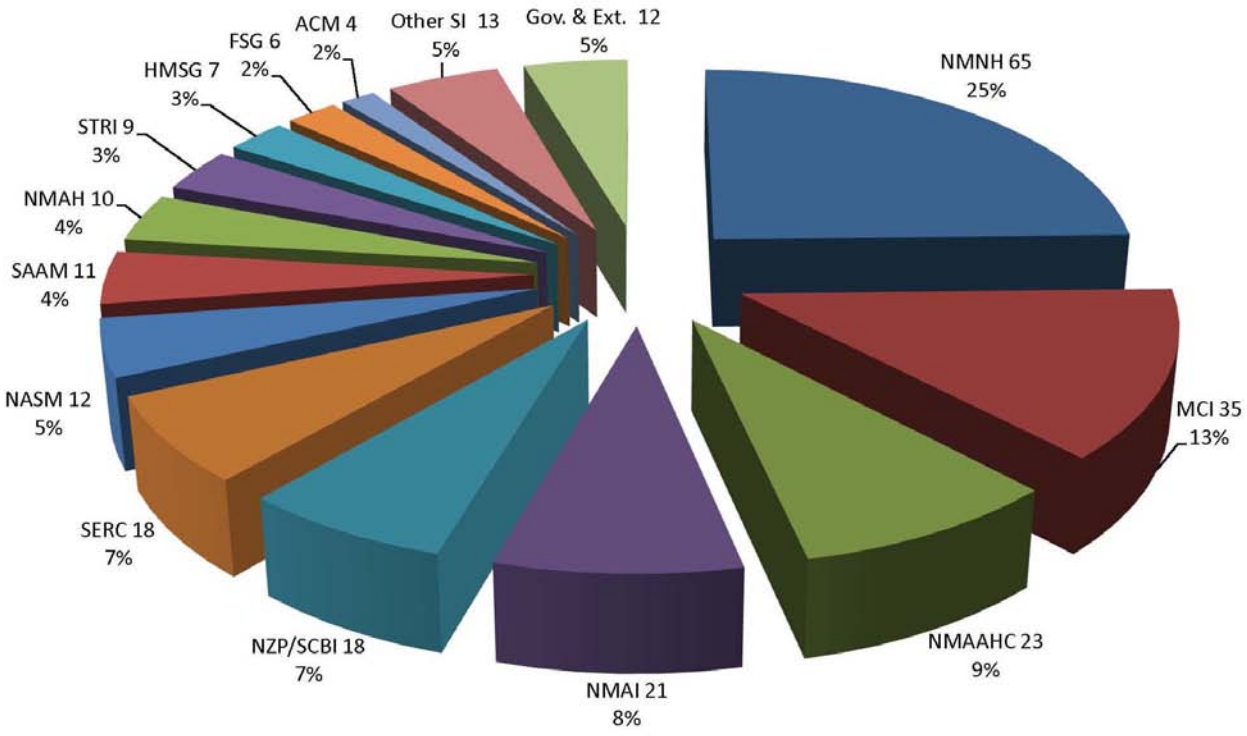
Smithsonian
Museum Conservation Institute

Project Summaries 2010-2011



Number of Percentage of 264 MCI Projects by Smithsonian Unit

October 2009 through September 2011

PREFACE: MCI OVERVIEW FOR FY2010-2011

MCI is a meeting place where science, art, history, and technology cross the traditional boundaries of the Smithsonian's museums and research centers, and where the next generations of conservators and scientists are inspired. Over the past years, MCI has successfully established itself as a partner within the Smithsonian to provide the museums with the most advanced and highest quality scientific, conservation, and technical expertise that funding resources permit. MCI is building partnerships for research and technical studies within the Smithsonian, as well as outside of it, as is shown by the large number of collaborative projects. Over the past two years, 264 projects were initiated, continued, or completed in collaboration with most of the Smithsonian's museums, research centers, and offices, and other U.S. government offices, including the Library of Congress, the National Park Service, the U.S. Senate and House of Representatives, and the Office of The Architect of The Capitol.

Key Accomplishments

- MCI Research Scientist Mehdi Moini, with Senior Conservator Mary Ballard, developed and published an improved method for estimating the age of silks based on amino acid racemization, the time-dependent change among two forms called *levorotatory* (L) and *dextrorotatory* (D). With an L to D conversion half-life of ~2,500 years for aspartic acid of silk from the silkworm *Bombyx mori*, the technique is capable of dating silk textiles ranging in age from several decades to a few thousand years old. Moini, Mehdi, Kathryn Klauenberg, and Mary Ballard (2011) Dating Silk by Capillary Electrophoresis Mass Spectrometry, *Analytical Chemistry*, 83(19): 7577-7581. http://smithsonianscience.org/2011/09/smithsonian-scientists-devise-new-technique-for-dating-silk/

- MCI Research Scientist Odile Madden, with Senior Conservators Jia-sun Tsang and Don Williams, proposed and received funding for The Age of Plastic program with the goal of building a community of researchers at the Smithsonian and collaborating institutions engaged in the study of polymer composites (more commonly known as plastic). The Program Steering Workshop was held on May 17, 2011 at the Hirshhorn Sculpture Garden

Art Lab and brought together the diverse perspectives of materials science, technology, history, anthropology, conservation, resource stewardship, and the environment, with 16 papers presented.

- MCI Research Scientist Edward Vicenzi, Senior Conservator Melvin Wachowiak, and Imaging Contractor Elizabeth Keats Webb worked with historians, research scientists, and conservators from the Smithsonian and external organizations, to understand the earliest techniques for photography and to preserve the priceless images. MCI contributed technical analysis to characterize surface properties and composition using non-destructive scientific techniques, such as computational imaging, electron microscopy, and x-ray fluorescence. These methods have provided new insights about the creation and preservation of daguerreotypes, the first successful photographic technique. The results are presented in a new Web site designed to communicate scientific and technical data to scholars and the general public. http://www.si.edu/mci/EarlyPhotography/index.html

- MCI Senior Conservator Jia-sun Tsang worked with the Anacostia Community Museum (ACM) to secure funding for a survey of modern and contemporary paintings and painted objects, and for re-housing the museum's fine art collection in appropriate storage units. ACM's collection includes a significant number of works of art, many by African American artists of national renown and self-taught or "folk" artists. Because many of these works use modern materials, traditional preservation techniques are often inappropriate. The key to their successful preservation is to precisely identify the complex modern paint media. The funding included purchase of portable equipment, a portable hand-held Fourier transform infrared spectroscopy (FTIR), to identify the paint components.

- MCI's Biodeterioration Research Team has studied the unsightly staining that has developed since the National Museum of the American Indian (NMAI) building was last cleaned, approximately three years ago. The Team identified the source of the soiling as cyanobacteria (blue-green algae), growing where water flows over the stone surface. The goal is to develop a maintenance protocol of periodic washing and biocidal treatment, with possible installation of biocidal zinc strips, which will reduce the colonization rate of organisms in the future.

- MCI Senior Conservators Mary Ballard, Carol Grissom, Jia-sun Tsang, and Don Williams examined and provided recommendations on possible acquisitions for the new National Museum of African American History and Culture (NMAAHC), including Civil War badges and coverlets; continued work on conservation and storage of the Black Fashion Museum collection, including selecting items for the inaugural exhibition; prepared a newly acquired painting *Slave Trade (Execrable Human Traffick, or The Affectionate Slaves)* for the exhibit *Slavery at the Jefferson's Monticello: Paradox of Liberty*; and worked with NMAAHC staff on opening temporary positions for museum conservators. In addition, they participated in NMAAHC's "Save Our African American Treasures" programs in Indianola, Mississippi, and Houston, Texas.

- MCI Scientist Christine France, with Research Scientist Edward Vicenzi and then-Head of Technical Studies Jeff Speakman, using funding from the Consortium for Understanding and Sustaining a Biodiverse Planet, organized and hosted the Smithsonian Climate Change Research Symposium, May 24-25, 2011. The symposium successfully brought together scientists from across the entire Smithsonian (10 museums and research centers) to discuss Smithsonian research regarding climate change and the effects of climate change on the Earth's environment. Several themes emerged indicating areas of climate change research in which the Smithsonian has a strong background, as well as areas in which the Smithsonian is beginning to emerge as a significant contributor.

Challenge grant to endow the directorship of the Smithsonian Institution's Museum Conservation Institute completed

In 2010 the MCI Directorship Endowment was established, supported by a $1,750,000 challenge grant from the Andrew E. Mellon Foundation and the required match of $3,250,000 from four bequests. The creation of an endowment for this important position has long been a high priority for Smithsonian Institution leadership. We are very grateful to the Mellon Foundation for providing a challenge grant that allowed us to realize this goal.

Enhancing Science Capability

MCI expanded its research program by hiring two new research scientists: Dr. Medhi Moini, a mass spectroscopist-proteomics expert, to build the Smithsonian's first proteomics facility; and Dr. Odile Madden, a Raman spectroscopy expert, to create a new Consortium program in modern materials called "The Age of Plastic."

Publication Quality and Productivity

MCI staff of 14 professional researchers (3 scientists, 7 conservators, and 5 technical specialists/analysts) published 108 papers, 50 peer-reviewed. The first volume in the Smithsonian Institution Scholarly Press series *Contributions to Museum Conservation*, "Pesticide Mitigation in Museum Collections: Science in Conservation: Proceedings from the MCI Workshop Series," quickly became the top download of all Smithsonian scholarly publications (more than 5,000 as of this writing). The second volume, "Biocolonization of Stone: Control and Preventive Methods" has been published (more than 500 downloads as of this writing), and a third volume in the series is in production.

Scientific and conservation research and treatment projects

MCI reached an all-time high with 264 active projects in FY2010 and 2011 encompassing Smithsonian, extra-governmental and non-governmental partners. The projects included collaborations with all 19 Smithsonian Museums and the Zoo, with additional SLC exhibit program; 8 of the 9 Research Centers; and 19 Offices and Committees, including the Digitization Center of Expertise, OCIO, OEC, OF, OGC, OIG, OIR, OP&A, OUSHAC, SISP, SLC, SI-Conservation, SI Folklife Festival, SI Gardens, SI Green Team, SI Haiti Initiative, SI Women's Committee, Smithsonian Affiliates, and Smithsonian Associates.

Non-Smithsonian conservation and research support or collaborations

MCI and the Smithsonian's Office of International Relations (OIR), with the support of the U.S. Department of State's Cultural Heritage Center (CHC) and the Department of Homeland Security's Homeland Security Investigations (HSI), developed, organized, and hosted four highly successful, 4-day training workshops for HSI agents. The workshops *Preventing Illicit Trafficking – Protecting Cultural Heritage* have trained 91 HSI agents and embassy-based

attachés with the goal of slowing and preventing the illicit trade of art and antiquities. In addition, MCI staff provided analytical support and consultations to the National Park Service, U.S. Secret Service, Folger Shakespeare Library, The Metropolitan Museum of Art, The Walters Art Museum, The Getty Conservation Institute, Bibliographic Conservation Information Network, Art and Archaeology Technical Abstracts, Canadian Conservation Institute Library, Netherlands Institute for Cultural Heritage. Centre for the Study of the Preservation and Restoration of Cultural Property, International Council of Museums, International Council on Monuments and Sites, and Library and Archives Canada, among others.

Furthering Dissemination: Lectures, Exhibits, Symposia, Training

MCI continued its educational activities with 73 lectures in our "Topics in Museum Conservation" series and 12 MCI-hosted conferences, symposia, and workshops. In addition, MCI co-hosted the "Cleaning 2010: new insights into the cleaning of paintings" conference with the Polytechnic University of Valencia (about 500 participants). MCI hosted and trained 3 interns, fellows, post-docs, and visiting scientists. MCI's research scientists, analysts, conservators and their fellows, interns, and volunteers made 126 professional presentations, seminars, lectures and workshops on conservation science, technical studies, conservation treatment, and collections care in the two year period, an average of 63 per year, and 4.5 presentations annually by each of the 14 professional staff members. This reflects the emphasis on dissemination for the staff.

MCI staff supported exhibits, including "Condensation Cube" at HMSG; "Suited for Space." "Pioneers of Flight" and "Out of this World" at NASM; "Ain't Nothing Like the Real Thing: How the Apollo Theater Shaped American Entertainment" and "Slavery at the Jefferson's Monticello: Paradox of Liberty" NMAAHC at NMAH; "Thomas Jefferson's Bible, entitled The Life and Morals of Jesus of Nazareth"´ at NMAH;"Vintage Point" and "Windows on Collections: Dolls" at NMAI; "Infinity of Nations" at the George Gustav Heye Center, NMAI; "Alexis Rockman: A Fable for Tomorrow" at SAAM; 40th Anniversary Exhibition at the Renwick Gallery; "Henry O. Tanner: An International Retrospective" SAAM loan to the Pennsylvania Academy of the Fine Arts; "Southern Identity: Contemporary Argentine Art" SLC

at the International Gallery; “Jim Henson’s Fantastic World” SITES traveling exhibit; and “Daniel Webster Desk” at the US Capitol Building/US Senate.

MCI’s traveling exhibit "Within the Emperor’s Garden: The Ten Thousand Springs Pavilion" has appeared at two Smithsonian Affiliates, the Irving Arts Center in Irving, TX, and the Historic Flushing Town Hall, Flushing, NY – the latter one of the largest Chinese communities in the United States. The exhibit features the stunning red sandalwood “Ten Thousand Springs Pavilion,” a contemporary 1/5th scale architectural model of a Forbidden City structure. An important part of the exhibit event is Senior Furniture Conservator Don Williams and a team of volunteers assembling the nearly one thousand pieces of the model over a three day period. The traveling exhibit is made possible by MCI’s on-going partnership with the Smithsonian Affiliates program.

Grants

With the increasingly tight federal budgets, MCI has had to look for new resources to carry out its mission. In FY2010-2011, MCI staff submitted 53 proposals to external and internal sources and has received 5 worth $1,028,230; 5 are still pending as of this date, worth $1,353,632.

Grand challenges internal program

New for 2010, is the grand challenges themes funded by the Bill and Melinda Gates Foundation. The purpose of this program is to pool the resources of the Smithsonian together to address the Secretary’s strategic plan’s grand challenges. In 2011, MCI staff led or participated in 11 Grand Challenge consortia proposals in collaboration with 14 other SI Units (44 scholars); five of these produced proposals that were awarded funding. Two of the consortia projects lead by MCI scientists organized and hosted conferences or workshops that brought together researchers from across the institution. The Smithsonian Climate Change Research Symposium (May 24-25, 2011) had 110 participants from 20 different Smithsonian units and five external institutions discussing Smithsonian research on climate change and the effects of climate change on Earth’s environment. The Age of Plastic Program Steering Workshop (May 17, 2011) had 45 participant from nine units, two central offices, and two external institutions building a coordinated research plan for polymer studies at the Smithsonian and beyond.

New Memorandum of Understanding (MOU)

MCI initiated a three new research MOU in 2010-2011. The first (2010-2015) was with the SOLEIL Synchrotron of France and its Institut photonique d'analyse non-destructive européen des matériaux anciens ('IPANEMA') platform. The first project in the collaboration examined the chemical mechanism of color change of the fascinating pigment, Prussian blue. The second (2010-2015) was with Centro per lo Studio dei il Restauro (The Centre for the Study of Materials for Restoration) – Cesmar7, Padova, Italy, for work on museum environments and the presentation of art and cultural heritage objects. The third, and most recent (2011-2016), was with The University of Maribor, Slovenia, and the Faculty of Chemistry and Chemical Engineering of the University of Maribor, Slovenia to conduct research in the area of the materials science of museum objects.

Active Memorandum of Understanding (MOU)

MCI also continued our research MOUs with: the Institute for the Protection of Cultural Heritage of Slovenia, Restoration Center, Ljubljana, Slovenia (2008-2013); the Biotechnical Faculty, University of Ljubljana, Slovenia (2007-2012); and with the Universidad Politécnica de Valencia, Spain (2008-2013).

Partnerships

MCI initiated or continued other, less formal, partnerships with California Institute of Technology, Jet Propulsion Laboratory (NASA proposal); the Centre de Recherche sur la Conservation des Collections (CRCC), Muséum National d'Histoire Naturelle, Paris.; *Centre Laser Infrarouge d'Orsay* (CLIO) Free-Electron Laser (FEL) (Grand Challenge Proposal); Department of Homeland Security Immigration and Customs Enforcement (ICE) and Homelands Security Investigations (HIS) (Training Workshops and Consultation); Department of Materials Science and Engineering (NSF-SCIART proposals); Department of State, Cultural Heritage Center (Training Workshops and Consultation); East Tennessee State University (NEH grant); FEI Company (NASA-LARS grant); Getty Conservation Institute; Harvard University; Lawrence Berkeley National Laboratory (NASA-LARS grant); National Institute of Standards and Technology (NIST); National Institutes of Health (NIH); North Carolina State, Department

of Textile Engineering, Chemistry, and Science (NSF- SCIART proposal); University of Kansas (NSF grant); and University of Maryland, College Park.

Scholarly/research honors won

Dr. Christine France received a Smithsonian Secretary's Research Prize for Physical Scientist's with her co-authored publication, Migratory Canada Geese Cause Crash of US Airways Flight 1549. *Frontiers in Ecology and the Environment* 7 (2009): 297-301. **Dr. Robert J. Koestler** was appointed to the **Scientific Council of Lascaux** convened by the French Ministry of Culture to investigate anthropogenic-induced changes over the past decade to one of the greatest cultural treasures of the western world, Lascaux the Paleolithic painted cave in the south of France. Also, was invited to participate in the Joint Committee Meeting or "JCM," organized by the U.S. Department of State's Office of Science and Technology Cooperation and French science and technology representatives. **Mary Ballard** received a "Lifetime Achievement Award" from the Textiles Specialty Group, AIC, as part of AIC Annual Meeting, Philadelphia, PA. **Dr. Paula DePriest** was appointed to the Editorial Board of International Biodeterioration and Biodegradation journal and gave an invited, scholarly lecture to the Audubon Society. A paper authored by **Carol Grissom** (conservator), **Dr. Claire Gervais** (conservation science fellow), **Nicole Little** (physical scientist), **Genevieve Bieniosek** (conservation intern), and **R. Jeff Speakman** (head of technical studies) – was the recipient of the Association for Preservation Technology International's 2010 Oliver Torrey Fuller Award for the *APT Bulletin* article that best demonstrates technical excellence and innovation. Research Scientist **Dr. Ed Vicenzi** served as President of the Microbeam Analysis Society, an organizer of Microscopy and Microanalysis 2010, and as Past-President of the Microbeam Analysis Society and Representative to the International Union of Microbeam Analysis Societies (IUMAS) triennial meeting, Seoul, Korea, in 2011; and was appointed Chair of the 2014 IUMAS/Microscopy and Microanalysis joint meeting in Hartford, CT. Senior Research Scientist **Dr. Marion Mecklenburg** (emeritus) served as co-organizer of Cleaning 2010: New insights into the cleaning of paintings, Valencia, Spain. MCI was a co-sponsor of the conference and will publish the peer-reviewed proceedings through the Smithsonian Institution Scholarly Press.

National and international leadership

NASA Mars Fundamental Research (panel); Studies in Conservation (Book Review Editor); U.S. Senate Curatorial Committee (member); SI Green Team (member); ICOM-CC Textile Working Group (recent chair and current editor for publications); Textile Conservation Discussion List (co-administrator); Society for American Period Furniture Makers (Board); SI-Haiti Response team (representative); SI-Conservation (representative); SI Digitization Strategic Plan, Digitization Centers of Expertise Committee (member); US-France Joint Committee; BCIN Content Review Board (member); CIN Board (member); Elsevier (IBB, editor-in-chief); MAS (President)

Social Media

MCI has enhanced our web presence (MCI Web Page: http://www.si.edu/mci) with: an MCI Facebook Page (307 fans): http://www.facebook.com/home.php?#!/pages/Suitland-MD/Smithsonians-Museum-Conservation-Institute/38663476844; MCI Facebook Group (154 members): http://www.facebook.com/home.php?#!/group.php?gid=37027678634; MCI LinkedIn: http://www.linkedin.com/company/305892; MCI Wikipedia: http://en.wikipedia.org/wiki/Museum_Conservation_Institute; and on Yammer: http://www.yammer.com.

In addition, MCI fielded 1594 public and professional inquiries received from 46 states and the District of Columbia, and 52 countries and gave 61 tours (313 people) of our institute.

Media Mentions

3D imaging: to unlock ancient mysteries - http://si-siris.blogspot.com/2010/10/3d-imaging-to-unlock-ancient-mysteries.html; Cultural Heritage Imaging (CHI) /MLS-sponsored training sessions in Reflectance Transformation Imaging (RTI) http://www.c-h-i.org/21st_MP_apply/index.html

Ancient Mammoth Carving: First Record of Art in North America, Newser, 6/24/11; Digitization Project Brings Ancient Inscriptions Into 21st Century, The Atlantic, 8/1/11; Ancient bone with carving found in Fla., Boston Globe, 6/23/11; Earliest American Art: Mammoth on Mammoth,

Discovery News, 6/22/11; Ice-age Carving of Mammouth or Mastodon Found in Florida, Epoch Times, 6/22/11; Oldest American Art Found on Mammoth Bone, National Geographic, 6/22/11; Scientists reveal a first in Ice Age Art http://www.eurekalert.org/pub_releases/2011-06/s-sra062111.php; Smithsonian and UF scientists visit to assess possible excavation of Old Vero Man site, Vero Beach Press-Journal, 6/23/11

Dating silk cited/linked in on-line news magazines, including Chromatography techniques http://www.laboratoryequipment.com/news-Amino-Acids-Authenticate-Silks-Age-090911.aspx; http://smithsonianscience.org/; http://pubs.acs.org/cen/news/89/i37/8937scene.html; http://cenblog.org/artful-science/; http://www.sciencecodex.com/smithsonian_conservation_team_develops_new_technique_for_dating_silk; http://online.wsj.com/article/SB10001424053111903927204576572590204200356.html?mod=googlenews_wsj;including PRISM banner at http://prism2.si.edu/Pages/Home.aspx; Wall Street Journal http://online.wsj.com/article/APe861e39c89504394ba5e95b77ffbd3be.html; Washington Post http://www.washingtonpost.com/local/smithsonian-conservators-develop-new-technique-to-determine-age-of-silk-artifacts/2011/09/12/gIQAQ359MK_story.html

Fungi visible in archaeological charcoal: http://smithsonianscience.org/2010/03/fungis-signature-still-visible-in-wood-charcoal-thousands-of-years-after-it-was-burned/

Historic zinc monument: Restoring History http://www.nwitimes.com/news/local/lake/hammond/article_2d5edf71-25b5-5872-bdc1-3c0cb2d2b6af.html

Jamestown Slate Tablet: National Geographic Mysterious Jamestown Tablet an American Rosetta Stone? http://news.nationalgeographic.com/news/2010/01/100113-jamestown-tablet-slate-american-rosetta-stone/; http://historicjamestowne.org/news/2010_dig_conclusion.php; http://www.thehistoryblog.com/archives/date/2010/01/18; http://historyenthusiast.wordpress.com/

Jefferson Bible: http://blog.americanhistory.si.edu/osaycanyousee/2011/08/unlocking-the-mysteries-of-jeffersons-bible-with-high-tech-analysis-and-microscopic-testing.html?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+OSayCanYouSee+%28O+Say+Can+You+See%3F-+National+Museum+of+American+History+Blog%29; Unlocking the mysteries of Jefferson's bible with high-tech analysis and microscopic testing,

http://ct.moreover.com/ct?haid=82e9ce382811313465332930f9fc6e76060a4443&co=f000000000432s-1158206718

Lascaux Rock Paintings: http://www.nature.com/news/2010/100922/full/467375a.html; http://www.scientificamerican.com/article.cfm?id=french-bid-to-save-rock-art

Light Levels and Collections Preservation: http://cool.conservation-us.org/byform/mailing-lists/cdl/2010/0903.html

Mario Martinez Vantage Point Exhibit: http://www.mmartinezpainting.com/press.php; http://www.examiner.com/smithsonian-museum-in-washington-dc/vantage-point-behind-the-scenes-mario-martinez-painting-stretched-video

Materials Scientists and Conservators Join Forces to Preserve Silver Artifacts and Art - http://www.prnewswire.com/news-releases/materials-scientists-conservators-join-forces-to-preserve-silver-artifacts-and-art-105764868.html

Mayan Artifact: http://www.archaeology.org/1011/etc/artifact.html

NMAAHC Treasures Tour at http://blogs.smithsonianmag.com/aroundthemall/2011/09/national-museum-of-african-american-history-and-culture-visits-mississippi/

Smithsonian-sponsored training sparks HIS Special Agents' Enthusiasm http://www.thecypresstimes.com/article/News/National_News/SMITHSONIANSPONSORED_TRAINING_SPARKS_HSI_SPECIAL_AGENTS_ENTHUSIASM/37098; http://www.mmdnewswire.com/smithsonian-sponsored-training-13751.html

Panama Gold: National Geographic http://ngm.nationalgeographic.com/2012/01/nata-chiefs/williams-text; http://news.nationalgeographic.com/news/2011/12/111221-gold-panama-cano-chiefs-tombs-science/

Scanning Mongolian Deerstones http://www.smithsonianmag.com/arts-culture/From-the-Castle-Mind-Meld.html; http://www.nytimes.com/2010/03/18/arts/artsspecial/18CONSERVE.html?pagewanted=all; http://www.breuckmann.com/en/arts-culture/applications/archaeology/monoliths-mongolia.html

SOLEIL Partnership:
http://www.artdaily.com/index.asp?int_sec=11&int_new=38630&int_modo=1;
http://www.highbeam.com/doc/1P3-2056704041.html

Spacesuits: The Right Stuff to Wear
http://www.nytimes.com/2010/12/21/science/21spacesuit.html (RHC's images included)

Ten Thousand Springs Pavilion: at Irving Art Center, Irving, TX,
http://irvingblog.dallasnews.com/archives/2010/06/morning-roundup-june-29-2010.html;
http://www.blog-affiliations.org/?p=2548; at Flushing Town Hall, NY
http://www.artdaily.org/index.asp?int_sec=11&int_new=41684; at Headley Whitney Museum,
Lexington, KY, http://www.facebook.com/#!/headleywhitney; http://www.headley-whitney.org;
http://www.kentucky.com/2011/09/28/1900978/scale-model-of-chinese-pavilion.html#wgt=rcntmulti; http://www.artsacrossky.com

Wayne Clough Wants Smithsonian Science to Escape Its Shadow, Science Now, 8/5/11

Written in Bone Exhibit, NMNH: http://www.michelegoodson.com/written-in-bone-exhibit-at-the-smithsonian-national-museum-of-natrual-history/;
http://blogs.smithsonianmag.com/aroundthemall/2009/02/the-secret-in-the-cellar-new-exhibit-inspires-webcomic/

If you would like more information on any of the projects or programs at MCI, please feel free to contact our Technical Information Specialist, Ann N'Gadi (Ngadia@si.edu), or me (Koestlerr@si.edu) directly.

Smithsonian
Museum Conservation Institute

Priority Research Programs

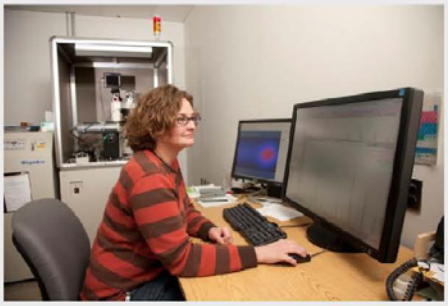
The Smithsonian's Museum Conservation Institute (MCI) is the center for advanced conservation research for all Smithsonian museums and collections. MCI's **Research Scientists and Conservators** – **Odile Madden** (modern materials/Raman spectroscopy)**, Mehdi Moini** (proteomics/mass spectrometry), **Edward Vicenzi** (geochemistry/ spectrographic imaging), and **Hanna Szczepanowska** (biodeterioration/conservation), headed by **Paula DePriest** (Deputy Director) – lead pan-Smithsonian research groups that include scientific, historical, and art historical curators in developing novel tools and applications to help answer more in-depth questions about the Smithsonian's and the world's cultural heritage. They support the four **Smithsonian Grand Challenges** working in 4 priority research areas:

Above: Aviation goggles from the NASM collection constructed of modern industrial materials. **Below:** MCI Research Associate **Claire Gervais** conducts measurements at SOLEIL Synchrotron

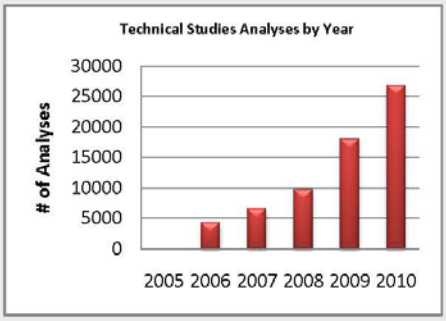
- **Imaging Spectroscopy Program** – adapting full spectroscopic imaging at multiple scale lengths for the study of cultural heritage.
- **Modern Materials Program** – studying modern and industrial materials, such as plastics and space age materials, with the aim of mitigating their deterioration.
- **Proteomics Program** – developing a proteomics-mass spectroscopy capability to gather more information from cultural heritage and biological specimens.
- **Biodeterioration Program** – using environmentally safe treatments to control insect and microbial infestations in collections.

Smithsonian
Museum Conservation Institute

MCI **Technical Studies** FY 2010



Above: Nicole Little, Physical Scientist, conducts analysis on the Micro-X-Ray Diffraction Spectrometer.
Below: Comparison of the number of scientific analyses over the past five years.



Historical and Archaeological Materials and Technologies

The Smithsonian's Museum Conservation Institute (MCI) is the center for specialized technical collection research for all Smithsonian museums and collections. MCI's Technical Studies Group – **Roland Cunningham, Christine France, Jennifer Giaccai, and Nicole Little** – headed by **Jeff Speakman**, conducts scientific analyses for museums, research centers, and offices across the Smithsonian. The Technical Studies Group, along with MCI's Applied Research Scientists and Conservators, combines knowledge of materials and the history of technology with state-of-the-art instrumentation and scientific techniques to provide technical research studies and interpretation of artistic, anthropological, biological, and historical objects. Their work contributes to MCI's traditional strength in ***Historical and Archaeological Materials and Technologies***. These services are available to Smithsonian units at no charge, with priority to projects that further the strategic goals of the Smithsonian and support the four Grand Challenges.

- In FY2010 the Technical Studies Group conducted more than **26,800** analyses (13,900 of these analyses were IRMS-based) in over 92 active projects (51 IRMS-based), completed more than 28 projects, and initiated more than 26 new projects in support of Smithsonian Research and all four of the **Smithsonian Grand Challenges**. The number of analyses represents an all-time record for the Technical Studies Group and continues a 5-year trend of increasing numbers of analyses (see figure).
- The Stable Isotope Laboratory conducted 13,900 analyses for 51 active/ongoing projects. This includes 40 projects in **Understanding and Sustaining a Biodiverse Planet,** 5 projects in **Unlocking the Mysteries of the Universe,** 3 projects in **Understanding the American Experience,** and 3 projects in **Valuing World Cultures.**
- Supported research from a wider customer base than in previous years – 10 museums, NZP, and 6 research centers, including underserved units such as SAAM, NPG, **SMSFP**, **NZP**, **SERC**, and **STRI**, as well as new customers within museums and research centers.
- Supported the research of dozens of SI interns, fellows, and post-docs.
- Responded to analytical requests and consultations from non-SI agencies and museums including the National Park Service, US Immigration and Customs Enforcement (ICE), US Secret Service, Folger Shakespeare Library, Metropolitan Museum of Art, Walters Art Museum, and Getty Conservation Institute.
- Received a Smithsonian Secretary's Research Prize for Physical Scientist **Christine France**'s co-authored publication, Migratory Canada Geese Cause Crash of US Airways Flight 1549. *Frontiers in Ecology and the Environment* 7(2009): 297-301.
- Authored **12** published papers, gave **19** professional presentations, and submitted **10** manuscripts for publication.

Smithsonian
Museum Conservation Institute

MCI **Conservation** FY 2010

Healthy Envirionments, Healthy Parctices, Healthy Collections

Above: Aging plastics from the NMAH collection.
Below: Red staining on the amphitheater at the Tomb of the Unknown Soldier, Arlington, VA.

The Smithsonian's Museum Conservation Institute (MCI) is the center for advanced conservation consultation, research, and treatment for all Smithsonian museums and collections. MCI's Senior Conservators – **Mary Ballard** (textiles), **Carol Grissom** (objects), **Jia-sun Tsang** (paintings), **Mel Wachowiak** (imaging techniques), and **Don Williams** (furniture/wood), headed by **Rae Beaubien** (archaeological objects) – conduct conservation projects, technical studies and research to further the preservation and technical understanding of the Smithsonian's collections. The Conservation Group has an umbrella theme "***Healthy Environments, Healthy Practices, Healthy Collections***," developing conservation protocols, procedures and products that are as safe as possible for the staff, the collections and the global environment. Consultation and treatment assistance are available to Smithsonian museums and research centers, with priority to projects that support new museums, such as NMAAHC, and the four **Smithsonian Grand Challenges**.

- In FY2010, the Conservation Group managed **116 active projects** — completed **34** projects, and undertook **39** new projects; and participated in **32** new and **17** on-going projects.
- Collaborations with all **19** Smithsonian museums, including A&I, NZP, **4** research centers (MCI, SIA, SIL, STRI), and **17** SI offices and interest groups. Federal partners included the Department of Homeland Security's Immigration and Customs Enforcement (ICE), the Department of State's Cultural Heritage Center (CHC) and Cultural Heritage Program/Interior Design; the Department of Interior's Museum, U.S. Secret Service, and U.S. Senate Curatorial Committee.
- Organized **6 training events**, including a 5-day workshop on the "Modular Cleaning Program," explored new cleaning methods based on non-toxic formulations (**Tsang**), and two 4-day courses "Preventing Illicit Trafficking/Protecting Cultural Heritage," for nearly 50 ICE agents (**Beaubien** with **Paula DePriest,** Deputy Director).
- Submitted **14 proposals**, of which five were funded. Several highlighted modern materials, an outgrowth of a collaborative NMAH-MCI project selected for presentation at the American Experience Idea Fair, entitled "Plastics: The Material of a Thousand Uses" (**Tsang**).
- Published **7** professional papers, submitted **12** papers, and delivered **36** presentations. One of the published papers "Red 'Staining' on Marble: Biological or Inorganic Origin?" *APT Bulletin: Journal of Preservation Technology* 41 (2-3): 11-20., authored by **Grissom** et al., was the recipient of the Association for Preservation Technology International's 2010 Oliver Torrey Fuller Award for the *APT Bulletin* article that best demonstrates technical excellence and innovation.
- Supported research and conservation efforts of many SI interns, fellows, and post-docs, including **13** MCI fellows, interns and contractors under their supervision. Fellow and intern projects were highlighted in the 3rd Annual SI-Conservation Conference, organized by **Ballard**.
- Featured in new outreach venues, including an MCI web-page on **Wachowiak's** Imaging Studio projects, and a Smithsonian Networks documentary on **Ballard**'s conservation team working on NMAAHC's Black Fashion Museum collection.

MCI Highlights

MCI Weekly Highlight 23 April 2010

On April 15 and 16, 2010, MCI hosted an international working group on biodeterioration and biocontrol of stone surfaces. The international guests included Dr. Eric May, UK; Dr. Ornella Salvadori and Dr. Francesca Cappitelli, Italy; and Dr. Thomas Warscheid, Germany. One focus of the group was the unsightly soiling that has developed on the NMAI building since it's last cleaning approximately three years ago. After examining the building and discussing relevant research experience, the group determined that the heavy and localized soiling can be attributed to the preferential water paths that develop along this unusual and elegant building. Along these water paths, because the surface of the stone remains wet for longer period, biocolonization – largely cyanobacteria (blue-green algae) – develops and air pollutants, both gaseous and particulate, settle preferentially. Therefore, to solve the problem the group recognized the need for a fundamental investigation of why water runs along those specific paths and possible architectural changes to correct this problem. The group prepared recommendation for short-term, medium-term, and long-term research programs with the goal of developing protocols for regular maintenance that minimize the need for complete cleaning of the building and extend the time between cleanings. The groups' recommendations were presented to OFEO on April 23. The working group meeting, organized by MCI Research Associate Dr. A. Elena Charola, was a follow-up to an April 20-21, 2009, conference Biocolonization of Stone: Control and Preventive Measures Workshop held at MCI. MCI's biodiversity and biodeterioration of stone team includes Director Koestler, Deputy Director DePriest, Research Scientist Vicenzi, and Senior Conservators Grissom and Wachowiak.

On April 14, 2010, Dr. Robert Koestler attended the inaugural meeting of the Scientific Counsel for Lascaux Cave, one of the greatest cultural treasures of the western world. Dr. Koestler is a member of the fourteen-member council, chaired by Professor Yves Coppens, that will provide advice and expertise to French Ministry of Culture and Communication on the scientific research necessary for the preservation of Lascaux Cave, especially to reduce the risk of biodegradation. The Paleolithic painted cave at Lascaux, France, with almost 2,000 vivid and vivacious animal paintings made from luminous iron and manganese oxide dating to 16,000 years ago, has been threatened by the rapid growth of garden-variety soil molds over the past ten years. The next council meeting is June 14-15th in Bordeaux, with a planned visit to the cave.

MCI Weekly Highlight 30 April 2010

Culmination of 20 years of green, energy savings research at MCI

Research at MCI over the past 20 years by Dr. Marion Mecklenburg and his international team of collaborators has shown that most cultural heritage materials are much more resistant to temperature and humidity changes than generally thought. As a result of this research, in 2004 the Smithsonian adopted new guidelines of 45% RH +/- 8% RH and 70°F +/- 4° for our 640+ buildings, including 19 museums. These guidelines permit most collection and building spaces a greater flexibility in temperature and humidity fluctuation over the year than the "common wisdom" versions that had previously been adhered to for over four decades. The new guidelines have been in place for over five years and have resulted in dramatic energy cost savings (about 17% per year); less condensation on walls in the winter, and therefore less wear and tear on the building envelope; and no known problems for any object, artifact, or collection. (Note: Collections, and individual objects, that conservators recommend be maintained with tighter controls than the new guidelines are still accommodated within the new guidelines.)

Interest in Europe about Dr. Mecklenburg's work has grown tremendously in recent years. He has helped create Ph.D. programs and taught extensively in universities in Barcelona and Valencia, Spain; as well as teaching in Copenhagen, Denmark; Torino, Italy; and Gotland, Sweden, where his research is prompting rethinking their museum climates. Now North American museum directors, conservation scientist, and conservators are reviewing and accepting Dr. Mecklenburg's guidelines.

- Dr. Mecklenburg presented a talk at the DC Metro Area Chapter of the IAMFA [International Association of Museum Facility Administrators] Quarterly meeting on April 28, 2010 at NMAI. Dr. Mecklenburg discussed research approaches taken to determine allowable ranges of temperature and relative humidity in museums in his talk "Determining the Acceptable Ranges of Relative Humidity and Temperature in Museum and Galleries." The audience included facilities managers, engineers and other people with vested interests from the SI, the National Gallery, The Walters Gallery, the National Archives, and the Library of Congress.

- Dr. Mecklenburg, Dr. Robert Koestler, and Dr. Paula DePriest participated in a meeting "Rethinking the Museum Climate" held at the Museum of Fine Arts, Boston on April 12-13, 2010. More than 65 representatives from major North American museums and conservation programs attended, with written input of those from the UK. After two days of presentations and discussion the group was nearly unanimous in approving a proposal with 16-25°C (59-77°F) and 40-60% RH ranges as acceptable for the majority of cultural materials that are on loan between museums. [Please note that the Smithsonian comes out on the conservative side of the proposed environmental guidelines with its current 70°±4°F and 45±8% RH.] The statement, supporting an earlier statement by the Bizot Group (also known as the International Group of Organizers of Large-scale Exhibitions), will go to an American Institute for Conservation (AIC) task force and to the National Museum Director Conference (NMDC) for further discussion. The session ended with an appreciation of Dr. Mecklenburg's ground breaking work.

- Dr. Marion Mecklenburg was the opening speaker and a member of the discussion panel at the international workshop "Allowable Microclimatic Variations for Polychrome Wood," February 18-19, 2010 in Oslo, Norway. The workshop summarized the findings of the multi-year research program *COST ACTION IE0601 – Wood Science for Conservation of Cultural Heritage* to determine the effects of heating historic churches in Poland and Norway that had no prior climate controls. In addition, he made a presentation "Structural response of painted wood to variations in relative humidity and temperature." The workshop was sponsored by EEA Grants (Iceland, Liechtenstein, and Norway), Norsk Institutt for Kultutminneforskning (NIKU), Institute of Catalysis and Surface Chemistry (ICSC), Polish Academy of Chemistry, and COST ACTION IE0601.

Related topic, but not MCI:

- The American Institute for Conservation of Historic and Artistic Works (AIC) is partnering with the International Institute for Conservation of Historic and Artistic Works (IIC) to present a roundtable discussion "The Plus/Minus Dilemma: The Way Forward in Environmental Guidelines" as part of the AIC Annual Meeting in Milwaukee, WI on May 13, 2010. The program notes that "Given the looming energy crisis, the global economic downturn, and the rising awareness of green technology equating to good stewardship of our natural resources, responsible and efficient environmental control has become essential."

MCI Weekly Highlight 7 May 2010

MCI's umbrella theme **"Healthy Environments, Healthy Practices, Healthy Collections,"** includes a focus on conservation protocols, procedures and products that are as safe as possible for the staff, the collections and the global environment. This requires testing and optimizing conservation products and methods that reduce the use of solvents and the release of volatile organic compounds (VOCs), and that are as "green" as possible in manufacturing and production.

Aqueous cleaning methods

Aqueous systems and aqueous/organic solvent hybrids provide great flexibility to the conservator in formulating appropriate methods for cleaning, and are safer for the environment than VOC containing products. In the case of the **Roosevelt Globe for the White House**, recently conserved at MCI, the accretions and contaminants resulting from an electrical fire were removed with aqueous solutions while leaving untouched the historic surface underneath.

- Aqueous technology was a vital component of a workshop on the **Modular Cleaning Program (MCP)**, hosted at MCI April 26-29, 2010, and coordinated by Jia-sun Tsang (Senior Paintings Conservator). The workshop, taught by Chris Stavroudis (creator of the MCP) and Tiarna Doherty (Paintings Conservator, J. Paul Getty Museum), introduced new approaches to cleaning artwork that reduce the usage of solvents through gelling, selection of solvents that have the least health risks, and exploration of the potential of water-based emulsion cleaning as a substitute for solvent cleaning. Co-sponsored by MCI and the National Gallery of Art (NGA), the workshop lectures were attended by sixty-five conservators from thirteen SI museums and NGA, the hands-on laboratory sessions by twenty-five. The response from participants was overwhelmingly positive, with enthusiastic support for follow-up sessions.

Aqueous coatings

Much of the development in coatings technology in recent years has revolved around the use of aqueous delivery systems for film-forming materials as a means of reducing the use of VOCs. In a museum context, understanding and developing water-based coatings systems is an increasingly critical component of conservation practice.

- An archival emulsion furniture polish, developed by MCI Senior Furniture Conservators Mel Wachowiak and Don Williams, and subsequently patented, is routinely employed in conservation treatments at the Smithsonian.

- Recent research carried out by Senior Objects Conservator Carol Grissom on protective coatings for silver, for use in museum settings, produced promising results for the acrylic dispersion Acrysol WS24. Further testing of application methods is necessary, however, in order to achieve satisfactory coatings from an aesthetic standpoint.

MCI Weekly Highlight 21 May 2010

Research at MCI over the past 30 years has established the Smithsonian's Museum Conservation Institute (MCI) as one of the leading centers in the world for studies related to the technology, provenance, and conservation of archaeological and historical materials. This research area relies heavily on advanced analytical instrumentation and imaging techniques in order to address archaeological questions and conservation issues. Important analytical techniques include stable isotope mass spectrometry, laser ablation-inductively coupled plasma-mass spectrometry, X-ray fluorescence spectrometry, electron microscopy, X-ray diffraction, and 3D imaging, which — among others — are all available in MCI's state-of-the-art analytical laboratories. Research focused on archaeological materials fits into the larger Smithsonian theme of ***Valuing World Cultures***.

MCI's archaeological research group includes ***Jeff Speakman*** (Head of Technical Studies/Archaeologist) with expertise in inorganic studies of archaeological ceramics and pottery; ***Harriet F. (Rae) Beaubien*** (Head of Conservation/Conservator) with expertise in the technical study and conservation of inorganic and organic archaeological objects with an emphasis on on-site conservation; ***Nicole Little*** (Physical Scientist/Archaeologist) with expertise in chemical and mineralogical studies of inorganic archaeological materials; and ***Christine France*** (Physical Scientist/Isotope Geochemist) with expertise in stable isotope characterization of organic and inorganic materials, diagenetic alteration of archaeological and paleontological specimens;, late Pleistocene/early Holocene archaeology and paleontology. ***Melvin Wachowiak*** (Senior Conservator) provides expertise in a variety of imaging techniques including light microcopies, 3D scanning, extended focal imaging, replication of objects, and advanced object documentation.

- **Recent symposia**. Jeff Speakman (MCI), Javier Iñañez (MCI) and Christopher Wolff (NMNH & MCI) organized two sessions at the ***75th Annual Meeting of the Society for American Archaeology***, St. Louis held April 14–18, 2010. The sessions titled *Archaeological Science 2010: Part I & II* included 32 presentations by archeological scientists from across the United States. MCI research was prominently represented at the ***38th International Symposium on Archaeometry***, held at the University of South Florida, Tampa, May 10–14, 2010, where 9 papers and posters were presented based on research undertaken at MCI.

- **Panamanian excavation featured in *National Geographic*.** Rae Beaubien (MCI) is working with a STRI archaeological team in the excavation of a Pre-Columbian mortuary site, El Caño, a project that will be featured in an upcoming issue of ***National Geographic***. The excavation has recovered numerous gold and related metal artifacts. This supports a broad study of goldworking in Pre-Columbian Panama conducted by Rae and two fellows in collaboration with archaeological colleagues at STRI. Detailed information on composition and fabrication is being compiled on gold artifacts in the collections of NMAI, NMNH, and the Museo Antropológico Reina Torres de Araúz, the national museum located in Panama City, as well as recently excavated finds from several sites in Panama, such as El Caño, curated at STRI. This dataset will be used to test hypotheses about the origins and development of goldworking technology in the Americas.

- **Dating volcanic eruptions with tree rings.** MCI researchers Christine France and Jeff Speakman, in collaboration with the University of Arizona, are looking for isotopic signatures for volcanic eruptions in tree rings. The annual growth rings obtained from well dated *Pinus michoacana* tree ring cores from Parícutin, Mexico show chemical signatures that correlate with a known local volcanic eruption (1943-1952) and its subsequent atmospheric and terrestrial inputs. This novel analytical approach can potentially be used to date unknown eruptions which in the past have often relied on the common dendrochronological technique of tree ring width

determination, or on historic human records. Results of this study were reported at several recent national and international meetings.

- **Obsidian tools trace the peopling of the Americas.** Jeff Speakman (MCI) and Nicole Little's (MCI) ongoing research, conducted at MCI in partnership with Dennis Stanford (NMNH), the National Park Service, University of Alaska Museum of the North, University of Washington, University of Missouri, and many Russian colleagues, is using unique trace elements in obsidian archaeological artifacts, such as arrow points, to find their volcanic source. The study has focused on archaeological sites and volcanoes in three geographic regions—the Kurile Islands, the Kamchatka Peninsula, and Alaska, and show that some artifacts from archaeological sites in Alaska originate from volcanic sources in northeast Russia. The primary objectives of this research include: (1) to study prehistoric inter- and intra-regional patterns of mobility, trade, exchange, resource exploitation, and cultural interaction; (2) to facilitate a better understanding of the prehistory of Eastern and Western Beringia; and (3) to foster collaborations between U.S. and Russian colleagues that will facilitate the exchange of ideas and research findings. To date chemical data have been generated thus far for more than 10,000 obsidian artifacts and geological source samples and have resulted in 1 NSF grant submission, 4 peer reviewed publications, and about 10 professional presentations in the past year.

- **Artifacts of American colonial history.** MCI researchers are collaborating with archaeologists from the Jamestown Rediscovery Team and Doug Owsley (NMNH), on a number of projects related to ongoing excavations at America's first permanent English settlement in the New World. MCI projects include the high resolution imaging of a Jamestown slate object that is covered with words, numbers, and etchings of people, plants, and birds that its owner likely encountered in the New World in the early 1600s. Additional research is underway to determine the geologic origin of the slate which is presumed to have been quarried in England. MCI also is collaborating on a project to determine the origin of Spanish majolica pottery recovered from recent excavations at the site. Finally MCI has recently completed the chemical analyses of human bone from ca. 60 individuals to better understand the health and status of these early settlers.

MCI Weekly Highlight 28 May 2010

Modern materials, especially synthetic polymers and plastics, had a significant influence on industrial, domestic and cultural life through the 19th and 20th centuries. The Smithsonian's museums and collections are repositories for many different forms of modern materials, from decorative and fine arts in the Cooper-Hewitt and Hirshhorn museums to industrial objects in the National Air and Space Museum and National Museum of American History. Now some of these modern materials are exhibiting signs of deterioration; past exposure to light, heat, moisture, chemical, and gaseous pollutants are reducing their integrity and longevity. The Museum Conservation Institute (MCI) studies modern and industrial materials, such as plastics and space age materials, with the aim of understanding why they are deteriorating and learning how to mitigate the deterioration. Without scientific investigation and new collections care strategies, priceless artifacts from the "Greatest Generation" will be forever lost. This research area relies heavily on advanced analytical instrumentation and imaging techniques in order to uncover how these materials were manufactured and how they will be conserved for future generations. This program supports the Smithsonian's themes of ***The American Experience*** and ***Valuing World Cultures***.

