of research projects including micro-chemical tests for gums and analyzing Hohokam artifacts.

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Hawaii

On October 11, after over two years of work, Doris Duke's Shangri La proudly presented the bedroom, dressing room, and bathroom (collectively known as the Mughal Suite) to the public for the first time.

Under the direction of staff conservator **Kent Severson**, and with the help of a host of interns, technicians, and contract conservators, over two hundred objects were treated, ranging from enameled gold chess pieces, gem encrusted jewelry and jade vessels, and mother of pearl inlaid furniture, to marble panels inlaid with semi-precious stones. Attention turns now to conservation of the deteriorating mosaic tile façade of the Playhouse.

Thor Minnick has begun treatments on a portion of the Heritage furniture collection owned by Queen Liliuokalani at Washington Place. Many of the pieces have never been treated while others have been neglected or over treated.

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Los Angeles

In November, **Tania Collas** and **Elizabeth Drolet** co-presented a seminar on integrated pest management for the UCLA/Getty conservation program class. The two NHM conservators are working with contract costume and textile conservator **Cara Varnell** on the temporary installation of the dress worn by Vivien Leigh in the barbeque scene of *Gone with the Wind*. The opening of the costume rotation on December 19th coincided with the 75th anniversary of the film's debut. Tania and Elizabeth have also been working on a temporary display celebrating the 150th birthday of cowboy silent film star William S. Hart, which will be installed at his mansion, a satellite museum of NHM.

Ozge Gencay-Ustun and **Jennifer Kim**, with the help of several amazing volunteers have completed the year and a half long condition survey of over 10,000 baskets from the collection of the Southwest Museum of the American Indian. The Autry is nearing completion of its now 12 years-long preservation project for the Southwest Museum collections.

At the Griffith Park campus, **LaLena Vellanoweth** is working on the conservation of textiles for the upcoming exhibition about the Civil War in the West, *Empire and Liberty*.

The Decorative Arts and Sculpture Conservation Department at the J. Paul Getty Museum welcomes graduate intern **Christina Simms**, a 2014 graduate of the Buffalo State College Art Conservation program. During her internship Christina will work with **Julie Wolfe**, focusing on a technical study and treatment of Barbara Hepworth's *Figure for Landscape* and research on protective coatings for outdoor sculpture.

Pre-program intern **Jacklyn Chi** recently completed an eight-month stint with the department, completing a range of jobs including documentation of the conservation treatment of a Calder and a diSuvero. Jackie also coordinated a project to set up slide digitization within the department as well as scanning of over 2,000 departmental radiographs with the NEDCC.

Brian Considine gave a talk in Paris on the Getty's period rooms at a conference in honor of the reopening of the Louvre's decorative arts galleries. **Jane Bassett** gave a talk at the Frick Collection on Jean-Antoine Houdon's life size terracotta *Diana the Huntress*.

Arlen Heginbotham, **Vincent Beltran** (GCI), former graduate intern **Briana Feston**, **Ruven Pillay** (C2RMF, Paris), and **Christina Simms** authored a paper presented in Amsterdam at the 12th International Symposium on Wood and Furniture Conservation titled: "An evaluation of coatings for Boule marquetry."

The Miami Marine Stadium, a 1963 concrete waterfront grandstand, was the recipient of one of the first round of the Getty Foundation's Keeping It Modern conservation grants.

Rosa Lowinger, Rosa Lowinger & Associates, and **John Fidler**, John Fidler Preservation Technology Inc., are serving as the lead researchers on a grant that will be used to determine conservation protocols for concrete repairs, corrosion mitigation, graffiti removal, and preservation of street art.

RLA conservators **Christina Varvi** and **Kelly Ciociola** achieved Professional

Regional News, continued

Associate status in the AIC. They also welcome pre-program intern **Tim Linden** to their Los Angeles staff. Look for Rosa's pre-conference tour on the Wednesday before AIC, *Cubans, Collectors, and other Miami Cultural Game Changers*, or join Rosa on AIC's third professional research trip to Cuba following the conference!

Terry Schaeffer, scientist emeritus in the Conservation Center at LACMA, presented a paper at the 33rd Meeting of Dyes in History and Archaeology at University of Glasgow, Scotland. Her talk, "Scarlet, or Mock, or Not" addressed the possibility of performing SERS on dye mixtures.

Joe Fronek and **Jini Rasmussen** are completing the conservation treatment of two 18th-century colonial paintings by Ecuadorian artist Vicente Albán. The paintings are part of a series that depict New Spain, portraying the racial types or 'castas' of the population and the exotic horticulture of the region. Joe traveled to Madrid with curator **Iiona Katzew** to examine paintings from an identical series by the same artist, providing valuable information that helped guide the restoration process.

A new update to *Digital Photography for Art Conservation* has been self-published by **Yosi Pozeilov**, LACMA conservation photographer. This 4th edition of the handbook is the largest and most comprehensive revision to date. It now includes: explanation of imaging techniques, review on light sources, some multispectral imaging, iPad condition reporting, naming conventions; in addition to previous material. The handbook can be found through LuLu.com (search: Pozeilov). A copy of the index can be requested at yosi@pozeilov.com.

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New Mexico

Conservation Solutions' recently completed projects include: the treatment of one of the twelve *Corporate Goddesses*, fiberglass sculptures by Muriel Castanis, installed atop a post-modern high rise in San Francisco, CA; the restoration of a 1905 sandstone & bronze monument to Christopher Columbus in Pueblo, CO; the treatment of three bronze statues, including

Rodin's *The Thinker*, on the Columbia University campus in New York, NY; the assessment and treatment of seven entrance features to the city of Coral Gables, FL; the restoration of 1930s aluminum entrance doors to the American Airlines hangar in Ft. Worth, TX; and the assessment of a B-26 Marauder aircraft in Yukon, Canada.

Currently ongoing projects include: the treatment of a pair of stucco and stone towers and tile mosaics at Miraflores Park in San Antonio, TX; the assessment and restoration of limestone panels at the Holocaust Museum in Washington, DC; the restoration of the main fountain at the Breakers Hotel in Palm Beach, FL; exterior bronze conservation at the US Capitol in Washington, DC; consulting and oversight at the Canadian Parliament West Block Façade; and conservation and treatment of bronze elements at the Ontario Supreme Court building in Ottawa, ON. CSI's team continues to grow with the recent technical staff additions of **David Espinosa** and **Kristy Wells** as assistant conservators.

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Pacific Northwest

Pre-program student **Alexia Symeonidou** has joined the staff at Alice Bear Conservation of Works of Art on Paper.

J. Claire Dean has had a busy autumn completing conservation reviews for the Washington State Arts Commission, as well as conducting fieldwork in Arizona at Organ Pipe Cactus National Monument. She continues to develop conservation projects at the Tulalip Tribes' Hibulb Cultural Center where most recently she oversaw the successful deinstallation of the last remaining part still standing of a one hundred and two year old story pole, *The Spirit Pole*, carved by Chief William Shelton.

The Royal BC Museum conservation staff is still glowing with pride after receiving the 2014 Keck Award at the IIC Congress in Hong Kong in May. The award was bestowed upon them for the excellent public conservation project, managed by **Lisa Bengston**, and involving a crew of conservators, in house staff, current and former interns, as well as a bevy of docents.

The project involved the conservation treatment of an early 20th-century Chinese Freemason's lantern in an exhibit context over a period of 7 months.

They are now in assembly line mode, preparing collections for the new *Gold Rush* exhibit, to open in May 2015, and are fortunate to have been assisted in these efforts by an intern from Fleming College, **Rachel Stark**.

Susan Lunas has been working on a note found in a bottle in the Cascade Mountains. The bottle was found under a shrub, with the neck of the bottle facing down slope. With this position, it appears that little moisture (rain, sleet, snow) entered the bottle, and the paper showed little water damage. The note and bottle have possibly been in place since the early 1900s. Treatment has involved humidifying the brittle paper, unrolling it from its wound state, and then piecing the paper back together again. Attempts have been made at reading the pencil writing, but the inside of the rolled paper note is so dark that the pencil writing is hard to decipher. Gentle washing lightened the darkened areas a bit.

Lisa Duncan bought a house in Seattle, and is working assiduously to turn the basement into a conservation studio. It's been quite a project, but rewarding to make ALL the decisions on design and material. She will be having a party this spring to show it off.

Corine Landrieu was busy this fall treating the Haub bronze collection, *Characters of the West*, now on exhibit in the new wing of the Tacoma Art Museum. She also worked on an embossed copper panel by Dirk Van Erp, 1948, from the Rainier brewery lobby for the Museum of History and Industry, and several other smaller projects including an Early Swindell diving helmet and a Momson lung for the Naval Undersea Museum.

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Rocky Mountain Region

Tara Hornung is on contract with the National Air and Space Museum, Smithsonian Institution, until the summer of 2015. Her main duties include treating aviation and space objects for the Collections Care Preservation Fund.

Regional News, continued

Kelsey Mellow, a recent graduate from the University of Delaware Pre-Conservation Undergraduate Program, just completed a two month pre-program internship at Western Center for the Conservation of Fine Art (WCCFA). She assisted WCCFA conservators with the treatment of two large Olinka Hrdy murals from Oklahoma City. The treatments are nearing completion and the two murals are scheduled for re-installation at the newly remodeled OCU Law School in early December.

D. Hays Shoop attended the Museums Alaska annual meeting in Seward in October. While in Alaska, he examined a number of paintings in Anchorage. Hays has been treating several over-sized paintings from the Colorado State Capitol Collection. **Carmen Bria** recently treated several Charlie Russell paintings on-site at the Russell Museum in Great Falls, Montana.

Victoria Montana Ryan recently assisted the Denver public schools administration in their efforts to relocate nine large murals. Depicting scenes from familiar nursery rhymes and painted by Leone Bradbury for the Ellsworth School in the 1930s, the murals had been moved to two separate locations after sale of the building in the 1990s. A new home for the murals was found at the El Paso County Administration Building.

The largest of the murals (30' long), required special handling to allow removal from the seventh floor and transport to Colorado Springs. All nine murals were successfully reinstalled. Victoria also recently completed the last scheduled workshop for Colorado Connecting to Collections on salvage of water-damaged materials that was attended by personnel from numerous institutions throughout Colorado.

After well over a year of painstaking planning and coordinating, *Brilliant: Cartier in the 20th Century* has opened at the Denver Art Museum. With assistance from **Nick Donaldson**, **Steve Osborne** designed and fabricated exceptional and versatile mounts for a range of bejeweled objects. **Allison McCloskey** devised a method for handsomely covering many of the mounts with fabric. **Julie Benner**, **Caitlin Whaley**, and Nick were instrumental in covering the mounts.

Allison and Julie attended the conference, *Dyes in History and Archaeology*, in Glasgow, Scotland in October. Here

at home, they have been engaged in examination and treatment of an array of tapestries from the collection for an upcoming rotation.

Kate Moomaw has been promoted to Associate Conservator of Modern and Contemporary Art. Congratulations, Kate! In early December, she attended the *ConservationSpace* workshop in Washington, DC. The workshop focused on further software development for the next phase, Release 2. In addition, she has been working on EMG programming for the upcoming annual AIC meeting. A new rotation in the modern and contemporary galleries is slated for February. For this, Kate has been preparing numerous contemporary objects as well as electronic media.

In preparation for the exhibit, *Glitterati: Portraits and Jewels from Colonial Latin America*. **Gina Laurin** recently treated and prepared 33 eighteenth-century adornment items, including jewelry and nun badges from the Spanish Colonial collection. As part of this exhibit, **Courtney Murray** treated a glass trinket box.

For her Kress Fellowship, Courtney continues research, analysis, and treatment of four eighteenth-century Ecuadorian polychrome Magi figurines. In addition, she participated in the FAIC forum, *Charting the Digital Landscape of the Conservation Profession* at the Dallas Museum of Art in early December.

Assisting researchers from the Yale Center for British Art, **Pam Skiles** will be undertaking IR examination of five Tudor-period paintings in the Berger Collection. In addition, she recently completed treatment of several Taos School paintings, new to the DAM. At the Clyfford Still Museum, Pam and **James Squires** continue to unroll, inventory, and stretch paintings.

Sarah Melching attended XRF Boot Camp at the Getty Villa in November.

Denver University undergraduate intern, **Rachel Henderson**, has been busy in the conservation department, assisting staff conservators, undertaking examinations and documentation, research, preparing materials, and treating select objects.

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San Diego

Objects conservator **Sabrina Carli** of Carli Fine Art Conservation is now in her fourth year of private conservation practice back in her native home of north San Diego County. She has recently concluded an extremely busy summer/fall season of outdoor sculpture maintenance in and around the San Diego area. Having attended master patineur Patrick Kipper's patina workshop in Loveland, CO, she enjoyed applying the insights gained into the surface treatment of bronze sculpture to this season's work.

She recently completed a year-long project with the Annenberg Foundation studying and treating Jean Arp's sculpture *Demeter*, which has returned to view at the Annenberg Retreat at Sunnylands. As multitasking inexorably continues, she is relishing being back at the bench, undertaking technical examinations and conserving ceramics from the San Diego Museum of Art's Islamic art collection while developing treatment protocols for several large-scale sculptural works by Alexander Calder in private collections.

In June of 2014, **Alfredo Antognini**, art conservator and artist, was invited by Universidad del Museo Social Argentino, Facultad de Artes in Buenos Aires, Argentina, to give a lecture discussing the profession of art conservation versus that of fine art. He has worked as an art conservator and an artist since the beginning of his career. He discussed common practices in the two fields, addressing some of their similarities and their differences. In particular, he focused on the different roles required of a conservator and of an artist -- the former involving a scientific attempt to carry out another person's creative intent, and the latter requiring one to engage one's own creativity.

The lecture was attended by professors and students from both conservation and fine art backgrounds. After the lecture, an engaging conversation followed, focusing on some of the specific challenges raised by the conservation of contemporary art. A series of additional lectures on this subject has been planned for 2015, in which Alfredo will participate.

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Regional News, continued

San Francisco Bay Area

The Fine Arts Museums of San Francisco were awarded a third Mellon position in the form of a much needed assistant textile conservator. **Anne Getts** was chosen from amongst an impressive group of applicants. Anne was a previously a Mellon Fellow for two years at LACMA and graduated from Winterthur in 2012. She is already swamped with a great variety of projects ranging from XRF analysis of recently donated Navajo blankets to prepping costumes for inclusion in the upcoming *High Style* exhibition coming to the Legion from the Costume Institute in March 2015, and designing an overhead photo documentation system for the lab's high ceilings.

The objects lab at the Fine Arts Museums of San Francisco continues in full swing, after the successful installation of two exhibitions: *Keith Haring: The Political Line* and *Houghton Hall: Portrait of an English Country House*. **Lesley Bone** is overseeing a rotation of the African galleries, while **Catherine Coueignoux** prepares Meissen ceramics for an upcoming exhibition. **Geneva Griswold**, the lab's Mellon Fellow, has been identifying white paints on African sculpture for *Embodiments: Masterworks of African Figurative Sculpture* to enrich the content of the didactic information presented via the web.

Katharine Untch is consulting on design and construction phases of artworks to be installed at the new San Francisco Transbay Terminal. She recently completed CAP assessments for the Heidrick Ag Museum and is consulting for an installation at the Museum of Art and History in Santa Cruz. She is also writing a discussion guide for an upcoming publication on sustainable environments for museums for the Smithsonian Institution.

Heida Shoemaker, private paper and photograph conservator working in Berkeley, returned from a fourth trip to Mali, West Africa this October. This trip was focused on the MSU Archive of Malian Photography project, for which she was the Conservation Specialist. This 2-year project is funded by the NEH and the aim of the project is to clean, scan, catalog, and house the negative archives of four important Malian photographers - 100,000 negatives all together.

Heida's work in Bamako consisted of

training a small group of Malian technicians and students, all photographers in their own right, to clean the medium format black and white negatives in preparation for scanning and house them in good quality paper envelopes and archival boxes. The workshop consisted of learning about careful handling practices, physical and solvent cleaning of the negatives to remove dust, dirt, and stains, and the proper methods for storage in paper envelopes and boxes.

Conservators **Rowan Geiger** and **Tegan Broderick** of SF Art Conservation prepared objects and sculpture belonging to the Anderson Collection for the opening of the new museum building at Stanford University. They also moved into a new larger studio in San Francisco.

Peng-Peng Wang, Julie Trospner, and **Allison Lewis** recently finished their work on the current Oakland Museum of California exhibitions *Fertile Ground* and *Days of the Dead*. They are now working on review and treatment of the Pacific Islands artifacts which will be shown in the next major exhibition *Pacific World*, scheduled to open in Spring of 2015. Peng-Peng is also currently working on an NEA Andrew Russell Grant to oversee the rehousing and digitization of 645 wet collodion glass negatives.

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Texas

Anne Zanikos is working on a collection of Dorothy Hood paintings in preparation for a retrospective at the Art Museum of South Texas in 2016.

Melanie Sanford has returned from a 5 month position at the Costume Institute, Metropolitan Museum of Art, New York. She worked as an Associate Conservator on the *Charles James: Beyond Fashion* exhibit.

Hilary Baker, a recent University of Rhode Island textile conservation graduate, spent the months of June and July as an intern with Melanie Sanford. Hilary spent the time assisting Melanie

with the installation of *American Brides: Inspiration and Ingenuity*, Denton, Texas and *Oscar de la Renta: Five Decades of Style*, Dallas, Texas.

The staff of Art Restorations Inc. was pleased to have the opportunity to tour the rare book collection and book conservation lab at the Bridwell Library of Southern Methodist University. **Jesse Hunt**, the paper conservator for the University, lead the tour giving the staff a well-informed visit through SMU's Conservation Lab.

Art Restorations would also like to welcome **Sarah Martin** onto their staff. Sarah completed her BA in Fine Art and English in May 2014 from Austin College in Sherman, TX. After receiving her degree, Sarah was brought on as a summer intern in the painting department and was then invited on as a painting conservator to complete a two year apprenticeship.

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IN MEMORIAM

Margaret Randall (Randy) Ash
Born April 12, 1943 in Des Moines, Iowa died November 7, 2014 in Denver, Colorado at Lutheran Hospital after a long illness. Services were private.

Ash resided in Denver, Colorado since 1987 where she was a professional paintings conservator. She founded M. Randall Ash and Associates, LLC in 1995 serving museums, galleries, and private collectors in the US and South America. Ash worked with the Anschutz Collection of Western Art, Montana Historical Society, Montana State Capitol, and the Old Courthouse Museum in Sioux Falls, South Dakota.

As Senior Paintings Conservator for the Rocky Mountain Conservation Center at the University of Denver from 1987 - 1995, she built relationships in South America through the Fulbright Foundation and the US State Department. Ash was awarded a Fulbright Scholarship for an educational conservation program in La Paz, Bolivia, and received an Academic Specialist Grant from the US State Department to teach in

Regional News, continued

Caracas, Venezuela on new materials and methods in painting conservation.

