2012

REFLECTIONS ON CONSERVATION

Canadian Conservation Institute

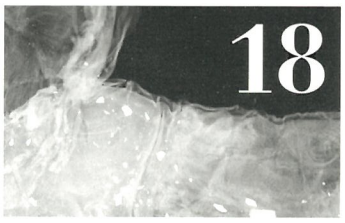
Institut canadien de conservation

Canada

REFLECTIONS on Conservation

In this issue

feature article



1972-2012

The Canadian Conservation Institute is proud to celebrate 40 years of serving clients and preserving Canada's history.

REFLECTIONS on Conservation

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ON THE COVER:

Yaxwiwe' or Peace Dance Headdress that recently underwent conservation treatment at CCI. The headdress has a remarkable history: initially surrendered under duress in 1922 to the Royal Canadian Mounted Police after a potlatch, it was later acquired by surrealist artist André Breton and taken to Paris, France. In 2002, the artist's daughter repatriated it to the U'mista Cultural Centre, Alert Bay, British Columbia, where it now resides. Reproduced with the permission of the U'mista Cultural Society, 2012.

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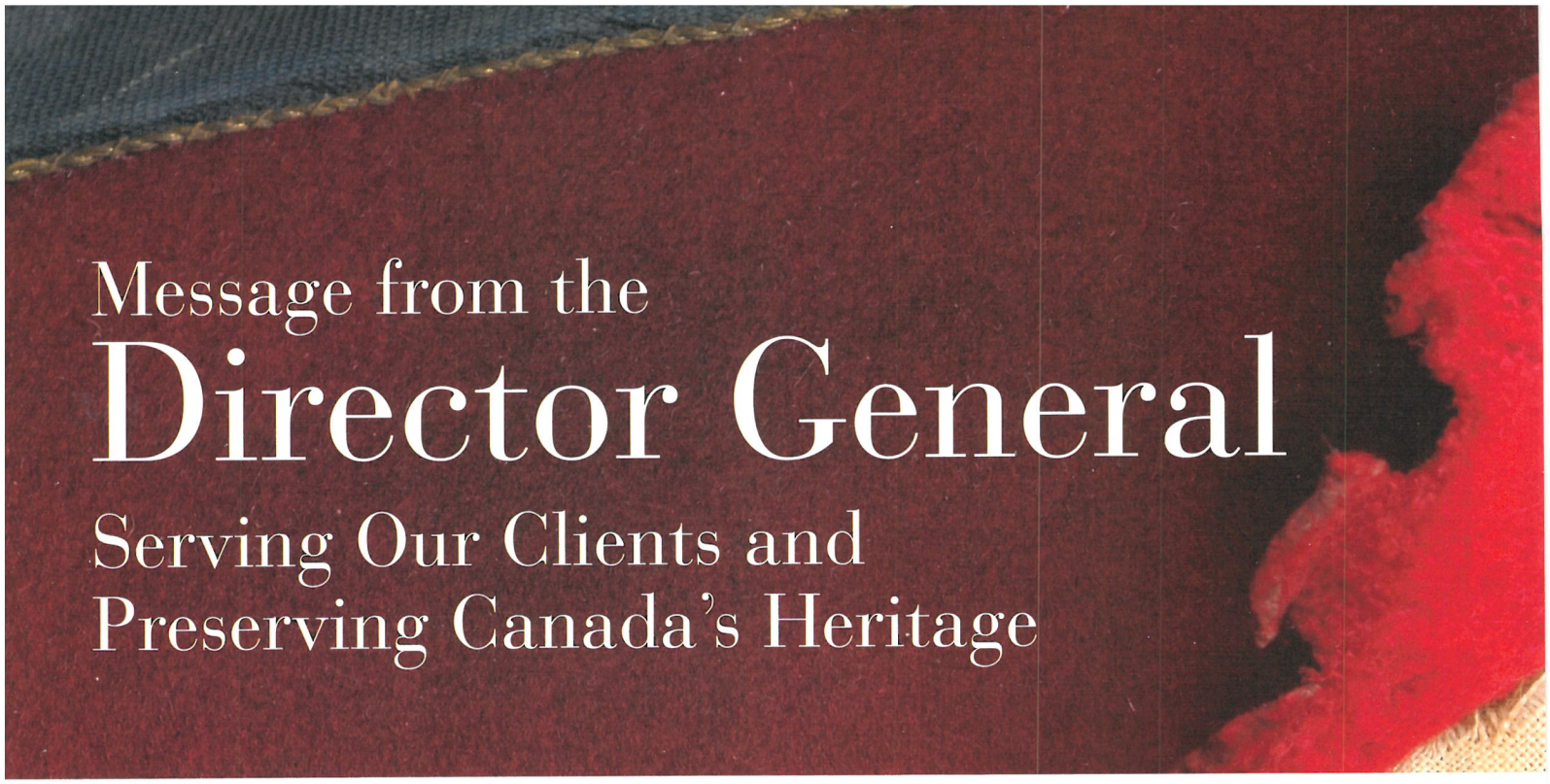


Message from the Director General

Serving Our Clients and Preserving Canada's Heritage

Jeanne Inch
Director General and Chief Operating Officer

An anniversary is a time to reflect — to look back on past experiences and to consider the challenges and opportunities of the future. As the Canadian Conservation Institute (CCI) celebrates its 40th anniversary, we are taking stock. We are examining the environment in which we find ourselves, and the global and national trends that are affecting the heritage institutions and professionals we are mandated to serve.

Global trends — economic uncertainty, rapid technological change, globalization, climate change — are affecting museums and other heritage institutions in Canada. Many are facing decreasing financial resources, increasing operating costs, and more competition. For many museums, collections are growing, infrastructure is aging, and storage is inadequate. Funds to develop staff professional competencies in collections care and conservation are often lacking, as is technical expertise to treat objects and works of art.

Museums and heritage institutions in Canada, as in many other countries, have also become increasingly conscious of the need to engage with their publics — to use their collections to connect with their communities and highlight relevant and current issues, whether these are local, national, or international. This role is especially important given societal changes: increasing diversity, aging populations, and the movement from rural to urban.

Robert Janes has summarized the challenges as follows:

> **… along with the willpower required to reduce consumption is the greater need to transform the museum's public service persona and culture/industry business agenda—defined by collections, ancillary education and entertainment—into one of a locally-embedded problem solver, in tune with the challenges and aspirations of communities.**[1]

To meet these needs, we at CCI are looking to better focus our activities to ensure we have the greatest impact on the preservation of significant heritage collections in Canada. In other words, to fulfil our mission:

Through conservation science, treatment, and preventive conservation, CCI supports heritage institutions and professionals in preserving Canada's heritage collections so they can be accessed by Canadians now and in the future.

Detail from an Egyptian Revival settee (from Fulford Place, a historic house museum in Brockville, Ontario), that was treated at CCI.

We have essentially two ways to accomplish this mission.

We provide expert services to heritage institutions that do not have the necessary conservation skills, knowledge, and equipment to conserve their artifacts and preserve their collections themselves. Through scientific analysis of materials and treatment of those artifacts, CCI can help to ensure that significant artifacts and collections in Canada are understood and preserved over the long term.

We also provide training, information, tools, and advice to heritage professionals so that they can make informed decisions about their collections for both preservation and access.

The foundation of all these activities is expertise and knowledge, which may be generated through our in-house research and development or acquired from other experts around the world.

CCI's role has evolved over the years and will continue to do so. When the Institute was created in 1972, the field of conservation was concerned primarily with the conservation of individual objects for the sake of restoring and stabilizing their physical state. Increasingly, however, we have recognized a responsibility to connect CCI's work to the meaning of significant heritage objects, works of art, and heritage interiors to Canadian history and identity. The objects we study and treat can be used by museums to tell stories that bring Canada's history and identity to life, and to address current issues facing their communities.

Conservation has also evolved since 1972. It now encompasses a much larger context that attempts to

▲ CCI Director General Jeanne Inch (right) listens as CCI conservator Sherry Guild explains the final steps of treatment of a hand-coloured aquatint from the Art Gallery of Nova Scotia. The aquatint depicts a War of 1812 battle between two ships — the HMS *Shannon* and the USS frigate *Chesapeake* — which took place on June 1, 1813 several miles off the shore of Boston. The *Chesapeake* was captured after 15 minutes of desperate fighting and towed to Halifax harbour. To satisfy public demand for mementos of the occasion, several aquatints were issued in the immediate aftermath of the battle. The one shown here is based on a painting by John Theophilus Lee; it was engraved by Joseph Jeakes and published by George Webster.

▲ In June 2010, CCI co-presented an advanced professional development workshop on the identification and care of plastics in museums with the Canadian Association for Conservation and the Canada Science and Technology Museum.

prevent damage to collections in the first place. Although the treatment of individual objects is still important, today there is an increased focus on efforts to develop approaches that consider the environment in which collections are stored, transported, and displayed. The financial restraints faced by heritage institutions have also created a need to preserve collections in a sustainable fashion. CCI has a responsibility to develop and share strategies to improve energy efficiency in climate control and lighting, and to use resources wisely through preventive conservation and risk reduction. We can help heritage institutions achieve cultural, economic, and environmental sustainability goals while preserving heritage collections over the long term.

At the same time we are working toward our own sustainability by demonstrating that we meet client expectations and achieve the results set out by the Department of Canadian Heritage, and by raising awareness among Canadians about our real contributions to the preservation of Canada's significant cultural heritage.

Our sustainability is also linked to valuing, supporting, and developing our greatest resource — our people. As a knowledge-based institution, our success is dependent on the experts we hire, develop, and retain. As CCI conservators and conservation scientists retire, it is critical that we renew and revitalize our expertise. We must also provide our people with access to the tools, scientific equipment, and laboratories essential to carry out the work.

Our vision is to be the leader in conservation for heritage institutions and professionals in Canada. Efforts to realize this vision rest on the following principles:

- to anticipate, understand, and respond to client needs, and identify emerging challenges so that we can make informed choices about future priorities
- to maximize our effectiveness through integrated ways of working such as strengthening links between research and services, and continuously applying new knowledge
- to ensure an environment of excellence
- to be fiscally prudent and environmentally conscious in all of our operations and decision-making

The next 40 years will undoubtedly bring new challenges to CCI and our clients. However, by focusing our conservation knowledge and expertise, we can ensure that CCI will achieve the greatest impact on the preservation of, and access to, significant objects and collections in Canada. We will continue to provide services for activities that heritage institutions and professionals cannot undertake themselves, and guidance for those that they can. Our services, professional development, and advice will continue to be based on the latest research and geared toward cost-effective strategies that are tailored to the specific needs of Canada's institutions.

Ultimately, we will strive to understand and conserve significant heritage objects, works of art, and interiors that contribute to the identity of Canadians, and to preserve heritage collections in Canada, while helping collecting institutions achieve their cultural, economic, and environmental sustainability goals.

Endnote

1. Robert R. Janes. "The Mindful Museum." *Curator: The Museum Journal* 53, 3 (July 2010), pp. 325–338.

About the Canadian Conservation Institute

The Canadian Conservation Institute (CCI) was created in 1972 as a consequence of Canada signing the UNESCO Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property (1970). To meet the obligations of this agreement, Canada set up a system to protect cultural property, and established structures to support the preservation of cultural property such as national inventories of protected property, a cultural property export control system, and CCI.

CCI's mandate was and continues to be to:

- promote the care and preservation of Canada's heritage collections
- advance the practice, science, and technology of conservation

Recognized and operating as a centre of expertise, the Institute became a Special Operating Agency of the Department of Canadian Heritage in 1992. As such it has the authority, responsibility, and flexibility to operate in a business-oriented manner in the delivery of expert services.

CCI's key clients are museums, galleries, archives, libraries, and historic sites across Canada whose primary role is to acquire, conserve, research, communicate, and exhibit (for purposes of study, education, and enjoyment) permanent heritage collections that are accessible to the Canadian public.

Today, CCI's strategic objectives are aligned with those of its home department, Canadian Heritage, and are to:

- improve the knowledge, skills, and professional practices of heritage institutions and workers to enable them to make informed decisions about the conservation and preservation of their collections
- support heritage institutions in preserving heritage collections so they can be accessed by current and future generations of Canadians

We have three interrelated and interdependent business lines: research and development, expert services, and professional development.

RESEARCH AND DEVELOPMENT

Research is the foundation of every activity that CCI undertakes. It is a vital part of fulfilling our responsibility to ensure that the services and the advice we provide to Canada's museums and heritage organizations are current and reliable. It is also essential to address the conservation challenges faced by Canadian heritage institutions. To that end, our conservation professionals participate in global networks of conservation science research, which ensures that the best knowledge and experience is brought to bear on Canadian heritage collections.

CCI's research activities are organized into categories related to their end point or target user. Although these activities exist on a continuum, with some research projects spanning more than one category, the research program is focused in three main areas:

Foundation research results in new knowledge or techniques that are required as building blocks for other types of research at CCI, but may not necessarily answer a direct conservation question. Work of this type is

▲ CCI conservator Helen McKay applies adhesive to consolidate the cracked edges of *Charlottetown Revisited* (oil on canvas by Jean Paul Lemieux, 1964; owned by the Confederation Centre Art Gallery, Charlottetown, Prince Edward Island).

Treatment of a four-volume set of John James Audubon's *Birds of America* was completed in 1996 for the Library of Parliament, Ottawa.

frequently triggered by questions raised by either applied research or collections preservation research. Foundation research is normally carried out in one of two areas:

- study of the chemical and physical properties of heritage materials
- development or refinement of scientific methods required for applied research

For instance, foundation research led to the development of a technique to measure the degree of polymerization of cellulose chains in paper. This work allowed CCI to create one of the most sensitive and reliable methods of measuring the deterioration of paper, and to play a leading role in projects such as the development of a Canadian permanent paper standard. Another example is the work done at CCI on the refinement of a shrinkage temperature technique using thermal analysis. This technique makes it possible to determine the condition of collagen using microscopic samples. It has been applied to objects such as the Royal Charter of the Hudson's Bay Company, which dates to 1670.

Applied scientific research addresses specific conservation challenges and results in new knowledge for treatments or for collections, based on the accumulation and interpretation of experimental data. The goal is to evaluate and optimize approaches and treatment techniques, and to enhance the understanding and protection of collections. For instance, CCI research on the materials and techniques of Canadian artists both informs decisions on effective and appropriate treatment of these works of art and answers questions of attribution, authenticity, and fraud. Artists studied in the project have included Jean Paul Riopelle, Norval Morrisseau, David Milne, and Tom Thomson. Another example is the applied research that led to the development of an ultrasonic mister that permits consolidation of powdery surfaces. The tool was designed and built by a conservation scientist, and the parameters for use were optimized by a conservator.

Collections preservation research includes risk assessment approaches to collections care as well as the development of frameworks, tools, and technical guidelines or standards. Frequently referred to as "preventive conservation," this research contributes to sustainability in museums by providing the means for improved decision-making and cost-effective management of heritage collections. Examples include CCI's work with the Pulp and Paper Research Institute of Canada to develop a Canadian standard for permanent paper (CAN/CGSB-9.70), and our contributions to the American Society of Heating, Refrigeration and Air Conditioning Engineers Inc. (ASHRAE) standard for museums, libraries, and archives, both of which draw on the results of applied research in a broader context. We also help to "translate" these standards for museum professionals, as evidenced by our online (www.cci-icc.gc.ca) *Environmental Guidelines for Museums — Temperature and Relative Humidity (RH)*, which is based on the ASHRAE guidelines. We have also conducted research on the preservation of the physical media holding digital assets, including their deterioration and longevity. Current research focuses on audio migration, the effect of jewel cases on CDs and DVDs, and the suitability of Flash Media and Blu-ray for long-term storage.

EXPERT SERVICES

Working with objects and collections is the core of CCI's activities. Our practical, hands-on activities identify questions and problems that are then resolved through research, with the resulting expertise being shared across the field.