- **Idea Fair proposal on plastics.** MCI Conservator Jia-sun Tsang, with Ann Seeger and other curators from the National Museum of American History, developed a proposal "Plastics: The Material of a Thousand Uses," which was selected by the OUSHAC and presented at the Idea Fair (held March 24) for the Consortium on Celebrating the American Experience, one of the Smithsonian's grand challenges.
- **Grant awarded by National Center for Preservation Technology and Training (NCPTT).** MCI Research Associate Odile Madden and National Air and Space Museum curator Alex Spencer were awarded a grant to study the "Molecular Characterization and Technical Study of Historic Aircraft Windows and Head Gear Using Portable Raman Spectroscopy." The early history of plastics parallels that of aviation, and many advances in manned flight were possible because of innovation in the nascent polymer industry. NASM's encyclopedic collections of early plastics are being studied to understand the composition, processing and current stability of plastic goggles, helmets, and aircraft windows using visual observation and MCI's portable Raman spectrometer.
- **Richard Diebenkorn's *Ocean Park #111*, HMSG.** MCI staff members Jennifer Giaccai, Mel Wachowiak and Marion Mecklenburg are contributing to a study by Hirshhorn Museum and Sculpture Garden (HMSG) fellow Ana Alba on the cracking of *Ocean Park #111*. Giaccai and Alba used infrared spectroscopy and pyrolysis-gas chromatography-mass spectrometry to identify the modern materials used in different layers of the painting -- the "size," ground and paints. They found the thick "size" layer is a very soft and flexible acrylic coating covered with primarily alkyd paints that are much more brittle. In addition, Alba and Wachowiak were able to identify zinc compounds in some of the paint layers, which may increases the brittleness of the alkyd paints. This information contributed to new travel restrictions for *Ocean Park #111* instituted by HMSG.
- **Brian Jungen's *Crux*, NMAI.** MCI conservation and scientific staff, Jia-sun Tsang, Jennifer Giaccai, and Marion Mecklenburg, provided assistance to the National Museum of the American Indian in the conservation and safe display of a large mobile by Brian Jungen, composed of a rowboat and five animals made from plastic luggage, in the newly opened exhibit "Strange Comfort." Technical study showed that the suitcases were made of polypropylene, acrylonitrile-butadiene-styrene, and polyurethane foam; phthalate plasticizers were identified in the polymers. The outcome of the project was to address concerns about possible stress on mobile components from the hanging mechanism and to develop a preventative care plan. The project was presented at the American Institute of Conservation annual meeting in Milwaukee, WI on May 13 and will also be presented at the international symposium "Contemporary Art: Who Cares?" in the Netherlands on June 8-11.

MCI Weekly Highlight 4 June 2010

Proteomics is an area of rapid growth in biological and medical research. Developed, and its name coined, in the mid-1990s, proteomics was an opportunistic outgrowth of the genomic revolution. It is driven by advances in molecular separation and mass spectrometry technology over the past twenty years. The Museum Conservation Institute (MCI) is developing a proteomics capability as a part of the OUSS's central research infrastructure – the Mass Spectrometry Center. Proteomics capabilities will allow us to gather more information from Smithsonian collections, cultural objects, and biological specimens, and to learn more about their materials, their origins, and their deterioration. Proteomics will allow us to move beyond identification of organisms to look at the activity and dynamics of their populations, their use in cultural and artistic expression, and their role in sustainable ecosystems. This program will use the instruments and techniques typical of ***Understanding and Sustaining a Biodiverse Planet*** to serve all of the Smithsonian's Grand Challenges.

- **Dr. Medhi Moini**, formerly of The University of Texas/Texas State University – San Marcos, began work as an MCI staff member on 1 June 2010. During the month of June, Dr. Moini will be in Texas completing preliminary data and writing a major grant proposal to NASA for development of a portable Mass Spectrometer for use in the Mars Rover program.

- MCI is working with **Rob Ritter**, Acting Director of Corporate Relations, to request a gift of a Thermo Scientific LTQ Velos Mass Spectrometer with a Proteome Discovery software package. Rob is scheduled to talk with Karen Kirkwood VP, Corp. Communications at Thermo Fisher Scientific Inc. on Monday, 7 June.

- Dr. Moini has developed a novel analytical technique called ultrafast capillary electrophoresis mass spectrometry (CE-MS) that uses short, narrow capillaries, with separation potentials in excess of 1000V/cm, to deliver samples into the mass spectrometer. This novel technique consumes very, very small samples, picoliters – one trillionth of a liter, with analysis times of about a minute. The technique is especially useful for the analysis of museum specimens, where sample consumption must be minimized. The drawback of using such small samples, however, is that the peaks generated are very narrow (sub second) and require a fast and sensitive mass spectrometer to even detect these narrow peaks. The Thermo Scientific LTQ Velos is the fastest, most-sensitive "ion trap" mass spectrometer available and essential for continued development of this technology for application to museum collections and deployment on the Mars Rover.

- Dr. Moini has two summer interns: **Naoko Araki** (Graduate student) conducting research using MALDI-Mass Spectrometry to detect deamidation of wool samples and **Ben Martinez** (Senior, Undergraduate student) conducting research on CE-MS analysis of D/L amino acids of wool samples. Both projects will develop methods for dating ancient textiles.

- Dr. Moini attended the 58th American Society for Mass Spectrometry Conference, May 23 - 27, 2010, in Salt Lake City, Utah. He presented two posters: *Comparison of the Self-Assembly of Calix[6]arene Analogues in Solution/Gas Phase by ESI-MS and in Solid Phase by X-ray Crystallography* (with Taylor Barker and Michael Blanda) and *Analysis of Protein Digests in about a Minute using a Handheld Ultrafast Capillary Electrophoresis Interfaced to MS using a Porous Tip* (with Ben Martinez).

MCI Weekly Highlight 11 June 2010

Collaborative partnerships with outside agencies and institutions foster creativity and stimulate transfer of our knowledge and skills to other researchers. Through such partnerships MCI researchers are motivated to pursue unique research questions using innovative and oftentimes cross-disciplinary approaches to examine collections and develop effective conservation treatments; to collaborate with researchers and organizations with complementary interests and skills; to develop and use specialized scientific instruments; to teach courses and mentor graduate students; and to apply for grant and contract funding. Over the past five years one of our most profitable international partnerships has been with the Universidad Politécnica de Valencia (UPV), Spain, and its Department of Conservation and Restoration of Cultural Heritage. This collaborative effort helps MCI support the Smithsonian's themes of ***The American Experience*** and ***Valuing World Cultures***.

- MCI was a co-sponsor of the international conference ***Cleaning 2010: New Insights into the Cleaning of Paintings***, held May 26-28, 2010, at the Universidad Politécnica de Valencia, Spain. The conference was fully subscribed with 480 attendees from all over the world, and representing every major cultural institution from the Metropolitan Museum of Art to the Louvre, and a waiting list of over 100. The conference included 20 invited presentations by major researchers in the field and 24 posters. The papers and poster abstracts will be printed as a volume of the SISP Contributions to Museum Conservation. The lead organizers for the conference were Laura Fuster Lopez, UPV Assistant Professor and MCI fellow in the summers of 2005 and 2007, and Marion F. Mecklenburg, Senior Research Scientist at MCI.

- On May 25, 2010, Julio M. del Hoyo-Melendez successfully defended his Ph.D. dissertation (*summa cum laude*), ***A Study on the Action of Light on Objects of Cultural Interest by Evaluating the Light Levels in the Museum and Performing Micro-Fading Tests of Materials***, Co-advisors, Marion F. Mecklenburg, MCI, and M. Teresa Domenech-Carbo, UPV. The dissertation research has thus far produced four papers in press and two manuscripts in review. The research was initiated during the time del Hoyo-Melendez was a fellow at MCI, September 2007 through October 2008, and focused on light levels in the recently renovated exhibit spaces of SAAM and NPG in the Old Patent Office Building (now the Donald W. Reynolds Center for American Art and Portraiture) and its potential fading effects on paintings.

- The collaboration between Universidad Politécnica de Valencia and MCI, formalized in a Memorandum of Understanding signed May 2008, has been very successful, producing an annual course taught by Mecklenburg and Fuster Lopez, *The Structure of Paintings and the Mechanical Properties of Cultural Materials, 2008-2009*; three Ph.D. programs: Fuster Lopez (2006), del Hoyo-Melendez (2010), and Miguel Silva (current); and 19 publications and manuscripts.

MCI Weekly Highlight 18 June 2010

Fellows and Interns are an important part of the Museum Conservation Institute's (MCI) professional training mission. Each year the conservation and scientific research programs at MCI host many fellows and interns. Whether they are at the Smithsonian for a few weeks or a few years, these fellows and interns significantly increase research and conservation treatment productivity.

- For the third year, MCI has hosted a one-day symposium the ***Annual SI-Conservation Conference***; on 10 June 2010. The conference, sponsored by the Smithsonian Conservation community, features fellows and advanced interns in conservation and conservation science from around the Smithsonian presenting their research topics and preliminary results. This year's conference had eight presentations from six Smithsonian museums or research centers, with topics ranging from the conservation of the letterpress copying books of Spencer Fullerton Baird to studies of pre-Columbian gold from Panama. Keynote speaker Catherine Harris, Director of the Office of Fellowships (OF), opened the conference with a warm welcome to the fellows and interns. During Ms. Harris's career at OF, we estimate that half the practicing conservators in the United States have benefited from an internship or fellowship at the Smithsonian Institution.

- This summer MCI is hosting nine interns working on a range of topics under the supervision of both conservators and scientists. The interns include **Stephanie Spence** working with textile conservator Mary Ballard; **Genevieve Bieniosek** with objects conservator Carol Grissom; **Rebecca Gieseking**, and **Laurie King** with paintings conservator Jia-sun Tsang; **Elizabeth Keats Webb** with conservator Melvin Wachowiak; **Sara Mills** with scientist Christine France; **Naoko Araki** and **Ben Martinez** with research scientist Mehdi Moini; and, **Amy Marquardt** with research scientist Ed Vicenzi. Projects range from treatment of shoes and hats in the Black Fashion Museum collection at the National Museum of African American History and Culture (NMAAHC) to analytical study of bronze patinas. For the summer program 109 applications were initiated and 39 completed; from this group, the nine interns were selected.

- This year MCI has hosted nine fellows, two year-long interns, 12 short-term interns (including the summer interns above), three research associates and four volunteers.

- External funding sources include the **Samuel H. Kress Foundation** (two), the **Calouste Gulbenkian Foundation** (two), and a **Marie Curie International Outgoing Fellowship** (to Javier Iñañez); Smithsonian funding sources include a Scholarly Studies grant for the study of Panamanian goldwork, NMAAHC funding for training in textile conservation on the Black Fashion Museum collection, and internal funds. One intern, Amy Marquardt working with Ed Vicenzi, is part of a joint collaboration between the Smithsonian and the University of Maryland College Park (UMCP).

- The **Smithsonian Postgraduate Fellowships in Conservation of Museum Collections** program had a total of 24 applications for which MCI staff members were listed as primary advisors or co-advisors and four applicants for which MCI staff members were listed as consultants. **Smithsonian Fellowships in Anthropology** received nine applications and the new **Interdisciplinary Postdoctoral Fellowship in the Area of Stable Isotope Biogeochemistry** received four applications in which MCI staff members were listed as primary advisors, co-advisors or consultants.

MCI Weekly Highlight 25 June 2010

Valuing World Cultures

The French Connection. The signing of a Memorandum of Understanding between the Smithsonian Institution and Synchrotron SOLEIL, held at the Ministry of Higher Education and Research on June 10, 2010, highlighted the growing relationship between French conservation scientists and synchrotron researchers, and the Smithsonian's Museum Conservation Institute (MCI).

- MCI Director **Robert J. Koestler** has just returned from the second meeting of the **Scientific Council of Lascaux** that included a visit to the Paleolithic painted cave in the south of France, one of the greatest cultural treasures of the western world. The Council was convened by the French Ministry of Culture to investigate anthropogenic-induced changes over the past decade. The almost 2,000 animal paintings made using luminous iron and manganese oxide paints, approximately 16,000 years old, were threatened by the rapid growth of garden-variety soil molds in the early 2000s. Some experts proposed that the mold damage was a consequence of global environmental change, although this is still unproven. The fungal contamination has been controlled in the past five years, but the Council is working to ensure that the cave is protected from damage in the future.

- MCI will host a tour on July 13 of a bilateral science and technology meeting with French representatives, called the Joint Committee Meeting or "JCM," organized by the **U.S. Department of State's Office of Science and Technology Cooperation**. Co-chairs of the US-French Archaeology Working Group -- John Yellen, NSF's Program Director for Archaeology and Archaeometry, and the Director of the Louvre's Conservation Laboratory -- will lead a discussion on cooperation in archaeology and museum practices. **Robert J. Koestler** has been invited to participate in the JCM.

- Over the past six years MCI has hosted a number of impressive French postdoctoral fellows. **Laure Dussubieux** used her fellowship to develop ICP-MS methods to determine the provenience of glass beads-she is now a researcher at the Field Museum in Chicago. **Amandine Pequignot** researched the preservation of natural history collections, including the detection of toxic inorganic residues and the effects of fixation and long-term fluid preservation; she is now a researcher and lecturer at the Centre de recherche sur la conservation des collections (CRCC), Muséum National d'Histoire Naturelle, Paris. **Caroline Solazzo** pioneered the application of proteomics in the study of archaeological materials; she now has a **Marie Curie International Outgoing Fellowship** for work with MCI and NMAI on identifying types of domesticated sheep and goat fibers in ancient, historical, and ethnographic textiles. **Claire Gervais** continues as a Research Fellow at MCI and SOLEIL/IPANEMA, leading the first Smithsonian-SOLEIL synchrotron project on the fading of Prussian blue.

Smithsonian
Museum Conservation Institute

MCI **Weekly Highlight** 2 July 2010

Understanding the Mysteries of the Universe.

The long-term partnership between **NASA** and the Smithsonian Institution has provided the Museum Conservation Institute (MCI) access to collections that are iconic, from rockets and spacesuits to moon rocks and star dust. Currently MCI is seeking support from NASA to build the next generation of analytical instruments that will provide new insight into the molecules of the universe whether they are brought back to earth or encountered in space.

A7-L Extra Vehicular Suit – A. Shepard, Apollo 14, ILC Industries, 1970. S.I. Image # 2003-27359. Catalogue # 1972-0587-000. (X-Ray by Roland Cunningham, MCI.)

- MCI Research Scientist **Mehdi Moini**, with colleagues from the Jet Propulsion Laboratory, has submitted a proposal to NASA – Astrobiology Science and Technology for Instrument Development, *Development of Capillary Electrophoresis Mass Spectrometry for Astrobiology*. The proposal is to develop a new flight instrument that integrates the following core technologies: lab-on-a-chip microfluidic sample handling, ultrafast capillary electrophoresis (UFCE), and portable mass spectrometry (MS). The instrument would allow extremely sensitive and rapid analysis of attomole (10^{-18}) quantities of chemical and biochemical compounds in complex mixtures, especially separation of the chiral forms of amino acids. The chiral analysis aspect of this research has profound scientific value in the field of astrobiology, as homochirality is generally accepted as the best chemical indicator of life.

- MCI Research Scientist **Ed Vicenzi** is a co-PI, with PI **Eric Silver** of SAO, on a proposal to NASA – Laboratory Analysis of Returned Samples, *Advanced Chemical Analysis of Cometary Material and Interstellar Dust Using a Microcalorimeter and A Low-Vacuum Scanning Electron Microscope.* The proposed project will integrate two advanced technologies — cryogenic X-ray microcalorimeter spectrometer built at SAO and a high resolution environmental scanning electron microscope (ESEM) modified to permit material-selective, gas-mediated, electron beam-induced etching (EBIE) — to examine dust grains collected in 2006 from the coma of comet Wild-2 by NASA's STARDUST spacecraft. Such comet dust provides a snapshot of early solar system materials with major implications for models of solar nebula.

- MCI's **Roland Cunningham** is collaborating with researchers at the National Air and Space Museum (NASM) and the Smithsonian Institution's Travelling Exhibit Services (SITES) on an exciting new exhibit entitled *Suited for Space*. The exhibit highlights how the modern technological marvel that is the spacesuit enables astronauts to live and work in space, using rare and original photography, including unique never before seen X-ray images of the interiors of the spacesuits produced by Cunningham. The exhibition includes amazing images—many life size—along with informative text and some small objects—including gloves, helmets, boots. Photographs of spacesuits by Mark Avino, NASM's chief of photographic services and X-ray images by Cunningham also are presented in Amanda Young's (NASM) recently-published book, Spacesuits: The Smithsonian National Air and Space Museum Collection (powerHouse Books, 2009). Additional information on the *Suited for Space* exhibit is available at: http://www.sites.si.edu/exhibitions/exhibits/suitedForSpace/index.htm

Smithsonian
Museum Conservation Institute

MCI **Weekly Highlight** 9 July 2010

Valuing World Cultures

The new partnership between **SOLEIL Synchrotron** and the Museum Conservation Institute (MCI) was initiated with the first SOLEIL beamline measurements regarding the fading of Prussian blue, the earliest modern synthetic pigment. The pigment, used in early cyanotype photographs, blueprints, paintings, textiles, etc., is electrochromatic – changing from blue to colorless upon reduction – and therefore fades when exposed to light or anoxic conditions. In addition, because of their magnetic and electronic properties, Prussian blue analogues have potential for energy storage. With the power of a synchrotron light source, researchers can explore the chemical/structural nature of fading to determine if the changes are reversible, and if so, these results will have implications for the preservation of important historical artifacts and priceless artworks.

SOLEIL's DIFFABS Beamline. Above: MCI Research Associate **Claire Gervais** measures the distance between Prussian blue samples. Below: MCI Research Scientist **Ed Vicenzi** prepares for an X-ray absorption measurement.

- **First Experiments.** MCI Research Scientist **Ed Vicenzi** and Research Associate **Claire Gervais**, with SOLEIL beamline scientists and staff, conducted experiments on synthesized Prussian blue powder on two SOLEIL beamlines: CRISTAL for high resolution X-ray diffraction, June 29-July 2; and DIFFABS for iron (Fe) X-ray absorption spectroscopy, July 2-5. These beamlines were selected for the first experiments to determine changes in the structure of the pigment as a function of pretreatment and substrate.
- **Experimental design.** Since the substrate on which Prussian blue is laid down can play a role in fading, samples of Prussian blue were prepared with different substrates, typically representing Prussian blue artifacts found in Smithsonian collections: textiles (cotton and linen), paper, gelatin (Prussian blue in photographs) and in paint binders. Half of these samples were placed under a high flux of light in order to simulate long term fading, or under nitrogen to simulate an anoxia treatment, while the remaining samples served as a control. All samples were then placed under an X-ray beamline and a scan in energy was made within a range where iron atoms begin to absorb the X-ray energy (~7 – 8 keV). The energy at which absorption takes place is called an "absorption edge" and it yields information about the chemical state of iron (Fe^{2+} and Fe^{3+}) as well as the local structure around iron atoms in the pigment. From this, the amount of Fe^{3+} and Fe^{2+} present in the structure is estimated and compared among samples to determine how it varies with fading treatments and substrate.
- **Preliminary observations.** Although the data have not been quantitatively analyzed, differences were observed in the chemical states of iron among the samples relative to controls, suggesting these initial experiments were successful.
- **Future work.** The team plans to extend the Prussian Blue project by proposing synchrotron measurements at very short time scales available through special high speed detectors at SOLEIL. Recent measurements on CRISTAL and DIFFABS required tens of minutes duration to acquire sufficient sensitivity. However, on this time scale the X-ray beam itself could possibly impart fading to the pigment. Making X-ray diffraction and absorption measurements at the sub-second time frame will allow Gervais and Vicenzi to evaluate any potential effect of the instrumental reduction of the Fe^{3+} in Prussian blue pigments.

Smithsonian
Museum Conservation Institute

MCI **Weekly Highlight** 16 July 2010

Biodiverse Planet/Understanding the Universe

The Museum Conservation Institute (MCI) is actively developing a proteomics capability that will allow us to gather more information from Smithsonian collections, cultural objects, and biological specimens, and to learn more about their materials, their origins, age, and their deterioration. Dr. Mehdi Moini, formerly of The University of Texas at Austin and Texas State University – San Marcos, arrived on site at MCI in July 2010. Previously, Dr. Moini developed a novel fast and sensitive separation technique called ultrafast capillary electrophoresis mass spectrometry (CE-MS) that uses short, narrow capillaries to deliver samples into the mass spectrometer. This cutting-edge technique consumes very small amounts of samples, picoliters – one trillionth of a liter, with analysis times of about one minute. To realize the potential of this technique, Dr. Moini must have access to a fast, high resolution/high mass accuracy Mass Spectrometer. At present he has a temporary loan of an older mass spectrometer, but will need to quickly replace this with a modern instrument. Dr. Moini was offered $400,000 in Smithsonian FY10 funds – Research Equipment Pool funds and Sprague Endowment funds – to purchase equipment (these funds, however, have not yet been released to MCI).

Thermo Scientific LTQ Orbitrap Velos.

- Thermo Fisher manufactures the most versatile, reliable, high resolution/high mass accuracy instrument, the LTQ VELOS Orbitrap Mass Spectrometer. We have worked with Themo to arrange either a gift or significant discount for this instrumentation. However, our negotiations seem to have stalled. We need action from Office of Development and OUSS to quickly determine if Thermo is a viable option.
- Bruker Daltonics offers a complementary type of reliable, high resolution mass spectrometer, a MALDI, which with its Biotyper system would allow us to research and identify microbes rapidly. However, it is not compatible with the separation technique developed by Dr. Moini.
- ABI-Sciex and Waters are other mass spectrometer manufacturers who might be approached for a gift or discount. However, Dr. Moini is not sure of the reliability of their equipment compared to those of Thermo and Bruker.
- Synchrotron SOLEIL provides an exciting future possibility for proteomics research that is complementary to the conventional proteomics instrument. However, their proteomics capability is limited to a few narrow applications. In addition, since access to the beamline and instruments would be limited to a few weeks a year, this would not allow development of an in-depth research program.
- N.B.: It is not clear how corporate gifts will be handled by the Office of Development since we have a gift offer for an ElvaX Prospector X-ray fluorescence unit from Elvatech that after one month is still awaiting a response.

Smithsonian
Museum Conservation Institute

MCI **Weekly Highlight** 23 July 2010

Unlocking the Mysteries of the Universe, Understanding and Sustaining a Biodiverse Planet, Valuing World Cultures, and Understanding the American Experience

A candidate for micro-drilling: captive *Nautilus pompilius* (post-mortem) exhibiting fine scale onset of morphologic abnormalities

RTI non-destructive processed view of paper mold from Freer archives that emphasizes surface features such as carved "letters"

The Museum Conservation Institute (MCI) has submitted two proposals for the 2011 Women's Committee Grant period and is a partner on a third proposal, submitted by NMNH.

- **Micro-drilling Technology.** MCI's Christine France has requested funds to purchase a computerized micro-drill system for our analytical instrument suite. The increased sensitivity of our new equipment allows us to take micro-samples, reducing the sample amount of rare and valuable artifacts necessary to achieve reliable and reproducible instrumental results. This new capability will benefit hundreds of our cross-disciplinary projects that span all four grand challenges of the Smithsonian Strategic Plan and all Smithsonian units.

- **Reflectance Transformation Imaging (RTI).** MCI's Mel Wachowiak has requested funds from the Women's Committee to help develop RTI imaging capabilites. Three-dimensional imaging has become the expectation of the public, as seen in current movies and commercial television. However, 3-D movies can use many hours of computing time and a "server farm" to render a single frame of animation. MCI has been developing a new application called RTI that will deliver 3-D imaging with low labor and very low equipment cost. RTI produces immersive images that replicate a three-dimensional experience without complex hardware. RTI-produced images of objects and archaeological sites can be viewed in high-resolution and as web-based downloads. The project goal is to develop technologies and methods that deliver appropriate 3-D imaging as the need arises, whether in SI collections, web pages, or in field research applications.

- **Genghis Khan's Mongolia website.** NMNH's Bill Fitzhugh, with MCI as a co-participant, has submitted a request to the Women's Committee for funding support to create a website that presents the highlights of the past decade of the Smithsonian's Mongolian research. MCI will contribute 3-D images from Paula DePriest's and Rae Beaubien's field expeditions to Mongolia.

Smithsonian
Museum Conservation Institute

MCI **Weekly Highlight** 6 August 2010

Understanding the American Experience, Valuing World Cultures

Henry O. Tanner (SAAM) painting in normal light image (above)
RTI (below) shows color component of design removed by RTI Viewer software. Image therefore shows surface features such as modelling impasto (moon at upper right) and surface defects (bottom third).

The Museum Conservation Institute (MCI) continues to be a leader in cultural heritage digital imaging.

- **Imaging Studio Highlights.** The Imaging program of MCI has made significant strides in the last few months. Our newest imaging technique, Reflectance Transformation Imaging (RTI), has been employed in several museum and research projects. Highlights include examination and documentation of several important paintings in the Smithsonian American Art Museum (SAAM) and the Walters Art Museum, and deciphering lost writing on a quilled leather bag from the National Museum of the American Indian.
- **New web site.** An in-house effort by Senior Conservator Mel Wachowiak and Visiting Scholar Elisabeth Keats Webb has resulted in a website to better describe the many techniques being employed for research and documentation of collections. This will help us present our capabilities and allow our potential collaborators to see an overview. Techniques include 3D scanning and microscopy, multispectral imaging, RTI, and high-dynamic range imaging (HDRI). [http://www.si.edu/mci/ImagingStudio]
- **Funding.** MCI recently collaborated on a successful NEH grant to document petroglyphs in remote Mongolia using RTI. Our portion of the grant will only fund travel and field expenses. Our recent application for a 2010 Women's Committee grant can fund the necessary equipment for this rugged setting. High performance battery powered flash units are an example of equipment that we do not currently have for fieldwork. In addition, we have collaborated with the National Museum of Natural History on a Women's Committee grant to create a website to show deer stones and disseminate results from several field seasons.

  MCI had hoped that the new technology of RTI would be an excellent fit for the Smithsonian 2.0 grant. Unfortunately, this grant was not funded. This would have enhanced the open-source software, demonstrated the methods on a wider range of collection material, and created written guidance for users. While we have trained several new users, no real documentation exists: funding is the only obstacle. We hope to pursue other sources to bring this innovative technique to a wider community within SI and the cultural heritage community. September presentations include the SI Digi-fair and VAST, the International Symposium on Virtual Reality, Archaeology and Cultural Heritage in Paris, France.
- **Vision for SI.** While these small efforts have been successful and well received despite limited resources, they do reflect a larger vision for the Smithsonian. By utilizing available technologies like 3D scanning and exploring new methods such as RTI to digitize and analyze, we are preparing to implement the Smithsonian Digital Strategic Plan. Secretary Clough has recognized the need for this and has constituted expert committees to put the plan into action. Mel Wachowiak is a member on a unique group, an Action Item Team that will interview and create a registry of experts and expertise in areas of digitization. This is essentially the only team that will examine the *human resources*, not just the methodology such as digital standards and best practices. MCI is positioning itself to become a central location for the best methods for multi-dimensional and multi-spectral imaging.

Smithsonian
Museum Conservation Institute

MCI **Weekly Highlight** 13 August 2010

Understanding the American Experience, Valuing World Cultures, Unlocking the Mysteries of the Universe, Understanding and Sustaining a Biodiverse Planet

The Museum Conservation Institute hosted 10 interns and volunteers this summer. These individuals significantly increase research and conservation treatment productivity at MCI. We would like to take the opportunity to acknowledge their contributions and wish them the best in their future endeavors.

- In the Paintings Conservation Laboratory under the mentorship of Senior Paintings Conservator, Jia-sun Tsang, **Laura King** worked on Sam Gilliam's *Muse I* from 1965 which is a stained acrylic painting, and James Aiken's *Swedish Cottage and Shakespeare Garden* from 1959 which is an oil painting—both paintings from the Anacostia Community Museum. **Allison Martin** continued to work with Jia-sun Tsang on several paintings conservation-related projects. **Rebecca Gieseking** worked with Jia-sun on a manuscript based on a plastics conservation project that they began two years ago.
- **E. Keats Webb** worked with Senior Conservator, Mel Wachowiak, on an in-depth exploration of 3D scanning, Quick Time Virtual Reality, High Definition digital video, and Reflectance Transformation Imaging. A publication is pending that will compare the strengths and weaknesses of the techniques in cultural heritage applications.
- In the Textile Conservation Studio, Mary Ballard, Senior Textiles Conservator, oversaw the work of several intern projects focusing on the Black Fashion Museum collection acquired by the National Museum of African American History and Culture. **Cathleen Zaret** finished re-housing the McGee collection of garments,and will turn to repairs on a lovely honeymoon peignoir as she finishes her internship August 30. **Stephanie Spence** worked on rehousing furs, while Laura Dellaccio worked on wool capes, all from the Black Fashion Museum (BFM) collection. **Mary Kuhn**, a volunteer working on the BFM project since May, was taught fiber identification on the FTIR by MCI Conservation Scientist, Jennifer Giaccai. from the Black Fashion Museum.
- **Genevieve Bieniosek's** internship focused on projects in a variety of specialty areas. She assisted Carol Grissom (Senior Objects Conservator) with the development of a protocol for cleaning sandstone used to build the NMAI museum on the National Mall. Sample stones of a similar type were treated with various products, evaluated for their impact on the stone, and monitored for their effectiveness in inhibiting biological growth. She assisted Rae Beaubien (Head of Conservation/Senior Objects Conservator) with her on-going study of painted organic objects from ancient Mesoamerica by carrying out the initial lab excavation of an artifact, found in an elite Maya tomb, on loan for analysis and conservation. Paint flakes uncovered in the matrix soil once formed a decorative coating on a now-disintegrated organic substrate, possibly the remains of a painted wooden bowl. With Don Williams (Senior Furniture Conservator), she participated in the conservation of a 19th c. gilded wooden frame, which included removal of extensive overpaint, cleaning the surviving original surface, and creating replacement components of the decoration to fill areas of loss.
- **Sara Mills** completed a 10-week internship with MCI Physical Scientist, Christine France, focused on the stable isotopic geochemistry of colonial era North Americans in an effort to ascertain dietary information and provenance. Nadia Jimenez Cano continued to work with Christine France on several isotope related projects.
- **Amy Marquardt** has studied the environmental corrosion products of a bronze Rodin sculpture housed in the Philadelphia Museum of Art with Research Scientist Ed Vicenzi and Senior Objects Conservator, Carol Grissom. The sculpture "Eve" was sampled under the supervision of Andrew Lins (Head of PMA conservation) as scrapings from 5 regions of the statue. Amy has been engaged in X-ray microanalysis of these particles and has identified a range of corrosion products using clustering algorithms with collaborators at NIST. The phases identified will inform an upcoming restoration project of Eve at the PMA.

Smithsonian
Museum Conservation Institute

MCI **Weekly Highlight** 20 August 2010

Understanding the American Experience, Valuing World Cultures, Unlocking the Mysteries of the Universe, Understanding and Sustaining a Biodiverse Planet

Sara Mills prepares human bone samples from 19th century North American burials for stable isotopic analysis. Sara joined us in the summer of 2010 from Harvard University.

MCI Researchers **Christine France** and **Jeff Speakman** have submitted a National Science Foundation (NSF) Research Experiences for Undergraduates (REU) proposal[1]. MCI personnel involved in putting the proposal together include **Ron Cunningham**, **Jennifer Giaccai**, **Nicole Little**, and **Mel Wachowiak**.

If funded, MCI will establish a REU program that will provide exciting and challenging summer research experiences for six 10-week and two 10-month undergraduate students in the interdisciplinary fields of archaeological and museum conservation science to help them prepare for future careers in science. This program, as envisioned, will serve to enhance traditional classroom education with mentored laboratory research in one of six research areas—*Stable Isotope Mass Spectrometry Analyses of Human Remains*, *Archaeometry*, *Environmental Studies*, *Analytical Studies of Artists Materials and Degradation*, *Documentation of NASM's Space Suit and Accessory Collection*, and *Advanced Imaging of Archaeological Objects*. Students selected for the internship will engage in multiple aspects of ongoing MCI research projects and will acquire basic laboratory skills and an in-depth understanding of the scientific method under the immediate supervision of a MCI staff mentor.

The fundamental goal of this program will be the education and training of undergraduate students who will utilize their unique interdisciplinary experience at MCI to achieve graduate degrees and establish themselves as professional scientists in this field. Students will be placed with a MCI mentor according to their interests and will assist on all aspects of a project including planning, execution of analyses, data analysis, and formulating conclusions. Students will receive training in professional presentation and career and graduate school selection, and will be included, as appropriate, in co-authored peer-reviewed publications and professional presentations at national and international scientific meetings. Insofar as all student interns will necessarily be enrolled in external universities, this program can establish partnerships with institutions across the country and provide their students with hands-on laboratory experience in an established research group. Applications will be solicited primarily through the NSF REU Sites website and the larger Smithsonian Internship Program. Several established minority programs within the Smithsonian Institution will provide additional venues to recruit underrepresented groups of young scientists.

---

1 *Christine France and Jeff Speakman would like to thank Cathy Fletcher (Office of Sponsored Projects) for assistance with preparing and submitting the proposal. Without the able assistance of OSP, permission to submit this proposal to NSF (as Federal employees) likely would not have been granted.*

Smithsonian
Museum Conservation Institute

MCI **Weekly Highlight** 10 September 2010

Valuing World Cultures

MCI has been an integral part of the **American-Mongolian Deer Stone Project** since the signing of a Memorandum of Understanding between the Mongolian Academy of Sciences, the Museum of Mongolian National History, and the Smithsonian Institution in 2004. In collaboration with the Arctic Studies Center of the National Museum of Natural History, MCI staff have participated in nine field seasons and contributed to annual field reports, conferences, and a 2005 project monograph http://www.mnh.si.edu/arctic/html/pub_field.html.

Mongolian Field Research. Above: Khotgoid worship structure, ovoo with characteristic construction from uprooted larch trees decorated with a sheep skull. Below: West Taiga reindeer herders with gifts of hay-cutting blades, salt, and children's books in front of an ortz (tipi).

- **Climate change in the subarctic reindeer pastures.** MCI Deputy Director **Paula DePriest** conducted field work in July and August 2010 in two reindeer camps in northern Mongolia - reportedly the southernmost domesticated reindeer herds in the world. In response to changes in climate and pasture conditions, the West Taiga reindeer herders, ethnic Dukha, have divided their reindeer among two summer pastures for the first time in our study period. Almost half of the herd was moved to a remote pasture, a one and a half day migration from the main pasture at Minge Buleg, in a search of better grass. A comparison of vegetation and climatic conditions by Mongolian project member J. Oyumaa has demonstrated a link between rising temperatures and decreasing pasture health in a nearby area. In addition, discovery of gold near the reindeer camps has created a gold rush with thousands of *Ninja* gold miners streaming into the area, causing social upheaval and ecological damage. [MCI Director **Robert Koestler** is currently translating critical ethnographic literature on the Dukha ethnic group from French into English.]
- **Worship structures define ethnic groups.** Paula DePriest continued to document with photographs and GPS locations traditional outdoor worship structures of Hovsgol Aimag (Mongolia's northern province), adding 67 ovoos (piles of rock or tipis of wood that mark sacred areas), sacred trees, and medicinal springs to the 2009 database of 45. The focus this year was comparing the worship structures of four ethnic groups, Khalkh, Khotgoid, Darkhad, and Dukha. Because the location and construction of these worship structures reflects the important landscape and ecological resources for a group, the structures will be important windows into their ecological concepts. A catalog of worship structures will be published in the next year.
- **Deer Stone catalogue nearing completion.** MCI Head of Conservation **Rae Beaubien**, Senior Conservator **Mel Wachowiak**, and former fellow Vicki Karas are completing a database of Mongolian deer stones, many of them with 3D images. A catalog of these Bronze Age monuments will be published in the next year, with an on-line exhibit. Three new deer stone sites were documented with photographs and GPS locations in the 2010 field season.
- **Donation presented to Mongolian reindeer herders.** On behalf of the Arctic Studies Center and donor Rikki Saunders, Paula DePriest presented a gift of 32 hay-cutting 'sickles,' animal salt, and children's books to the reindeer herders of the West Taiga. Changes in precipitation patterns over the past two years, with drier summers and snowier winters, have caused disastrous zuds, a weather condition in which livestock can not find fodder through deep snow cover and die from starvation. The 2010 zud killed an estimated 20 million Mongolian farm animals, including many of the horses of the reindeer herders. The gift of sickles will help the herders prepare extra hay for the next winter.

Smithsonian
Museum Conservation Institute

MCI **Weekly Highlight** 17 September 2010

Valuing World Cultures/Universe

The partnership of the French national synchrotron facility — **SOLEIL Synchrotron**, its ***Institut Photonique d'Analyse Non-destructive Européen des Matériaux Anciens*** **(IPANEMA)** platform, and the Museum Conservation Institute (MCI), formalized with an MOU signing in June 2010, is moving to a new level with the formation of collaborative teams and projects.

- **Proteomics for the dating of antiquities.** On September 9, MCI Research Scientist **Mehdi Moini** visited our MOU partners at SOLEIL to discuss use of the synchrotron's beamlines for proteomics studies of archaeological specimens and antiquities. Although the group determined that SOLEIL does not have the appropriate instruments for the project, they agreed to form a three-partner collaboration, between MCI, SOLEIL/IPANEMA, and ***Centre Laser Infrarouge d'Orsay*** (CLIO) Free-Electron Laser (FEL), to study intact non-soluble proteins, such as hair keratins, using laser MRI and MALDI. The goal is to develop a novel method for estimating the age of human and animal hair. The CLIO FEL is a French user facility producing a high peak power and tunable wavelength laser beam, in the mid-infrared spectral range, well suited to these experiments. Dr. Moini also visited our sister organization ***Centre de recherche sur la conservation des collections*** **(CRCC)** at *Muséum national d'Histoire naturelle* and presented a seminar on the use of proteomics in the museum setting.

Right --1852 cyano-type photograph "*Poppy*" by Anna Atkins, who produced the first photographic ally illustrated book, proposed for CRCC Prussian blue exhibit. From the collection Victoria & Albert Museum, London.

Below: French national synchrotron facility, SOLEIL, located just south of Paris.

- **Proposals for SOLEIL beamline time.** Research Associate **Claire Gervais** and Research Scientist **Ed Vicenzi**, have submitted two proposals to SOLEIL for beamline time to complete the study of the fading of Prussian blue, the earliest modern synthetic pigment. The pigment, used in early cyanotype photographs, blueprints, paintings, textiles, etc., is electrochromatic — changing from blue to colorless upon reduction — and therefore fades when exposed to light or anoxic conditions. The proposals are to study the phenomenon of fading due to the transition from iron (III) to iron (II) by using X-ray diffraction on the CRISTAL beamline to study the location of the different forms of iron in the Prussian blue crystal structure, and using the XANES, EXAFS, and SAMBA beamlines to study the role of the substrate typically found in museum collections, e.g., paper, gelatin, textiles, in partnership with CRCC.
- **Unlocking the Mysteries of the Universe Idea Fair.** Two MCI Research Scientists, **Mehdi Moini** and **Ed Vicenzi**, participated in the Universe Idea Fair on September 13. Dr. Moini's presentation **"Handheld device to detect life on Mars"** described a project to develop a new flight instrument that integrates the core technologies — lab-on-a-chip microfluidic sample handling, ultrafast capillary electrophoresis (UFCE), and portable mass spectrometry (MS) — to look for chemical indicators of life. Dr. Vicenzi's proposal, presented by his collaborator **Eric Silver (SAO), "A new method for studying interstellar dust returned by NASA's STARDUST Mission Searching for the Building Blocks of the Universe"** described integrate two advanced technologies — 1) cryogenic X-ray microcalorimeter spectrometer built at SAO, and 2) a novel nanoscale-control electron beam-induced etching (EBIE) method to remove silica aerogel used to capture interstellar grains by NASA's STARTDUST spacecraft. While thousands of comet grains were collected only a few interstellar grains are available for study and the MCI-SAO team has perhaps the most innovative proposal for decontaminating and analyzing this precious material that provides a snapshot of solar system precursor matter.

FY2010 Education and Outreach (Revitalizing Education and Broadening Access)

November 3-5, 2009
DHS-ICE/CHC Training Course
SI Staff from NMNH, FSG, NMAfA, NMAI and MCI

November 13, 2009
From the nanostructure of an Ancient Greek vase to the field study of rapid stone decay: Recent adventures in analytical imaging for conservation
Eric Doehne, The Getty Conservation Institute

November 20, 2009
Identification of organic colorants: from fibers to walls
Cecily M. Grzywacz, The Getty Conservation Institute

December 17, 2009
RTI@MCI: A New Method in Computational Imaging
Mel Wachowiak and **Keats Webb**, Museum Conservation Institute

January 6, 2010
Recent Developments in MALDI-TOF for Microbiology and Tissue Classification
Gary Kruppa, Bruker Daltonics, Inc.

February 2, February 16, February 23 and April 20, 2010
Corcoran/SI Program: exhibit design and furniture connoisseurship
Don Williams, Museum Conservation Institute

March 9-12, 2010
DHS-ICE Workshop: Preventing illicit trafficking/Protecting cultural heritage
SI Staff of MCI, NMNH, FSG, NMAfA, HMSG, OIR, OUSHAC, and others

March 30, 2010
World War II Aircraft: Museum Object… Antique… or Archaeological Site?
David Morris, Curator of Aircraft, Fleet Air Arm Museum, Bournemouth University

April 15-16, 2010
Biocontrol workshop

April 26-29, 2010
Modular Cleaning Program Workshop
Chris Staroudis, Private Paintings Conservator, and **Tiarna Doherty**, Associate Conservator of Paitings, J. Paul Getty Museum [Co-sponsors: MCI and NGA, Conservation Division]

May 10-11, 2010
Microscopy and Imaging Workshop

May 24-28, 2010
Cleaning 2010: New insights into the cleaning of paintings

June 10, 2010
SI-Conservation 3rd Annual Conference
Ana Alba (HMSG): Update: Materials Analysis of Richard Diebenkorn's *Ocean Park #111* and Paintings Survey for the Move to Pod 3
Amber Kerr-Allison (SAAM): Surface, Texture, and Color: Exploring the materials and artistic techniques of Henry Ossawa Tanner
Ainslie Harrison (NMAI): Update: Technology of Pre-Columbian Gold in Panama: A Study of Fabrication & Compositional Analysis
Kate Moomaw (HMSG): Seeking Old Rubber Bands
Elizabeth Beesley (FSG/DCSR): Investigating Conservation Treatment for Water Logged Asian Lacquer: Implications for Long Term Care
Javier Iñañez (MCI): Technological Features and Provenance of *Indigena ware* ceramics in Colonial Mexico
Yoonjo Lee (NMAI): Parafilm M Fills for a Mexican Lacquered Gourd Vessel
Beth Antoine (SIA-SCAC): The conservation of letterpress copying books: a study of the Baird collection – a progress report

September 15, 2010
PLEX-ID: Broad Microbian Identification with High Resolution Strain Typing using PCR Mass Spectrometry
Greg Eppink, Abbott Molecular

FY2011 Education and Outreach (Revitalizing Education and Broadening Access)

October 29, 2010
Surface Morphology Investigations of Pre- and Post-Conservation Processes: Techniques & Analysis.
Thomas G. Mathia, Senior Scientist, Laboratoire de Tribologie et Dynamique des Systemes Centre National del la Recherche Scientifique, and Serge Carras, CEO, ALTIMET

November 2-5, 2010
DHS-DOS-SI ICE Workshop on "Preventing Illicit Trafficking/Protecting Cultural Heritage.
SI Staff from MCI, NMNH, and NMAI

November 18, 2010
Synchrotron SOLEIL IPANEMA: Recent Results and Perspectives for Synchrotron Studies on Cultural Heritage.
Dr. Loïc Bertrand, Researcher and Head of Institut Photonique d'Analyse Non-Destructive Europeen des Materiaux Anciens (IPANEMA), SOLEIL Synchrotron and CNRS

January 20, 2011
Mineral-microbe interactions: Applications to the remediation of metal contaminated environments.
Cara Santelli, Research Geologist, NMNH, Department of Mineral Science

March 1, 2011
Center for the Conservation, Investigation and Study of Cultural Patrimony in Puerto Rico.
Solimar Salas Rodríguez, Museo de Arte de Puerto Rico

March 8-11, 2011
Preventing Illicit Trafficking, Protecting Cultural Heritage; HSI Training Program; [formerly known as ICE training!]
SI Staff from MCI, NMNH, and NMAI

April 8, 2011
Two Conservators' Experiences at the Smithsonian's Haiti Cultural Recovery Project.
Helen Ingalls, Senior Objects Conservator, SAAM, and **Carol Grissom**, Senior Objects Conservator, MCI

May 17, 2011
The Age of Plastic Program Steering Workshop;
HMSG; sponsored by the Smithsonian Consortia for World Cultures and Understanding the American Experience
Odile Madden, MCI

May 24-25, 2011
Smithsonian Climate Change Research Symposium;
Ripley Center; sponsored by the Consortium for Understanding and Sustaining a Biodiverse Planet
Christine France, MCI

May 31, 2011
Response of Historic Materials to Environmental Instabilities.
Dr. Łukasz Bratasz, Polish Academy of Sciences

June 16, 2011
The 4th Annual Smithsonian Institution Conservation Conference: included **Secretary Clough as Key Note Sp**eaker; Catherine Harris, as invited speaker, and 6 Fellows presenting 7 topics (MCI – C. West, SIA – Anna Friedman (2x), NMAI – Lauren Horelick, Luba Dovgan-Nurse, FSG – Federico Carò, SAAM – Laura Kubick)
Mary Ballard, MCI Moderated

August 17, 2011
Heritage Preservation Webinar
Mary Ballard, MCI

2010 Fellows, Interns, Visiting Researchers, and Volunteers

Naoko Araki, *Intern*, MALDI-Mass Spectrometry to detect deamidation of wool samples
Sara Babo, *Paintings Conservation Fellow*, Cleaning modern and contemporary art
Genevieve Bieniosek, *Volunteer/Intern*, 'Ain Ghazal and Object Projects
A.Elena Charola, *Visiting Scholar*, Symposia Series
Kimberly Cobb, *Intern*, Archaeological objects conservation
Laurie Dellaccio, *Volunteer*, Black Fashion Museum Costume Collection
Victoria Florey, *Intern*, Technical Studies projects
Maria Fusco, *Kress Conservation Fellow*, Glass Bead Conservation and Analysis
Claire Gervais, *Visiting Scholar*, Research and Analysis of Ancient Textile
Rebecca Giesking, *Intern*, Paintings
Martha Goodway, *Emerita*, Metallurgist
Danielle Haswell, *Intern*, Raman reference library of minerals and elastomers
Ainslie Harrison, *Fellow*, Archaeological Conservation
Greg Henkes, *Contractor*, IRMS; Fellow
Javier Iñañez, *Post-Doctoral Fellow*, Spanish Colonial Pottery
Nadia Jimenez Cano, *Post-Graduate Chemistry Fellow*, Fatty Acids on Paints and Archaeological Pots
Laurie King, *Intern*, Paintings
Kathryn Klaudenberg, *Volunteer/Intern*, Proteomics and conservation science
Joe Koles, *Volunteer*, Mechanics
Mary Kuhn, *Volunteer*, Black Fashion Museum Costume Collection
Odile Madden, *Fellow/Contractor*, Arsenic and Heavy Metal Pesticides Project
Amy Marquardt, *Intern*, Bronze corrosion and patinas
Allison Martin, *Intern*, Conservation of Modern and Contemporary Arts
Benjamin Martinez, *Intern*, CE-MS analysis of D/L amino acids of wool samples
Sara Mills, *Intern*, IRMS projects
Michele Pagan, *Volunteer*, Non-Invasive Upholstery
Dawn Rogala, *Post-Graduate Fellow*, Modern painting materials and ground layers
Caroline Solazzo, *Visiting Scientist*, Prometics and animal fiber identification
Stephanie Spence, *Intern/Contractor*, Black Fashion Museum Costume Collection
E. Keats Webb, *Volunteer/Contractor*, Imaging projects
Cathleen Zaret, *Intern/Contractor*, Black Fashion Museum Costume Collection

2011 Fellows, Interns, Visiting Researchers, and Volunteers

Emily Aloiz, *Fellow*, Investigate of the feasibility of non-destructive measurement of moisture in porous materials using frompt gamma neutron activation
Cecil Krarup Andersen, *Pre-Doctoral Fellow***,** 'Lining of Danish Golden age paintings. The mechanical effect on moisture and temperature sensibility'
Blair Wallace Greene Bailey, *Intern***,** Basic Characterization and testing of paint samples using FTIR-ATR, GC-MS

A.Elena Charola, *Visiting Scholar*, Symposia Series
Aiofe O'Halloran, *Fellow,* Analysis of *Nautilus pompilius* shell
Wang Chong, *Visiting Scientist***,** Biocolonization on Mankato Kasota Stone
Kimberly Cullen Cobb, *Contractor,*
Laurie Dellaccio, *Volunteer Intern*, Black Fashion Museum Costume Collection
Juliane Derry, *Intern,* Furniture Conservation and Finishing - Shellac
Charlotte, R. Doney, *Intern,* Stable Isotope Analysis
Kaitlin E. Edwards, *Volunteer Intern*, Wood Conservation
Claire Gervais, *Visiting Scholar*, Research and Analysis of Ancient Textile
Martha Goodway, *Emerita*, Metallurgist
Daniela Gross, *Intern,* Furniture Conservation and Finishing
Marci Ann Jefcoat, *Intern***,** Characterization of Polymer Composite Materials by Raman Spectroscopy
Kathryn Klaudenberg, *Intern,* Proteomics and conservation science
Casey Kohnhorst, *Intern,* Proteomics and conservation science
Joe Koles, *Volunteer,* Mechanics
Mary Kuhn, Volunteer *Intern*, Black Fashion Museum Costume Collection
Anastasia Lewis, *High School Intern***,** ID of resins and running samples of resins on the GC-MS **Seed Project**
Allison Martin, *Intern*, Conservation of Modern & Contemporary Arts
Molly McGath, *Intern,* Investigate interaction of cellulose acetate and triphenyl posphate in polymer composites
Whitney Miller, *Intern,* Chemical Analysis of Bone and Teeth
Laura Mina, *Fellow***,** Fashion History Research MCI
Aiofe O'Halloran, *Fellow,* Analysis of *Nautilus pompilius* shell
Michelle Pagan, *Volunteer,* Non-Invasive Upholstery
Hae Min Park, *Intern,* Conservation of Modern & Contemporary Arts
Gretchen Peppers, *Intern,* Building a Resin Library using GC-MS
Bartosz Rachwal, *Pre-Doctoral Fellow*, Computer modeling of panel paintings exposed to fluctuation in relative humidity
Solimar Salas Rodriguez, *Visiting Scholar,* Investigation and Study of Cultural Patrimony in Puerto Rico
Dawn Rogala, *Post-Graduate Fellow,* Modern painting materials and ground layers
Alyssa Sanders, *Intern*, Black Fashion Museum Costume Collection
Caroline Solazzo, *Visiting Scientist*, Prometics and animal fiber identification
Hannah Tubb, *Intern,* Furniture Conservation
E. Keats Webb, *Contractor,* Imaging projects
Donald L. Williams, *High School Intern***,** ID of resins and running samples of resins on the GC-MS **Seed Project**
Cathleen Zaret, *Visiting Scholar*, Anoxia Research of Art & Artifacts

Table of Contents

PROJECT DESCRIPTIONS

The following section gives a short synopsis of most of the technical and conservation projects MCI staff collaborated on during FY2010. There were 161 projects for 22 Smithsonian museums, research units, and 9 other collaborators including the Folger Shakespeare Library, the Library of Congress, National Park Service, the Office of the Architect of the Capitol, the US House of Representatives and Senate.