She later received support from the US State Department and Banco Boliviana to teach painting conservation in La Paz, Bolivia and then organized a residency program for museum professionals from Panama and Costa Rica with a Smithsonian /Fulbright Central American Training Partnership.

In the West, she conserved murals in the Pierre, SD State Capitol, the Siouxland Heritage Museum in Sioux Falls, SD, and the Colorado State Capitol Annex. As a conservator in private practice in Baltimore, Maryland from 1985-1987, Ash worked with collections in Baltimore, Washington, and throughout the Midwest, including the Meyerhoff Collection of Contemporary Art in Phoenix, MD and the International Folk Museum in Santa Fe, NM.

As conservator for the Baltimore Museum of Art from 1974-1985 Ash was responsible for the collections of paintings, sculpture, and decorative arts and assisted as technical editor for museum publications on the American paintings collection and the Cone Collection catalogue. She advised on collection storage and installation during museum renovations.

As a freelance conservator in Des Moines, Iowa from 1969-1974, Ash conserved six Grant Wood murals at Iowa State University Library in Ames, IA funded by a National Endowment for the Arts grant, contracted with the General Services Administration (GSA) to survey WPA murals throughout Iowa, and conserved 16th and 17th-c. Italian crèche figures at Simpson College in Indianola, IA.

Years later she conserved the murals in the Iowa Supreme Court building. Ash held a Samuel H. Kress Foundation Fellowship in painting conservation at the Nelson-Atkins Museum of Art from 1968-69 and a Committee to Rescue Italian Art (CRIA) Fellowship in 1967 to conserve paintings in Florence, Italy after the 1966 floods.

Ash received an M.A. from University of Iowa in art history, studio art, and conservation in 1968, and a B.A. in art history from Maryville College of the Sacred Heart in St. Louis, MO in 1965 with a semester in Rome, Italy through

Loyola University, Chicago. Ash served on the Fulbright Scholar Awards Discipline Advisory committee from 1993-1998 and on the Fulbright Scholar Awards Application Review committee in 1992. Ash was a Fellow in the American Institute for Conservation (AIC), an Associate member of the International Institute for Conservation (IIC), and a member of the Western Association for Art Conservators (WAAC), Midwest Regional Conservation Group (MRCG), Washington Conservation Group (WCG). She served on the board of the Maryland Craft Council from 1982-84 and the Curators of Maryland Arts from 1983-1986. Ash mentored many junior colleagues and maintained close friendships as these conservators moved on in their careers.

She was a fine practitioner of conservation, an avid collector of art glass and Guadalupe, a committed gardener of roses and tomatoes, a fabulous cook, a gracious hostess, and a genuine friend to many. Her unique, artistic style and grand presence brought color and joy to every room. She will be greatly missed by family, friends, and colleagues around the world.

Dr. Werner S. Zimmt

Passed away peacefully on September 12, 2014. He would have turned 93 on September 21. Werner was a member of the Arizona State Museum Conservation Laboratory for 29 years. Since 1985, over eighty conservation professionals and interns had the privilege to learn from him. While he always made people laugh and think, he also made us hope that we could be as warm, friendly, and intelligent when we reached our 90s.

Werner was born in Berlin, Germany in 1921, and he and his twin Gerald were two of "1000 Children" brought to the United States (Chicago) with the limited American Kindertransport as Nazism rose in Germany. After service with the US Army in World War II, he earned his undergraduate, graduate, and doctoral degrees in chemistry from the University of Chicago.

In 1951 he began his career as a polymer chemist working for the DuPont Co in Philadelphia where he developed the paint used on most GM cars produced before 1971. He was an invited speaker at the 1979 AIC annual meeting in Philadelphia.

In 1981 he was awarded a master's of science degree in archaeology from the University of Pennsylvania. After retiring from the DuPont Co in 1984, he moved to Tucson and became involved with numerous organizations and activities.

While working in the ASM Conservation Laboratory since 1985, he contributed to nearly every research based treatment undertaken. He was a critical member to at least seven federally funded projects, participated in guiding graduate degree research, and co-authored numerous professional papers, posters, and presentations.

His scholarly career included numerous publications and patents in chemistry, and recently he was a translator for the 2014 book *A Jesuit Missionary in Eighteenth Century Sonora, The Letters of Father Philipp Segesser*. In the conservation field, his noteworthy publications/presentations include:

Material Characterization Tests for Objects of Art and Archaeology. Second Edition. London: Archetype Press. First Edition 2000. Odegaard, N., S.Carroll, and W.S. Zimmt.

Novel approaches to pesticide removal from museum objects. In *Pesticide Mitigation in Museum Collections: Science in Conservation*. Edited by A.E.Charola/R.J.Koestler. Washington DC: Smithsonian Institution Press. 2010. Zimmt, W.S., N. Odegaard, and D.R.Smith.

Pesticide removal studies for cultural objects. In *Preserving Aboriginal Heritage: Technical and Traditional Approaches*, Edited by C.Dignard et al., Ottawa: Canadian Conservation Institute. 2009. Odegaard, N. and W. Zimmt.

Coping with arsenic-based pesticides on textile collections. In *Objects Specialty Group Postprints*. Proceedings of the OSG Session at the 42nd Annual Meeting, American Institute for Conservation, May 28-31, 2014, San Francisco, CA. Anderson,J., M. Dawley, D.J.Farley, W. Zimmt, and N.Odegaard.

Detecting and identifying salts during the desalination process with spot test papers. *WAAC Newsletter*, 33(1):14-17. 2011. Odegaard, N, P.Hill, B.Santarelli, and W. Zimmt.

Membership

Chris Stavroudis
membership secretary

Dear WAAC Membership,

As of the Ides of March (the 15th), 2015 membership renewal notices have not been sent out. WAAC is trying to get an online payment system up and running.

Online payments will save WAAC considerable money - we pay a huge premium to accept credit cards in the "card not present" mode. It also requires that the Treasurer's computer system and handling of all credit card information be PCI compliant which, despite promises from the services selling compliance testing, we never have managed. So we also pay a non-compliance fee.

All of these problems will disappear once we can accept online payments for all things WAAC. It will also save the WAAC Treasurer a huge amount of work: with the current system all of the credit card information must be typed into a secure, web-based terminal.

As always, members automatically receive the January number of the *WAAC Newsletter* regardless of their renewal status.

Thank you for your patience,

Chris Stavroudis, WAAC Membership Secretary & WAAC Treasurer

WAAC Welcomes the following new members and late renewals:

Alexandra Allardt, Charlotte Seifen Ameringer, Holly Anderson, Theresa Meyer Andrews, Mary W. Ballard, Kelly Bennett, Victoria Binder, Caitlin Breare, Tish Brewer, Heather Brown, Kathryn Carey, Ellen Carrlee, Jacklyn Chi, Céline Chrétien, Jennifer Correia, Megan Crouch, Kristin N. Dimitrova - Van Alstine, Elise Effmann, Charlotte Eng, Debra Evans, Christina Fisher, Debra Fox, Rowan Geiger, Tina Gessler, Cristiana Ginatta, Nicole Grabow, Emily Hamilton, Courtney Helion, Joyce Hulbert, Sarah Kleiner, Laura Kubick, Corine Landrieu, Breana Latty, Allison Lewis, Dawn Lohnas, Douglas MacLennan, Melissa Mariano, Ian G. McClure, Angela Yvarra McGrew, Laura Moeller, Johana Moreno, Suzanne Morris, Vanessa Muros, Courtney VonStein Murray, Musée du Quai Branly, Jennifer Myers,

Jobs

Paintings Conservator Oakland Museum of California

The Oakland Museum of California (OMCA) is currently seeking an experienced Paintings Conservator, 4 or 5 days/week (benefits included), in the Collections and Information Access Center.

OMCA has a large collection of paintings spanning from pre-Gold Rush California to the present. The collection includes more than 5000 works representing the Bay Area Figurative movement, Society of Six, Abstract Expressionism, 19th Century Landscape, Modern and Contemporary painting, and more. This collection is one of the museum's most active with works rotating in the permanent gallery, exhibition spaces and both domestic and international outgoing loans.

The Paintings Conservator is responsible for a wide range of treatments, as well as advising on proper conditions for storage, exhibition, and loan. Incumbent performs skilled conservation work including research, examination, treatment, and preventive care, plus grant collaboration, IPM, environmental monitoring, and community engagement. Additionally, the successful candidate will be responsible for providing training and supervision for specialists, preparators, and interns/volunteers. Candidate must have a valid passport that allows courier travel in and out of the US. Reports to the Senior Conservator.

This position is open until filled.

Additional information regarding this position may be found at www.museumca.org/employment-internships.

Douglas Nishimura, Patricia O'Regan, Colleen O'Shea, Kathleen Orlenko, Jennifer Parson, Penn Museum Conservation, Marta Pinto-Llorca, Frances Prichett, Allison Rabent, Shiho Sasaki, Melody Scarborough, Asti Sherring, Kristen St. John, Beth Szuhay, Marcin Szymczykowski, Kim Taira, Christina Varvi, Debra Vigna, Weissman Preservation Center, David Wessel, Western Archeological & Conservation Center, Annie Wilker, Jane Williams, Aneta Zebala, and Karen Zukor,

WAAC Publications

Handling Guide for Anthropology Collections

Straightforward text is paired with humorous illustrations in 41 pages of "do's and don'ts" of collection handling. A Guide to Handling Anthropological Museum Collections was written by Arizona State Museum conservator Nancy Odegaard and illustrated by conservation technician Grace Katterman. This manual was designed to be used by researchers, docents, volunteers, visitors, students, staff or others who have not received formal training in the handling of museum artifacts. Paper-bound and printed on acid-free stock.

Price: \$8.85

(\$6.60 copy for orders >10 copies)

Back Issues of WAAC Newsletter

Back numbers of the *Newsletter* are available. Issues Vol.1 - Vol.14, #3 (Sept. 1992) are \$5/copy. Issues Vol.15 - Vol.29, #3 (Sept. 1997) are \$10/copy. Issues Vol.30 (Jan. 2008) and after are \$15/copy. A 20% discount will be given to libraries seeking to obtain back issues to complete a "run" and for purchases of ten copies or more of an issue.

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Make checks payable to WAAC
drawn in US dollars on a US bank.**

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Gelatin and Carrageenan Mixtures: Use of Proteinaceous and Carbohydrate Adhesive Combinations for Consolidating Southeast Asian Paintings

Summary

In 2009, the consolidation treatment of 33 very large Southeast Asian paintings on fabric provided an opportunity to evaluate the working characteristics of two adhesives: gelatin and carrageenan. These two adhesives were evaluated in mixtures of different proportions to achieve the desired levels of viscosity, penetration, strength, flexibility, and visual appearance. Varying proportions, concentrations, and application methods were found useful for different treatment situations.

Section 1. Introduction

The Asian Art Museum (AAM) received 167 Southeast Asian paintings, objects, and textiles in 2002 from the Doris Duke Charitable Foundation. Duke (1912-1993) had kept these works in an indoor tennis court building in Hillsborough, New Jersey (figure 1). In 1999, after Duke's death but before her estate was dispersed, Hurricane Floyd caused record storm surges along the New Jersey coast, flooding Duke Farms. The artworks were severely damaged, sustaining mud tidelines, flaking, warping, rust, and mold.



Figure 1. Indoor tennis court, Duke Farms, Hillsborough, New Jersey, 2002. Image courtesy of the Asian Art Museum of San Francisco

In preparation for AAM's special exhibition, *Emerald Cities: Arts of Siam and Burma*, which was on display from October 23, 2009 through January 10, 2010, the AAM Conservation Center conserved a total of 145 artworks from the AAM's Southeast Asian collection. Seventy percent of the artworks for the exhibition were from the Doris Duke Charitable Foundation's donation.

Many of the paintings were found to be highly unstable, due to their construction method and to poor storage. The paintings were stored in the Duke Farm's tennis court stacked up and/or rolled. This storage method is actually thought to be similar to what the paintings would have experienced if they had remained in their original environment. It is believed that these paintings were made as offerings for Buddhist ceremonies and were not meant for a long-term use, so good storage was not a priority.

For the same reason the production of the paintings was also technically rather poor (unlike the quality of *thangka* paintings, which are generally, and mistakenly, thought of as similar in construction). Thus in order to physically stabilize the paintings, consolidation of the painting media was a critical step in the conservation treatment.

Among those artworks for the *Emerald Cities* exhibit, 33 paintings on fabric supports were treated to stabilize them for safe display. The smaller paintings are approximately 3 feet high and 2 feet wide, and nine large ones are as much as 11 feet high and 4 feet wide. The painting laboratory had a little over one year to prepare them for the exhibition. With these serious time constraints, physical stabilization was the priority. Suitable consolidants needed to be determined to stabilize the severely flaking paint media.

Section 2. Methodology

As the first step of the conservation treatment, testing was carried out to determine the best consolidant. Three characteristics were required:

- The consolidant must have very good penetration into both the pigment and ground layers by traveling slowly on a suction table.
- It must maintain flexibility.
- It must maintain a matte appearance.

The amount of consolidant needed for the large number of over-sized paintings would be quite large, creating another necessary requirement:

- Preparation of the consolidant must be straightforward and produce consistent quality.

Pure isinglass was initially considered, prepared from sturgeon air bladder membrane. But the resultant isinglass film was found to be too varied; some samples were flexible and others brittle. A consolidant film made from a mixture of isinglass and *funori* has occasionally been used at AAM in the past. This film was very flexible and difficult to break by folding repeatedly. I thought this film had great potential as a consolidant for this application.

Two seaweed-based adhesives (natural carbohydrate polymers) were also considered. The unique character of *funori* has been reported in conservation articles such as Swider and Smith 2005.¹ *Funori* has been long used in Japanese painting conservation, and many paper conservators are familiar with its application. Carrageenan was the second seaweed adhesive tested for this project. Carrageenan is manufactured from red edible seaweed, processed as a refined powder of a light cream color. It has been used in food and other industries as a thickening and/or stabilizing agent.

Using AAM's isinglass-*funori* consolidant film as a starting point, I compared the selected materials to determine the candidate that best met our criteria. Six consolidant mixtures were prepared, using four ingredients:

- Isinglass 5% v/w in deionized water.
- Gelatin, photographic grade 5 % w/v in deionized water.
- *Funori*, a 2"x3" sheet, slowly cooked in a double pan with 100ml de-ionized water, and gently sieved with two layers of fine gauge cotton.
- Carrageenan 1 % w/v in deionized water.

The components were prepared individually in glass beakers, and continually warmed (approximately 60 to 70 degrees Celsius) and stirred until completely dissolved. Solutions were then mixed in two different ratios: 1:1 protein:seaweed and 3:1 protein:seaweed. Isinglass was tested with *funori*; gelatin was tested with both *funori* and carrageenan.

Results

The results of the initial testing are summarized in the chart below.

Film appearance

Cast films were evaluated for color and clarity. Each mixture was stirred and poured onto a silicon release polyester sheet to dry. During the drying, it was noted that *funori* and isinglass solutions created lines, as if the two ingredients separated on the polyester sheet. Dried consolidant sheets showed slight differences. The gelatin-carrageenan mixtures were very clear, and much less yellow than other two types of *funori* mixtures. The dried films prepared with more carrageenan were much more flexible.

Adhesive penetration

Next, the mixtures were tested on paper to evaluate penetration and gloss. Each mixture was tested on three different prints: a black and white etching on a light-weight

cotton paper from a late 19th or early 20th-century book; a fragment of a contemporary color etching on heavy-weight cotton paper (figure 2); and a fragment of a color lithograph on a heavy-weight paper. A 1% w/v solution prepared from each dried film with de-ionized water was applied to the prints using fine brushes on a suction table. The prints were left on the suction table until dried and the results were examined under normal and UV light.

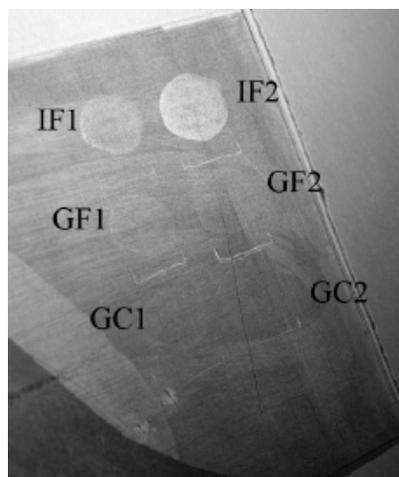


Figure 2. Consolidants tested on a fragment of contemporary color etching on heavy-weight cotton paper. Clockwise from upper left: IF1 and IF2 (most shiny) GF2 and GC2 (most matte) GC1 and GF1. Photographed at the time of consolidant testing.

The mixtures of isinglass and *funori* were visible on the surfaces of all prints. They appeared to have remained on the surface, failing to penetrate well to the versos of the prints. The mixtures of gelatin and *funori* acted similarly, and penetration to the versos of the prints was uneven. The mixtures of gelatin and carrageenan resulted in print surfaces with the least gloss among the tested solutions. The surface of the prints remained matte, and the adhesive penetrated well into the versos of the prints.

| Consolidant | MIXTURE RATIOS | | | | TEST RESULTS | | | | |
|-------------|---------------------|-------------------|--|-----------------------|---------------|-------------|--------|-------------|---|
| | Isinglass 5% w/v | Gelatin 5% w/v | Funori 2"x 3" in 100 ml water | Carrageenan 1% w/v | Appearance | Penetration | Gloss | Flexibility | After aging 18 months |
| IF1 | 1 | | 1 | | lines, yellow | low | glossy | OK | Darkened |
| IF2 | 3 | | 1 | | lines, yellow | low | glossy | OK | Darkened |
| GF1 | | 1 | 1 | | yellow | uneven | glossy | OK | Less, but darkened |
| GF2 | | 3 | 1 | | yellow | uneven | matte | OK | Less, but darkened |
| GC1 | | 1 | | 1 | clear | good | OK | best | OK, some tidelines on recto |
| GC2 | | 3 | | 1 | clear | good | matte | best | Best Less darkening, some tidelines on recto |

Gelatin and Carrageenan Mixtures, continued

Aging

The tested prints were re-examined 18 months after the date of the testing. The tested areas of the prints showed different degrees of discoloration. Because the application of the consolidant mixtures was carried out on a suction table followed by drying on the table, no discoloration or tidelines were noted on the prints at the time of testing.

Upon re-examination, it was noted that the mixtures of isinglass and *funori* made the darkest discoloration, and IF2 (lower ratio of *funori* in the mixture) had slightly darker discoloration. The mixtures of gelatin and carrageenan showed the least discoloration among all consolidants. GC2 (more carrageenan in the mixture) had the least discoloration. However tidelines did form on the rectos of tested prints, so this remains a concern. For this particular treatment, however, the consolidant was applied overall on the painting surfaces so the risk of local tidelines was low.