CCI offers a wide range of expert heritage conservation services that focus on:

- historic and contemporary materials
- heritage objects, works of art, and heritage interiors
- collections and the facilities in which they are stored and displayed

As the only source of scientific services for conservation in Canada, CCI analyzes contemporary and historic materials so as to provide scientific data to clients who in turn use the results of these analyses to make informed decisions

◂ Artist Alex Colville discusses treatment of his iconic painting *Horse and Train* (owned by the Art Gallery of Hamilton) with CCI conservator Debra Daly Hartin.

about conservation treatments. Examples of materials we have analyzed include:

- the inks used on the the Proclamation of the Constitution Act, 1982
- the parchment of the Royal Charter of the Hudson's Bay Company of 1670
- totem poles from Ninstints off the coast of British Columbia (to determine the state of deterioration)
- paints in historic houses

With multiple conservation labs and conservators with a variety of specializations, CCI delivers treatment services for a broad assortment of heritage objects and artworks. Paintings that have been treated range from James Barry's *Death of General Wolfe* (at the1759 Battle of Quebec) to Alex Colville's *Horse and Train*. Objects treated include James Audubon's *Birds of America*; the medals of John McRae (a Canadian medical officer in World War I who wrote *In Flanders Fields*); the Chairs of the Justices of the Supreme Court; a small child's parka excavated in Nunavut that dates from between 1000 and 1400 AD; and regimental banners from the War of 1812. Heritage interiors offer a new focus for CCI — the characterization or identification of heritage elements in historical buildings, and the conservation of those elements, whether they are murals, decorative arts, or fixtures. Central to understanding CCI's role in treatment services is to realize that our treatments are the basis for new knowledge and expertise that can be shared with Canadian conservators and other heritage professionals through publications, online learning materials, advice, and professional development opportunities, including internships and workshops.

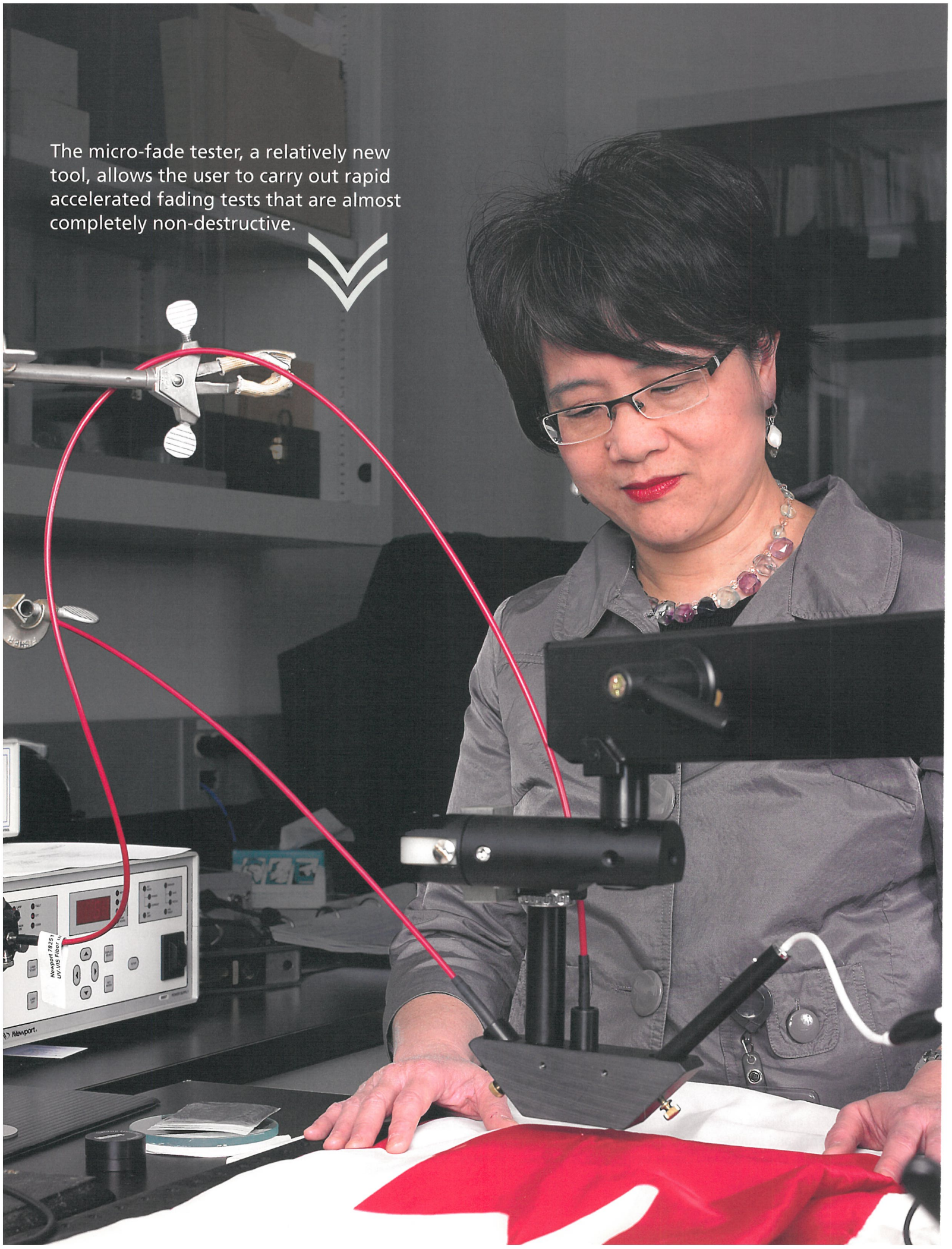
Finally, CCI evaluates collections, undertakes facility assessments, and provides advice on preventive conservation. One of our key clients in this area is the Department of Canadian Heritage, for which we provide assessments of the environment, fire suppression, and security systems for museums seeking funding and other support. We have also contributed to the development of heritage collections policies and guidelines for other federal government departments. Increasingly, we focus on aspects of sustainability: museum lighting and environmental guidelines to save energy costs, and a risk assessment approach that identifies and quantifies the risks that a collection or museum faces — which enables improved decision-making to help ensure that time, money, and energy are spent in the most effective manner. We are also adding a sustainability lens to the next edition of our *Framework for the Preservation of Heritage Collections Wall Chart*, the original version of which can be found on lab walls all over the world, in French, English, and Spanish.

Demand for CCI services generally exceeds our capacity to deliver them. For this reason, and to ensure that services are allocated in a manner that is consistent and transparent, we assess all requests against a set of criteria that include the significance of the object or collections, the broader benefits to the heritage community, and the equitable distribution of services across Canada.

PROFESSIONAL DEVELOPMENT

One of the most critical ways CCI serves the museum and heritage community in Canada — and internationally — is sharing the accumulation of research results, generated both in-house and by the wider scientific research community, and the experience gained from the hands-on treatment of objects and assessments of heritage collections and facilities. Our professional development program ranges from in-person training to online learning resources, and from internships for new conservators to professional development courses for conservators already working in the field.

The way that CCI delivers information has changed significantly over the years, gradually moving from print to Web-based dissemination for both technical and scientific information and learning materials. For example, CCI Notes (which began as a print publication in 1983) were released on our website in 2010. This approach not only enables our clients to access information and guidance easily, and at no cost, but also allows us to constantly update information so that it is current and based on the latest research.



The micro-fade tester, a relatively new tool, allows the user to carry out rapid accelerated fading tests that are almost completely non-destructive.

Conservation Science

Challenges and Opportunities

Marie-Claude Corbeil
Manager, Conservation Science
Research, Conservation and Scientific Services

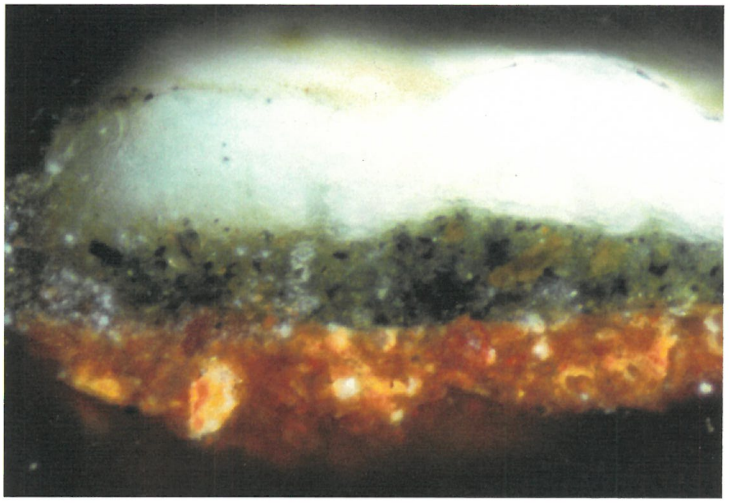
Science has been playing a key role in revealing fascinating aspects of the creation of artifacts and works of art ever since scientific laboratories were established in museums in the early 20th century, and institutes such as the Canadian Conservation Institute (CCI) were created. "Conservation science" (as this discipline is commonly referred to) has also been providing a strong foundation for the choice of materials and methods to conserve these objects for future generations. In fact, it has become an integral part of conservation. At CCI, we are particularly fortunate to work in an environment that integrates the efforts of conservators and scientists so that conservation is truly a shared responsibility.

Reflecting on what science has contributed to the understanding and conservation of the many materials that make up heritage objects, I am amazed at the formidable increase in knowledge in a relatively short period. At the same time, the reality is that the more we explore, the more there is to research.

While we have certainly gained a better understanding of traditional materials, we have not uncovered all of their secrets. Oil paint, for example, remains a highly complex system, the aging of which is governed by many parameters: the nature of the individual components (pigments, fillers, and media, as well as other additives) and their interactions when mixed; the nature of the substrate to which the paint is applied; the thickness of the paint layer and its location within the painting structure; and the environment to which the paint is exposed over the years. We still cannot predict how well oil paintings will survive the passing of time. And just when we think we know everything about crack propagation, cleavage, cupping, and other defects from which oil paintings suffer, another potential problem is added to the list! Take, for example, the formation of metal soaps[1] protrusions in paint films (Figure 1), which has been the focus of many studies in the past few years. Conservation scientists are just beginning to understand what triggers excessive soaps formation and why soaps sometimes aggregate and protrude through paint films. This should lead to preventive measures. In the meantime, we can only observe the impact on masterpieces in collections around the world.

Another traditional material that still requires research is paper, one of man's most ancient means of expression and communication. While traditional paper made from cotton or linen fibres is fairly stable, the wood pulp paper that was introduced in the 19th century is often acidic and therefore prone to degradation. In addition, some historic inks and colourants contain metal ions such as iron and copper.

FIGURE 1
▾ Photomicrograph of a cross-section showing lead soaps aggregate protruding through green paint in *L'Annonciation* by Jean-Baptiste Aide-Créquy, 1776 (parish of Notre-Dame de Bonsecours de l'Islet).



These present significant risk as they catalyze the oxidation of paper. Deteriorated papers are extremely fragile and pose challenges to archives in particular, due in large part to the size of their paper-based collections. Adding to the complexity of traditional materials is the fact that they are now being used in non-traditional ways, a practice that is often observed in contemporary art collections.

The advent of modern materials is posing new questions for scientists. Many new materials have appeared on the market since the 19th century, and creators have been eager to explore them. But the manufacturers of these materials were not necessarily concerned with the longevity of their products. While one would think these materials would hold little mystery (since their manufacturing processes were carefully documented through publications and patents), we are just starting to address their conservation needs as they enter museum collections. Science and technology museums encountered these materials early on, but polymers, modern alloys, and composite materials are now found in many types of collections and are posing new challenges. The complexity of museum collections is a threat in itself, as conservation professionals have to understand and find solutions for an ever-increasing number of materials and techniques.

Fortunately, we are now better equipped to research and investigate the composition, behaviour, degradation, and conservation of materials than we were 40 years ago. For example, today's research into original materials from museum objects benefits from instrumental methods that require smaller sample sizes or no sampling at all (Figures 2 and 3). Research into lightfastness no longer involves lengthy accelerated aging tests and the making of mock-ups; instead, the micro-fade tester allows us to obtain data in a few seconds and to perform tests directly on objects (Figure 4). Digital imaging has also opened a whole new world of possibilities.

CCI has contributed many scientific findings and innovative solutions over its 40 years of existence, but these were not achieved in isolation. Conservation is very much an international field. Because of the nature of collections, it is impossible to limit ourselves to issues that are strictly Canadian. While Canadian collections may comprise mostly objects made by Canadian creators, many objects of foreign origin are also part of our collective heritage. Even as we care for the works of the Group of Seven and Jean Paul Riopelle, we also care for the van Goghs and Rembrandts in Canadian collections. However, the conservation community is very generous and willing to share knowledge. Because we can count on our colleagues from other countries to disseminate knowledge gained on their creators, we can concentrate our research efforts on Canadian creators. By sharing the knowledge we gain with our international colleagues, we can assist in providing conservation solutions that contribute to the long-term preservation of objects of all origins.

FIGURE 3
▾ Non-destructive Raman spectrometer probe analysis of a terrestrial globe (see p. 31) to determine the composition of watercolours and extent of degradation.

The same applies to research. In the process of addressing the needs of the Canadian conservation community, CCI conservation scientists also contribute to advances in conservation at the international level. For example, research on the materials and techniques of Canadian artists led to the discovery of new data on pigments, such as cobalt violet and lead white. Research on Canadian amber led to the establishment of a new class of amber. And CCI's pioneering work on conservation of

FIGURE 2

▾ Non-destructive analysis of *Jar of Apricots* by Jean-Siméon Chardin, 1758 (Art Gallery of Ontario, accession number 61/36) with the Raman spectrometer probe to determine the composition of original paint and locate areas of overpaint.

FIGURE 4

▾ CCI conservation scientist Season Tse tests the lightfastness of dyes on a Canadian flag with the micro-fade tester.

waterlogged wood made an important contribution to international efforts in this area.

CCI also partners with foreign institutions to achieve more rapid progress and to be more efficient and cost effective. The number of these potential partners — institutions that devote their energy to the safeguarding of cultural heritage — has been growing over these past decades. They increasingly join forces to tackle one or several particular problems, a trend that should be encouraged to increase the chances for success. For example, the European Commission's Frameworks have provided funding and structure for conservation research that has resulted in remarkable advances. This model, although maybe not perfect, should be adopted more broadly if we want to ensure that increased resources for conservation research are not dispersed in too many directions and possibly diluted as a result.

One of the big challenges in conservation research (as with any research) is that it is not always a linear path; obstacles or unforeseen results can often lead to small detours or entirely new directions. We are very conscious of this challenge at CCI as our human and financial resources are limited and the topics deserving research are numerous. We work hard to find a balance between the legitimate desire to explore new paths that present themselves along the way and the need to deliver useful results to the Canadian conservation community in a timely manner.

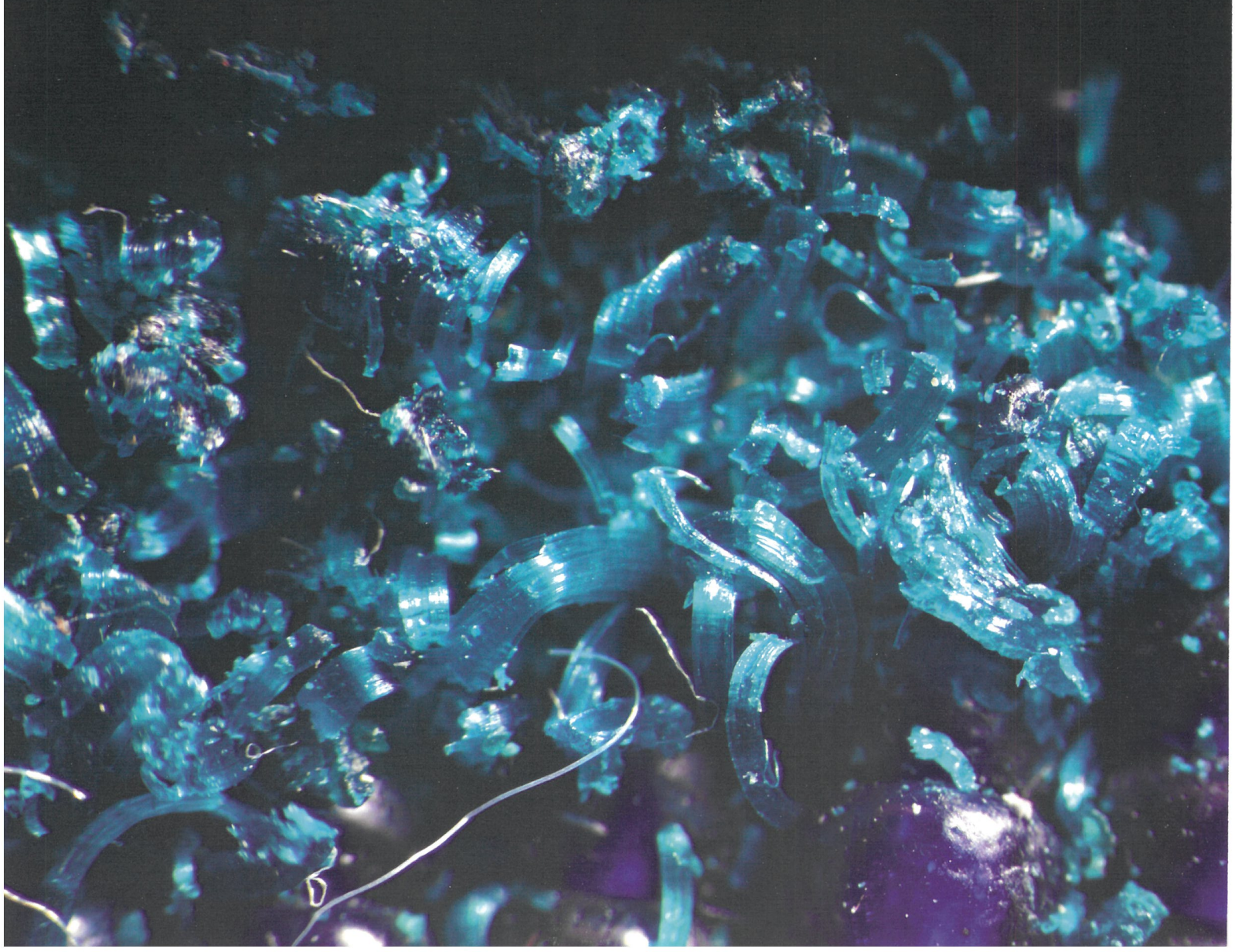
For any conservation research to fully reach its goals, the output (whether it is a new material, a new method, or a better understanding of materials and their behaviour) needs to be disseminated. We are not short of ways to distribute information and CCI is particularly active and diligent in that respect by publishing research results and conclusions in Technical Bulletins and other CCI publications, in external publications, and on its website, as well as by sharing information through professional development activities such as workshops and conferences. While it is critical that conservation scientists are aware of developments in the field of conservation science,[2] they also need to stay abreast of developments in mainstream science and related fields — since conservation can benefit from these advances. With ever-growing information scattered over a multitude of platforms, we need to find a way not only to find information when we need it, but also to be aware of new information as it appears.