Anacostia Community Museum

MCI 6336 Painting: *Muse I* by Sam Gilliam

MCI Staff: Jia-sun Tsang, Laurie King

Muse I by Sam Gilliam is a large, stained acrylic painting on unprimed canvas, recently acquired by the Anacostia Community Museum. Sam Gilliam is a local and current artist in Washington, D.C., who influenced African American artists and the entire Abstract art movement. The painting had some damage when acquired from built up surface dirt on the matt black paint and some abrasions were paint was removed. The conservation process included development of a dry cleaning technique to remove dirt and inpainting to minimize damage due to paint loss.

MCI 6337 Painting: *Swedish Cottage and Shakespeare Garden* by James Aiken
MCI Staff: Jia-sun Tsang, Laurie King

Swedish Cottage and Shakespeare Garden is a varnished oil painting from 1959 by James S. Aiken, which was acquired with a number of other Aiken paintings by the Anacostia Community Museum. Aiken was an artist who painted a number of historical cities and landscapes, and the lives of African Americans at the time. The varnish had yellowed with age, distorting the original pigments. The painting suffered from collection of surface dirt, vanish yellowing, and paint loss. Cleaning, inpainting and re-varnishing was performed on the work of art.

Photo by Don Hurlbert, NMNH, CSIP

MCI 6338 Painting: *3PM in the Studio* by Kenn Simpson

MCI Staff: Jia-sun Tsang, Rebecca Gieseking

Kenn Simpson's still life painting *3 PM in the Afternoon* depicts an arrangement of five pots and pitchers on a white cloth on a table. The painting is painted freely with a range of grays and browns. The paint varies from very thin washes to impasto areas. The medium was determined to be acrylic. The painting was painted on a canvas board, which was bowed and was covered by a thick layer of dust and dirt, particularly near the bottom edge, which obscured the subtle color differences. The frame was dusty, and the painting was poorly secured in its frame.

The buckling was corrected by closed contact with lightly misted blotting paper under weight. The dirt and dust were successfully removed with an eraser followed by slightly moistened cotton swabs. The artist's original intent in colors, contrast, and subtlety shifting and blending in color was regained through the treatment.

Photo by Don Hurlbert, NMNH, CSIP

MCI 6339 Painting: *Lake and Golf Course, Van Cortland Park, NYC* by James Aiken

MCI Staff: Jia-sun Tsang, Rebecca Gieseking

This oil landscape painting depicts a lake and golf course in New York City's Van Cortland Park. Mr. Aiken, a Sunday painter, enthusiastically painted the genteel urban atmosphere of the African American community in New York City, and his cityscapes are about what he encountered in his daily life with friends and family in the neighborhood in the 1930s to 1940s. The Anacostia Community Museum owns a series of Mr. Aiken's cityscape paintings. These paintings record "humanity in motion" at a specific time and place in the life of the African American Community. Mr. Aiken's interpretation of the interrelation between society and the urban context is valuable. The Anacostia Community Museum would like to preserve Mr. Aiken's work, celebrate his accomplishments, and plan for a future one-man exhibition.

There was an uneven layer of natural varnish on the painting, which had yellowed and darkened. There were two areas of significant paint loss and several scratches in the paint. The painting was poorly secured in its frame. Conservation focused on removing surface dirt and darkened varnish, inpainting the damaged areas of the painting, and attaching the painting properly to the frame for display.

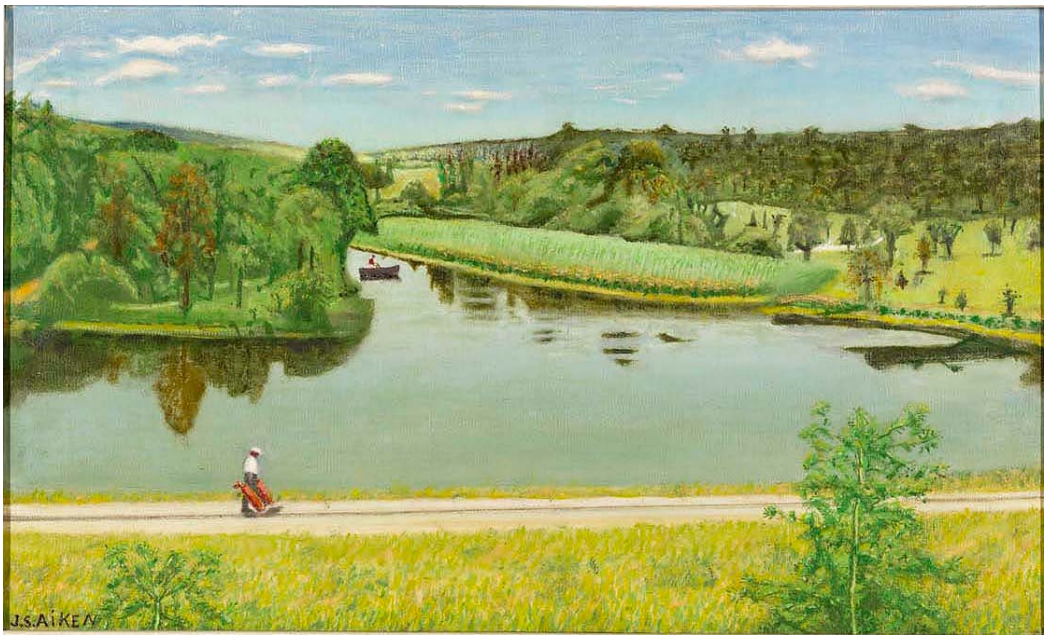


Photo by Don Hurlbert, NMNH, CSIP

Cooper-Hewitt National Design Museum

MCI 6190 Conservation of ivory-inlaid and ebony cabinet on stand

MCI Staff: Don Williams, Mel Wachowiak, E. Keats Webb

Stabilization of this extremely finely inlaid chest cabinet to make exhibitable. The cabinet has developed cracks and lifted pieces in the ivory inlay on wood. The secondary goal it to understand, by an analysis of the specific woods, methods and materials of construction, more precisely the location and date of creation in addition to conserving a well-made object that displays numerous techniques and materials. The analysis also will help to establish whether the stand is original to the object.

Freer Gallery of Art/Arthur M. Sackler Gallery of Art

MCI 6289 Paper molds of archaeological monuments

MCI Staff: Mel Wachowiak, E. Keats Webb

A new imaging technique, reflectance transformation imaging, was developed for these paper sheets, with the ultimate goal of recording all 400 sheets in the FSG collection. The FSG would like to make these images available on their webpage. These rare paper molds were produced by the German archaeologist Ernst Herzfeld in the early 1900s at various Near Eastern archaeological sites. In many cases they are the only extant legible examples of the inscriptions carved on the walls. By making the images available on the internet, scholars and the general public will be able to study and translate the inscriptions. In addition, digitizing this collection will preserve the objects, which in some cases area now the primary records.

MCI 6319 Korean glass beads

MCI Staff: Nicole Little

The composition of Korean glass, mostly in bead form, associated with a lacquer box of miscellaneous Korean objects in the Freer collection will be determined by XRF techniques, and the source for these objects potentially established. Source information will be compared to a Japanese map attached to the lid, which has marked provenance locations presumably providing provenances for the glass.

MCI 6348 Paper molds of Near Eastern inscriptions

MCI Staff: Mel Wachowiak, E. Keats Webb, Jeff Speakman

This collaborative project with FSG will produce a digital document archive using reflectance transformation imaging that will be available for scholars and the general public via the web. The intent is to further the understanding of these rare molds and produce translations and other collaborations. Development of methodology for spatial data capture of this unique material; publication/presentation expected.

MCI 6360 Use and selection of natural versus man-made mercury sulfide in China: development of a method to differentiate them

MCI Staff: Christine France

Both natural (cinnabar) and synthetic (vermilion) forms of the red pigment, mercury II sulfide, HgS, are known to have been in use in China, where the pigment occurs widely in archaeological contexts. However, differentiation between vermilion from the Chinese dry-process of manufacturing and natural cinnabar is currently not possible. The goal of the research is to develop a method that will discriminate between the two, and possibly identify geological sources of mercury sulfide given sufficient analyses of raw materials. The method will be used to increase understanding of the selection, production, and use of mercury II sulfide pigments in China in terms of past human and social dynamics. Specifically, the investigators propose to develop a method by 1) producing vermilion using traditional methods and characterizing it for chemical and physical properties; and by 2) performing sulfur isotope analysis, total mercury analysis (to arrive at mercury to sulfur ratios), and X-ray fluorescence analysis on the vermilion as well as other selected reference materials. The method development will lay the groundwork for more extensive studies of mercury sulfide from archaeological sites in Shaanxi province, China, including a study of HgS used for ritual versus decorative purposes and a study of HgS in wall paintings from the Qin, Han, Sui, and Tang dynasties.

MCI 6393 Chinese Buddhist Sculptures in the Freer Gallery of Art

MCI Staff: Christine France

The Freer Gallery of Art holds a major collection of Buddhist sculpture, many of which are from (or thought to be from) the cave sites of Xiangtangshan, Gongxian, and Longmen. Little technical research has been done on these materials to date, and our ongoing collaboration aimed at the integration of art historical aspects of the sculpture with scientific data to construct the most complete understanding of our collections, their origin, and history. Several additional object-specific issues will be addressed, such as whether free-standing sculpture is similar in rock type and treatment to those carved in-situ.

Hirshhorn Museum and Sculpture Garden

MCI 6253 Painting: *Ocean Park #111* by Richard Diebenkorn

MCI Staff: Judy Watson, Jennifer Giaccai, Mel J. Wachowiak

Examination of the condition of *Ocean Park No. 111* revealed some significant condition issues, most clearly a number of cracks. Examination also revealed a thick translucent layer of stretch material between the painting ground layer and the canvas, applied as a canvas size layer. This project sought to identify the materials used in the painting's construction and determine if the paint materials affected the severe cracking on *Ocean Park No. 111* and related paintings from other museums.

Five other paintings in the Ocean Park series were examined and samples analyzed as a part of this study. In all of the paintings with a size layer, the size was applied extremely thickly and consisted of the same acrylic medium. The size layer was coated with an acrylic ground, in all but one, and generally had multiple alkyd and oil paint layers.

In paintings without the size layer an acrylic ground and alkyd paint layers were still identified which suggests the sizing layer is a significant contributor to the formation of cracks. The structure of the paintings appeared to be canvas, ~100 μm of acrylic size, ~10-40 μm of acrylic ground, topped with 4-10 layers of alkyd and oil paints (up to 110 μm total paint thickness). The difference in brittleness between the acrylic size and alkyd paints allowed cracks to form in the paint layers. The size separated the paint layers from the stiffer stabilizing effect of the canvas and allowed cracks to propagate. Documentation revealed that paintings that had had a more extensive travel exhibition schedule also had greater cracking, this led to the recommendation to restrict travel for *Ocean Park No. 111*.

MCI 6300 Plastic and Rubber Sculptures

MCI Staff: Jennifer Giaccai, Marion Mecklenburg

This work will contribute to a postgraduate fellowship project to examine and treat plastic and rubber sculptures in the collection of the Hirshhorn Museum and Sculpture Garden.

Part of this project is a condition survey of sculptures in the collection with major components in plastic or rubber. The survey will include examination and documentation of the works, as well as specification of storage conditions, minor treatment, and re-housing when necessary. Identification of the polymers of the various plastic and rubber materials is highly desirable as different plastics can be difficult to distinguish through visual examination alone, and many have special storage and treatment needs.

The second part of the project is a more involved treatment of one of the sculptures that will be included in the survey, *Fishman* (1968) by Paul Thek, which is a hollow, latex rubber cast that has become brittle and distorted due to degradation of the latex. Treatment will involve structurally stabilizing the work and repairing tears and losses in the latex. Research is needed to find an adhesive for use in the course of the treatment that has appropriate tensile strength, flexibility, and reversibility properties.

MCI 6424 Identification of Oil on Man Ray's "Nut Girls"

MCI Staff: Jennifer Giaccai

The walnut half used in a Man Ray collage, Nut Girls (*Les Filles des Noix*), shows a viscous oily substance beginning to collect on the surface. The HMSG conservation staff was concerned that the appearance of the oil droplets was a sign that the walnut half was beginning to deteriorate and giving off walnut oil which was beading on the surface. Analysis of the substance by GC-MS showed that it was not walnut oil, but rather appeared to be poppy seed oil, or another oil with a high palmitic/stearic acid ratio. This suggests that the beading oil droplets are not being produced by the walnut, but rather are due to an oil from another, non-walnut, source that was added to the collage.

MCI 6438 Identification of Materials used in Antoni's "Lick and Lather" Soap Bust

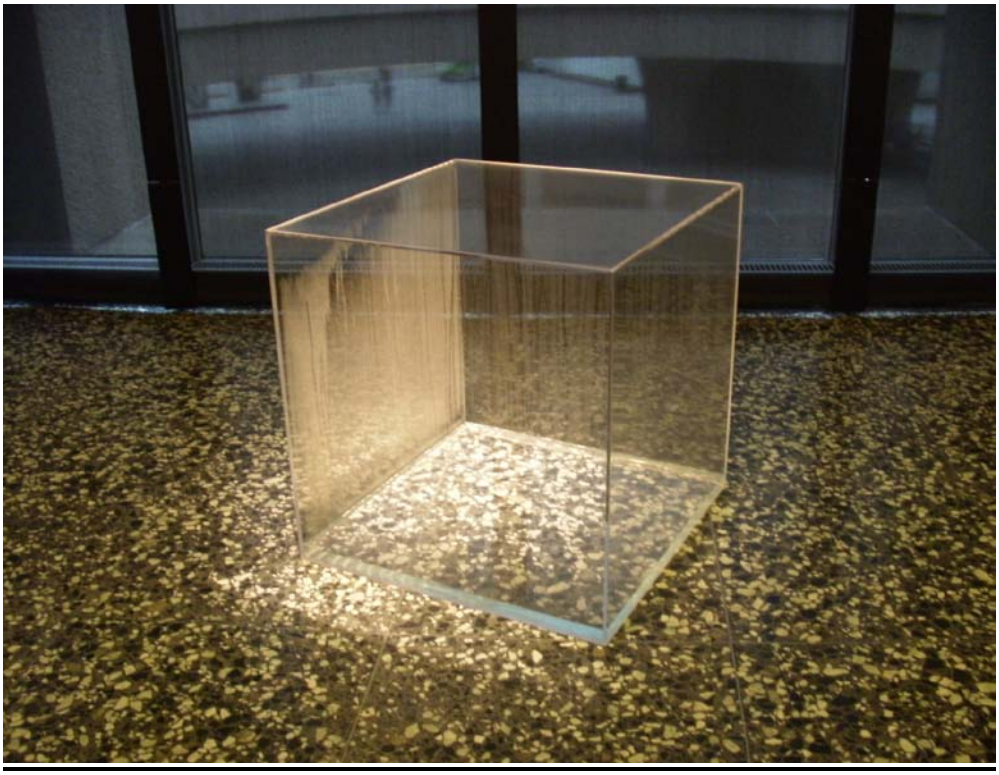
MCI Staff: Jennifer Giaccai, Nicole Little, R. Jeff Speakman

White puff efflorescing material on the surface of the sculpture was sampled for analysis. This is a soap sculpture by Antoni that is being recast. This study hopes to determine if the soap was made by the artist using lard-based soap or later cast by the soap maker employed by the artist using palm and coconut oil-based soap. The presence or absence of fillers will also help to date the casting of this bust within the greater "Lick and Lather" series. The identification of efflorescent material may help determine what is leading to the unwanted (and unacceptable to the artist) deterioration of the sculpture in this fashion, and may help prevent similar deterioration of the recast sculpture.

MCI 6444 Fungal Biodeterioration of "Condensation Cube"

MCI Staff: Hanna Szczepanowska, Paula DePriest, Odile Madden, Carol Grissom

The Condensation Cube, a contemporary sculpture, on exhibit at the Hirshhorn Museum, Washington DC was infested by fungi. The Museum's conservator, Gwynne Ryan, contacted MCI in January of 2011 asking for assistance. Subsequently, on February 3, 2011, a team of MCI's employees examined the Cube in situ, at the Hirshhorn Museum. The goal of the project is to: determine the composition of the (plastic) cube; develop cleaning and aseptic refill protocol; establish an effective biocide; and ensure that the original structure is not affected by the biocide.



MCI 6454 Stain Removal Protocols for Claes Oldenburg Sculpture

MCI Staff: Mary Ballard

Claes Oldenburg's "Soft Bathtub (Model) – Ghost Version" had four water stains and one smear that disfigured the surface of the sculpture. The object was examined and conservation treatment options were recommended. The object was requested for loan to an exhibit scheduled for 2012.

MCI 6457 Coatings Tests for Beeswax, "Palimpsest" Installation Art

MCI Staff: Hanna Szczepanowska

Tests were conducted at MCI to find a suitable coating to protect the surface of this installation art.

National Air and Space Museum

MCI 6282 Painting: *The Fledglings* by Rudolph Dirks

MCI Staff: Jia-sun Tsang, Allison Martin, Genevieve Bieniosek, Sara Babo

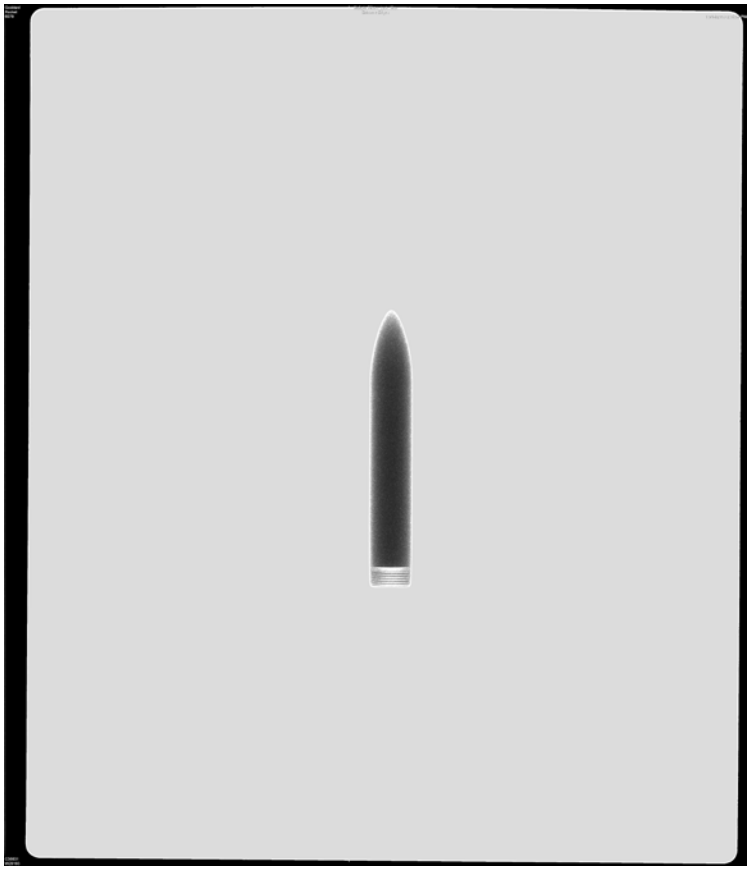
The Fledglings (1908) by Rudolph Dirks, a recent acquisition for the National Air and Space Museum, illustrates a historically important aeronautical meet at Morris Park in The Bronx, New York City. During a previous restoration, the oil on canvas painting was lined to an aluminum panel and reattached to the stretcher bars with tacks and staples. The weight of the aluminum panel had caused the tacking edge to tear and detach from the stretcher bars, making the painting structurally unstable. The project goal was to stabilize and re-house the painting in its original frame that permitted safe handling and display. Minor aesthetic work on the painting was also to be undertaken.

This project involved collaboration among MCI, NASM, NMAI, and OEC, and represented a meeting of the disciplines of art and science. Through an open communication between conservators, curator, and experts in acrylic and green material fabrication, a result was achieved that not only encompassed all of the goals of the project, but did so without sacrificing aesthetics or practicality. The resulting housing design allows one to see the verso of the piece and is secured neatly to the frame; it is also easy to remove and can be handled without directly touching the painting, protecting the delicate edges. Non-intrusive analytical techniques were completed during the treatment process in order to support art historical information and illuminate new information on the artist's working technique.

MCI 6292 1918 Goddard Warhead

MCI Staff: Ron Cunningham

A 1918 Goddard Warhead was radiographied to ascertain the structure of the object (e.g., hollow, possibly with interior components, or solid construction). This information will allow appropriate handling recommendations to be developed at NASM as well as guide treatment decisions for removing corrosion. The object is being prepared for display at NASM, in an exhibition “Pioneers of Flight” to open in the spring 2010.



MCI 6342 Lowell H. Smith's Distinguished Service Medal

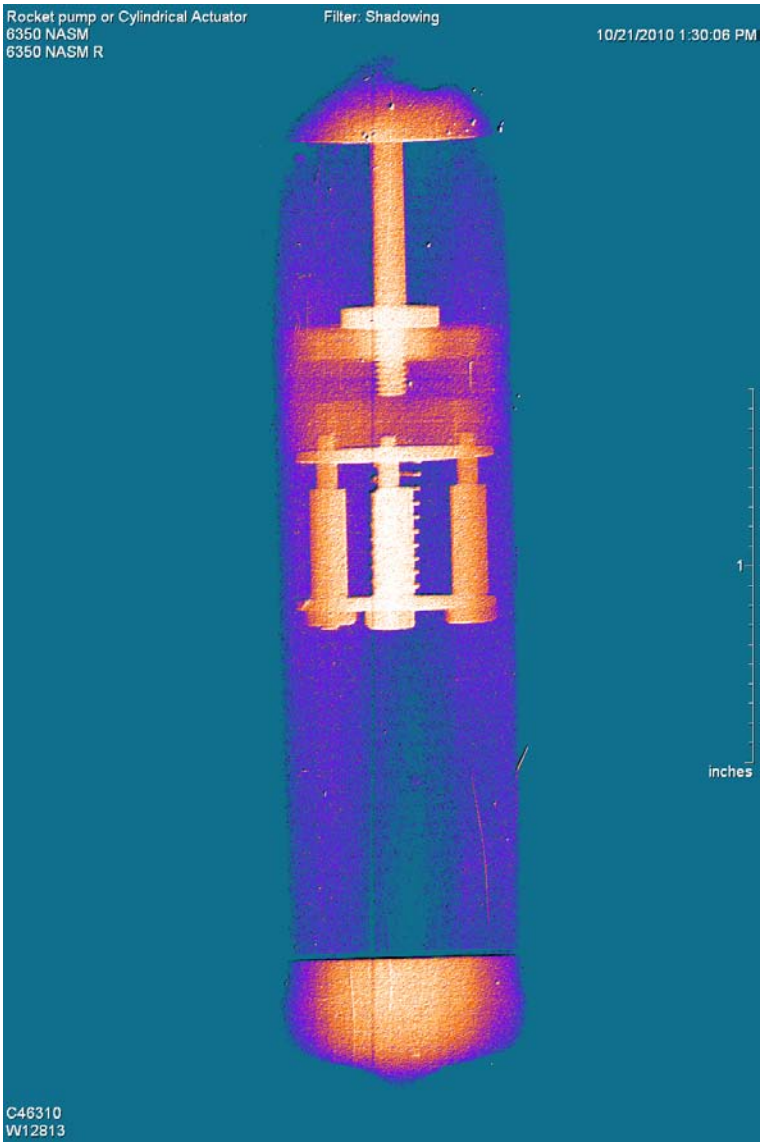
MCI Staff: Mary Ballard

The ribbon of Lowell H Smith's Distinguished Service Medal is highly deteriorated. This is a common problem for ribbons attached to medallions. Since the ribbon is an integral part of the medal, it can not be replaced. A suitable mounting/display method is being sought for the ribbon, that can also potentially be used in the future at NASM with other similar medals.

MCI 6350 Rocket Pump

MCI Staff: Ron Cunningham

Radiography of the cylinder was done to provide information which will help determine the original function of the device. Disassembly may be difficult and increases the risk of damage to the object. There are also concerns that asbestos may be present as an internal gasket material. Radiography should illustrate the internal components and provide sufficient information thus avoiding risk to the object.



MCI 6431 Molecular Characterization and Technical Examination of Historic Aircraft Windows and Head Gear Using Portable Raman Spectroscopy

MCI Staff: Odile Madden

This is the first large scale technical survey of the plastics used in aviation. It leverages the world's largest air and space collection as evidence of the materials and technologies used to create plastic objects in the early 20th Century, and the extent to which they have degraded. The survey will rely heavily on Raman spectroscopy, a technique ideally suited to non-invasive characterization of polymers and 3-dimensional plastic objects. Its potential in the museum context is beginning to be explored. Recent innovations in optical materials have made possible portable Raman spectrometers that can analyze objects directly without sampling.

Early aviation design incorporated the most innovative polymers and polymer composites, commonly known as "plastics", available at the time. Unfortunately, many of these materials now show signs of advanced deterioration. Their material composition and fabrication methods remain a bit of a mystery—documentation was either lacking or has been lost in the intervening years. Without knowing their composition, we can not understand their degradation mechanisms or how to arrest its progress.

MCI 6442 Analysis of Paint on Wood Component, 1905 Wright Flyer

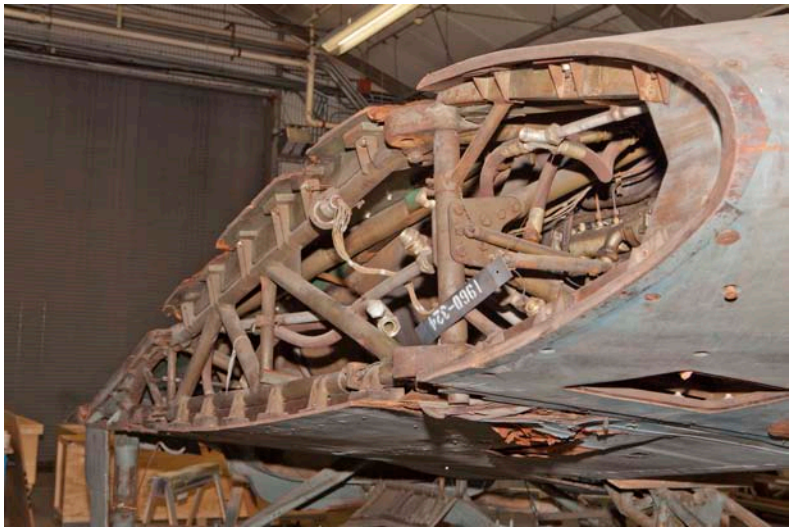
MCI Staff: Mel Wachowiak, Jennifer Giaccai, Jeff Speakman, Carol Grissom

A painted wooden part of the forward elevator actuating mechanism from the 1905 Wright Flyer was examined to characterize: paint binder (nitrocellulose lacquer is suspected); determine the composition of a metal flake (aluminum?); and determine the size distribution of the metal flakes. The results will contribute to the on-going study of the Wright Brothers' aircraft, including how protective and decorative paints were used by the Wright shop.

MCI 6445 Materials Analysis and Stabilization of Horten Ho 9 V3 fuselage

MCI Staff: Don Williams, Mel Wachowiak, Jennifer Giaccai, Nicole Little

The Horton Ho 9 V3 is called the “Flying Wing”. It was twin jet powered, constructed of welded steel with a plywood skin. The goal of this project is to characterize the plywood: to look for any unusual construction features, determine ply thickness, unusual binder or additives; identify paint strata, and the original color; devise a method to stabilize the fuselage for transport to the Udvar Hazy Center; and assist in the stabilization. Identification of the material may answer the questions: if carbon powder had been used as a radar-absorbing material; can we determine the deterioration rate based upon knowledge of the plywood structure and adhesives; and provide historical data about manufacture of the aircraft.

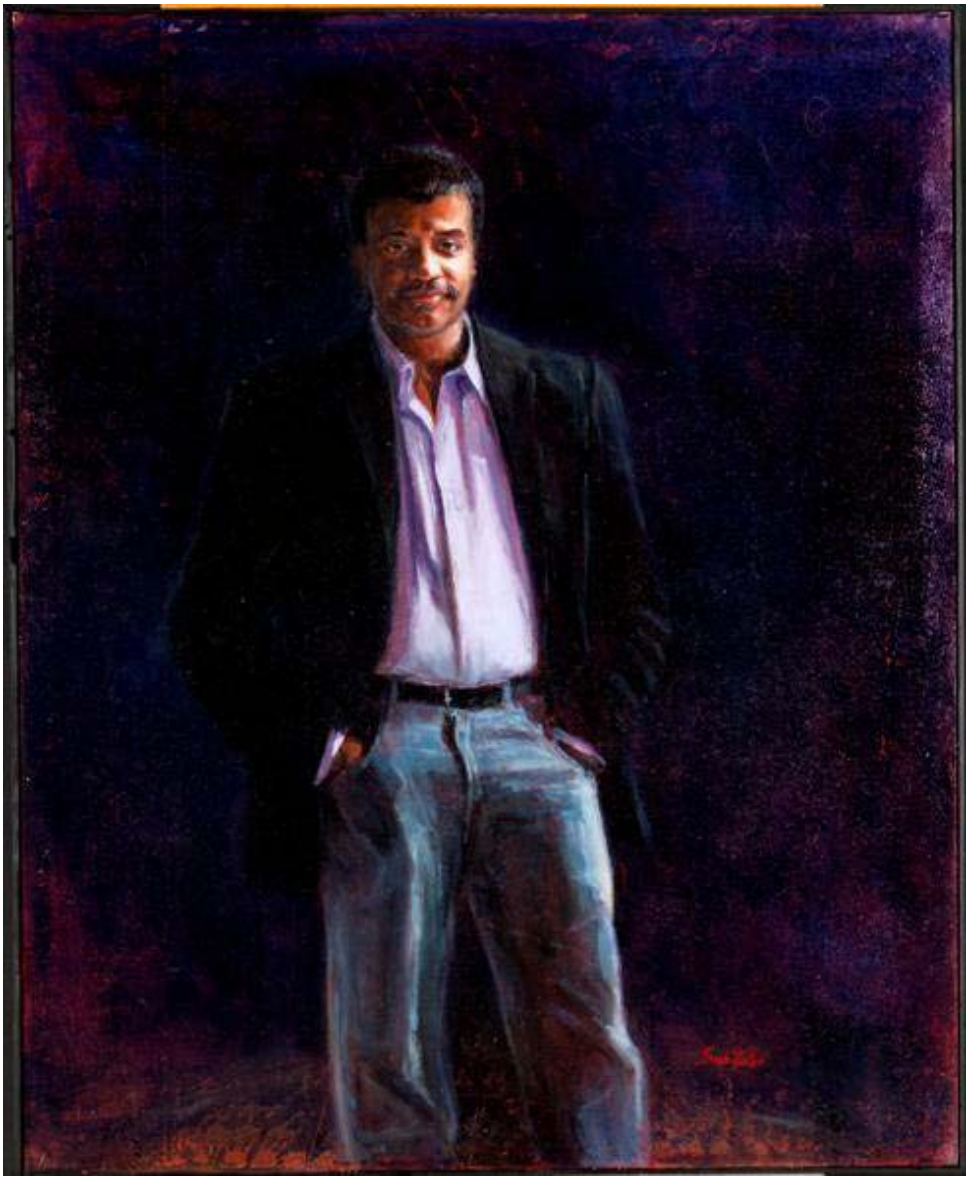


MCI 6451 Condition Assessment of “Portrait of Neil Tyson”

MCI Staff: Jia-sun Tsang, Hae Min Park

The painting entitled “Portrait of Neil Tyson” was brought to the Museum Conservation Institute (MCI) from the Smithsonian’s National Air and Space Museum because the plastic cover had adhered to the surface of the painting. After assessing overall condition of the support, the frame, the paint layer and the degree of adhesion, immediate and extensive treatment was deemed necessary. A series of analyses were performed to determine the paint used, as well as to find a way to separate the plastic from the paint without inflicting damage to the original paint. Samples of the paint were analyzed using FTIR and GC-MS, and samples of paint-adhered plastic were exposed to a low temperature to determine whether softening of the paint could be reversed with coldness. A solvent test was also performed on both the paint layer and plastic to determine whether commonly used conservation-grade solvents have significant ability to separate the paint and plastic. The plastic was ultimately removed with application of the Stoddard solution that was found to loosen the paint from plastic and have no effect on the

original paint and or the surface texture of the painting. After removing the plastic, the painting's overall condition was assessed and a treatment plan was devised. Various debris and hair that adhered to the wet surface of the painting were removed, and Galkyd drier was applied to dry the paint. A new crossbar was made for the frame to provide better support of the painting, and the slackened painting was re-stretched. All major damages to the painting were deemed appropriately accounted for, and the artist was contacted to make final adjustment to the paint loss.



After Cleaning. Image credit: Don Hurlbert, NMNH, CSIP

National Museum of African-American History and Culture

MCI 6070.2 Black Fashion Museum Costume Collection Phase II Re-housing

MCI Staff: Mary W. Ballard, Cathleen Zaret, Stephanie Spence, Mary Kuhn, Jeff Speakman

During FY2010, over 80 garments were accessioned, examined, evaluated and documented for condition. Some garments required analysis in order to ascertain proper identification, dating, and causation of conditions. For a few, the pre-existing condition was quite surprizing while for others extensive investigation was required to document complex construction. In a few cases, careful mending was undertaken, losses or tears were repaired and/or masked by conservation techniques. Any treatments were carried out to stabilize the specimen for storage and handling. Some examples are given below:

One of the difficulties in cataloguing a collection is in providing a definitive identification of the materials associated with a garment. In some cases, MCI's portable and non-invasive identification of instrumentation permitted Transform fur (with Fourier protein Infrared Spectroscopy, for fur on this coat confirmation). The spotted cheetah or was questioned: could it be pattern of the jaguar? The shape and specimens of spots were compared with collection and cats from the NMNH were studied the fur fibers of the coat definitely microscopically. It is trimmed with leopard fur, and definitely mink.

Another material incorporated into this coat was unexpected: orange powder sifted through the multiple tears on the entire coat, including a tear across the back. Exploring that tear revealed the degraded orange foam padding that fell out in chunks and in small particulate masses every time the coat was adjusted or moved. Such degraded foam can be mistaken for insect frass (insect waste material).

Printed Slave Dress

Using a non-invasive (e.g., non-contact with the object) micro-X-ray fluorescence spectrometer the individual colors used in this printed cotton were analyzed along with the background white to determine whether or not mordants were present. Mordants (metal ligands) would indicate that the dyes used in this pattern had been printed with natural dyestuffs. The dark maroon and brown black lines had a high iron content as did the orange stripe; the light orange had no iron but showed the presence of tin; the greenish tan, the presence of both copper and iron. The white background had only a minor amount of iron. The elemental analysis of the dyed pattern, the sewing thread, and the buttons are all consistent with the dress being dated as made prior to the Civil War (1861-65), as is the quality of the stitching and the dress design.

Every piece of fabric yardage was used: flowers between the stripes were set to face upwards in some areas and downwards in others in order to make maximum use of the available cloth. The lining of plain cotton in the bodice had been a sacking cloth bag or something similar. Small tears were abutted and couched with hair silk (very fine silk thread) onto silk crepeline.

This detail shows the back placket, original stitching, and a small area of the verso of the fabric (right side of the slide) where silk crepeline has been laid down to secure a torn area.

A collection of hats was found in a bag, discolored with dry frass and mold. With the aid of a HEPA (high efficiency particulate air filter) vacuum cleaner, each hat was carefully vacuumed inside and out, and shaped for photography and storage. Final steam pressing will only occur prior to exhibition, but now the objects can be seen as they were designed.

Among the gems of the Black Fashion Museum collection are a variety of accessories--handbags, shoes, and gloves—that epitomize a particular era. This handbag is one example, a late 1960's or early 1970's transparent bag with plastic flower rosettes connecting brass rings and a pair of plastic handles made by threading a stack of plastic beads. There is no front or back—no indication which side would be held closer to the body. It could have been held in the hand or carried on the forearm. While the plastics in this handbag are relatively stable and the transparent envelop suffers only minor discoloration and yellowing, other handbags are in a more deteriorated state.

A strapless debutante or cocktail dress, from the late 1950's or early 1960's was processed. The variegation of tone is due to soiling caught in the net overskirts. The top level, a nylon net embroidered by lurex (a polymeric mixture of cellulose acetate/butyrate), is relatively clean. The interior layer is a plain weave of cellulose acetate that is also generally unsoiled. The flounces that give the dress 'bounce' and shape are nylon 6,6 and have absorbed a disproportional amount of particulate soil. While vacuuming can remove some of this soiling, sequential treatments of aqueous cleaning and dry cleaning in whole or in part will be needed to bring this dress back to its party mode for exhibition. In the meantime, the dress will be stable in storage.

MCI 6070.3 Black Fashion Museum McGee Collection

MCI Staff: Mary W. Ballard, Cathleen Zaret, Stephanie Spence, Laura Dellaccio, Mary Kuhn,

Nineteen garments designed by Arthur McGee were transported to MCI and treated anoxically in FY2009 for the National Museum of African American History and Culture. Initially, the project was not meant to include the cataloguing of the garments directly into the Black Fashion Museum collection at MCI. This plan was modified later to do exactly that. The McGee collection is accessioned as the following numbers:

TR2007-5.329a&b Coat & skirt: Lavender tweed
TR2007-5.330 Jacket: Gray with polka dot lining
TR2007-5.331a&b Two grey striped blouses
TR2007-5.332a&b Jacket & Skirt: Denim cotton
TR2007-5.333a&b Cape & Skirt: Red
TR2007-5.334 Cocktail dress: Elephant gray velvet
TR2007-5.335 Skirt: Gray pinstripe
TR2007-5.336 Skirt: Taupe Flared
TR2007-5.337 Skirt: Dark gray heather Flared
TR2007-5.338 Split Skirt
TR2007-5.339 Dress: Gray with Dolman sleeves, Patch pockets
TR2007-5.340 Dress: Light gray/tan Tie collar, long sleeves, patch pockets, buttons
TR2007-5.341a, b, &c Dress, belt, pocket flap
TR2007-5.342 Cape: Hooded, Tweed
TR2007-5.343 Coat: Gray, Swing, with tie collar
TR2007-5.344a&b Dress & Jacket: Kabuki
TR2007-5.345 Cape/coat: Beige twill with tie Collar, patch pockets, enclosed buttons, & covered placket front (buttons)
TR2007-5.346a&b Dress &tie: tablecloth

Dress designed by Arthur McGee

The cataloguing and treatments of these garments extended into FY2010. These garments share a number of design characteristics. They are understated, quiet garments that have interesting cutting and construction methods. The dress shown here has seams in the front and back center but not on the sides. Sleeve construction is often unusual. There are also bias elements (diagonal to the fabric length) and finishing details that harmonize carefully with the drape and weight of the fabric used. Each garment or ensemble in this collection could easily have been the most adaptable, useful, and prized one in a woman's closet.

During treatment

This twill wool cape was constructed of two full half circles, with a circumference at the hem of 263 inches. A two-part hood and four buttons for closure at the neck were the only embellishments. The cape was meant to hang and swirl loosely but could not do so because it was disfigured by distorting wrinkles. These were relaxed by indirect hand steaming. After thorough air drying overnight the cape was photographed and carefully packed with soft paper sausages so it can easily display its jaunty drape in the future.

After Treatment

Kabuki jacket with printed label “Arthur McGee N.Y.C.” at center back, interior

An example of Arthur McGee’s inventive construction lies in this ‘Kabuki’ jacket that provides two pockets with the diagonal slant of the front panels. McGee finished the seams and left the jacket unlined. Worn over a matching gray wool dress, also unlined, the wool flannel pinstripe would have a slightly different drape for such a lightweight fabric. Cataloguing such a garment requires a careful review of the weave direction, dimensions, and cut to describe the object accurately.

During Treatment, view of the front, inside out

One of the best ways to see the sculptural approach that Arthur McGee takes with fabrics is to examine the garment from the inside. The clean lines are precise and the finish of the seams quite meticulous. His approach makes any wrinkle or crease appear particularly inappropriate. Here creases were being reduced by steaming the unlined garment from the inside and using blotter to absorb the moisture. Because of the garment’s construction, the steam relaxation had to take place lying flat and upon itself. Consequently, the front and back were isolated physically, thermally, and with a moisture barrier, so that each side could be treated separately.

MCI 6217.3 Chief's Bag

MCI Staff: Carol A. Grissom, Genevieve Bieniosek, Jennifer Giaccai, Nicole C. Little

This African (Nuna [Gurunsi], Burkina Faso) is constructed of tanned leather, with a flap, closure and strap, is tooled and decorated with leather fringe ending in cowry shells, and has attachments of three wooden whistles, a wooden carving, iron tweezers, and iron picks. White spew was present over much of the leather on the front and in areas of the back and fringe. The spew was visually disfiguring, and the curator requested it be removed. FTIR analysis of the white spew determined it was composed mainly of fatty acids, which could be present as a result of the tanning process and/or post-production application of leather dressing/conditioner. An initial cleaning by mechanical means, and in places with Stoddard solvent, removed all visible spew. However, after one week white spew reappeared in multiple areas on the front and back of the bag. FTIR analysis showed the new spew had a similar composition of fatty acids. The bag was again mechanically cleaned, and the majority of the spew was removed. Future reappearance of spew cannot be prevented with currently available techniques. The bag was packed for transport to storage with the understanding that outbreaks of spew may recur.

Front and back of bag before cleaning

MCI 6217.4 Seven artifacts from a “Civil War shadow box”

MCI Staff: Carol Grissom, Mary Ballard

This report summarizes results of the examination of seven objects purchased by NMAAHC from the collection of Danny Drain to determine if they date to the Civil War period. In addition, a hemp brake (originally identified as a flax swingle), donated by Danny Drain to NMAAHC, was examined to determine its provenance and use.

MCI 6247 Painting: *Behold Thy Son* by David Driskell

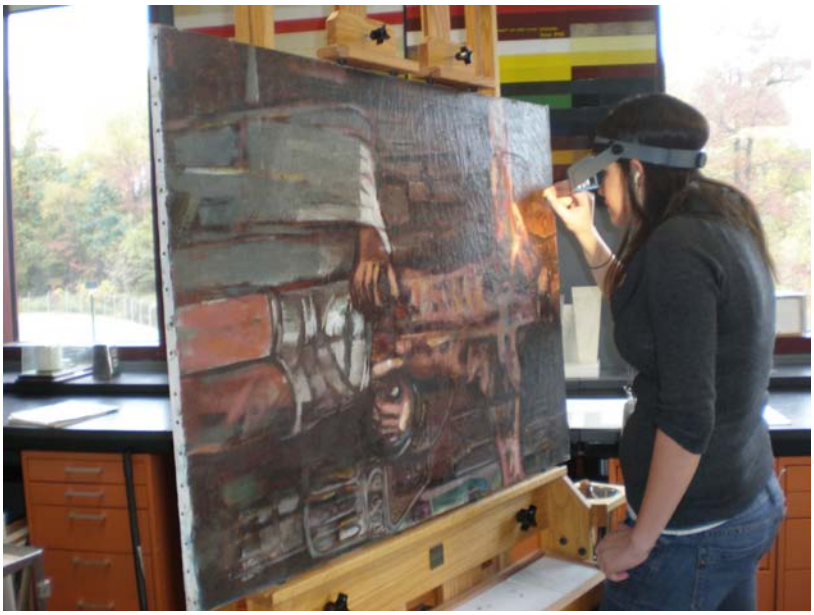
MCI Staff: Jia-sun Tsang, Allison Martin

Behold Thy Son by David Driskell, 1956, is an iconic piece in the artist’s career, representing Driskell’s first attempt at social commentary through painting.

The most prominent problem with the painting was cracking and active flaking of the paint layer. The artist used mixed media to create the piece; water-based media, fluorescent and emulsion paints were used and possibly alkyd paints. The mixed media, in combination with less than ideal environmental storage and display conditions has led to extensive craquelure. The cracking has led to a quilting of the canvas; the canvas has contorted in areas of heavy paint, which has caused pinholes and a general weakening and warping of the canvas. Warping has caused the painting’s dimensions to distort as well. There is a bowing on the right and left sides that has caused the white of the pre-primed canvas to show. These distortions and deformations are not reversible but the paint layer can be consolidated to prevent further loss. Finally, the

varnish is overall uneven. Previous partial cleaning had caused some areas to be matte and other areas to remain glossy. The matte, unvarnished areas appear obscured and the color unsaturated.

The goal is to safely consolidate the paint layer while maintaining the integrity of the painting. In order to do this, it was necessary to stabilize the paint layer from the front. A loose lining was added to create structural support to the weakened canvas as well as work as a barrier from environmental factors such as heat or moisture. Inpainting and varnishing was also completed to create a more homogenous appearance. It was also noted that a new frame is necessary for the piece.



MCI 6291 James Brown Costumes

MCI Staff: Mary Ballard, Cathleen Zaret, Nicole Little

A two-piece red suit, a black 'sex' jumpsuit, and a black cape used by James Brown were anoxically treated for insects, stabilized, examined, vacuumed with HEPA filtered vacuum cleaners, measured, photographed, and packed for shipment for storage and exhibition preparation. The black "Sex" (spelled out with rhinestone studs center front) jumpsuit is apparently a wool double-knit, as there was insect damage on the proper left front of the chest and at the proper left shoulder, as well as loss on the top of right neckline at the waist. Minor loss or grazing appears on the left proper leg and cuff. Breaks in the back seam were restitched.

The Cape, synthetic damask with a synthetic fabric lining, did not suffer insect damage; it showed only light surface soil and small, pinhead-sized white spots on the lining (usually associated with spider frass). The red jumpsuit and vest were in excellent overall condition, although insect carcasses were found in the hem and seam of the vest lining. A disfiguring stain at the shoulder and neckline of the vest were greatly reduced by treatment. The proper left pant legs back cuff on the red jumpsuit has a burn mark as from an iron.

MCI 6294 Jones-Sims House

MCI Staff: Don Williams

The log cabin was dismantled in July 2009, and moved from its original location to Virginia, where reconstruction and restoration work will take place. It will then be dismantled for storage. MCI will provide technical review, oversight, and advice for the reconstruction of the log cabin. The goal is for any restoration and replacement work to be done in a way that would neither mask the original fabrication evidence and materials, nor be so glaring that it would detract visitors' attention from the original pieces and presentation of the structure.

MCI 6313 Timmie Rogers' Tiple

MCI Staff: Don Williams, Nicole Little

The tiple (small three string instrument) was treated with argon suffocation (to eradicate any live insects), cleaned and restrung in preparation for display in the exhibition, "Ain't Nothing Like the Real Thing: How the Apollo Theater Shaped American Entertainment" at NMAH in 2010. After the NMAH exhibit, the instrument is expected to travel with the exhibition for three years.