Discussion

The best consolidants were the mixtures of gelatin and carrageenan, which produced very clear dried consolidant films. These films were very flexible, and could not easily be broken by folding repeatedly by hand. It is expected to maintain the same flexibility on the paintings. Coincidentally, the gelatin-carrageenan mixture was the simplest to prepare, because the ingredients did not require separate preparation. This would help ensure consistent quality.

The ratio of carrageenan also affects the matte appearance on the tested prints. Although it was assumed that a higher proportion of gelatin would make the consolidant mixtures shinier, GF2 and GC2 resulted in the most matte appearance.

One question remained. Would the consolidant with more gelatin form crystals along the fragmented pigment particles when applied in a higher concentration? This was not tested on the prints, but it was expected that some crystallization of gelatin on the pigment surface would occur. This left the final candidate GC1: gelatin and carrageenan in a 1:1 mixture.

NOTE see facing page

Section 3. Gelatin-Carrageenan Mixtures for Consolidation of Paintings

Following the testing, gelatin-carrageenan mixtures were used on a number of paintings from the Duke Collection, using different mixture ratios for different treatment needs. Three paintings are described here as examples: a painting executed on fabric with thick ground layer; a painting on fabric with no ground layer; and a painting on wood. Different ratios of gelatin to carrageenan and different application methods were used for each treatment. The gelatin-carrageenan consolidant mixtures used in the treatments can be summarized in the examples that follow.

Figure 3. *Scenes from the Life of the Buddha*

Painting example 1: Fabric with thick ground layer

Scenes from the Life of the Buddha

Thailand, approximately 1800-1850

Pigments and gold on cloth, 99 7/8" H x 45 1/8" W

Gift from Doris Duke Charitable Foundation's Southeast Asian Art Collection, Asian Art Museum of San Francisco

This painting was executed on medium-weight, coarsely woven cotton fabric with a very friable, fairly thick ground layer (figure 3). Thread count of the painting is 17 and 16 per square centimeter. The ground layer was applied from the recto of the primary fabric support in order to make the surface smooth enough to be painted. Pigments and gold paint were then applied with narrow blank areas on the edges. This painting is unlined, and the primary support was very soft and flexed easily.



This is the correct text and the chart that was inadvertently left out of the original article.

Section 3. Gelatin-Carrageenan Mixtures for Consolidation of Paintings

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| Consolidant | Gelatin 5% w/v | Carrageenan 1% w/v | Ratio gelatin: carrageenan | Viscosity |
|--------------------|---------------------------|-------------------------------|---|------------------|
| G1 | 3.0g in 60ml | 0.6g in 60ml | 1:1 | highest |
| G2 | 3.0g in 60ml | 0.3g in 30ml | 2:1 | medium |
| G3 | 3.0g in 60ml | 0.2g in 20ml | 3:1 | lowest |

Gelatin and Carrageenan Mixtures, continued

The pigment and ground layers on this painting were flaking severely. However, it was noted that areas with coarsely ground mineral pigments remained better adhered to the primary support than did the thinly applied areas of organic pigments. Probably the larger amount of binder required by the coarse pigments contributed to securing the ground layer.

The pigment surface was so friable that the fragments lifted when touched with wet brushes. Therefore, a 0.5 % w/v G1 solution was first delivered as a mist using an ultrasonic humidifier on a suction table in order to secure the finest, most powdery pigments. Tweezers were used to realign the pigment fragments in their correct positions. The second step was to apply a stronger, 1% G1 consolidant to secure small fragments using medium sized brushes on the suction table. The condition was improved, but the painting needed to be further consolidated so this application was repeated three times. A stronger 1.5% G1 consolidant was then applied with larger brushes on the suction table.

The condition of the flaking and consolidants was again reevaluated. The pigment layer appeared secure, but the ground layer still needed a stronger consolidant. Another consolidant (G2) was then made with more gelatin and less carrageenan. The fourth step was to use this consolidant in a higher concentration of 1.75% in order to further secure large fragments. After one application of this consolidant, the pigment and ground layers were finally considered stable.

At this point, a crystalline shine was noted along the edges of the fragmented pigments under the laboratory working light. Although it is not visible under normal lower lighting, it seems that 1.75% is the highest concentration that can be applied if the G2 solution is used. It may be that a repeated application of weaker consolidant would work without risking crystal formation. However, a single application of a stronger consolidant secured the pigment and ground layers better, so this was used.

During the application steps, it was noted that the ground layer softened when wet, even after consolidants were repeatedly applied. It came to resemble cookie dough, difficult to touch or apply pressure to. By placing blotter paper on the painting surface and applying suction pressure, better contact was achieved between the pigments and the fabric support than by using small weights on top.

Painting example 2: Fabric with no ground layer

Standing Buddha Flanked by Two Disciples; and Five Scenes of the Buddha's Previous Lives

Thailand, approximately 1850-1900

Pigments and gold on cloth, 115 3/4" H x 36 1/2" W

Gift from Doris Duke Charitable Foundation's Southeast Asian Art Collection, Asian Art Museum of San Francisco

The second example is a painting executed on light-weight, tightly woven fabric with no ground layer (figure 4). Thread count of the painting is 32 and 34 per square centimeter. Pigments and a gold paint were applied directly to the primary fabric support, and the painting is unlined. The

pigment layer has a uniform, shiny surface, and is still fairly intact, possibly due to the use of a larger amount of binder, or to a previous consolidation. However, a moderate level of flaking was still noted, particularly along the losses, creases, and folds. These areas required consolidation. Severe damage is in the form of darkened pigment and badly degraded primary support associated with a green pigment.²

Consolidant, prepared as a 1% solution of G1, was delivered in a single application using medium size brushes on the suction table. After completion of the consolidation, the pigment layer was secured.

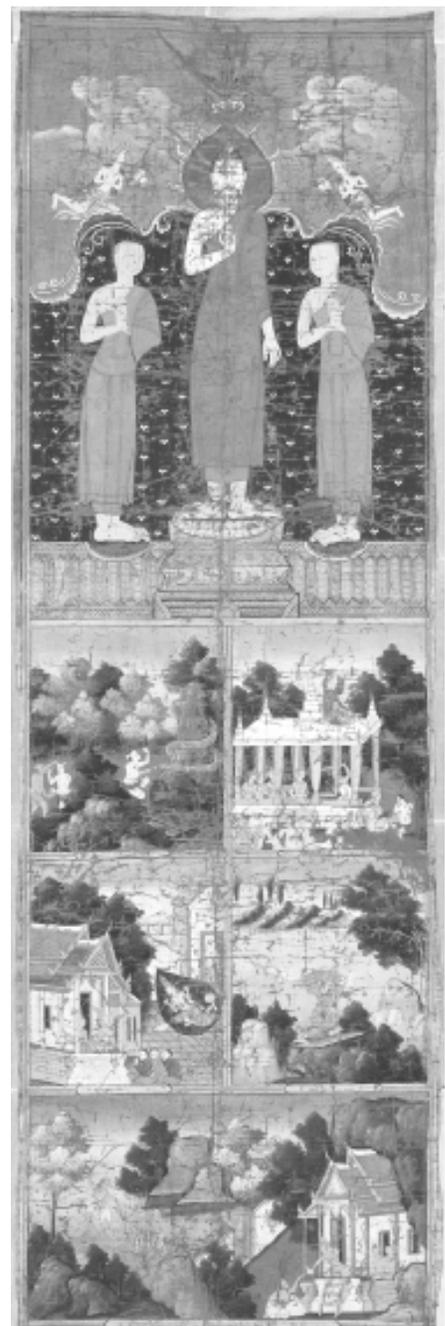


Figure 4. *Standing Buddha Flanked by Two Disciples; and Five Scenes of the Buddha's Previous Lives.*



Figure 5. *The Great Departure of the Buddha-to-Be from His Father's Palace, and the Cutting of the Hair*

Painting example 3: Wood substrate

The Great Departure of the Buddha-to-Be from His Father's Palace and the Cutting of the Hair

Thailand, approximately 1850-1900

Pigments and gold on wood

24 1/2" H x 16 1/2" W

Gift from Doris Duke Charitable Foundation's Southeast Asian Art Collection, Asian Art Museum of San Francisco

The final example is a painting executed on a single flat board of dark hardwood (figure 5). The face of the board has a thin, off-white ground, and the design is painted in matte colors and gold. Microscopic examination of the stratigraphy shows that there is red underpaint under the black lines and that the blue sky was painted in entirely before the figures occupying that part of the composition were painted on top. The paint and ground layers were heavily cracked with much lifting and loss overall, especially in the upper half.

Consolidation was carried out with a 1% solution of G1 consolidant. Because of the severely lifted pigmented surface, a piece of very thin Japanese paper or rayon tissue was first laid over a section and wet with a 1:2 ethanol/water mixture to dampen the paper and the underlying pigment surface. This was immediately followed by the application of the consolidant with a smaller brush, generally diluted further by dipping the brush first in warm water. After allowing several minutes for penetration the paper was gently lifted off and discarded. Additional consolidant was then applied with a fine brush to the edges of losses,

cracks and other areas where it would penetrate under the pigments. By wetting large, adjacent areas consecutively, each before the previous one was dry, tidelines and water marks were prevented. The pigments were successfully secured.

Section 4. Conclusions

In conclusion, the conservation treatment of this series of Southeast Asian paintings was successfully carried out using gelatin-carrageenan mixtures.

At AAM, the Southeast Asian paintings on fabric supports are rolled onto large archival tubes for storage due to their very large size and museum storage limitations. Many Asian paintings are traditionally rolled for storage, including most East Asian hanging scrolls, and the rolling and unrolling is often a major cause of flaking pigments. These Southeast Asian paintings are no exception, and are frequently unrolled for scholarly research, exhibition, and loan. However, since the completion of these treatments, we have found that the treated paintings have remained stable, with very little local flaking.

In the years following this initial research, the G-series gelatin-carrageenan mixtures have been successfully used on a range of different Asian paintings. The mixtures have been used on Himalayan and Chinese thangkas to secure large fragmented pigments through direct application. And on East Asian scrolls and South Asian paintings, they have been applied as a mist for pigmented areas that had become powdery.

It is important to realize that the different ratios and different application methods must be tailored to each individual project. For example, when the gelatin-carrageenan solutions are used in a mist, a lower ratio of carrageenan (G3) is less viscous and so a mist can be easily created using an ultrasonic humidifier.

A lower ratio of carrageenan (G2 or G3) is recommended when the consolidant needs to be applied in high concentration, because those G2 or G3 consolidants tend to be too runny in lower concentrations, travel through the pigments and ground layers too quickly, and require multiple applications to secure larger pigments.

An obvious crystallization of the gelatin can occur when the G2 solution is made to 1.75% or higher concentration, although it is not visible under normal lower lighting levels. This was a dilemma because repeated applications of more diluted consolidant were not effective, while a single application of a stronger consolidant secured the pigment and ground layers better.

As with all conservation, risks are involved, and the adhesives are not suitable for every case. The gelatin-carrageenan mixtures can provide flexibility and versatility, and have proved to be a useful tool for consolidating thickly applied pigments on flexible fabric supports.

Materials:

Russian Sturgeon Bladders.
Conservation Support System, Santa Barbara, CA.
Gelatin, Photographic grade. Talas, NY.
Funori. Hiromi Paper International, CA.
Carrageenan. Talas, NY.

Acknowledgments:

The author would like to thank Dr. Charlotte Eng at the Los Angeles County Museum of Art for her kind analysis of the pigments and Ms. Katherine Holbrow, former Head of Conservation at AAM, currently Director of Conservation at ARTEX for her support throughout the project and preparation of this article.

1. Swider, Joseph R and Smith, Martha. "Funori: Overview of a 300-Year-Old Consolidant," *JAIC*, 2005, Volume 44, Number 2, (pp. 117-126).

2. A green sample was analyzed by Dr. Charlotte Eng at the Los Angeles County Museum of Art using FTIR and XRF and was found to be copper acetoarsenite (emerald green), a pigment commercially manufactured in Germany in 1814. Emerald green is extremely toxic, can be decomposed by acids and warm alkalis, and darkens in the presence of sulfur. All of these reactions were certainly noted with this painting.

"TOUR IN A CART"

by Sarah Gates and Anne Getts

The conservation labs at the Fine Arts Museums of San Francisco receive a lot of visitors. The multi-room textile lab covers more than 2500 square feet, and among its amenities are an eighteen foot high hoist for hanging flat textiles, a "wet room" with sloped floor and drain, a "dye room" with stove top, fume hood, and large capacity RO water system, and soon a Mellon-funded overhead camera.

Because the textile conservators are not always present during tours, they have put together a surrogate "tour in a cart" – which is a designated, wheeled Metro cart that houses examples of textile conservation treatments.



The cart is kept in the lab and used as an educational tool to showcase the various responsibilities of the lab. This includes preventive projects such as custom storage supports for complex hats and shoes, as well as stabilization treatments on smaller textiles.

The cart enables many subjects to be introduced for discussion: archival

storage materials and methods, deterioration of textile materials over time, modular storage, textile technology and fabrication techniques, construction of faux accessories or missing parts for display, safe handling techniques, design for safe handling, and not least of all, the costs of safe storage and the space it requires.



Included on one of the shelves is a notebook with information on each textile, e.g. date, culture, a description of why it is being showcased, etc. This enables non-conservators to access the cart when conservators are absent and allows everyone, from the chief curator to the technicians, to put the cart to good use when leading visitors through the lab.

Evaluating Light Sources with Portable Spectroradiometers – LED Case Study

Introduction

In museum galleries, artificial light sources used to illuminate works of art were traditionally incandescent or halogen lamps. In the last few years, light emitting diodes (LEDs) have been added, and use of diffuse natural light has returned to favor. These recent developments are partly driven by new federal and state laws requiring energy efficiency.¹ The regulations effectively render inefficient light sources such as incandescent bulbs obsolete and encourage the use of LEDs and diffuse daylight in building design.

Light sources can differ markedly in their spectral power distributions (SPDs). Typical SPDs of each type of light source are shown in Figure 1. Conservation professionals will notice immediately that most of these light sources contain ultraviolet (UV) radiation, which has enough energy to break some chemical bonds. This can lead to degradation of works of art, which can be prevented by the use of UV-blocking glazing or UV filters in light fixtures.

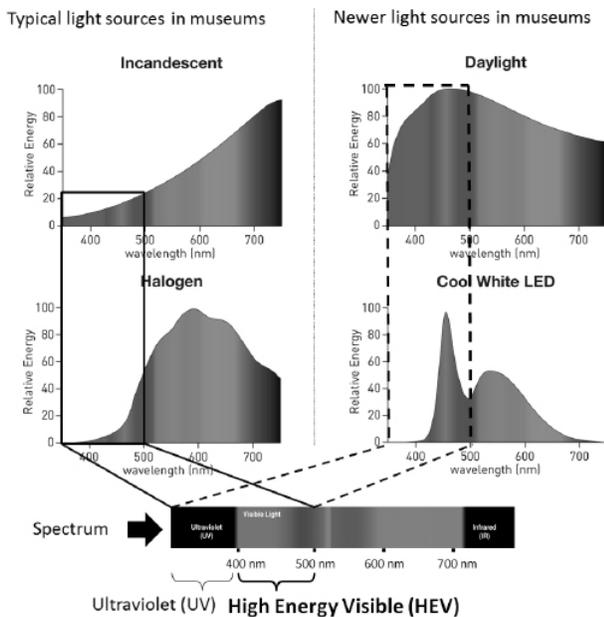


Figure 1: Spectral Power Distributions

However, UV is not the only type of radiation that can trigger damaging photochemical reactions. It has recently been reported that UV may contribute half or less of the observed light-induced fading.² Infrared radiation, i.e. heat, can also be deleterious, inducing physical stresses in artwork. Visible light also has the potential to cause damage, particularly if the shorter – blue – wavelengths are absorbed.

Medical research has shown that blue light can damage the eye.³ It is well known that UV can induce formation of cataracts in the lens of the eye, but more recently it has

been found that blue light, which penetrates deeper into the eye, can damage the retina. With the increased use and prolonged exposure to self-luminous electronic devices that emit blue light (e.g. cell phones, tablets), there is a growing concern regarding eye damage attributable to “high energy visible” light (HEV), a term now used in the medical field to describe light in the wavelength range from 400-500 nm. Thus, the use of sunglasses that block both UV radiation and HEV light is encouraged.⁴

In contrast to the recent recognition of the damage potential of HEV light by ophthalmologists, the conservation community has been aware for decades that visible light may induce damage in a variety of artists’ materials [Padfield and Landi 1966, Krochmann 1986, Ishii et al.]. The wavelength dependence of damage to many materials by UV and visible light was investigated by Krochmann. He showed that some were sensitive to HEV light and that the damage function is characteristic of the material.

Measuring Damage Function using Microfade Testing

The Principle of Photochemical Activation states that only those wavelengths of light absorbed by a material can result in photochemical change of that material.⁵ Figure 2 shows absorption spectra for textiles dyed with red and yellow Colorhue Instant-Set dyes. The yellow textile absorbs HEV light very strongly whereas the red textile has a low absorption in this region.

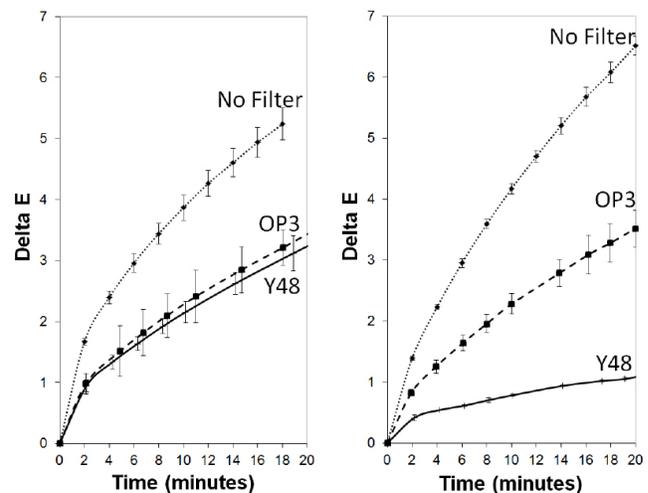


Figure 2: MFT results for a) Colorhue Red and b) Colorhue Yellow dyed silk samples

Because the red textile does not absorb much HEV light, its removal should not have a significant effect on the appearance of the textile. In contrast, it might be expected that the greater absorbance of HEV light by the yellow textile would result in a larger appearance change.