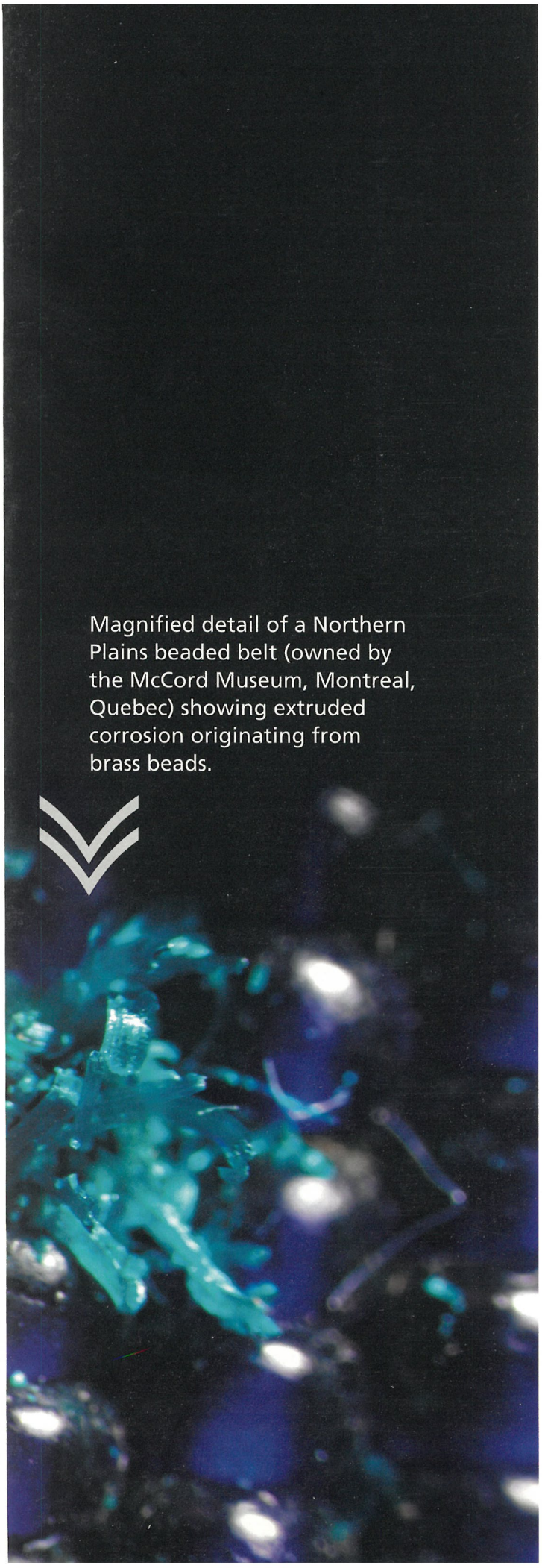
At 40 years of age, CCI has reached maturity and has accomplished a great deal in the area of conservation science and research. However, as "40 is the new 30," I can say with certainty that CCI has not lost its youthful enthusiasm, drive, and, even, a certain attraction to risk. There is still a lot to do and we are up to the challenge.

Endnotes

1. Metal soaps (metal carboxylates) often result from the reaction of pigment with drying oil.
2. The Art and Archaeology Technical Abstracts (AATA) Online (http://aata.getty.edu/nps) and the Bibliographic Conservation Information Network (BCIN) (http://www.bcin.ca) both specialize in conservation information. Statistics from AATA reveal the amount of iwnformation available: "AATA Online comprehensively reviews and abstracts 150 journals and conference proceedings as new issues appear that selectively represent the field's core literature; volunteer contributors abstract additional relevant publications, both from the field of conservation and from allied fields, on an irregular basis; over 1,000 new abstracts are added to the database each quarter." However, even with this level of effort, the volume of relevant material is so great that not all of it finds its way to AATA or to BCIN.

Metals Research
for the Conservation Community





Magnified detail of a Northern Plains beaded belt (owned by the McCord Museum, Montreal, Quebec) showing extruded corrosion originating from brass beads.

Lyndsie Selwyn
Senior Conservation Scientist
Conservation Science
Research, Conservation and Scientific Services

The Canadian Conservation Institute (CCI) has always placed a high strategic value on delivering services to the community, conducting research projects that respond to the needs of the community, and disseminating the knowledge CCI generates throughout Canada — and indeed internationally.

SERVING CLIENTS AND SHARING INFORMATION

As a Senior Conservation Scientist, my research focuses on the corrosion and conservation problems associated with metals — but what I love most is to teach other people how to address these problems.

When I started at CCI as a metals conservation scientist in 1987, I had no specific expertise in conservation. I had a PhD in physical chemistry from the University of California at San Diego in California (1985) and I had conducted post-doctoral research at the National Research Council in Ottawa, but I had to learn about metals, conservation, and the specific needs of conservators on the job.

Throughout my career, I have received questions from across Canada about metals in a wide range of environments (indoors, outdoors, burial) and about common metals and alloys in museums. For example, silver was — and still is — a popular topic. Frequently asked questions have focused on how to prevent tarnish when silver is in storage or on display (either in a display case or in an historic house), and how best to remove tarnish if it does occur. I have investigated these and many other questions, and tried to provide useful, practical answers oriented to the needs of clients.

The tarnish has been removed from the right side of these silver-plated spoons using silver dip containing thioruea and sulphuric acid (top spoon) and silver polish containing precipitated calcium carbonate (bottom spoon).

While it is important to conduct research to comprehend the science behind conservation treatments for metals, it is equally important to share the results of this research in a straightforward way so that people working in museums and heritage sites can apply them to the conservation of objects in their collections. Conservators (like most people) are not usually fond of chemistry, so I try to present information that is simple and clear, with understandable concepts. Over the past 20 years at CCI, I have shared my work through CCI Notes, articles on the CCI website, workshops, and even a book — *Metals and Corrosion: A Handbook for the Conservation Professional*. Through it all, the critical questions have remained the same: who are our clients and what is the best way to reach them?

JOURNALS AND OTHER PUBLICATIONS

Peer-reviewed journals and conference proceedings (which are also often peer-reviewed) are the traditional approach for sharing information in scientific disciplines. I have contributed to several conservation-related conference proceedings including the triennial conference of the International Council for Museums – Committee for Conservation (ICOM-CC) Metals Working Group in 1995 and 2004 and the Conservation of Archaeological Materials conference in 2005 (published in 2010). These papers, along with a series of others published in *Studies in Conservation*, all dealt with various aspects of treating salt-contaminated archaeological iron, a complicated conservation problem.

External publications other than peer-reviewed journals offer another effective way to promote conservation science to a broader audience. I have contributed to *Gilded Metals: History, Technology and Conservation* (Archetype Publications, 2000) as well as scientific publications by the National Association of Corrosion Engineers, the ASM (American Society for Metals) Handbook, and the Handbook of Archaeological Sciences.

Regardless of the publication, I always try to write about conservation science research in a way that is understandable for conservators who are treating objects. Scientific literature can often be intimidating to anyone outside the scientific community, but careful presentation can effectively transfer knowledge from scientists to conservation professionals.

FROM CCI NOTES TO THE WEB

Writing in a straightforward way with minimum jargon is especially important for CCI publications, which serve a broad range of audiences — collections managers, students, conservators, directors, site managers, and volunteers. In fact, CCI Notes were initially developed specifically for museum volunteers.

As CCI moves toward publishing more content on the Web, new possibilities are available for the use of images and even video. *Recognizing Metals and their Corrosion Products* is a prime example of a Web document with many images intended to help people recognize different common metals and their corrosion products. It was a collaborative effort involving conservators from CCI and Parks Canada, as well as experts in Austria and the Netherlands. Parks Canada has turned the information into a booklet — *Rust Never Sleeps* — which can be given to site staff as an educational tool. And CCI will eventually be adding demonstration videos and a "before and after" photo gallery to these Web pages.

CCI WORKSHOPS

Workshops are an ideal way for CCI to share information on a wide range of conservation-related topics. However, while preparing and presenting workshops on metals conservation, I was struck by the difficulty of finding easy-to-use reference material to recommend to workshop participants. So, over time, I compiled a set of notes for

metals workshops (particularly *What's New in Old Metals*) that summarized key information on common metals and alloys in museums.

When delivering a workshop on metals conservation, I almost always team up with a conservator. This provides a wider range of experience to participants, and allows us to answer most questions from the perspectives of both conservation and conservation science. Workshops also include a hands-on component, though this aspect has evolved over the years. Initially, it involved simply passing around samples of metals, alloys, and corrosion, but there had to be a better way to engage participants in the lab.

The opportunity to develop a new approach came in 2007, when the Heritage Conservation Centre in Singapore approached CCI to develop a 5-day workshop. Former CCI conservator Robert Barclay and I divided each day into an equal mix of lectures and lab exercises. Then, in addition to preparing lectures on different metals, we prepared lab exercises to reinforce the lectures. This allowed participants to "learn by doing" in the lab. We also developed 14 sets of written instructions for the lab work, both as a memory aid and as reference materials for participants to use when they went home. Since then, more sets of instructions for workshop lab exercises have been developed for use in two 4-day workshops given at the Campbell Center in the United States and in CCI workshops.

A COMPREHENSIVE HANDBOOK

Developing the workshops and related support material eventually led to a book — *Metals and Corrosion: A Handbook for the Conservation Professional* — published in 2004. This book concentrates on the chemical and physical characteristics of metals and their corrosion products. It is aimed at heritage professionals who survey, care for, and treat metals, or who come across metals during the course of their work, and assumes that the reader has a general comprehension of chemistry at the first-year-university level.

The book is used as a textbook or reference material for metals courses in numerous conservation programs. In Canada, this includes conservation programs at Queen's University in Kingston and Fleming College in Peterborough. Informally, I have been told it is being used in Denmark, Greece, and the United States. In fact, in 2010, a German professor told me his students (whose first language is not English) often quote from *Metals and Corrosion* rather than from a German reference, and I often receive requests from students around the world asking if I have more information about something that they read in the book. Given the positive feedback, the goal of writing a simple, clear, and understandable reference book was clearly achieved.

▲ CCI archaeology and objects intern Ute Werner measures the concentration of chloride ions.

▲ Magnified detail of a Northern Plains beaded belt (owned by the McCord Museum, Montreal, Quebec) showing damage on the surface of a few brass beads.

INTERNS AT CCI

In addition to delivering workshops and writing for students, I also enjoy working with interns from Canada and abroad, for example Ute Werner from Germany and Charlène Pelé from France. The recent creation of a dedicated metals research lab at CCI has allowed me to work with many more students. It is wonderful to have a lab in which I can demonstrate and teach techniques and procedures that conservators might use when they are treating artifacts containing metals.

When teaching conservation science to interns, I always try to include a knowledge dissemination component in the projects. This may take the form of posters for conferences or the CCI lab walls, written procedures for new lab exercises, or papers for publication. I have always believed that a project isn't complete until the results have been shared — and I work hard to pass this belief on to CCI interns.

Implications of Digitization on Library and Archive Materials

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For reasons of preservation and accessibility, traditional library and archives materials (textural records, photos, and analog audio and video recordings) are being digitized at increasing rates. This digitization and the collection of original digital information have introduced a whole new set of information carriers that present new preservation issues. There are three key issues to consider:

- the long-term stability of the information carriers themselves (e.g. CDs, DVDs, and data tapes)
- the "playback" problem, i.e. the long-term stability and availability of the devices (and the necessary software utilities) used to read these information carriers
- the preservation of the information stored on the carrier

This third issue involves a host of other complex issues such as the authenticity of the information, the integrity of the information over time, and the adoption of proper preservation strategies to address the previously mentioned factors.

Digitization also presents the related problem of what to do with the original source material. Some institutions, especially the larger ones, are making efforts to preserve the original materials (textural records, photos, and analog audio and video recordings) after they have been digitized. This may be due to the policy of the institution, the value of the originals as artifacts, and/or the hope that better methods of digitization can be performed in the future if and when more resources become available.

CCI's work on optical discs, magnetic tapes, and magnetic disks began in earnest in 1996, when the Canadian Council of Archives asked us to initiate research on the stability of these materials. This research is necessarily an area of constant change as new technologies introduce new materials that must be evaluated (such as Blu-ray discs). The introduction of new materials for the storage of digital information leaves us with pressing questions for the present and the future. How long will these materials last? What are the consequences of a disaster? Can the data be restored? What about the machines and software necessary to access the data in its various formats? Steps have to be taken to ensure that the critical and authentic information can be accessed even as technology changes.

In 2003, CCI hosted an international symposium[1] on the preservation of electronic records to explore the critical decisions required to preserve these types of records. Participants gained information on the appraisal and authenticity of electronic records as well as the strategies that should be considered for preservation of the information.

The preservation of digital information is now an important part of the preservation strategies for all libraries and archives, and is being addressed on several

◂ The layers of this CD-R have delaminated following exposure to elevated temperature and relative humidity conditions.

fronts by many large organizations worldwide. CCI's research has focused on the stability and longevity of these new information carriers, as well as how they deteriorate due to natural causes or disaster, and how damaged or deteriorated media can be made readable.

THE HERITAGE COMMUNITY IN CANADA

While it would be easy to expand this research in many interesting directions, answering the questions presented by modern information carriers must be done in light of the needs of Canada's libraries, archives, and heritage community. Thus, when CCI is deciding which information carriers to assess for longevity and stability, our decision-making process is informed by a number of interrelated concerns.

Of first importance is the rate of adoption. Are people using a particular technology? Is the format widely accepted and readily available in the marketplace? For example, HD-DVD was a competitor with Blu-ray. However, use of HD dropped off and, in fact, its manufacturers have dropped the technology. Therefore, it is important to focus research on Blu-ray rather than HD.

It can also be as simple as looking at what is happening in the marketplace. How quickly are options changing? How many manufacturers are producing a given technology? What are the consumer price points? This last point reflects the accessibility of the technology, which is crucially important to CCI's target client group of small to mid-size institutions.

The large institutions tend to have the necessary resources — both human and financial — to address all aspects of digitization. However, the smaller institutions are much more dependant on low-cost solutions. Thus CCI targets research at this latter client group, balancing marketplace availability against current client information requests. The most common questions we receive are about migrating analog audio and video to a digital format, and choosing CDs or DVDs (composition and/or brand) to obtain the best longevity.

THE FUTURE OF DIGITIZATION AND THE CANADIAN HERITAGE COMMUNITY

Research into digitization and its related issues will necessarily expand in the future. Canadian institutions are still in the relatively early stages of digitizing their collections. To move these projects forward, particularly for small to mid-size institutions, more collaboration (i.e. sharing equipment and expertise) will be important.