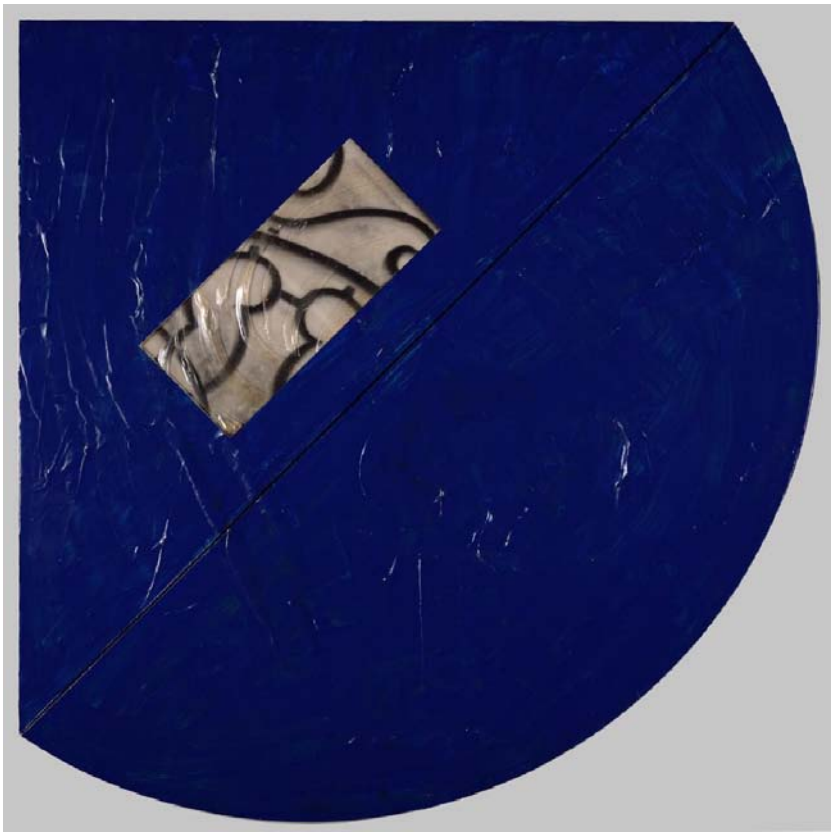
MCI 6335 Paintings: *Wonder* by Sam Gilliam and *Blue Jazz* by Bill Dallas

MCI Staff: Jia-sun Tsang, Rebecca Gieseking, Laurie King

Wonder, 2005, by Sam Gilliam was sent to the NMAAHC as a part of a travelling collection of paintings from the collections of Bernard and Shirley Kinsey. When the collection arrived at NMAAHC all of the paintings were found to be wrapped in plastic sheeting. The plastic wrapping had stuck in a few places to two of the paintings. *Wonder* was one of these paintings.

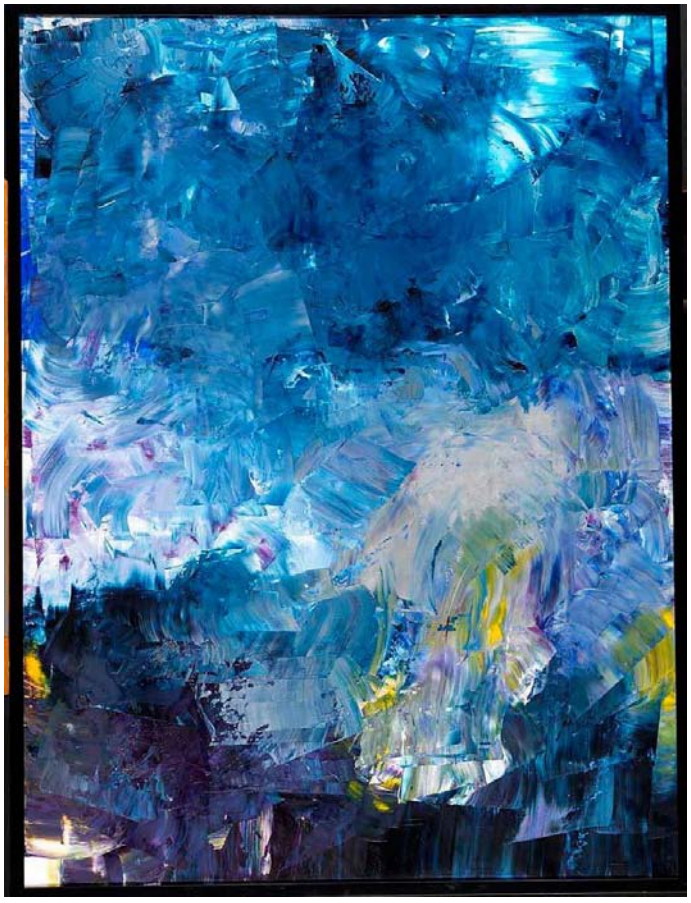
The medium of *Wonder* was determined to be acrylic and acrylic gel. The painting is supported by two boards, one triangular and one semicircular, which are hinged together. The acrylic paint stuck to its plastic cover during shipment. While the plastic was easily removed, there were areas of high gloss caused by the plastic that had adhered to the paint. The painting was also covered with a thin layer of surface dirt.

All treatment and testing were non-invasive and minimal; the purpose was to return the painting to a good display state. The glossy areas were treated and minimized to match the original gloss of the painting.



Blue Jazz, 1995, by Bill Dallas was sent to the NMAAHC as a part of a travelling collection of paintings from the collections of Bernard and Shirley Kinsey. It was the second of two paintings that were found to be wrapped in plastic sheeting that when removed by the collection managers at NMAAHC had plastic stuck in a few places to the paintings.

The medium of *Blue Jazz* was determined to be oil or alkyd paint (modified oil paint). The oil paint was applied to a board of unknown material using a palette knife blending pigments together, giving it a unique texture. The plastic sheeting had adhered to the painting in a few areas. In some of these areas, the plastic stuck to small areas of purple paint which did not match the other colors and patterns of the painting. It was later discovered that this purple paint was still wet and therefore not original to the painting. The project soon became to carefully remove the plastic wrapping without further damaging the painting, removing the unoriginal wet oil paint, and inpainting where original paint had been removed.



MCI 6433 Technical Assessment of Two Painted Metal Signs in the Meyer Collection

MCI Staff: Carol Grissom, R. Jeff Speakman

The objects, being assessed prior to acquisition by the National Museum of African American History and Culture, are purportedly signs used to exclude or segregate African Americans at a swimming pool and in a waiting room in the South. Based on their appearance of recent manufacture, absence of wear or other signs of age, and similarity to many other replicas in the marketplace, it has been concluded that these are not authentic period signs.

MCI 6443 18th Century Men's Silk Suit

MCI Staff: Laura Mina, Mary Ballard

Adhesive samples applied about 1935 to an 18th Century men's silk suit were brought to the Museum Conservation Institute for analysis. While the exact composition of the adhesive was left somewhat unresolved, the detailed examination on the history of the garment and its dating, as confirmed by curator Phyllis Magidson, revealed important historical information on the care and conservation of the garment. In addition, the extensive documentation of the garment permitted a minute sample of its silk to be included as a control data point in a new silk dating project under way at MCI. This dating technique follows the conversion of the amino acid aspartic acid from the "L" form to the "D" form; it has been published in: Mehdi Moini, Kathryn Klauenberg, and Mary Ballard, "Dating Silk by Capillary Electrophoresis Mass Spectrometry," *Analytical Chemistry* 2011, ***83*** (19), pp 7577–7581

MCI 6447 Condition Assessment/Examination of Chesapeake Bay Oyster Boat

MCI Staff: Don Williams

To assess the overall condition and likelihood for conservation and exhibit of a Chesapeake Bay oyster boat with an important provenance, MCI Senior Furniture Conservator Don Williams accompanied NMAAHC researcher Deborah Tulani Salahu-din on a site visit to Quantico MD, May 9, 2011.

The boat is approximately 31' long x 9' wide x 9' high. Though badly degraded the total remaining fabric and configuration of the artifact is surprisingly high, certainly enough remains for a reconstruction into an exhibitable display. This task could be accomplished through collaboration between curatorial interpreters, marine/oyster boat specialists, and exhibits designers and fabricators who could derive an excellent representation of the original artifact.

MCI 6450 Assessment of Civil War-era Metal Badges, Stencil, and Shackles

MCI Staff: Carol Grissom, R. Jeff Speakman

Six metal badges, one stencil, and one shackle were examined to details of materials/manufacture, dimensions and possible dates.

MCI 6458 Condition and Treatment of "Slave Trade" painting

MCI Staff: Jia-sun Tsang, Brittney Shaked

The *Slave Trade* was brought to the Museum Conservation Institute (MCI) from the Smithsonian's National Museum of African American History and Culture (NMAAHC) for condition assessment to determine if any treatment was necessary before being exhibited at *Slavery at the Jefferson's Monticello: Paradox of Liberty*, which runs from January 27 to October 14, 2012. The painting has a small ridge at the lower proper left, but there is no major structure instability. There are two layers of coating, synthetic on top and natural resin below it. The natural resin has darkened and marred the tonal quality of the painting. The craquelures were heavily inpainted previously, most notably in the sky at the proper left side and along the edge near the boat at the proper right side. Upon closer examination, there are numerous areas of heavy-handed inpainting between the top layer of synthetic varnish and the lower layer of natural resin varnish. The degree and location of the inpainting was documented with UV photography during the current condition examination.

Considering the time constraint of the impending exhibition, it was decided not to remove the surface coating and uneven inpainting at this point in time and only to do the minimum inpainting to improve visual quality of the painting. This was implemented by first removing the surface dirt and then by aesthetically integrating the traction crackles and disfiguring marks from the previous uneven cleaning and improper inpainting.

The tonal visual quality of the painting has been improved and preserved by selective and minimal inpainting. The traction cracks toward the bottom portion of the painting were inpainted, creating a less noticeable appearance. Both the color and contrast were regained in selective key figures such as the three depicted behind the boy and dog. The location of the current inpainting was documented with UV photography as part of the after treatment.

Before Treatment

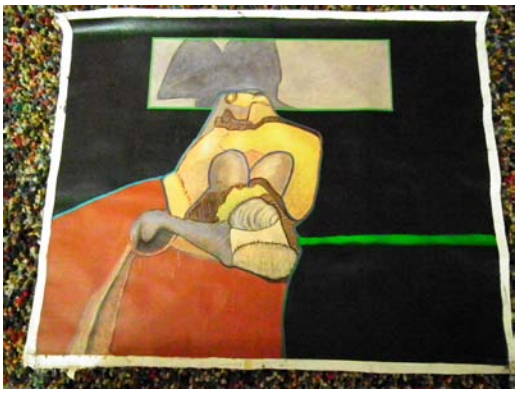
After Treatment

MCI 6463 Assessment and Mounting of Two Coleman Paintings

MCI Staff: Jia-Tsang

Two acrylic-on-canvas paintings, *Founding Fathers* and *Shango's Helper* were examined and treated to provide protection for the paintings and to prepare them for installation in the "Inaugural Exhibitions" for the Visual Arts Gallery in the new museum, scheduled to open in 2015.

"Founding Fathers"



"Shango's Helper"

National Museum of African Art

MCI 6248 African Beaded Dress: Characterizing Deterioration Issues and Investigation of Cleaning Treatments

MCI Staff: R. Jeff Speakman, Nicole C. Little, Judy Watson, Jennifer Giaccai, Maria Fusco

This was part of a study of beaded art at the Smithsonian Institution's National Museum of African Art (NMAfA). The goal was to characterize the conservation issues of African beaded art. Of interest was the condition of the collection and trends in degradation (i.e., greater weakness or stability amongst certain object types, combinations of materials or cultural groups.)

It was anticipated that glass beaded components would be problematic, as had been found on beaded art of other cultures. Of particular interest was whether glass degradation observed here would follow classic glass deterioration patterns, and more specifically, glass bead degradation patterns. This knowledge is important in devising the appropriate treatment regime.

A condition survey of 344 pieces of beaded sculpture and costume from 24 different cultures was undertaken. Trends in degradation were observed 1) in the stability of component parts and 2) amongst cultural groups. Substrates and stringing mechanisms were stable overall; any degradation was attributable to mechanical wear. Degradation of the glass was a distinct problem: 17% of the glass beaded collection surveyed (57 objects) exhibited glass deterioration to some degree. Furthermore the majority of these deteriorating objects (78%) were from just two African regions: 16 from two cultural groups in Cameroon and 28 from one cultural group of South Africa, the Ndebele.

Degrading objects were examined visually noting trends in bead stability. Patterns in the glass' surface integrity and presence of accretions became apparent. Types of degradation were correlated to glass color. They were classified by their physical appearance and an understanding of the underlying chemical trends was sought through instrumental analysis.

A study set of 10 representative objects was formed. Deposits on the glass beads were removed and analyzed using Fourier transform infrared spectroscopy, X-ray diffraction (XRD) in efforts to identify the deposits by general chemical class as well as at a compound level. Qualitative glass compositional analyses were undertaken with scanning electron microscopy with energy dispersive spectroscopy (SEM-EDS) to analyze glass composition and any chemical deteriorative products.

National Museum of American History

MCI 6287 Painting: *Samuel Blodget* attributed to John Trumbull

MCI Staff: Jia-sun Tsang, Allison Martin, Mel J. Wachowiak, Ron H. Cunningham, R. Jeff Speakman, Jennifer Giaccai, Nicole Little

The Portrait of Samuel Blodget has been attributed to the artist John Trumbull and dated 1784, due to existence of several similar known paintings by the artist. The painting, referred to as the INA portrait, in the collection at NMAH is surrounded by speculation as to the validity of this attribution as well as to the identity of the sitter. Extensive research had been done prior to the painting's arrival by Trumbull scholars Theodore Sizer, C.A. Palmer, and Helen Cooper, who consider it an early Trumbull painting. Since the painting's arrival at NMAH, the painting was assessed further by curators at the NMAH and NPG.

The painting was brought to MCI in order to supplement the art historical research with non-destructive and very minor invasive analytical research. Through advanced technological processes including infrared imaging, computed radiography, X-ray diffraction, and polarized light microscopy, new information was obtained about the painting. This analysis in combination with past research on Trumbull's career and techniques as well as pigment history allowed the painting to be attributed with greater confidence.

The goal of the study was to implement available analytical techniques to help determine if the painting could be from the suggested time and region. The results of the analysis support the attributed year and region. Stylistically the painting recalls early Trumbull style. The shadows and basic shapes were defined with quick, confident schematic brush strokes much like a preparatory study for a painting. Thin layers of oil paint were painted in layers which correlate with the period technique. The original paint layers were tested and the pigments used also match the traditional oil paints used in the period. An area of concern for some researchers involved the apparent blocking and re-positioning around the head of the figure, however, XRF and SEM-EDS of the paints show that the alteration was most likely done by the original artist and not done at a later date by different hands. Based on the analysis done at the MCI, it has been suggested that the painting could have been completed by John Trumbull, though the sitter may not be Captain Samuel Blodget.

MCI 6299 Fireman's Painted Hat

MCI Staff: Jia-sun Tsang, Jennifer Giaccai

The dark varnish applied to painted surfaces of a fireman's hat was analyzed to develop an appropriate cleaning protocol to remove the varnish.

MCI 6351Thomas Jefferson’s Bible, entitled *The Life and Morals of Jesus of Nazareth,* and two source books

MCI Staff: Jeff Speakman, Mel Wachowiak

The National Museum of American History (NMAH) has established a project to conserve the Bible and the two source books for the Bible and to "restore" their usability for exhibition, research, and public outreach at the museum and via the web.

The Bible is an 81-page assemblage of passages from the first four books of the New Testament, created by Thomas Jefferson around 1819. It is considered a national treasure and represents the work of Jefferson's own hands and a product of his extraordinary mind. Jefferson arranged the passages to create a chronological and edited account of Jesus' life, parables, and other teachings. The Bible speaks profoundly to some of the most fundamental and lasting issues of American identity and nationhood, for it speaks to the important question of the religious beliefs of the nation's founders and to Jefferson's own position as an important Enlightenment thinker. The volume expresses key moral beliefs held by the author of America's Declaration of Independence, while raising fascinating and important questions about the nature of Christian beliefs in the era of the founding and the Early Republic. NMAH also holds two of the source books, both English Bibles, from which Jefferson cut out passages to construct his Bible. They provide an added dimension for gaining insight into Jefferson's thinking and work processes.

The Jefferson Bible faces a multitude of complex preservation issues and is too fragile to handle, display, or reproduce without causing significant damage. As a result, use of the Bible is almost entirely restricted. The paper is brittle-and combined with the poor design of the Bible's stubbed page structure, it is virtually impossible to handle the Bible without causing significant damage. The sewing structure is intact, but damaging to the pages, due to the stubs at the inner hinge of each gathering. The pages cannot turn without breaking over the stubs. So, each page has cracked or torn along the stubs at the inner margin of each leaf. Evidence exists of dangerous paper weakness at the iron gall ink ruled vertical lines at the center of each page. The stiff glue beneath the glued-on translation text fragments has contributed to the paper's stiffness and inflexibility. It has also caused brown glue staining and planar distortion to the entire text block. The two source books have brittle and fragile paper, with bindings that are no longer intact.

The goal of the analysis is to, as far as possible, quantify the condition of the Bible, and to give us data to use in determining the final protocols and procedures for the Bible's treatment. The treatment goal for all three volumes is chemical and physical stabilization. For the Bible, it is also to stabilize the ink before the acid completely degrades the paper beneath it, repair and support the paper, repair and reuse the original binding, create a custom protective enclosure as a housing, and construct an exhibit mount for safe display of the Bible. The final goal is to preserve the Bible and restore its usability, so that it will accessible for future generations of Americans.

MCI 6430 Develop Cleaning Protocol to Remove Aged Coatings on Painted Fire Engine

MCI Staff: Jia-sun Tsang

Two painted side panels from a Globe Engine Company fire engine have an aged coating on them. The museum would like to remove the coatings without damaging the underlying paint layers. MCI has been asked to design an appropriate and safe non-solvent cleaning protocol to remove the overlays so that the objects can be put back on display.

MCI 6446 Technical Examination and Replication of NMAH Gragg Chair

MCI Staff: Don Williams

The purpose of this project is to identify and document the structure of NMAH's Graff Chair and to produce a replica. The decorated bentwood chairs of Samuel Gragg (Boston, ca. 1810) are among the most innovate furniture in U.S. history. Predating other well-known bent or laminated furniture makers by several decades, these chairs pushed the limits of what could be accomplished with wood. Interpretations of Gragg are still being produced today in welded bent steel. In addition to their importance due to technical innovation, Gragg chairs were invariably exuberantly decorated, usually culminating with a gilt and polychrome peacock feather ascending the center back splat element.

The NMAH Gragg chair is in remarkable structural condition, nearly perfectly intact and complete. A repaired fracture where the front stretcher meets the proper right leg is almost certainly accompanied by significant loss reducing the utilitarian functions, but in no way interferes with the presentation nor study of the chair. The entire surface of the chair is covered with multiple layers of orange and red paint of undetermined origin or age. Analyses of the cross section samples prepared by Mel Wachowiak indicate the original paint pigment composition includes lead, thus previous attempts to radiograph the chairs to study either the decoration or structure have been unsuccessful due to the x-ray opacity of the paint. The paint binder has not yet been analyzed. At present there is no reasonable estimate of the condition of the original decorative scheme. However, the generally crisp edges of the structure even through many layers of overpaint suggest a surface that has avoided disfiguring abuse. In addition the previous cross-sectional analysis and microscopy by Mel Wachowiak revealed a complete decorative coatings stratigraphy underneath the overpaint in numerous disparate locations.

National Museum of the American Indian

MCI 6100.3 Pre-Columbian Gold Beads

MCI Staff: Rae Beaubien, Jeff Speakman, Mel Wachowiak

Pre-Columbian gold beads were analyzed by XRF, ESEM-EDS, and stereo microscopy. The analyses will test hypotheses about fabrication methods used in Pre-Columbian Panama to produce gold beads and test hypotheses about goldworking trends in Panama versus in other centers in Central and South America. The data will contribute to research on the origins and development of Pre-Columbian goldworking in Panama from a technical standpoint.

MCI 6195 Three-Dimensional Scanning of NMAI Moundville Duck Bowl

MCI Staff: Mel Wachowiak, Becky Mendelsohn

3D scanning was the initial step in creating a reproduction that can go on long-term loan at the Moundville State Park. This is an exhibit venue close to modern descendents of the original creators of the object. The original "Duck Bowl" is one of the iconic objects of NMAI and is regularly used for NMAI exhibits and other loans. It was scanned using structured white light so that the data files could be evaluated and potentially used to make a reproduction for loan to the park. MCI staff also provided advice for the park regarding reproduction options, which include milling or direct printing. A mold could be directly printed in a rapid prototyping machine using elastomeric resin.

MCI 6293 Chimú Gold Atlatl

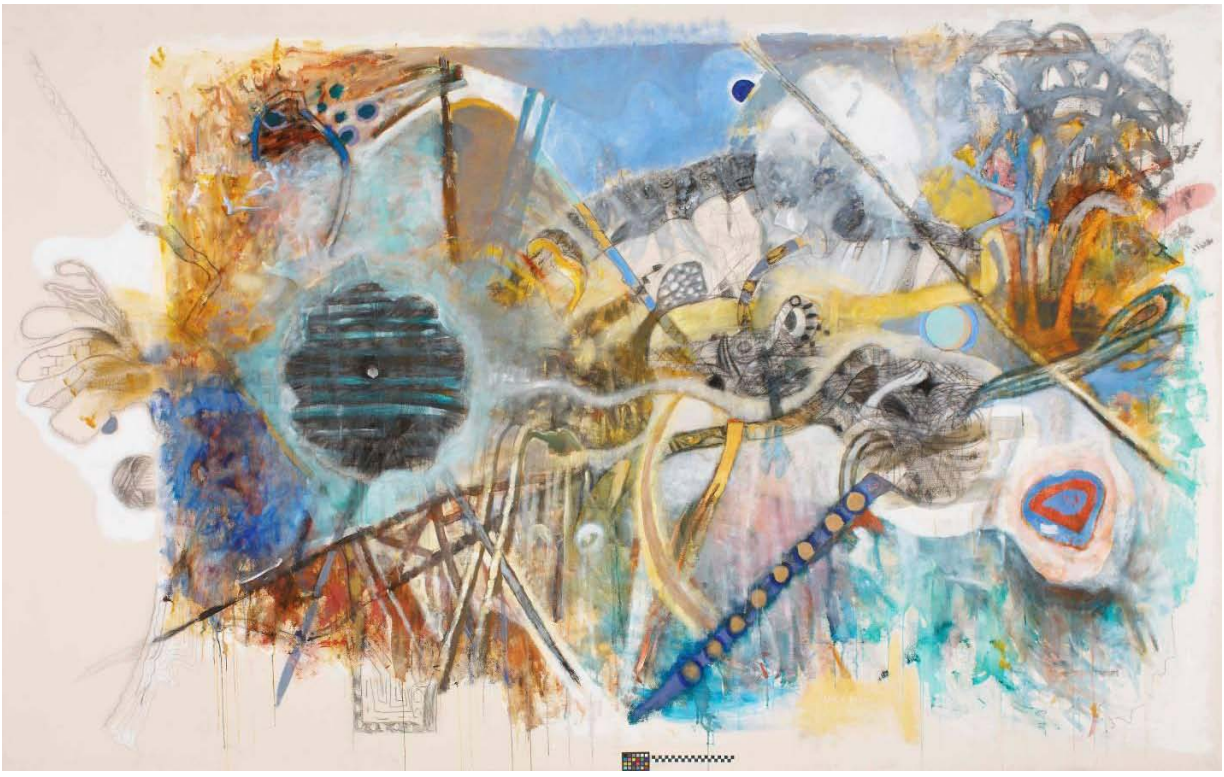
MCI Staff: Nicole Little

A wooden atlatl wrapped in a hammered gold sheet from north coast Peru has white residue concentrated in the nail holes of the object. Samples of the white residue as well as unidentified brown fragments were selected for analysis at MCI to determine the crystalline compounds present in the residue. X-ray diffraction analysis was able to successfully identify silicon dioxide in both the white and brown samples. Additional crystalline compounds were identified in the brown residue, including calcium palmitate, calcite, and silicon sulfide. It was concluded that the residue is from a commonly used polishing compound and adhered dirt.

MCI 6297 Painting: *Brooklyn* by Mario Martinez

MCI Staff: Jia-sun Tsang, Sara Babo, Genevieve Bieniosek, Allison Martin

The large mixed-media painting by Mario Martinez (Pascua Yaqui) entitled *Brooklyn* (2004) is a recent acquisition by the National Museum of the American Indian. The oversized painting (12'4" w x 7' 3" h) includes acrylic paint, charcoal, and graphite on unprimed canvas. The painting showed extensive cockling and ripples throughout, the result of having thick, unevenly applied paint combined with improper rolling for shipment. It was also discovered that the original stretcher bars (stored separately) suffered from insect infestation. The planar deformation could not be corrected by traditional moisture and pressure contact methods because they would alter the surface quality of the media and change the chemical characteristics of the acrylic. MCI's painting conservation team devised an alternative strategy and successfully treated the painting, working in collaboration with conservators, curators, exhibit designers, and production staff from NMAI, a photographer from NMNH, and a museum specialist from NASM. Over the course of two months the buckling was reversed by stretching the heavy canvas on a specially designed temporary Dutch strainer and maintaining a constant and even stretching force. It was then mounted on a lightweight strainer with an aluminum floating frame added to provide protection and mechanical stability for safe display. The treatment was captured on video for inclusion in NMAI's forthcoming exhibition *Vintage Point* (opening October 2010), showcasing the innovative conservation approaches and successful results that can be achieved through interdisciplinary and intra-institutional collaboration.



MCI 6301 Inka and Colonial Wooden Qeros: White Pigments

MCI Staff: Ed Vicenzi, Nicole Little, Jennifer Giaccai, Odile Madden

There appear to be two types of white pigments used on sub-groups of qeros, Andean ceremonial drinking vessels, which may correlate with chronology. They are sometimes used as admixtures with other pigments to augment the palette. The two types of white pigments included in the sample group are: lead white pigments, which may have originated in Spain and were then brought to the Andean region by European colonizers; and silicate-based white pigments with what may be naturally occurring TiO_2 (anatase) content. This is an unusual pigment and has not been reported on any other artifacts from this region in any era. Despite the high TiO_2 content, it is convincing that this pigment is original, not from modern restoration. The analytical project – focusing on white pigments – is part of a larger study to characterize and identify materials and techniques used for qero production.

MCI 6305 Modern Mexican lacquer decorated gourd

MCI Staff: Jennifer Giaccai, Nicole Little, Rae Beaubien

Using the detached red-pigmented decorative layer fragments, identification and characterization of the decorative layer, including the red side and white side, with appropriate analytical techniques for organic and inorganic materials will assist in treatment decisions to consolidate and relax and replace detached and lifting flakes. The data will also add to the understanding of cultural context and provenance. The object is scheduled for display in the "Infinity of Nations" exhibit.

MCI 6331 Illegible Writing on Lenape/Delaware Bandolier Hide Bag

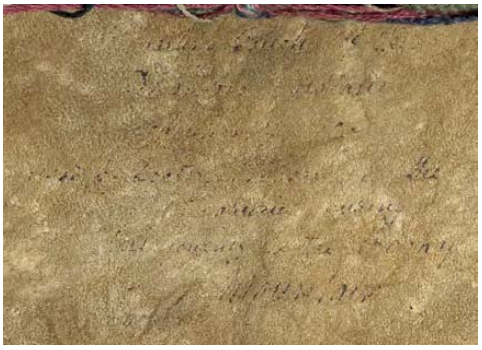
MCI Staff: Mel Wachowiak, E. Keats Webb

Several imaging techniques were used to decipher most of the writing on the leather bag. Ultraviolet and infrared imaging was used with some success, but reflectance transformation imaging (RTI) and the source images was most effective. Seven words of an unknown total, on seven lines were recognized by NMAI staff.

- two words in line #4 is written, "….doctor…….the"
- line 6 and 7 "journey to the rocky mountain".

RTI imaging and source images revealed 22 words in total, of which 9 words are probable; only two words are indistinct. Comparison of the RTI file and the source images gave the best results.

(into a) (P)ouch of the
Delaware Indians
( )
(used) by Doctor ( ) (in) the
(C)ar( )ie(s) during
(the or his) journey (to the) Rocky
Mountains
[single stroke]



This Lenape/Delaware bag will be in the Infinity of Nations exhibit at the George Gustav Heye Center in NYC and will be on display for 10 years.

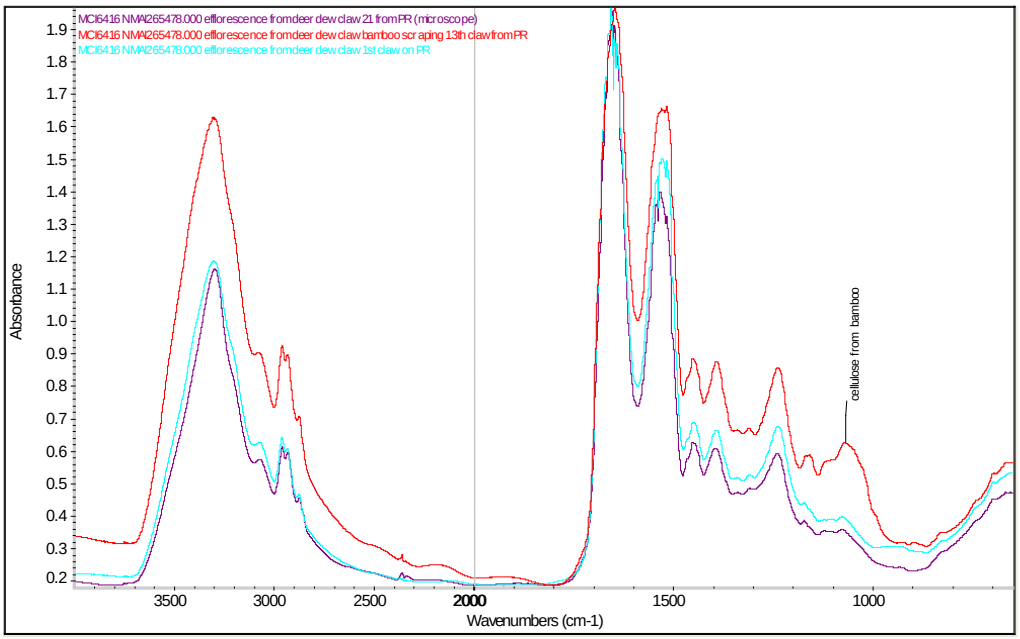
MCI 6343 Southern Ute Doll
MCI Staff: Ron Cunningham

With the exception of the beadwork, head, and chest area, the artifact readily transmits X-rays. The artifact is largely cloth construction with beads serving as surface decoration. Nothing was noted internally to suggest the presence of a metallic support or full-length armature.

MCI 6416 Analysis of Efflorescence on deer claw/hoof

MCI Staff: Jennifer Giaccai, Nicole Little, Mehdi Moini

The surface of the deer dew claws has a hazy appearance that can appear as a crust or efflorescence in certain areas. NMAI asked for help in identifying the haziness to determine if it was a fatty bloom from an applied oil or if it was delamination of the keratin in the dew claw. Samples of the haze were taken from three dew claws, all showing only proteinaceous material with no sign of oils or fats in the FTIR spectra. The hazy surface appears to be caused by delamination of the keratin dew claw layers.



All three samples showed the same spectrum when analyzed with FTIR; samples were clearly a proteinaceous material with no sign of fats or other non-protein-based material present. Note that the sample collected with the bamboo stick did show slight contamination from cellulosic material, but otherwise agrees with the spectra from the previous samples.

MCI 6417 Identification of headdress feather dyes

MCI Staff: Jennifer Giaccai, R. Jeff Speakman, Nicole Little

Analysis on the bright red and blue feathers of the headdress was desired to inform exhibit guidelines for light levels. No specific dye could be conclusively identified on the feathers, although they were obviously present (visual appearance of feathers and DMF extraction). FTIR, XRF, XRD and a number of GC-MS techniques were performed on previously detached feather fragments to try to identify the class of dyestuffs used on the feathers. No specific or general class of dye could be identified in analysis of the blue feather. However, Py-GC-MS of the red feather showed the presence of a number of amines that can be attributed to the pyrolysis products of aniline or azo dyes, which were commercially available by 1909.

MCI 6419 Analysis of Pre-Columbian Resins from Panama

MCI Staff: Jennifer Giaccai, Harriet F. (Rae) Beaubien

Six pre-Columbian gold-resin objects from Panama, in the NMAI collections will be analyzed to identify the type of resin on the objects. Identification of the resins will contribute to the museum and excavation records for this class of artifacts, as well as providing useful information the archaeological and technological interpretation of other artifacts from the region.

MCI 6428 Analysis of Exhibition Fabric for "Windows on Collections: Dolls"

MCI Staff: Nicole Little, Jennifer Giaccai, Mary Ballard, Jia-sun Tsang

Request is to characterize the fabric and outgassing to assess if it is a suitable material for use in the exhibition "Windows on Collections: Dolls".

MCI 6436 Study of Adhesives for use on Gutskin Objects

MCI Staff: Odile Madden, Marion Mecklenburg

This project is part of a fellowship project, at NMAI, by Lauren Anne Horelick to evaluate methods of repairing gutskin garments and other functional and ceremonial items, with the goal of developing appropriate and ethical treatment strategies. This study of gutskin is just beginning, and the results reported here are very preliminary. The initial results with scanning electron microscopy (SEM) of cross-sections of eighteen adhesives applied onto summer seal gutskin demonstrated the potential of SEM to characterize adhesives bonds. This initial set of experimental samples, selected because they are adhesive formulations that have been used by conservators to repair summer gutskin artifacts, points to some interesting factors that may influence adhesion and a successful repair. For example, the mixture of Lascaux 498/360 HV acrylic emulsions in 3:1 proportion adhered more intimately to gutskin that had been dampened prior to application. On the other hand the acrylic resin Acryloid B-72 did not adhere well to the gutskin or goldbeater's skin perhaps because of bubbles formed during volatilization of the acetone solvent. Synthetic resins applied in mineral spirits and xylene and as a heat-set film without solvent did not show this bubbling phenomenon. Though the adhesives used in this study were prepared with different solvents and cannot be compared definitively, the use of less volatile solvents could be important not only for an intimate and continuous adhesive bond but also to protect fragile gutskin from forces imposed during solvent volatilization. These are just a few potential avenues for future research. Our initial results also seem to disfavor the idea of adhesive penetration for most formulations tested, and this certainly warrants further study. With the Intimate-Intermittent-Not Intimate classification, we have proposed a straightforward system for visually assessing adhesive success with the SEM. NMAI advisor was Kelly McHugh.

MCI 6441 Conservation of Tlingit Spruce Root Basketry

MCI Staff: Jennifer Giaccai, Nicole Little, Mel Wachowiak

Samples of aged spruce root fragments, representative of 120 objects within NMAI's collections were examined to characterize and assess the condition of the material using non-destructive or minimally invasive techniques. This is part of an Andrew W. Mellon fellowship for Luba D. Nurse, under the supervision of NMAI textile conservator Susan Held.

National Museum of Natural History

MCI 2018.2 Spiro's Craig Mound Black Mineral Lumps

MCI Staff: Jennifer Giaccai, Nicole Little

Samples were submitted for analysis.

MCI 6118.4 Determining Heavy Metal Content of Bone using Portable XRF

MCI Staff: Nicole C. Little, Irma Molina, R. Jeff Speakman

The ability of ICP-MS to quantify trace amounts of heavy metals in skeletal remains has been integral to the determination of health and social status in early colonial populations. Due to the low detection limits and sensitivity of ICP-MS to most elements on the periodic table, this technique is ideally suited for the quantification of Pb and other heavy metals in bone. However, the time required for sample preparation, expense, and laboratory availability limits researchers' abilities to utilize this technique for archaeological applications. Therefore, researchers are attempting to utilize inexpensive and portable instrumentation for elemental analysis in the field. X-ray fluorescence has shown to be an extremely useful tool for archaeologists doing quantitative analysis of cultural materials such as obsidian and metals. However, little work has been done to optimize portable XRF for the determination of heavy metals at low concentrations in organic matrices. Therefore, this study is focused on the calibration of portable XRF instrumentation for the quantification of lead in bone, thereby providing a quick and easy method for archaeologists interested in heavy metal content of human remains and the surrounding soil. Successful calibration promises to give researchers a portable and non-destructive alternative to ICP-MS for the determination of health and social status in early colonial populations.

MCI 6315 Temporary Burial Pit

MCI Staff: Nicole Little, Jennifer Giaccai, Christine France

XRD, GCMS, and IRMS analysis of three samples comprised of red clay and a white chalky substance will provide a better understanding of events that occurred at the site.

MCI 6320 Permian Fossil Plant

MCI Staff: Mel Wachowiak, E. Keats Webb

The Permian fossil plant was photographed using the reflectance transformation imaging (RTI) technique to aid in identification of the specimen and produce an image that is suitable for publication.

MCI 6321 Neanderthal Bones

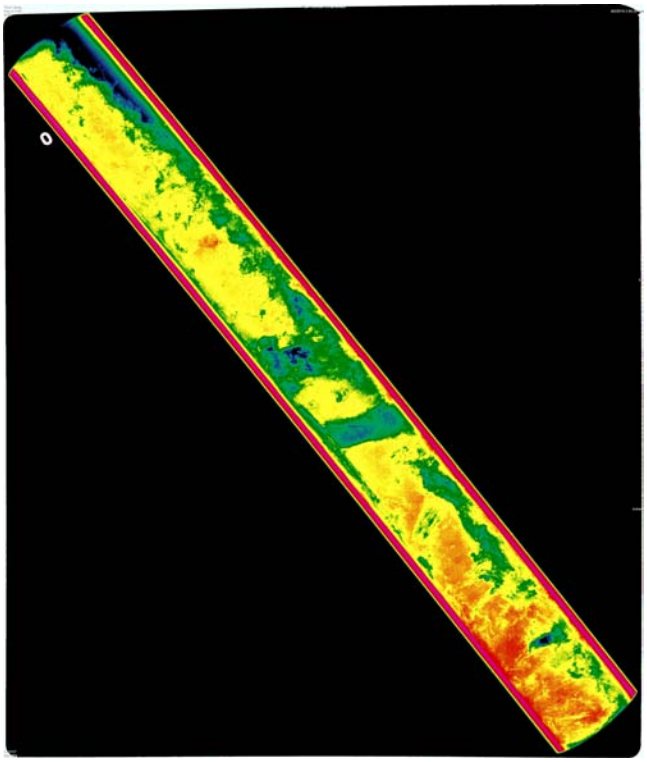
MCI Staff: Jennifer Giaccai

As part of conservation treatment of the Neanderthal skeleton, Shanidar III, analysis of various modern adhesives and coatings was requested. The identification of the materials would allow the conservators to determine if the material or the aging of the material will potentially damage the bones and affect possible conservation treatment of the skeleton. Four types of adhesive, coating and fill materials were identified in these samples. Both fragment 21 adhesive and fragment 75 coating contained polyvinyl butyral. Fragment 21 adhesive also contained cellulose nitrate and a small amount of polyvinyl alcohol. The fill material from fragment 73 is most likely beeswax, although it may be composed of a synthetic ester wax. Of these, only the use of cellulose nitrate had previously been described in the conservation or object files.

MCI 6323 Mangrove Peat and Sediment cores from the Indian River Lagoon, Florida

MCI Staff: Ron Cunningham

Mangrove peat cores look dense and black with no stratigraphic levels visible. These cores contain significant siliclastic sediment, which will show up in X-rays and help identify the changing depositional environments in the core, as well as identify the base of the peat section and any important horizons or disturbances in the sequence that would affect other analyses.

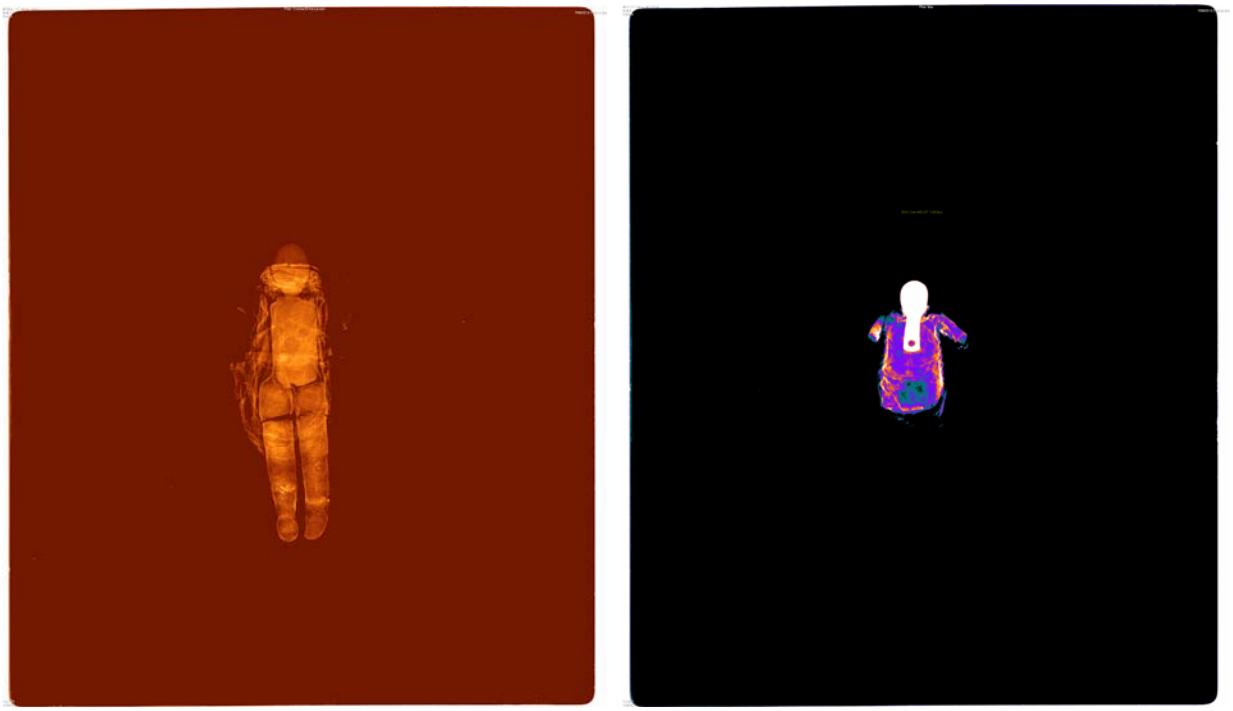


MCI 6333 Storage Cabinets
MCI Staff: Nicole Little

The NMNH's Anthropology Department plans to donate used quarter unit collections storage cabinets currently housed at NMNH to other museums. However, before such donations can be made, a good faith effort to identify the presence or absence of heavy metals is necessary, given that many of the cabinets are known to contain lead-based paints or to be contaminated with arsenic (As). MCI conducted a survey of more than 300 cabinets using XRF analysis to identify 90 cabinets that could be safely donated. The paint from cabinets and cabinet doors containing little or no lead (Pb) were marked for easy identification. Special attention was paid to those cabinets previously marked with "Tested: No Pb." Two such cabinets were found to contain significant Pb levels. Intermittently, the drawers contained within the cabinets were also tested for Pb as well as the felt lining for As.

MCI 6340 Two Yup'ik Dolls
MCI Staff: Ron Cunningham

With the exception of the head, neck, and torso areas, both artifacts readily transmit X-rays through what appears to be largely fabric. In both Doll A and Doll B, the figures are supported by internally placed ivory or bone supports which also serve as the neck, head, and torso support. Both internal supports appear to be one-piece in construction. Nothing was noted internally to suggest the presence of a metallic support or full-length armature within either artifact.



MCI6341 Two Zapatera Island (Nicaragua) Statues

MCI Staff: Carol Grissom

Two Zapatera Island (Nicaragua) statues carved in volcanic stone by the Chorategas tribe around 1300 A.D. were examined. One statue is thought to depict an alligator and the other a standing female figure. The U.S. Army is in the process of requesting the return of the statues to the Museo Nacional de Nicaragua. Recommendations are provided regarding possible reattachment of the two parts (head and body) of the female figure. Reproduction in lieu of repair is not recommended.

Torso and head pallets for the female figure with metal supports in place.

MCI 6345 Saber-tooth Cat Bone with Human Modification

MCI Staff: Mel Wachowiak, E. Keats Webb

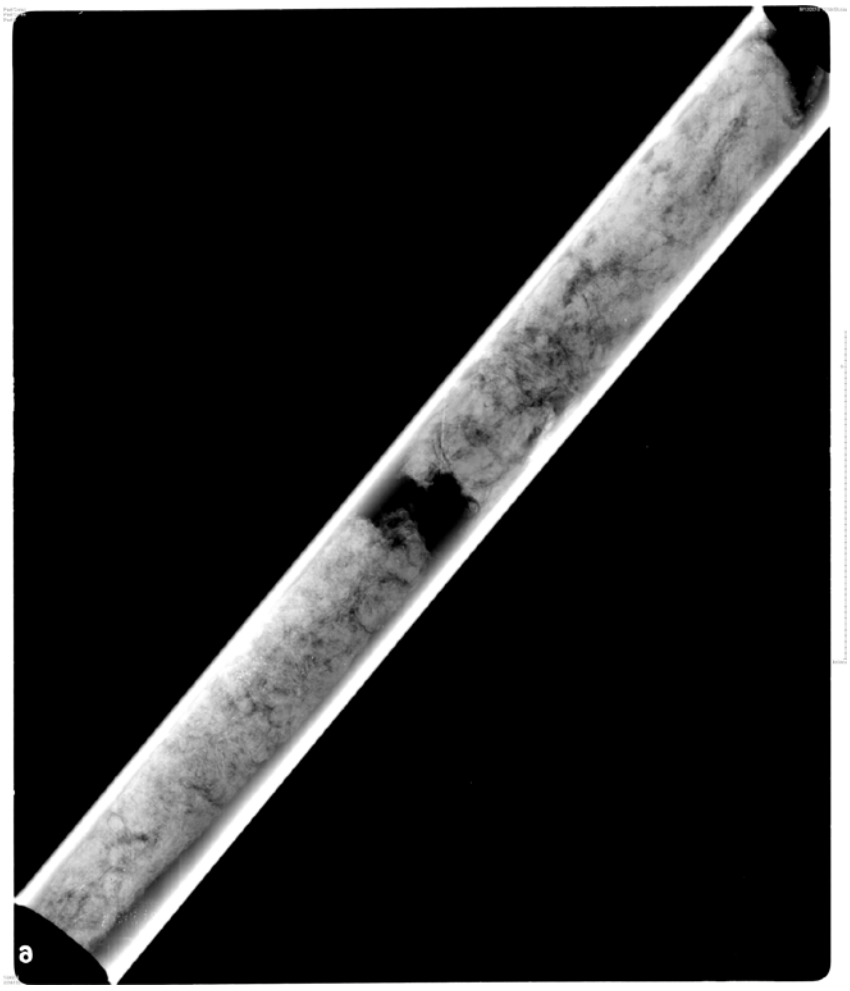
The bone and potentially the silicone peel will be documented using reflectance transformation imaging (RTI) and multifocus montage microscopy (3-D microscopy). The results will be used to help determine the type of bone (may be saber tooth cat or bear or other animal) and the fabrication method, as well as if the object is found to be ancient.

MCI 6347 Megafauna Bone Fragment with Possible Decoration
MCI Staff: Mel Wachowiak, E. Keats Webb

The silicone peel of the bone will be documented using reflectance transformation imaging (RTI) and multifocus montage microscopy (3-D microscopy) to determine if the decoration is ancient.

MCI 6352 Mangrove Peat and Sediment Cores from Indian River Lagoon, Florida
MCI Staff: Ron Cunningham

Radiography of fifteen 50-cm half core sections helped identify changing depositional elements, and helped identify the base of the peat section.



MCI 6353.1 Entomology Department Storage Environment
MCI Staff: Hanna Szczepanowska

This project is to assist NMNH in providing proper collection care. The advice provided in the form of a report which will serve as guidance to the Entomological Collection staff in maintaining a proper environment for the collection.

MCI 6353.2 Entomology Department Storage Materials
MCI Staff: Hanna Szczepanowska

Recommendations about the effects of freezing temperatures on the storage materials, particularly on adhesives used for mounting specimens, will provide guidance to the Entomological Collection staff in developing appropriate protocols and maintain proper care of the collection.

MCI 6354 Mammal Skulls with Mandibles
MCI Staff: Mel Wachowiak, E. Keats Webb

Determine the feasibility of digital imaging, using reflectance transform imaging (RTI) and multifocus microscopy, of ‘difficult’ mammalian skeletal materials to include (minimally) lateral, dorsal, and ventral of crania and lateral and occlusal surface of the mandibles. Results will be used to determine which imaging technique, if any, will suffice in digitally recording sufficient detail.

MCI 6355 Tuxtla Jade Statuette
MCI Staff: Mel Wachowiak, E. Keats Webb

A determination of the various generations of carving on the statuette, and in particular their relative dating, i.e. which carving is the oldest and which is the newest, using reflectance transformation imaging (RTI) on silicone molds of the statuette was undertaken.

MCI 6356 White Cloud Pipe

MCI Staff: Mel Wachowiak, E. Keats Webb

Capture enhanced image of now nearly illegible label on ornamented pipe stem using multispectral imaging and reflectance transform imaging (RTI) to create a permanent record of a key piece of collection documentation.

MCI 6365 Using Stable Isotope Signatures of Marine Zooplankton to Identify Water Masses

MCI Staff: Christine France

Marine zooplankton will be used in identifying water masses using the stable carbon and nitrogen isotope signatures of different zooplankton taxa. Additional tests will be performed to determine how different preservation techniques affect these zooplankton stable isotope ratios. The potential use of $\delta^{18}O$ and δD analyses will be considered in light of results from carbon and nitrogen isotopic analyses.

MCI 6366 Diets of Mesopelagic Fish

MCI Staff: Christine France

Mesopelagic fish muscle will be used to discern little known aspects about the diets of these fish. Carbon and nitrogen stable isotopic data will help assess what and where these fish are foraging.