1 energy.ca.gov/title24/ and http://www.energycodes.gov/sites/default/files/documents/Lighting_Resource_Guide.pdf

2 energy.gov/sites/prod/files/2015/01/f19/gateway_museums-report_0.pdf

3 apps1.eere.energy.gov/buildings/publications/pdfs/ssl/opticalsafety_fact-sheet.pdf

4 health.harvard.edu/staying-healthy/blue-light-has-a-dark-side

5 It should be noted that for some materials, absorbed light energy can be dissipated without causing photochemical reactions. Thus, not all absorbed light energy will result in appearance change.

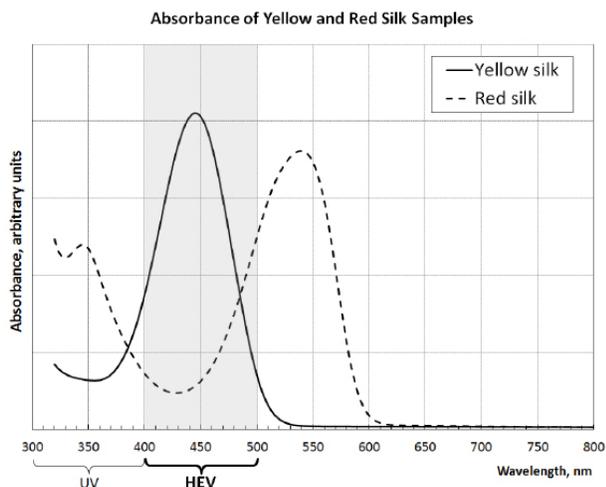


Figure 3: Absorbance spectra of yellow and red silk samples

This hypothesis was investigated by using a modified procedure for microfade testing (see Appendix). The red and yellow textiles were faded with various cut-on filters in the light path of the microfade tester: an Optivue OP-3 UV-blocking glazing, or a Hoya Y-48 filter (blocks both UV and HEV light), or no filter in the light path. The MicroFade Test (MFT) results for the red and yellow textiles are shown in Figure 3.

Not surprisingly, the appearance change of the dyed textiles was greatest (largest delta E values) when the UV and HEV radiation were both in the light source. For the red textile, the fading behavior was not significantly different whether or not HEV was removed. Because removal of HEV light did little to decrease the appearance change, UV radiation is most likely the major contributor to light damage of this sample.

This behavior contrasts with the response of the yellow textile. Removal of HEV as well as UV radiation further decreased the appearance change, indicating that UV and HEV light each have a significant role in causing photodegradation.

Spectroradiometry vs. Photometry of Display Lighting

The MFT results demonstrate that damage to an object is dependent on the spectral absorption characteristics of its surface. If a source does not include light in the range absorbed by the material, that source will not be able to cause light damage in the material. Thus, knowledge of the SPD of light sources is equally important to understanding of photodegradation of a work of art [Schaeffer 2014].

Typical monitoring of light levels in a museum environment does not include spectral information (spectroradiometric data). Instead, measurements, either foot-candles or lux, are made photometrically using photometers. The readings would then be compared to the recommended levels.⁶

⁶ A standard light level for light sensitive objects such as paper and textiles is 5 foot-candles or 50 lux.

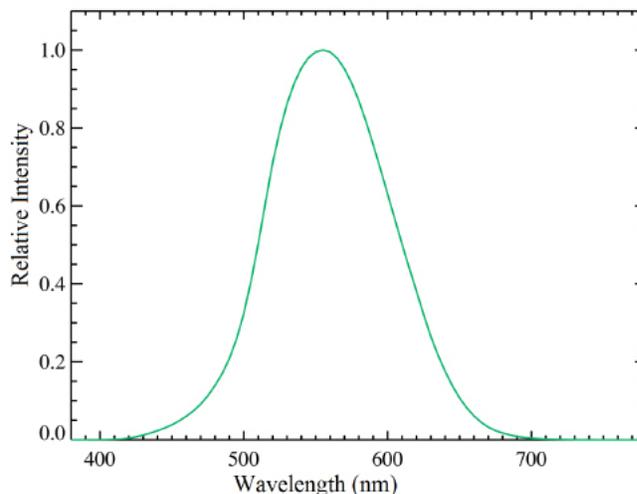


Figure 4: Photopic Curve (en.wikipedia.org/wiki/Photopic_vision)

The important difference between spectroradiometric and photometric data is that the former measures light objectively in terms of absolute power across the spectrum while the latter reports the light in terms of apparent brightness to our eyes.

To generate photometric data, the spectral data detected by the photometer are modified mathematically using the photopic curve (Figure 4). This curve shows that the human eye is very sensitive to green light but not very sensitive to either ends of the visible spectrum (blue or red light).

If protection of art objects from possible light damage, rather than the sensitivity of our eyes, is the major factor in choosing appropriate display lighting, one might wonder why light levels aren't measured with spectroradiometers rather than the photometers. Spectroradiometers would clearly provide more relevant information than photometers [Cuttle 2007].

Barriers to widespread use of spectroradiometers have been cost (about \$20,000), bulkiness, and complexity of use. However, portable spectroradiometers with user-friendly software that calculate photometric and colorimetric data from the spectra are now appearing on the market. In the near future, the quality, ease of use, and cost of portable spectroradiometers should make them well suited for wider adoption in the museum environment.

At LACMA, we have been evaluating the Ocean Optics Jaz spectroradiometer and its associated software for measurement of museum lighting. We are using this portable spectroradiometer not only to characterize light sources, but also to monitor a wide range of gallery lighting conditions. The instrument can quantify the amount of light energy in different regions of the spectrum (e.g. near UV, blue, and total visible) even when the overall light levels are lower than 50 lux.

Evaluating Light Sources with Portable Spectroradiometers – LED Case Study, continued

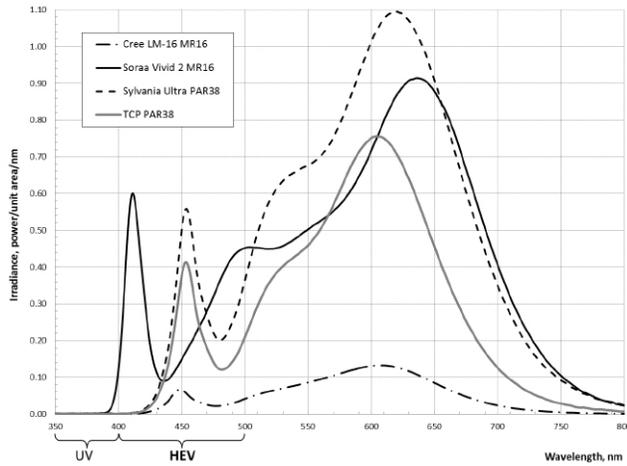


Figure 5: Spectral Power Distribution of LEDs tested in this study

Case Study: LEDs

To demonstrate the usefulness of spectroradiometry for monitoring light sources, we measured the SPDs of five different LED lamps with our Jaz spectroradiometer. The lamps were available commercially in summer 2014. They all had a correlated color temperature (CCT) of 3000K, but their rated brightness and color rendering indices varied substantially. The SPDs of some of these LEDs are shown in Figure 5.

One of the most important features of the spectral output of LEDs is the HEV diode emission band that “pumps” the phosphors in the lamp to create white light.

The Soraa Vivid 2 MR16 LED has a violet pump, which includes a small amount of long wavelength UV. The majority of LEDs currently available, like the other LEDs we tested, are blue-pumped.

In Figure 6, the HEV regions of the spectra have been plotted. It can be seen that the blue bands vary subtly in

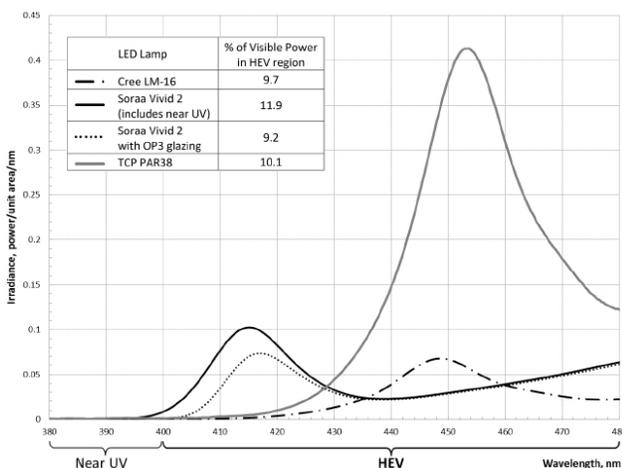


Figure 6: Spectra of LEDs in the HEV region

Table 1. Colorimetric data for LEDs tested in this study

| LED Lamp | Meas CCT | Ra (CRI) | CRI TS R9 |
|-----------------|----------|----------|-----------|
| Cree | 2989K | 83.3 | 14.9 |
| Osram | 3137K | 82.8 | 13.7 |
| SORAA | 3007K | 93.0 | 91.0 |
| Sylvania PAR 38 | 2964K | 93.8 | 61.7 |
| TCP PAR 38 | 2980K | 83.5 | 11.3 |

position and intensity. The HEV band usually accounts 8 to 12 percent of the total visible output of the LED (See table in Figure 6). It should also be noted that the amount of light in the violet band can be reduced by UV-blocking glazing (dotted line in Figure 6).

Another benefit of using spectroradiometry is that photometric and colorimetric data can be calculated from the spectra (See Table 1). Lux values varied as expected based on the lumen information provided with the lamps. Four of the five lamps had CCTs within a percent of the 3000K as stated by the manufacturers; the CCT of one lamp exceeded the stated value by 5%.

The color rendering indices (CRI) calculated from the spectral data are also given in Table 1.

Neither the peak location nor the relative output of the blue or violet band appears to be directly related to the CRI.

The Sylvania Ultra PAR38 lamp had the lowest relative output in the blue band (peak at 453 nm) and an excellent CRI (93.8). Of the LEDs we evaluated, it appears that this lamp would be a better choice for illuminating works of art particularly sensitive to HEV light. During the decision making process, tradeoffs may be necessary in the selection of lamps (e.g. lower HEV output vs. better CCT or CRI).

Conclusions

New requirements for energy efficient museum operation encourage the use of LED gallery lighting and a return to the inclusion of daylight in display spaces. LED technology is in flux, and daylight spectral quality is highly variable. The use of these light sources, combined with the wide range of wavelength dependencies of light induced appearance changes in different artists’ materials, make measuring SPDs of display lighting highly advantageous.

Having both the spectral information on the light source and knowledge of the damage potential for a particular art object would provide the most complete information for selecting light sources.

Ideally, the light source would not emit much light in regions of the spectrum where the artwork has its highest absorbance, but would still provide high color rendering.

Evaluating Light Sources with Portable Spectroradiometers – LED Case Study, continued

This matching of light source to each object would obviously require a larger budget, additional personnel time, and more information on the light sensitivity of most materials than are currently available.

Photometers are not designed to measure spectral outputs (SPDs) of light sources. Measuring light levels photometrically (in lux or foot candles) and knowing the color temperature of the source will not necessarily give an accurate indication of the spectral output of the lamp. Spectroradiometers overcome this problem by providing SPDs directly. In a limited survey of some LED lamps designed for use in track lighting, we have demonstrated the range of information obtainable from spectroradiometric measurements. Fortunately, portable spectroradiometers are now commercially available at prices that make them feasible for light monitoring in some institutions.

Microfade testing is one method of measuring the damage potential of light for a particular material in an art object. In this study, we demonstrated its usefulness by comparing the sensitivities of two dyed textiles to UV and HEV radiation.

In general, knowledge of the damage potential for more materials would be an improvement on the current assumption that blocking UV and limiting overall light exposure are the only available means of reducing photodegradation. In the future, we hope to have the ability to provide more specific light level recommendations for individual art objects without relying on generalized damage functions.

Comments, Suggestions, and Practical Considerations

- LEDs are not always UV free. Violet-pumped LEDs are likely to emit near UV radiation. LEDs are not completely IR free.
- Lamps can get hot. If they are to be used in enclosed fixtures, confirm that they are designed for this.
- If possible, personally evaluate all LEDs under consideration.
- If the SPD of an LED cannot be measured in house, request the IES LM79-09 report from the manufacturer or distributor.
- Get warranties (at least 3 years if possible).
- Consider LEDs with CCTs of 2700-3000 K. The higher the CCT, the larger the portion of total visible output that is in the HEV region.
- SPDs will change over time as LED components age at different rates. Continue to monitor the SPDs of lamps in use.
- For best color rendering, choose CRI > 90 (incandescent lamp CRIs are 99+). LEDs with CRIs in the mid or upper 80s may suffice if R9 (bright red) and R12 (bright blue) values are both high.

- Dimmable LEDs may require special track or fixtures.
- LED technology is in rapid flux; improved products are constantly being introduced.
 - A paradigm shift may be occurring - to LED fixtures that eliminate replaceable bulbs by directly integrating a module with the diode and phosphors. Dedicated mounting track will likely be required for these systems, presenting additional budget needs.
 - Smaller portable spectroradiometers are likely to come on the market at prices that make them competitive with high-end light monitors based on photometry.

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Acknowledgements

We thank Yoon Jo Lee, former textile conservation fellow, for supplying the dyed silk samples and the Andrew W. Mellon Foundation for support of Frank Preusser, Senior Conservation Scientist.

Appendix

The microfade tester consists of a xenon light source, an optical fiber bundle, and visible-range spectrometer [Whitmore 1999]. Light from the xenon source travels through one fiber down to the sample while the other fibers collect the reflected light and send it to the spectrometer.

The microfade tester can be used with or without filters in the light path. In order to record the entire visible reflectance spectra of the sample during the course of the fading with a filter in place, it had to be removed periodically for a few seconds. This very small amount of exposure to UV and HEV did not affect the fading significantly. The appearance change, expressed as Delta E, is calculated from the spectra by software.

Detecting Individual Paints in Mixed-Media Paintings

The Challenge of Conserving Mixed-Media Paintings

Conserving modern and contemporary mixed-media paintings is made difficult by the impossibility of visually identifying individual paints in the mix. Furthermore, because paints have different chemical and physical properties, traditional single-media conservation techniques may cause unwanted damage and irreversible changes to the surface of a mixed-media painting.

Mixed-Media Test Panels with Known Ratios of Acrylic, Alkyd, and Oil

A 2008 research project at the Smithsonian's Museum Conservation Institute explored procedures that could be used to detect each paint component in a mixed-media painting. This study used Grumbacher oil, Winsor & Newton Griffin alkyd, and Golden acrylic emulsion in weight ratios of 25:75, 50:50, 75:25, 90:10, and 100.

Samples were prepared from drawdowns on Mylar sheets and left to age in an indoor environment with stable temperature and humidity. These experimental test panels were used to develop and refine the testing procedures and provided an excellent resource for studying the aging behaviors of mixed media.

Tests

In our studio, examining and interpreting the spectra of the binder media alone using Fourier Transform Infrared Spectroscopy (FTIR) is the first step in paint identification and is a straightforward process. While carbonyl peaks overlap, especially as oil paint ages, the fingerprint and C-H regions are readily distinguishable. The analysis can be completed in one to two minutes.

For mixed paint binders, however, FTIR analysis is less straightforward. Pigments and fillers make infrared identification of individual paints more difficult to confirm. Infrared spectroscopy of mixed-media paintings may provide information on multiple components of a paint mixture, but peak overlaps can prevent observation of some less prominent peaks from different paints.

Thus, microtesting of physical properties, such as melting points and solubility (often used in forensic and pharmaceutical laboratories), is standard procedure in our protocols and is used to establish safety limits for temperature and solvents for treatments such as lining and cleaning. Our solubility test is adapted from the National Bureau of Standards Special Publication 480-40, Paint Solubility Test, prepared for the National Institute of Justice, issued in 1982. We used a Fisher-Johns melting point apparatus for our melting point tests.

We performed the first full-scale investigation of paint mixtures at various ratios in the summer of 2012. It included assessments of gloss, color, melting point, solubility (under visual and 3D microscope examination), FTIR, and gas chromatography-mass spectrometry (GC-MS). Preliminary results indicated that it is not possible to visually identify paints by color or gloss, and that even FTIR identification is not completely reliable. Pyrolysis-gas chromatography/mass spectrometry using tetramethylammonium hydroxide (Py-GS-MS using TMAH) can successfully identify all components, but is not always accessible or affordable for practicing conservators.

Findings from this study demonstrated the feasibility of using microsamples of paint to microscopically observe melting points and solubility, and integrating FTIR analysis in the test protocol to detect single-component paints in mixed media.

In the second phase of our investigation, carried out in 2013, we employed paint samples we had prepared in 2008, but expanded the investigation to include commercial household paint samples. The scope of our current investigation is smaller and focuses on establishing testing criteria and standardizing reagent concentrations and other parameters for tests of melting points and solubility. When followed rigorously, with controlled time and temperature, these procedures can be used to classify paints by their chemical reactivity and physical properties, and thus characterize individual paint components in mixed media.

Attenuated Total Reflectance Fourier Transform Infrared Spectroscopy (ATR-FTIR)

Instrument: Thermo Nicolet 6700 FTIR spectrometer. Resolution: 4 cm⁻¹. Sampling accessory: Golden Gate ATR with diamond crystal, single bounce, 45°. Detector: DTGS. Number of scans: 128. Correction: ATR corrected. Samples for ATR-FTIR were placed directly on the diamond crystal of the ATR accessory. For small samples, a piece of aluminum foil backed the sapphire anvil to eliminate any sapphire absorption in the IR spectrum. Samples of medium alone were also available for FTIR analysis.

FTIR Analysis of Single-Component Paints (Fig. 1)

Interpretation of single-component paints (acrylic, oil, and alkyd) is straightforward. Carbonyl peak C=O can overlap, especially in aged oil samples. The C-H and fingerprint region are easily distinguishable: alkyd peaks at 1274 cm⁻¹ and oil peaks at 1170 cm⁻¹. However, when pigments and fillers are added, infrared interpretation becomes more difficult.

FTIR Analysis of Alkyd and Oil Paints (Fig. 2)

Differentiating alkyd and oil paint in mixtures would appear to be easy: alkyd peaks at 1274 cm⁻¹ and oil peaks at 1170 cm⁻¹. However, peaks from fillers can obscure these peaks. Silica's 1100–1000 cm⁻¹ Si-O-Si stretch and sulfate's asymmetric stretching band of 1200–1050 cm⁻¹ can overlap these two markers, making it difficult to identify individual paints. 25% alkyd paint has no peaks that can be attributed to alkyd.

As seen in the sample of 75% alkyd: 25% oil paint, peaks from fatty-acid soaps present in the aged oil paint film, at 1540 cm⁻¹, are quite prominent. The main peak in the alkyd paint film, at approximately 1400 cm⁻¹, is actually due to carbonate filler and is not distinctive to alkyd paint. The sample with 25% alkyd: 75% oil paint has no peaks that can be attributed to alkyd paint.