As digital research moves forward, CCI will be focusing on two key issues:

- finding inexpensive solutions for migrating analog audio and video, particularly for small to mid-size museums and heritage institutions
- expanding research on new media

For instance, Blu-ray offers much higher capacity than CDs or DVDs, making it an attractive storage solution. However, we need to know more about its relative stability and longevity before we can recommend it. CCI is also getting more questions on flash media and whether it can be used for long-term storage. As this format increases in capacity, becomes more popular, decreases in price, and slowly replaces computer hard drives, we will need to know more about it.

While CCI must address these new challenges, questions still remain regarding traditional information carriers such as books and paper. Therefore, we are continuing research in the areas of deacidification, accelerated aging, and storage environments. This includes improving accelerated aging methods to better predict the long-term stability of materials, and developing more accurate models to predict the effect of storage conditions (temperature and relative humidity) on various materials.

Endnote

1. CCI organizes symposia on topics of interest to the conservation and preservation community on a regular basis. Other topics that have been presented include research and applications of adhesives and consolidants (2011), preserving Aboriginal heritage (2007), the conservation of heritage interiors (2000), textile conservation (1997), the authenticity and permanence of varnishes (1994), and the conservation of 20th-century materials (1991).

The binder/magnetic oxide layer is flaking off the plastic base of this 10-year-old VHS videotape.

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Influences Shaping the Direction of Conservation Treatments

X-ray detail of a Thule child's parka (dating from 1000 to 1400 AD) from Sannirajaq, Nunavut.

Conservation treatment and development work carried out by the Canadian Conservation Institute (CCI) conservators has been at the core of the Institute's activities since its inception in 1972. This work influences and supports conservation science research projects, provides the means to test the viability of the research results, and instigates scientific analysis of materials. It is also vital for training young professionals and generates knowledge that is shared through workshops and publications.

Conservation treatment has its roots in the traditional activity of restoration, and the debate regarding the nature and extent of treatments has existed for centuries. In 1930, the International Museum Office of the League of Nations organized the first international conference on the quality and ethics of treatments and the training of practitioners. The art of preserving objects had become a science — with the evolution of approaches, materials, and ethics.

The field of conservation continues to evolve. A few of the factors influencing this evolution over the last 40 years at CCI include:

- research into materials and conservation treatments, and the subsequent advances and developments in science and technology
- shrinking resources and the resultant need to be strategic in accepting objects for treatment (without compromising ethics)
- demographic changes affecting conservation and curatorial professions
- workplace health and safety issues and their impact on the greening of conservation work

▲ CCI conservator Sherry Guild prepares the Salzinnes Antiphonal (a 16th-century illuminated liturgical manuscript from the Rare Book Collection of the Patrick Power Library at Saint Mary's University, Halifax, Nova Scotia) for hyperspectral imaging.

ADVANCES AND DEVELOPMENTS IN SCIENCE AND TECHNOLOGY

Scientific research has played a major role in shaping the field of conservation, and continues to do so. CCI's integration of scientific research and conservation treatment services is at the heart of what has made our services so unique and useful for our clients. New techniques and tools are constantly changing the way conservators work and approach the artifacts they treat. Take, for example, hyperspectral imaging. Current research into the possible applications of this imaging and image analysis technique is exploring its use for revealing original images of daguerreotype photographs hidden under tarnished surfaces.

All treatments carried out at CCI benefit from this interdisciplinary approach. Newly hired conservators at CCI, as well as interns, are mentored to embrace this team approach as they carry out treatments or research projects in collaboration with research scientists and colleagues from other conservation specialties.

Our treatment research and development is linked to real issues identified by the conservation community, and the results are shared with them through publications, workshops, conference presentations, etc. Based on expressed interest from Canadian conservators, we are presently exploring the viability of CO_2 blasting for use in conservation by testing the method on various materials.

STRATEGIC CHOICE OF CONSERVATION TREATMENTS AND ALLOCATION OF RESOURCES

CCI receives treatment requests from Canadian heritage and cultural institutions across the country, but we do not have the resources to accept all of them. Given this reality, we must carefully select the work we undertake, and the decision to accept or reject a request is never taken lightly.

All the treatment requests are assessed on the basis of the information that clients provide. To better support clients in accessing our services, we have been improving the application process for object treatment and are developing tools to assist clients in preparing their treatment requests.

We use very specific criteria to guide our decisions:

- **Significance:** One of the primary criteria for evaluating a treatment request is the significance of the object within the client's collection and/or to the collective understanding and appreciation of Canadian history. For example, the colours of the Third Regiment of York Militia (see p. 26) are nationally significant objects that are undergoing treatment at CCI.
- **Intended use following treatment:** Will the object be part of an exhibition or permanent display, or a critical part of a research or educational program?
- **Potential to develop new treatment protocols:** Can the object be used to develop new treatment protocols that can be shared with other conservation professionals through CCI publications and training programs?
- **Training potential:** Is the object appropriate for training conservators? Given CCI's role in developing expertise in young conservators, objects may be accepted to match interns' skill levels and interests, giving them a grounded and realistic training experience.
- **Available resources:** Do we have the expertise, equipment, and budget to undertake the treatment? If we do not have the in-house knowledge, we can look to models of sharing information or acquiring resources from other organizations. This approach was used to treat a pair of early-19th-century globes (see p. 30). If the equipment and funds to cover the costs related to treatment are not available, it may be possible to develop procedures or standards to protect objects and/or sites until treatment can be carried out. For example, reburial is a growing trend in archaeology when treatment costs are prohibitive; this preserves finds for future examinations, conservation, and use. There are several studies underway to test land and underwater reburial of archaeological finds. These have the potential to lead to the development of protocols, standards, and legislation for monitoring and managing archaeological sites.

From an ethical point of view, CCI will not accept an object if the necessary expertise is not available, if we do not have the resources to treat it, or if the owner is not able to preserve it after treatment. We also refer our clients to the private sector whenever possible, recognizing that private-sector conservators are valuable partners.

DEMOGRAPHIC CHANGES AFFECTING CONSERVATION AND CURATORIAL PROFESSIONS

The retirement of the first generation of CCI conservators is having an impact on our conservation treatment activities. It is not always possible to replace these specialists. In some cases, the knowledge they have acquired through years of practice is unique and simply unavailable elsewhere. In other cases, limited budgets mean that resources must be directed to a different conservation specialty to meet emerging issues and client needs.

Demographic changes within the curatorial profession in our clients' institutions are also affecting conservators at CCI. Curators play an important role in the conservation decision-making process, contributing valuable information on the history, original state, and purpose of an object. Conservators use this information when determining how treatment choices will affect an object's integrity. Working together, curators and conservators share the responsibility to choose the course of action that will best meet the goal of the treatment (object conservation), the proposed use of the object (client need), and the environment in which it will be stored or exposed (client resources). As specialist curators retire, their knowledge of the collections they have cared for may leave with them, including information on what is significant. This loss of knowledge obliges CCI conservators to devote more time to curatorial-type research and take more responsibility for treatment choices.

As resources shrink in heritage institutions, conservators (and other professionals) are often called upon to broaden their skills, knowledge, and the scope of their work. Conservators may be required to devote more time to preventive conservation and related collections management activities, leaving less time to carry out conservation treatments. With fewer conservation treatments, the chances for emerging and mid-career conservators to advance their skills through practice and mentorship by senior conservators are reduced. CCI's learning programs, including the Visiting Professionals program, can help to rectify this situation by providing an opportunity for conservators to maintain, share, and enhance their treatment skills.

HEALTH AND SAFETY FOR CONSERVATION PROFESSIONALS, PART OF A GREENER APPROACH

Hazard risk prevention has a new ally — concern for the environment — which has led to the development of treatment approaches that are less toxic and often less expensive. We are more aware of the long-term health risks associated with certain treatments today than we were in the past, and we are more cautious when developing new treatment techniques. Ensuring that safety protocols are in place to protect CCI staff from potential risks is a priority. In an effort to make our workplace greener and safer, we continue to test and improve local extraction devices for toxic chemicals in our labs and to look for the least toxic alternative when developing treatment protocols.

▲ Interns and emerging conservators were part of the team testing the performance of a micro-blasting CO_2 (dry ice) machine.

LOOKING TO THE FUTURE

Conservation treatments contribute to the preservation of Canadian heritage and benefit communities across the country now and in the future. Stephen Weil, in discussing the value of museums, identified a number of direct outcomes that relate to conservation treatment: transmit traditions and traditional knowledge from one generation to another, trigger memories, kindle imagination, illustrate historical sequences, and provide aesthetic pleasure and stimulation.[1]

As CCI moves forward, conservation treatment approaches will continue to be assessed, researched, adjusted, and rethought. Our conservators do not work in isolation; they will continue to thrive on the collaboration and exchange of knowledge with colleagues — conservators, conservation scientists, curators, archivists, and other professionals in heritage institutions. We will always be learning as we work on the amazing and unique objects that tell the stories of Canada and Canadians… which is why conservation is such an amazing profession!

Endnote

1. Stephen Weil. *Making Museums Matter*. Cultural Resource Management Program, University of Victoria, British Columbia, 2004.

The Conservation of Heritage Interiors

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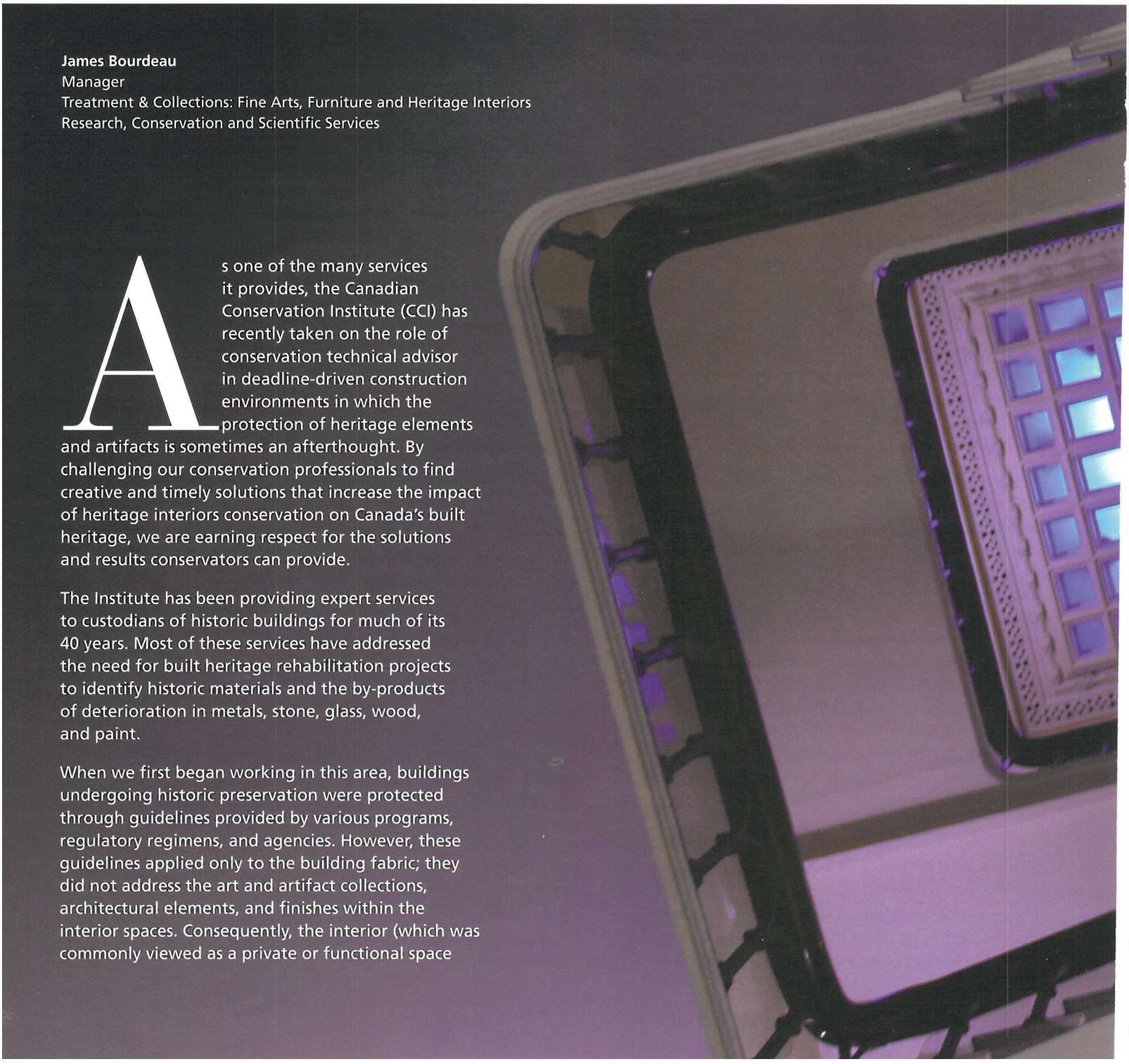
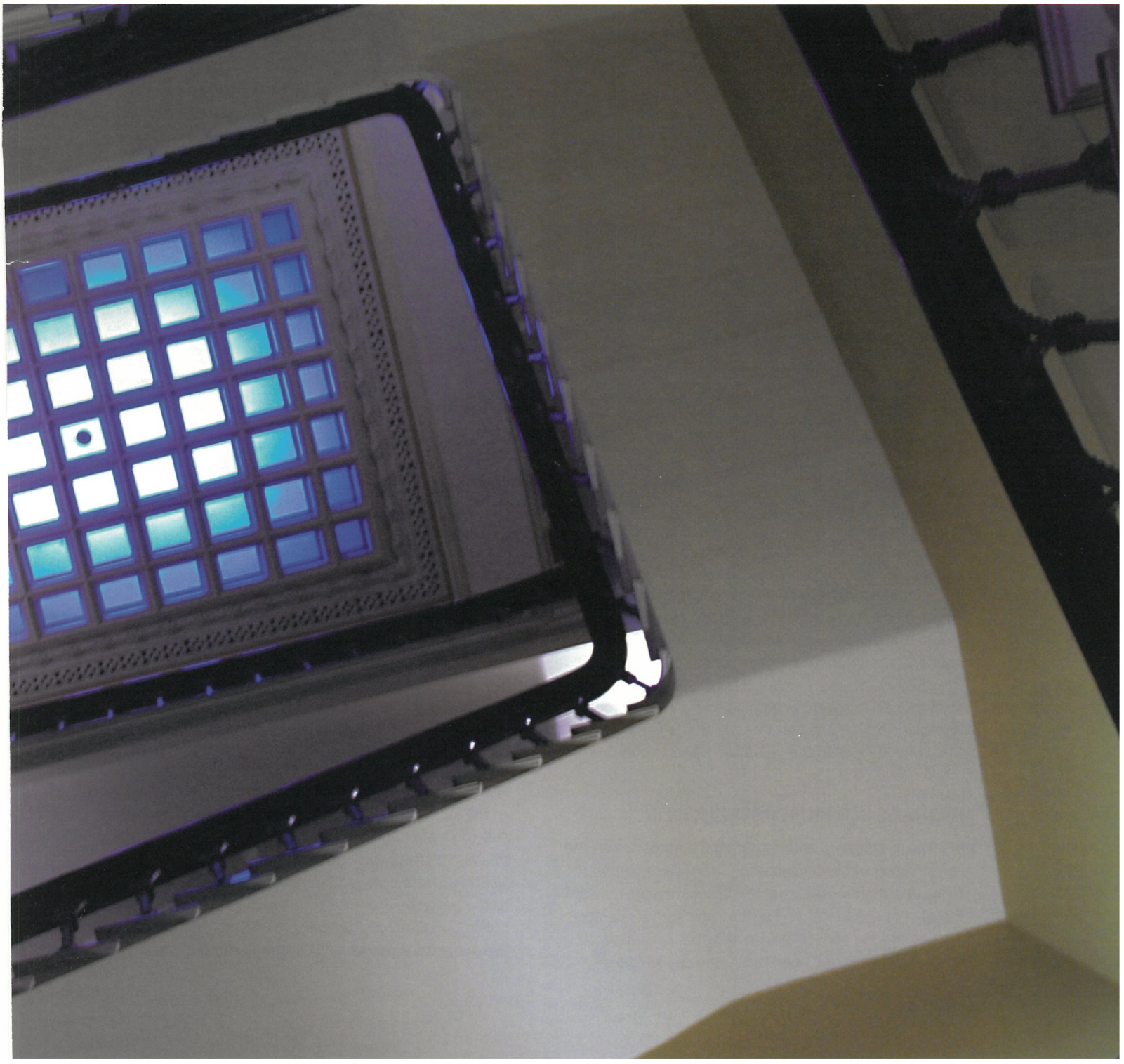


As one of the many services it provides, the Canadian Conservation Institute (CCI) has recently taken on the role of conservation technical advisor in deadline-driven construction environments in which the protection of heritage elements and artifacts is sometimes an afterthought. By challenging our conservation professionals to find creative and timely solutions that increase the impact of heritage interiors conservation on Canada's built heritage, we are earning respect for the solutions and results conservators can provide.