MCI6367 Using Stable Isotope Signatures of Monk Seals to Examine Trophic Structure of Northwest Hawaiian Islands throughout the 20th Century

MCI Staff: Christine France

This study looks at the trophic structure of the Northwest Hawaiian Islands throughout predominantly the 20th century in an effort to better understand this species and develop appropriate conservation methods. This study includes monk seal bone collagen as well as vertebrate and invertebrate prey items of these seals which will be used to establish a food web through carbon and nitrogen stable isotope analyses.

MCI 6368 Using Stable Isotope Signatures of Sea Otter Vibrissae to Look at Temporal/Spatial Distribution

MCI Staff: Christine France

This study consists of the analysis of sea otter vibrissae. The animals' temporal/spatial distribution will be correlated to the $\delta^{13}C$ and $\delta^{15}N$ values.

MCI 6369 Using Stable Isotope Signatures of Sea Otter Vibrissae to Look at Temporal/Spatial Distribution, Bering Sea and North Pacific

MCI Staff: Christine France

This study consists of analyses of Steller sea lion vibrissae for carbon and nitrogen stable isotopes. This is a continuation of our long-term temporal sea lion trophic studies, focused on the western side of the Bering Sea and North Pacific.

MCI 6370 Using Stable Isotope Signatures to Track Turtles' Ocean Journey

MCI Staff: Christine France

Many species of sea turtles are known to be highly migratory throughout their lifespan. Understanding these migration patterns is crucial for conservation efforts. This project will analyze the stable carbon and nitrogen isotopic signature of several species of sea turtle scute (shell), egg case, and bone collagen. This preliminary project will determine if the turtles' ocean journey can be tracked with stable isotopes.

MCI 6371 Using Stable Isotope Signatures of Seagrass to Examine its Contribution in Diet and as Habitat

MCI Staff: Christine France

This project examines seagrass contribution to diet and as habitat. A variety of organisms such as algae, invertebrates, and vertebrates will be examined isotopically for their relationship to the seagrass. In addition, seasonal variability in the seagrass influence will be examined.

MCI 6382 Stable Isotopic Analysis of Bronze Age Burial Mounds (Khirigsuurs) in Mongolia

MCI Staff: Christine France

This project focuses on the $\delta^{13}C$, $\delta^{15}N$, and $\delta^{18}O$ values from human remains from Bronze Age burial mounds in Mongolia. The stable isotopic values will serve as proxies for reconstructing diet and possibly migratory patterns. These analyses will put into a cultural context to determine status of particular individuals and patterns of movement among separate populations.

MCI 6383 Stable Isotopic Analysis of Civil War Soldiers from an Excavated Cemetery in New Mexico

MCI Staff: Christine France

The remains of several Civil War soldiers were unearthed from an abandoned military fort cemetery in New Mexico. The remains consisted of both native and immigrant persons as well as both black and white soldiers. Carbon and nitrogen stable isotopes will be used to determine dietary differences among these different groups. This information will be placed into a cultural context whereby inferences concerning the quality of life of different soldiers will be considered.

MCI 6385 Incorporating Stable Isotopic Data into the Larger Biostratigraphic Record of the Miocene Siwalik Sequence in Pakistan

MCI Staff: Christine France

This project aims to incorporate stable isotopic data into the larger biostratigraphic record of the Miocene Siwalik sequence in Pakistan. Specifically, carbon and oxygen isotopic signatures from *Pila* snail opercula will be examined for climate signals and seasonality. Snails from several stratigraphic levels will be examined to determine changes in seasonality strength over time.

MCI 6386 Using Stable Isotope Signatures to Examine Adaptive Radiation of the Passerine Bird Genus *Cinclodes*

MCI Staff: Christine France

This project is a study of the adaptive radiation of the passerine bird genus *Cinclodes*, using an integrated approach involving stable isotopes, phylogeny, and physiology. The genus *Cinclodes* consists of thirteen species of ovenbirds, several of which have independently adapted to marine environments. This adaptation is unique among passerine birds, which lack functional salt glands and are constrained by their relative inability to produce concentrated urine. The purpose of the project is to track the pathways that led to the evolution of a marine niche in an evolutionary radiation of passerine birds. We are testing the proposition that *Cinclodes* is an adaptive radiation in which diversification was mediated by changes in osmoregulatory function. We are also examining the hypothesis that the evolution of a marine niche in the marine clades of *Cinclodes* has been accompanied by profound changes in the form and function

of the kidney. Stable isotopes will allow us to determine the relative reliance of the different species on marine and terrestrial-freshwater sources, as well as to determine the spatial and temporal changes in the use of these two types of resources in both individuals and populations.

MCI 6387 Evolution of Photosynthetic Systems in *Euphorbia* (Euphorbiaceae)

MCI Staff: Christine France

Euphorbia (Euphorbiaceae) is the second largest genus of flowering plants with nearly 2200 species that contains familiar species such as the ornamental poinsettia. The group contains tremendous adaptive life form diversity (especially rich in xeromorphic species such as diverse succulents and cactiform species) and is the only genus to contain all three photosynthetic systems (C_3, C_4, and CAM). Fewer than thirty species have been examined for C isotope discrimination, but this has revealed significant variation in $\delta^{13}C$ values. A large *Euphorbia* research project has been initiated under the NSF-PBI (Planetary Biodiversity Inventory) program and we are conducting molecular phylogenetic work for this project at LAB. We presently have a large (176 taxa x 9 genes) phylogenetic tree to use for further investigations into the evolution of *Euphorbia*. Our project seeks to understand photosynthetic system evolution by using C isotope analysis of leaf tissue (mostly with the same samples used for DNA extractions), which will be mapped on the phylogeny and correlated with life forms using modern methods of character reconstruction and comparative analysis.

MCI 6389 Stable Isotopic Analyses of Eastern United States (Chesapeake Area) Historic Human Remains

MCI Staff: Christine France

Human remains from several North American east coast grave sites spanning time periods from colonization forward will be analyzed for carbon, nitrogen, and oxygen stable isotopes. These analyses will provide insight into diet and migratory patterns. Specifically, isotopic differences between immigrants and native-born citizens as well as among social classes will be examined in an effort to discern patterns that can be applied to individuals of unknown origin.

MCI6394 Stable Isotope Analysis of Faunal Remains from Liang Bua, Flores, Indonesia: Implications for the Disappearance and Possible Extinction of *Homo floresiensis* and *Stegodon florensis* During the Late Pleistocene

MCI Staff: Christine France

On the Indonesian island of Flores, a well-dated faunal and archaeological sequence has been recovered at Liang Bua cave. This sequence spans the last 100,000 years and includes the only anatomical and behavioral evidence of *Homo floresiensis*, a new species of human first discovered in 2003. From 95 to 17 kyr, the faunal sequence contains a host of endemic mammal, reptile, and bird species, including *H. floresiensis* and *Stegodon florensis*. Both *H. floresiensis* and *S. florensis* disappear from the sequence at approximately 17 kyr, however small endemic fauna such as rats and bats persist. After 11 Ka, modern humans appear in the sequence along with several new introduced animals (i.e., non-endemic to Flores) including *Sus celebensis*, *Sus*

scrofa, *Hystrix javanica*, *Paradoxurus hermaphrodites*, and *Macaca fascicularis*. The goal of this project is to reconstruct the local diet and ecosystem surrounding Liang Bua from stable isotope analyses of this incredibly rich 100 kyr faunal sequence. Such data are critical to understanding differences in behavior and diet between *H. floresiensis* and modern *Homo sapiens* as well as for testing hypotheses about the disappearance of *H. floresiensis* and other taxa from the Liang Bua sequence.

MCI 6400 Heterotrophy and Mineral Nutrition of Tropical Hyperparasitic Mistletoes

MCI Staff: Christine France

Stable isotopic carbon and nitrogen information has illuminated heterotrophic carbon gain of temperate aerial hemiparasitic plants of the Loranthaceae and Viscaceae. However calculations of proportional heterotrophy in hemiparasitic tropical mistletoes can be confounded by different water use strategies than temperate mistletoes. Our goal is to integrate mineral nutrition, stable isotopic values, and direct measurements of water relations of host and parasites to better estimate heterotrophy and the mechanisms of solute and water uptake in tropical mistletoes.

MCI 6405 Seasonality of Early Holocene Archaeological Sites on the California Channel Islands

MCI Staff: Christine France

The samples included in this study are from marine mollusks excavated at Early Holocene archaeological sites on San Miguel Island, California. A series of sites dated between about 8000-10,000 years old have recently been identified on the island. These are interpreted as small, temporary encampments left behind by the first people to occupy the island. One of our primary hypotheses is that these sites may be seasonal encampments occupied near bedrock sills where fresh water could be collected during the dry summer months. The analysis of this suite of shell carbonate samples will help test this hypothesis by providing sea surface temperature data, including samples from the terminal ring that can be used to infer the season of site occupation.

MCI 6406 Holocene Sea-Level Change in the Caribbean: Implications for Geophysical Modeling and Ocean-Climate Interactions

MCI Staff: Christine France

The Caribbean is a proxy-rich natural laboratory with ^{14}C-datable sea-level tracking *Acropora palmata* (coral) and *Rhizophora mangle* (mangrove) peat especially suitable for local and regional Holocene sea-level reconstructions. The specific objectives of this project are: 1) To collect new sea-level data from mangrove peat involving a complete suite of paleoenvironmental indices, precise elevation measurements tied to sea level, state of the art analyses and data interpretation; 2) To synthesize existing and new data to produce a quality-controlled, spatially and temporally comprehensive Caribbean sea-level database; and 3) To determine the nature and magnitude of glacial isostatic adjustments within Caribbean sea-level database.

The project is NSF-funded to Toscano, with collaborators within SI, the University of Pennsylvania, and the University of Toronto. As part of this project we also have a 10-m core from Belize that has already been analyzed elsewhere for bulk isotopes and which now constitutes the longest continuous isotope record form a mangrove area. These previous results have afforded us a unique perspective into the history of the mangrove sequence; as such it has become an essential component of the suite of paleoenvironmental indices we know to be important. We are requesting a comparable $\delta^{13}C$, $\delta^{15}N$, C/N and TOC record to be produced for our newest core data from southeast Florida. Interpretations of this isotope record will reveal ecological changes in the mangrove over time, hydrologic or precipitation histories, depth of disturbance or dieback events, and ultimately influence which intervals we choose to date with radiocarbon methods. This paleoenvironmental history will also correlate to our microfossil assemblages over time. We hope to complete these analyses for our other sites to be cored in the next year.

MCI 6412 Effects of ecosystem size, productivity, and habitat complexity on community structure

MCI Staff: Christine France

This project explores effects of ecosystem size and ecosystem productivity on food chain length. Working first on a variety of islets at Palmyra Atoll (Central Pacific Ocean) the compare diversity, abundance, and trophic position of consumers of different trophic positions will be studied. The islets of Palmyra are all of the same parent material (calcium carbonate), but vary strongly in nutrient levels due to differing densities of seabird inputs; the islets also vary in size. By comparing increase in d15N levels above soil and leaf levels (which also vary by islet due to high d15N of seabird guano) for a variety of consumers (at different trophic positions) across all the islets, the effect of these two variables on food chain length can be examined. Preliminary results suggest that, contrary to current consensus opinion, productivity is a much stronger driver of food chain length than ecosystem size. This is also supported by direct measurements of diversity and abundance of consumers. The current project will 1) expand the sample size of islands surveyed, and 2) expand the taxonomic breadth of animals sampled (particularly focusing on herbivores, which should not show significant changes in trophic position if changes are indeed due to increased food chain complexity). Also, examination of d13C to control for direct consumption of guano or seabird inputs, which would elevate d15N in consumers for reasons other than changes in food chain length will be measured. A parallel project has just been started in Kenya that builds on this work to examine the mechanistic reasons that productivity increases food chain length, using the same variables (abundance, diversity, and isotopic position) along experimental gradients of both productivity and habitat complexity.

MCI 6414 Design of new Pod 5 storage tanks

MCI Staff: Marion Mecklenburg

MCI provided assistance in the design of new Fluid Storage tanks for Pod 5, which will be used for large specimens.

MCI 6422 Historical Ecology in Coastal Alaska

MCI Staff: Christine France, R. Jeff Speakman

Using a combination of zooarchaeological and stable isotope data, this project will address the effects of climate change on prehistoric hunter-gatherers and marine ecosystems during the last 7000 years. Stable isotopes preserved in the bone and shell material in archaeological sites, including oxygen, nitrogen, and carbon, are a direct link with prehistoric environmental conditions and human activity. These isotopes provide insight into shifting ecological regimes and trophic organization, as well as ocean temperature and local environmental conditions. This project will employ archaeological assemblages from the Kodiak Archipelago in Alaska, which are stored at the Smithsonian Institution and the University of Washington. These large collections of faunal material represent thousands of years of occupation and a lengthy record of human-environmental interaction. Given the current concerns of fisheries managers and marine ecologists in the face of global warming, archaeological data have the potential to increase our understanding of long-term changes in climate and their effects on local ecology. Such information may provide important data both for establishing a baseline for earlier conditions and for understanding the complex role of prehistoric hunter-gatherers in marine ecology. With Catherine West and Torben Rick, Anthropology.

MCI 6434 Identification of Accretions on Movie Film

MCI Staff: Jennifer Giaccai, Mel Wachowiak, Nicole Little, Paula DePriest

Black and white negative film by the South American artist Jorge Preloran, from Argentina, shows a white filamentary material on edges of wound reels of film. The material is a spotty white growth often found coincident with film splices, but also in areas without splices. The immediate goal is to determine if the white material is biological or whether this is a leaching product from the film, perhaps recrystallization of (phosphate) flame retardant or platicizers in deteriorating plastic.

MCI 6425 Imaging Skull Morphology for Determination of Sex in Lions

MCI Staff: Mel Wachowiak, E. Keats Webb

On 4 January 2011, Wachowiak and Webb conducted photographic imaging of ten lion skulls in the National Museum of Natural History collections at the Museum Support Center in Suitland, Maryland. These illustrations of maxillary views will be incorporated as figures in two manuscripts under revision. A detailed workflow for digital imaging of these specimens was prepared to guide the researchers' subsequent documentation work. The requestor was visiting scientist Dr. Virginia L. Naples (Professor of Biological Sciences, Northern Illinois University). The images of the maxillary regions of the adult and juvenile skulls demonstrate bone texture differences between males and females. In addition to these images, dorsal, lateral and ventral views of a single reference skull were made for illustration of measurement locations taken of the entire group. Close-up views of one juvenile specimen with a healed bite mark in the parietal bone and another specimen with an unhealed wound were made for comparison. The close-ups of the bite wound are planned for inclusion in a manuscript discussing a similar phenomenon in the extinct saber-tooth *Smilodon fatalis*.

MCI 6448 Imaging of Plaster Cast of Kaminaljuyu Bas-Relief

MCI Staff: Mel Wachowiak

A cast stone bas-relief from Kaminaljuyu, a Mayan archaeological site in Guatemala will be imaged to record the subtle surface details. The plaster cast was taken by Ian Graham in 1956. The original stone surface has suffered some 60 years of outdoor exposure that has degraded much of the text. The reflectance imaging technique that will be employed to record the surface of the cast is ideally suited to capture fine, low-profile surface images. The results will aid Dr. John Justeson, in the NMNH Anthropology Department in his translation efforts of this first written language in Mesoamerica.

MCI 6449 Imaging for Comparison of Red Siskin Plumage

MCI Staff: Mel Wachowiak

The Red Siskin is one of Venezuela's most endangered birds due to decades of uncontrolled trapping for the illegal cage bird trade. It is presently the focus of a NMNH study using genetic tools to understand variation within and among natural and captive populations, as a foundation for the ex situ conservation of the species. The morphological characteristic of color variation measurements will be used to complement the genetic studies. This is important to detect color variants outside the range of natural variation that may have been introduced by deliberate hybridization in captivity.

MCI 6460 Analysis of Deposits from MSC Pod 5 Storage Tank

MCI Staff: Nicole Little, Jennifer Giaccai, Carol Grissom

Some metal tanks for storage of fluid-preserved specimens in MSC Pod 5 have begun to corrode. MCI was asked to examine the problem and advise on the nature of the deposits and their cause.

MCI 6461 Variation in Individual Feeding Habits Through Time and Space: Gauging the Sensitivity of Seabirds to Changes in Prey Availability

MCI Staff: Christine France

Human consumption has pushed nearly 1/3 of the world's open sea fisheries into a state of collapse, altering the food available to seabirds that forage exclusively on marine prey. This research will seek to gauge the sensitivity of an endangered seabird, the Hawaiian petrel (*Pterodroma sandwichendsis*) to changes in prey availability through detailed study of their feeding habits during the period of winter feather growth. Using knowledge of molt sequence, four flight feathers were chosen that grow at different times. Stable carbon d13C and nitrogen d15N isotope data from these feathers reflect feeding habits, and will allow study of the degree to which individuals rely consistently (i.e., specialize) on various diets and foraging locations. Because species are most sensitive to the loss of resources on which they specialize, the results will help inform conservation management of the endangered Hawaiian petrel. This is a collaborative project with Helen James, mentor, and Anne E. Wiley, fellow.

MCI 6462 Investigating Meridional Gradients in Temperature, Seasonality, and Diversity During Greenhouse Periods in the US Coastal Plain

MCI Staff: Christine France

Late Cretaceous and Paleogene fossil faunas of the US Coastal Plain (CP) have been a paleontological treasure trove since they were first described more than 150 years ago. The region offers what is arguably one of the best preserved marine faunas in the world for this interval. Molluscs dominate the assemblages; they are particularly diverse and well-described, and the Smithsonian National Museum of Natural History contains a significant collection of these fossils. The CP is composed of the subtropical Gulf Coastal Plain (GCP) and the more temperate Atlantic Coastal Plain (ACP), both of which preserve detailed records of the end Cretaceous mass extinction (K-Pg extinction) and of a rapid global warming event, the Paleocene-Eocene Thermal Maximum. Because preservation of original skeletal carbonate is common in the CP, an oxygen-isotope-based record of climate change can be refined and linked directly to the ecological response of faunas. As such, it is possible to track the waxing and waning of diversity and shifts in composition and community structure across latitudes during greenhouse worlds in parallel with mean and seasonal temperature estimates derived from the fossils themselves. This depositional setting thus offers the potential for a detailed comparative study of an extinction boundary, a rapid global warming event, the historical legacy of those events on the long-term composition of the biota, and the interplay between climate change and ecology across latitudinal gradients. By comparing the first occurrences of taxa in the subtropical GCP to their time of arrival in the temperate ACP after the K-Pg extinction, one can directly evaluate the timescales on which taxa migrate, the ecological characteristics that may be associated with migration, and assess how climatic perturbations may mediate migrations. Intern project of Jocelyn A. Sessa, with mentors Brian Huber, Gene Hunt, and Scott Wing.

National Zoological Park

MCI 6222 Analysis of *Nautilus pompilius* shell
MCI Staff: Jeff Speakman, Greg Henkes, Judy Watson, Nicole Little

Nautili are a nocturnal species that undergo a daily, vertical migration. In captivity, nautilus require cool-water, dark, and deep, dedicated aquariums. Even in “proper” environments, they experience buoyancy problems (they float) , and are unable to properly grow new shell in captivity. In addition, it appears the mortality rate for captive specimens is quite high. Identifiable chemical differences between the "new" and "old" shell growth may point to/help determine why the mortality rate is so high and how to alter the environmental conditions to improve their survivability.

MCI 6314 East African Bustard Feathers

MCI Staff: Nicole Little, Jeff Speakman

The kori bustard *(Ardeotis kori)* is a flagship species for the vanishing African savanna ecosystem. Due to a complex combination of factors, kori bustards are declining throughout their natural range in eastern and southern Africa. Although selected studies investigating the ecology of these birds in the wild exist, little is known about the health and physiology of wild kori or other smaller bustards. In captivity, kori bustards suffer from various infectious and metabolic diseases. Many of the problems facing these captive birds arise from a lack of available information on normal health and physiology of this and similar species. In order to close this knowledge gap and increase understanding of these birds, an investigation was designed to examine the general health, physiology, and disease status of wild kori bustards and other bustards that share the same environment in central Kenya.

Over the course of 3 months, wild bustards were captured on the premises of the Mpala Research Centre (MRC) and surrounding areas in Laikipia district, Kenya. This study used methods and built upon data collected during a 2006 pilot study. The primary goal of this research was to examine blood, fecal, and feather samples in order to learn about the normal physiology and identify specific disease and environmental conditions affecting the health of bustards in their native habitat. Understanding of wild bustard health and physiology will improve knowledge of their ecology and will identify potential disease and environmental threats affecting these birds. The data collected with this investigation will provide the information needed for development of future research and targeted conservation of wild bustard species. Finally, the knowledge gained in this study will improve the successful management of kori and other bustards in captivity.

ICP-MS analysis of the feathers to determine if bustards in the Laikipia ecosystem are: 1) exposed to heavy metals that are potentially contaminating their habitat from local use of leaded gasoline/diesel fuel and the common custom of garbage burning; 2) if they are affected by this exposure, i.e., concentrating heavy metals in their system at levels that could have physiologic implications (e.g., affect their reproductive rate/success); and 3) if bustards could be used as indicators of environmental contamination for this ecosystem.

MCI 6318 Sparrow Specimens Plumage Brightness

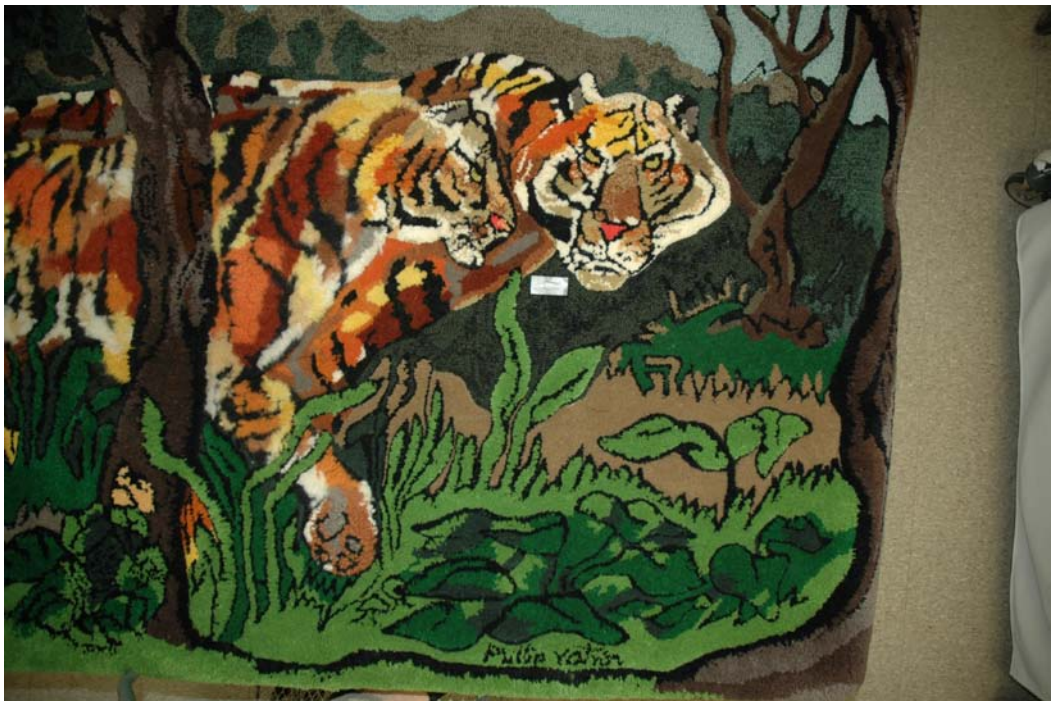
MCI Staff: Mel Wachowiak, with NMNH

The NZP is developing a technique for comparing plumage brightness in different subspecies of the Song Sparrow (*Melospiza melodia*) based on historical specimens and birds captured in the field. The work with MCI focuses on developing the image gathering technology and photographic techniques for obtaining a standard image of plumage specimen coloration. The long-term goal is to determine if there has been a historical change in the endemic subspecies (*Melospiza melodia atlantica*).

MCI 6346 Sculpted Wool Tapestry: Special Tigers

MCI Staff: Mary Ballard, Mary Kuhn, Nicole Little

The Special Tigers sculpted wool tapestry was stabilized with a pre-treatment of argon and had a proper hanging and support system attached. Advice on how to monitor conditions to safely and appropriately display the textile at the Zoo in a manner that protects it and meets museum standards were provided.



MCI 6358 Patterns of Stable Carbon Isotope Variation over the Arrival Period in a Long-Distance Migratory Bird

MCI Staff: Christine France

This project continues to gather information on how stable carbon isotopes vary over the arrival period for a long-distance migratory bird population.

MCI 6359 Carry-Over Effects of Winter Population Limitation in the Endangered Kirtland's Warbler (*Dendroica kirlandii*)

MCI Staff: Christine France

Factors limiting the population size of the Kirtland's warbler (*Dendroica kirtlandii*), an endangered migratory bird, on their Bahamian wintering grounds and how these factors carry over to affect breeding season events remain unstudied, which could undermine conservation efforts. The objectives of this project are: 1) examine whether the consequences of winter habitat and diet affect arrival dates and body condition of Kirtland's warblers on the breeding grounds, and 2) assess the influence of these carry-over effects on the reproductive success. This will be accomplished by monitoring eight 30-ha study plots near Mio, MI, for the spring arrival dates of male warblers. Incoming males will be captured and banded, condition measured, and tissue samples will be collected for stable isotope analyses. The $\delta^{13}C$ of crown feather, blood, and claw material will be used as a measure of winter habitat type (wet vs. dry), and $\delta^{15}N$ of these tissues will represent winter diet (proportion of insects vs. fruit). Nests of banded males will be found and reproductive success (number of fledglings per year) will be recorded. Correlations between isotope ratios representing winter habitat and diet and 1) arrival date; 2) body condition; and 3) reproductive success of individual males will be examined. Identifying limiting factors is vital for effective conservation practices, yet the consequences of non-breeding season events on the population dynamics of this species, as well as most Neotropical migratory birds, are not understood. This study will assess the effects of winter population limitation, and increase our understanding of how seasonal interactions shape the fundamental ecology of migratory animals.

MCI 6373 Investigation of the Migratory Nature of Canadian Geese Causing the Crash of US Airways Flight 1549

MCI Staff: Christine France, Greg Henkes

In January 2009, multiple engine strikes from Canadian geese forced the crash-landing of US Airways Flight 1549 in the Hudson River. Hydrogen isotopes will be examined from the feather remains of the birds and compared to both migratory and local populations of geese in an effort to determine which of these groups is most similar isotopically to the bird remains. Determination of the migratory status of the birds responsible for the crash is critical to future preventative measures.

MCI 6374 Connectivity of Migratory Bird Populations Wintering in the Caribbean Basin

MCI Staff: Christine France

Natural selection acts on individual animals throughout the annual cycle, and events during each phase of the annual cycle likely influence subsequent events. For migratory animals, understanding these selection processes has been impossible because of our inability to follow individuals year-round and determine where breeding populations winter and where winter populations breed. In this study, isotopic basemaps will be constructed for seven species of Nearctic-Neotropical migratory birds wintering within the Caribbean basin by using stable-hydrogen isotopes in tail feathers grown in North America and collected during the tropical non-breeding season. The final products of this research will include a map linking the breeding and wintering areas of each species. Such data will not only help determine the degree to which migratory bird populations mix between winter and summer, but will also provide an invaluable template for region-specific monitoring efforts.

MCI 6377 Evaluating Quality of Winter Feeding Grounds for Declining Rusty Blackbird

MCI Staff: Christine France

The Rusty Blackbird is one of the fastest declining songbirds in North America. Rates of population decline are estimated at 80-90% over the last 40 years and the cause is unknown. The decline could be occurring on the wintering ground, on breeding sites, or at migration stopover sites. We are studying the bird on the wintering ground to determine high quality habitat sites. It is thought that sites with pecans available may be higher quality than sites without. We are collecting blood samples from the birds we catch in South Carolina and intend to run stable isotope analyses for C and N and correlate them with body condition via indicators of body condition and blood metabolites assays.

MCI 6378 Patterns of Stable Carbon and Nitrogen Isotope Variation Across an Urbanization Gradient

MCI Staff: Christine France

This was an exploratory project to develop some initial patterns of isotopic variation across an urbanization gradient in the feathers of gray catbirds.

MCI 6379 Trophic Structure of Several Fluvial Ecosystems in the Western United States

MCI Staff: Christine France

This study aims to reconstruct the trophic structure of several fluvial ecosystems in the western United States. The sample set will include all levels of the food chain from plants to salamanders.

MCI 6381 Using Stable Isotopes to Study Patterns of Long-Distance Dispersal in Neotropical Migratory Birds

MCI Staff: Christine France

Hydrogen isotopes from feathers collected from neotropical migratory bird species will be used to study patterns of long-distance dispersal. Specifically, samples were collected from ~200 birds representing 6 species during the 2009 breeding season. Because these feathers were grown the previous year on or near the birds' breeding/natal ground, we hope to use H isotopes to determine the likely origin of these individuals, which will allow us to determine patterns of long-distance dispersal and how these patterns differ between ages, sexes and species. Subsequent work will combine these methods with experimental work in order to test hypotheses about the causes and consequences of long-distance dispersal.

MCI 6390 Reconstructing Food Web Dynamics in the Understory of an Eastern Deciduous Forest

MCI Staff: Christine France

This project uses stable carbon and nitrogen isotopes to reconstruct and understand the trophic relationships of the ground level food web in an eastern deciduous forest. Samples have been collected from a variety of organisms, plant and animals, from rotting roots to insects to ground foraging vertebrates for the assessment of both stable carbon and nitrogen.

MCI 6391 Tracking the Skylark throughout the Annual Cycle

MCI Staff: Christine France

This project links detailed information at the individual level with regards to behavior, reproduction, physiology and survival in Skylarks. Since 2006 this research has followed color-ringed birds throughout the year, and focused on identifying seasonal patterns of immune function during the annual cycle, on detecting connectivity between different seasons (using isotopes) and on searching for potential bottlenecks in the annual cycle of this species. Thus, this study will result in a unique dataset, one which connects life history stages and events in the annual cycle with immune function within a population of free-living birds and will contribute to understand how birds in general cope with their environment. Furthermore, it will provide the framework needed to establish a powerful conservation strategy for this rapidly declining species.

MCI 6401 Effect of Simulated Rainfall on Plant Productivity, Insect Abundance and the Condition of Migratory Birds in Lowland Scrub Forest of Jamaica

MCI Staff: Christine France

An irrigation experiment was used to examine the effects of simulated rainfall on plant productivity, insect abundance, and the condition of American redstarts during the dry season at Font Hill, Jamaica. A component of this project uses carbon and nitrogen isotopes to compare the isotopic signatures between control and irrigated plots for several trophic levels including: 1) the leaves of logwood (*Haematoxylon campechianum*); 2) arthropods (primarily hemipterans, coleopterans and aranea); and 3) redstarts, using blood samples. This project was carried out with a Smithsonian and NSERC postdoctoral fellow at the migratory bird center in collaboration with Pete Marra and Scott Sillett.

MCI 6403 Variation in Hydrogen Stable Isotopes in Feathers of Two Bird Species Along an Elevational Gradient

MCI Staff: Christine France

Seasonal elevational migration of birds in mountainous areas is a widespread but poorly studied phenomenon. A major obstacle to the study of elevational migration is recapturing, resighting, or following marked or tagged individuals. Stable isotopes are increasingly being used to study bird movements including migration and dispersal in situations where the movement is parallel to a strong isotopic gradient. Strong gradients of stable hydrogen and oxygen isotopes may be found in most mountain ranges, and this type of analysis may be useful in studying elevational migration. As a first step in determining the efficacy of using isotopes to study elevational migration, it is proposed to measure the correlation between elevation and stable hydrogen isotope ratios in the feathers of two completely non-migratory bird species in the Andes of Peru. If the correlation between elevation and isotope ratios is strong, this method could potentially be applied to migratory species in order to identify individuals that have migrated after their most recent feather molt.

MCI 6429 Understanding the Migratory Connectivity of the Pied Flycatcher

MCI Staff: Christine France

This project explores the migratory connectivity of the Pied Flycatcher across its vast breeding range in Europe and wintering range in Africa. Capitalizing on the fact that there is a huge citizen science network banding and studying the flycatcher, we have collecting feathers across this range to studying the connectivity which could have important implications for population dynamics. With Pete Marra.

*MCI 6439 Historical and contemporary diet in the most range-restricted bird in North America, the Island Scrub-Jay (*Aphelocoma insularis*)*

MCI Staff: Christine France

Species endemic to islands are particularly vulnerable to anthropogenic disturbance because they tend to have restricted geographic ranges and are adapted to environments with few competitors and predators. As a result, the vast majority of extinction events have been documented on islands. Island Scrub-Jays (*Aphelocoma insularis*) are the only endemic bird species on the California Channel Islands and, as the most range-restricted bird in North America, are a species of high conservation value. Intensive mark-recapture efforts have been on-going since the 1970s and indicate the species may be declining sharply in abundance, although it is not clear what factor(s) may be causing the decline. The species is a year-round resident and is entirely restricted to Santa Cruz Island, an island that has experienced dramatic changes in vegetation since the settlement of ranchers during the 1850s. We propose to examine long-term trends (1875-present) in the diet of Island Scrub-Jays, using stable-isotopes of carbon ($\delta^{13}C$), nitrogen ($\square^{15}N$), sulfur ($\square^{34}S$), and hydrogen ($\square D$) in samples from museum specimens and the contemporary population. We will also test whether variation in bill morphology corresponds to variation in diet, as our preliminary data from the contemporary population indicate that jays in pine habitat have longer bill than jays in oak habitat. Our first step will be to analyze feathers and blood collected from jays in different habitat types across Santa Cruz Island to test our *a priori* expectations that: (1) dry habitats will have higher $\delta^{13}C$ values, (2) $\square^{15}N$ will be higher in the spring diet compared to the fall, (3) regions with high acorn abundance will have high $\square^{34}S$ values, and (4) $\square D$ will be highest in the diet of jays in pine habitat. This will be done in collaboration with Dr. Scott Sillett, Smithsonian Migratory Bird Center who serves as a co-advisor on Katie Langin's dissertation research and will be a co-author on all publications resulting from this work.

OFEO

MCI 4546.2 Examination of Zinc Sculpture on A&I Building

MCI Staff: Carol Grissom

The zinc statue of Columbia Protecting Science and Industry is to be conserved as part of the current roofing project for the Arts & Industries building. MCI will provide advice on what should be done and how it should be accomplished. Work is now underway to remove the 10-foot tall statue.

MCI 6304 Exterior of the NMAI Building

MCI Staff: Carol Grissom, Robert J. Koestler, Paula T. DePriest, Ed Vicenzi, Mel Wachowiak

Black staining on the exterior of the National Museum of the American Indian building was analyzed to identify the staining of the Mankato Kasota Limestone and to recommend options for cleaning and prevention.

Office of the Undersecretary for History, Art, and Culture

MCI 6440.1 Smithsonian Haiti Project: Sculpture Treatment and Consultation

MCI Staff: Carol Grissom

Three objects were treated by Carol Grissom at the Haiti Cultural Recovery Center in Port-au-Prince, Haiti, from March 9 to 18, 2011: a bronze and marble statue of a female slave by Bracony from the Haitian Pantheon Museum, a plaster and bronze relief of the Haitian Act of Independence from the Parliament building, and granite reliefs by Drabanet from its Chamber of Deputies. Grissom was accompanied during the treatment period by Smithsonian American Art objects conservator Helen Ingalls, who also worked on two of the objects as well as a plaster bust of *Petion*. A power point presentation was given by both conservators in the MCI theater on April 8, 2011 (a copy of the presentation is included in the file). Chief conservator for the project was former Smithsonian conservator Stephanie Hornbeck.

The conservators also visited the almost completely destroyed Episcopal Cathedral of Haiti (Holy Trinity), photographed removal of wall paintings by other project conservators there, and attended a press conference held by the Smithsonian Undersecretary for Museums Richard Kurin, the Bishop of Haiti, the Haitian Minister of Culture, and Haitian Minister of Tourism.

MCI 6440.2 Smithsonian Haiti Project: Haitian Wall Paintings

MCI Staff: Odile Madden, Jennifer Giaccai, Carol Grissom

Fragments from two wall paintings recovered from the Holy Trinity Episcopal Church in Haiti after the January 2010 earthquake. The fragments were analyzed to characterize and/or identify paint binder, wall painting structure and mortar/aggregate substrate. This was a special effort by Under Secretary Richard Kurin to help recover as much of the murals as possible. Contract conservators, Viviana Dominguez and Rosa Lowinger, on-site supplied the samples.

Smithsonian American Art Museum

MCI 5984.2 Linen Sculpture: *The Principal Wife Goes On* by Sheila Hicks
MCI Staff: Mary Ballard, Genevieve Bieniosek, Mary Kuhn, Cathleen Zaret

After the *High Fiber* exhibition closed in July, 2005, this work was packed and moved to storage. In 2007, it was then carefully vacuumed and examined by two MCI textile conservation summer interns. They banded each irregularity--loose skein wrapping, slippage, pulled yarn, exposed end—with white Teflon tape. In June 2010, the irregularities they found were corrected on all six sections of *The Principal Wife Goes On*. No additional, new threads were needed for the repair of the textile hanging and none was introduced. Small loose fibers or yarn samples were collated and fiber identification was carried out using Fourier transform infrared spectroscopy. The sections of the hanging were repackaged in acid free tissues and returned to the crate in which they are stored.

MCI 6278 Painting: *Les Clochards, Montmartre, Paris* by Loïs Mailou Jones

MCI Staff: Jia-sun Tsang, Allison Martin, Mel J. Wachowiak, Jennifer Giaccai, Judy Watson, Ron H. Cunningham

Seven paint samples from the Loïs Mailou Jones' *Les Clochards, Montmartre Paris* were brought to the Museum Conservation Institute for technical analysis. The painting was undergoing conservation treatment and questions arose as to the surface coating and paint media. The aim of the project was to identify and better understand the surface coating and paint media of the painting. The requested actions were as follows: FTIR of untreated samples, microscopy of cross-section samples, and SEM-EDS of paint.

The FTIR analysis was effective in identifying the surface coating as shellac, however, the painting media was not able to be identified with any certainty. The paint layer does not have the characteristic appearance of oil paint and microscopy showed that the paint layer is thinly layered with the appearance of water-based media such as casein, protein, and gum. The dispersion of pigment particles, sedimentary layering on each other and their sharp distinct edges as seen in SEM support the possibility of a water-based media. As water-based media in general is lean, this would further explain the inconclusive results of the FTIR analysis.

MCI 6280 Painting: *Self Portrait* by Loïs Mailou Jones

MCI Staff: Jia-sun Tsang, Allison Martin, Mel J. Wachowiak, Jennifer Giaccai, Judy Watson

Samples from *Self Portrait* by Lois Mailou Jones were brought to the Smithsonian Institution's Museum Conservation Institute (MCI) in order to identify the surface coating. The coating is similar to that of another painting by the artist, *Les Clochards, Montmartre, Paris* which is also being analyzed at MCI. The coating is of interest as identification would aid in the restoration and preservation of the painting as well as identify artist media and working technique.

MCI 6290 Terra Cotta Portrait Medallion: *Jennie Waite*

MCI Staff: Nicole Little, Jennifer Giaccai

The terra cotta medallion of *Jennie Waite* was gifted to SAAM in 1974, and was manufactured of fired terra cotta in 1879. During the course of its storage, the medallion acquired white efflorescence within the pores of the terra cotta. The surface of the medallion also has powdery white material which was concentrated on raised portions of the object. Because the efflorescence could be salts resulting from prior treatments, some of which may be potentially damaging to the object, XRD analysis was performed to determine whether the efflorescence was the result of salts, natural inclusions or deliberate additives in the clay matrix. XRD analysis was unable to identify the small efflorescence particles in the terra cotta pores; the white material on the surface of the medallion was identified as gypsum. It was determined the gypsum likely resulted from storage adjacent to plaster materials.

MCI 6303 Silver Rattle

MCI Staff: Carol Grissom, Jeff Speakman, Nicole Little

The green corrosion products on the silver rattle and the silver rattle itself were sampled and analyzed using XRF and XRD to inform the course of the conservation treatment and to learn more about the techniques used to manufacture the rattle.

MCI 6308 Textile Art: *Leaf Lock* by Diane Itter
MCI Staff: Mary Ballard, Cathy Zaret, Genevieve Bieniosek

This is part of the Renwick Permanent Collection Storage Project, initiated June 2005. Conservation will enable the textile to be safely exhibited so as to reflect the artist's vision of how it should be shown, and will help arrest any ongoing rust issues related to its current state. Exhibition is being considered within the next several years.

MCI 6309 Textile Art: *Lay Inlet* by Barbara Lee Smith

MCI Staff: Mary Ballard, Cathy Zaret, Genevieve Bieniosek

The laminated, lightweight, translucent non woven diptych, *Lay Inlet*, is part of the Renwick Permanent Collection Storage Project, initiated June 2005. A protective storage/exhibition mount will enable the piece to be displayed safely in the Renwick's 40th Anniversary Exhibition in 2012. Plans for a storage container and display support for exhibition are described to address the unique needs of this artwork. At the present time it must be stored face down and cannot be easily shown nor hung for exhibition.

MCI 6311 Henry O. Tanner Painting Materials and Techniques

MCI Staff: Jennifer Giaccai, Jeff Speakman, Mel Wachowiak, Jia-sun Tsang

The American Art Museum (SAAM) and the Pennsylvania Academy of Fine Arts (PAFA) are working collaborative1y with MCI to research the materials and techniques of American painter Henry O. Tanner. The project was initiated by a request from PAFA, which is organizing a 2012 exhibition of Tanner's works titled, *Henry* O. *Tanner: An International Retrospective*. The technical analysis will concentrate on several paintings from SAAM's extensive collection of Tanner's work. PAFA has applied for and received funding from the Luce Foundation to support an independent researcher, who will assist in the assessment, analysis, and interpretation of materials from this research study. A collaborative essay will be written on the analytical results and interpretations of the artist's technique for inclusion in the exhibition catalogue being published by PAFA.

This study will be the first scientific appraisal of Tanner's painting technique and will result in the first published conservation study of this artist. The project has three main goals for the technical analysis: 1) To understand the evolution of Tanner's working methods and materials; 2) To differentiate authentic from spurious works; and 3) To guide future conservation of Tanner's work, as well as serve as a model for future systemic studies of American artist's techniques.

As stated by PAFA in their research grant application: Tanner is known to have experimented with unorthodox materials and recipes in the creation of his paintings. A major focus of the analysis will be to characterize the materials and layering used by Tanner at various periods of his career. This would allow for a fuller understanding of the painter's work, provide a possible template for dating paintings within the artist's *oeuvre,* and help to differentiate authentic works by Tanner from those misattributed to him. The analysis may also give clues about the condition of Tanner's paintings. [Authored by Anna Marley, Curator of Historical American Art, PAFA]

As outlined during a preliminary project meeting between MCI, SAAM, and PAFA project personal, the specific sample sites and material analysis will be selected and taken in collaboration with MCI staff. MCI analysis being requested for this project includes: Fourier transform infrared spectrometry; X-ray fluorescence spectroscopy; scanning electron microscopy-energy dispersive X-ray spectroscopy; and reflectance transformation imaging. Fluorescence microscopy, cross-section analysis, X-radiography, and infrared reflectography will be performed by SAAM and PAFA. Gas chromatography-mass spectrometry will be done in collaboration with Washington and Lee University.

MCI 6418 Exhibition Conservation of Four Rockman Paintings

MCI staff: Jia-sun Tsang, Claire Walker

MCI provided emergency care for four paintings in the exhibition “Alexis Rockman: A Fable for Tomorrow”, scheduled from November 19, 2010 to May 8, 2011. The mixed-media nature of the paintings had caused active flaking and delamination. The media, possibly natural resin varnish, wax, alkyd, and oil, limited the types of adhesives that could be used and the methods of applying the adhesives. Organic solvents were avoided and if needed, smallest amount of solvents were applied with a #1 brush to the area of paint loss only. Most of the paint losses in scratches and scuffs were locally inpainted with PVA resin-based conservation paints and indentations were filled with clear, microstalline wax. The fills, inpainting and scratches and scuffs were varnished locally with MS2A in Stoddard solution, applied with a #1 brush.

The artist in front of 'South' (2008) at the Smithsonian exhibit; oil on gessoed paper. Collection: Pappas family, Boston. ©Alexis Rockman. Photo courtesy the artist.

MCI 6420 Comparative Study of Sacrificial Coatings for Marble Sculptures

MCI staff: Jia-sun Tsang, Claire Walker

Assistance and consultation on conservation fellow project to evaluate coatings applied to marble.

MCI 6456 Binder Analysis, Moser Paint-on-Paperboard Artwork

MCI staff: Jia-sun Tsang, Claire Walker

MCI was asked to analyze the binding medium in the original paint and overpaint on the Moser artwork. While the later overpaint was easily soluble in water, the original paint was not soluble in water, but was somewhat soluble in non-polar solvents, suggesting that it may be an oil paint. Identification of the binding media was sought to aid in determining a treatment for the artwork and in storage requirements for the painting. Samples of both paints were analyzed using μFTIR. The infrared spectra clearly showed that the original paint was a gum-bound gouache paint. The white overpaint was significantly different from the original white paint, primarily containing calcium carbonate.

Smithsonian Conservation Biology Institute

MCI 6435 Integrating native plant diversity within agricultural grasslands to increase forage production and improve habitat for grassland birds

MCI Staff: Christine France

The overall goal of this project is to determine how native warm season and cool season grasses differ in their ability to provide important ecosystem services such as the production of plant biomass, and providing food and habitat for grassland birds. As part of this project we will work in collaboration with Bill McShea, a research ecologist at the Smithsonian Conservation Biology Institute to evaluate diets of various species of insects and birds from these various pasture type. Stable isotope analysis from the grasses, insects and bird tissues (blood and feces) will allow us to determine what these birds are eating, and where that food is coming from.

Smithsonian Environmental Research Center

MCI 6263 Terpenes in Spicebush (*Lindera benzoin*) Leaves

MCI Staff: Jennifer Giaccai

SERC is studying the effects of browsing by white-tailed deer (*Odocoileus virginianus*) on spicebush leaves, specifically if browsing by white-tailed deer increased or decreased later activity by the specialist spicebush swallowtail (*Papilio troilus* L.) and other generalist insects. Their studies show that after deer browsing on spicebush plants, new leaves with different water content and nutrient chemistry are produced. In SERC laboratory studies, spicebush swallowtail caterpillars showed increased interest in post-browse leaves where as generalist insect activity in the field showed preferences for pre-browse leaves. GC-MS analysis of spicebush leaves was undertaken to examine differences in terpene levels in pre-browse and post-browse leaves.

Leaves from bushes both browsed and unbrowsed by deer were sampled and analyzed. Forty-seven dichloromethane extracts were analyzed by GC-MS to determine the changes in the level of terpenes. The results will be presented in a forth-coming paper.

MCI 6357 Effects of Nutrient Enrichment and Species Diversity on Ecological Stoichiometry

MCI Staff: Christine France

This is a study on how nutrient enrichment alters food webs in the mangroves. These samples cover how different snail species differ their feeding on different species of enriched mangrove leaves.

MCI 6361 Preliminary Project – Analysis of Plant and Animal Ecosystems in Alaska

MCI Staff: Christine France

Plant and soil samples from Alaskan ecosystems will be run in an effort to reconstruct the food webs of the area.

MCI 6376 How Riparian Vegetation Communities Influence Stream Food Web Structures

MCI Staff: Christine France

This study is focused on how riparian vegetation communities influence stream food web structure, as inferred using hydrogen, carbon and nitrogen stable-isotope ratios. Using samples collected across different wetland geomorphic settings (ecosystems), it will be determined if different riparian wetland vegetation along headwater streams differentially support stream food webs. The study will help quantify the hypothesized linkage between uplands, wetlands, and streams in supporting juvenile salmon production. This information will be an important first step for regulators and managers to assess the ecological consequences of development activities in the headwater regions of watersheds on the Kenai Peninsula.

MCI 6380 Effects of Environmental Change on the Mycorrhizal Relationships of the Native Orchids *Goodyera pubescens* and *Tipularia discolor*

MCI Staff: Christine France

Environmental change poses a many-faceted threat to native orchid species. Not only do habitats threaten to change directly, but the effects these fluctuations can have on necessary mycorrhizal communities also limit the ability of orchids to withstand changing conditions, especially at times of heightened stress when they may be depending on their mycorrhizal partners extensively for nutritional needs. This study incorporates *Goodyera* and *Tipularia* individuals at field sites on the SERC campus. Orchids obtain carbon from photosynthesis and also by digesting their mycorrhizal fungi; carbon can also be transferred from the plant to the fungi. These different nutritional patterns and the different fungal species incorporated into the orchids will be traced using stable carbon and nitrogen isotopes. Additionally, orchids will be exposed to reduced water and light in an effort to estimate the extent to which the orchids rely on their mycorrhizal fungi for nutrition during periods of stress, and whether increased stress induces myco-heterotrophy.