FTIR Analysis of Alkyd and Acrylic Paints (Fig. 3)

With C-H stretching bands of 2986 cm⁻¹ and 2955 cm⁻¹, the overall profile of the C-H stretching region, C=O stretching at 1732 cm⁻¹ and the fingerprint at 1179 cm⁻¹, are indicative of acrylic emulsion. The OH peak of around 3300 cm⁻¹ and

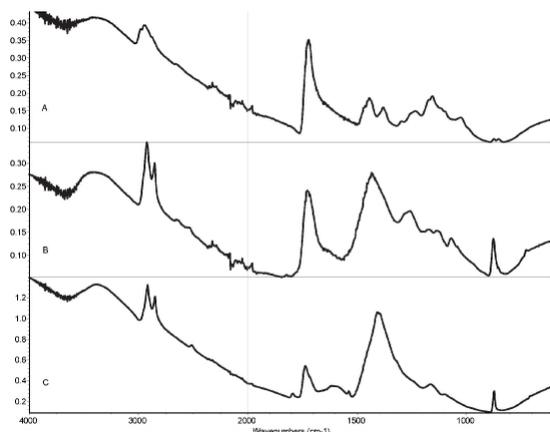


Figure 1. IR absorbance spectra for single-component paints.
A: acrylic; B: alkyd; C: oil.

C=O stretching at 1730 cm⁻¹, peak 1274 cm⁻¹ fingerprint region 1123 cm⁻¹ and 1072 cm⁻¹, are indicative of alkyd paint. Alkyd's fingerprint region peaks of 1123 cm⁻¹ and 1072 cm⁻¹ often mask acrylic's skeletal vibration of 1179 cm⁻¹.

FTIR Analysis of Acrylic and Oil Paints (Fig. 4)

When acrylic and oil paint are mixed, fatty-acid soaps from aged oil paint peak at 1170 cm⁻¹ and dominate the infrared spectrum. An unknown sample with 75% acrylic paint and 25% oil would be difficult to identify as containing acrylic.

However, any sulfate or silicate pigments or extenders ruin quantification due to peak overlaps. Acrylic C–O and C–C stretch also have high absorption in the 1100–1300 cm⁻¹ region and prevent quantification of a mixture of three paints.

As described, when acrylic and oil paints are mixed, fatty-acid soaps formed in the aged oil paint dominate the infrared spectrum. If the acrylic peak at 1170 cm⁻¹ is attributed to oil paint rather than acrylic, even an unknown sample that is 75% acrylic paint and 25% oil paint would be difficult to identify as containing acrylic. Acrylic C–O and C–C stretch also have high absorption in the 1100–1300 cm⁻¹ region and prevent quantification of a mixture of three paints.

Summary

Interpreting single-component paints (acrylic, oil, and alkyd) is straightforward. However, when pigments and fillers are added, infrared interpretation of individual paints becomes more difficult. Chalk's characteristic CO₃²⁻ stretching band of 1490–1370 cm⁻¹, calcium sulfate's characteristic asymmetric SO₄²⁻ stretching band of 1140–1080 cm⁻¹, and silica's asymmetric Si–O–Si stretching band of 1100–1000 cm⁻¹ often obscure the telltale peaks of individual paints, and overlapping peaks can inhibit identification.

Infrared spectroscopy of mixed-media paintings may provide information on multiple components of a paint mixture, but peak overlaps will prevent seeing some less prominent peaks from different paints.

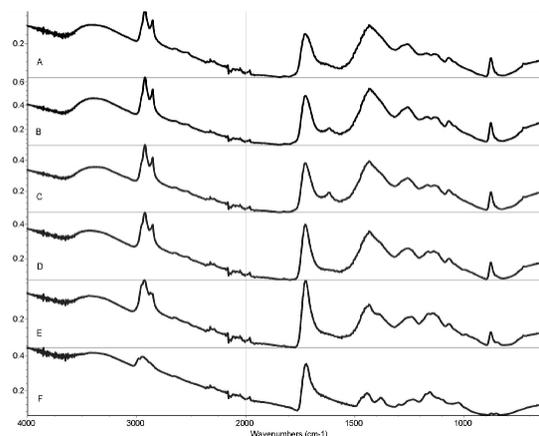


Figure 2. IR absorbance spectra for alkyd/acrylic mixtures.
A: 100% alkyd; D: 50% alkyd, 50% acrylic;
B: 90% alkyd, 10% acrylic; E: 25% alkyd, 75% acrylic;
C: 75% alkyd, 25% acrylic; F: 100% acrylic.

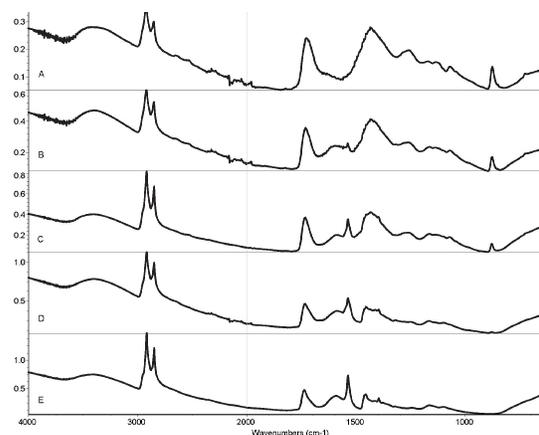


Figure 3. FTIR absorbance spectra for alkyd/oil mixtures.
A: 100% alkyd; D: 10% alkyd, 90% oil;
B: 75% alkyd, 25% oil; E: 100% oil.
C: 50% alkyd, 50% oil;

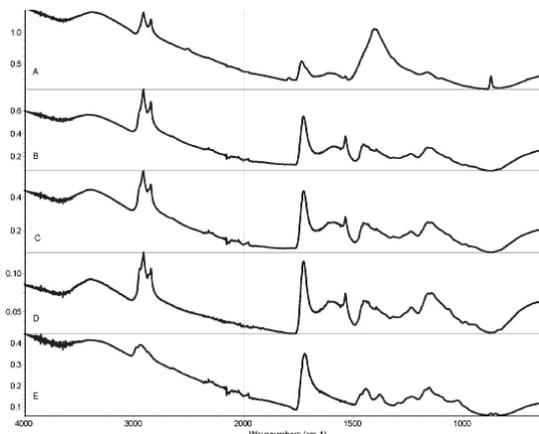


Figure 4. FTIR absorbance spectra for oil/acrylic mixtures.
A: 100% oil; D: 25% oil, 75% acrylic;
B: 75% oil, 25% acrylic; E: 100% acrylic.
C: 50% oil, 50% acrylic;

Detecting Individual Paints in Mixed-Media Paintings, continued

Melting-Point Tests

Melting-point tests were conducted on a Fisher-Johns melting point apparatus, with a small hotplate heating area connected to a thermometer that can measure up to 210°C. All paint samples were exposed to a temperature range of 30°–210°C. An 18-mm circular cover glass was placed between the heating area and the sample to keep the heating area clean. A rotary knob on the apparatus controlled the speed of heating. The melting point apparatus was placed under a microscope to observe sample reactions. Two metal needles were used to manipulate the samples and test their behavior under pressure.

Melting-Point Characteristics of Acrylic, Alkyd, and Oil Paints (Table 1)

The melting behaviors of acrylic, alkyd, and oil paints are highly distinct. Alkyd and oil paints cannot approach the softness and elasticity of acrylic emulsion paint. Moreover, alkyd paint starts to soften at lower temperatures than oil paint (alkyd: 30°–40°C; oil: 40°–100°C) and loses softness at a very specific temperature point (100°–110°C). Oil paint typically chars and discolors at 120°–140°C. The degree of charring is age-dependent: fresh oil paint will char and turn brown-black at a lower temperature than aged oil paint, which chars at around 180°C or above.

Melting-Point Characteristics of Acrylic Paint

The acrylic paint samples we analyzed were soft and elastic. Probing left a dent that would return to its original shape when the pressure was released. All of the samples immediately reacted to rising temperature with increasing softness and elasticity. This behavior intensified at higher temperatures, but no other changes were seen. At 210°C nearly all the samples were still very soft and very elastic. No changes in color appeared.

Melting-Point Characteristics of Alkyd Paint

The alkyd paint samples were essentially hard and non-elastic. Probing with a needle left a dent that did not bounce back. However, all of the samples showed clear softening and elasticity at temperatures of 30°–40°C. This behavior increased up to a point, but at around 100°–110°C the samples lost elasticity and became increasingly hard and brittle and would break when poked with a needle. At 210°C all samples hardened and became quite brittle. No color changes were observed.

Melting-Point Characteristics of Oil Paint

Oil paint samples ranged from soft (but non-elastic) to very hard and brittle, depending on the age of the sample. Most samples started to soften at 40°–100°C. At 120°–150°C the oil paint samples started to congeal and become increasingly brittle (one sample congealed at 90°C). This was typically accompanied by a color change. Lighter-colored samples yellowed then turned brownish. Darker-colored samples became darker. Color changes were not noticeable in very dark-colored samples. In oil paint, these color changes mark the beginning of charring, a process that is complete at higher temperatures than could be measured in our study. Melting-point characteristics of oil paint are highly variable, depending on the degree of dryness and oxidation. Some samples became hard and brittle and changed color significantly at 210°C, while others remained soft even while becoming brittle and changing color.

Melting-Point Characteristics of Mixed Media (Table 2)

Our observations suggest that a mixture of two paints will exhibit the characteristics of both types of paint present. These dual characteristics were seen in each sample tested, especially upon exposure to mid and upper temperatures. Noting this, it is possible to see that certain combinations encourage certain types of paint to be more prominent. Oil will darken at high temperatures. Alkyd alone will harden but not darken at 110°C, but these reactions require a higher temperature when alkyd is mixed with another type of paint. Acrylic will turn soft and react to probing with a fine needle only at 210°C. Fortunately, in tests the melting-point characteristics of one type of paint will not be dominant. Thus, if conservators carefully examine paint reactions at both lower and upper temperature ranges, they can be confident that a melting-point test will not falsely indicate the presence of only one paint when, in fact, there are mixed media.

Summary

Melting point tests cannot provide the weight ratio of the mixture. However, the individual paint melting behavior is noted in the mixture. Acrylic emulsion and alkyd paint have predictive and consistent melting behaviors. Acrylic emulsion will soften at 30°C and remain soft without drying or darkening at 210°C. Aged and young acrylic paint behave similarly. Alkyd paint will harden but not darken at 110°C and remain that way up to 210°C. This is true for aged and young alkyd paint. The melting-point characteristics of oil paint are age-dependent. At 30°C oil paint is hard. It will soften at around 60°C and melt at 120°–160°C, depending on the age of the sample. It will char and darken at 160°–210°C.

Solubility Tests (Table 3)

For the solubility tests, each sample was placed in the depression of a porcelain plate that was positioned under a microscope. The depression was then filled by syringe with one of the testing solvents (acetic acid 10%, sodium hydroxide 30%, xylene, and isopropanol) until the sample was immersed in the solvent. The sample was left in the solvent for 5 minutes and observed visually, after which it was probed with a needle to look for changes in consistency.

Immersion Solubility Tests of Oil Paint

Sodium hydroxide 30%: Oil paint reacted to sodium hydroxide 30% by becoming partially soluble to soluble. In most cases, after being placed in the solvent the binder began to leach, appearing as a yellowish ring around the sample. After 5 minutes of exposure to the solvent, the samples seemed not to have changed in structure, yet they disintegrated when poked with a needle.

Xylene: Exposing oil paint samples to xylene resulted either in non-elastic softening or no reaction at all, depending on the age and degree of oxidation of the oil paint. Younger paint tended to soften, while aged paint showed no effect on exposure to xylene.

Acetic acid 10%: Exposing oil paint samples to acetic acid 10% resulted in non-elastic softening.

Isopropanol: Exposing oil paint samples to isopropanol caused no reaction.

Detecting Individual Paints in Mixed-Media Paintings, continued

Table 1. Melting-point characteristics of acrylic, alkyd, and oil paints.

| | 30°C | 110°C | 130°C | 210°C |
|---------|---------------------|--------------------------|------------------------------|------------------------------|
| Acrylic | Soft and elastic | Soft and elastic | Soft and elastic | Soft and elastic |
| Alkyd | Remains non-elastic | Hardens; does not darken | Hardens; does not darken | Hardens; does not darken |
| Oil | Remains hard | Softens | Melts, darkens, then hardens | Hardens, darkens, then chars |

Table 2. Melting-point characteristics of mixed media of acrylic, alkyd, and oil paints.

| | 30° C | 40° C | 50° C | 60°C | 110° C | 120° C | 130° C | 150° C | 160° C | 210° C |
|--------------------------|--------|--------|--------|--------|--------------------------------------|------------------------------------|---------------------------------|----------------------|------------------|--------------------------------|
| 75% alkyd 25% acrylic | soften | soft | | | hard & some softness no darkening | | | | | |
| 90% alkyd 10% acrylic | hard | soften | soft | soft | hard & some softness no darkening | | | | | |
| 50% alkyd 50% acrylic | soften | soft | | | | hard some softness no darkening | | | | |
| 75% acrylic 25% alkyd | soften | soft | | | | hard some softness no darkening | | | | |
| 75% acrylic 25% oil | soft | soft | | soften | soft | | | | soft & harden | soft, non elastic, darken |
| 50% oil 50% acrylic | soft | soft | | soften | soft | | | darken, very soft | | |
| 75% oil 25% acrylic | soft | soft | soften | soft | | | melting w/some softness | | | soft, deformed mess, darken |
| 75% alkyd 25% oil | hard | soften | soft | | | | harden brittle and no darkening | | | |
| 90% oil 10 % alkyd | hard | hard | soften | soft | | | | melting | melting | dry out & darken |

Table 3. Solubility of single-component paints.

| | Acetic acid 10% | Sodium hydroxide 30% | Xylene | Isopropanol |
|---------|--|---|--|--|
| Acrylic | Becomes soft and elastic, then swells | No reaction | Becomes soft and elastic, then swells | Becomes soft and elastic, then swells |
| Alkyd | No reaction | Becomes partially soluble, then completely soluble | Becomes soft, non-elastic | Becomes soft, non-elastic |
| Oil | Becomes soft, non-elastic | Becomes soluble | Aged sample: no reaction Fresh sample: becomes soft, non-elastic | No reaction |

Detecting Individual Paints in Mixed-Media Paintings, continued

Immersion Solubility Tests of Alkyd Paint

Sodium hydroxide 30%: When exposed to sodium hydroxide 30%, alkyd paint reacted with partial solubility. Similar to oil paint samples, the paint binder leached during exposure, creating a yellowish ring around the sample. The samples retained their shape until they were poked with a needle.

Xylene: Alkyd paint samples reacted to xylene with non-elastic softening. A few of the samples also reacted with slow, minor swelling during exposure.

Acetic acid 10%: Exposing alkyd paint samples to a 10% acetic acid solution caused no reaction.

Isopropanol: Exposing alkyd paint samples to isopropanol resulted in non-elastic softening.

Immersion Solubility Tests of Acrylic Paint

Sodium hydroxide 30%: Exposing acrylic paint samples to sodium hydroxide 30% caused no reaction.

Xylene: Acrylic paint samples reacted to xylene with elastic softening and immediate, marked swelling.

Acetic acid 10%: Exposing acrylic paint samples to acetic acid 10% resulted in elastic softening and slow, minor swelling.

Isopropanol: Exposing acrylic paint samples to isopropanol resulted in elastic softening and slow, minor swelling.

Immersion Solubility Tests of Mixed Paints (Table 4)

Individual paints in a mixture react independently to solvents. For example, in a 75% alkyd / 25% acrylic mixture, xylene and isopropanol will soften and swell the acrylic paint, but non-elastically soften the alkyd paint. Sodium hydroxide 30% will dissolve the alkyd paint in the mixture but will not dissolve the acrylic paint. These and other telltale signs can alert conservators to the presence of both alkyd and acrylic paint in the mix.

Summary

The solubility test cannot provide weight ratio of the individual paints in the mixture. However, the individual paints in the mixture will react to the solvents independently, and their solubility and chemical properties can be used to classify the paint.

Conclusion

With practice and patience, conservators can perform practical, low-cost tests of melting points and solubility in their studios, and use criteria for chemical and physical characterization to detect individual paints in mixed-media paintings and develop treatment strategies. FTIR can be used as the first step in the identification process or as the final step to backtrack the spectra or sharpen FTIR identification skills. Our modest study aimed to follow the great tradition of “looking into paint” by extending that looking to include alkyd, acrylic emulsions, and modern mixed paints.

Table 4. Solubility of various paint mixtures.

| | Acetic acid 10% | Sodium hydroxide 30% | Xylene | Isopropanol |
|--------------------------|---------------------------|--|--|--|
| 75% alkyd 25% acrylic | No reaction | Becomes partially soluble, then swells | Becomes soft, non-elastic | Becomes soft, non-elastic |
| 75% oil 25% acrylic | Becomes soft, non-elastic | Becomes soft, non-elastic | Becomes soft, then swells suddenly | Becomes soft and non-elastic, then swells slowly |
| 75% alkyd 25% oil | Becomes soft, non-elastic | Becomes soluble | Becomes soft, non-elastic | Becomes soft, non-elastic |
| 90% alkyd 10% acrylic | Becomes soft, non-elastic | Becomes soluble | Becomes soft, non-elastic | Becomes soft, non-elastic |
| 90% oil 10% alkyd | Becomes soft, non-elastic | Becomes partially soluble, then dissolves | Becomes soft, then swells slowly | Becomes soft, non-elastic |
| 50% alkyd 50% acrylic | Becomes soft, non-elastic | Becomes partially soluble | Becomes soft and non-elastic, then swells slowly | Becomes soft and non-elastic, then swells slowly |
| 75% acrylic 25% alkyd | Becomes soft, non-elastic | Becomes soft, non-elastic | Becomes soft and non-elastic, then swells slowly | Becomes soft and non-elastic, then swells slowly |
| 75% acrylic 25% oil | Becomes soft, non-elastic | Becomes soft and non-elastic, then swells slowly | Becomes soft and non-elastic, then swells suddenly | Becomes soft and non-elastic, then swells slowly |

Annual Meeting Abstracts

The 2013 WAAC Annual Meeting was held September 8 - 12 at the Asian Art Museum in San Francisco

The papers from the meeting are listed below along with summaries prepared by the speakers.

Building New Expectations: Collections Management in a Multiple Facility Workflow

Kelly Bennett

The Berkeley Art Museum has a longstanding tradition as a highly accessible art collection. Over the last 40 years the majority the collection has been housed in the museum, and the community that utilizes it has come to rely on the immediacy with which their requests can be met. Following alongside other U.S. museums building new facilities, the BAM/PFA remodel has been designed with different priorities for the space available, by housing the majority of the collection in offsite warehouses. Using multiple warehouses will significantly affect the way the staff, the university, and the public interact with the collection.

This presentation will illustrate the significant changes that will be necessitated in collections management, and how they will impact the relationship of the museum with the community.