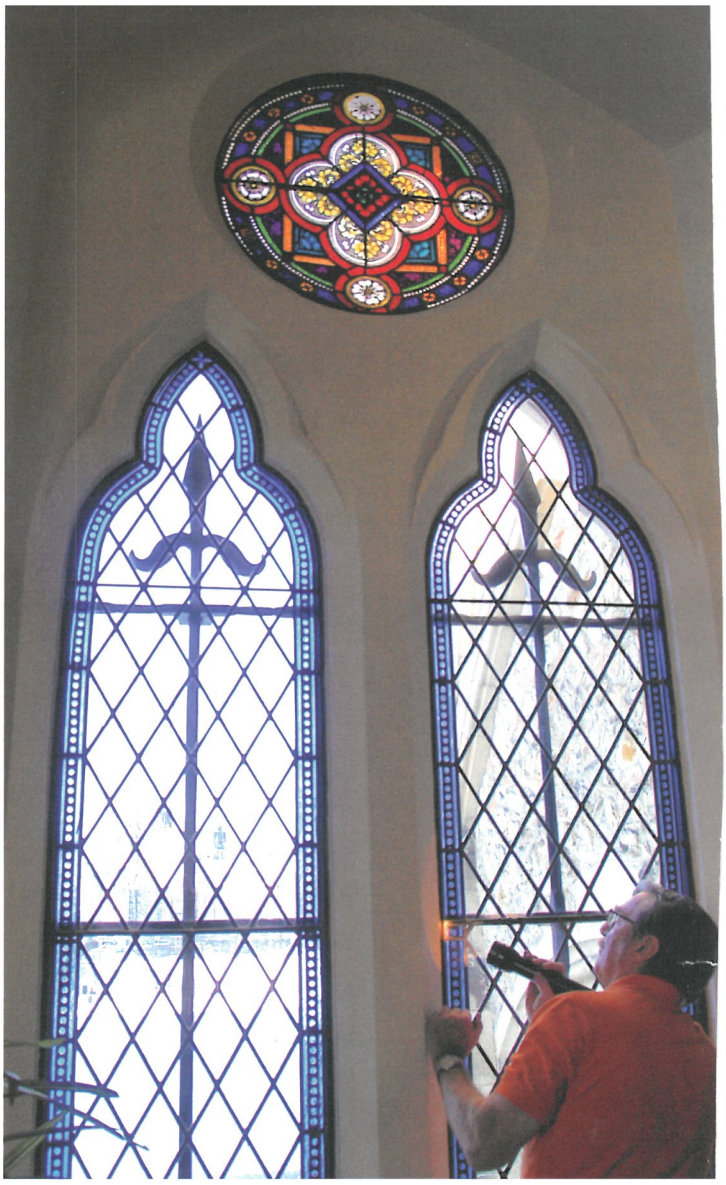
The Institute has been providing expert services to custodians of historic buildings for much of its 40 years. Most of these services have addressed the need for built heritage rehabilitation projects to identify historic materials and the by-products of deterioration in metals, stone, glass, wood, and paint.

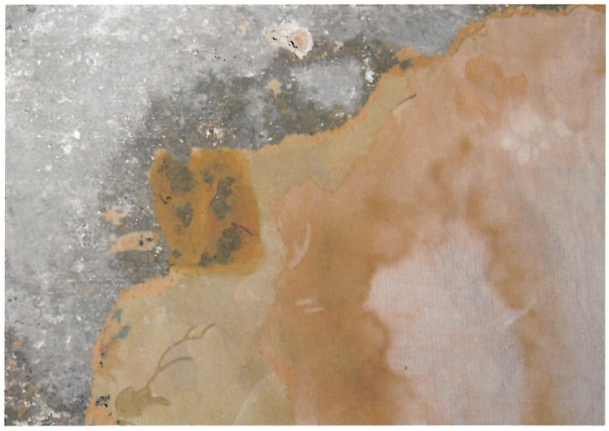
When we first began working in this area, buildings undergoing historic preservation were protected through guidelines provided by various programs, regulatory regimens, and agencies. However, these guidelines applied only to the building fabric; they did not address the art and artifact collections, architectural elements, and finishes within the interior spaces. Consequently, the interior (which was commonly viewed as a private or functional space

View from below of the Agricultural Entrance stairs of the East Block 1867 Wing of Canada's Parliament Buildings, Ottawa.



CCI examined these stained glass windows in a Senate office in the East Block 1867 Wing of Canada's Parliament Buildings, Ottawa.





Wallpaper removal tests were conducted on the south wall of the Painted Room at Sinclair Inn Museum, Annapolis Royal, Nova Scotia.

and exempt from protection) was often sacrificed. But this has been changing. During the 1980s and 1990s, heritage designations began to include some elements of building interiors, although not without considerable legal debate (Lloyd 2008). By the 1990s, custodians of designated historic buildings were beginning to ask CCI for more systematic advice and assistance with the fixed collections that were integral to the buildings' historic interior spaces.

HERITAGE INTERIORS AS A DISCIPLINE

In 2000, CCI hosted an international symposium on the conservation of heritage interiors. This event helped to focus attention on the issue as a distinct discipline within the field of conservation. The idea gained considerable traction among conservation colleagues in Canada and abroad who had been facing the challenges of investigating and conserving complex interior spaces within active building rehabilitation projects. Since that time, numerous professional subgroups have been created to exchange experience and knowledge. As a relatively new area of practice, professional benchmarks and training programs are slowly being created. For young people entering conservation, it is an area of growth.

Over the years, CCI conservators and scientists have worked on diverse projects ranging from the rehabilitation of the interior of the debating chamber of the Legislative Assembly of Ontario in Toronto to the recent assessment of a late-18th-century painted room in the Sinclair Inn National Historic Site at Annapolis Royal in Nova Scotia to the protection of a vast mosaic vault in the Wellington Building in Ottawa. The strength of these services lies with the materials expertise of CCI staff in the preservation of

fine and decorative art, wood, metals, leather, organic and inorganic materials, and historic decorative paint.

Since 2008, when the Treasury Board of Canada Secretariat (TBS) named CCI as a Centre of Expertise[1] (CoE) for the conservation of heritage collections, we have experienced a significant increase in demand for conservation advice and assistance pertaining to the conservation management of heritage collections in federal government departments. To address the growth in this demand, CCI created a section that focuses on collections integral to historic interiors within the Fine Arts, Furniture and Heritage Interiors division.

Aside from our efforts to characterize and conserve heritage interiors, our focus for the foreseeable future will be on heritage asset collections (both movable and fixed) and how they are put at risk by construction.

ADVICE AND EXPERTISE

CCI's role as a CoE is to provide expert advice to federal departments, identifying heritage assets within building management projects so that appropriate care for these assets is written into contracts. In these cases, the conservation work is typically carried out by the private sector. However, we may offer quality assurance or oversee the project, providing federal partners the benefit of expertise derived from hands-on experience.

One of the major projects we have undertaken is a partnership with Public Works and Government Services Canada in the Parliamentary Precinct, which includes work on three Major Crown Projects — the West Block, the East Block, and the former Bank of Montreal Building.[2] More information on this project is available in Bourdeau and Ward (2011).

Another example is a project we carried out with Agriculture and Agri-Foods Canada (AAFC). AAFC was headquartered in the Sir John Carling Building, designed by Hart Massey, located in the Central Experimental Farm in Ottawa. This building contained a monumental mural — *The Seasons* by Canadian artist Takao Tanabe — which had been commissioned for the building in 1966–1967 (making it an important centennial year commission). When the 50-year-old building was slated for demolition, AAFC contacted CCI for advice on how to safely remove the mural as per the TBS policy requirements. We provided guidelines on care, handling, removal, risk mitigation, and storage. Because the artist is still alive, we encouraged AAFC staff to contact him directly. Although now in his mid-eighties, Tanabe came to Ottawa to supervise the removal, and developed a plan with the custodians to repurpose sections of the mural as a new work that will be installed in the new AAFC headquarters, currently under construction. Everyone at AAFC was creative and accommodating, and the end result is a superb example of how a preservation goal can be met via a non-traditional solution. A little bit of creative collaboration eliminated the risk that the mural would be completely lost in the building demolition. The salvaged mural was put on exhibition by the Ottawa Art Gallery in the autumn of 2011 (Sinclair 2011).

▲ CCI conducted an architectural paint study and cleaning tests on the vault of the former Bank of Montreal Building, Ottawa.[2]

LOOKING FORWARD

CCI is making a long-term commitment to continue our work in the Parliamentary Precinct for at least the next 5–15 years. This is our laboratory for change in this special discipline. The professional expertise, research, and new techniques that conservators develop from this work will strengthen the next generation of conservation professionals, who will undoubtedly be here to unveil these landmarks at the centre of Canadian democracy when the work is completed.

Endnotes

1. TBS renewed their heritage asset management policy in 2006, at which time they identified federal heritage collections as special assets requiring special conservation and care. Two years later, they named CCI as a CoE for the conservation of heritage collections. The CoE is a concept that TBS uses to direct managers in departments to a knowledgeable source of information with quasi authority to assess the quality of plans and projects in departments that don't have the required knowledge or skills.
2. On January 12, 2012, the Government of Canada announced that it has renamed this building in honour of Sir John A. Macdonald, Canada's first Prime Minister.

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Conserving Canadian Identity

The Colours of the Third Regiment of York Militia

Detail of the crown of England embroidered near the centre of the regimental colour of the Third Regiment of York Militia.

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The Canadian Conservation Institute (CCI) has often played a role in preserving artifacts significant to the history of Canada, so it was no surprise that the coming bicentennial of the War of 1812–1815 presented another opportunity. This time it was the City of Toronto, which manages Fort York, that applied to CCI to treat two flags referred to as the colours of the Third Regiment of York Militia.

According to Dr. Carl Benn of Ryerson University in Toronto (Benn 2007), these colours are significant for several reasons. Canadian militia colours of this early period are very rare, and those that survive from the War of 1812 tend to postdate the conflict by a year or two. However, the colours of the Third Regiment of York Militia were actually produced during the conflict, and were most likely carried in battle at York in April 1813. Further, they were sewn by an identifiable group of women, led by a Miss Mary Warren Baldwin who created the design. This provides a point of entry for exploring the larger roles of women in the War of 1812, and colonial society in general. Finally, the design of the regimental colour does not conform to British and Canadian norms, but rather follows American practice. This suggests that the women who made them were not familiar with military protocol but had probably seen a number of captured American regimental colours.

◂ Detail of the regimental colour of the Third Regiment of York Militia.

The ladies presented these colours to the militia in gratitude for the "efficiency of their protection" and General Isaac Brock is known to have complimented them on their handiwork before the colours were finished. The colours were not captured when Fort York fell to the Americans in April 1813, but were spirited away and buried in a garden, apparently wrapped in canvas to protect them. By 1901, they hung in the Cathedral Church of St. James in Toronto.

ABOUT FORT YORK AND THE WAR OF 1812

The settlement of modern Toronto began in 1793 when Lieutenant Governor John Graves Simcoe built a garrison on the present site of Fort York. Fearful of war with the United States, Simcoe planned to establish a naval base at Toronto in order to control Lake Ontario. Simcoe also moved the capital to Toronto from the exposed border town of Niagara. Civilian settlement followed and a community named York began to grow 2 kilometres east of the fort (York was renamed Toronto in 1834).

In 1812, the United States declared war on Britain and invaded Canada. On April 27, 1813, the American Army and Navy attacked York with 2700 men on 14 ships and schooners. The defenders put up a strong fight but fell back to Fort York in the face of overwhelming odds, eventually abandoning the fort and town to the enemy. In autumn of that year, the British returned to Toronto and built the fortification that stands today.

Fort York's cannon and earthworks became obsolete in the 1880s, although the army continued to use the fort for training, barracks, offices, and storage until the 1930s. Fort York opened as an historic site museum in 1934. Today, it is home to Canada's largest collection of original War of 1812 buildings. The Fort is open year round and offers a number of services, including tours, exhibits, period room settings, and seasonal demonstrations.

During the summer months, the site comes alive with the colour and the pageantry of the Fort York Guard.

The War of 1812 may have been a comparatively small conflict, but it is fundamental to Canadian history. It answered the question as to whether Canada would survive or be absorbed into the United States. In 2012, Fort York plans to mark the bicentennial with a number of celebrations, and the original colours of the Third Regiment are to be featured in the new visitor centre, which is currently under development.

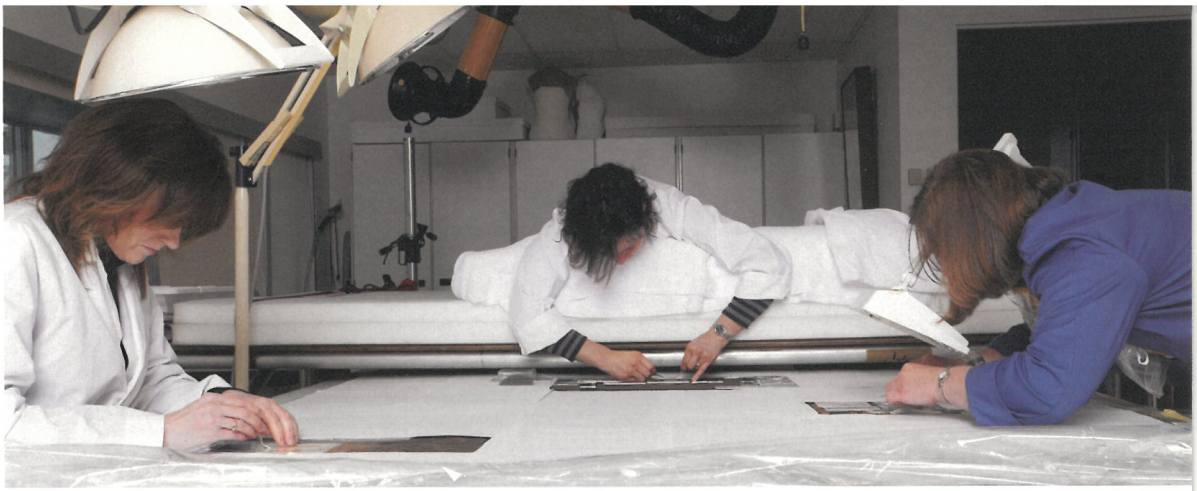
ABOUT THE COLOURS

A stand of colours is made up of a regimental colour and a sovereign's colour — the sovereign in this case being King George III. Both flags of the colours of the Third Regiment of York Militia are made of silk and are in incredibly fragile condition.

The silk ground fabric of the regimental colour is embroidered with silk thread. The design features the crown royal of England at the centre, flanked by the letters G and R (*Georgius Rex*, Latin for "King George"). Below the crown is a branch of leaves, likely laurel, followed by the lettering "3rd REG^{MT} York Militia" and then a ribbon-like scroll with the motto "deeds speak." The Arms of Upper Canada are depicted in the top left corner, and the white rose of York in the top right. The silk embroideries are all faded to various shades of gold and the ground fabric now appears khaki green. It is impossible to say precisely what its original colour may have been, but dye analysis conducted by CCI conservation scientist Jennifer Poulin found indigo carmine (a blue dye) and brazilwood (a red dye) in the ground fabric as well as lac (another red dye) in the embroidered crown and fringe. This suggests that the flag was a bluish red with a brighter red crown embroidered in the centre.

The king's colour is in somewhat better condition because it was made of slightly heavier fabrics; however, it is

The king's colour of the Third Regiment of York Militia is essentially a Union Jack, but it does not fit the standard pattern and lacks the usual royal cipher in the centre. Although it appears to be small, the existing portion, which is shown, measures 1.75 m (69 in.) by 2 m (79 in.). When the missing fly end is reproduced, the flag will extend to approximately 2.35 m (92–93 in.).



Conservators work from a bridge and leaning support to remove previous restoration fabric from the regimental colour of the Third Regiment of York Militia, which measures 1.7 m (66.75 in.) by 2.75 m (108.5 in.).

missing 35–40 cm (14–16 in.) at the fly end. The king's colour is essentially a Union Jack, but this one does not fit the standard pattern and lacks the usual royal cipher in the centre.

Military colours that have been superseded with new ones or those from disbanded units were often laid up in churches. In 1901, these colours were moved to the Cathedral Church of St. James in Toronto, where they were displayed in various locations. In 2009, ownership was transferred to the City of Toronto. The flags have undergone more than one campaign to preserve them. In 1927, the colours were sent to England where the ladies of the Royal School of Needlework (RSN) stitched them between two layers of coarse cotton net. Evidence of other stitch lines indicates that both colours were stitched to a support fabric even before 1927. Sometime during the 1970s the netted colours were sandwiched between foam core and Plexiglas with the addition of double-sided tape along their top edge.

