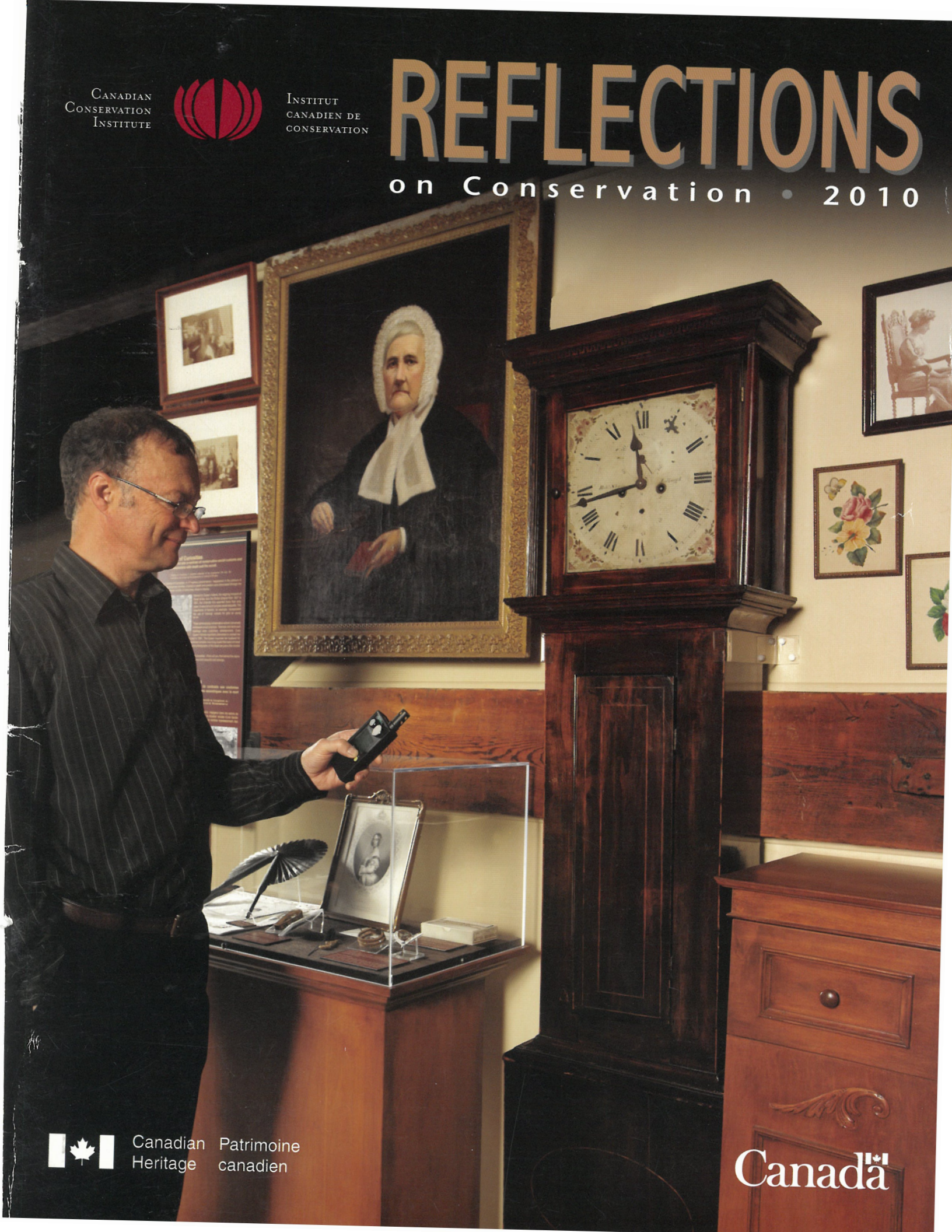

Canadian Conservation Institute
Institut canadien de conservation
REFLECTIONS
on Conservation • 2010
Canadian Heritage
Patrimoine canadien
Canada

CONTENTS

Cover: *CCI Manager of Conservation Research David Grattan uses an ELSEC 764 UV+ Monitor to determine the environmental conditions at the Bytown Museum in Ottawa, Ontario.*

REFLECTIONS on Conservation

ISSN 1920-9525

Editorial Review Committee
Jeanne Inch (Chair)
James Bourdeau
Marie-Claude Corbeil
Michael Harrington
David Grattan
Elisabeth Joy
Barbara Patterson
Shanna Stevens

Production Team
English Editor: Barbara Patterson
French Editors: Jean-Michel Johnson and Vincent Deslandes
Design: Sophie Georgiev

REFLECTIONS on Conservation is published once per year by the Canadian Conservation Institute, and is available free upon request.

The Canadian Conservation Institute is a Special Operating Agency of the Department of Canadian Heritage.

Printed in Canada

To subscribe to ***REFLECTIONS*** on Conservation

Visit the CCI Web site
www.cci-icc.gc.ca

or contact

Publications Sales
Canadian Conservation Institute
1030 Innes Road
Ottawa ON K1A 0M5 Canada

Tel.: 613-998-3721
1-866-998-3721 (toll-free in Canada)
Fax: 613-998-4721
E-mail: cci-icc.publications@pch.gc.ca

MESSAGE FROM THE DIRECTOR GENERAL

Welcome to the first issue of *REFLECTIONS* on Conservation — CCI's new annual publication for the conservation and heritage community in Canada and internationally.