MCI 6395 Environmental Controls on Diatom Distribution in the Patuxent Estuary, Past and Present: Implications for Holocene River Discharge and Sea-Level Change

MCI Staff: Christine France

Present models of Holocene estuary evolution are driven largely by changes in relative sea-level with little reference to long-term changes in fluvial regime and regional climate. Recent US studies of estuarine sequences have shown that decadal-centennial scale fluctuations in river discharge and freshwater inflow can be inferred by changes in estuarine paleosalinity and that the timing of these events reflects changes in regional precipitation. It is therefore becoming apparent that estuarine sequences may hold an archive of mid-late Holocene climate change information, as well as being recorders of RSL change. This study will use the contemporary distribution and salinity preferences of diatoms along the inner Patuxent estuary salinity gradient to quantitatively reconstruct paleosalinity in two dated sediment cores. Relationships between diatom distribution and a range of environmental variables will be investigated over a 12 month period so as to incorporate a range of tidal range and seasonal discharge variation. This will enable the development of a robust predictive transfer function, with smaller errors, that calibrates diatom variation to salinity. This will then be applied to the Holocene diatom record. The Patuxent watershed lies in a jet stream transition zone that is particularly sensitive to climatic variability, including the North Atlantic Oscillation. This should enable a sensitive and high resolution precipitation-driven discharge record to be reconstructed for the mid-late Holocene. The resulting climate record will be compared with other proxy climate records from the eastern United States and North Atlantic region. The methodology used in this study can then be applied to other estuarine systems, such as those affected by a Monsoon climate in south-east Asia.

MCI 6396 Assessing Denitrification at the Watershed Scale Based on N and O Isotopes in Nitrate

MCI Staff: Christine France

The goal of this research is to determine the fate of nitrogen (N) added to watersheds by agriculture. Building on previous research, this project will apply new methods to assess denitrification in agricultural watersheds. Denitrification consumes nitrate, the main form of N exported from N-enriched watersheds, and produces dinitrogen and nitrous oxide gases. The project will measure accumulations of dinitrogen and nitrous oxide gases in groundwater and surface soils, and changes in the isotopic composition of nitrate that are indicative of denitrification. The study will identify locations within watersheds where denitrification is hypothesized to be most important: damp areas such as stream buffers and wetlands.

MCI 6397 The Mycorrhizal Status of *Epifagus virginiana*

MCI Staff: Christine France

Work in the plant ecology lab has focused on mycorrhizal associations of a variety of plant species. One species that we have studied is the parasitic plant *Epifagus virginiana*. This plant belongs to a plant family thought to be entirely directly parasitic on other plants (Orobanchaceae), yet recent studies have suggested that at least *E. virginiana* may require a mycorrhizal fungus to establish connections with host plants. If the parasitic association is direct, *E. viriginiana* $\delta^{15}N$ will resemble the soil environment and host plant. If the parasitic association is mediated via a mycorrhizal fungus, then *E. virginiana* $\delta^{15}N$ will resemble the fungus. Because *E. virginiana* is parasitic on beech trees, potential fungal hosts are ectomycorrhizal and will have very elevated $\delta^{15}N$ (~5-8‰ higher) relative to the tree host or soil. Conducting an isotopic analysis will determine whether mature *E. virginiana* plants use a fungus as an intermediary host.

MCI 6398 A Novel Application of Bio-Geochemical Fingerprinting to Evaluate the Nursery Potential of Chesapeake Bay Subestuaries to Contribute to the Blue Crab Spawning Stock

MCI Staff: Christine France

The objective of this project is to further develop and optimize a novel application of well-studied bio-geochemical tracers (trace elements, stable isotopes) for the blue crab to understand spatial variation in the production of mature female blue crabs among Chesapeake Bay tributaries. This goal is a key step toward providing managers with spatially explicit information about the value of individual tributaries as nursery habitats to contribute to the female spawning stock of blue crabs in Chesapeake Bay. If successful, this promising technique could be employed with other blue crab populations in the U.S., and potentially for other crustaceans that support valuable fisheries worldwide.

MCI 6402 Penobscot River Mercury Study

MCI Staff: Christine France

This is part of a large multi-investigator study examining the mercury pollution problem in the Penobscot River, Maine part of which is being carried out at SERC. Wetland sediments will be collected to measure mercury methylation rates, and biogeochemical parameters associated with the mercury methylation, and the sediment C and N stable isotopes in the sediments will be measured as part of that characterization. The possibility of analyzing total S and d34S in the sediments will be investigated as well.

MCI 6404 Evaluating the Effects of Anthropogenic Nitrogen Pollution in the Invasion of a Non-Native Genotype of the Common Reed, *Phragmites australis*

MCI Staff: Christine France

This project is studying how the historic and predicted global change, namely nitrogen pollution and rising CO_2 concentrations, have and will affect the invasion process of the common reed, *Phragmites australis* (hereafter *Phragmites*). Prior to the doubling of reactive N in the global N cycle and 100 ppm increases in CO_2 in preindustrial times, a non-native lineage of the common reed, *Phragmites* was introduced to the North American continent in the 19th century. Although native genetic lineages were found throughout North America, the rapid expansion of introduced *Phragmites* has been attributed to the particularly vigorous lineage from Europe. This field and laboratory research on native and introduced lineages indicated differences in plant physiology, N uptake parameters, and these differences should also be reflected in their stable isotope and elemental C and N content. Using collected herbarium specimens from (1856-present day), the historical changes in plant ^{15}N and ^{13}C content will be investigated, which may support the hypothesis that global change is driving the invasion of the introduced lineage.

MCI 6407 Peat Decomposition as Exposed to Elevated CO_2 and N

MCI Staff: Christine France

These samples consist of peat taken from the elevated CO_2 site located at the Global change Research Wetland at SERC. Intact marsh was exposed to a combination of elevated CO_2 and soil N addition. These samples are from decomposition bags. Fine membrane bags were filled in the plots and allowed to decompose for up to two years. The remaining N and C will be estimated, as well as an estimate for the residence time of C and N using ^{13}C and ^{15}N.

MCI 6408 *Cypripedium fasciculatum* Fungal Dependence

MCI Staff: Christine France

This project is aimed at elucidating the mechanisms that may influence current and future distribution of a rare orchid species in the genus *Cypripedium*. Using modeling techniques and experiments, the study will test the strength of various elements of environmental niche (microclimate and climate). Orchid species also depend on fungi for germination in the wild, and at times, for nutrition and carbon at late lifestages. Isotopes can be used to demonstrate orchid dependence on ectomycorrhizal carbon – even for green leaved, photosynthesizing plants. Preliminary research on *Cypripedium fasciculatum* has indicated that some populations may associate with ectomycorrhizal fungi and may have isotope signatures indicating nutrition from ectomycorrhizae. If *Cypripedium fasciculatum* does associate with ectomycorrhizae, and particularly if such dependence varies with other climatic or forest characteristics, the observation could improve models of species distribution and strategies for species conservation. This project is relevant to ongoing research being done by the Plant Ecology Lab at SERC in several respects. This study will both continue studies of the mycorrhizal ecology of orchids, as has been a priority for Dr. Melissa McCormick and Dr. Dennis Whigham, and also extend a new research collaboration with Stella Copeland (PhD student, U.C. Davis) on the genus *Cypripedium*. In addition, this study will address a present lack of data within the scientific

community regarding the extent to which many green, and so potentially photosynthetic, orchids depend on their mycorrhizal fungi.

MCI 6409 A Novel Application of Bio-Geochemical Fingerprinting to Evaluate the Nursery Potential of Chesapeake Bay Subestuaries for Blue Crabs

MCI Staff: Christine France

The dynamics of marine and estuarine species are often characterized by complex life histories involving dispersal among segregated sub-populations. Defining the ecologically relevant scales of connectivity among spatially distinct local populations is necessary for a full understanding of metapopulation dynamics. Although investigations of dispersal during early life history stages are relatively common, for species that undergo dispersal as juveniles or adults, an understanding the degree of connectivity between spatially segregated juvenile nurseries and adult spawning habitats is also critical. The blue crab (*Callinectes sapidus*) exhibits a complex life history with large-scale dispersal between estuarine and marine habitats during larval, juvenile and adult phases. Consequently, local sub-populations of this species are connected through dispersal at multiple life stages, and at varying spatial scales, contributing to a relatively poor quantitative understanding of metapopulation dynamics.

The proposed work assesses the potential of geochemical signatures (trace elements, stable isotopes) as natural tags for the blue crab to determine the nursery potential and connectivity of juvenile blue crab populations at the scale of an estuary. Such techniques have been extensively utilized for finfish and some invertebrates, but have almost no history of use in crustaceans. The overall hypothesis is that female blue crabs maturing in spatially segregated nurseries within Chesapeake Bay will incorporate distinct geochemical signatures into their calcified exoskeleton as a result of regional variation in biological, chemical and geological processes. Unlike juvenile and adult male blue crabs which continue to molt, mature female blue crabs exhibit a terminal or final molt, such that geochemical signatures may be retained and serve as a natural tag to identify nursery origin and determine population connectivity. Preliminary data from six pilot study locations in Chesapeake Bay support this concept. Broad objectives are: (i) to carefully evaluate the value of geochemical signatures as natural tags in blue crabs, and (ii) to test our ability to use natural tags to assess the nursery potential of individual nurseries of the bay to the adult spawning stock.

MCI 6423 Predicting Impacts of Stressors at the Land-Water Interface: Effects of Multiple Stressors on Estuarine Macrofauna

MCI Staff: Christine France

This project will examine the direct effects of shoreline modification, as well as the interactive effects of shoreline modification, watershed land use, SAV loss, and diel-cycling hypoxia on macrofauna abundance, diet, and health. Fish and macroinvertebrates will be collected among replicate shoreline types in subestuaries from Virginia and Maryland portions of

Chespeake Bay that differ by land use (forested, agricultural, and developed). To understand if shoreline modification affects trophic positioning of key species δ13C and δ15N ratios in tissues of four ecologically and economically important species common throughout the mid-Atlantic will be analyzed. Mummichog (*Fundulus herteroclitis*) and Atlantic silverside (*Menidia menidia*) are shallow water forage fishes that will likely reflect small-scale local conditions; and white perch (*Morone americana*) and spot(*Leiostomus xanthurus*) are important consumers in shallow subestuaries and will integrate conditions over larger spatial areas. This work is part of a 5-year, multi-investigator project funded by NOAA on the effects of shoreline modification and watershed development on the nearshore ecology of Chesapeake Bay. Of the 17 project PI's, 11 are from or affiliated with the Smithsonian Environmental Research Center.

MCI 6426 The Indirect Effects of Invasive Earthworms on Tree Seedling Recruitment in Deciduous Forests

MCI Staff: Christine France

The main objective of this project is to understand complex interactions between major aboveground (trees) and belowground (fungi and earthworms) components of the forest ecosystems. The main hypothesis is that non-native earthworms affect the recruitment of tree seedlings through effects on mycorrhizal fungi. Field experiments were conducted in young and mature forest stands in the deciduous forests at the Smithsonian Environmental Research Center. Earthworm abundance and leaf litter input was manipulated for two years. Upon harvesting, soil samples were collected for analyzing soil characteristics, enzyme activity, and microbial community assessment. It is expected that the experimental plots will differ in these plots due to feeding and mixing activity of earthworms. This will result in different C- and N-content and stable isotope ratios as a function of treatment and soil depth.

Smithsonian Institution Archives

MCI 6296 Letterpress Copying Books: A Study of the Baird Collection

MCI Staff: Mel Wachowiak, Jennifer Giaccai, Jeff Speakman, Ron Cunningham, Marion Mecklenburg

The proposed research will investigate the conservation treatment options to preserve the treasured Smithsonian collection of letterpress copying books handwritten by Spencer Fullerton Baird (1823-1887), the second Assistant Secretary for the Smithsonian Institution. Housed in the Smithsonian Institution Archives, the Baird copying books comprise eighty volumes of outgoing correspondence (1850- 1877) including approximately 32,000 leaves bound in quarter-leather cloth bindings. The letters document, not only the history of the Smithsonian Institution, but also the growing fields of museology and natural history in the mid-nineteenth century. This unique primary source provides an irreplaceable window into a formative period of the history of the nation. The copying books are currently unavailable to researchers due to their severely deteriorated condition. The fragile paper exhibits conditions such as fading inks, offsetting, feathering, embrittlement, and letter drop-out or lacing, which are symptomatic of advanced iron gall ink corrosion and are commonly found in copying books.

The historic copy press process involved the transfer of ink on a freshly written document to a moistened sheet of copy paper through the use of direct contact and pressure. Because the soluble copying ink was transferred directly, it left a mirror image print to be read from the verso of the thin paper. The process required inks and papers to have certain properties to be effective. It was necessary for the ink to remain wet for an extended period in order to achieve multiple high quality copies without causing unacceptable damage to the original. The paper had to be thin enough to read through the verso of the sheet, but also had to be strong enough to withstand the strains of being handled wet and pressed repeatedly. These parameters led to the experimentation and development of many different formulations of ink and papers. These unusual papers and inks create special challenges for conservation treatment. Because the inks and papers used are unique to copying books, their preservation needs are likewise unique.

The proposed study will build upon a research project conducted by the applicant in 2008. The project will rely on analytical techniques to investigate the complex nature of the materials and experimental procedures using artificially aged samples to further investigate treatment options, such as alkalization, phytate treatment, sizing, and paper splitting. Although the previous study did develop an effective lining technique for copying book paper, lining is not always a desirable treatment solution and it does not address the widespread ink corrosion problem. The proposed study will attempt to develop a treatment protocol that will stabilize the materials both chemically and physically. In addition, this study will investigate methods of imaging the ledger books, either with or without conservation treatment.

Smithsonian Institution Libraries

MCI 6298 Book: *The Principles and Practice of Modern Surgery* (1860) by Robert Druitt
MCI Staff: Nicole Little, Mary Ballard

The book was stabilized and given an anoxic treatment before cataloguing and addition to the Smithsonian Institution Libraries research collections.

Smithsonian Latino Center

MCI 6310 Exhibit: *Contemporary Argentine Masterworks*

MCI Staff: Jia-sun Tsang

Jia-sun Tsang served as the exhibition conservator for the SI exhibition "Southern Identity: Contemporary Argentine Art", which was organized by the Smithsonian Latino Center and Ministry of Foreign Affairs Division, Argentina. The exhibition is located at the International Gallery at the S. Dillon Ripley Center. It opened on October 12, 2010 and closed on January 10, 2010. The purpose of the conservation project was to ensure that the lender's requirements in the condition survey, handling, installation, and security were met.

This exhibition, organized by the Argentine State Secretary of Culture together with Smithsonian Latino Center, gathered 80 works from 32 prominent artists of contemporary Argentine visual arts including three dimensional models, paintings, paper, and photographs. It represented the diverse origins and trends as well as the complexity and variety in Argentine contemporary visual art.

The artworks were unpacked, unwrapped, and installed following the conservation guidelines. There were no condition reports from the lender. The condition reports of 80 objects in 27 crates were generated by Jia-sun during the installation. The tight installation schedule did not allow much time for detailed inspection. For the most part, the artworks are in stable condition. Any noticeable damage from transportation was documented in the condition reports.

Smithsonian Marine Station at Fort Pierce, Florida

MCI 6392 Use of Isotopic Signatures to Assess the Importance of Mangroves as Feeding Areas for Mangrove Fish Communities in Florida and Belize

MCI Staff: Christine France

The aim of this research is to determine the importance of mangrove ecosystem as fish feeding ground in Florida (Indian River Lagoon – Smithsonian Marine Station in Fort Pierce) and Belize (Twin Cays – Smithsonian Marine Station in Belize). It is hypothesized that the importance of mangrove-derived carbon sources in fish food webs may vary on mangrove location (tropical and subtropical latitudes) and physiognomy (offshore islands and riverine mangrove). Moreover, fish residence times in mangroves (resident, transient) may have an influence on their feeding habits. As stable-isotope composition in a consumer reflects the isotopic ratios of its diet, analyses of the natural abundance of carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) stable isotopes provide a powerful method to trace sources and transfer of organic matter through food webs. Provided that primary producers and then consumers have distinct isotopic signatures, carbon and nitrogen stable isotopes are proving increasingly useful as tracers in coastal trophodynamics studies. Mangroves are characterized by negative $\delta^{13}C$ values compared with other ecosystems (such as seagrass beds), thus allowing a discrimination of food-source origins. When conducted in conjunction with gut-content analyses to identify prey items, stable-isotopes analyses provide a powerful tool for untangling food webs.

MCI 6399 Seagrass Food Web Structure in the Banana River Lagoon

MCI Staff: Christine France

Some of the small animals that live in seagrass beds are believed to indirectly benefit the seagrass by consuming algal epiphytes and detritus while not eating the seagrass blades themselves. Because these small herbivores are eaten by small predators, which are in turn eaten by large fish that may be harvested by humans, the potential exists for overfishing to induce a trophic cascade that would result in overgrowth of seagrass by epiphytes. Whether or not such a cascade occurs depends on exactly what eats what in the seagrass beds- something we currently know only vaguely. Stable isotope and gut contents analyses will be used to examine to compare the species-specific food-web connections in two seagrass beds, one in a no-fishing reserve and one in a heavily-fished area, to see if it's true that food web changes caused by overfishing could be bad for the health of the seagrass.

MCI 6410 Comparative Functional Role of Mangroves and Swamps for Nekton

MCI Staff: Christine France

Structurally complex tidal wetlands such as mangroves and salt marshes are important habitats for a great diversity of organisms, including many of ecological and economic significance. As global temperatures rise, mangroves are expanding their geographic range and colonizing wetlands previously dominated by more cold-tolerant salt marshes. Despite considerable research effort in these ecosystems, our understanding of the values of tidal wetlands for nekton generally remains at a paradigmatic level broadly applied to all wetland types; they are valuable, particularly as nurseries, in providing some combination of abundant food and refuge from predation. Yet even within particular wetland types, evidence is emerging that these functional roles may show considerable geographic variation driven by variations in wetland flooding patterns, vegetation structure, and food-web dynamics. The aim of this project is to compare the functional roles of mangroves and *Spartina* salt marshes in the support of estuarine nekton. At sites along the south-eastern coast of the USA spanning the transition from mangrove- to *Spartina*- dominated wetlands where key species of nekton are common throughout, three key elements of estuarine wetlands will be examined: 1) access for aquatic organisms will be compared by quantifying physical flooding of vegetated wetlands at each site and determining the primary driving forces of flooding (tides, meteorologic events, rainfall/river flows); 2) the physical habitat structure available to nekton accessing the wetlands will be compared in terms of the refuge it may provide; and 3) the contribution of wetland production to estuarine food webs will be compared using stable isotope analysis to produce simple food web models examining the trophic support of representative consumer groups. This project will highlight emergent properties of coastal wetlands, as well as describe fundamental differences in the ecological functioning within and among mangrove and *Spartina* dominated wetlands. The findings will clarify the processes and mechanisms underpinning coastal wetland value, and provide insights into future changes in wetland functioning where mangroves expand into salt marshes. Project is being conducted as a Post-Doctoral Fellowship awarded to R Baker and advised by Dr. Candy Feller.

Smithsonian Traveling Exhibition Service

MCI 6096 Review of Fabric Samples for “Jim Henson’s Fantastic World” Exhibition

MCI Staff: Mary Ballard, Walter Hopwood

MCI was asked to review the suitability of cotton velveteen fabrics as installation fabric for *Jim Henson’s Fantastic World.* Two types of velveteen were reviewed: one set (Velling color #362 and Velling Color #363)produced by Baumann; the other (Applause cotton velvet #2672-08 color: Peanut Vendor) by Gretchen Bellinger. The Gretchen Bellinger fabric is listed as being ‘treated for stain, crush, and soil resistance.’ FTIR analysis of the surface finish extracted with methylene chloride produced a spectrum consistent with that of a silicone resin-wax coating.

Smithsonian Tropical Research Institute

MCI 6100.2 Technology of Pre-Columbian Gold from Panama. A Study of Fabrication and Compositional Analysis

MCI Staff: Harriet (Rae) F. Beaubien, Ainslee Harrison, R. Jeff Speakman, Jennifer Giaccai, Judy Watson, Ron Cunningham

Archival research, technical examination, and elemental analysis of gold-alloy and gilded Pre-Columbian objects of Panamanian origin in the Smithsonian Institution collections was completed. Seventy eight artifacts, now in the National Museum of Natural History, originating from Panama were examined along with 221 now in the National Museum of the American Indian. These included objects from excavations in Chiriquí, Veraguas, and Herrera Provinces, the Panama Canal Zone, and numerous objects with no specific site provenience. A database of information was created for all 299 objects. Project collaborators were Richard Cooke and Julia Mayo, both from STRI.

MCI 6256.2 El Caño Archaeological Project: 2010 Field Season

MCI Staff: Harriet (Rae) F. Beaubien, Kim Cullen Cobb

In 2010, conservators from the Smithsonian's Museum Conservation Institute joined the El Caño Archaeological Project to provide conservation assistance and training during excavations in the El Caño Archaeological Park (Coclé Province), as well as the laboratory phase. The 2010 field season included field recovery, conservation, and rehousing of objects found during the field season, preliminary examination of gold finds, and basic conservation training for archaeological project members, related to objects. The purpose was to have stable conditions for storage, analysis, and possible exhibition for the archaeological finds and improved lifting methods and finds processing for the archaeological project team.

MCI 6256.3 El Caño Archaeological Project: 2011 Field Season

MCI Staff: Harriet (Rae) F. Beaubien

In 2011, Head of Conservation, Rae Beaubien from the Smithsonian's Museum Conservation Institute joined the El Caño Archaeological Project to provide conservation assistance and training during the continued excavations in the El Caño Archaeological Park (Coclé Province), as well as the laboratory phase.

MCI 6362 Preliminary Project – Cross-Laboratory Comparison and Confirmation of Standard Values for Stable Isotopic Analysis

MCI Staff: Christine France

Standards with accurate known isotopic values are critical to proper data handling and linear correction to internationally calibrated isotopic standards. In this study, organic materials developed at the Smithsonian Tropical Research Institute are tested in an inter-laboratory comparison to confirm stable carbon and nitrogen isotopic values.

MCI 6388 Nutrients Dynamics during Ecosystem Development

MCI Staff: Christine France

This project examines transformations of nutrients during pedogenesis using a series of soil chronosequences in Australia and New Zealand. Ecosystem development is characterized by a progressive increase in phosphorus limitation of primary productivity, which eventually leads to a reduction in forest biomass (retrogression). Changes in major nutrients (C, N, P) have been relatively well-studied, but evidence from hydrolytic enzymes from one sequence (the Franz Josef post-glacial sequence in New Zealand) indicates that sulfur may limit productivity during ecosystem development when ample nitrogen and phosphorus are available. XANES work to identify sulfur compounds in soils along the sequence has already been performed and now the goal is to assess total sulfur concentrations and the isotopic ratios in soil and leaf tissue (from the major species along the sequence). Taken together, this will provide detailed information on sulfur pools and dynamics along the sequence with which to assess the long-term sulfur status of the ecosystem.

MCI 6415 A Pilot Study Using Carbon and Oxygen Stable Isotopes to Source the Marine Bivalve *Spondylus*

MCI Staff: Christine France

For this pilot project, stable isotopes of carbon and oxygen will be measured to assess the utility of isotopic ratios as a means to identify the origin of archaeological Spondylus. Spondylus, a tropical marine bivalve, has played a significant role in societies throughout the world. People of the pre-Columbian states of Andean South America consumed massive quantities of Spondylus. Since it is not available in the cooler waters of modern day Peru, Spondylus was imported from the north. It has been hypothesized that in order to satisfy the demand of Andean societies to their south, coastal Ecuadorian people overfished local Spondylus beds and, to maintain exchange, they initiated trade with societies farther and farther north, eventually reaching West Mexico. Recently, the assumptions of this hypothesis have been questioned. However, there is no way to determine the origin of archaeological Spondylus. This research is a pilot project to begin to determine the applicability of isotopic research to provenience analysis of archaeological shell. It is proposed to test approximately 30 samples from 10 *Spondylus princeps* shells from two regions of Panama, the Gulf of Panama and the Gulf of Chiriqui. I will first collect a controlled sample of S. princeps shells with the assistance of Richard Cooke. I will prepare samples for analysis of oxygen ($\partial^{18}O$) and carbon ($\partial^{13}C$) at the Soils Laboratory at STRI. Because these two regions have distinct temperature/salinity/upwelling regimes, they should produce distinct isotopic signatures. This pilot study is the initial phase of a broader research project. Ph.D. project by Benjamin P. Carter, Muhlenberg College with Dr. Richard Cooke, STRI.

MCI 6419.2 Analyses of organic substances from Necropolis of El-Caño Panama

MCI Staff: Jennifer Giaccai, Harriet F. (Rae) Beaubien, Nicole Little, Mel Wachowiak

Organic substances adhering to human bones and artifacts from the El-Caño dig site in Panama will be examined and, identified, if possible. Results will assist in identifying this unusual material, will contribute to excavation documentation, and provide new information for the archaeological and technological interpretation of such burial installations. In particular, resins from Pre-Columbian cultures have undergone limited study to date, and identification will contribute to a better understanding of the plants and types of resins that may have been used by native inhabitants of Panama for a number of different purposes, including adhesives, metal working, and composite materials for burial shrouds.

Pan-Institutional Projects and Museum Conservation Institute

MCI 6099 10,000 Springs Pavilion Exhibition

MCI Staff: Don Williams, Paula DePriest, Jia-sun Tsang, Marion Mecklenburg, Mel Wachowiak, other staff as needed

An exhibit was produced to showcase the red sandalwood replica of the 10,000 Springs Pavilion. The carved sandalwood architecture model, a 1:5 scale, was a gift from Dr. Chan Laiwa, founder and curator of the China Red Sandalwood Museum. The 10,000 Springs Pavilion was on exhibit at the Irving Arts Center in Irving, Texas, where it remained for about one year, de-installed, and then the exhibit was re-installed at the Historic Flushing Town Center in Queens, New York.

MCI 6202 Non-Destructive and Minimally Invasive Analytical Approaches Applied to Modern and Contemporary Paintings Conservation

MCI Staff: Jia-sun Tsang, Maria Meléndez Bernués

Maria Meléndez Bernuès, a Kress Paintings Conservation Fellow at MCI in 2008, undertook a project, investigating the use of non-destructive analytical methods for identifying natural and synthetic paint binders and varnishes used in modern and contemporary paintings. Maria developed a research plan for her fellowship. The scope of the experimental phase was considerably refined, and this summary outlines what she carried out for this phase of the project.

Maria prepared samples of acrylic, alkyd, and oil paints, as individual materials, in layers, and as mixtures, in the form of draw-down applications on Mylar sheets. (The leftovers of the original paints are still in tubes and they are stored as archival material that can serve as control materials in future studies.) In addition to the prepared samples, Maria had intended to include in her study a series of naturally-aged paint samples on Mylar that had been prepared several decades ago by Marion Mecklenburg. These sample groups were to be analyzed using non-destructive and minimally invasive methods, including microscopy, glossmeter, thickness measurements, FTIR and Raman spectroscopy. These data would serve as base-line information about the paint media, which might prove effective in interpreting results obtained from paintings, useful for art historical understanding and conservation efforts.

Before she had a chance to undertake the analytical phase of the project, Maria was offered a permanent job in Spain and she ended her fellowship without completing the research.

MCI 6233 Isotope Ratio Mass Spectroscopy (IR-MS) Analysis of Natural and Synthetic Indigo

MCI Staff: Christine France, Mary Ballard, Elizabeth Shuster, Cathy Zaret, Greg Henkes, Odile Madden

The purpose of this research project was to determine whether isotope ratio mass spectroscopy can aid in the discrimination of synthetic and natural indigo dyes derived from plants incorporated into cultural artifacts. It was hypothesized that natural and synthetic indigo can be identified in cultural artifacts according to differences in their isotopic makeups, even though their chemical formulas are identical. For example, the carbon isotopes in natural indigo derived from plants and synthetic indigo are likely to be dissimilar because only in natural indigo derived from plants are the isotopes guided by photosynthetic processes. In addition to distinguishing between natural and synthetic indigo, it may be possible to identify the geographic sources of natural indigo used in cultural artifacts, since hydrogen and oxygen isotopes very geographically. In order to test this hypothesis, the tendencies of carbon, nitrogen, oxygen, and hydrogen isotopes toward fractionation in natural and synthetic indigo at various stages of processing were recorded.

This preliminary research did not indicate whether or not IRMS can help differentiate natural and synthetic indigo. The challenges of preparing IRMS samples by extracting dye from a textile indicate that the issue of acceptability of sampling from cultural artifacts for the purpose

of running IRMS analysis may trump the question of whether or not IRMS can be used to differentiate natural and synthetic indigo. The next phase of this project should, therefore, focus on the development of new extraction techniques.

MCI 6244 Sourcing Slate in the Far Northeast: An Examination of Prehistoric Exchange Systems in Newfoundland and Labrador

MCI Staff: Chris Wolff, Jeff Speakman, Nicole Little, Judy Watson

This research focused on the movement of slate among the Maritime Archaic peoples of Newfoundland and Labrador in order to evaluate its role in the long-distance exchange network that existed during their occupation of that region between 8000 to 3200 years ago. Using a Bruker pXRF instrument, approximately 200 samples from sites throughout Newfoundland and Labrador, in collections housed at the National Museum of Natural History (NMNH) and the Provincial Museum of Newfoundland and Labrador were analyzed. Using multivariate statistics, 3-5 chemical varieties of slate were identified among Maritime Archaic assemblages that were used for a number of tool types (e.g., projectile points, wood working tools, plummets, etc). These slate varieties also have interesting geographical patterning that suggests a movement of certain types north from Newfoundland up into central and northern Labrador. One group of slate appears to have moved northward along the coast of Labrador, and may be part of the long-distance exchange system that involved the well-documented southerly movement of Ramah chert whose only sources was found in northern Labrador. Interestingly, and an unexpected discovery, this material was also highly favored in the manufacture of weapons (projectile points and bayonets), perhaps because of its higher silicon dioxide (quartz) content that made it possible to get sharper and harder edges. While it was also used to make woodworking tools, such as celts and adzes, the other types of slate were rarely used for weapons.

MCI 6306 Cleaning Synthetic Polymers in Modern and Contemporary Art

MCI Staff: Jia-sun Tsang, Sara Babo

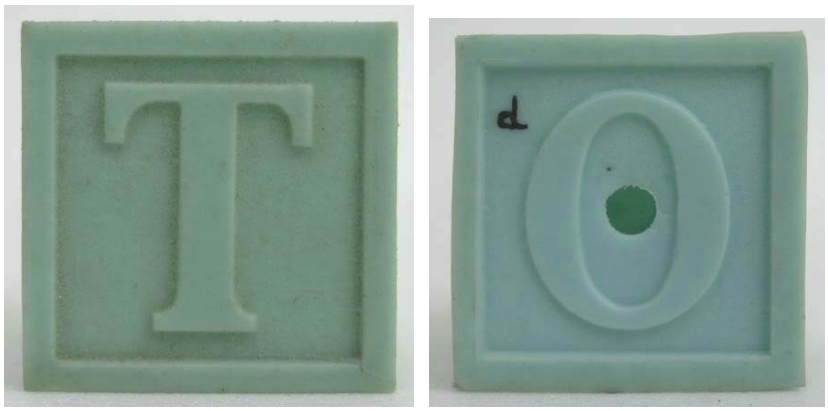
Part 1. Many synthetic polymers, including acrylic emulsion paints and several plastics, are sensitive to traditional cleaning with solvents and water. Dry cleaning methods appear as a good alternative and are sometimes used by conservators but there aren't many in-depth studies. The aim of this project was to study several selected dry cleaning and non-contact methods, considering their efficiency as cleaning agents and risks of use.

For this study, soot-covered acrylic emulsion paint test samples from real and simulated fires were used. Test samples consisted of an acrylic emulsion gesso panel and paint with known pigment composition, cast on glass slides and gesso panels. Commercial products (erasers and sponges) and homemade bread were tested along with non-contact cleaning atomic oxygen and carbon dioxide snow. Atomic oxygen cleaning was conducted by Sharon Miller and Bruce Bank at National Aeronautics and Space Administration (NASA) and carbon dioxide snow cleaning was tested by Hugh Shockey at Smithsonian American Art Museum (SAAM). Paint surfaces were observed before and after cleaning with visual and microscope examination and analyzed with gloss meter, colorimeter, and FTIR-ATR. The effectiveness and limitations of each dry

cleaning method are discussed. In addition, several case-studies are presented including objects from the National Museum of American History (NMAH) and the National Museum of American Indian (NMAI), that were conducted during the course of this project.

Part 2. Surface cleaning of selected plastic objects from NMAH, Division of Medicine and Science.

The work done at the Division of Medicine and Science of the National Museum of American History (DMS-NMAH) included five objects showing surface dirt chosen from the collection: three poly (vinyl chloride) objects and two acrylic objects. Cleaning tests were performed with a variety of dry cleaning methods (erasers, sponges, homemade bread) and water. Visual analysis and optical microscopy were used to assess the effectiveness of the cleaning methods and their effects on the surface. Although the main objective was to apply dry cleaning methods, the objects were cleaned with the method that presented the best results, which at times involved some use of water.



Difference between the upper and the bottom face of one of the blue blocks, before cleaning. On the left the upper face with accumulation of dirt, on the right the bottom face with no presence of dirt.

MCI 6307 Chilkat Blankets

MCI Staff: Mary Ballard, Jennifer Giaccai, Cathy Zaret

There are conflicting legends about the source of the mid-blue turquoise tone of the Chilkat blankets. Copper corrosion products are cited but were disproved. Other sources mention trade blankets and urine. Technologically, a vat dye like indigo is a likely candidate: it was used in trade blankets as a light fast navy blue dye; it had a yellow degradation product (isatin) that is not very light fast (a problem with the turquoise of Chilkat blankets); and urine is a viable source of a reducing reagent. Neither these components nor the hypothesized process itself have been confirmed by published analysis. This project would effectively answer this long-standing identification question, and concomitantly confirm the possibility of using insect frass for dye identification. It has been suggested that insects that digest keratin do not digest the dyestuff, based on numerous observations of frass colored according to that of the damaged wool. Positive identification of indigo would support this, in the case of vat dyes, as well as the usefulness of frass as a sample source for some dye identification.

MCI 6312 Protocols for Vacuum Cleaning Textiles

MCI Staff: Mary Ballard, Elizabeth Shuster, Marion Mecklenburg, Micaela Sousa

A few years ago Mary Ballard gave a presentation to the Washington Conservation Guild summarizing her efforts to provide guidance for textile conservators, who so regularly employ vacuums in their work. Using a manometer to measure suction (normal force), and an anemometer to measure airflow (shear force), Mary posed and answered questions about many of the things that are intuitive to conservators about vacuuming gently and efficiently (e.g., the effects of holding the nozzle at various angles and distances from the textile surface). Mary found it convenient to measure the normal and shear forces acting at a simulated textile surface using these inexpensive instruments, and her experiments confirmed that it is the hand of the person operating the vacuum that will play the crucial role in determining is a vacuuming campaign is gentle and effective. This research project was an expansion of Mary's study intended to determine if a larger data set might reveal trends that would lead to specific recommendations about variables such as vacuum settings, distances, and angles, for various attachments and various textiles. The results of this research indicate that more of this kind of methodical data collection is warranted.

The aggregate data collected DO show trends indicating that more of this sort of methodical testing is worthwhile, and that the data might be extrapolated, to ultimately achieve more standardized methods of "gentle" and effective vacuuming. This reinforces the notion that the technique of the individual operating the vacuum will truly play THE critical role in determining how gentle and/or efficient a vacuuming campaign will be, and that we CAN measure how gentle and efficient we are.

Setup measuring normal forces on a simulated textile surface with the manometer.

MCI 6316 Stale Isotope Indications of Trophic Structure in Late Pleistocene North American Mammals and Implications for the Cause of the End-Pleistocene Extinction Event

MCI Staff: Christine France

This study aims to use carbon and nitrogen stable isotopes from bone collagen to reconstruct the food web of a late Pleistocene (~10,000-12,000 years before present) fauna from Florida. Carbon-14 dating will be used to precisely place each individual in a time sequence and examine the robustness of various niches at different time periods as well as changing food preferences among specific genera. Changing trophic structures at this site will be compared to other east coast North American fauna from Saltville, Virginia (this work) and data from the literature. The observed trophic patterns will be related to concurrent climate events and human dispersal patterns in an effort to determine which of these two factors was the primary cause of the late Pleistocene extinction.

MCI 6317 The Effects of PVA Treatment and Chemical Removal on the Stable Isotopic Signature of Bones and Teeth

MCI Staff: Christine France

During excavation, treatment of bones and teeth with PVA solution is a common method to maintain the integrity of highly weathered fossil material. Polyvinyl acetate dissolved in acetone has the potential to exchange carbon and oxygen isotopes with the bone/tooth material. Additionally, the removal of the PVA with various organic solvents may further fractionate isotope signatures and alter them from their original state. This study aims to determine if treatment with PVA and subsequent chemical removal alters isotopic values in fossil bones and teeth. The best strategy for removal will become the recommended standard procedure for handling specimens treated with PVA.

MCI 6324 Biodeterioration of Cultural Heritage, Microbes

MCI Staff: Robert J. Koestler

Conservation and preservation of our cultural heritage requires an understanding of the complex chemical, physical, and biological threats to its integrity. Recently, MCI's Director Robert J. Koestler chaired a panel "Microorganisms in subterranean environments" for the French Ministry of Culture at their International Symposium Lascaux and Preservation Issues in Subterranean Environments, February 26-27, 2009. This meeting was convened to investigate anthropogenic-induced changes over the past decade to one of the greatest cultural treasures of the western world - the Paleolithic painted cave at Lascaux, France. The almost 2,000 vivid and vivacious animal paintings made from luminous iron and manganese oxide, approximately 16,000 years old, are suddenly threatened by the rapid growth of garden-variety soil molds. Some experts proposed that the mold damage was a consequence of global change, MCI convened its own international workshop on the topic, Biocolonization of Stone: Control and Preventive Measures*, to provide a discussion forum for biologists, material scientists, and conservators with expertise in microbial (bacterial and fungal) damage to stone. The workshop explored new methods to detect and prevent microbial deterioration and colonization, and future directions for collaborative research. The conference papers are available as a pdf, free of charge at: http://hdl.handle.net/10088/16617

*Charola, A. Elena, McNamara, C., and Koestler, R.J., (Eds.). 2011. Biocolonization of Stone: Control and Preventive Methods: Proceedings from the MCI Workshop Series, Smithsonian Contributions to Museum Conservation: 2, Washington, DC: Smithsonian Institution Scholarly Press. 116 p.

MCI 6325 Biodeterioration, Natural History Collections, and Mongolian Cultural History and Objects

MCI Staff: Paula T. DePriest

Deer Stones, Mongolia's mysterious ancient monuments, are the country's most important archaeological treasures and some of the most spectacular expressions of Bronze Age megalithic art anywhere in the world. These 3,000-year-old carved stone monoliths, standing 1 to 4 meters high, are scattered in unprotected sites throughout northern Mongolia. Deer Stones bear elaborate depictions of flying 'spirit deer' with swept-back antlers and legs folded beneath their bodies—perhaps representing spirits of ancient chiefs and clan leaders. MCI Senior Objects Conservator Rae Beaubien, with the assistance of the Office of Exhibits Central Model Maker Carolyn Thome and fellows and interns, worked with a multidisciplinary Smithsonian team led by William Fitzhugh, NMNH, and Paula DePriest, MCI Deputy Director, to study, protect, and preserve these monuments in their natural settings, and to capture their pictorial information with 3-D laser scanning. This information will be available virtually through the Smithsonian Web to researchers studying the Deer Stone iconography. Our 3-D laser scans serve also as a snapshot of the condition of the stone monuments, with resolution in the millimeter range, pinpointing not only the surface decorations but also the physical evidence of damage. Using GIS techniques, we can wrap a sketch map marked with today's visible damage – bird droppings, lichens, and surface erosion – like a skin around the 3-D image. Then we can ask if a type of stone damage is

correlated with a particular feature – a concave surface, a roughened stone texture, a heavily carved area, a patch of lichen or fungi, etc. Over time we can follow changes in the stone, to see how rapidly the damage increases, and if the organisms come and go either on their own, in concert with climate changes, or after a treatment to control them.

MCI 6326 Structure and Conservation of Paintings, Museum Envelopes and Storage Conditions, Mechanical Properties

MCI Staff: Marion Mecklenburg

Research at MCI over the past 20 years by Dr. Marion Mecklenburg and his international team of collaborators has shown that most cultural heritage materials are much more resistant to temperature and humidity changes than generally thought. As a result of this research, in 2004 the Smithsonian adopted new guidelines of 45% RH +/- 8% RH and 70ºF +/- 4º for our 640+ buildings, including 19 museums. These guidelines permit most collection and building spaces a greater flexibility in temperature and humidity fluctuation over the year than the "common wisdom" versions that had previously been adhered to for over four decades. The new guidelines have been in place for over five years and have resulted in dramatic energy cost savings (about 17% per year); less condensation on walls in the winter, and therefore less wear and tear on the building envelope; and no known problems for any object, artifact, or collection. (Note: collections, and individual objects, that conservators recommend be maintained with tighter controls than the new guidelines are still accommodated within the new guidelines.)

Interest in Europe about Dr. Mecklenburg's work has grown tremendously in recent years. He has helped create Ph.D. programs and taught extensively in universities in Barcelona and Valencia, Spain; as well as teaching in Copenhagen, Denmark; Torino, Italy; and Gotland, Sweden, where his research is prompting rethinking their museum climates. Now North American museum directors, conservation scientist, and conservators are reviewing and accepting Dr. Mecklenburg's guidelines.

Dr. Mecklenburg presented a talk at the DC Metro Area Chapter of the IAMFA [International Association of Museum Facility Administrators] Quarterly meeting on April 28, 2010 at NMAI. Dr. Mecklenburg discussed research approaches taken to determine allowable ranges of temperature and relative humidity in museums in his talk "Determining the Acceptable Ranges of Relative Humidity and Temperature in Museum and Galleries." The audience included facilities managers, engineers and other people with vested interests from the SI, the National Gallery, The Walters Gallery, the National Archives, and the Library of Congress.

Dr. Mecklenburg, Dr. Robert Koestler, and Dr. Paula DePriest participated in a meeting "Rethinking the Museum Climate" held at the Museum of Fine Arts, Boston on April 12-13, 2010. More than 65 representatives from major North American museums and conservation programs attended, with written input of those from the UK. After two days of presentations and discussion the group was nearly unanimous in approving a proposal with 16-25°C (59-77°F) and 40-60% RH ranges as acceptable for the majority of cultural materials that are on loan between museums. [Please note that the Smithsonian comes out on the conservative side of the proposed

environmental guidelines with its current 70°±4°F and 45±8% RH.] The statement, supporting an earlier statement by the Bizot Group (also known as the International Group of Organizers of Large-scale Exhibitions), will go to an American Institute for Conservation (AIC) task force and to the National Museum Director Conference (NMDC) for further discussion. The session ended with an appreciation of Dr. Mecklenburg's ground breaking work.

Dr. Marion Mecklenburg was the opening speaker and a member of the discussion panel at the international workshop "Allowable Microclimatic Variations for Polychrome Wood," February 18-19, 2010 in Oslo, Norway. The workshop summarized the findings of the multi-year research program *COST ACTION IE0601 – Wood Science for Conservation of Cultural Heritage* to determine the effects of heating historic churches in Poland and Norway that had no prior climate controls. In addition, he made a presentation "Structural response of painted wood to variations in relative humidity and temperature." The workshop was sponsored by EEA Grants (Iceland, Liechtenstein, and Norway), Norsk Institutt for Kultutminneforskning (NIKU), Institute of Catalysis and Surface Chemistry.

On a related note:

The American Institute for Conservation of Historic and Artistic Works (AIC) is partnering with the International Institute for Conservation of Historic and Artistic Works (IIC) to present a roundtable discussion "The Plus/Minus Dilemma: The Way Forward in Environmental Guidelines" as part of the AIC Annual Meeting in Milwaukee, WI on May 13, 2010. The program notes that "Given the looming energy crisis, the global economic downturn, and the rising awareness of green technology equating to good stewardship of our natural resources, responsible and efficient environmental control has become essential."

Light has the potential to cause damage to objects in museum collections. The Smithsonian's Museum Conservation Institute (MCI) Senior Research Scientist Marion Mecklenburg has worked with the Smithsonian American Art Museum, the National Portrait Gallery, and the Hirshhorn Museum and Sculpture Garden to investigate light levels, especially in recently constructed or renovated exhibits and collection spaces that take full advantage of natural lighting via skylights and windows to enhance the visitor's experience. Although accommodations and preventive measures have been made for controlling the light intensity and spectrum, especially ultraviolet radiation, visible light levels recorded in some galleries and collection storage exceed accepted museum standards. Are these standards valid? Are collections in danger of fading? MCI researchers are experimentally testing the fading of materials under widely different light intensities. With an understanding of fading and its interaction with temperature, relative humidity, and ambient or reduced oxygen levels, we will develop guidelines for acceptable lighting levels. These guidelines complement our recommendations for safe temperature and relative humidity levels in exhibits and collections.

MCI 6327 Biological Materials, Proteomics, Stable Isotope Analysis

MCI Staff: Mehdi Moini

Proteomics is an area of rapid growth in biological and medical research. Developed, and its name coined, in the mid-1990s, proteomics was an opportunistic outgrowth of the genomic revolution. It is driven by advances in molecular separation and mass spectrometry technology over the past twenty years. The Museum Conservation Institute (MCI) is developing a proteomics capability as a part of the OUSS's central research infrastructure – the Mass Spectrometry Center. Proteomics capabilities will allow us to gather more information from Smithsonian collections, cultural objects, and biological specimens, and to learn more about their materials, their origins, and their deterioration. Proteomics will allow us to move beyond identification of organisms to look at the activity and dynamics of their populations, their use in cultural and artistic expression, and their role in sustainable ecosystems. This program will use the instruments and techniques typical of ***Understanding and Sustaining a Biodiverse Planet*** to serve all of the Smithsonian's Grand Challenges.

Dr. Medhi Moini, formerly of The University of Texas/Texas State University – San Marcos, began work as an MCI staff member on 1 June 2010. During the month of June, Dr. Moini will be in Texas completing preliminary data and writing a major grant proposal to NASA for development of a portable Mass Spectrometer for use in the Mars Rover program.

Dr. Moini has developed a novel analytical technique called ultrafast capillary electrophoresis mass spectrometry (CE-MS) that uses short, narrow capillaries, with separation potentials in excess of 1000V/cm, to deliver samples into the mass spectrometer. This novel technique consumes very, very small samples, picoliters – one trillionth of a liter, with analysis times of about a minute. The technique is especially useful for the analysis of museum specimens, where sample consumption must be minimized. The drawback of using such small samples, however, is that the peaks generated are very narrow (sub second) and require a fast and sensitive mass spectrometer to even detect these narrow peaks. The Thermo Scientific LTQ Velos is the fastest, most-sensitive "ion trap" mass spectrometer available and essential for continued development of this technology for application to museum collections and deployment on the Mars Rover.

Dr. Moini has two summer interns: Naoko Araki (Graduate student) conducting research using MALDI-Mass Spectrometry to detect deamidation of wool samples and Ben Martinez (Senior, Undergraduate student) conducting research on CE-MS analysis of D/L amino acids of wool samples. Both projects will develop methods for dating ancient textiles.

Dr. Moini attended the 58th American Society for Mass Spectrometry Conference, May 23 - 27, 2010, in Salt Lake City, Utah. He presented two posters: *Comparison of the Self-Assembly of Calix[6]arene Analogues in Solution/Gas Phase by ESI-MS and in Solid Phase by X-ray Crystallography* (with Taylor Barker and Michael Blanda) and *Analysis of Protein Digests*

in about a Minute using a Handheld Ultrafast Capillary Electrophoresis Interfaced to MS using a Porous Tip (with Ben Martinez).

MCI 6328 Archaeological Objects and Materials

MCI Staff: R. Jeff Speakman

Research at MCI over the past 30 years has established the Smithsonian's Museum Conservation Institute (MCI) as one of the leading centers in the world for studies related to the technology, provenance, and conservation of archaeological and historical materials. This research area relies heavily on advanced analytical instrumentation and imaging techniques in order to address archaeological questions and conservation issues. Important analytical techniques include stable isotope mass spectrometry, laser ablation-inductively coupled plasma-mass spectrometry, X-ray fluorescence spectrometry, electron microscopy, X-ray diffraction, and 3D imaging, which — among others — are all available in MCI's state-of-the-art analytical laboratories. Research focused on archaeological materials fits into the larger Smithsonian theme of ***Valuing World Cultures***.

Jeff Speakman (MCI), Javier Iñañez (MCI) and Christopher Wolff (NMNH & MCI) organized two sessions at the ***75th Annual Meeting of the Society for American Archaeology***, St. Louis held April 14–18, 2010. The sessions titled *Archaeological Science 2010: Part I & II* included 32 presentations by archeological scientists from across the United States. MCI research was prominently represented at the ***38th International Symposium on Archaeometry***, held at the University of South Florida, Tampa, May 10–14, 2010, where 9 papers and posters were presented based on research undertaken at MCI.

Panamanian excavation featured in *National Geographic*. Rae Beaubien (MCI) is working with a STRI archaeological team in the excavation of a Pre-Columbian mortuary site, El Caño, a project that will be featured in an upcoming issue of ***National Geographic***. The excavation has recovered numerous gold and related metal artifacts. This supports a broad study of goldworking in Pre-Columbian Panama conducted by Rae and two fellows in collaboration with archaeological colleagues at STRI. Detailed information on composition and fabrication is being compiled on gold artifacts in the collections of NMAI, NMNH, and the Museo Antropológico Reina Torres de Araúz, the national museum located in Panama City, as well as recently excavated finds from several sites in Panama, such as El Caño, curated at STRI. This dataset will be used to test hypotheses about the origins and development of goldworking technology in the Americas.

Dating volcanic eruptions with tree rings. MCI researchers Christine France and Jeff Speakman, in collaboration with the University of Arizona, are looking for isotopic signatures for volcanic eruptions in tree rings. The annual growth rings obtained from well dated *Pinus michoacana* tree ring cores from Parícutin, Mexico show chemical signatures that correlate with a known local volcanic eruption (1943-1952) and its subsequent atmospheric and terrestrial inputs. This novel analytical approach can potentially be used to date unknown eruptions which in the past have often relied on the common dendrochronological technique of tree ring width determination, or on historic human records. Results of this study were reported at several recent national and international meetings.