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Questions that need answering include: what will it take for BAM/PFA to continue to meet its community's expectations and desires? What new collection management challenges will the museum face, and what institutional priorities will need to shift to maintain a safe environment for the collection?

This presentation will begin with a quick overview of the current management of the collection. This includes curatorial use, educational use, expectations of the university, as well as the museum's relationship with lenders and donors. Next, there will be an overview of the existing/new facilities, outlining resources available during and after the transition to the new museum. This portion will include a description of changes that will occur, specifically the suspension of loans, the closing of the building, and how this period will be used to setup the new workflow. The presentation will also incorporate the handling/movement of the collection, and plans for managing the expectations of the staff and university.

The changing priorities for museums being built in many parts of the U.S. today have dramatically changed the accessibility of artwork. In response, collections management workflows will have to adjust to create a safe and effective new system, as well as maintaining a culture where the community can experience the collection. A multiple facility system opens up new concerns and conservation issues, requiring an institutional shift in priorities to steward the collection. The BAM/PFA has a loyal and committed community that will need to find new methods and techniques to allow them to continue to connect with the artwork.

San Francisco Rock Posters and the Art of Photo-Offset Lithography

Victoria Binder

Offset lithography was the dominant method of commercial printing of the twentieth century. This workhorse of printing, with its complicated equipment and production sequence, left very little room for artistic experimentation. It was during the nineteen sixties, in the small photo-offset lithographic shops

of San Francisco, that commercial need and artistic vision came together in the creation of psychedelic rock posters.

These posters were created to promote music and dance venues featuring many of the greatest rock bands of the sixties. Working under tight deadlines, the artists broke every rule of conventional design, producing works that reflected the visual chaos and revolutionary spirit of the scene. Using sheet-fed offset presses, the small offset lithographic shops affordably produced runs of single-color and multicolored posters in a short period of time. However, unlike larger commercial shops, they were able to provide an environment that was conducive to artistic input.

This presentation examines the process of photo-offset lithography within the context of making early San Francisco rock posters (1966–1968). The materials and major steps of the production sequence for flat multicolor prints are discussed and illustrated with images of original artifacts.

The Conservation of a Human Skeleton Modified for Medical Instruction

Niccolo Caldararo, Claire Antonetti, and Jena Hirschbein

This talk describes the examination and restoration treatment of a male human skeleton that had long been used as a teaching specimen. The treatment would require reassembly and extensive repairs to broken bones due to a fall. Breaks resulted in shattering of the brittle bone material and fragment loss. The skeleton had been previously wired together, had steel inserts for rotation, as well as rods to facilitate weight balance. Bones were first disassembled and catalogued, cleaned and then stabilized using consolidants. Damage to wire or metal-segments was addressed, weak areas of bone were reinforced with metal pins and lost fragments from impact were replaced and secured with adhesive and polymer paste. A new hanging system was suggested that would be more stable. A review of earlier work in the restoration of vertebrate skeletons is provided.

Annual Meeting Abstracts, continued

How We Moved the Alaska State Museum

Ellen Carrlee

In Spring 2014, the Alaska State Museum moved 40,000 objects to a new storage vault in less than 6 weeks. The move team was led by just seven staff members, but included dozens of museum professionals from all over Alaska, flown in to help while also getting hands-on training thanks to an IMLS grant. This session describes the Incident Command System used to coordinate the effort, lessons learned from moving into an active construction zone, and plenty of packing tips, favorite tools, and equipment for everything from totem poles to a lighthouse lens to a 40-foot walrus skin boat.

See the Full Spectrum: Measuring Light Sources with Portable Spectroradiometers

Charlotte Eng, Frank Preusser, and Terry Schaeffer

Light levels in museums are usually monitored photometrically, *i.e.* in lux or footcandles. That is, the radiation illuminating the surfaces of objects or emitted by the light source is documented according to the spectral sensitivity of the human eye. This measurement method indicates how well objects will be seen and – approximately – the amount of visible light that is illuminating the objects. In museums, near ultraviolet (UV) radiation is also routinely monitored. These data, when combined with knowledge of the light stability of various materials, are used by conservators to develop lighting guidelines and recommend appropriate exhibition times for display of light sensitive objects.

However, photometric measurements cannot provide complete information on the radiation reaching objects. For example, the spectral energy distribution of the light is not available, and blue and far red radiation are both underrepresented. Light energy in either of these regions may thus be overlooked. In addition, UV meters currently in use also are not able to provide spectral information. Because

the UV and blue regions of the spectrum are often more damaging to objects, a full spectral characterization of light sources is desirable.

Spectroradiometry, in contrast to photometry, measures the complete spectrum of near UV and visible light. User-friendly portable spectroradiometers and the accompanying software now available not only record the spectral output of light sources, but also offer multiple options for data evaluation. These include calculation of photometric and colorimetric quantities.

We recently acquired an Ocean Optics Jaz spectroradiometer to monitor lighting in the galleries. In particular, LEDs are being introduced, but there is controversy over their suitability, partly because some LED sources emit a large band of blue light.

The presence and intensity of this blue band cannot be determined adequately by photometry but is easily assessed using spectroradiometry. We demonstrated this by measuring selected LED sources with the Jaz spectroradiometer and comparing these results with readings from an Elsec light meter. Various blue cut-on filters were also placed in the light path. The changes in the blue region were clearly shown in the spectral data, but not evident in the photometric readings.

Battling the Beetles: Insect Growth Regulators as a Tool for Pest Management

Tania Collas

Conservators and collections managers at the Natural History Museum had been battling an infestation of drugstore beetles (*Stegobium paniceum*) within the Birds and Mammals collections for a number of years without success. Despite diligent freezing of infested specimens, the large size of the collections (over 200,000 specimens) meant that, in many cases, previously frozen specimens became reinfested before the freezing of the rest of the collections had been completed.

We realized that we needed to add some new weapons to our arsenal in order to win our battle with the beetles.

While continuing to follow a proactive pest management approach, including cleaning, eliminating clutter, freezing infested or potentially infested specimens, and monitoring the collection areas to identify specific areas of infestation, we also decided to try a species-appropriate insect growth regulator and other safe pest control products.

While we did not expect any one of these approaches to be effective on its own, we hoped that in combination, they would slow the spread of the beetles long enough for us to make headway with targeted freezing treatments. After nearly a year following this approach, our results will be relevant to any cultural or natural history collection vulnerable to pests.

The Use of a Water-Based Vegetable Polysaccharide as an Anti-Graffiti Coating to Protect Outdoor Sculpture

Mark Gilberg and John Hirx

Graffiti can be a major problem in both urban and rural settings and affects both older and historic buildings and monuments as well as outdoor sculpture. While much has been published in the literature over the years on its prevention and removal, no one method for graffiti prevention and removal has found widespread application.

In this presentation the authors will discuss the merits of PSS-20, a water-based anti-graffiti coating made from vegetable polysaccharides, in light of its recent application for the protection of Michael Heiser's monumental sculpture *Levitated Mass*. This artist installation consists of a 340 ton granite boulder straddling the walls of a 139 meter long trench. The boulder is bolted to two stainless steel shelves that are attached to the top of the trench which descends from ground level to almost 4.5 meters below the boulder at its center allowing visitors to stand directly beneath it.

To date, PSS-20 has proven to be an effective anti-graffiti coating for this monumental work of art. The possible use of PSS-20 as a sacrificial coating for other outdoor sculpture at LACMA will also be discussed.

Annual Meeting Abstracts, continued

Art in the Woods/Art in the Museum: Collecting an Experience

Amanda Hunter Johnson

This talk will describe the collaborative effort required to implement an artist's vision of a commissioned work as well as address the unique challenges of its acquisition.

SFMOMA's 2012 SECA show included David Wilson's 16-foot framed drawing, *Frog Woman Rock from Arrivals*, which was displayed outside along a trail in Presidio Park. Framing and installing this large scale drawing outside tethered to a eucalyptus tree involved substantial collaboration between the artist, museum staff, and the National Park Service and the Presidio Trust.

At the Presidio site, visitors could view the drawing and listen to music recorded by Wilson and his collaborators. Visitors were also encouraged to interact with the installation by writing their thoughts or reactions and leaving the notes in the box holding the audio equipment.

After the exhibition closed, SFMOMA acquired the drawing and recorded music as well as almost one hundred individual responses and drawings left by visitors. Acquisition of this piece poses challenges in collecting a work that combines elements of the genre of social practice as well translating an outside site-specific installation into a museum display.

Being the Art: Introduction and Guide to Enter the Mandala Exhibition, Asian Art Museum

Jeff Durham

In this talk, we'll explore how scientific investigation of art objects can clarify "context," which depending on the object can vary from physical provenance to philosophical charge. In that connection, I'll discuss several objects in the AAM collection, most prominently Simhavaktra Dakini, the Svayambhu Stupa, and the Buddha Vairochana, as examined by our conservation department. There will be special emphasis on how the different

conservation practices involved in researching each object have allowed us to access, visualize, and restore context.

In Consideration of the Thangka

Denise Migdail

By examining the history of storage, display, and conservation of thangkas over fifty years at the Asian Art Museum, San Francisco, it is possible to trace an evolution in conservation philosophies and the efficacy of preventive and sustainable care. With the 2003 move from Golden Gate Park to the museum's current home in San Francisco's Civic Center Plaza, the storage design shifted from vertical, free-hanging, paintings-style storage to horizontal, flat-tray storage with full support.

Further changes followed and developments in storage systems, approaches to conservation treatments, and shifts in exhibition methods are examined, culminating in the creation of the museum's current modular magnetic mounting system, which streamlines departmental costs, reduces material waste, and successfully supports and displays much of the Asian Art Museum's thangka collection.

What Lies Beneath: Analytical Studies of Bronze and Glass Artifacts from the Prehistoric Tumulus at Lofkënd

Vanessa Muros

This paper presents the results of a study undertaken to analyze 14th-8th-c. BC bronze and glass artifacts excavated from the prehistoric tumulus of Lofkënd in southwestern Albania. The conservators on the project were involved in the characterization of the finds and their treatment, as well as aiding project archaeologists with several technical studies on the excavated finds for publication. It was during the course of the analysis of the bronze and glass artifacts that unusual condition issues were discovered on some of the artifacts.

The findings of the technical study will be discussed, the condition issues described, and possible causes for the

deterioration observed will be offered. Since archaeological conservators primarily rely on visual examination, as well as knowledge and expertise, in the field to identify materials and make determinations about condition to preserve the excavated artifacts, it is important to share these unexpected findings to add to the knowledge base conservators can draw on when working with archaeological materials.

The Importance of Being Emile

Devi Ormond

Controversial art historical debates can often be clarified by evidence provided by technical examination of the works in question. Two names surface in one such long-term dispute over Symbolism, those of Paul Gauguin and Emile Bernard. Discussions over who influenced who *vis-à-vis* the birth of Symbolism will be revisited in this presentation.

In September 1888, in the Brittany village of Pont-Aven (France), Gauguin and Bernard painted canvases with a similar motif of Breton women in traditional dress – *The Vision after the Sermon* and *Breton Women in the Meadow (Pardon at Pont-Aven)*. Composed of broad, flat areas of pure color coupled with thick dark outlines and suggestion of the image being cropped, these two works are reminiscent of prints by Kunichika, Hokusai, Hiroshige, and other Japanese artists whose works began to infiltrate Paris in the 19th century. They are good examples of the influence that Japanese prints had on the development of a new way of painting.

Three years after the works were completed, an essay appeared in the *Mercure de France* written by Gabriel-Albert Aurier entitled «Le Symbolisme en Peinture, Paul Gauguin ». Aurier wrote of Gauguin's *Vision* as being a key work and its artist being the leader of this modern style which he coined 'Symbolism.' In this essay, there was no mention of Emile Bernard.

Feeling slighted that his part in the creation of this new type of painting was completely ignored, it has commonly been believed that, in reaction to Aurier's

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article, Bernard added ‘Pardon at Pont-Aven’ to the title of his painting *Breton Women in the Meadow*. At the same time he was said to have written ‘Pardon’ in black ink on to the reverse of his canvas. In doing so, it is thought that he was giving his work a more religious context ~ that of a Pardon (a penitential ceremony which occurs on the feast of the patron saint of a church). This would subsequently allow his work to stand up to Gauguin’s *Vision* and thus show that his work had a significant part to play in the development of Symbolism. In 1903, it was clear that his grudge against Gauguin had not subsided. Bernard went as far as to accuse Gauguin of plagiarism:

“Le Pardon de Pont-Aven venait d’avoir lieu et j’avais peint, me servant comme thème du costume local, une prairie ensoleillée de parti pris jaune historié de coiffes bretonnes et de groups noir-bleu. De ce tableau Gauguin partit et fit *La Vision du Sermon*, tableau dans lequel les coiffes forment également le motif principal.”

Within the context of a multidisciplinary research into the materials and techniques of Vincent van Gogh and his contemporaries carried out at the Van Gogh Museum between 2005-2013, the opportunity arose to examine other works by Gauguin and Bernard, as well as by Van Gogh, who brought the unlikely pair together and was involved in their artistic discourse, albeit from afar. A clearer picture emerges of the close working relationship between Gauguin and the younger Bernard during their short sojourn in Pont-Aven, especially in terms of their choice of materials.

Recent technical and scientific research into *Breton Women* has thrown fresh light onto this particular issue in the debate concerning Bernard’s tampering with titles. On the reverse of the canvas of *Breton Women*, residues of paint can be seen. Pigment identification as well as imprints on the painted surface show that these residues are indeed from the front of the work. The still slightly wet paint was transferred onto the back of the canvas when the work was rolled prior to transport.

Gauguin carried this painting with him to Arles in October 1888. Van Gogh, when he

first saw the painting, waxed lyrical about this ‘magnificent canvas’ to his brother Theo. (Letter 715 to Theo van Gogh on or about Thursday 25th October 1888)

In fact, he was so taken by the painting that he made a detailed watercolor copy of it. It is this copy that we can refer to and definitively state that after painting the work in September 1888, Bernard made no changes to the composition when it later was in his possession. What is of great interest to note is that the small remnants of green paint found on the canvas reverse can clearly be seen to lie on top of the inscription ‘Pardon.’ By deduction, Bernard had written the inscription shortly after completing the work and before it was taken down to Arles, intending his work to be placed within a religious context.

It cannot be denied that Gauguin’s *Vision*, does carry a profound spirituality devoid in Bernard’s work. The evidence retrieved from the technical examination, in spite of Bernard’s claim that his work influenced Gauguin, does not categorically prove this to be the case. What it does provide us with, however, is an end to the discussion of when and why Bernard decided to change the title of this important painting. *Breton Women in the Meadow (Pardon at Pont-Aven)* was always originally to be painted in the setting of a religious ceremony. Taking into consideration that both artists were using the same materials (and possibly sharing them), it is without doubt that they must also have shared their ideas, subsequently influencing each other in the artistic paths they ultimately chose to take thereafter.

Conservation Materials Assessment Methodologies for Transparent Plastic Art and Design: Risks, Joint integrity, Artificial Aging, and Analysis

Donald Sale

Modern and contemporary collections are rich in art and design made of transparent plastic. Exquisite sculpture, paintings, photographs, and art-books exploit the exceptional properties of a range of transparent synthetic polymers. Extraordinary furniture, designer items, costume accessories, and architectural

models rely on the structural properties of transparent plastics to articulate form and space. Art and design made of transparent polymers may be tinted, lacquered, painted, or printed in a variety of polymeric materials.

The conservation of modern art and design made of transparent plastic is complex due to the differing sensitivities of individual polymers to solvents and adhesives. In this study frameworks were developed to assess conservation materials for rigid transparent plastics. Test methods are presented, data from previous studies are summarized, and assumptions from the results are reassessed. Standards used in industry to identify adhesives and solvents that will not damage thermoplastics, by dissolving them or causing stress-crazing, are compared. Artificial aging, sample designs, scientific analysis, tensile strength, yellowing, and conservation treatments are discussed.

The aim of this study was to investigate molecular changes in a group of adhesives 20 years after exposure to a range of extreme environmental conditions used to accelerate aging. Samples stored in the dark were compared to those exposed to intense heat, light, combinations of each, and a museum window used to investigate the impact of the spectral distribution of filtered sunlight, and daily cycles of different levels of light, heat, and relative humidity. The aged samples were analyzed using Fourier Transform Infrared (FTIR) Spectroscopy, Thermo Gravimetric Analysis (TGA), Pyrolysis Gas Chromatography Mass-Spectrometry (Py GC-MS), and Dynamic Load Thermal Mechanical Analysis (DL TMA).

A case study of aged 1:1 Paraloid B-67 / Paraloid F-10 on PMMA indicated that these polymers didn’t yellow after exposure to any environment, but there were changes in the glass transition temperature (T_g) that appeared dependent on the aging conditions. Preliminary DL TMA data indicated that the T_g increased more in samples exposed to multiple environmental parameters involving either a part dose of high heat (50%) combined with a part dose of light (25%), or a full dose of light in a museum window (100%) with cycles of changing levels of filtered sunlight, temperature, and humidity.

Annual Meeting Abstracts, continued

The T_g increased less in samples exposed to a continuous full dose of only heat (100%) or artificial museum light (100%). There are three streams of results in this study: adhesives and solvents that appear suitable for the conservation of specific transparent plastics in art, architectural models, and design; an evaluation of the methods used to assess the materials; and the relationship of the aging environments to museum conditions.

This paper summarizes research and scientific analysis carried out as a guest scholar in the Getty Conservation Institute in 2012-13. This unparalleled opportunity involved examination of the excellent collection of transparent plastic art, architectural models, and photography in the Special Collections of the Getty Research Institute and the J Paul Getty Museum, and consultation with staff and scholars in all Getty Programs including the Trust.

An Approach toward Treating Composite Materials in an Outdoor Environment

Frank Preusser and Christina Fisher

Since January 2011, the Los Angeles County Museum of Art (LACMA) has worked under contract to the city of Los Angeles on the conservation of the Watts Towers, a National Historic Landmark and 'outsider art' sculptural site. The Towers were created by artist Sabato Rodia between 1921 and 1954. The site consists of 8 sculptures constructed of scrap metal covered in Portland cement with embedded glass and tile fragments, shells, stones, and other materials. LACMA's mandate is to update the site's conservation and maintenance plan and provide daily preservation maintenance.

Challenges to the preservation of these structures arise due to the effects of the environment on original and restoration materials as well as inherent vice in the combination of materials used by the artist. Thermally-induced, wind-driven, and seismically-induced mechanical stresses and weaknesses in the original structural design are causing cracking of the cement shell. The open cracks allow for water ingress, causing corrosion of

the steel armature and subsequent mortar spalling. Varying thermal expansion coefficients of the materials used in the composition of the structures result in loss of ornamentation.