REFLECTIONS on Conservation will use the work of CCI to present developments in conservation and scientific research, and their impact on the conservation and heritage community. It will also offer forward thinking, from both scientific and technical aspects as well as a management viewpoint, on the role and importance of conservation for museums and for society. The articles will be drawn from our expertise: research in conservation science (such as development of the micro-fading tester, p. 15), conservation treatment of complex artifacts (such as the non-destructive low-intervention treatment of upholstered furniture, p. 13), and preventive conservation of entire collections (such as the development of a risk assessment strategy, p. 4).

We deliberately chose the title *REFLECTIONS* on Conservation to reflect the diverse and multidisciplinary nature of conservation and the external environment in which it functions. The title expresses our goal for this new publication: to offer valuable and thought-provoking reflections on the issues facing the conservation and heritage community and to add perspective to the many healthy debates in the field of conservation.

We want to speak to all professionals who work in the museum environment — not only conservators, preparators, and curators, but also museum directors and facility managers. We begin with a look at new strategies for preserving collections (p. 2). The economic recession, climate change, increasing energy costs, and the need for sustainability are raising questions about the accepted museum environment standards, which are technically difficult to achieve and expensive to maintain. It is the responsibility of everyone in the museum, from conservators (who want to provide the best care possible) to directors (who must balance budgets, attract visitors, and remain relevant to their communities), to ensure that these short-term considerations do not jeopardize the long-term preservation of the collections.

We want to highlight the diversity that is to be found in conservation. The subjects covered in this first issue range from outdoor collections (industrial artifacts and murals, p. 6) to contemporary paintings (p. 21), and include investigation and treatment of artifacts that are native to Canada (p. 10) as well as those that have been brought here from afar (p. 18).

We want to present different voices. Among our authors are an experienced and internationally recognized conservation scientist (p. 2), a recent conservation graduate and 2009 intern (p. 21), and a visiting post-doctoral fellow (p. 15).

We want to emphasize the importance of collaboration with others as a way of achieving better outcomes and mutual learning as well as economies of scale. This holds true whether the collaboration is with other conservation professionals (p. 13), professionals in other fields (p. 18), or Aboriginal communities (p. 10).

Finally, we want to include new technical and scientific information that will be useful to conservators whether they are responsible for preserving collections (p. 2) or for treating objects in a laboratory (p. 23).

I hope you enjoy reading *REFLECTIONS* on Conservation, and find the articles both interesting and useful. Please send me your views and suggestions so that future issues can address and present the ideas and topics of most concern to you, the conservation and heritage community.

I look forward to hearing from you.

Jeanne Inch

Director General and Chief Operating Officer, CCI

Tel.: 613-998-3721 ext. 115
1-866-998-3721 ext. 115 (toll-free in Canada)
E-mail: jeanne.inch@pch.gc.ca

Strategies for Preserving Collections

FEATURE ARTICLE

David Grattan, Manager, Conservation Research Division, CCI

"Economic recession", "climate change", "increasing energy costs", and "sustainability" are terms that splash across the news headlines today, and all of them have a tangible impact on Canadian collecting institutions. Never before have museums and archives been under as much pressure to do more with less — and to do it faster.

Complicating these realities is the tendency in conservation to err on the side of caution. When asked how to care for objects, conservators have a professional responsibility to suggest a level of care that is certain to preserve the objects. Their ethical code allows them to do nothing less.

Oil paintings on canvas are vulnerable to physical damage, such as depicted here, when exposed to fluctuations in relative humidity. Moccasin Seller *(by Cornelius Krieghoff, ca. 1853–1863), collection of the MacKenzie Art Gallery, Regina, Saskatchewan, gift in memory of Norman Ratner.*

Adding to this dilemma is the fact that the internationally accepted museum environmental regimes, which have long been advocated as standard conservation practice, are technically difficult to achieve and expensive to maintain. This is especially true in temperate zone countries such as Canada that have extreme seasonal climates. The sustainability of the required heating, ventilating, and air-conditioning (HVAC) systems is further threatened by the steadily escalating cost of energy — not to mention the issue of responsible energy consumption. The immediate impact on the conservator is a pressure from museum management to relax environmental standards to cut costs.

It is not just the conservator who faces the dilemma, it is the museum management who must balance budgets, ensure greater efficiency, cut costs, and attract visitors — in the short term. Long-term preservation of the museum's collection understandably moves down the list of priorities.

CCI has been aware of these complex issues for several years and has been developing the following strategies to enable museum staff to tailor the preservation environment to the needs of their collections.

Strategy #1. Materials Research

The aim of materials research is to develop more knowledge and understanding of the impact of the environment on objects and materials, thereby determining what environmental conditions are actually necessary to prevent deterioration. Conservators are well aware of the importance of understanding artifact materials, but anticipating how dissimilar materials behave when combined within composite artifacts is not easy or straightforward.