Obsidian tools trace the peopling of the Americas. Jeff Speakman (MCI) and Nicole Little's (MCI) ongoing research, conducted at MCI in partnership with Dennis Stanford (NMNH), the National Park Service, University of Alaska Museum of the North, University of Washington, University of Missouri, and many Russian colleagues, is using unique trace elements in obsidian archaeological artifacts, such as arrow points, to find their volcanic source. The study has focused on archaeological sites and volcanoes in three geographic regions—the Kurile Islands, the Kamchatka Peninsula, and Alaska, and show that some artifacts from archaeological sites in Alaska originate from volcanic sources in northeast Russia. The primary objectives of this research include: (1) to study prehistoric inter- and intra-regional patterns of mobility, trade, exchange, resource exploitation, and cultural interaction; (2) to facilitate a better understanding of the prehistory of Eastern and Western Beringia; and (3) to foster collaborations between U.S. and Russian colleagues that will facilitate the exchange of ideas and research findings. To date chemical data have been generated thus far for more than 10,000 obsidian artifacts and geological source samples and have resulted in 1 NSF grant submission, 4 peer reviewed publications, and about 10 professional presentations in the past year.

Artifacts of American colonial history. MCI researchers are collaborating with archaeologists from the Jamestown Rediscovery Team and Doug Owsley (NMNH), on a number of projects related to ongoing excavations at America's first permanent English settlement in the New World. MCI projects include the high resolution imaging of a Jamestown slate object that is covered with words, numbers, and etchings of people, plants, and birds that its owner likely encountered in the New World in the early 1600s. Additional research is underway to determine the geologic origin of the slate which is presumed to have been quarried in England. MCI also is collaborating on a project to determine the origin of Spanish majolica pottery recovered from recent excavations at the site. Finally MCI has recently completed the chemical analyses of human bone from ca. 60 individuals to better understand the health and status of these early settlers.

MCI 6329 Imaging Spectroscopy, Minerals Analysis, Meteorites and Star Dust, Bronze Corrosion, Paleobiology Materials, Synchrotron Analysis

MCI Staff: Ed Vicenzi

One area of special interest for the Smithsonian's Museum Conservation Institute (MCI) is adapting full spectroscopic imaging at multiple length scales from what can be seen with the naked eye down to nanoparticles for the study of cultural and heritage objects as well as research specimens from the National collections. Spectroscopic imaging using ultra violet-visible (UV-VIS), X-ray energy, infrared, Raman shift, etc., each in two dimensions, can be combined to produce datasets that reveal chemical/ molecular information for each pixel in the array and are often referred to as 3-D data cubes or hyperspectral datasets. This comprehensive imaging approach will undoubtedly lead to discovery of object alteration and modification on the macroscopic scale and clues to a specimen's history and origin on the microscopic and nanoscopic length scales. These datasets can be mined for information long after the initial data are collected, as is typically done in the remote-sensing community's study of planetary bodies. Our goal is to lead the Smithsonian in building a network of complimentary techniques to allow

researchers to zero in on anomalous regions of importance to achieve a greater understanding of specimens. MCI's spectral imaging team includes ***Edward Vicenzi*** – research scientist/geochemist with experience in spectroscopic imaging down to the sub-micrometer level of extraterrestrial and terrestrial materials; ***Melvin Wachowiak*** – senior conservator who has expertise in a variety of light microcopies, including 3D scanning, extended focal imaging, replication of objects, and advanced object documentation; ***Jennifer Giaccai*** – conservation scientist with expertise in characterization of specimens using a variety of chromatographic and spectroscopic techniques, including imaging using XRF, SWIR, and the mid-IR; and ***Odile Madden*** – research associate with expertise in characterization of specimens using traditional Raman and surface enhanced Raman spectroscopy. MCI currently has electron induced X-ray spectroscopic imaging in the SEM and Raman, and over the past year had access to a Bruker ARTAX portable micro-XRF spectrometer. Though our new partnership with SOLEIL Synchrotron we will have capabilities at all image positions (imaging XRD, imaging X-ray absorption, e.g. XANES, and EXAFS, as well as imaging micro XRF).

Ed Vicenzi, President of the Microbeam Analysis Society, is an organizer of Microscopy and Microanalysis 2010. The meeting will be held in Portland, OR, August 1-5, 2010, and is the premiere meeting for interdisciplinary microanalysis science with ~ 1000 presentations and 2500 attendees distributed over 35 symposia (http://www.microscopy.org/MandM/2010/index.cfm). He is giving an invited talk as well as co-authoring multiple presentations at the meeting.

Vicenzi was one of four speakers from the US invited to attend and present at the May 6, 2010, grand opening of a state-of the-art High Resolution Scanning Electron Microscopy Facility in the Department of Materials Engineering at McGill University's campus in Montréal, Quebec. His presentation was entitled "Hyperspectral Imaging and Microanalysis of Complex Natural Materials."

Ed Vicenzi is co-PI on a grant proposal entitled *"Materials science of aqueous artificial bronze patina formulations"* submitted to the NSF SCIART program with Dick Livingston at the University of Maryland. The proposed research will image and analyze corrosion surfaces and cross-sections of bronze alloys and conservation-applied patinas to mitigate degradation. Focused ion beam (3-D) and scanning electron microscopy (2-D) as well as scanning transmission microscopy (2-D) of the microstructure of the metal-oxide interface lie at the heart of this study.

Ed Vicenzi is in the early stages of developing a new method for determining the provenance of jade objects. His approach involves linking of cathodoluminescence (CL) spectral features with trace element chemistry on the micrometer length scale. The initial data are just now being processed and require new software to correlate the two different methodologies. If successful, analysts will have a new mechanism for 2D quantitative trace element imaging of jade via CL, and further trace element ratio imaging may aid in determining the provenance of jades, including "blood jade" from conflict zones around the globe.

On May 19 and 21, a next generation scanning X-ray Fluorescence spectrometer workshop will be held at MCI, sponsored by instrument manufacturer EDAX Corporation. This vacuum chamber- or atmospheric-based system is ideal for non destructive elemental imaging of

objects at a length scale between macroscopic and microscopic. The instrument will remain at the Smithsonian for a few weeks after the workshop for MCI research scientist Ed Vicenzi and Jeff Speakman, Head of Technical Studies, and other MCI staff to evaluate the spectroscopic imaging datasets collected on SI collection materials and research projects.

The MCI and SOLEIL joint programs will include exchange of staff and fellows, collaborative research using the synchrotron platforms, development of advanced methods, and joint seminars, workshops and meetings. The first project, with research scheduled to begin in June 2010, will examine the fading of Prussian blue, the first modern pigment accidentally discovered at the beginning of the eighteenth century. A favorite of nineteenth century painters, artisans and manufacturers because it was both stable and cheap, the dye was ubiquitous in the period's wallpapers, textiles, stamps, cosmetics and early photographs. It is the blue in architectural blueprints. However, the pigment is subject to fading under special condition because of its unique electronic and magnetic properties. Study at the synchrotron will examine the fading of Prussian blue at the nano scale.

MCI 6330 Detection of Volatiles, Detection of Heavy Metal Residues, Technology, Characterization and Degradation of Natural and Synthetic Polymer Composites, Characterization of Graphite

MCI Staff: Odile Madden

The Smithsonian's Museum Conservation Institute (MCI), working with an extensive network of Smithsonian collaborators, has addressed pesticide detection and quantification, assessment of health risk, and strategies for mitigating that risk. Pesticides were applied historically to Smithsonian collections to eradicate and/or prevent infestation by insects, rodents, and mold. Many of these chemicals are now known to be hazardous to human health. MCI visiting scientist and fellow, Odile Madden, developed protocols for calibrating and using portable X-ray fluorescence instruments to detect heavy metal pesticide residues - arsenic, lead, and mercury - on ethnographic collections. Currently, she is developing methods to trap and detect volatile organic pesticide residues using Raman spectroscopy. The protocols and results have been reported in a number of high-profile invited presentations and publications. The goal of the collaborative project, with the National Museum of the American Indian and the National Museum of Natural History, is to identify potentially hazardous pesticide residues on collections and, ultimately, to accurately communicate whether or not the risk posed is significant.

MCI 6332 Bronze Patinas

MCI Staff: Ed Vicenzi, Carol Grissom, Amy Marquardt, Mel Wachowiak

The composition and structure of selected samples will be analyzed by surface characterization methods such as charged particle beam microscopy and related analytical methods (X-ray microanalysis, EBSD, and FIB) will be performed for the most part at NIST, though some SEM/EDS work will also be performed at SI's NMNH, in addition to photomicrography (at MCI), including extended focal imaging for certain specimens.

Should the grant be funded, it is proposed that patina development will be monitored by the rotating disk electrode technique. Patina color will be quantified in terms of CIE chromaticity coordinates and texture by Principal Component Analysis (PCA) of the Bi-directional Reflectance Distribution Function (BRDF) data. Mechanical properties of the patina will be measured by a nanoindentor and residual stresses by neutron diffraction and will be performed at the University of Maryland/College Park.

The objective of this research is to develop a fundamental understanding at the molecular and microstructural level of the relationships between techniques for artificial patination of bronze and the resulting appearance and stability of the patinas. To this end, a project entitled "Materials Science of Aqueous Artificial Bronze Patina Formulas" has been submitted for a National Science Foundation grant. If successful, it would fund the graduate work of University of Maryland Materials Science & Engineering student Amy E. Marquardt, presently an MCI summer intern.

MCI 6363 IRMS Round Robin Exercise

MCI Staff: Christine France

This study is a round-robin test of several new urea and acetanilide standards for $\delta^{13}C$ and $\delta^{15}N$ values. The values obtained from multiple labs around the world will be combined and an average value published for purposes of international use. These standards will be used as new calibration points for purposes of correcting data to international standards.

MCI 6364 Stable Carbon and Sulfur Isotopic Indicators of Volcanic Eruptions as Recorded in Tree Rings from Central and North America

MCI Staff: Christine France, Jeff Speakman

The identification of past volcanic eruptions as recorded in tree rings is typically accomplished by standard methods of dendrochronology and examination of tree ring morphology. The goal of this study is to add the examination of chemical tracers in the tree rings that may be indicative of an eruption. Specifically, the stable carbon and sulfur isotopic record of the tree rings may reflect an eruption insofar as the isotopic signature of the surrounding atmosphere is often altered by gaseous volcanic input. Tree cores in close proximity to a well dated cinder cone eruption in Paracutin, Mexico will be examined for unique isotopic patterns during the eruption time period. Once a chemical pattern is established, tree cores in proximity to the poorly dated eruption at Sunset Crater, Arizona will be examined in a similar manner. Confirming an exact date for this and other culturally important eruptions will contribute greatly to our understanding of ecologic perturbations as cause for population movements in historic time.

MCI 6372 Thermoregulatory Adaptations of Acrocanthosaurus atokensis – Evidence from Oxygen Isotopes

MCI Staff: Christine France

The thermoregulatory strategy of *Acrocanthosaurus atokensis* is currently unknown. This study aims to discern the internal temperature patterns of this large theropod dinosaur and determine if it was a homeotherm or a heterotherm. Oxygen isotopes, which are sensitive to variations in body temperature, will be compared across different bones of the same individual. The overall interbone temperature pattern as indicated by the $\delta^{18}O$ values will be compared to the pattern from an ostrich (a known homeotherm and direct descendant of the dinosaur lineage), an elephant (a known large homeotherm), and an alligator (a known large heterotherm).

MCI 6375 Stable Isotopic Characterization of a Mammoth Tusk from Coastal Virginia and Associated Fauna on the East Coast of North America

MCI Staff: Christine France

A mammoth tusk dredged from the ocean floor off the coast of Virginia represents a unique opportunity to study a mammoth specimen with a known associated spear point. The direct implication of human predation on this species indicates that humans were present in established communities at a time concurrent to this specific animal. Initial carbon dating suggests an age of ~20ka, a time which is older than the currently accepted presence of humans on the east coast of North America. Stable isotopic analyses will determine if this particular animal lived on the coast of Virginia or if it was a "wash-out" from upriver. Establishment of this animal as being from local population is critical to confirming human presence at this time at this location.

MCI 6384 Development of New In-House Standards for Isotopic Linear Correction

MCI Staff: Christine France

Development of in-house working isotopic standards is necessary to reduce the use of certified standards. The project aims to find alternative standards to the limited supply of NIST certified USGS40, USGS41, and others.

MCI 6432 The Age of Plastic

MCI Staff: Odile Madden

This long-term research effort will examine many aspects of the Age of Plastics, including technical and historical.

MCI 6453 Investigation of the Feasibility of Nondestructive Measurement of Moisture in Porous Materials Using Prompt Gamma Neutron Activation (PGNA)

MCI Staff: Carol Grissom

This project is a collaborative effort with the University of Maryland, to develop a prototype system based on Prompt Gamma Neutron Activtation for nondestructive measurement in porous materials used in art and architecture. With Dr. Richard Livingston and the UMD Nuclear Engineering Dept.

MCI 6455 Analysis of Natural Resins Using FTIR and GC-MS, MCI Reference Collections

MCI Staff: Jennifer Giaccai, Gretchen Peppers, Anastasia Lewis, Donald L. Williams

This was a summer intern project to update MCI instrumental libraries with new natural resins data sets. The results will be used to develop a protocol for analyzing resins within the Smithsonian collections.

MCI 6465 Technical Study of Daguerreotypes

MCI Staff: EdVicenzi

As part of MCI's contribution to "Understanding Early Photography", with an SI-wide consortium, Ed Vicenzi is characterizing the surface properties and composition, using non-distructive techniques, of non-collection Daguerreotypes. This includes documentation with a variety of e-beam microscopy techniques. Results are posted to a dedicated webpage: Understanding Early Photography (http://si.edu/mci/EarlyPhotography/index.html)

Non-Smithsonian Organizations

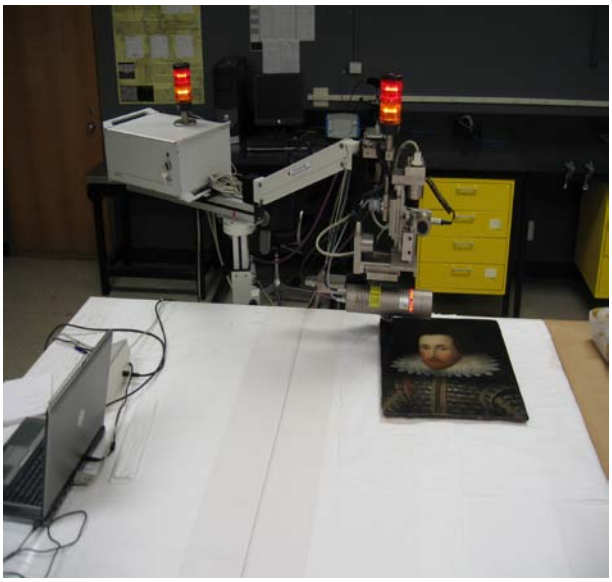
Folger Shakespeare Library

MCI 6264 Janssen Shakespeare Portrait

MCI Staff: Jennifer Giaccai, Jia-sun Tsang, Mel J. Wachowiak, Judy Watson, Nicole C. Little, Ron H. Cunningham

A technical study of the portrait is underway, including analysis of both the original paint and overpaint. Close examination, UV fluorescence examination, X-radiography, infrared reflectography, wood identification, radiocarbon dating, optical and fluorescence microscopy, SEM imaging, FTIR, XRD, GC-MS, X-ray fluorescence, and X-ray fluorescence imaging will all potentially be used to analyze the portrait.

Janser Portrait (post-1988) Folger Library



Historic Jamestowne

MCI 6288 Jamestown Slate Writing Tablet

MCI Staff: Mel Wachowiak, E. Keats Webb

Mysterious 400 year-old slate tablet gets a closer look at MCI. Staff at the Museum Conservation Institute (MCI) recently helped Jamestown researchers decipher inscriptions from a unique stone tablet. The slate tablet, about 8x10 inches, dates from the earliest days of Jamestown. The tablet was found in an ongoing excavation of a well and so can be dated to about 1610. The inscribed surfaces have writing as well as pictures of birds and trees, and still indecipherable markings.

Using a new method called reflectance transformation imaging (RTI), MCI staff created a digital surrogate of the tablet's two surfaces. RTI is a non-contact way to digitize the surface qualities and apply non-destructive computational methods of enhancement. RTI allows the viewer to control the lighting angle and intensity in an intuitive and interactive way. One of the tremendous advantages to RTI is that it allows the user of the software to quickly become self-guided.

Soon after processing images, the Jamestown staff agreed that they had already seen more than was possible by other methods. MCI staff will process all the data for the Jamestown researchers and prepare it for them to assess back at their museum.

For more on the discovery:
http://historicjamestowne.org/news/2010_dig_conclusion.php

Metropolitan Museum of Art

MCI 6349 Inca Pottery from NW Argentina

MCI Staff: Nicole Little

Archaeological ceramics excavated from several Inca sites contain black pigments which could not be identified by Raman, XRF, and Open Architecture XRD. The inability of researchers to identify these pigments has necessitated the use of μXRD for the determination of manganese oxides used in the construction of surface decorations. μXRD was able to successfully identify Jacobsite and hematite as the primary colorants used in the prehistoric pigments.

Mount Vernon Estate and Gardens

MCI 6295 Martha Washington Seat Cushion Covers and Needlepoint Envelope at Mount Vernon

MCI Staff: Mary Ballard, Cathleen Zaret, Genevieve Bieniosek, Jeff Speakman

A major project at George Washington's Estate has been the examination and reproduction of a set of seat cushion covers documented as being stitched by Martha Washington over a period of several decades. Lacking instrumentation and analytical services there, the curatorial and conservation staff there asked the Museum Conservation Institute to carry out a variety of technical studies, using samples taken with curatorial permission and also non-destructive testing of entire cushions and a needlepoint envelope.

Initially, part of the interest in this project was the goal to measure the colors of the yarns for reproduction purposes with a micro-fading tester, described as being able to measure a very small (0.2cm) diameter with CIE L*a*b* values. Such measurements would be very helpful in various stages of the reproduction work. Eventually, the equipment at MCI was determined to be unsuitable for this purpose for technical reasons; the effort to ascertain this fact, however, expanded to become a major technical study and is reported under a separate MCI number.

Fiber microscopy was carried out primarily on samples of the tape and fringe using polarized light microscopy to explore the anisotropic character and morphology of fibers. The fibers were found to be silk (warp) and cotton (weft, self-fringing).

The main thrust of the project was to examine the actual fringe, tape, cushions, and a fragmentary portion of a cushion remade into an envelope in order to determine non-destructively which materials were consistent with an 18^{th} century dating. This analysis relied upon the presumption that the colorants in the wool and silk and cotton would have been mordant dyed. Both micro-X-ray fluorescence spectrometry and energy dispersive spectroscopy (EDS) on MCI's scanning electron microscope (SEM) were utilized.

Analytical results were inconclusive: some of the yarns might be mordanted and dyed with natural dyes; some of the yarns could be dyed with natural dyes that do not require a mordant; some of the yarns could have been dyed with late 19^{th} century synthetic dyes. Mount Vernon Estate and Gardens is encouraged to pursue the investigation with high performance liquid chromatography.

Phillips Collection

MCI 6193 Antoine Pevsner's Plastic Sculpture

MCI Staff: Jia-sun Tsang, Judy Watson, Lynn Brostoff, Fabien Pottier

Antoine Pevsner made "Construction in Space" in 1928. Pevsner and his younger brother Naum Gabo enjoyed making sculptures out of cellulose nitrate. Cellulose nitrate is much like glass, but is lighter, easier to handle while being durable. Presently, the cellulose nitrate sculptures by Naum Gabo and Antoine Pevsner suffer from unique deterioration, coined "The Doritos Syndrome" at a 2007 conservation workshop at London's Tate. The original clear plastic components of "Construction in Space" now display severe signs of degradation, including warping, cracking, and discoloration, which have further exacerbated corrosion in the metal frame. The damage is irreversible.

The purpose of this technical study is to generate technical information on this plastic sculpture, to assess the degradation, and to provide assistance and advice for long-term preservation issues.

The first step of the investigation was to confirm the presence of cellulose nitrate by FTIR. The second part of the investigation focused on identifying efflorescence as a by-product of the metal corrosion caused by the acid released from the degraded cellulose nitrate. A small, crumbled plastic sample from the object was examined and analyzed by FTIR, XRD, and SEM-EDS. The acid released from the degraded cellulose was confirmed by A-D strip tests and through XRD analysis of white deposits (corroded material caused by the acid) on the metal frames.

Storing cellulose nitrate objects at low temperature, low relative humidity, and low light will slow down the degradation. It is best to separate this sculpture from other objects.

U.S. Senate

MCI 6209 Daniel Webster Desk

MCI Staff: Don Williams

In 2007 Don Williams was approached by the Senate Curator's Office, as directed by the Office of the Senate Rules Committee, Sen. Dianne Feinstein, Chair, to request my assistance for the Senate Capitol Cabinet Shop as they began a project to replicate perhaps the most renowned piece in their collection, the desk of Senator Daniel Webster of New Hampshire, who served from 1827 to 1841. Don Williams gave two taped lectures to U.S. Senate craftsmen to explain the processes used by the original makers, to demonstrate those techniques in real time, and to assist with further advice and direction as necessary.

On completion the desk was placed in the Old Senate Chamber for exhibit until it is moved to the permanent exhibit in the new Capitol Visitors' Center galleries.

The first video session in the Senate Cabinet shop. John Lee, the lead craftsman for the project, is in the center of the frame.

The finished desk

Walters Art Gallery

MCI 6322 Painting: The Ideal City by Fra Carnevale

MCI Staff: Mel Wachowiak, E. Keats Webb

Reflectance transformation imaging was used to create digital images of the entire painted surface and reveal scribe lines and other surface features of Fra Carmevale's 15th century painting "The Ideal City". This painting is on a panel of edge-jointed wood, very thinly painted and almost transparent in some areas. The surface is somewhat glossy, which precludes most 3-D scanning techniques. The Walters' conservator investigating the painting was most interested in the scribe lines in the preparatory layer used to layout the single point perspective of the painting. While they are evident in raking light, the indented scribe lines are difficult to image and study.

The painting is nearly seven feet (2.13 meters) wide and the area of interest, the indentations from the scribe line, is sub-millimeter. The indentations are too small to be seen in an image of the entire painting but were resolvable when the images were collected in three overlapping sections (with about 25% overlap).

MCI Publications

Ballard, Mary W., **Harry Alden**, **Roland H. Cunningham**, **Walter Hopwood**, **Joseph Koles**, and **Laure Dussubieux**. 2010. Appendix 8: Preliminary Analyses of Textiles Associated with the Wooden Furniture from Tumulus MM." In *The Gordion Wooden Objects, Volume I: The Furniture from Tumulus MM*, Elizabeth Simpson. (ed.). pp. 203–223. Leiden: Brill.

Benco, Nancy L., Said Ennahid, M. James Blackman, Hector Neff, Michael Glascock, and **Robert J. Speakman.** 2009. Chemical Analyses of Pottery and Clays from the Medieval Islamic City of al-Basra and its Hinterland in Northern Morocco. In Actas del VIII Congreso Interancional de Cerámica Medieval en el Mediterráneo, edited by Juan Zozaya Stabel-Hansen, Manuel Retuerce Velasco, Miguel Ángel Hervás Herrera, and Antonio De Juan García, pp. 673–684. Asociación Española de Arqueología Medieval, Ciudad Real, Spain.

Broadbent, Noel, Janine Hinton, Claire O'Brien, Lauren Marr, Alyson Aldridge, Sarah Dickey, Catherine Magee, **Christopher B. Wolff**. 2010. The ASC Goes Local: Fort Circle Park Archaeological Project. Arctic Studies Center Newsletter, 17: 26.

Cedrola, Marcela L. and **A. Elena Charola**. 2009. Biodeterioro de materials porosos inorgánicos : Biodeterioração de materiais porosos inorgãnicos. In: Manual Básico de Conservación par alas Misiones Jesuíticas Gyaraníes: Programa de Capacitación para la Conservación, Gestión y Desarrollo Sustable de las Misiones Jesuíticas Guaraníes : Manual Básico de Conservação para as Missões Jesuíticas dos Guaraní: Programa de Capacitação para a Conservação, Gestão e Desenvolvimento Sustentável das Missões Jesuíticas dos Guarani. A. Elena Charola and Marcelo L. Magadán, (eds.). New York: World Monument Fund. pp. 52-62.

Cedrola, Marcela L. and **A. Elena Charola**. 2009. Protocolos de Campo. PC1 – Determinación in situ de la absorción capilar de agua : Procedimentos de Campo. PC1 – Determinação in situ da absorção capilar de água. In: Manual Básico de Conservación par alas Misiones Jesuíticas Gyaraníes: Programa de Capacitación para la Conservación, Gestión y Desarrollo Sustable de las Misiones Jesuíticas Guaraníes : Manual Básico de Conservação para as Missões Jesuíticas dos Guaraní: Programa de Capacitação para a Conservação, Gestão e Desenvolvimento Sustentável das Missões Jesuíticas dos Guarani. A. Elena Charola and Marcelo L. Magadán, (eds.). New York: World Monument Fund. pp. 3-4 and pp. 3-4.

Cedrola, Marcela L. and **A. Elena Charola**. 2009. Protocolos de Campo. PC3 – Eliminación de películas superficiales de Resinas acrílicas : Procedimentos de Campo. PC3 – Eliminação de películas superficiais de resinas acrílicas. In: Manual Básico de Conservación par alas Misiones Jesuíticas Gyaraníes: Programa de Capacitación para la Conservación, Gestión y Desarrollo Sustable de las Misiones Jesuíticas Guaraníes : Manual Básico de Conservação para as Missões Jesuíticas dos Guaraní: Programa de Capacitação para a

Conservação, Gestão e Desenvolvimento Sustentável das Missões Jesuíticas dos Guarani. A. Elena Charola and Marcelo L. Magadán, (eds.). New York: World Monument Fund. pp. 6-7 and pp. 6-7.

Cedrola, Marcela L. and **A. Elena Charola**. 2009. Protocolos de Campo. PC4 – Limpieza de depósitos delgados de colonización biológica : Procedimentos de Campo. PC4 – Limpeza de depósitos finos de colonização biológica. In: Manual Básico de Conservación par alas Misiones Jesuíticas Gyaraníes: Programa de Capacitación para la Conservación, Gestión y Desarrollo Sustable de las Misiones Jesuíticas Guaraníes : Manual Básico de Conservação para as Missões Jesuíticas dos Guaraní: Programa de Capacitação para a Conservação, Gestão e Desenvolvimento Sustentável das Missões Jesuíticas dos Guarani. A. Elena Charola and Marcelo L. Magadán, (eds.). New York: World Monument Fund. pp. 8-9 and pp. 8-9.

Cedrola, Marcela L. and **A. Elena Charola**. 2009. Protocolos de Campo. PC5 – Desmalezamiento y eliminación de Plantas superiors : Procedimentso de Campo. PC5 – Controle de ervas e eliminação de plantas superiores. In: Manual Básico de Conservación par alas Misiones Jesuíticas Gyaraníes: Programa de Capacitación para la Conservación, Gestión y Desarrollo Sustable de las Misiones Jesuíticas Guaraníes : Manual Básico de Conservação para as Missões Jesuíticas dos Guaraní: Programa de Capacitação para a Conservação, Gestão e Desenvolvimento Sustentável das Missões Jesuíticas dos Guarani. A. Elena Charola and Marcelo L. Magadán, (eds.). New York: World Monument Fund. pp. 10-12 and pp.10-12.

Cedrola, Marcela L. and **A. Elena Charola**. 2009. Protocolos de Laboratorio. PL2 – Determinación de la presencia de carbonatos y del yeso en eflorescencias: Procedimentos de Laboratório. PL2 – Determinação da presence de carbonatos e de gesso em eflorescências. In: Manual Básico de Conservación par alas Misiones Jesuíticas Gyaraníes: Programa de Capacitación para la Conservación, Gestión y Desarrollo Sustable de las Misiones Jesuíticas Guaraníes : Manual Básico de Conservação para as Missões Jesuíticas dos Guaraní: Programa de Capacitação para a Conservação, Gestão e Desenvolvimento Sustentável das Missões Jesuíticas dos Guarani. A. Elena Charola and Marcelo L. Magadán, (eds.). New York: World Monument Fund. pp. 9-10 and pp. 9-10.

Cedrola, Marcela L. and **A. Elena Charola**. 2009. Protocolos de Laboratorio. PL3 – Determinación de la presencia de sulfates y cloruros por reacciones de toque : Procedimentos de Laboratório. PL3 – Determinação da presence de sulfates e cloretos por reações de toque. In: Manual Básico de Conservación par alas Misiones Jesuíticas Gyaraníes: Programa de Capacitación para la Conservación, Gestión y Desarrollo Sustable de las Misiones Jesuíticas Guaraníes : Manual Básico de Conservação para as Missões Jesuíticas dos Guaraní: Programa de Capacitação para a Conservação, Gestão e Desenvolvimento Sustentável das Missões Jesuíticas dos Guarani. A. Elena Charola and Marcelo L. Magadán, (eds.). New York: World Monument Fund. pp. 11-12 and pp. 11-12.

Cedrola, Marcela L. and **A. Elena Charola**. 2009. Protocolos de Laboratorio. PL4 – Determinación de la presencia de sulfates y cloruros por tiras reactivas : Procedimentos de Laboratóio. PL4 – Determinação da presence de sulfates e cloretos por fitas reagentes. In: Manual Básico de Conservación par alas Misiones Jesuíticas Gyaraníes: Programa de Capacitación para la Conservación, Gestión y Desarrollo Sustable de las Misiones Jesuíticas Guaraníes : Manual Básico de Conservação para as Missões Jesuíticas dos Guaraní: Programa de Capacitação para a Conservação, Gestão e Desenvolvimento Sustentável das Missões Jesuíticas dos Guarani. A. Elena Charola and Marcelo L. Magadán, (eds.). New York: World Monument Fund. pp. 13-14 and pp. 13-14.

Centeno, Silvia A., **Polonca Ropret**, Eleonora Del Federico, Jacob Shamir, Boris Itin, and Alexej Jerschow. 2010. Characterization of Al(III) complexes with hematein in artistic alum logwood inks. Journal of Raman Spectroscopy, 41(4): 445-451.

Charola, A. Elena. 2009. Introducción a la cal y morteros : Introdução à cal e argamassas. In: Manual Básico de Conservación par alas Misiones Jesuíticas Gyaraníes: Programa de Capacitación para la Conservación, Gestión y Desarrollo Sustable de las Misiones Jesuíticas Guaraníes : Manual Básico de Conservação para as Missões Jesuíticas dos Guaraní: Programa de Capacitação para a Conservação, Gestão e Desenvolvimento Sustentável das Missões Jesuíticas dos Guarani. A. Elena Charola and Marcelo L. Magadán, (eds.). New York: World Monument Fund. pp. 80-82.

Charola, A. Elena and Marcela L. Cedrola. 2009. Protocolos de Laboratorio. PL1 – Determinación de la curva de absorción capilar de agua, de la absorción por inmersión total y de la curva de secado : Procedimentos de Laboratório. PL1 – Determinação da curva de absorção capilar de água, da absorção por imersão total e da curva de secagem. In: Manual Básico de Conservación par alas Misiones Jesuíticas Gyaraníes: Programa de Capacitación para la Conservación, Gestión y Desarrollo Sustable de las Misiones Jesuíticas Guaraníes : Manual Básico de Conservação para as Missões Jesuíticas dos Guaraní: Programa de Capacitação para a Conservação, Gestão e Desenvolvimento Sustentável das Missões Jesuíticas dos Guarani. A. Elena Charola and Marcelo L. Magadán, (eds.). New York: World Monument Fund. pp. 3-8 and pp. 3-8.

Charola, A. Elena and Marcela L. Cedrola. 2009. Protocolos de Campo. PC2 – Extracción de sales soluble : Procedimentos de Campo. PC2 – Extração de sais solúveis. In: Manual Básico de Conservación par alas Misiones Jesuíticas Gyaraníes: Programa de Capacitación para la Conservación, Gestión y Desarrollo Sustable de las Misiones Jesuíticas Guaraníes : Manual Básico de Conservação para as Missões Jesuíticas dos Guaraní: Programa de Capacitação para a Conservação, Gestão e Desenvolvimento Sustentável das Missões Jesuíticas dos Guarani. A. Elena Charola and Marcelo L. Magadán, (eds.). New York: World Monument Fund. pp. 5 and pp. 5.

Charola, A.E., S.A. Centeno, and N. Kyle. 2010. The New York Public Library: Protective Treatment for Sugaring Marble, Journal for Architectural Conservation 16(2): 29-44.

Charola, A. Elena, Luiz Antônio Bolcato Custódio and Marcelo L. Magadán. 2009. Conclusiones : Conclusões. In: Manual Básico de Conservación par alas Misiones Jesuíticas Gyaraníes: Programa de Capacitación para la Conservación, Gestión y Desarrollo Sustable de las Misiones Jesuíticas Guaraníes : Manual Básico de Conservação para as Missões Jesuíticas dos Guaraní: Programa de Capacitação para a Conservação, Gestão e Desenvolvimento Sustentável das Missões Jesuíticas dos Guarani. A. Elena Charola and Marcelo L. Magadán, (eds.). New York: World Monument Fund. pp. 124-125.

Charola, A. Elena and Marcelo L. Magadán. 2009. Conceptos básicos de conservación : Conceitos básicos de conservação. In: Manual Básico de Conservación par alas Misiones Jesuíticas Gyaraníes: Programa de Capacitación para la Conservación, Gestión y Desarrollo Sustable de las Misiones Jesuíticas Guaraníes : Manual Básico de Conservação para as Missões Jesuíticas dos Guaraní: Programa de Capacitação para a Conservação, Gestão e Desenvolvimento Sustentável das Missões Jesuíticas dos Guarani. A. Elena Charola and Marcelo L. Magadán, (eds.). New York: World Monument Fund. pp. 11-13.

Charola, A. Elena and Marcelo L. Magadán. 2009. Factores de deterioro de materials porosos inorgánicos : Fatores de deterioração dos materiais porosos inorgãnicos. In: Manual Básico de Conservación par alas Misiones Jesuíticas Gyaraníes: Programa de Capacitación para la Conservación, Gestión y Desarrollo Sustable de las Misiones Jesuíticas Guaraníes : Manual Básico de Conservação para as Missões Jesuíticas dos Guaraní: Programa de Capacitação para a Conservação, Gestão e Desenvolvimento Sustentável das Missões Jesuíticas dos Guarani. A. Elena Charola and Marcelo L. Magadán, (eds.). New York: World Monument Fund. pp. 40-51.

Charola, A. Elena and Marcelo L. Magadán. eds. 2009. Manual Básico de Conservación par alas Misiones Jesuíticas Gyaraníes: Programa de Capacitación para la Conservación, Gestión y Desarrollo Sustable de las Misiones Jesuíticas Guaraníes : Manual Básico de Conservação para as Missões Jesuíticas dos Guaraní: Programa de Capacitação para a Conservação, Gestão e Desenvolvimento Sustentável das Missões Jesuíticas dos Guarani. New York: World Monument Fund. 231 p. Available at: http://www.wmf.org/sites/default/files/wmf_publication/Jesuit%20Mission%20Manual%20Reduced.pdf

Charola, A. Elena and Marcelo L. Magadán, 2009. Principales materials utilizados en las Misiones Jesuíticas de los Guaraníes : Principais materiais utilizados nas Missões Jesuíticas dos Guarani. In: Manual Básico de Conservación par alas Misiones Jesuíticas Gyaraníes: Programa de Capacitación para la Conservación, Gestión y Desarrollo Sustable de las Misiones Jesuíticas Guaraníes : Manual Básico de Conservação para as Missões Jesuíticas dos Guaraní: Programa de Capacitação para a Conservação, Gestão e Desenvolvimento Sustentável das Missões Jesuíticas dos Guarani. A. Elena Charola and Marcelo L. Magadán, (eds.). New York: World Monument Fund. pp. 29-39.

Charola, A. Elena and Marcela L. Cedrola, 2009. Tratamientos de conservación : Tratamentos de conservação. In: Manual Básico de Conservación par alas Misiones Jesuíticas Gyaraníes: Programa de Capacitación para la Conservación, Gestión y Desarrollo Sustable de las Misiones Jesuíticas Guaraníes : Manual Básico de Conservação para as Missões Jesuíticas dos Guaraní: Programa de Capacitação para a Conservação, Gestão e Desenvolvimento Sustentável das Missões Jesuíticas dos Guarani. A. Elena Charola and Marcelo L. Magadán, (eds.). New York: World Monument Fund. pp. 63-79.

Charola, A. Elena and **Robert J. Koestler**. (eds.). 2010. Pesticide Mitigation in Museum Collections: Science in Conservation: Proceedings from the MCI Workshop Series, Smithsonian Contributions to Museum Conservation, No. 1, Washington, DC: Smithsonian Institution Scholarly Press, 72 p.

Charola, A. Elena, Christopher McNamara, and **Robert J. Koestler**. (eds.). 2011. *Biocolonization of Stone: Control and Preventive Methods: Proceedings from the MCI Workshop Series*, Smithsonian Contributions to Museum Conservation: 2, Washington, DC: Smithsonian Institution Scholarly Press. 116 p. http://hdl.handle.net/10088/16617

Charola, A. E., **Marion F. Mecklenburg**, and Ma. Teresa Domenech-Carbo. (eds.). 2010. Cleaning 2010: New Insights into the Cleaning of Paintings. Preprints containing the abstracts of the International Conference "New Insights into the Cleaning of Paintings (Cleaning 2010)" held in Valencia in May 26th to 28th and organized jointly by the Instituto Universitario de Restauracion del Patrimonio (Universidad Politecnica de Valencia) and the Museum Conservation Institute (Smithsonian Institution) Valencia (Spain): Universidad Politecnica de Valencia. 108 p.

Craig, Nathan, **Robert J. Speakman**, Rachel Popelka-Filcoff, Mark Aldenderfer, Luis Flores Blanco, Margaret Brown Vega, Michael D. Glascock, and Charles Stanish. 2010. Identifying the Location of the Macusanite Obsidian Source in Southern Peru. Journal of Archaeological Science 37(3): 569–576.

Davis, Jeffrey M., Dale E. Newbury, Albert Fahey, Nicholas W.M. Ritchie, **Edward Vicenzi**, and Dale Bentz. 2011. Bridging the Micro-to-Macro Gap: A New Application for Micro X-Ray Fluorescence. Microscopy and Microanalysis, 17 (3): 410-417.

del Hoyo-Melendez, Julio M. and **Marion F. Mecklenburg**. 2010. A survey on the light-fastness properties of organic-based Alaska Native artifacts, Journal of Cultural Heritage 11(4): 493-499. doi:10.1016/j.culher.2010.01.004

del Hoyo-Melendez, Julio M. and **Marion F. Mecklenburg.** 2011. An Investigation of Reciprocity Principle of Light Exposures Using Microfading Spectrometry. Spectroscopy Letters, 44(1): 52-62.

del Hoyo-Melendez, Julio M. and **Marion F. Mecklenburg**. 2011. The Use of Micro-Fading Spectrometry to Evaluate the Light Fastness of Materials in Oxygen-Free Environments. Spectroscopy Letters, 44: 113-121.

del Hoyo-Melendez, Julio M., Marion F. Mecklenburg, and Maria Teresa Domenech-Carbo. 2010. An evaluation of daylight distribution as an initial preventive conservation measure at two Smithsonian Institution Museums, Washington DC, USA, Journal of Cultural Heritage. available online at http://www.sciencedirect.com. doi:10.1016/j.culher.2010.05.003

del Hoyo-Melendez, Julio M., Marion F. Mecklenburg, and Maria Teresa Domenech-Carbo. 2011. Determination of the Annual Light Exposure Received by Two-Dimensional Museum Objects Displayed on Vertical Surfaces using Photometric Measurements. Studies in Conservation 56 (1): 31-40.

del Hoyo-Melendez, Julio M., Mecklenburg, Marion F., and Maria Domenech-Carbo. 2011. An Evaluation of Daylight Distribution as an Initial Preventive Conservation Measure at Two Smithsonian Institution Museums, Washington, DC, USA. Journal of Cultural Heritage, 12: 54-64.

Delgado Rodrigues, Jose, Marta Vale Anjos, and **A. Elena Charola**. 2011. Recolonization of Marble Sculptures in a Garden Environment, *Biocolonization of Stone: Control and Preventive Methods: Proceedings from the MCI Workshop Series*, Smithsonian Contributions to Museum Conservation: 2, Charola, A. Elena, Christopher McNamara, and Robert J. Koestler, (eds.). Washington, DC: Smithsonian Institution Scholarly Press, pp. 71-85.

DePriest, Paula T. 2010. Documenting Worship Structures in Northern Mongolia's Hovsgol Aimag, 2009: Part V, American-Mongolian Deer Stone Project: Field Report 2009, Fitzhugh, William and Jamsranjav Bayarsaikhan, eds. Washington, DC: Arctic Studies Center, National Museum of Natural History, Smithsonian Institution, pp. 165-186.

DePriest, Paula T. 2010. On the Ancient Uighur Trail in Northern Mongolia, Arctic Studies Center Newsletter, 17: 21-23.

DePriest, Paula T. 2010. Traditional Birch Bark Ortz Cover Collected for the National Museum of Mongolia: Part VI, American-Mongolian Deer Stone Project: Field Report 2009, Fitzhugh, William and Jamsranjav Bayarsaikhan, eds. Washington, DC: Arctic Studies Center, National Museum of Natural History, Smithsonian Institution, pp. 187-194.

DePriest, Paula T. and **Harriet F. Beaubien**. 2011. Case Study: Deer Stones of Mongolia after Three Millennia, Biocolonization of Stone: Control and Preventive Methods: *Proceedings from the MCI Workshop Series*, Smithsonian Contributions to Museum Conservation: 2, Charola, A. Elena, Christopher McNamara, and Robert J. Koestler. (eds.). Washington, DC: Smithsonian Institution Scholarly Press, pp. 103-108.

Domenech-Carbo, Ma. T., Miguel F. Silva, Elvira Aura-Castro, Antonio Domenech-Carbo, Laura Fuster-Lopez, Jose Gimeno-Adelantado, Stephan U. Kroner, Maria Martinez-Bazan, Xavier Mas-Barbera, **Marion F. Mecklenburg**, and Laura Osete-Cortina. 2010. A Multi-Technique Approach for Evaluating Cleaning Treatments in Acrylic and PVAc

Paints In: Fuster-Lopez, Laura, Charola, A. E., Mecklenburg, Marion F. and Domenech-Carbo, Ma. Teresa, Cleaning 2010: New Insights into the Cleaning of Paintings. Preprints containing the abstracts of the International Conference "New Insights into the Cleaning of Paintings (Cleaning 2010)" held in Valencia in May 26th to 28th and organized jointly by the Instituto Universitario de Restauracion del Patrimonio (Universidad Politecnica de Valencia) and the Museum Conservation Institute (Smithsonian Institution). Valencia (Spain): Universidad Politecnica de Valencia, pp. 39-40.

Domenech-Carbo, Maria Teresa, Silva, Miguel F., Aura-Castro, Elvira, Fuster-Lopez, Laura, Kroener, Stephan, Luisa Martinez-Bazan, Maria, Mas-Barbera, Xavier, **Mecklenburg, Marion F.**, Osete-Cortina, Laura, Domenech, Antonio, Vicente Gimeno-Adelantado, Jose, and Julia Yusa-Marco, Dolores. 2011. Study of Behaviour on Simulated Daylight Ageing of Artists' Acrylic and Poly(vinyl acetate) Paint films. Analytical and Bioanalytical Chemistry, 399(9): 2921-2937. doi:10.1007/s00216-010-4294-3

Fusco, Maria, and **Robert J. Speakman**. 2010. The Application of X-ray Fluorescence (XRF) Spectrometry in the Characterization of Glass Degradation in Beaded African Art. Bead Forum, 52: 1–12.

Fuster-López, Laura, **Marion F. Mecklenburg**, María Castell-Agustí, and Vicente Guerola-Blay. 2008. Filling materials for easel paintings: when the ground reintegration becomes a structural concern. In: Preparation for Painting: The Artist's Choice and its Consequences, Joyce H. Townsend, Tiarna Doherty, Gunnar Heydenreich and Jacqueline Ridge (eds.), London: Archetype Books, pp. 180-186.

Grebennikov, Andrei V., Vladimir K. Popov, Michael D. Glascock, **Robert J. Speakman**, Yaroslav V. Kusmin, and Andrei V. Ptashinsky. 2010. Obsidian Provenance Studies on Kamchatka Peninsula (Far Eastern Russia): 2003–2007 Results, *Crossing the Straits: Prehistoric Obsidian Source Exploitation in the North Pacific Rim*, edited by Y.V. Kuzmin and M.D. Glascock. British Archaeological Reports S2152, Oxdord: Archaeopress, pp. 89-120.

Gervais, Claire, Carol A. Grissom, Nicole C. Little, and **Melvin J. Wachowiak**. 2010. Cleaning Marble with Ammonium Citrate, Studies in Conservation 55: 164–176.

Gervais, Claire, Carol Grissom, Christopher McNamara, Nick R. Konkol, and Ralph Mitchell. 2011. Case Study: Red Staining on Marble, *Biocolonization of Stone: Control and Preventive Methods: Proceedings from the MCI Workshop Series*, Smithsonian Contributions to Museum Conservation: 2, Charola, A. Elena, Christopher McNamara, and Robert J. Koestler. (eds.). Washington, DC: Smithsonian Institution Scholarly Press, pp. 87-90.

Goodway, Martha. 2009. Overstrung strings from 18th- and 19th-century English square pianos, Historical Metallurgy 43(2): 98-102.

Grissom, Carol A., Claire Gervais, **Nicole C. Little**, **Genevieve Bieniosek**, and **Robert J. Speakman**. 2010. Red "Staining" on Marble: Biological or Inorganic Origin?, APT Bulletin, 41: 11-20.

Iñañez, Javier G., Robert J. Speakman, Jaume Buzeda I Garrigós, and Michael D. Glascock. 2010. Chemical Characterization of Tin-Lead Glazed Ceramics from Aragon (Spain) by Neutron Activation Analysis. Radiochimica Acta 98(8):525–532.

Iñañez, Javier G., Jeremy J. Bellucci, Enrique Rodriguez-Alegria, Richard Ash, William McDonough, and **Robert J. Speakman.** 2010. Romita Ware Revisited: A Reassessment of the Provenance of Colonial Mexico Ceramics by LA-MC-ICP-MS and INAA. Journal of Archaeological Science 37(11):2698–2704.

Karas, Basiliki Vicky, **Harriet F. Beaubien**, and William W. Fitzhugh. 2010. Documenting Mongolia's deer stones: application of 3D laser scanning technology to archaeological conservation. Chapter 13, in *The Conservation of Archaeological Materials: Current trends and future directions* (British Archaeological Reports 2010), edited by Emily Williams and Claire Peachey. Oxford: British Archaeological Reports BAR S2116. pp. 103-112.

Keel, William G., William Moser, **Jennifer Giaccai**, Andrea Ormos, Jackson Tanner, and Lee A. Weigt. 2011. Alcohol Recycling at the Smithsonian Institution, National Museum of Natural History. Collections Forum, 25(1): 10-21.

Lopez-del-Rio, H., F. Mireles-Garcia, R.Y. Mendez-Cardona, M. Nicolas-Caretta, **R.J. Speakman**, and M.D. Glascock. 2009. Characterization of pottery from Cerro de Las Ventanas, Zacatecas, Mexico. Radiochimica Acta, 97(9): 513-518.

Madden, Odile, Jessica Johnson, Jae R. Anderson. 2010. Pesticide Remediation in Context: Toward Standardization of Detection and Risk Assessment. In: Pesticide Mitigation in Museum Collections: Science in Conservation: Proceedings from the MCI Workshop Series, A. Elena Charola and Robert J. Koestler, eds. pp. 1-6.

Magadan, Marcelo L. Gisela M.A. Korth, Marcela L. Cedrola, **A. Elena Charola**, and Jose L. Pozzobon. 2011. Case Study: Biocontrol Testing at the San Ignacio Mini Jesuit-Guarani Mission, Misiones, Argentina. *Biocolonization of Stone: Control and Preventive Methods: Proceedings from the MCI Workshop Series*, Smithsonian Contributions to Museum Conservation: 2, Charola, A. Elena, Christopher McNamara, and Robert J. Koestler. (eds.). Washington, DC: Smithsonian Institution Scholarly Press, pp. 91-98.

Mecklenburg, Marion F., Charles S. Tumosa, and **Edward Vicenzi.** 2010. The Influence of Pigments and Ion Migration on the Durability of Drying Oil and Alkyd Paints In: Fuster-Lopez, Laura, Charola, A. E., Mecklenburg, Marion F. and Domenech-Carbo, Ma. Teresa, Cleaning 2010: New Insights into the Cleaning of Paintings. Preprints containing the abstracts of the International Conference "New Insights into the Cleaning of Paintings (Cleaning 2010)" held in Valencia in May 26th to 28th and organized jointly by the

Instituto Universitario de Restauracion del Patrimonio (Universidad Politecnica de Valencia) and the Museum Conservation Institute (Smithsonian Institution). Valencia (Spain): Universidad Politecnica de Valencia, pp.27-28.