The development of a treatment protocol for the structures incorporates macro- and microscopic approaches to evaluate the condition of the structures, determine the causes of deterioration, select and test materials, and monitor offsite and in situ tests. A global treatment approach was developed to extend life expectancy of repairs to once every 20-25 years.

Research and testing evaluated cementitious, elastomeric, and adhesive repair materials as well as corrosion protection and water repellency. Reliance was placed on image capturing in high resolution photography, thermal imaging, digital microscopy, and digital radiography. Measurements of crack movements, tilt, vibration, environmental conditions, and corrosion potential were recorded using purchased and engineered equipment. Collaborations took place with the LACMA Conservation Center, UCLA Department of Civil and Environmental Engineering, and the Getty Conservation Institute. An internship program was implemented to pair local high school students with recent graduates from the UCLA/Getty Program in Archaeological and Ethnographic Conservation.

The methods used by the LACMA conservation team and their collaborators at the Watts Towers will be discussed with a focus on relaying a contemporary approach toward treating a complex structure composed of composite materials in an outdoor environment.

Preservation Strategies for a Busy Chinoiserie Interior Within an Indian Inspired Palace: Using New Technology and Tried Strategies to Manage the Historic Environment in the Royal Pavilion in Brighton, England (without central heating)

Donald Sale

The Royal Pavilion in Brighton, England is a world renowned former royal palace of King George IV by John

Nash inspired by India, with an exquisite Chinese inspired, or chinoiserie interior by Frederick Crace and Robert Jones. It is the key attraction in Brighton, attracting 100,000 visitors a year, and is in fact within an estate in the center of Brighton, comprising the earlier Indian inspired riding stables and later gatehouse. The Royal Pavilion is also the key element of a service of 5 museums and historic properties, and other historic and auxiliary buildings, which hold over 200,000 collection items.

This paper focuses on the conservation and preservation strategies, and the prototype trials and change initiatives, which were developed to manage the continuous flow of visitors through the richly decorated interiors of the Royal Pavilion. Working jointly with education, curatorial experts, front of house and income development teams, a preservation program was developed to ensure long-term public engagement with the lavish chinoiserie interior and collections within this Indian inspired architectural gem.

Some interesting considerations that impact the preservation of the chinoiserie interior and collections is that the historic environment is illuminated with natural lighting from hundreds of windows and roof-lights, augmented with rewired original light fixtures and reproductions. The temperature in the winter is managed predominately with dispersed independent electric heaters at low levels, instead of a centrally controlled system, and cooled with natural ventilation through open windows in the summer.

It's novel structure, which is a feat of engineering and architectural design, has minimal building mass to mitigate the exterior weather conditions of a seaside palace retreat on the south coast of England. The collection furnishings, many designed or reproduced for the rooms that they occupy, are on open display and separated from the public when visiting or attending events by free-standing barrier ropes. While prints, drawings, and paintings are displayed mostly behind glass, and there are a couple of display cases for temporary exhibitions, the wall-papers, furnishing textiles, and richly painted decorative interiors are on open display.

Annual Meeting Abstracts, continued

In this paper, preservation strategies are presented that were developed to manage collection care and interior environmental conditions to international standards by modelling aspects of now familiar frameworks such as the Agents of Decay first presented by Stefan Michalski of the Canadian Conservation Institute and Conservation Risk Management by Robert Waller of the Canadian Museum of Nature.

Further consultation involved the frameworks developed by Sarah Staniforth and many others at the National Trust in England, Wales, and Northern Ireland and Kate Frame and others at Historic Royal Palaces in London. A broad range of engaging examples are presented that demonstrate the development of institution-specific risk-management strategies and the use of new technology through prototype trials, developed by the author at different institutions, to ensure that the exquisite chinoiserie interiors within the magnificent Indian inspired Royal Pavilion, continues to engage and inspire current and future audiences.

An Inventory of the Photographic Collection at the Los Angeles County Museum of Art: A Collaborative Approach

Asti Sherring and Laura Moeller

The photography collection held at the Los Angeles County Museum of Art (LACMA) encompasses more than 15,000 objects which span the history of the medium, from 1839 to present day. This paper will address the comprehensive inventory and conservation assessment of LACMA's photography collection undertaken from 2014 to 2015. This effort is grant funded with financial support from the Institute of Museum and Library Services (IMLS).

The inventory of LACMA's photography collection aims to address the imminent preservation needs of the collection as a whole, while also providing accurate and extractable data for future conservation and collection management initiatives. The IMLS project focuses on four core aspects, which include: the standardization of naming conventions

for photographic processes, the input and verification of descriptive metadata at an object level, the digital documentation of artworks, and planning for long term storage needs. This effort will help prepare the collection for the establishment of a Photography Study Center, scheduled to open fall of 2014.

Within LACMA's database platform, The Museum System (TMS), a custom module was built for the project. The implementation of this database feature addresses the needs of conservation, collection management, curatorial, and registration, allowing for greater accuracy during data collection. By implementing a specific constituent within the existing database to fit the needs of the inventory, useful data can be collected and collated, which will in turn provide the museum with reliable information for the management and use of its collection.

As consistent nomenclature is added to the TMS database, the efficacy and use of these records improves museum wide. Additionally, the development of a uniform language for photographic processes seeks to contribute to the larger international discussion within the field of conservation regarding the standardization of naming conventions. Paramount to LACMA's vision, this project provides the opportunity for advocacy and public engagement with programs related to the care and management of a rapidly growing and active photograph collection.

Gelatin and Carrageenan Mixtures: Protein-Carbohydrate Adhesive Combinations for Consolidating Southeast Asian Paintings

Shiho Sasaki

In 2009, the treatment of some very large Thai paintings on woven fabric provided an opportunity to evaluate certain characteristics of two adhesives: gelatin and carrageenan. These two adhesives were evaluated alone and combined in different proportions to achieve the desired levels of viscosity, penetration, strength, flexibility, and visual appearance. The proportions,

concentration and application methods were varied for different application methods of the consolidation treatment.

The Best Thought(out) Schemes o' Mice an' Men Gang Aft A-gley [often go awry]

Chris Stavroudis

With apologies to Robert Burns and thanks to the Internet for the proper quote, a more reflective title would be: Preliminary results: Testing the Swelling of Cotton Fibers with Different pH and Conductivity Solutions Using Cotton Duck Fabric and a Biaxial Strain Tester.

Richard Wolbers' insights into the importance of pH and ionic strength (conductivity) in controlling the swelling of acrylic paint films have opened up a new way to look at aqueous treatments in general. As a result, many of us are thinking about applying these insights to other aspects of conservation treatments.

The background and theory for wanting to control the ionic strength, pH, and osmotic potential of a bath will be presented. In that context, the preliminary results with the canvas tests will be discussed.

In addition, details of the construction of the DIY biaxial strain tester will be presented. (I'm sure everyone will want to run home and build their own.)

Neutralizing the Nuclear Option

Donna Williams

Los Angeles artist Chris Burden's anti-war diorama *A Tale of Two Cities* was originally assembled 32 years ago - a collection of five thousand models and toys glued to slabs of cardboard, designed to be exhibited on a panoramic landscape of sculpted wet sand.

Over the course of multiple exhibitions, the piece's substrate had become warped and delaminated, the cardboard encrusted with black mold. By 2013, the installation had become sufficiently dilapidated that Burden publicly expressed his intent to exercise the artist's contractual right to

“Vandalized Monet Painting Receives Radical Restoration,” *Fine Art Today*, 07/03/2014

Almost exactly two years after a visitor to its galleries punched a hole through a prized Monet, the National Gallery of Ireland unveiled the restored painting.

In late June 2012, the National Gallery of Ireland was in the headlines under unfortunate circumstances. A visitor to the museum’s galleries attacked Claude Monet’s “Argenteuil Basin with

alter his work via the “nuclear option,” blowing it up as a final performance piece - a logical conclusion to this broad depiction of futuristic feudal warring states. “The work would still exist,” said the artist, “but as rubble.”

However, in response to a mockup of a conserved single panel, Burden instead agreed to consider the alternative option of an extensive conservation campaign. Over the course of several months, the installation was cleaned, repaired, re-fabricated, and remounted on lightweight, interlocking sheets of honey-comb aluminum panel.

Following conservation, *A Tale of Two Cities* was loaded into 16 custom-made crates and shipped across the country, where it occupied a major place in the artist’s one-man survey *Chris Burden: Extreme Measures* at the New Museum in New York last year. The work is currently scheduled for exhibit at the Orange County Museum of Art in the fall.

Mi Vida: The Saving of a Mural on Dry Wall

Anne Zanikos

In 1972, San Antonio artist Jesse Trevino returned from service in the Viet Nam war to recover from the loss of his right arm. As he healed and taught himself to paint with his non-dominant left hand, he painted his first mural on the wall of his bedroom. In 2005, the house was sold, and the biographical mural was slated for destruction. The deinstallation, relocation, and treatment of the mural will be discussed with emphasis on the treatment decisions associated with the fragile dry wall support.

a Single Sailboat” (1874) as it hung on the wall, reportedly putting his hand through the canvas. Shortly afterward, the museum launched the Claude Monet Research and Conservation Project to mend a three-branch tear in the canvas and restore it to its original condition.

The National Gallery’s website details the various stages of the extensive project, which included stabilizing the painting, testing materials, repairing the tear, lining and restretching the canvas, restoring and replacing paint fragments, and filling in the paint.

One of only three Monet paintings in Ireland, “Argenteuil Basin with a Single Sailboat” is back on view at the National Gallery in Dublin. The painting now hangs behind a thin layer of protective glass.

“Gothic Church’s Frescoes Destroyed during Restoration,” *The Art Newspaper*, 08/26/2014

German heritage advocates have accused the Russian Orthodox Church of causing irreversible damage to the 14th-century Brick Gothic church of St Catherine at Arnau near Kaliningrad, especially to its frescoes.

“The... iconography of the painting[s] in St Catherine’s Church in Arnau from the 14th century had not yet been thoroughly researched [and they] are irretrievably lost,” wrote Nicole Riedl, an expert in Medieval wall paintings at Hawk University of Applied Sciences and Arts in Hildesheim, Germany in her report, after she visited the church in July with a group of activists from the German-based Kuratorium Arnau.

Just three patches of fresco remain in St Catherine’s, following restoration work carried out after the church was handed over to the Russian Orthodox Church by local legislators in 2010. The frescoes were created when St Catherine’s was a Catholic church. It became a Lutheran church after the Reformation and the frescoes were whitewashed for centuries, then uncovered in the early 20th century.

Riedl wrote that, from a conservation point of view, the Russian church’s actions in restoring the Arnau church have violated both the Charter of Venice as well as Russian culture laws. Following the German delegation’s visit, the news website Newkaliningrad.ru

reported that the Kaliningrad Diocese of the Russian Orthodox Church was cutting off relations with Kuratorium Arnau.

“Cheltenham Banksy ‘Mural to Cost £26,000 to Restore,’” *BBC News*, 08/22/2014

A graffiti-damaged mural in Cheltenham by street artist Banksy can be restored at a cost of almost £26,000, a professional art conservator has said.

The ‘Spy Booth’ artwork, which depicts three spies “snooping” on a telephone box, appeared in Hewlett Road in April. It was badly damaged with spray paint earlier this month. Robin Barton, from London’s Bankrobber gallery, who asked Tom Organ to assess the damage, said the six-week project would return it “to its former glory”. Mr. Barton said it had been “established beyond doubt” that the mural could be successfully restored whilst keeping the structural integrity of the Grade II listed building intact.

The artwork was daubed with white paint just days after it appeared in April but it was saved by drinkers who rushed from a nearby pub to wash off the paint before it dried. In August, silver and red graffiti was sprayed over the mural and, less than two weeks later, protective hoardings were removed and holes made at the four corners.

After the holes appeared, businessman Hekmat Kaveh - who has offered funds to buy the house to ensure the mural stays in the town - said he thought an attempt was being made to remove it.

“Clyfford Still Touch-up Exhibit shows Art sans Makeup,” *The Denver Post*, 09/02/2014

Time hasn’t been kind to Clyfford Still’s 1942 abstract masterpiece, PH-126. Paint is separating along its left edge, and its whole surface appears to be randomly flaking.

So it goes in the world of oil-coated canvases, and a good percentage of the 825 paintings in the Clyfford Still Museum’s collection are showing signs of age. Fortunately, Chief Conservator James Squires and his team are there to perform cosmetic surgery.

Their touch-ups are delicate and tedious. The museum’s new exhibit,

“The Art of Conservation: Understanding Clyfford Still” takes a lot of the mystery out of the process. Using raw canvases, some worse for wear, the show explains how paintings are inspected and mended when a fix is in order.

It’s a bold move for the museum; really, stapling a sampling of Still’s more worthy pieces to the wall and letting us stare at the blemishes. The exhibit shows us a huge work table where a damaged canvas is stretched wide and push-pinned on its sides, holding it tight so the repair work can be done.

For those of us who have gotten to know Still on a surface level, this exhibit offers a chance to go deeper, to see the things before they’re made perfect for public consumption. But it’s refreshingly honest and goes long way toward making Still, who can seem remote, look a lot more human.

“Massive Dürer Print Undergoing Painstaking Restoration,” *ArtNet News*, 09/04/2014

This fall, visitors to the National Gallery of Denmark can see conservators at work on Albrecht Dürer’s The Arch of Honor of Maximilian I, the largest woodcut print made during the Renaissance.

The delicate artwork, over 9 feet wide and 11 feet tall, is made from 36 separate sheets of paper, printed from no less than 195 wooden blocks. It is being repaired in anticipation of a spring exhibition organized by Denmark’s Royal Collection of Graphic Art. Commissioned by Maximilian I, the Holy Roman Emperor, to honor his family, and created by Dürer and his workshop between 1512 and 1515, pages of The Arch were initially stored individually in a binder.

In the mid-19th century, however, they were glued together on a single canvas by the Royal Collection of Graphic Art. In the 16th century, such multi-sheet prints were usually used to decorate walls, and were often hand-colored.

Over the years, the piece had deteriorated due to exposure to light and changing climate conditions. Eventually, the museum had to remove the massive artwork from view, and it has been in storage ever since. Restoring the work to its former glory is no easy task, but

conservators have opened the process to the public, allowing visitors to observe and ask questions as they painstakingly separate the individual pages, carefully cleaning each one, mending tears and repairing other damage.

“The Fall of Rome? Italy’s Fears that Corporate-Sponsored Restoration Projects Will Lead to the Disneyfication of its Cultural Heritage,” *The Independent*, 09/07/2014

As Italy courts private cash to rescue some of the globe’s best-known relics of the ancient world, a debate is raging over the commercialisation of history. The Italians have been careful to avoid, say, the kind of US-style rebranding that could lead to Prada’s Pompeii or the Leaning Tower of Gucci. But critics are already fretting about corporate exploitation of Italy’s national patrimony.

Yet something, everyone agrees, needs to be done. Fearing the Disneyfication of its landmarks, the Italian government has largely eschewed private donations and sponsorships for upkeep and renovations. But in the face of Italy’s multi-year economic malaise and the gravity of deterioration at some sites, the Italians have done an about-face. Portraying themselves now as merely caretakers of some of humanity’s most important artifacts, they are rallying billionaires, companies and even foreign governments to their cause.

As the Italians peddle their monuments like so many troubled children in need of sponsors, the dandies of Italian fashion have come to the rescue. They are throwing millions of euros toward desperately needed restorations in exchange for various sponsorship rights, helping spur one of the single-largest periods of archaeological and artistic renewal in modern Italian history.

“John Kerry Blasts ISIS’s Cultural Destruction in Met Speech,” *Artnet.org*, 09/23/2014

The US Secretary of State spoke to an audience in the Met’s Temple of Dendur wing Monday night, laying out the justification for military intervention in the interest of protecting cultural heritage sites in Iraq and Syria just hours before the US and its allies commenced

airstrikes against the Islamic State of Iraq and the Levant (ISIL, or ISIS) near Raqqa.

“ISIL is not only beheading individuals; it is tearing at the fabric of whole civilizations,” Kerry told the audience. “Far from hiding their destruction of churches and mosques, they broadcast these, purposefully and with pride, for all the world to see their act of depravity and for all of us to be intimidated and to perhaps back off from our values. For the proud people of Iraq and Syria—ancient civilizations, civilizations of great beauty, great accomplishment, of extraordinary history and intellectual achievement—the destruction of their heritage is a purposeful final insult, and another example of ISIL’s implacable evil. ISIL is stealing lives, yes, but it’s also stealing the soul of millions.”

Kerry is in town this week for the UN Climate Summit and was joined at the museum by UNESCO’s Director General Irina Bokova and professor Michael Danti of Boston University, who provided historical context for the audience with a presentation on the region’s archaeology.

“Hidden Monuments Under Stonehenge Revealed by High-Tech Mapping,” *National Geographic*, 09/13/2014

An astonishing complex of ancient monuments, buildings, and barrows has lain hidden and unsuspected beneath the Stonehenge area for thousands of years.

Scientists discovered the site using sophisticated techniques to see underground, announcing the finds this week. Among the discoveries announced Wednesday are 17 ritual monuments, including the remains of a massive “house of the dead,” hundreds of burial mounds, and evidence of a possible processional route around Stonehenge itself.

There’s also evidence of a nearby mile-long “superhenge” at Durrington Walls that was once flanked by as many as 60 gigantic stone or timber columns, some of which may still lie under the soil. The discoveries result from the Stonehenge Hidden Landscape Project, a four-year effort to create a high-resolution, 3-D underground map of

the landscape surrounding Stonehenge.

The project team, led by researchers from the U.K.'s University of Birmingham and Austria's Ludwig Boltzmann Institute, mapped the area down to a depth of about ten feet (three meters) using ground-penetrating radar, high-resolution magnetometers, and other state-of-the-art remote-sensing equipment.

In all, nearly 3,000 acres have been excavated virtually, making this the largest and most ambitious project of its kind ever undertaken anywhere in the world.

“Science to the Rescue of Art,” *Rappler.com*, 09/14/2014

Some of our most treasured paintings are fading, warn experts who would like more money for the use of sophisticated technology to capture the masters' original palettes before the works are unrecognizably blighted.

“Our cultural heritage is suffering from a disease,” Robert van Langh, director of conservation and restoration at Amsterdam's Rijksmuseum, told Agence France-Presse (AFP) in Paris this week. Van Langh was speaking on the sidelines of a conference on the use of synchrotron radiation technology in art conservation at the molecular level. Much more science is needed to understand the chemical reactions that cause color changes in canvases, in order to stop them, said Jennifer Mass, an art conservationist from Winterthur Museum in Delaware, who also attended the meeting.

Understanding the degenerative process would allow museums to display the precious works in the appropriate light, atmosphere and humidity. According to Belgian chemist Koen Janssens of the University of Antwerp, a further role of science could be to beat the drum for art conservation. “As researchers, we are working on a simulation that will allow us to show what certain artworks will look like in 50 years,” if nothing is done, he said.