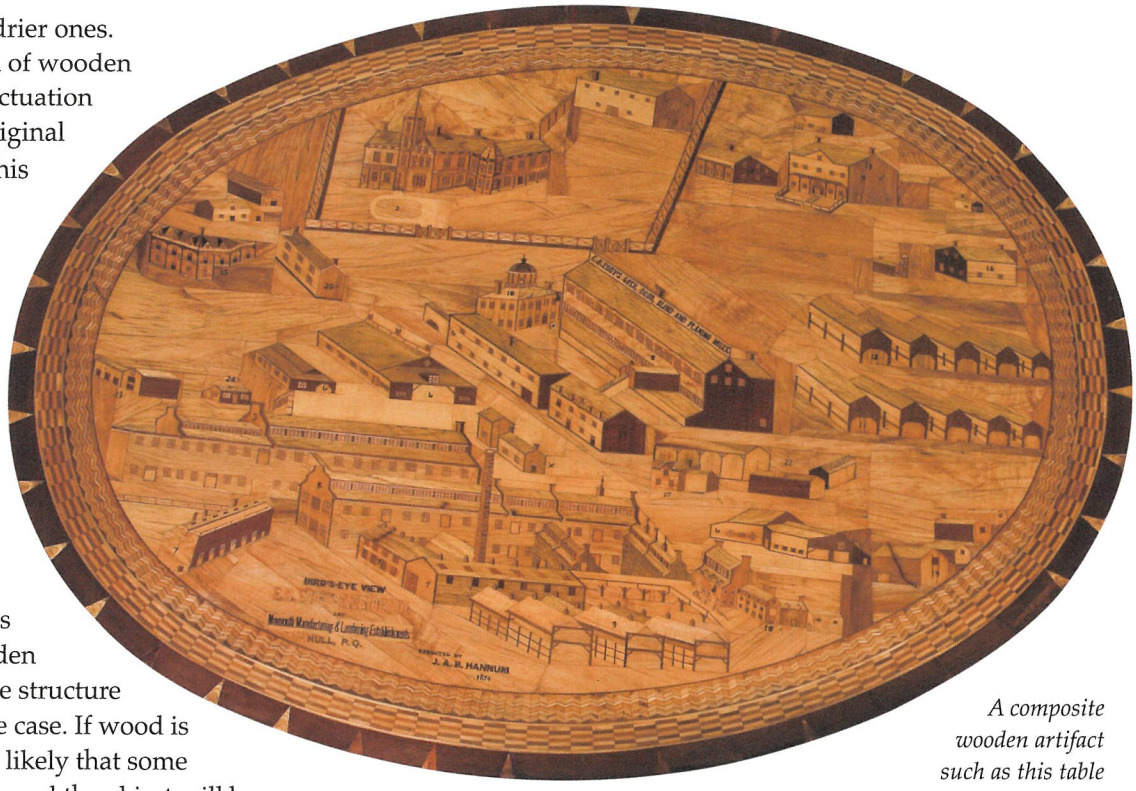
The following environmental factors influence deterioration through physical, chemical, and/or biological means: lighting, pests, physical handling and support, pollutants, relative humidity (RH), and temperature.

Physical damage

Physical damage can arise from many sources, e.g. moisture, improper handling, poor support design, and seismic activity. Environmental control moderates or eliminates the physical damages arising from RH variability.

Wooden furniture is a good example of the type of object that requires a stable RH level, as wood responds physically to changes in RH by swelling in wetter

conditions and shrinking in drier ones. One might think that an item of wooden furniture subjected to RH fluctuation would simply return to its original dimensions. Unfortunately, this is not the case. Because of a delay in response to RH changes (known as hysteresis), damage may remain even after a return to the habitual RH levels, e.g. drawers may still stick and surfaces may still be slightly warped.



A composite wooden artifact such as this table (a spectacular example of marquetry made by James Hannum in 1874 from 10 000 pieces of wood of 19 separate species) could be severely damaged if subjected to fluctuations in relative humidity. The table top is in the collection of the Bytown Museum in Ottawa, Ontario. Photo: Graham Iddon, Bytown Museum.

The situation becomes even more complex when restraints on the movement of the wooden components are implicit in the structure of the furniture, as is often the case. If wood is prevented from swelling, it is likely that some permanent damage will occur and the object will be unable to return to its original shape and size. Likewise, if wood is prevented from shrinking, the stresses created may be great enough to crack the wood. Objects can be classified into those that are dimensionally sensitive to RH fluctuations and those that are not. For furniture, this sensitivity classification is related to specific design features such as the application of hardwood veneers over joints.

The environmental history of objects is also of significance. Objects that have experienced regular seasonal RH changes will probably already be cracked or altered in shape, so a strict control regime for RH is unlikely to be of any measurable benefit. In this context, it is easy to see the importance of understanding all the factors that influence crack growth in wood. One of our research projects is to quantify what kind of RH variation must take place before rupture occurs and a crack propagates. This knowledge is key to understanding what limits should be applied to RH fluctuations.

Chemical damage

Chemical processes such as acid degradation or oxidation can damage paper and cellulosic materials. These chemical processes are more likely to occur in certain environmental conditions. Influencing factors that should be controlled include:

- acidic atmospheric pollutants (e.g. SO_2 or NO_2 from internal combustion engine exhaust or industrial sources, and acetic acid from decaying paper or oak furniture)
- RH and temperature

CCI's paper permanency studies from several years ago revealed that all unbuffered papers (including those that were previously considered relatively non-vulnerable, such as rag papers) are influenced by acidic pollutants. Once acid is introduced into paper, acid degradation is inevitable unless a buffer such as calcium carbonate is present to absorb the acid. The resultant chemical processes lead to damage such as embrittlement and total loss.

How can this chemical damage be controlled? Should collections be maintained in cooler conditions, drier conditions, or environments that are both cool and dry? Should they be deacidified? If RH is to be controlled, should it be at 50±2% or some other level? We thought we understood these factors, but our conservation research to establish standards for paper permanence raised new issues that we are now exploring. We are creating a new version of an old tool that calculates the combined impacts of temperature and RH on the rate of acid decay of cellulosic materials. This work will produce more accurate ISOPERM[1] calculations.

Biological damage

Damage can also be caused by biological organisms such as mould and bacteria, which are affected by temperature

and RH. Generally speaking, fungal, microbial, and insect attacks are all more likely in moist conditions. We usually advise that collections be kept at an RH below 65% to prevent biological attack.

Summing up Strategy #1

Inappropriate environmental conditions can lead to damage through physical, chemical, and/or biological means. Keeping the environment stable with little fluctuation will reduce the likelihood of physical damage, keeping it cool and dry will help to prevent chemical damage, and keeping it below 65% RH will help to avoid biological attack.