Meier, Douglas C. Jeffrey M. Davis, and **Edward P. Vicenzi**. 2011. An Examination of Kernite ($Na_2B_4O_6(OH)_2 \cdot 3H_2O$) Using X-Ray and Electron Spectroscopies: Quantitative Microanalysis of a Hydrated Low-Z Mineral. Microscopy and Microanalysis, 17: 718-727 doi: 10.1017/S1431927611000602

Mireles, Fernando, Jose Luis Pinedo, J. Ignacio Davila, Jesus E. Oliva, **Robert J. Speakman**, and Michael D. Glascock. 2011. Assessing Sediment Pollution from the Julian Adame-Alatorre Dam by Instrumental Neutron Activation Analysis. Microchemical Journal 99 (1): 20–25. DOI: **10.1016/j.microc.2011.03.014**

Moini, Mehdi. 2010. Metal displacement and stoichiometry of protein-metal complexes under native conditions using capillary electrophoresis/mass spectrometry, Rapid Communications in Mass Spectrometry, 24: 2730-2734.

Moini, Mehdi, **Kathryn Klauenberg**, and **Mary Ballard**. 2011. Dating Silk by Capillary Electrophoresis Mass Spectrometry. Analytical Chemistry, 83(19): 7577-7581. (Web publication: Technical Note, August 30, 2011) DOI: 10.1021/ac201746u.

Moini, Mehdi, Longfei Jiang, and Samir Bootwala. 2011. High-throughput Analysis Using Gated Multi-inlet Mass Spectrometry. Rapid Communications in Mass Spectrometry, 25(6): 789-794, DOI: 10.1002/rcm.4924.

Moskal-del Hoyo, M., M. Wachowiak, and R.A. Blanchette. 2010. Preservation of fungi in archaeological charcoal, Journal of Archaeological Science, 37: 2106-2116.

Pabst, Sonja, Thomas Zack, Ivan P. Sovov, Thomas Ludwig, Detlef Rost, and **Edward P. Vicenzi**. 2011. Evidence for Boron Incorporation into the Serpentine Crystal Structure. American Mineralogist, 96(7): pp. 1112-1119.

Phillips, S. Colby. 2010. Bridging the Gap Between Two Obsidian Source Areas in Northeast Asia: LA-ICP-MS Analysis of Obsidian Artefacts from The Kurile Islands of the Russian Far East. In *Crossing the Straits: Prehistoric Obsidian Source Exploitation in the North Pacific Rim*, edited by Y.V. Kuzmin and M.D. Glascock pp. 121–136. British Archaeological Reports S2152, Archaeopress, Oxford.

Pohl, Christie M., Greg Hodgins, **Robert J. Speakman** and **Harriet F. Beaubien**. 2009. The effect of cyclododecane on carbon-14 dating of archaeological materials, Journal of the American Institute for Conservation, 48 (3): 223-233.

Purdy, Barbara A., Kevin S. Jones, John J. Mecholsky, Gerald Bourne, Richard C. Hulbert Jr., Bruce J. MacFadden, Krista L. Church, Michael W. Warren, Thomas F. Jorstad, Dennis J. Stanford, **Melvin J. Wachowiak**, and **Robert J. Speakman**. 2011. Earliest Art in the

Americas: Incised Image of a Proboscidean on a Mineralized Extinct Animal Bone from Vero Beach, Florida. Journal of Archaeological Science, 38: 2908-2913.

Rogala, Dawn, Susan Lake, Christopher Maines, and **Marion Mecklenburg**. 2010. Condition Problems Related to Zinc Oxide Underlayers: Examination of Selected Abstract Expressionist Paintings from the Collection of the Hirshhorn Museum and Sculpture Garden, Smithsonian Institution, Journal of the American Institute for Conservation, 49 (2): 96-113.

Ropret, Polonca, Costanza Miliani, Silvia A. Centeno, Crtomir Tavzes, and Francesca Rosi. 2010. Advances in Raman mapping of works of art, Journal of Raman Spectroscopy. 41: 6 p. available at www.interscience.wiley.com. DOI: 10.1002/jrs.2733

Salvadori, Ornella and **A. Elena Charola**. 2011. Methods to Prevent Biocolonization and Recolonization: An Overview of Current Research for Architectural and Archaeological Heritage, *Biocolonization of Stone: Control and Preventive Methods: Proceedings from the MCI Workshop Series*, Smithsonian Contributions to Museum Conservation: 2, Charola, A. Elena, Christopher McNamara, and Robert J. Koestler. (eds.). Washington, DC: Smithsonian Institution Scholarly Press, pp. 37-50.

Silva, Miguel F., Maria Teresa Doménech-Carbó, Laura Fuster-Lopéz, Susana Martin-Rey, and **Marion F. Mecklenburg**. 2009. Determination of the plasticizer content in poly(vinyl acetate) paint medium by pyrolysis-silylation-gas chromatography-mass spectrometry, Journal of Analytical and Applied Pyrolysis, 85(1-2): 487-491.

Silva, Miguel F., Maria Teresa Doménech-Carbó, Laura Fuster-López, **Marion F. Mecklenburg**, Susana Martin-Rey. 2010. Identification of additives in poly(vinylacetate) artist's paints using PY-GC-MS, Journal of Analytical & Bioanalytical Chemistry, 397(1): 357-367. DOI 10.1007/s00216-010-3505-2.

Solazzo, Caroline, Susan Heald, **Mary W Ballard**, David A Ashford, **Paula T DePriest**, **Robert J. Koestler**, and Matthew Collins. 2011. "Coast Salish blankets: a tale of shaggy dogs?" Antiquity 85: 1-14.

Speakman, Robert J., Nicole C. Little, Darrell Creel, Myles R. Miller, and **Javier G. Iñañez**. 2011. Sourcing Ceramics with Portable XRF Spectrometers? A Comparison with INAA using Mimbres Pottery from the American Southwest. Journal of Archaeological Science, 38(12): 3483-3496. doi:10.1016/j.jas.2011.08.011.

Tavzes, Č., Šilc, F., Kladnik, A., Fackler, K., Messner, K., Pohleven, F., **Koestler, R.J**., 2009. Enzymatic degradation of mould stains on paper. International Biodeterioration and Biodegradation 63(7): 873-879.

Wachowiak, Melvin J. and **Basiliki VIcky Karas**. 2009. 3D Scanning and Replication for Museum and Cultural Heritage Applications. Journal of the American Institute for Conservation, 48: 141-158.

Tsang, Jia-sun. 2010. Safe handling of plastics in museum environment, WAAC Newsletter (Western Association of Art Conservators), 32(2): 16-22.

Tumosa, Charles S. and **Marion F. Mecklenburg**. 2010. Oils: The Chemistry of Drying Oils and the Potential for Solvent Disruption In: Fuster-Lopez, Laura, Charola, A. E., Mecklenburg, Marion F. and Domenech-Carbo, Ma. Teresa, Cleaning 2010: New Insights into the Cleaning of Paintings. Preprints containing the abstracts of the International Conference "New Insights into the Cleaning of Paintings (Cleaning 2010)" held in Valencia in May 26th to 28th and organized jointly by the Instituto Universitario de Restauracion del Patrimonio (Universidad Politecnica de Valencia) and the Museum Conservation Institute (Smithsonian Institution). Valencia (Spain): Universidad Politecnica de Valencia, pp.25-26.

Vaslet, A., **C. France**, D.L. Phillips, I.C. Feller, and C.C. Baldwin. 2011. Stable-isotope Analyses Reveal the Importance of Seagrass Beds as Feeding Areas for Juveniles of the Speckled Worm Eel *Myrophis punctatus* (Teleostei: Ophichthidae) in Florida. Journal of Fish Biology, 79: 692-706. doi: 10.1111/j.1095-8649.2011.03052.x

Watson, Judy. 2010. Appendix 1. Smithsonian Museum Conservation Institute Report on Mongolian Slag, American-Mongolian Deer Stone Project: Field Report 2009, Fitzhugh, William and Jamsranjav Bayarsaikhan, eds. Washington, DC: Arctic Studies Center, National Museum of Natural History, Smithsonian Institution, pp. 211-218.

Williams, Don, 2009. The Art of Japanning, American Period Furniture (Journal of the Society of American Period Furniture Makers), 9: 4-11.

Wolff, Christopher B. 2010. Subsistence, Settlement, and Prehistoric Exchange in Newfoundland and Labrador. Arctic Studies Center Newsletter, 17: 18-19.

A complete listing of MCI publications can be found on the Smithsonian Research Bibliography at http://research.si.edu/.

Projects by Museum

Anacostia Community Museum
MCI 6336 Painting: Muse I by Sam Gilliam
MCI 6337 Painting: Swedish Cottage and Shakespeare Garden by James Aiken
MCI 6338 Painting: 3PM in the Studio by Kenn Simpson
MCI 6339 Painting: Lake and Golf Course, Van Cortland Park, NYC by James Aiken

Cooper-Hewitt Museum
MCI 6190 Ivory-inlaid and ebony cabinet on stand for CHM

Freer Gallery of Art/Arthur M. Sackler Gallery of Art
MCI 6286 Mercuric sulfide samples
MCI 6289 Paper molds of archaeological monuments
MCI 6319 Korean glass beads
MCI 6348 Paper molds of Near Eastern inscriptions
MCI 6360 Use and selection of natural versus man-made mercury sulfide in china: development of a method for differentiation
MCI 6393 Chinese Buddhist Sculptures in the Freer Gallery of Art

Hirshhorn Museum and Sculpture Garden
MCI 6191 A closer look at the characteristics and compatibility of materials used in modern paintings with MCI
MCI 6253 Painting: Ocean Park #111 by Richard Diebenkorn
MCI 6300 Plastic and Rubber Sculptures
MCI 6424 Identification of Oil on Man Ray's "Nut Girls"
MCI 6438 Identification of Materials used in Antoni's "Lick and Lather" Soap Bust
MCI 6444 Fungal Biodeterioration of "Condensation Cube"
MCI 6454 Stain Removal Protocols for Claes Oldenburg Sculpture
MCI 6457 Coatings Tests for Beeswax, "Palimpsest" Installation Art

National Air and Space Museum
MCI 5990 Wiley Post 1934 Pressurized Flight Suit
MCI 6012 Confederate Balloon Fabric
MCI 6060 Acrylic Painting on Canvas
MCI 6073 WWII Balloon Basket
MCI 6082 Heinkel He 219 A German WWII Aircraft Wing
MCI 6125 Cabinet Felt
MCI 6139 Civil Aeronautics Board Flag
MCI 6144 Fokker D-7 Aircraft Fabric
MCI 6219 Gemini 8 Thruster resin
MCI 6251 Aviator's Goggles, Scarf and Helmet
MCI 6282 Painting: The Fledglings by Rudolph Dirks
MCI 6292 1918 Goddard Warhead
MCI 6342 Lowell H. Smith's Medal
MCI 6350 Rocket Pump

MCI 6431 Molecular Characterization and Technical Examination of Historic Aircraft Windows and Head Gear Using Portable Raman Spectroscopy
MCI 6442 Analysis of Paint on Wood Component, 1905 Wright Flyer
MCI 6445 Materials Analysis and Stabilization of Horten Ho 9 V3 fuselage
MCI 6451 Condition Assessment of "Portrait of Neil Tyson"

National Museum of African American History and Culture
MCI 6070.2 Black Fashion Museum Collection – Phase II
MCI 6070.3 Black Fashion Museum McGee Collection
MCI 6217.3 Chief's Bag
MCI 6217.4 Seven artifacts from a "Civil War shadow box"
MCI 6247 Painting: Behold Thy Son by David Driskell
MCI 6257 Yo-Yo Coverlet
MCI 6262 Slave Clothing
MCI 6279.1 Oil painting on canvas
MCI 6279.2 Oil painting on canvas' frame
MCI 6284 Emmett Till Casket
MCI 6291 James Brown costumes (3)
MCI 6294 Jones-Sims House (log cabin)
MCI 6313 Timmie Rogers' Tiple
MCI 6334 Slave Coverlet
MCI 6335 Paintings: Wonder by Sam Gilliam and Blue Jazz by Bill Dallas
MCI 6344 Sisters of the Mysterious Ten Pin
MCI 6433 Technical Assessment of Two Painted Metal Signs in the Meyer Collection
MCI 6437 Technical Assessment of Metal Bus Sign
MCI 6443 18th Century Men's Silk Suit
MCI 6447 Condition Assessment/Examination of Chesapeake Bay Oyster Boat
MCI 6450 Assessment of Civil War-era Metal Badges, Stencil, and Shackles
MCI 6458 Condition and Treatment of "Slave Trade" Painting
MCI 6459 Technical Assessment of Drinking Fountain
MCI 6463 Assessment and Mounting of 2 Coleman Paintings

National Museum of African Art
MCI 5977 Flag
MCI 6248 African Beaded Costume

National Museum of American History
MCI 6036 Gunboat Philadelphia
MCI 6052 Fabric
MCI 6113 Civil War Confederate Uniform
MCI 6161 Dried grains, beans and seeds
MCI 6215 Plastic artifacts in the Division of Medicine and Science
MCI 6287 Painting: Samuel Blodget
MCI 6299 Fireman's Painted Hat
MCI 6351 Thomas Jefferson's Bible
MCI 6430 Develop Cleaning Protocol to Remove Aged Coatings on Painted Fire Engine

MCI 6446 Technical Examination and Replication of NMAH Gragg Chair

National Museum of the American Indian
MCI 6068.2 Heavy Metal Pesticide Identification
MCI 6100.3 Pre-Columbian Gold Beads
MCI 6103 Southeastern North American archaeological copper artifacts
MCI 6178 Animal skins and hides
MCI 6195 Moundville Bowl
MCI 6224 Horse mask
MCI 6225 Andean pottery
MCI 6272 Brian Jungen's mobile piece Crux
MCI 6293 Chimú Gold Atlatl
MCI 6297 Painting: Brooklyn by Mario Martinez
MCI 6301 Inka and Colonial Wooden Qeros: White Pigments
MCI 6305 Modern Mexican lacquer decorated gourd
MCI 6331 Hide bag
MCI 6343 Southern Ute Doll
MCI 6416 Analysis of Efflorescence on deer claw/hoof
MCI 6417 Identification of headdress feather dyes
MCI 6419 Analysis of Pre-Columbian Resins from Panama
MCI 6428 Analysis of Exhibition Fabric for "Windows on Collections: Dolls"
MCI 6436 Study of Adhesives for use on Gutskin Objects
MCI 6441 Conservation of Tlingit Spruce Root Basketry

National Museum of Natural History
MCI 2018.2 Spiro's Craig Mound Black Mineral Lumps
MCI 6084.1 Deer Stones, Ushkiin Uver, Mongolia
MCI 6084.2 Deer Stone #15, Ushkiin Uver, Mongolia
MCI 6094.1 Lepidoptera Genitalia Slides
MCI 6094.2 Prepared Microscope Slides – Degradation of Embedding Medium
MCI 6095 Chilkat Blanket and Related Textiles
MCI 6110.2 Mesoamerican Clays
MCI 6118.2 Colonial American Skeletal Material
MCI 6118.4 Historic Human Bone
MCI 6126.1 Colvis Obsidian Biface from Idaho
MCI 6126.2 Prehistoric Projectile Points
MCI 6126.3 Late Pleistocene stone tool
MCI 6126.4 Late Pleistocene biface from Ocean City, New Jersey
MCI 6127 Animal hides
MCI 6269 Human Skeletal Remains from the Richards Family Vault, Congressional Cemetery, Washington, DC
MCI 6273 Engraved shell ornaments
MCI 6283 Maya Ceramic Texture and Temper
MCI 6302 Mammal Skulls and Taxidermy Specimens in MSC Pod 2
MCI 6315 Temporary burial pit
MCI 6320 Permian Fossil Plant

MCI 6321 Neanderthal bones
MCI 6323 Mangrove peat and sediment cores from the Indian River Lagoon, Florida
MCI 6333 Storage cabinets
MCI 6340 Two Yup'ik Dolls
MCI 6341 Two Zapatera Island (Nicaragua) Statues
MCI 6345 Saber-tooth cat bone with human modification
MCI 6347 Megafauna bone fragment with possible decoration
MCI 6352 Mangrove peat and sediment cores
MCI 6353.1 Entomology Department Storage Environment
MCI 6353.2 Entomology Department Storage Materials
MCI 6354 Mammal skulls
MCI 6355 Tuxtla Jade statuette
MCI 6356 White Cloud Pipe
MCI 6365 Using stable isotope signature of marine zooplankton to identify water masses
MCI 6366 Diets of Mesopelagic fish
MCI 6367 Using stable isotope signatures of monk seals to examine trophic structure of the Northwest Hawaiian Islands throughout the 20th century
MCI 6368 Using stable isotope signatures of sea otter vibrissae to look at temporal/spatial distribution
MCI 6369 Using stable isotope signatures of sea otter vibrissae to look at temporal/spatial distribution, Bering Sea and North Pacific
MCI 6370 Using stable isotope signatures to track turtles' ocean journey
MCI 6371 Using stable isotope signatures of seagrass to examine its contribution in diet and as habitat
MCI 6382 Stable isotopic analysis of Bronze Age burial mounds (Khirigsuurs) in Mongolia
MCI 6383 Stable isotopic analysis of Civil War soldiers from an excavated cemetery in New Mexico
MCI 6385 Incorporating stable isotopic data into the larger biostratigraphic record of the Miocene Siwalik sequence in Pakistan
MCI 6386 Using stable isotope signatures to examine adaptive radiation of the passerine bird genus Cinclodes
MCI 6387 Evolution of photosynthetic systems in Euphorbia (Euphorbiaceae)
MCI 6389 Stable isotopic analyses of Eastern United States (Chesapeake area) historic human remains
MCI 6394 Stable Isotope Analysis of Faunal Remains from Liang Bua, Flores, Indonesia: Implications for the disappearance and possible extinction of Homo floresiensis and Stegodon florensis during the Late Pleistocene
MCI 6400 Heterotrophy and mineral nutrition of tropical hyperparasitic mistletoes
MCI 6405 Seasonality of Early Holocene Archaeological Sites on the California Channel Islands
MCI 6406 Holocene Sea-Level Change in the Caribbean: Implications for Geophysical Modeling and Ocean-Climate Interactions
MCI 6412 Effects of Ecosystem Size, Productivity, and Habitat Complexity on Community Structure
MCI 6422 Historical Ecology in Coastal Alaska
MCI 6425 Imaging Skull Morphology for Determination of Sex in Lions
MCI 6434 Identification of Accretions on Movie Film

MCI 6448 Imaging of Plaster Cast of Kaminaljuyu Bas-Relief
MCI 6449 Imaging for Comparison of Red Siskin Plumage
MCI 6460 Analysis of Deposits from MSC Pod 5 Storage Tank
MCI 6461 Variation in Individual Feeding Habits Through Time and Space: Gauging the Sensitivity of Seabirds to Changes in Prey Availability
MCI 6462 Investigating Meridional Gradients in Temperature, Seasonality, and Diversity During Greenhouse Periods in the US Coastal Plain

National Portrait Gallery
MCI 5957 Andrew Jackson on Horseback
MCI 6181 Painting: Cornelia Otis Skinner by Gladys Rockmore Davis
MCI 6202.2 Analyses of Acrylic, Alkyd and Oil Mixed-Media Samples

National Zoological Park
MCI 6222 Analysis of Nautilus Pompilius shell
MCI 6314 East African bustard feathers
MCI 6318 Sparrow Specimens with NMNH
MCI 6346 Sculptured wool tapestry: Special Tigers
MCI 6358 Patterns if stable carbon isotope variation over the arrival period in a long-distance migratory bird
MCI 6359 Carry-over effects of winter population limitation in the endangered Kirtland's Warbler (*Dendroica kirlandii*)
MCI 6373 Investigation of the migratory nature of Canadian geese causing the crash of US Airways Flight 1549
MCI 6374 Connectivity of migratory bird populations wintering in the Caribbean Basin
MCI 6377 Evaluating quality of winter feeding grounds for declining Rusty Blackbird
MCI 6378 Patterns of Stable Carbon and Nitrogen Isotope variation across an urbanization gradient MCI 6379 Trophic structure of several fluvial ecosystems in the western United States
MCI 6381 Using stable isotopes to study patterns of long-distance dispersal in neotropical migratory birds
MCI 6390 Reconstructing food web dynamics in the understory of an eastern deciduous forest
MCI 6391 Tracking the skylark throughout the annual cycle
MCI 6401 Effect of simulated rainfall on plant productivity, insect abundance and the condition of migratory birds in lowland scrub forest of Jamaica
MCI 6403 Variation in hydrogen stable isotopes in feathers of two bird species along an elevational gradient
MCI 6414 Design of New Pod 5 Storage Tanks
MCI 6439 Historical and contemporary diet in the most range-restricted bird in North America, the Island Scrub-Jay (*Aphelocoma insularis*)

ODC
MCI 4546 Zinc Statue of Columbia

Office of Exhibits Central
MCI 6186.1 Exhibition case materials

MCI 6186.2 Exhibition case materials

OFEO
MCI 4546.2 Examination of Zinc Sculpture on A&I Building
MCI 6128 South Mall Zone Smithsonian Buildings
MCI 6304 Exterior of NMAI building

Office of the Undersecretary for History, Art, and Culture
MCI 63440.1 Smithsonian Haiti Project: Sculpture Treatment and Consultation
MCI 63440. 2 Smithsonian Haiti Project: Haitian Wall Paintings

Smithsonian American Art Museum
MCI 5964 Andrew Jackson on Horseback
MCI 5984.2 Linen Sculpture: The Principal Wife Goes On by Sheila Hicks
MCI 6171 Hiram Powers hand
MCI 6258 Sculpture: Group of Deer by Paul Manship
MCI 6278 Painting: Les Clochards by Lois Mailou Jones
MCI 6280 Painting: Self Portrait by Lois Mailou Jones
MCI 6290 Terracotta medallions
MCI 6303 Silver Rattle
MCI 6308 Textile Art: Leaf Lock by Diane Itter
MCI 6309 Textile Art: Lay inlet by Barbara Lee Smith
MCI 6311 Henry O. Tanner Painting Materials and Techniques
MCI 6418 Exhibition Conservation of 4 Rockman Paintings
MCI 6420 Comparative Study of Sacrificial Coatings for Marble Sculptures
MCI 6456 Binder Analysis, Moser Paint-on-Paperboard Artwork

Smithsonian Conservation Biology Institute
MCI 6435 Integrating native plant diversity within agricultural grasslands to increase forage production and improve habitat for grassland birds

Smithsonian Environmental Research Center
MCI 6263 Terpenes in spicebush leaves
MCI 6357 Effects of nutrient enrichment and species diversity on ecological stoichiometry
MCI 6361 Preliminary project – analysis of plant and animal ecosystems in Alaska
MCI 6376 How riparian vegetation communities influence stream food web structure
MCI 6380 Effects of environmental change on the mycorrhizal relationships of the native orchids Goodyera pubescens and Tipularia discolor
MCI 6395 Environmental controls on diatom distribution in the Patuxent Estuary, past and present: implications for Holocene river discharge and sea-level change
MCI 6396 Assessing denitrification at the watershed scale based on N and O isotopes in nitrate
MCI 6397 The mycorrhizal status of Epifagus virginiana
MCI 6398 A novel application of bio-geochemical fingerprinting to evaluate the nursery potential of Chesapeake Bay subestuaries to contribute to the blue crab spawning stock
MCI 6402 Penobscot River Mercury Study

MCI 6404 Evaluating the effects of anthropogenic nitrogen pollution in the invasion of a non-native genotype of the common reed, Phragmites australis
MCI 6407 Peat decomposition as exposed to elevated CO2 and N
MCI 6408 Cypripedium fasciculatum fungal dependence
MCI 6409 A novel application of bio-geochemical fingerprinting to evaluate the nursery potential of Chesapeake Bay subestuaries for blue crabs
MCI 6413 Prescribed burns in the sustainable conservation of coastal marshes
MCI 6423 Predicting Impacts of Stressors at the Land-Water Interface: Effects of Multiple Stressors on Estuarine Macrofauna
MCI 6426 The Indirect Effects of Invasive Earthworms on Tree Seedling Recruitment in Deciduous Forests

Smithsonian Institution Archives
MCI 6142 Detached ink silhouette fragments from William Bache silhouette portrait album
MCI 6296 Letterpress Copying Books: A study of the Baird Collection

Smithsonian Institution Library
MCI 6298 Book: The Principles and Practice of Modern Surgery (1860) by Robert Druitt

Smithsonian Institution Traveling Exhibits
MCI 6096 Fabric Samples

Smithsonian Latino Center
MCI 6310 Exhibit: Contemporary Argentine Masterworks

Smithsonian Marine Station at Fort Pierce, Florida
MCI 6392 Use of isotopic signatures to assess the importance of mangroves as feeding areas for mangrove fish communities in Florida and Belize
MCI 6399 Seagrass food web structure in the Banana River Lagoon
MCI 6410 Comparative Functional Role of Mangroves and Swamps for Nekton

Smithsonian Traveling Exhibition Service
MCI 6096 Review of Fabric Samples for “Jim Henson’s Fantastic World” Exhibition

Smithsonian Tropical Research Institute
MCI 6029 STRI Library
MCI 6223 Volcanic rocks from Panama
MCI 6256.2 El Cano Archaeological Project: 2010 Field Season
MCI 6256.3 El Caño Archaeological Project: 2011 Field Season
MCI 6362 Preliminary project – confirmation of standard values
MCI 6388 Nutrients dynamics during ecosystem development
MCI 6415 A Pilot Study Using Carbon and Oxygen Stable Isotopes to Source the Marine Bivalve Spondylus
MCI 6419.2 Analyses of Organic Substances from Necropolis of El-Caño Panama

Pan-Institutional Projects (MCI)

MCI 4834 Plaster objects from ‘Ain Ghazal
MCI 5277.1 Gordion Textiles from Turkey
MCI 5277.2 Textile fragments from Tumulus MM, Gordion, Turkey
MCI 5277.3 Goethite coloration of textiles
MCI 5500 Mudbrick Consolidation Methods and Materials
MCI 5804 Possible codex from baking pot, Belize
MCI 5927.2 Salish blanket fiber materials
MCI 5959 Sulfur-Permeability in Organic Coating Materials for Silver
MCI 6005 Two Objects from Tomb 1 Burial in Mongolia
MCI 6039.2 Mesoamerican Painted Organic Objects
MCI 6068.1 Heavy Metal Pesticide Deterioration
MCI 6099 10,000 Springs Pavilion
MCI 6100.1 Pre-Columbian Goldworking in Panama: Illuminating its history, preserving its heritage MCI 6100.2 Technology of Pre-Columbian Gold in Panama: A study of fabrication and compositional analysis
MCI 6115 Alaska Projectile Points
MCI 6131 Tortoiseshell and tortoiseshell substitutes
MCI 6134 Argon registration: Application and documentation
MCI 6153 Prussian Blue and Indigo
MCI 6187 Salts in ceramics
MCI 6202 Non-Destructive and Minimally Invasive Analytical Approaches Applied to Modern and Contemporary Paintings Conservation
MCI 6205 Arlington Cemetery’s Memorial Amphitheater
MCI 6206 3M Novec Fluids
MCI 6207 Cleaning of marble with ammonium citrate
MCI 6211 Studying the effects of light on sensitive museum objects and materials and the application of research results in setting lighting levels in museums
MCI 6212 Investigation of microorganisms and composition of archaeological wood charcoal
MCI 6221 African Ivory – Bioarchaeological Study: tracing the links between elephants, humans, and land use during the 19th century East African caravan trade
MCI 6226 Evaluation of the effects caused by the use of PVAC in lined modern posters
MCI 6233 Isotope Ratio Mass Spectroscopy (IR-MS) Analysis of Natural and Synthetic Indigo
MCI 6235 Mongolian Deer Stone Catalog Project
MCI 6240 Imitation-metal paint study
MCI 6244 Sourcing slate in the Far Northeast: An examination of prehistoric exchange systems in Newfoundland and Labrador
MCI 6245 Development of SERS Active Vapor Sensors for Detection of Volatile Museum Contaminants
MCI 6306 Cleaning synthetic polymers in modern and contemporary art
MCI 6307 Chilkat blankets
MCI 6312 Protocols for Vacuum Cleaning Textiles
MCI 6316 Stable isotopic indications of trophic structure in late Pleistocene North American mammals and implications for the cause of the end-Pleistocene extinction event
MCI 6317 The Effects of PVA Treatment and Chemical Removal on the Stable Isotopic Signature of Bones and Teeth

MCI 6324 Biodeterioration of cultural heritage, microbes
MCI 6325 Biodeterioration, natural history collections, and Mongolian cultural history and objects MCI 6326 Structure and conservation of paintings, museum envelopes and storage conditions, mechanical properties
MCI 6327 Biological materials, proteomics, stable isotope analysis
MCI 6328 Archaeological objects and materials
MCI 6329 Imaging spectroscopy, minerals analysis, meteorites and star dust, bronze corrosion, paleobiology materials, synchrotron analysis
MCI 6330 Detection of volatiles; detection of heavy metal residues; technology, characterization and degradation of natural and synthetic polymer composites; characterization of graphite
MCI 6332 Bronze patinas
MCI 6363 IRMS round robin exercise
MCI 6364 Stable carbon and sulfur isotopic indicators of volcanic eruptions as recorded in tree rings from Central and North America
MCI 6372 Thermoregulatory adaptations of Acrocanthosaurus atokensis - evidence from oxygen isotopes
MCI 6375 Stable isotopic characterization of a mammoth tusk from coastal Virginia and associated fauna on the east coast of North America
MCI 6384 Development of new in-house standards for isotopic linear correction
MCI 6432 The Age of Plastic
MCI 6453 Investigation of the Feasibility of Nondestructive Measurement of Moisture in Porous Materials Using Prompt Gamma Neutron Activation (PGNA)
MCI 6455 Analysis of Natural Resins Using FTIR and GC-MS, MCI Reference Collections
MCI 6465 Technical Study of Daguerrotypes

Non-Smithsonian Organizations

American Museum of Natural History
MCI 5948 Ivory specimens for AMNH

Folger Shakespeare Library
MCI 6264 Painting: Janssen Shakespeare Portrait

Historic Jamestowne
MCI 6288 Jamestown slate writing tablet

Metropolitan Museum of Art
MCI 6349 Inca Pottery from NW Argentina

Mount Vernon Estate and Gardens
MCI 6295 Martha Washington chair cushion tops at Mount Vernon
MCI 6421 Report on using the Micro-Fading Tester for colorimetry
MCI 6295 Martha Washington Seat Cushion Covers and Needlepoint Envelope at Mount Vernon

Phillips Collection
MCI 6193 Antoine Pevsner’s Plastic Sculpture

U.S. House of Representatives
MCI 6254 Taxidermy specimens at the US House of Representatives

U.S. Senate
MCI 6177 Minimally intrusive upholstery prototypes
MCI 6209 Daniel Webster Desk

Walters Art Gallery
MCI 6243 Altarpiece triptych: Madonna and Child with the Crucifixion and the Annunciation, the Coronation of the Virgin and the Presentation in the Temple
MCI 6322 Painting: The Ideal City by Fra Carnevale

Projects by Grand Challenge

Unlocking the Mysteries of the Universe

MCI6316 Stable isotopic indications of trophic structure in late Pleistocene North American mammals and implications for the cause of the end-Pleistocene extinction event for MCI

MCI6317 The effects of PVA treatment and removal on the stable isotopic signature of bones for MCI

MCI6329 Imaging spectroscopy, minerals analysis, meteorites and star dust, bronze corrosion, paleobiology materials, synchrotron analysis for MCI

MCI6362 Preliminary project – confirmation of standard values for STRI

MCI6363 IRMS round robin exercise for MCI

MCI6364 Stable carbon and sulfur isotopic indicators of volcanic eruptions as recorded in tree rings from Central and North America for MCI

MCI6365 Using stable isotope signature of marine zooplankton to identify water masses for NMNH

MCI6384 Development of new in-house standards for isotopic linear correction for MCI

MCI6396 Assessing denitrification at the watershed scale based on N and O isotopes in nitrate for SERC

Understanding and Sustaining a Biodiverse Planet

MCI5948 Ivory specimens for AMNH

MCI6094.1 Lepidoptera Genitalia Slides for NMNH

MCI6094.2 Prepared Microscope Slides – Degradation of Embedding Medium for NMNH

MCI6127 Animal hides for NMNH

MCI6131 Tortoiseshell and tortoiseshell substitutes for MCI

MCI6153 Prussian Blue and Indigo for MCI

MCI6161 Dried grains, beans and seeds for NMAH

MCI6178 Animal skins and hides for NMAI

MCI6181 Painting: Cornelia Otis Skinner by Gladys Rockmore Davis for NPG

MCI6186.1 Exhibition case materials for OEC

MCI6186.2 Exhibition case materials for OEC

MCI6187 Salts in ceramics for MCI

MCI6190 Ivory-inlaid and ebony cabinet on stand for CHM

MCI6191 A closer look at the characteristics and compatibility of materials used in modern paintings for MCI/HMSG

MCI6193 Antoine Pevsner's Plastic Sculpture for Phillips Collection

MCI6206 3M Novec Fluids for MCI

MCI6212 Investigation of microorganisms and composition of archaeological wood charcoal for MCI

MCI6221 African Ivory – Bioarchaeological Study: tracing the links between elephants, humans, and land use during the 19th century East African caravan trade for MCI

MCI6222 Nautilus pompilius shell for NZP

MCI6223 Volcanic rocks from Panama for STRI

MCI6254 Taxidermy specimens at the US House of Representatives for US House of Representatives

MCI6263 Terpenes in spicebush leaves for SERC

MCI6302 Mammal Skulls and Taxidermy Specimens in MSC Pod 2 for NMNH
MCI6304 Exterior of NMAI building for OFEO
MCI6314 East African bustard feathers for NZP
MCI6318 Sparrow Specimens for NZP/NMNH
MCI6320 Permian Fossil Plant for NMNH
MCI6323 Mangrove peat and sediment cores from the Indian River Lagoon, Florida for NMNH
MCI6324 Biodeterioration of cultural heritage, microbes for MCI
MCI6325 Biodeterioration, natural history collections, and Mongolian cultural history and objects for MCI
MCI6327 Biological materials, proteomics, stable isotope analysis for MCI
MCI6352 Mangrove peat and sediment cores for NMNH
MCI6353.1 Entomology Department Storage Environment for NMNH
MCI6353.2 Entomology Department Storage Materials for NMNH
MCI6354 Mammal skulls for NMNH
MCI6357 Effects of nutrient enrichment and species diversity on ecological stoichiometry for SERC
MCI6358 Patterns if stable carbon isotope variation over the arrival period in a long-distance migratory bird for NZP
MCI6359 Carry-over effects of winter population limitation in the endangered Kirtland's Warbler (Dendroica kirlandii) for NZP
MCI6361 Preliminary project – analysis of plant and animal ecosystems in Alaska for SERC
MCI6366 Diets of Mesopelagic fish for NMNH
MCI6367 Using stable isotope signatures of monk seals to examine trophic structure of the Northwest Hawaiian Islands throughout the 20th century for NMNH
MCI6368 Using stable isotope signatures of sea otter vibrissae to look at temporal/spatial distribution for NMNH
MCI6369 Using stable isotope signatures of sea otter vibrissae to look at temporal/spatial distribution, Bering Sea and North Pacific for NMNH
MCI6370 Using stable isotope signatures to track turtles' ocean journey for NMNH
MCI6371 Using stable isotope signatures of seagrass to examine its contribution in diet and as habitat for NMNH
MCI6372 Thermoregulatory adaptations of Acrocanthosaurus atokensis - evidence from oxygen isotopes for MCI
MCI6373 Investigation of the migratory nature of Canadian geese causing the crash of US Airways Flight 1549 for NZP
MCI6374 Connectivity of migratory bird populations wintering in the Caribbean Basin for NZP
MCI6375 Stable isotopic characterization of a mammoth tusk from coastal Virginia and associated fauna on the east coast of North America for MCI
MCI6376 How riparian vegetation communities influence stream food web structure for SERC
MCI6377 Evaluating quality of winter feeding grounds for declining Rusty Blackbird for NZP
MCI6378 Patterns of Stable Carbon and Nitrogen Isotope variation across an urbanization gradient for NZP
MCI6379 Trophic structure of several fluvial ecosystems in the western United States for NZP
MCI6380 Effects of environmental change on the mycorrhizal relationships of the native orchids Goodyera pubescens and Tipularia discolor for SERC

MCI6381 Using stable isotopes to study patterns of long-distance dispersal in neotropical migratory birds for NZP
MCI6385 Incorporating stable isotopic data into the larger biostratigraphic record of the Miocene Siwalik sequence in Pakistan for NMNH
MCI6386 Using stable isotope signatures to examine adaptive radiation of the passerine bird genus Cinclodes for NMNH
MCI6387 Evolution of photosynthetic systems in Euphorbia (Euphorbiaceae) for NMNH
MCI6388 Nutrients dynamics during ecosystem development for STRI
MCI6390 Reconstructing food web dynamics in the understory of an eastern deciduous forest for NZP
MCI6391 Tracking the skylark throughout the annual cycle for NZP
MCI6392 Use of isotopic signatures to assess the importance of mangroves as feeding areas for mangrove fish communities in Florida and Belize for Smithsonian Marine Station at Fort Pierce
MCI6394 Stable Isotope Analysis of Faunal Remains from Liang Bua, Flores, Indonesia: Implications for the disappearance and possible extinction of Homo floresiensis and Stegodon florensis during the Late Pleistocene for NMNH
MCI6395 Environmental controls on diatom distribution in the Patuxent Estuary, past and present: implications for Holocene river discharge and sea-level change for SERC
MCI6397 The mycorrhizal status of Epifagus virginiana for SERC
MCI6398 A novel application of bio-geochemical fingerprinting to evaluate the nursery potential of Chesapeake Bay subestuaries to contribute to the blue crab spawning stock for SERC
MCI6399 Seagrass food web structure in the Banana River Lagoon for Smithsonian Marine Station at Fort Pierce
MCI6400 Heterotrophy and mineral nutrition of tropical hyperparasitic mistletoes for NMNH
MCI6401 Effect of simulated rainfall on plant productivity, insect abundance and the condition of migratory birds in lowland scrub forest of Jamaica for NZP
MCI6402 Penobscot River Mercury Study for SERC
MCI6403 Variation in hydrogen stable isotopes in feathers of two bird species along an elevational gradient for NZP
MCI6404 Evaluating the effects of anthropogenic nitrogen pollution in the invasion of a non-native genotype of the common reed, Phragmites australis for SERC
MCI6405 Seasonality of Early Holocene Archaeological Sites on the California Channel Islands for NMNH
MCI6406 Holocene Sea-Level Change in the Caribbean: Implications for Geophysical Modeling and Ocean-Climate Interactions for NMNH
MCI6407 Peat decomposition as exposed to elevated CO2 and N for SERC
MCI6408 Cypripedium fasciculatum fungal dependence for SERC
MCI6409 A novel application of bio-geochemical fingerprinting to evaluate the nursery potential of Chesapeake Bay subestuaries for blue crabs for SERC

Valuing World Cultures

MCI2018.2 Spiro's Craig Mound Black Mineral Lumps for NMNH
MCI4834 Plaster objects from 'Ain Ghazal for MCI
MCI5277.1 Gordion Textiles from Turkey for MCI
MCI5277.2 Textile fragments from Tumulus MM, Gordion, Turkey for MCI
MCI5277.3 Goethite coloration of textiles for MCI
MCI5500 Mudbrick Consolidation Methods and Materials for MCI
MCI5804 Possible codex from baking pot, Belize for MCI
MCI5927.2 Salish blanket fiber materials for MCI
MCI5959 Sulfur-Permeability in Organic Coating Materials for Silver for MCI
MCI5977 Flag for NMAfA
MCI5984.2 Linen Sculpture: The Principal Wife Goes On by Sheila Hicks for SAAM
MCI6005 Two Objects from Tomb 1 Burial in Mongolia for MCI
MCI6029 STRI Library for STRI
MCI6039.2 Mesoamerican Painted Organic Objects for MCI
MCI6052 Fabric for NMAH
MCI6068.1 Heavy Metal Pesticide Deterioration for MCI
MCI6082 Heinkel He 219 A German WWII Aircraft Wing for NASM
MCI6084.1 Deer Stones, Ushkiin Uver, Mongolia for NMNH
MCI6084.2 Deer Stone #15, Ushkiin Uver, Mongolia for NMNH
MCI6095 Chilkat Blanket and Related Textiles for NMNH
MCI6096 Fabric Samples for SITES
MCI6099 10,000 Springs Pavilion for MCI
MCI6100.1 Pre-Columbian Goldworking in Panama: Illuminating its history, preserving its heritage for MCI
MCI6100.2 Technology of Pre-Columbian Gold in Panama: A study of fabrication and compositional analysis for MCI
MCI6100.3 Pre-Columbian Gold Beads for NMAI
MCI6110.2 Mesoamerican Clays for NMNH
MCI6115 Alaska Projectile Points for MCI
MCI6125 Cabinet Felt for NASM
MCI6126.1 Colvis Obsidian Biface from Idaho for NMNH
MCI6126.2 Prehistoric Projectile Points for NMNH
MCI6126.3 Late Pleistocene stone tool for NMNH
MCI6126.4 Late Pleistocene biface from Ocean City, New Jersey for NMNH
MCI6134 Argon registration: Application and documentation for MCI
MCI6142 Detached ink silhouette fragments from William Bache silhouette portrait album for SIA
MCI6144 Fokker D-7 Aircraft Fabric for NASM
MCI6177 Minimally intrusive upholstery prototypes for US Senate
MCI6202 Non-Destructive and Minimally Invasive Analytical Approaches Applied to Modern and Contemporary Paintings Conservation for MCI
MCI6207 Cleaning of marble with ammonium citrate for MCI
MCI6211 Studying the effects of light on sensitive museum objects and materials and the application of research results in setting lighting levels in museums for MCI
MCI6224 Horse mask for NMAI

MCI 6225 Andean pottery for NMAI
MCI6226 Evaluation of the effects caused by the use of PVAC in lined modern posters for MCI
MCI6233 Isotope Ratio Mass Spectroscopy (IR-MS) Analysis of Natural and Synthetic Indigo for MCI
MCI6235 Mongolian Deer Stone Catalog Project for MCI
MCI6240 Imitation-metal paint study for MCI
MCI6243 Altarpiece triptych: Madonna and Child with the Crucifixion and the Annunciation, the Coronation of the Virgin and the Presentation in the Temple for Walters Art Gallery
MCI6244 Sourcing slate in the Far Northeast: An examination of prehistoric exchange systems in Newfoundland and Labrador for MCI
MCI6245 Development of SERS Active Vapor Sensors for Detection of Volatile Museum Contaminants for MCI
MCI6248 African Beaded Costume for NMAfA
MCI6253 Painting: Ocean Park #111 by Richard Diebenkorn for HMSG
MCI6256.2 El Cano Archaeological Project: 2010 Field Season for STRI
MCI6264 Painting: Janssen Shakespeare Portrait for Folger Shakespeare Library
MCI6273 Engraved shell ornaments for NMNH
MCI6283 Maya Ceramic Texture and Temper for NMNH
MCI6286 Mercuric sulfide samples for FSG
MCI6289 Paper molds of archaeological monuments for FSG
MCI6290 Terracotta medallions for SAAM
MCI6293 Chimú Gold Atlatl for NMAI
MCI6296 Letterpress Copying Books: A study of the Baird Collection for SIA
MCI6298 Book: The Principles and Practice of Modern Surgery (1860) by Robert Druitt for SIL
MCI6300 Plastic and Rubber Sculptures for HMSG
MCI6301 Inka and Colonial Wooden Qeros: White Pigments for NMAI
MCI6303 Silver Rattle for SAAM
MCI6305 Modern Mexican lacquer decorated gourd for NMAI
MCI6306 Cleaning synthetic polymers in modern and contemporary art for MCI
MCI 6307 Chilkat blankets for MCI
MCI6310 Exhibit: Contemporary Argentine Masterworks for SLC
MCI6312 Protocols for Vacuum Cleaning Textiles for MCI
MCI6319 Korean glass beads for FSG
MCI6321 Neanderthal bones for NMNH
MCI6322 Painting: The Ideal City by Fra Carnevale for Walters Art Gallery
MCI6328 Archaeological objects and materials for MCI
MCI6331 Hide bag for NMAI
MCI6332 Bronze patinas for MCI
MCI6333 Storage cabinets for NMNH
MCI6340 Two Yup'ik Dolls for NMNH
MCI6341 Two Zapatera Island (Nicaragua) Statues for NMNH
MCI6345 Saber-tooth cat bone with human modification for NMNH
MCI6347 Megafauna bone fragment with possible decoration for NMNH
MCI6348 Paper molds of Near Eastern inscriptions for FSG
MCI6349 Inca Pottery from NW Argentina for Metropolitan Museum of Art
MCI6355 Tuxtla Jade statuette for NMNH

MCI6356 White Cloud Pipe for NMNH
MCI6360 Use and selection of natural versus man-made mercury sulfide in china: development of a method for differentiation for FSG
MCI6382 Stable isotopic analysis of Bronze Age burial mounds (Khirigsuurs) in Mongolia for NMNH
MCI6393 Chinese Buddhist Sculptures in the Freer Gallery of Art for FSG

Understanding the American Experience
MCI4546 Zinc Statue of Columbia for ODC
MCI5957 Andrew Jackson on Horseback for NPG
MCI5964 Andrew Jackson on Horseback for SAAM
MCI5990 Wiley Post 1934 Pressurized Flight Suit for NASM
MCI6012 Confederate Balloon Fabric for NASM
MCI6036 Gunboat Philadelphia for NMAH
MCI6060 Acrylic Painting on Canvas for NASM
MCI6068.2 Heavy Metal Pesticide Identification for NMAI
MCI6070.2 Black Fashion Museum Collection – Phase II for NMAAHC
MCI6070.3 Black Fashion Museum McGee Collection for NMAAHC
MCI6073 WWII Balloon Basket for NASM
MCI6103 Southeastern North American archaeological copper artifacts for NMAI
MCI6113 Civil War Confederate Uniform for NMAH
MCI6118.2 Colonial American Skeletal Material for NMNH
MCI6118.4 Historic Human Bone for NMNH
MCI6128 South Mall Zone Smithsonian Buildings for OFEO
MCI6139 Civil Aeronautics Board Flag for NASM
MCI6171 Hiram Powers hand for SAAM
MCI6195 Moundville Bowl for NMAI
MCI6205 Arlington Cemetery's Memorial Amphitheater for MCI
MCI6209 Daniel Webster Desk for US Senate
MCI6215 Plastic artifacts in the Division of Medicine and Science for NMAH
MCI6217.3 Chief's Bag for NMAAHC
MCI6219 Gemini 8 Thruster resin for NASM
MCI6247 Painting: Behold Thy Son by David Driskell for NMAAHC
MCI6251 Aviator's Goggles, Scarf and Helmet for NASM
MCI6257 Yo-Yo Coverlet for NMAAHC
MCI6258 Sculpture: Group of Deer by Paul Manship for SAAM
MCI6262 Slave Clothing for NMAAHC
MCI6269 Human Skeletal Remains from the Richards Family Vault, Congressional Cemetery, Washington, DC for NMNH
MCI6272 Brian Jungen's mobile piece Crux for NMAI
MCI6278 Painting: Les Clochards by Lois Mailou Jones for SAAM
MCI6279.1 Oil painting on canvas for NMAAHC
MCI6279.2 Oil painting on canvas' frame for NMAAHC
MCI6280 Painting: Self Portrait by Lois Mailou Jones for SAAM
MCI6282 Painting: The Fledglings by Rudolph Dirks for NASM
MCI6284 Emmett Till Casket for NMAAHC

MCI6287 Painting: Samuel Blodget for NMAH
MCI6288 Jamestown slate writing tablet for Historic Jamestowne
MCI6291 James Brown costumes (3) for NMAAHC
MCI6292 1918 Goddard Warhead for NASM
MCI6294 Jones-Sims House (log cabin) for NMAAHC
MCI6295 Martha Washington chair cushion tops at Mount Vernon for Mount Vernon
MCI6297 Painting: Brooklyn by Mario Martinez for NMAI
MCI6299 Fireman's Painted Hat for NMAH
MCI6308 Textile Art: Leaf Lock by Diane Itter for SAAM
MCI6309 Textile Art: Lay inlet by Barbara Lee Smith for SAAM
MCI6311 Henry O. Tanner Painting Materials and Techniques for SAAM
MCI6313 Timmie Rogers' Tiple for NMAAHC
MCI6315 Temporary burial pit for NMNH
MCI6326 Structure and conservation of paintings, museum envelopes and storage conditions, mechanical properties for MCI
MCI6330 Detection of volatiles; detection of heavy metal residues; technology, characterization and degradation of natural and synthetic polymer composites; characterization of graphite
MCI6334 Slave Coverlet for NMAAHC
MCI6335 Paintings: Wonder by Sam Gilliam and Blue Jazz by Bill Dallas for NMAAHC
MCI6336 Painting: Muse I by Sam Gilliam for AM
MCI6337 Painting: Swedish Cottage and Shakespeare Garden by James Aiken for AM
MCI6338 Painting: 3PM in the Studio by Kenn Simpson for AM
MCI6339 Painting: Lake and Golf Course, Van Cortland Park, NYC by James Aiken for AM
MCI6342 Lowell H. Smith's Medal for NASM
MCI6343 Southern Ute Doll for NMAI
MCI6344 Sisters of the Mysterious Ten Pin for NMAAHC
MCI6346 Sculptured wool tapestry: Special Tigers for NZP
MCI6350 Rocket Pump for NASM
MCI6351 Thomas Jefferson's Bible for NMAH
MCI6383 Stable isotopic analysis of Civil War soldiers from an excavated cemetery in New Mexico for NMNH
MCI6389 Stable isotopic analyses of Eastern United States (Chesapeake area) historic human remains for NMNH