“Lincoln Conservation Consultants Battle to Save Rare Historic Paintings,” *Lincolnshire Echo*, 09/10/2014

A team of historic conservation consultants based in Lincoln are battling

to save a number of rare wall paintings.

The artwork was discovered inside a Georgian townhouse in Great Yarmouth, Norfolk, which was at risk of demolition due to structural problems. But experts at Crick Smith, who are based at the University of Lincoln, have now stepped in to help.

The paintings date from the 16th century and were recently found hidden behind 1970s plasterboard. The property has been purchased with a view to renovation by the Great Yarmouth Preservation Trust, which engaged Crick Smith to restore the works of art to their former glory.

The Lincoln-based staff will spend three weeks stabilising and cleaning the historic artwork. “This is a real piece of art – once you clean it you realise that every brushstroke is deliberate. We are consolidating all of the edges that are lifting away, anything that's proud, anything that's fragile,” said Crick Smith's Debs Russell.

“After trying different adhesives, we have gone with lime water and that's ideal for conservation because the paintings are already on a lime base, so we are conserving with the original materials.”

“Dallas Museum of Art Announces 2014 Art Conservation Project Grant from Bank of America,” *Artfix Daily*, 09/04/2014

The Dallas Museum of Art today announced that they have received funding from Bank of America to restore the Wittgenstein silver display case, or vitrine, through the bank's 2014 global Art Conservation Project.

The silver and gem-studded vitrine is the most lavish piece of silverwork known from the Wiener Werkstätte (or Vienna Workshops), a guild of artists and craftsmen practicing in Austria in the early 20th century. Designed by Carl Otto Czeschka and presented at the 1908 Vienna Art Show, this vitrine marks a crucial time in the evolution of modern design. Acquired by the Dallas Museum of Art last year, it is one of their most important pieces.

Fran Baas, associate conservator of objects, working in close collaboration with Kevin W. Tucker, the Margot B. Perot senior curator of decorative arts and design at the Dallas

Museum of Art and Mark Leonard, chief conservator, is currently carrying out the restoration and technical study of this unique masterpiece of decorative design and craftsmanship.

The grant from Bank of America is fully funding the restoration of the piece, which is the centerpiece of the upcoming Modern Opulence in Vienna: The Wittgenstein Vitrine exhibition. The exhibition is scheduled to open on November 15 in the DMA's Conservation Gallery, after a special media preview on November 13.

“Egypt Says Restoration of Oldest Pyramid on Track,” *Al Arabiya*, 09/16/2014

Egypt's antiquities minister took journalists inside a 4,600-year-old pyramid on Tuesday to reject recent accusations of mismanagement at the site as false and “without evidence.”

At a press conference at the Saqqara pyramid complex, some 30 kilometers south of Cairo, Minister of Antiquities Mamdouh el-Damaty decried recent media reports alleging that the Djoser pyramid might collapse.

Criticism of the project centers on the government's choice of a contractor, the Shurbagy construction company, which has no antiquities experience. Critics point to a new brick wall built on top of the pyramid's base, which they say risks damaging the ancient structure.

Monica Hanna, an Egyptian archaeologist, advocates the formation of an independent committee of Egyptian conservationists to oversee the restoration of all the country's historical sites, including Saqqara. “Looking at archival images of Saqqara over the past 100 years, the pyramid actually looks new,” Hanna said. “This should never be the case: we have to conserve these monuments in a way that is unnoticeable.”

The government has recently announced a range of programs to revitalize the tourism sector, which fell by nearly 46 percent following the 2011 uprising that toppled longtime autocrat Hosni Mubarak. Funded by museum and site ticket sales, the ministry of antiquities is facing bankruptcy as international tourists remain wary of visiting Egypt after three years of turmoil.

“Heinz History Center Debuts Conservation Center,” *Pittsburgh Business Times*, 09/18/2014

Pittsburgh’s Sen. John Heinz History Center is opening a new conservation center Saturday, becoming one of the first museums in the United States to provide professional conservation services directly to the public. Located behind the history center’s Strip District building, the new Museum Conservation Center will provide visitors with expert advice on how to preserve heirlooms and connect them with conservators if professional repair is required.

“Hailstorm does €1.5m Worth of Damage to Florence’s Museums,” *The Art Newspaper*, 09/22/2014

Freak weather events caused around €1.5m worth of damage to Florence’s institutions last week, including the Uffizi Galleries, which were evacuated and closed for the day.

Refunds were offered to visitors who couldn’t make back it on the weekend, after the city was brought to a standstill by an intense downpour and hailstorm on Friday, 19 September. The façade of the Pitti Palace was damaged by hailstones, which also broke several windows. Part of the Costume Gallery was still closed at the time of writing, due to water leaks.

The Museo Nazionale di San Marco, housed in the 15th-century cathedral that was once home to the Renaissance painter and monk Fra Angelico, also suffered from leaks; four paintings were damaged and are now being restored. The museum is scheduled to reopen on 24 September.

The 14th-century Palazzo Davanzati has now reopened, although the rooms containing its collection of lace are still closed because of significant water damage. Conservators from Florence’s Opificio delle Pietre Dure are already at work to preserve the delicate lace and a small number of paintings that were affected.

“Leonardo Restoration Sheds Light on Genius as a Young Man,” *Reuters*, 09/24/2014

If there is any mind an art restorer would die to get into, it would be that of

Leonardo da Vinci. That was the unique opportunity restorers in Florence have relished as they clean the “Adoration of the Magi”, a massive painting that Leonardo started in 1481 at the age of 29 but abandoned a year later, leaving it in various stages of development.

Done on 10 slabs of wood glued together, it has blank areas, areas with under-drawings, and sections in advanced stages. In the late 1500s the painting was acquired by Florence’s Medici family, whose restorers added layers of varnish to give it a homogenous, monochrome look when they put it in their collection.

The current restoration project, which began three years ago, has removed much of the dull, oxidized varnish as well as traces of past restoration attempts. This revealed that Leonardo did all the under drawings freehand.

Experts at the Opificio delle Pietre Dure have ruled out a hypothesis put forward 15 years ago that Leonardo had done only the preliminary work and the paint was added by an unknown artist long after the master’s death in 1519. After the wood backing of the painting is restored, it is due to return to a special room in the Uffizi, where it will be on display with two other Leonardo works.

“Leonardo Da Vinci ‘Painted Three Ermine Portraits,’” *BBC News*, 09/24/2014

Engineer Pascal Cotte has spent three years using reflective light technology to analyse The Lady with an Ermine. Until now, it was thought the 500-year-old painting had always included the ceremonial animal. Mr. Cotte has shown the artist painted one portrait without the ermine and two with different versions of the fur.

Mr. Cotte, who is a co-founder of Lumiere Technology in Paris, has pioneered a new technique called Layer Amplification Method (LAM). It works by projecting a series of intense lights on to the painting. A camera then takes measurements of the lights’ reflections and from those measurements, Mr. Cotte is then able to analyse and reconstruct what has happened between the layers of the paint.

Mr. Cotte said: “The LAM technique gives us the capability to peel the painting like an onion, removing the surface to see what’s happening inside

and behind the different layers of paint. “We’ve discovered that Leonardo is always changing his mind. This is someone who hesitates - he erases things, he adds things, he changes his mind again and again.”

The painting belongs to the Czartoryski Foundation and is usually on display at the National Museum in Krakow, Poland.

“29 Murals from New Deal Era in Rincon Center are being Restored,” *SFGate*, 09/28/2014

High on a scaffolding in the lobby of the handsome Rincon Center complex on lower Mission Street, Thomas Portue is hard at work most afternoons, preserving a San Francisco treasure. He is working carefully to repair the marks of time and remove a bit of grime from 29 murals that ring the lobby and tell the story of San Francisco as a pageant in rich color.

The murals painted by Anton Refregier were part of a New Deal project and were completed in 1948 when the Rincon Center was San Francisco’s busiest post office. They are revered now as classic works of stylized realism — perhaps even masterpieces of public art. But once, they were denounced in Congress as distortions of history and Communist propaganda.

Times have certainly changed. These days tour groups come through the lobby to see them, and they are on the National Register of Historic Places. Portue, a professional fine arts conservator, restored the murals to their original brilliance in a major effort more than 27 years ago. There has been some deterioration with the murals, he said, chipping of the paint here and there, damage by fly droppings, the wear and tear of the years.

“Antiquities Lost, Casualties of War,” *The New York Times*, 10/03/2014

Tracking the cultural treasures of Syria and northern Iraq has become a heartbreaking task for archaeologists and antiquity scholars. And the list of destroyed, damaged or looted works has only grown longer as the Islamic State, also known as ISIS, which seeks to create a caliphate, has pushed into northern Iraq.

Sunni extremists like the

Islamic State and others are deliberately wrecking shrines, statues, mosques, tombs and churches — anything they regard as idolatry. Over the last three years of war, international groups have come up against the limits of their power and ability to intervene in a conflict that has killed tens of thousands. In several cases, the security of many antiquities has largely been left up to nearby residents, many of whom have taken huge risks to defend their cultural patrimony.

The question of what has been destroyed has few complete answers, scholars say. The Islamic State often issues false reports to exaggerate its conquests, while other groups may do so to draw international sympathy. But the State Department, officials in the Syrian government and networks of scholars are trying to document the damage.

As the experts peer at maps, they are concerned about what might be next, but also disagree on how to handle it. The United States-led bombing campaign is a new threat. Major cultural heritage groups have urged that any American military action take account of vulnerable sites. A branch of the Pentagon is training pilots and ground soldiers to protect cultural property during military operations. But many hope that the Islamic State rampage will slow as it comes under pressure.

“Cleaning Aged Ceiling, High Walls Unearth Rare Finds at Oberlin Museum,” *The Chronicle-Telegram*, 10/09/2014

One hundred years of dirt concealed hidden treasures, sprawled across the ceiling of the Allen Memorial Art Museum at Oberlin College.

This summer, the art museum finally embarked on a project leaders have discussed for more than a decade: cleaning the ceiling for the first time since the museum was built in 1917. The museum hired ICA Art Conservation, a nonprofit art conservation organization based in Cleveland, and in 2013 they began testing cleaning methods on small sections of the ceiling.

It wasn't until August that the group started the actual cleaning process, using water with a sequestering agent to wipe away dirt from the upper walls and ceiling which hadn't been cleaned since the building was erected.

The two months of work revealed little square paintings of animals, musical instruments, foliage and boats laid across the ceiling. Other squares contain designs painted in gold leaf and on the walls, quotes from Christopher Pearse's 19th century poem “Stanzas” are scrawled in silver paint.

Conservator Wendy Partridge said the organization plans to spend the rest of the year into early January completing the cleaning and restoring areas damaged by humidity and temperature fluctuations since the early 1900s. After the cleaning is complete, another group will come in early 2015 to touch up the “aged” paint on the ceiling panels.

“Egypt Completes Restoration of Famed Coptic Hanging Church,” *Al Arabiya*, 10/12/2014

Egypt's 1,300-year-old Hanging Church has on Saturday opened its doors once again to visitors, after the culmination of an over one-and-a-half decade restoration. The Egyptian prime minister and Pope Tawadros II of Alexandria on Saturday attended the opening ceremony of the Hanging Church - also known as St. Virgin Mary's Coptic Church - marking the end of a \$5.4 million restoration project.

The Hanging Church was established on the ruins of a 2nd century Roman fortress from which it gained its name, the suspended, or al-Moallaqa in Arabic. Egypt's Antiquities Minister Mamdouh Eldamaty told Al Arabiya News that due to the church's significance, its meticulous restoration process had to be “studied very well” to ensure it was true to its historic roots.

The restoration process took around 16 years, where it was carried out on several phases to reduce water leakage and reinforce the church's foundations. It also included the restoration of the church's decorations and icons. The church has a unique Byzantine architectural style and features a wooden roof in the shape of Noah's ark.

“Ricerca: ‘Biologi Indiana Jones’ per Salvare Beni Culturali, 30% Risparmi per Restauri,” *Panorama*, 10/17/2014

From the test tubes and microscopes of the laboratory to paintings and archaeological remains, the biologist

is the guardian of cultural heritage, a sort of “Indiana Jones” without whip and hat.

When called upon in the preservation of cultural treasures, “he could help save 30% of funds that are spent today on restoration: because it is the biologist who can determine, for example, whether a lichen that covers a monument is aggressive or instead helps to preserve the surface”, explains Ermanno Calcatelli, president of the National Order of Biologists (ONB) that today in Rome opened the second national conference on cultural heritage.

The order has recently promoted three scholarships to work in the excavations in Pompeii. Matteo Montanari, biologist and part of the Commission for cultural heritage of the ONB, occupies himself with saving reliquaries and works of art from attack by mold and micro-organisms.

His firm has carried out non-invasive microbiological analysis to determine the condition of the Constitution in the Central State Archives in Rome. He is currently working on anti-vegetative mortars for archaeological sites as well as a new stream of research to develop innovative products for the maintenance of the headstones.

“Laser technology Gives Priceless Vatican Artworks a Face-lift,” *Euronews*, 10/11/2014

The restoration laboratory of the Vatican Museums is home to one of the largest collections of paintings and sculptures in the world. This is where ancient and priceless pieces of art come for a face-lift.

Art restoration requires the use of highly non-invasive tools to minimise the impact on the work. Laser technology answers these criteria and can be used in conjunction with traditional cleaning techniques.

“This new technology is really fantastic,” says Guy Devreux, director of the marble laboratory. “But it's not a miracle cure. We're obviously continuing to use the other methods we've been using up to now. The laser gives us that bit extra in the sense that it allows us to hone the cleaning process, it allows us to clean in a way we never could have done with another system.”

Strictly controlled tests are carried out before the cleaning process

starts to make sure the pulses of light bombarding the object in question do not penetrate it. Many of the artefacts at the Vatican Museums' ethnological department contain feathers, which are particularly difficult to restore.

“Art Conservators to Speak about WIU Work Oct. 28,” *Western Illinois University News*, 10/22/2014

As work begins next week on the conservation of two wall murals in the third floor auditorium of Western Illinois University's Sherman Hall, two talks have been scheduled with those completing the work.

Conservators Amber Smith and Kendra Fuller will speak Tuesday, Oct. 28 at 2 p.m. and 5 p.m. about “What Do Art Conservators Do? A Treatment Plan for the History of Illinois Murals in Sherman Hall.” Both women work for Chicago's The Conservation Center, which has previously done extensive work on the University's Works Progress Administration (WPA) collection.

Smith and Fuller will be on campus next week to complete restoration work on two of the four Sherman Hall wall murals, “Fort Dearborn 1820” and “Mormon Temple Ruins – Nauvoo, IL.” During the Oct. 28 event, Smith and Fuller will speak about the purpose of art conservation and what art conservators do, as well as some of the more interesting and unusual projects The Conservation Center has handled. They will also discuss the specific treatment planned for the Sherman Hall project.

“How Science Saved a Priceless Work of Art,” *Popular Mechanics*, 10/24/2014

You hear Harvard University and think: Smart people there. They ought to know how to preserve great art. So it was baffling and a little tragic when, in the 1960s and '70s, the university allowed the irreversible damage of five murals by the American Abstract Expressionist painter Mark Rothko.

Commissioned in 1962 and hung in a student-center dining room, the paintings were faded by sunlight, dinged by furniture, and even marred by graffiti. Finally, under a cloud of shame, Harvard placed the canvases in storage in late 1979.

On Nov. 16 the murals will

go back on display at the Harvard Art Museums, in Cambridge, Massachusetts. They will look as if they were freshly painted, but that will be an illusion, because the original colors will appear via light beamed onto the surfaces from ceiling-mounted projectors.

The current restoration effort began with Kodak Ektachrome color transparencies of the murals, taken in 1964. The transparencies themselves were faded, so conservation scientists from Harvard worked with experts from the University of Basel to digitally restore the original colors.

Rothko's son, Christopher, then provided the crucial piece of reference: a sixth mural that his father had painted for the installation but stashed away. Using the Ektachromes and the sixth mural as references, MIT's Ramesh Raskar, a pioneer in computational photography, coded an algorithm that allowed him to fine-tune the color, pixel by pixel, so that the projections compensated for fading and damage rather than simply covering it up. The painting and the light work in concert to create the image of the mural as new.

“Mosaics Revealed at Ancient Greek City of Zeugma in Turkey,” *Greek Reporter*, 11/11/2014

The ancient city of Zeugma was originally founded as a Greek settlement by Seleucus I Nicator, one of the generals of Alexander the Great, in 300 BC. The population of the city at its peak was approximately 80,000 inhabitants. Zeugma is 80 percent underwater, after it was flooded with the waters of a nearby artificial lake. The mosaics, which were recovered in excellent condition, belong to the 2nd century B.C.

“New Course for Engineers in Heritage Conservation,” *The Hindu*, 10/24/2014

The State (India) government has decided to conduct a six-week course on conservation and restoration of monuments for the present set of engineers, who lack the requisite skills.

Need for such a course was felt as a large number of restoration and conservation projects had been undertaken by various government departments, especially the Hindu Religious and Charitable Endowments

(HR&CE) department, in the last three years. In all, restoration and renovation works are over in respect of 5,400 temples so far.

To be run by the State Archaeology Department, the course, in two batches, will be compulsory to those engineers working with the HR&CE Department. Also, those who are in the Public Works and Highways Departments can participate in the course.

The syllabus for the course has been framed with the help of the HR&CE, the Archaeological Survey of India, IIT, Madras University and the State Archaeology and Museums Departments. An official explains that the course covers all heritage monuments, both temples and secular. He adds that such a course is the first of its kind in the country.

“Vatican Sistine Chapel gets New Lighting and AC System,” *BBC News*, 10/29/2014

The Vatican has unveiled a high-tech lighting and air-conditioning system to better preserve and display the famous frescoes of the Sistine Chapel. The new air-conditioning aims to reduce the damage to the frescoes from dust, and from the breath, sweat and heat of some six million annual visitors.

The new LED lighting saves energy and highlights neglected features. The new illumination system comprises 7,000 LED lights. Some of these lights aim to show off the deep blue background of another Michelangelo fresco, The Last Judgement. Others highlight frescoes by artists such as Botticelli, Perugino and Domenico Ghirlandaio, whose Sistine Chapel work has been overshadowed by Michelangelo's.

The new lighting is expected to cut the Vatican's energy bills by more than 80%, the Associated Press news agency reports. The new air-conditioning will move air slowly through the vast chamber, so as not to damage the frescoes. The flow, humidity and temperature of the air will be adjusted using data from 70 sensors in the chapel walls, as well as from TV cameras that monitor the number of visitors.

Dust, body sweat and carbon dioxide are regarded as major threats to the fragile frescoes. The existing air-conditioning was installed 20 years ago, when the Sistine Chapel received only 1.5 million visitors every year.