And this leads us to Strategy #2.

Strategy #2. Influence "Standards Bodies"

The second strategy for CCI's approach to the preservation environment is to collaborate with organizations that set standards or guidelines for museums and archives. One such "standards body" is the American Society for Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), which publishes a handbook used by many industry professionals to design HVAC systems. The ASHRAE handbook contains standards for every imaginable type of building, including a chapter on "Museums, Galleries, Archives and Libraries"[2] with topics such as:

- Environmental Effects on Collections
- Determining Performance Targets
- Airborne Pollutants
- Design Parameters
- Performance and Target Specifications
- System Selection and Design

The recommendations in the museum chapter are under continuous development by a group of HVAC engineers and conservation scientists — including Jean Tétreault and Stefan Michalski of CCI. The guidelines are not "preachy"; instead, they provide a reasonable compromise between the capacity of systems and the needs of collections. They explain clearly the connection between level of control and expected damage. For example, the most stringent level of control ("AA", which requires RH to be tightly controlled to 50±5% and temperature fluctuations to be within ±2°C) is required for only the most vulnerable objects in a collection, e.g. delicate wood veneers where the veneer covers a joint in the wood. In contrast, a collection of agricultural vehicles in a farming museum may be perfectly safe with the most relaxed level of control ("D", which requires only that the collection be kept dry).

Summing up Strategy #2

Standards bodies such as ASHRAE, which relate environmental conditions to needs of collections, allow the conservation profession to have a direct influence on the construction specifications that will guide the de-intensification of climate control — with the resultant cost savings and reduced energy consumption.

The fact that not all collections require the same level of control brings us to the final strategy.

Strategy #3. Risk Assessment of Collections

Environmental control, though clearly important, is just one element in an overall preservation strategy. Collection loss can occur for numerous other reasons: flood, fire, building collapse, acts of war or terrorism, theft, or building problems such as electrical failure or burst water pipes. More mundane but equally catastrophic are loss of labelling, misuse, or custodial neglect. Any museum that is serious about preserving its collection must consider all these issues. And, given that museums have limited financial resources, it is important to direct funds to the most serious threats. One way to do this is to identify the most serious threats through risk assessment.

Risk assessment is not only for conservators. It is a job for everyone, from maintenance staff to exhibition designers, from curators to tour guides, from museum directors to the museum board.

Classical "risk assessment" can be defined by five elements. These are listed below – together with the implications for museums.

1. **Establish the context** — determine what kind of collection you have, what sort of building, number of staff and their responsibilities, location, climate, security measures, environmental control, etc.
2. **Identify the risks** — list all possible risks, e.g. flood, fire, building collapse, acts of war, terrorism, theft, and building problems.
3. **Analyse the risks** — establish which of the risks are likely to occur and what their impact would be.
4. **Evaluate the risks** (in many ways the most important step) — establish which risks are likely to cause the most harm; this will, in turn, establish the preservation priorities.
5. **Treat the risks** (control, reduce, mitigate, etc.) — determine what the institution can afford to spend, what procedures are possible within this budget, and which of these procedures deal with the most risks.

Because of its focus on cost-effectiveness of collections care, risk assessment is a high priority for CCI. Our major objective is to make risk assessment techniques available to Canadian institutions through training courses and Web-based tools. Indeed, some institutions have already benefitted.

To develop the field as quickly and effectively as possible, we are collaborating with the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM) and the Institut Collectie Nederland (ICN) to deliver international courses on risk assessment and management. These courses have been developed and led principally by Stefan Michalski of CCI; they have already been delivered in several countries, including twice in Canada.

Our supporting research includes data to measure collections risk accurately: we must compile seismic, fire risk, and security data, and develop accurate deterioration models (as per the ISOPERMS above). Having collected these data, we need to develop an objective and accurate way to evaluate and compare the risks. To ensure we are on the right path, we have gone beyond the conservation profession to engage an expert in the field of risk assessment. This expert has not only been a mentor to CCI's risk research group, but has also introduced us to sophisticated software that models and compares risks. In addition, one of CCI's Visiting Fellows, Dr. Eric Hagan, has been developing the "Umbrella Risk Analysis Model", which compares and evaluates various types of risk. The ultimate aim is to create a Web-based user-friendly tool.

Another aspect of our approach to risk assessment is the design and delivery of a risk assessment protocol for use by Canadian institutions. The aim is to enable heritage institutions to evaluate total risks and develop strategies to treat, avoid, or mitigate them. This protocol is strongly rooted in the international course that was developed with ICCROM and ICN, and will be supported by an online manual.

Summing up Strategy #3

Risk assessment will allow museums to identify the most serious threats to their collections and ensure that their limited financial resources are directed to those areas where they will have the most impact.

Conclusion

Some conservation specialists may still argue that it is unwise to deviate from traditional rigid environmental standards. They think that we should be doing our utmost to continue with their application.

This moccasin has been damaged by insects. Note how the black-dyed skin has been selectively eaten, allowing the white interior padding to protrude. Moccasin from CCI Training Collection.

However, we think that the traditional rigid approach to environmental standards is doomed to failure. When dealing with economic recession, climate issues, and sustainability, the old standards become unrealistic, and they set conservators at loggerheads with museum colleagues and management. Adhering to rigid and expensive standards could also have a negative effect on the preservation of collections, for what cannot be achieved has a tendency to be ignored — especially when budgets are tight.