CCI TREATMENT PROJECT

When the flags arrived at CCI, it was not clear whether it would even be possible to treat them, as they were seriously degraded and their mounts made it impossible to assess their true condition.

The first step was to conduct a risk analysis to determine whether treatment should be pursued. CCI conservation scientist Gregory Young conducted an image analysis, and through a digital image reconstruction of the flags, he was able to remove the layers of restoration fabrics from the flags to show the client how much original material actually remained. These images greatly facilitated discussions of treatment options. Following this, both parties agreed to proceed with the treatment.

The fragility and large size of the flags has presented serious treatment challenges. Even the simple requirements of daily handling are difficult — the team of conservators must move very carefully and consider every motion. Reaching the middle of the flags is also physically challenging, requiring the team to use a bridge that spans over the flags.

The team began by removing the old restoration fabrics from 1927 and earlier. The coarse cotton net applied at the RSN, now weak and degraded, is being replaced by a much finer nylon net dyed to match the colour of the flags today.

Once sandwiched between the two layers of net, each flag will be placed on a rigid aluminum honeycomb panel covered with layers of padding and cotton fabric, with colour-matched fabric beneath missing portions. Then the flags will be glazed using anti-static, anti-glare, ultraviolet-filtering acrylic. This method, known as "pressure mounting," is a relatively standard option for stabilizing textiles for display. However, not much is known about using this method for such heavily fragmented and large flags, so CCI will conduct considerable testing. In essence, this treatment (netting and pressure mounting) is the same as that carried out in the past. It is worth noting that these two actions saved the flags — had they not been done, the flags would certainly not have survived.

WORKING TOWARDS 2012

At each step in the treatment, CCI is evaluating the condition of the flags and making recommendations to the client about how to move forward.

The team anticipates that the research involved will generate at least two or three papers for various journals. The treatments have also provided learning experiences for conservation interns Gretchen Guidess (United States), Clare Lewarne (Canada), Kathleen Lawrie (Canada), and Asefeh Kenari (Canada).

Thanks to the CCI team (which included conservators, conservation scientists, and the building services crew) working collaboratively to provide advice, analyses, and physical support, the colours of the Third Regiment of York Militia will again be accessible for all Canadians to appreciate at Fort York in time for the bicentennial of the war that shaped Canada.

Reference

Benn, C. "The York Militia Colours." *The Fife and Drum* 11, 2 (July 2007), pp. 5–6.

The northern hemisphere of the terrestrial globe before treatment, showing the discoloured varnish, extensive cracking, and a large loss that had been filled with plaster.

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▸ The terrestrial globe following varnish removal.

A Team Approach to Treating a Pair of Early-19th-century Globes

The treatment of a pair of 53 cm (21 in.) floor globes — one terrestrial and one celestial — has become an intensive hands-on collaboration that is remarkable in the size of the team involved, the variety of expertise required, and the participation of external partners. When treatment is completed and the globes are on display, viewers will be able to see the details of the world as it was known in 1835 on the terrestrial globe, and to appreciate the delicate drawings of constellations on the celestial globe.

ABOUT THE GLOBES

The globes were made in 1835 by John and William Cary, brothers who manufactured globes in London (United Kingdom) during the late 1700s and early 1800s. They were purchased by the Séminaire de Saint-Hyacinthe (Québec, Canada) in 1837, and have been in their possession ever since.

To create the globes, papier mâché was applied to a spherical mould. The papier mâché sphere was removed from the mould, a wooden central support was tacked in place at the north and south poles, and the hemispheres were rejoined at the equator. Once assembled, the spheres were covered in plaster to create a perfect sphere of the correct diameter. Thirty-six half-split gores made of high-quality paper were adhered to the plaster.

On the terrestrial globe, the gores were printed with an engraved map of the world as it was known at the time, as well as the tracks and discoveries of Captains Cook and Vancouver, and M. De Laperouse. Watercolour was then used to highlight bodies of water and land masses. The celestial globe was printed with stars, nebulae, and depictions of the constellations, which were then painted in watercolour with figures of constellations.

The globes were subsequently varnished and mounted in wooden stands that featured a horizon circle (circular bands of printed paper adhered to wood that encircled the globe when mounted), a circular, engraved brass meridian ring (which held the globe at the poles and allowed it to spin within the stand), and an hour circle (small, thin metal circles divided into 24 segments and engraved with the hours of the day and night, located at each pole to allow the calculation of the time difference between various locations on the globe).

Over time, the thick varnish layer on both globes darkened, rendering them almost impossible to read. The terrestrial globe was also significantly damaged and, due to previous repairs to cracks and losses of both plaster and paper, it could not be turned. Some varnish had been removed.

▾ Four conservators work together to remove varnish and old adhesive from the terrestrial globe.

The Cary terrestrial globe before treatment. The globe is suspended within a brass meridian ring and encircled by a wooden horizon ring/circle. Two legs are replacements.

ABOUT THE TREATMENT

When the Bibliothèque du Séminaire de Saint-Hyacinthe approached CCI to treat the globes in 2009, we decided that it was important to get some expert advice on the most appropriate treatment protocol. Consequently, we consulted globe specialist Sylvia Sumira, an independent conservator based in London (United Kingdom), who visited CCI for 3 days in early February 2011 to consult on the project. However, prior to her visit, we got off to a serious start by removing the considerable layers of varnish and adhesive from the terrestrial globe. This required extensive hours, with as many as four conservators working on the globe at the same time.

"When you got up, someone would take your seat – it was a real team effort!"
-Sherry Guild

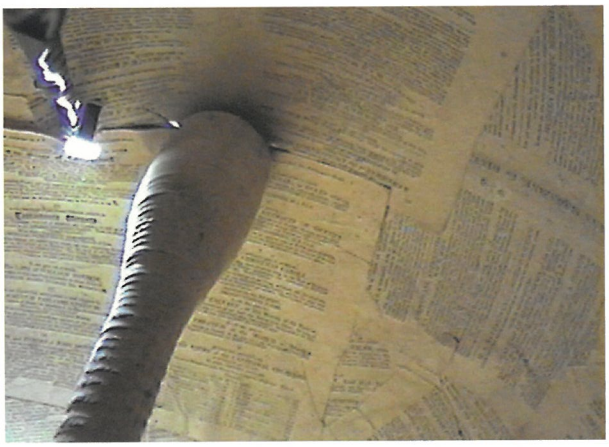
Because the required work demanded so many hands, we requested help from Library and Archives Canada (LAC). LAC conservator Doris St-Jacques subsequently assisted with the varnish removal and also participated in the 3-day consultation with Sumira, allowing both CCI and LAC to benefit from her expertise. In the end, it required about 450 hours of hands-on team effort to remove all the varnish and adhesive. In addition to the authors and Doris St-Jacques, the team included CCI conservators Carole Dignard and Wendy Baker, as well as Emily Leonoff, a recent graduate of Queen's University (Kingston, Ontario, Canada), who worked on the project for several weeks.

RESEARCH AND ANALYSIS: PART OF THE TREATMENT

As part of the treatment, old repairs were removed. Among these was an old plaster repair near the top of the terrestrial globe. Removing this repair allowed the team to create a small window in the exposed papier mâché. In turn, this allowed CCI scientific documentation technologist Carl Bigras to insert a small video camera into the interior to confirm the stability of the central support. The camera also revealed that the inner layer of the sphere was made of magazine pages dated prior to the globe's construction. Bigras also took radiographs of the terrestrial globe, and extensive documentary photography of both globes, before treatment began.

To better determine treatment options, CCI conservation scientists Kate Helwig and Jennifer Poulin analyzed the varnish (identifying it as colophony), the plaster components and adhesives used to repair the terrestrial globe, as well as the paint from the horizon circle. Helwig and Poulin conducted Fourier transform infrared spectroscopy (FTIR), polarized light microscopy (PLM), scanning electron microscopy/energy dispersive spectrometry (SEM/EDS), and gas chromatography-mass spectrometry (GC-MS) analyses.

▲ Dental carvers were used to crush and remove the brittle colophony varnish.



▲ A small video camera and a light source (upper left) captured the interior layers of pages taken from a period magazine.

Sumira pointed out that the colour of the landmass perimeters on the terrestrial globe was unusual — the perimeters on Cary globes were typically bright green, but on this one they were brown with a hint of olive green in some places. CCI conservation scientists Kenza Kahrim (post-doctoral fellow) and Marie-Claude Corbeil (Manager of Conservation Science) investigated this anomaly using Raman spectroscopy and X-ray fluorescence spectrometry (XRF). Raman spectroscopy identified the pigments indigo, Prussian blue, chrome yellow, and emerald green in selected brownish green areas on the globe. Elemental analysis by XRF identified large amounts of copper in areas of olive green adjacent to land and on the brown areas within the land mass. The XRF results indicate the presence of a copper-containing pigment in these areas but not emerald green as no arsenic was detected.

Conservators from CCI's Paper Lab have been working on the paper gores that cover both globes, as some of them were stained. CCI conservation intern Joanna McMann has been using Gellan gum to reduce the stains on the terrestrial globe. Gellan gum (a high-molecular-weight rigid polysaccharide gum) is a flexible and easily manipulated gel medium, and is a relatively new material in paper conservation.

"It was great that Doris joined us from LAC. I've learned a lot on this project — particularly about paper. The sharing of information is just amazing."
-Janet Mason

Extensive work was also required on the wooden stands, the metal meridians, and the hour circles. Two interns in CCI's Furniture and Decorative Arts Lab — Rémi Catillon (from France) and Meri Karinen (from Finland) — repaired the horizon circle, straightening imperfectly aligned breaks.

CCI conservation scientist Eric Hagan assisted with the removal of a stubbornly attached hour ring on the celestial globe, and will investigate milling a brass component to stabilize the terrestrial globe in its meridian ring. The CCI Objects Lab will treat the plasterwork and metal components. The terrestrial globe's missing hour rings may be replicated in paper using digital images of the dials from the celestial globe.

Once repairs are complete, the globes will be revarnished. However, before that work is undertaken, CCI will research the various options to determine which varnish treatment offers the best solution for both look and stability over the long term.

A REAL TEAM EFFORT

As is evidenced by the number of names throughout this article, this project involved a large team and a diverse range of expertise and experience. Sharing information across disciplines was a highlight for everyone involved in the work. The teamwork was very intense, especially during the period of varnish removal, but always enjoyable.

"Everyone in the Institute was interested, and people kept coming by to see how it was going."
-Sherry Guild

Once the work is complete, the globes will be returned to the Bibliothèque du Séminaire de Saint-Hyacinthe for exhibition.

Prayer book that belongs to the Miawpukek First Nation in Newfoundland and Labrador. CCI had the privilege of treating this extremely rare book that contains Roman Catholic hymns, prayers, and other religious texts in a hieroglyphic script that is unique to the Mi'kmaq tradition.

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The Evolution of Preventive Conservation

INTRODUCTION

As long as people have been collecting precious objects, they have taken steps to protect them from the obvious threats of being crushed, stolen, burned, soiled, faded, deformed, flooded, or eaten by pests. However, by the middle of the 20th century, the museum community began to search for a better understanding of all the risks to their collections. Among these risks, conservation science has focused particularly on pollutants, light and ultraviolet radiation, and humidity. These risks, which are often subtle yet continuous, were categorized under the title "the museum environment."

MUSEUM ENVIRONMENT

CCI created an Environment and Deterioration Research division in the 1970s to study the museum environment and the various elements related to environmental deterioration. However, these elements were frequently investigated as isolated components.

The first major source of information on environmental standards for museums was Garry Thomson's *The Museum Environment*. Released in 1978, the book pulled together much of the conservation science that had been done up to that time. Drawing on the best practices of the day, Thomson identified three main elements to be controlled: light, humidity, and air pollution. By providing a simple set of guidelines, he made the research done to date more accessible to museum workers.

PREVENTIVE CONSERVATION

By the 1980s, the guidelines that Thomson and others had developed were quite well entrenched within museums and heritage organizations. Conservation research continued to progress, and the term "preventive conservation" emerged — effectively expanding Thomson's approach. Preventive conservation encompassed a broad range of activities related to collections care, from handling procedures and housekeeping to all the elements of the museum environment. This approach raised awareness of the range of threats to collections, and led to the development of publications and training to address these threats.

CCI's *Framework for the Preservation of Heritage Collections* (released in 1994) was an important step in preventive conservation as it offered the first holistic approach. It identified (and presented at one glance) nine agents of deterioration: physical forces, fire, thieves or vandals, water, contaminants (pollution), radiation (light), incorrect temperature, incorrect relative humidity, and pests. A tenth agent — dissociation — was added later by Rob Waller of the Canadian Museum of Nature (CMN). This framework identified the threats that are specific to museum environments and encouraged prevention starting with the following actions: avoid, block, detect — then respond and treat.

The "10-agents" approach, as it is known, helped museums and heritage organizations to examine a broad range of threats all at once and to realize that they should not focus exclusively on one issue (e.g. tight control of relative humidity) while ignoring the others. However, although it provided a checklist of various threats along with some possible control methods, it did not provide information on the relative importance of individual threats or offer any help in determining priorities when faced with a multitude of simultaneous threats. Obtaining this type of information requires risk assessment.

RISK ASSESSMENT

Risk assessment provides a process to quantify the state of preservation of a collection and to predict the impact of possible actions. It considers both the impact of an agent, and its frequency or rate. This

▲ CCI has contributed to the study and preservation of many significant Canadian artifacts, such as the Royal Charter of the Hudson's Bay Company, which dates to 1670.

allows for the prioritization of risks, using both objective and subjective criteria. Over the past 10 years, CCI has worked with the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM) and the Netherlands Cultural Heritage Agency (RCE) to develop a risk framework and training materials. Rob Waller has also contributed a great deal to the field and has applied the risk assessment approach to a number of major heritage collections.

Objectively, risk assessment allows for the calculation of the relative severity of different risks, and the comparison of sporadic, severe risks with slow, continuous ones. Once an institution knows the likelihood of a particular risk, it can make better decisions about investing in specific risk prevention measures.

When conducting a risk assessment, the need to quantify the various risks can also help to identify research and data gaps. For instance, to assess the risk of fire in a museum, research into the frequency of fires in museums must be conducted. Likewise, if a client considers raising the temperature of collection areas from 20°C to 25°C during the summer months to save energy, the increased risk of pest infestations must be investigated. CCI has conducted research into probability and rates of occurrence of various risks, including fire, and has identified areas where more research and/or data is required. Some reliance on expert opinion is important where data is not available. Another important element of risk assessments is transparency, ensuring that all data and necessary assumptions used to inform the risk calculations are shared.

Subjectively, risk assessment requires that the relative value or significance of an object within a collection be taken into account in determining the appropriate course of action. Actions proposed to preserve a highly significant object in a collection may be very different than those proposed to preserve an object of lesser importance. Risk assessment is not a barrier to the use of a collection. Rather, it helps to assess the risks related to an actual condition or a proposed use. For example, it can be used to assess risks associated with the display of an object within a museum, or its use in an outdoor activity; both may be legitimate uses for the object, but they will have different risk profiles. Options to minimize the various risks can then be suggested to the owner. Sometimes, it is appropriate to take measured risks because using an object can add to its meaning and/or benefit the museum and its community.

The shift towards including an assessment of relative value reflects the changes that have occurred throughout the museum and heritage community. Today's conservators aim to reach conservation treatment decisions via collaborative dialogue involving owners, sometimes creators, and other stakeholders. Questions commonly addressed include: How important is the object? To which communities is it important? How will it be used? Decisions about the preservation of an object take both social values and the need for exhibition into account. Decision-making also filters the relative risks associated with the object, and prioritizes those risks relative to the various contexts specific to it. All of this information is then considered by a group that works together to find creative solutions appropriate to the given object. There is no one-size-fits-all solution for achieving the delicate balance between safeguarding an object to prevent loss of value while allowing it to be used.

THE FUTURE

The approach to "preventive conservation" has evolved from a focus solely on protecting collections to one of assisting museums and owners to manage the risks associated with the use of their collections. While the comprehensive risk assessment approach is currently somewhat onerous (because it requires complex data collection), it does give museum directors, collection managers, exhibition staff, owners, and conservators the tools they need to make nuanced, collections-specific decisions. Over time, as all of the factors related to risk assessment are more widely understood and more routinely evaluated, it is likely that some patterns will emerge that will further shape the evolution of preventive conservation. This work will also unfold in the larger context of other future challenges such as sustainability, accessibility, and measuring the conservation state of a collection. As CCI addresses these issues, we will be challenging our assumptions of material science and developing tools to help the Canadian museum and heritage community celebrate Canadian history, both today and tomorrow.