CCI sincerely hopes that risk assessment will allow a more rational appraisal of the preservation needs of collections and lead to the development of a less rigid approach to preservation. We believe that this is the best hope for long-term preservation of cultural heritage collections in Canada and elsewhere.

Endnotes

1. An ISOPERM is a line of constant deterioration for cellulosic materials on a graph of RH versus temperature. The term "ISOPERM" was coined by Donald Sebera of the Library of Congress, who was the first to adopt this approach. Note that different authors may use other names for the same concept.

2. The ASHRAE standards are described in detail on CCI's Web site (www.cci-icc.gc.ca/crc/articles/enviro/index-eng.aspx).

Conservation Challenges of Outdoor Collections

Debra Daly Hartin, Senior Conservator - Fine Arts, CCI
George Prytulak, Conservator - Preservation Services and Training, CCI

Outdoor collections such as murals and industrial artifacts present some of the greatest challenges in conservation. These artifacts are big, visible, and… vulnerable! They typically have no protection from high levels of ultraviolet radiation, drenching rains, severe winds, freeze/thaw cycles, periods of neglect, and all sorts of vandalism. However, as vulnerable as they may be, there is still hope for their long-term preservation.

Outdoor Murals

Debra Daly Hartin

Well-executed and well-located murals can be truly meaningful; they can inform, inspire, entertain, and bring about a vibrant sense of community. However, a mural that deteriorates prematurely, or is damaged or vandalized, will not promote the positive values it was meant to inspire. In fact, creating the mural could be a waste of money and effort, and might even create a disregard or disrespect for public art and the conservation of cultural property in general.

The 21st century has seen a revival of outdoor mural programs. More large murals are being commissioned to revitalize communities, provide positive programs for youth and troubled neighborhoods, and promote tourism. The communities that spend funds and energy on these murals want to ensure they will remain in good condition. To achieve this goal, municipalities, industry, artists, and conservators are increasingly working together to address the problems of outdoor murals. CCI has been actively involved in this process, along with organizations such as Mural Routes, Inc.[1] and Rescue Public Murals.[2]

When Mural Routes, Inc. first approached CCI in 2000, we had been receiving an increasing number of enquiries about outdoor murals. Since that time, we have been involved in various initiatives and given numerous presentations at conferences and workshops.[3] Two important documents have grown out of this work: a template for a condition report and inspection record[4] to help with routine inspections of murals and *Conservation Guidelines for Outdoor Murals*[5] to help in the creation of durable murals.

Side Launch *by John Hood and Alexandra Hood, Town of Collingwood mural, 2000; Collingwood, Ontario. (Artists' acrylic paints on medium density overlaid plywood panels and extruded polystyrene additions.)*

The recommendations in *Conservation Guidelines for Outdoor Murals* emphasize the importance of collaboration and forethought right from the initial planning phase of a mural project. Detailed information is provided on issues affecting the longevity and durability of the mural, including information on supports, surface preparation, paint media, and surface coatings, as well as guidelines for maintenance strategies.

Sample recommendations include:

- In the planning phase, consult with community members and seek experts to advise on the many factors (including location, primary support, materials, technique, installation, maintenance) that will influence longevity of the mural.
- Ensure the stability of the wall and the suitability of the site; these are critical to the longevity of the mural. For example, if a wall is the primary support for the mural, it must be inspected to verify that it does not have a moisture problem. In addition, the proposed site must

be assessed in terms of its use, maintenance activities, proximity to traffic, and environmental conditions.

- Use materials and installation methods that are durable, and keep written and photographic records. Whatever media are used, obtain technical information and advice from the manufacturer(s). The experience and advice of other mural communities and mural artists can also be sought. Documenting the procedures and materials used, as well as taking detailed photographs of the mural upon completion, will assist in future maintenance and treatment and will provide information on what is, or is not, durable.

- Plan and budget for maintenance — routine inspection, cleaning, minor repair, and site maintenance. This maintenance plan should include who is to be involved, what their roles and responsibilities will be, and how the work will be funded. A conservation policy should also be established to determine who will be consulted when more extensive treatment is required and how decisions regarding treatment will be made.

- Use signage and programs within the community to educate, inform, and thereby promote "ownership" and preservation of the mural within the community. Maintaining community awareness and "buy-in" is the first line of defence against vandalism and neglect.

Many mural programs now address the maintenance and conservation of their outdoor "collections". Through collaboration and networking, CCI will continue to build an inventory of innovative best practices to help communities install durable murals and preserve those that have become community treasures. With forethought, planning, and ongoing care, a well-executed mural should last remarkably well.

Industrial Artifacts

George Prytulak

Most industrial artifacts are immense, heavy objects that can never be brought to CCI for in-house treatment. The expense of moving a 100-ton locomotive to Ottawa would be prohibitive and, even if by some miracle such a vehicle were to appear on CCI's doorstep, the facilities and staff required to carry out the restorative work would not be on hand.

Because in-house treatments are not a practical option, CCI offers its clients something of equal value: a site visit by an industrial conservator followed by a written report. The lengthy, illustrated report describes practical recommendations such as weatherproofing, repairs, and cleaning that, if implemented in a timely fashion, will prevent further damage and deterioration. The site visit also establishes an ongoing dialogue between the museum and the conservator. As the museum introduces the preventive measures and makes new discoveries on-site, the conservator allots a generous amount of time to the project in terms of personal e-mail and telephone advice.

CNR steam locomotive no. 1531
(Simcoe County Museum, Minesing, Ontario).

CNR business car "Acadia"
(Markham Village Museum, Markham, Ontario).

Site visits are a *raison d'être* for CCI's industrial conservator. They offer a welcome chance to leave the confines of the office and to connect with museum professionals as well as the incredible artifacts in their collections. What makes the task challenging is the fact that most industrial objects requiring attention are located outdoors. This being Canada, the "window of opportunity" for travel is severely limited.

Museums are exceptionally busy with school-related programming in the spring and fall, so the most convenient time to visit is in the summer — precisely when most people plan their family vacation. And although

Centurion tank (The Military Museums, Calgary, Aberta).

Thousand Island Railway diesel locomotive no. 500 (City of Gananoque, Ontario).

making a site visit on a summer's day is a welcome and much-anticipated event, the excursion is far from relaxing when industrial artifacts are involved.

Take, for example, an artifact such as a steam locomotive, which is really an assemblage of dozens of sub-assemblies attached to a gigantic boiler on wheels. Many of the components are barely accessible and they are further complicated by still more internal sub-assemblies. There are far too many details to take in during the course of a two-day site visit! Accordingly, the conservator must rely on a photographic record to capture as much information as possible in the time available. This means taking pictures — hundreds, if not thousands — for later reference while compiling the report. The photos are also indispensable when discussing the artifact with the client during the long winter months.

Ironically, summer provides the worst possible lighting conditions for taking pictures of outdoor industrial artifacts. Clear blue skies and 12 hours of bright, direct sunshine are wonderful from the perspective of a hammock at the cottage or a reclining chair at the beach, but the sun just brings extra hardship for a conservator-photographer climbing on a black locomotive (with surfaces as hot as a skillet). Only high-contrast photographs are possible: areas in direct sunlight will be overexposed and washed-out, while shadowed areas will be underexposed and overly dark. "Photoshopping" the images can reduce the contrast to some degree, but the results will never be as good as images taken with the diffused light that occurs on cloudy or lightly overcast days. For the industrial conservator, every cloud really does have a silver lining.

Site visits and the remedial measures they generate can go a long way in preserving industrial artifacts, but they are most effective when they are introduced early in the game — ideally within a year of the object being decommissioned and placed outdoors.

In the meantime...

Many museums and heritage sites can slow down the deterioration of their outdoor collections with remedial measures and regular maintenance (see CCI Notes 15/8 *Outdoor Storage and Display: Basic Principles* and 15/9 *Outdoor Storage and Display: Remedial Measures*[6]).

The first step is to establish priorities. Determine which materials and components are most at risk on a case-by-case basis and target these for remedial measures as funding and labour become available.

Industrial artifacts outdoors are attacked by many forces. Some, such as fire and vandalism, are catastrophic events while others, such as rot and corrosion, are slow and steady processes. Because fire and vandals can do more damage in one hour than neglect can do in 20 years, fire prevention and security will likely be high priorities. When these threats have been addressed, the remaining problems will be water, direct sunlight, and pests such as insects, birds, and rodents.

Protecting outdoor industrial collections often requires pro-active intervention with materials that can detract from the appearance of the artifacts. The demands of maintenance and monitoring also tie up staff and tax the resources of the museum or interpretive site. Much labour, expense, and permanent damage can be avoided by bringing the artifacts indoors. This should be the ultimate goal.

Bay City power shovel (Keno Mining Museum, Keno, Yukon).

Endnotes

1. A not-for-profit charitable organization, Mural Routes, Inc. (www.muralroutes.com) is the hub of a network of Canadian mural communities that promotes and facilitates the creation of public art murals across the country.

2. In the United States, Rescue Public Murals (www.heritagepreservation.org/RPM) is securing the expertise and support to document and save their significant community murals.

3. I made presentations at three annual symposia of Mural Routes, Inc.: *Conservation Issues Relating to Outdoor Murals* (4th Annual Symposium, Welland, Ontario, 2000); *A Condition Report Form for Outdoor Murals – Working Together to Build our Knowledge* (6th Annual Symposium, Ottawa, Ontario, 2002); and *Conservation Guidelines for Outdoor Murals* (11th Annual Symposium, Toronto, Ontario, 2008). I also presented *Building a Resource Network for Outdoor Murals* at the Canadian Association for Conservation (CAC) workshop "Care and Preservation of Art and Artifacts in Public Places" (Kingston, Ontario, 2002) and co-presented (with George Prytulak) at the Creative Cities Pre-conference workshop "Conservation of Public Art and the Conservation of Outdoor Murals" (Regina, Saskatchewan, 2004). In addition, I have co-presented CCI workshops that included information on outdoor murals to artists.

4. This template is available on the CCI Web site (www.cci-icc.gc.ca/crc/articles/murals/conditionreport_e.pdf).

5. These guidelines will be available on the CCI Web site in 2010.

6. These CCI Notes are scheduled for release in early 2010.

Using Conservation Science to Shed Light on the Past:
CCI's Examination of the Kwäday Dän Ts' ìnchi Knife

Kate Helwig, Senior Conservation Scientist, CCI

The scientific examination of cultural objects can make an important contribution to our collective understanding of the past. This was the case when CCI examined a centuries-old hand tool. The information gained was added to the growing body of knowledge about the life of its owner, an Aboriginal man whose frozen remains were found in the Canadian North.

The story begins in August 1999, when three teachers on a sheep hunting expedition found the body of a young man melting out of a glacier in the Tatshenshini-Alsek Park — an area in the traditional territory of the Champagne and Aishihik First Nations (CAFN) that is now part of northwestern British Columbia. His clothing and belongings suggested that he was an Aboriginal man from an earlier time. The hunters recognized the significance of their find and immediately hiked out of the park and reported their discovery to authorities in Whitehorse.