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Seeing the Light!

An Overview of CCI's Work on Lighting

Museums, libraries, and archives around the world are increasingly taking steps to reduce their energy usage. Sometimes these actions are simply to relieve the pressure of operating costs, but they also reflect a commitment to improve environmental sustainability. In 1996, in Canada and most other countries, reflector lamps such as those used in museums came under regulations that specified minimum energy efficiency. This minimum effectively eliminated traditional tungsten reflector lamps in favour of quartz halogens.

In 2014, similar regulations will apply to the most common incandescent lamp of all — the round "A19" (specific details for Canada are available from Natural Resources Canada[1]). New lamp technology, such as the compact fluorescent that was introduced in the 1990s and the even more recent light emitting diode (LED), offers even higher efficiency than the regulated minimum, and institutions want these maximum energy savings. Unfortunately, there have been trade-offs between lamp efficiency and light quality, i.e. our visual

CCI made four custom light-boxes (one each for incandescent, fluorescent, LED, and ceramic metal halide lamps) to test material fading by exposure to the various light sources.

This Datacolour ColorMatcher® lightbooth was used to conduct a colour comparison exercise during CCI's 2011 advanced professional development workshop on museum lighting.

access to heritage. Canadian Conservation Institute (CCI) advisers have had to follow the rapidly developing lamp technology in order to provide relevant advice on lighting.

Regardless of the lighting system in place, institutions must also balance the exhibition of collections with their long-term preservation (this problem of "seeing versus saving" is discussed in more detail in *Ten Agents of Deterioration: Light, Ultraviolet and Infrared*[2]). To assist in the selection of appropriate lighting, CCI has developed a Web-based light damage calculator. In addition, we continue to collect measurements of the light sensitivity of heritage materials using both conventional lightfastness testing techniques and a new tool, the micro-fade tester. And to package this advice, we develop and present workshops on this topic.

MICRO-FADE TESTING

CCI assembled its first micro-fade tester in 2008, based on a design by Paul Whitmore of Carnegie Mellon University and Newport Oriel Instruments. A relatively new and almost non-destructive procedure, micro-fade testing involves subjecting an object to a small spot (~0.3 millimetres in diameter) of intense light for a period as short as 10 minutes, and measuring the colour change over time. The fading rate of the test area is then compared to the fading rate of well characterized standard blue wools. The technique is uniquely able to identify light-sensitive colourants with negligible damage to the objects, and to help us predict their behaviour when exposed to light. This provides concrete data that helps museums and galleries plan the exhibition of valuable artifacts.

CCI has been using this technique since 2009 to test many significant Canadian artifacts, e.g. the written dedication and signature by Queen Victoria in a book belonging to the Library of Parliament; the herbaria collections in Catherine Parr Traill's scrapbooks belonging to the Canadian Museum of Nature; a collection of Inuit prints belonging to the Canadian Museum of Civilization; and the signatures on both copies of Canada's Proclamation of the Constitution Act, signed in 1982. Micro-fade testing can be conducted either at CCI or, if the object cannot be brought to CCI, on-site with a portable unit. For instance, it was not possible to bring the two Canadian constitution documents to CCI, so the portable unit was taken to Library and Archives Canada (LAC) and the testing was carried out there. This also offered the opportunity to discuss lighting issues with LAC staff.

CONVENTIONAL LIGHTFASTNESS TESTING

CCI has recently built a set of four light-boxes to test the lightfastness of sample colourants under different illuminants. The enclosures were constructed to simulate interior lighting at elevated intensity (kilolux levels) using four common light sources: LED, halogen, fluorescent, and ceramic metal halide. Fading behaviour of the blue wool standards is currently being investigated for comparison with published data and CCI micro-fading measurements. The blue wool standards are reference materials for lightfastness ratings, so a thorough understanding of their fading characteristics is important for museum lighting recommendations.

LIGHT DAMAGE CALCULATOR

CCI will launch a Web-based light damage calculator in 2012. This tool will allow users to select variables such as colourant, degree of preliminary fade, lux level, hours of display per day, days per year, and even the number of camera flashes, and obtain plausible predictions of their impact on colour (using numeric and visual outputs). This will make decisions for both older collections and pristine collections simpler and much more informed.

The first release of the program will calculate fading using parameters derived from published blue wool ratings of various colourants. It will provide a framework for future revisions that will incorporate spectral data from measured fading curves using equipment at CCI, such as the newly designed light-boxes and the micro-fade tester.

LIGHTING WORKSHOPS

In addition to conducting research and developing tools, CCI also offers training workshops to support the Canadian museum and heritage community. In June 2011, we hosted an advanced professional development workshop on museum lighting, with a particular emphasis on high efficiency lamps such as LEDs. Kit Cuttle, author of *Light for Art's Sake: Lighting for Artworks and Museum Displays* (Butterworth-Heinemann, 2007) led the discussion of exhibit design; Jim Druzik of the Getty Conservation Institute presented state-of-the-art data on LED lamps and their use in galleries; and Stefan Michalski reviewed preservation issues. Jim and Stefan have prepared guidelines for selecting LED lamps that will be published for wider distribution. CCI is also examining the evaluations of this workshop, as well as the many requests we receive for advice on this topic, and will use this information to develop a lighting workshop within the standard services available to Canadian clients.

LOOKING FORWARD

When CCI began offering advice on lighting 35 years ago, we had only a handful of lamps from which to choose and one simple but inflexible rule about lux. Over time, a multitude of new lamps appeared (none of which was perfect) and CCI's advice about lux and exposure time became more flexible and more subtle — but more difficult to apply. Today, industry is on the verge of producing ideal lamps for museum usage, lamps that provide the right combination of spectrum, conformation, and sustainability. And CCI is rolling out the tools and services required to make those difficult decisions about lux and exposure time.

Endnotes

1. Natural Resources Canada. *Guide to Canada's Energy Efficiency Regulations.* http://oee.nrcan.gc.ca/node/17723
2. Canadian Conservation Institute. *Ten Agents of Deterioration: Light, Ultraviolet and Infrared.* www.cci-icc.gc.ca/caringfor-prendresoindes/articles/chap08-eng.aspx
3. US Department of Energy. Energy Efficiency and Renewable Energy. *Understanding Photometric Reports for SSL Products.* http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/understanding_photometric_reports.pdf

About LEDs

Incandescent lamps are in the process of being phased out and museums are increasingly looking toward LED lamps to replace them. Over the past several years, LEDs have improved significantly, and they are now beginning to compete with halogens in terms of lumen output and spectral quality.

LED lamps offer several distinct advantages over conventional light sources:

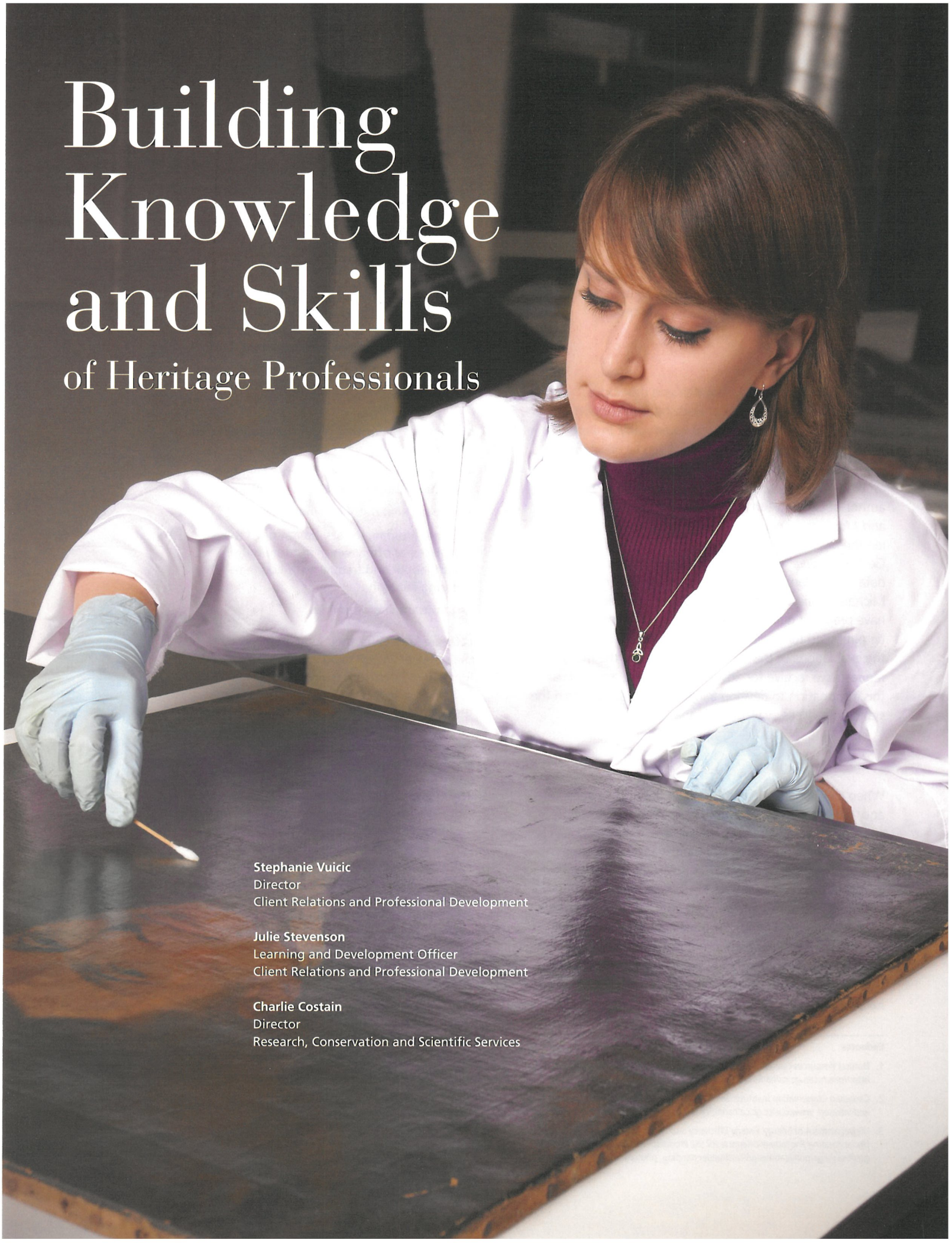
- minimal ultraviolet and infrared energy in the spectrum, both of which can damage objects
- reduced heat output from the lamp
- longer lifespan, so they do not need to be replaced as often, which in turn reduces staff labour and frequency of accidents during lamping
- significant energy savings

LEDs are known for their long lifespan (in the range of 25 000 to 50 000 hours) in open luminaires. Lifespan is typically expressed by the L70 value — that is the number of hours until the lamp is at 70% of the original lumen output. LED lamps do not burn out in the way that incandescent lamps do, but rather just get dimmer with time.

The quality of the light spectrum is especially important for museum applications and, unlike incandescent lamps, the spectra of LED lamps can vary dramatically between products. There has been concern with the large blue peak in the spectrum of some products; however, this can be minimized by selecting a lamp with a high colour rendering index (CRI). A CRI greater than 85 is typically considered good, and over 90 is ideal. When selecting an LED bulb, ask for the "LM-79" report[3] (a standardized independent test of LED lamps that provides CRI and other spectral characteristics). It is also advisable to test LED lamps for specific use and personal preference before purchasing large quantities. The beam characteristics may not be as expected. Testing for compatibility with existing system components (transformers, dimmers, and so on) is also important prior to a large purchase. Finally, ask for a written warranty of lamp lifetime.

Building Knowledge and Skills

of Heritage Professionals



Stephanie Vuicic
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Charlie Costain
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Former CCI intern Jennifer Morton treats a painting.

Demand from heritage institutions for CCI's conservation services and support consistently exceeds our capacity to serve them — so one of our fundamental objectives is to build the knowledge and skills of heritage and conservation professionals so they can take care of their collections themselves. We believe it is more efficient and effective in the long run to "teach others to fish" than to do all the fishing for them. Building the capacity of professionals takes many forms, from offering guidance over the phone to delivering a range of professional development opportunities to providing technical publications and online learning resources.

As collections grow and become more diverse, so too does the need for an integrated and comprehensive approach to delivering information, advice, and training in collections care and conservation. This comprehensive approach not only means that CCI can offer clients a range of options, but it also allows us to maximize our capacity, which is critical given our limited resources and mandate to serve all museums in Canada. For example, interactions with clients during workshops provide information on the current challenges they are facing, which helps us to identify gaps in our training and online learning resources and to guide our planning for the future. Likewise, requests to CCI's Enquiry Services can be used to identify whether additional online content is needed to address a new or growing need, or if existing content should be featured more prominently in response to demand. Training materials can also be adapted as online learning resources.

To be effective, CCI's approach to professional development needs to be flexible, multidisciplinary, and offer a choice of options. We must ensure that our teaching materials, information, and tools are geared not only to the specific needs of heritage professionals, but also to their level of expertise. To meet these needs, our conservators and scientists work together to bring unique and specialized training to the field of conservation, and to deliver both general as well as highly advanced training that covers a wide range of disciplines. We have also redesigned our website so that clients can access the information they need more easily, either by subject matter or by their roles and responsibilities for conservation and collections care.

LOOKING TO THE FUTURE

As the need for information, advice, and training continues to increase, CCI is examining new approaches to meet the demand.

Technology is part of the answer. We continue to expand and deepen our online content, as well as to improve the way the information is presented so that users can quickly and easily find the resources they need. This move toward more online publishing also offers an opportunity to increase the use of videos to demonstrate techniques or highlight conservation issues, strategies, or recommendations as well as to add more online resources (e.g. a light damage calculator) to the currently available PEGcon and PadCAD online tools.

Our goal is to reach more Canadian heritage professionals, and provide them with quick access to information at no cost. Online publishing also enables us to quickly and easily update materials as our research yields new approaches and information.

The redesigned website will enable us to draw on Web metrics to identify valuable and useful content, and to use business intelligence from enquiries to identify new content that needs to be developed. By implementing search engine optimization techniques, users will have better success finding the resources they need. We will continue to enable direct access to the most frequently sought information, including CCI Notes; *Ten Agents of Deterioration; Mould Outbreak – An Immediate Response*; and *Conservation Guidelines for Outdoor Murals*.

CCI's social media strategy will direct more professionals to our website and eventually provide a forum for the community to connect — to share not only experiences but also best practices and resources.

Although our focus will be more and more on providing information and tools through our website, we will continue to use traditional methods of professional development, and to adapt them through new technologies. For example, we have begun exploring different teaching and learning strategies for training

conservation professionals. In 2011, we partnered with the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM) and the Netherlands Cultural Heritage Agency (RCE) to pilot a blended learning course *Reducing Risks to Cultural Heritage*. For 6 months, 30 participants from 25 countries worked individually on their own collections and institutional needs while collaborating online with instructors and other participants. The course concluded with a week of on-site learning as a group. Each participant was supported by a mentor throughout the course. We will be using the lessons learned through this pilot presentation as the basis for Canadian courses that combine distance, online, and in-person training. Stay tuned!

Finally, effectively and efficiently building the capacity of those who work in heritage institutions requires partnerships. To meet this need, we will continue to work collaboratively with organizations in Canada such as the Centre de conservation du Québec (CCQ), as well as national and provincial museum, archival, and conservation associations. Where it will benefit Canadian heritage professionals, we will also collaborate with international partners.

For further information on CCI workshops, publications, or other professional development opportunities, we invite you to visit the CCI website (www.cci-icc.gc.ca).

Professional Development Opportunities

CCI's professional development efforts are geared to specialists and non-specialists, serving conservation students, new graduates, and professionals, as well as others who work in the heritage community.

HERITAGE AND CONSERVATION PROFESSIONALS

CCI offers a variety of ways for professionals to enhance their knowledge, gain new skills, or access tools and information resources.

We share the results of our research with conservation professionals through articles in academic and peer-reviewed journals, books and tools that we produce, presentations at professional conferences, and advice.

CCI Technical Bulletins, for instance, provide technical and detailed information on current techniques and principles of conservation of use to curators and conservators of cultural artifacts, and detailed information of a specialized technical nature about selected conservation and care-of-collections topics. Our two most popular Technical Bulletins address integrated pest management (TB 29) and care of electronic media (TB 27).