The CAFN and the Government of British Columbia co-managed the recovery and research efforts, with the Elders and members of the CAFN taking on a leadership role in shaping appropriate procedures. They named the discovery Kwäday Dän Ts'ìnchi (which means "Long Ago Person Found" in the Southern Tutchone language) and agreed that it was important to find out more about the man before he could be properly buried.

Since then, a group of Aboriginal people, archaeologists, scientists, conservators, and other researchers have been trying to answer questions about the man found in the glacier: When did he die? Where did he come from? How did he spend his final days? What did he take with him on his last trip?

A symposium at the end of April 2008 brought the researchers and Aboriginal people involved in the project together for the first time to share what they had learned. The level of respect, collaboration, and the blending of scientific and traditional perspectives made the symposium a remarkable event. CCI presented our small piece of the larger picture that has emerged of the young man and his final voyage.

Forensic examination revealed that the man had been only about 18 or 19 years old when he lost his life (Straathof et al. 2008[1]). Radiocarbon dating and isotopic analysis showed that he had died some 150–300 years ago (Richards et al. 2008). Biomolecular studies indicated that he had likely been travelling from the coast to the interior (Dickson et al. 2008). In a very moving presentation, Chief Diane Strand and Sheila Greer of the CAFN, along with Karen Mooder (currently at the British Columbia Institute of Technology), revealed that, thanks to mitochondrial DNA studies, living relatives of the man had been located in the Yukon, northern British Columbia, and Alaska (Strand et al. 2008).

The young man had several objects with him on his last journey. His gopher skin robe was studied and conserved by the Royal British Columbia Museum (Mackie 2008) and his spruce root hat by the Government of Yukon, Heritage Branch (Monahan 2008). A hand tool (shown in Figure 1) was examined and conserved at CCI.

The hand tool is a composite object, consisting of a metal blade hafted to a wooden shaft. It was found inside a leather sheath, on top of the gopher skin

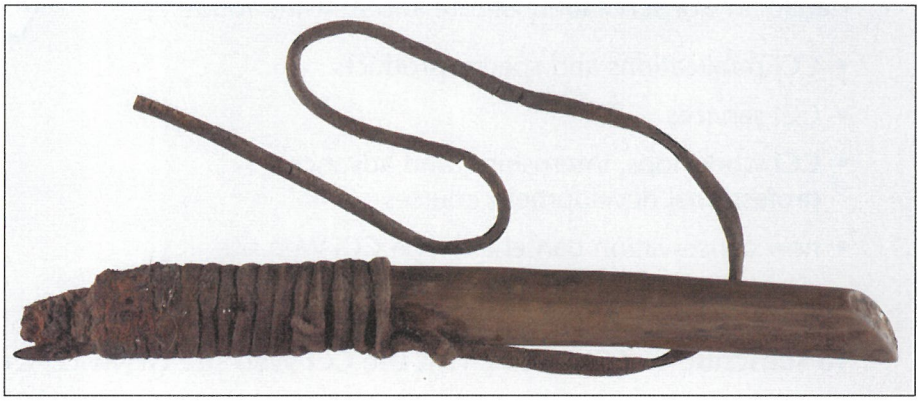


Figure 1. Kwäday Dän Ts'ìnchi knife, before treatment.

robe, which was directly associated with the body. Radiocarbon dating of the wooden handle gave an approximate date of AD 1730–1780 (Richards et al. 2008), which falls in the range of the most probable date for Kwäday Dän Ts'ìnchi. The appearance of the hand tool is similar to Tlingit knives collected from several locations in Alaska in the early 20th century, and indicates that the object is very likely a knife (Greer et al. 2008).

CCI's scientific examination had two main objectives: to provide information about the materials and construction of the object; and to provide information about its current state of preservation. The goal of the conservation treatment was to stabilize the hand tool and remove some of the disfiguring corrosion that obscured important features related to its construction.

Both the metal and organic components of the knife were studied using X-radiography. Because the thickness and chemical composition of materials affect the way they absorb X-rays, X-radiography can show the internal structure of an object. X-radiographs were taken in two orientations: with the blade flat (Figure 2) and with the blade turned by 90° so that it was edge-on (Figure 3). On the basis of the X-radiographs and close visual examination, we determined that the metal blade was held in an asymmetrical, open-sided slot in the wooden handle. It was stabilized within the slot by hide lashing and an organic backing piece wedged between the wood and the lashing. The off-centre hafting suggested that the slot may have been formed by placing the blade on one side of the handle and lashing a small, secondary piece of wood on top of it.

The corroded iron blade was very fragile and had split into at least three layers that were separating. Because the blade was so corroded, we could not determine what its original length or shape would have been. It may have had a blunt end, as it appears now, or it may have had a pointed tip that had broken off. The X-radiographs indicated that the blade was highly corroded and that there was likely no intact metal inside the wooden handle. The corrosion products found on the knife (goethite, lepidocrocite, magnetite, siderite, and vivianite) are consistent with the object having been in a low oxygen environment under the ice and snow and subsequently melting out. The fact that there was complete corrosion of the metal inside the handle might have been due to "crevice corrosion" (a mechanism whereby corrosion is accelerated in protected areas).