Among our best-selling books are *Lighting Methods for Photographing Museum Objects* (released in 2010, it is a practical guide to 15 techniques for lighting objects effectively) and *Metals and Corrosion: A Handbook for the Conservation Professional* (released in 2004, it remains a popular source of information on common metals and their corrosion problems indoors, outdoors, and in archaeological settings). Upcoming publications will present technical information on adhesives and consolidants, and the migration of analog audio data to a digital format.

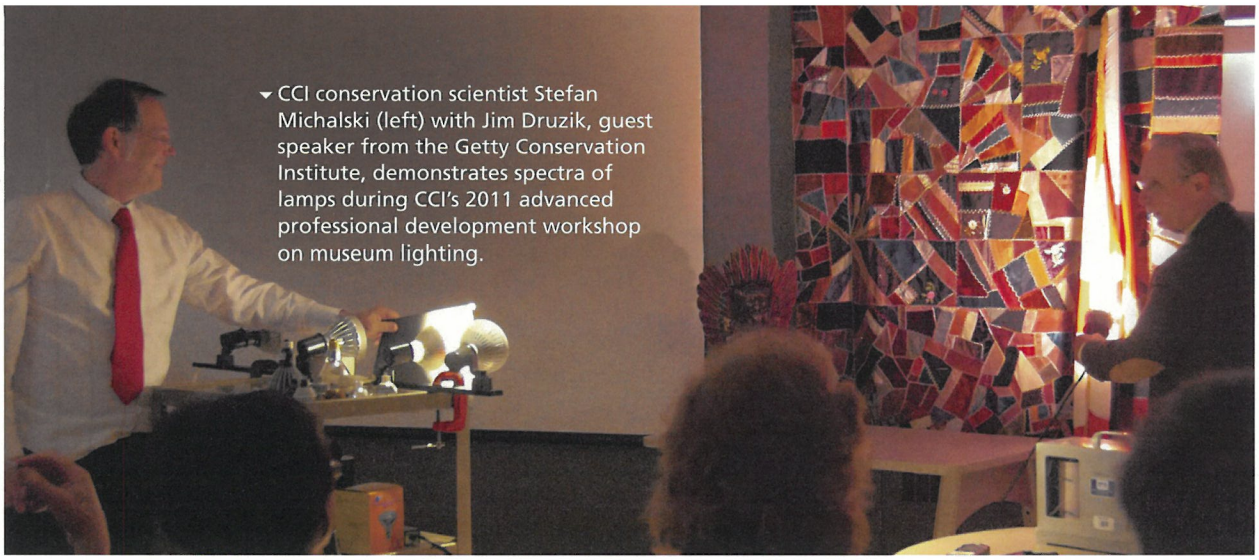
In addition to our own publications, we routinely submit the results of our conservation science research for publication in peer-reviewed professional journals, both Canadian and international, and share them through presentations at assorted conferences in Canada, including those of conservation, museum, and archival associations.

Should conservation professionals not be able to find the information they need through any of the above sources, they can also contact CCI Enquiry Services by telephone (613-998-3721) or email (cci-icc.services@pch.gc.ca) to ask technical questions about specific conservation problems.

CCI also offers two programs for professionals who require training in specialized treatment techniques or information and advice on managing their collections.

Two **advanced professional development courses** have been offered each year since 2008. These 3- to 5-day courses, which are intensive and technical, are geared to the mid-level career professional. Topics range from sophisticated treatment techniques to collection management approaches. While the courses are intended primarily for Canadians, participants from other countries are admitted if space allows. Depending on the subject matter, participants comprise conservators, curators, preservation officers, conservation managers, designers, collection managers, preparators, museum technicians, exhibit designers, executive directors, preservation consultants, and archivists. Possible topics for future advanced professional development courses include care of photographic materials, industrial collections, museum display cases, and risk assessment.

Conservators and conservation scientists can also take advantage of our opportunities for **Visiting**



▾ CCI conservation scientist Stefan Michalski (left) with Jim Druzik, guest speaker from the Getty Conservation Institute, demonstrates spectra of lamps during CCI's 2011 advanced professional development workshop on museum lighting.

Professionals. Individuals in the program collaborate with CCI staff on specific projects, have access to tools or equipment unique to CCI, and obtain short-term training on specific conservation techniques and practice.

MUSEUM STAFF AND VOLUNTEERS

Staff in the approximately 2500 museums and other heritage institutions across Canada can access basic information on care of collections through CCI Notes and obtain basic training through regional workshops.

We began publishing CCI Notes in 1983 as a way to provide practical information about issues and questions related to the care, handling, and storage of cultural objects. This ever-expanding series now contains more than 100 Notes, which are all freely accessible on the CCI website (www.cci-icc.gc.ca). The response to the free and open access to CCI Notes online was extremely positive, and we continue to improve our online presence and content offering. The website's new look in 2012 offers an improved layout and content structure, which will help clients find information to meet their conservation needs. By integrating the "Preserving my Heritage" website (which offered valuable resources for training museum volunteers) into our main website, this information is now more widely available and better linked to other relevant CCI resources.

Our workshops for museum professionals in Canada debuted in the mid-1980s. Since that time the program has steadily expanded to the point that we now offer at least 16 workshops a year across the country. These workshops, hosted by museum, archival, and other associations, are usually 2 days in length and offer a mix of hands-on activities, lectures, and discussions. Like CCI Notes, they cover a variety of types of artifacts (Aboriginal and archaeological objects, archival materials, industrial objects, paintings, and new media) as well as topics such as storage planning, facility planning, digital photodocumentation of museum objects, and environmental guidelines. Some of the most popular workshops include *Emergency and Disaster Preparedness for Cultural Institutions; Packing and Shipping Cultural Property*; and *Storage Planning*. Participants can comprise conservators, curators, archaeologists, archivists, museum coordinators, board members, historians, consultants, students, librarians, cultural interpreters, museum and conservation technicians, preparators, exhibit coordinators, collections officers, and artists. New workshops currently under development include offerings on museum lighting and book conservation, as well as an updated version of the storage planning workshop.

RECENT GRADUATES IN CONSERVATION

For recent Canadian graduates of conservation programs, CCI offers 1-year paid internships. These provide an opportunity to work on treatment, research, and/or preservation projects under the supervision of an experienced staff member, and to experience and benefit from CCI's interdisciplinary environment. Interest in these positions is high: in 2011, we hosted three interns, one in the Paper Lab, one in the Textiles Lab, and one in Preservation Services.

CONSERVATION STUDENTS

CCI is proud to contribute to the education of conservation students. Our specialists deliver workshops and lectures to students at Queen's University (in the Master of Art Conservation program) in Kingston and at Fleming College (in the Collections Conservation and Management program and the Museum Management and Curatorship program) in Peterborough.

We also offer unpaid internships to students currently enrolled in a relevant post-secondary program as well as recent (within the last 5 years) graduates. These internships can range in duration from 6 weeks to 1 year, and are open to individuals from all countries — although preference is given to Canadian citizens and landed immigrants. In 2011, we received 21 applications from nine different countries, including 6 applications from Canada.

The Global Reach
of CCI's Internship Program

Julie Stevenson
Learning and Development Officer
Client Relations and Professional Development

Detail of the metal furnishings of the Salzinnes Antiphonal, a 16-century illuminated liturgical manuscript from the Rare Book Collection of the Patrick Power Library at Saint Mary's University, Halifax, Nova Scotia.

Since 1980, the Canadian Conservation Institute (CCI) has welcomed interns from across Canada and around the world. As active participants in the daily workings of our interdisciplinary environment, they have the opportunity to gain in-depth knowledge of collection needs, conservation research, and treatment projects. They often maintain ties with CCI as they move on through their careers, perpetually reinforcing our links to the wider conservation community.

Four of our past interns have provided some insight on how their time at CCI contributed to their professional development and career path.

Susan Walker completed an undergraduate degree in art history followed by a Master of Art Conservation (Paintings) at Queen's University in Kingston, Ontario, Canada. Upon graduating from Queen's in 1991, she was the successful candidate for a Getty internship at the National Gallery of Canada (NGC) in the conservation of modern Canadian art. She came to CCI in 1992, and spent the next 2 years working on assorted paintings conservation projects with Peter Vogel, Helen McKay, James Bourdeau, Debra Daly Hartin, and Leslie Carlyle.

Patricia Smithen was born and raised in Ontario. She completed studies in paintings conservation at Queen's University in Kingston in 1993, and came to CCI in 1994. She spent 2 years in our Paintings Conservation section, working under James Bourdeau on paintings that included (among others) a small 17th-century panel and a modern acrylic painting with graffiti damage. While at CCI, she also undertook a small study of 18th-century ground[1] preparations under Leslie Carlyle.

Laurianne Robinet hails from France, and studied analytical chemistry at the Université d'Orsay in Paris. She subsequently acquired experience in conservation science through internships and work experience in various museums and research laboratories. As part of her studies for a Master's degree, Laurianne came to CCI in March 2000 for a 6-month internship. While here, she carried out a project on the characterization of metallic soaps under the supervision of Marie-Claude Corbeil.

Carmen Li was only 8 years of age when her family moved from Hong Kong to Toronto. She earned a diploma in Collections Conservation and Management from Fleming College in 2004, and a Master of Art Conservation (Objects) from Queen's University in 2006. She came to CCI for a 1-year internship in archaeology in October 2007, working under the supervision of Tara Grant.

QUESTION

Tell me about your current role. Where are you now, and what are you working on?

ANSWER

SW: I am a conservator of paintings at NGC. After completing my CCI internship in 1994, I held various term positions at NGC and the Art Gallery of Ontario and completed a postgraduate Getty internship at the Hamilton Kerr Institute of Cambridge University, United Kingdom. In 1998, I was fortunate enough to join NGC as an assistant conservator for a 1-year term, which was extended and eventually made permanent in 2001. In addition to my work as a paintings conservator, I have also had the opportunity to develop a level of expertise in the X-radiography of works of art. This aspect of my work is hugely satisfying and credit must be given to senior management at NGC for supporting technological advances in the examination and documentation of works of art.

PS: I am head of the conservation program at Tate in London, United Kingdom. I run a department of approximately 50 staff, including conservators, technicians, managers, scientists, administrators, and additional interns, contractors, and researchers. Tate has four exhibition sites and an active loans program, so our work is focused on supporting these programs. I coordinate the planning, ensuring the resources and support staff are in place.

I specialize in the conservation of modern and contemporary paintings, particularly acrylic paint surfaces due to my work on the Tate AXA Art Modern Paints Project. I am treating a painting by British artist Nigel Cooke. The surface is meant to have the appearance of a black mirror, but due to a slow-drying paint and varnish mix, some white particles have spoiled the effect.

LR: I was working on the IPANEMA platform at the SOLEIL synchrotron[2] in France, where I facilitated access to the synchrotron facility for professionals working on ancient materials. I was also developing a new analytical approach for these materials. I have recently moved to a permanent position as a scientist at the Centre de Recherche sur la Conservation des Collections in Paris, where I am working on the conservation of leather and parchment.

CL: I am the preventive conservation manager at the University of Alberta Museums — a distributed network of 28 collections that encompasses more than 17 million specimens and artifacts that are used daily in research, teaching, and outreach. My work includes establishing conservation priorities across different collections, stabilizing objects for exhibition, assessing and planning facilities, preparing for emergencies, and providing conservation advice for collections.

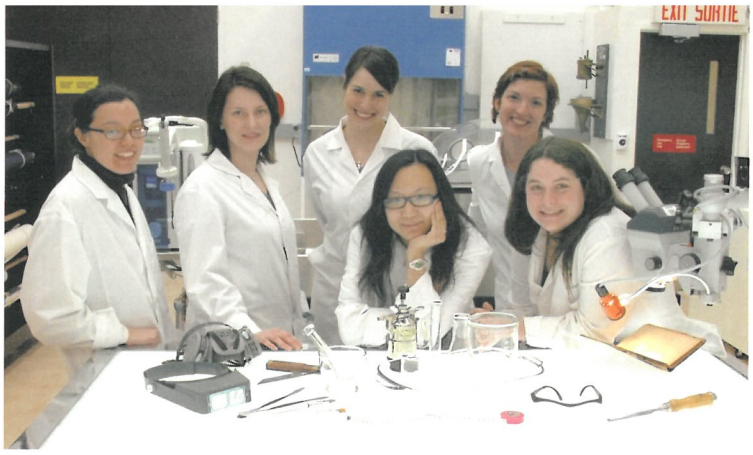
QUESTION

What stands out the most for you about your internship experience at CCI? What did you learn and how has it benefited your career?

ANSWER

SW: CCI was fantastic and I thoroughly enjoyed everything about it. The people were wonderful and incredibly willing to share their knowledge and experience. The focus on research meant there was not only the time but also the support to investigate any technical questions that might arise during treatment of a work of art. As well, given CCI's wonderfully collegial and

▾ As part of her CCI internship, Carmen Li conducted 4 weeks of fieldwork in the Arctic.



▲ Interns at CCI in 2007–2008 (from left to right): Natalie Boruvka, Amanda Gould, Marie-Catherine Cyr, Carmen Li, Myriam Lavoie, and Amanda Salmon.

cooperative environment, there was ample opportunity to visit other sections and see other projects underway. Last, but certainly not least, I really enjoyed the workshop program, as part of which I travelled to far-flung parts of the country and met many enthusiastic and dedicated museum professionals. In short, I would say that my experience at CCI was invaluable to my growth as a conservator.

PS: CCI is the purest conservation experience I have ever had. As I look back, it is amazing to have had that opportunity to work in an institution devoted to the conservation of cultural heritage, filled with the most dedicated people, obsessed with advancing the field. I loved walking through the various studios and talking to the specialists, learning about the variety of activities. CCI was unique in my experience in that it allowed conservators the time to really think through problems and try different options. It was both cutting edge (with the latest techniques) and wonderfully pragmatic. It was at CCI that I learned to borrow materials and techniques from other specializations, to talk to experts, and to be open-minded in my approach.

My favourite experiences were with the outreach programs. I gave a 2-day seminar to local artists in Whitehorse, which laid the foundation for my interest in modern and contemporary art practice, and highlighted the importance of thinking through techniques and materials from the perspective of the artists. I also participated in a survey trip to New Brunswick with the CCI experts in facilities, security, and fire protection. This provided invaluable knowledge of how to examine museum systems all together, and to see the practicalities of dealing with a working collection in context.

And finally, I assisted James Bourdeau on a survey of outdoor murals in Welland, Ontario. This gave me a master class in coming up with practical solutions and recommendations for a unique community art project, not to mention an appreciation for the impact of weather, traffic, and teenagers on supposedly sound materials. James also taught me to appreciate a good cup of coffee, for which I am forever grateful!

LR: Although more than 10 years have passed, my time at CCI, and in Canada, remains a special period of my life. I learned so much about the field of conservation just by being in contact with the CCI conservators and conservation scientists. All of them shared their passion for their work with me, as well as their knowledge of objects and culture. Marie-Claude Corbeil welcomed me warmly, shared her deep knowledge, and gave me invaluable advice for carrying out high-quality research. I have never felt so valued and respected as I did at CCI. Looking back, I benefited hugely from this experience: it opened the door to an international career in conservation science and made me fluent in English, which expanded my opportunities. Following CCI, I worked at the British Museum in London, and then the National Museums of Scotland.

My experience at CCI also inspired me to undertake a PhD on the degradation of historic glass in museum collections. Although it is 5 years since I returned to France, I remain connected to the different cultures and countries I came across. In many ways, CCI was the source of inspiration that led me to where I am now. I am extremely grateful for that and I hope that CCI will continue to inspire others.

CL: I definitely remember being a little "star-struck" upon meeting so many of the experts who had written the articles we studied in training! My year-long internship at CCI is a career highlight. I was involved in treatments, research projects, and even 4 weeks of fieldwork in the Arctic. It was stimulating to be in an environment where conservation research and treatment innovation go hand-in-hand, with a focus on practicality and usability from the point of view of museums, both small and large.

While I learned many practical skills, the most valuable tool I gained from CCI was an approach for solving conservation problems, i.e. using practical issues to frame research questions, and then seeking the answers within a framework that allows flexibility in finding solutions. I feel fortunate to have worked with — and learned from — so many wonderful mentors, in addition to forging friendships with my fellow interns. My time at CCI has formed the basis of a professional network that I value greatly.

To learn more about CCI's internship program, please visit our website: www.cci-icc.gc.ca.

Endnotes

1. A "ground" is a coating applied to the painting support material (e.g. canvas, wood, paper, ceramic, metal, glass, ivory, or plastic) as a base for the paint layers.
2. A synchrotron is a particular type of cyclic particle accelerator in which the magnetic field (to turn the particles so they circulate) and the electric field (to accelerate the particles) are carefully synchronized with the travelling particle beam. Synchrotron radiation allows analysis at the atomic and molecular level.