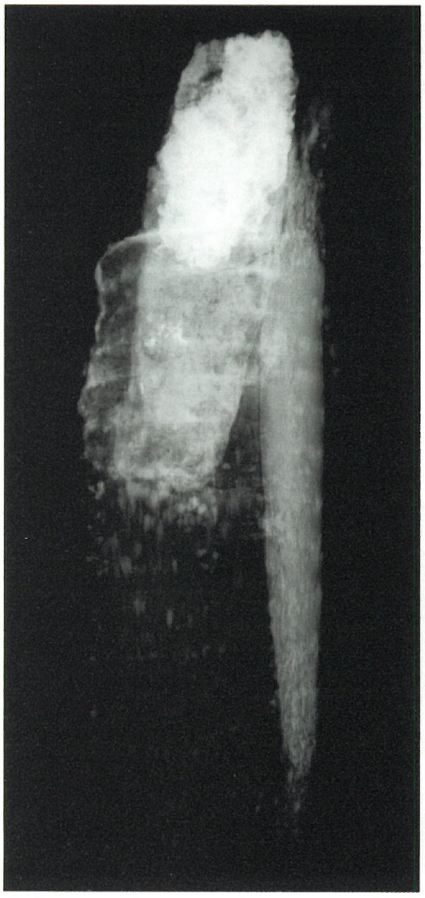


Figure 2. X-radiograph of the knife blade (with the blade parallel to the image plane).

Figure 3. X-radiograph of the knife blade (with the blade perpendicular to the image plane).

Given the likely date of the knife (AD 1730–1780), the blade was probably made from wrought iron or steel, obtained from one of several possible sources. However, it could also have been made from naturally occurring iron from a meteorite. When our analysis of the corroded metal from the blade showed that it contained less than 1% nickel, we concluded that it was from a non-meteoritic source. Because of the high level of corrosion, there was little metallographic microstructure remaining.

Study of the tapered, organic backing piece, wedged between the wood and the lashing, revealed that it was made of partially de-mineralized bone or antler. Bone and antler are composed of a calcium phosphate compound (hydroxylapatite) in an organic framework of collagen. We determined that much of the hydroxylapatite had dissolved from the backing piece and been replaced with vivianite (an iron phosphate), due to the presence of a high concentration of iron from the corroding iron blade.

Our information about the materials used and construction technology of the knife is just one small part of the growing body of knowledge about the young man who died on a glacier so many years ago. For more information about the project, including the availability of a book that describes all the research that has been undertaken, visit the Kwäday Dän Ts'ìnchi Symposium Web site (www.kdtsymposium.bc.ca).

Further Reading

Dickson, J.H., M.J. Richards, R.J. Hebda, P.J. Mudie, O. Beattie, S. Ramsay, N.J. Turner, B.J. Leighton, J.M. Webster, N. Hobischak, G.S. Anderson, P.M. Troffe, and R.J. Wigen. "Kwäday Dän Ts'ìnchi, the First Ancient Body of a Man from a North American Glacier: Reconstructing his Last Days by Intestinal and Biomolecular Analyses." *The Holocene* 14, 4 (2004), pp. 481–486.

Mackie, K. "Long Ago Person Found — An Ancient Robe Tells A New Story." pp. 35–46 in *Recovering the Past: The Conservation of Archaeological and Ethnographic Textiles: Preprints* (compiled by E. Cortes and S. Thomassen-Krauss). Mexico City: North American Textile Conservation Conference, 2005.

Richards, M.P., S. Greer, L.T. Corr, O. Beattie, A. Mackie, R.P. Evershed, A. von Finster, and J. Southon. "Radiocarbon Dating and Dietary Stable Isotope Analysis of Kwaday Dan Ts'inchi." *American Antiquity* 72 (2007), pp. 719–734.

Endnote

1. All references cited in this article are conference abstracts from the Kwäday Dän Ts'ìnchi Symposium, Victoria, BC, April 2008. They can be found on the symposium Web site (www.kdtsymposium.bc.ca/ Content_Files/ Files/kdts/ Authors_abstracts_ current_ready_April23.pdf).

CCI Learning Opportunities

CCI provides unique and specialized learning opportunities that respond to the growing need for collections care and conservation training. Our conservators and scientists work together to provide both general and highly advanced training on a wide range of topics. All workshops and advanced professional development courses are flexible and take a multidisciplinary approach to learning.

Workshops

CCI delivers workshops in cooperation with Canadian host organizations. Enrollment is restricted to Canadians but not limited to the membership of the host organizations. The Workshop Calendar is available on the CCI Web site, and is updated regularly as new events are scheduled.

Advanced Professional Development

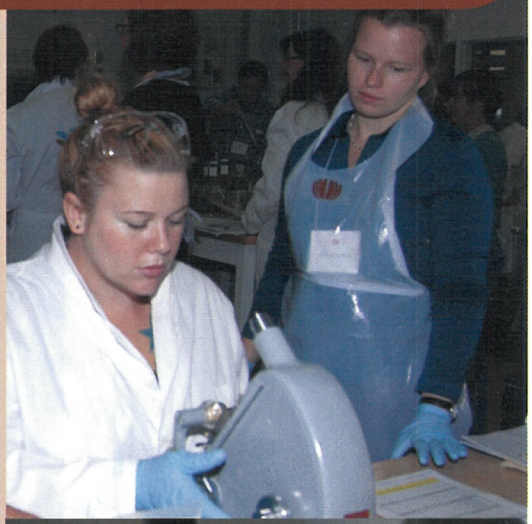
CCI also offers advanced professional development courses for conservation professionals working in the Canadian or international heritage community.

Topics for 2010 include:

The Conservation of Feathers: An Introductory Workshop (June 7 – 9, 2010), presented in Ottawa, Ontario in partnership with the Canadian Association for the Conservation of Cultural Property 36th Annual Conference

Identification and Care of Plastics in Museum Collections (June 8 – 9, 2010), presented in Ottawa, Ontario in partnership with the Canada Science and Technology Museum and the Canadian Association for the Conservation of Cultural Property 36th Annual Conference

For more information on CCI Learning Opportunities, visit the CCI Web site (www.cci-icc.gc.ca).



Overcoming a Conservation Challenge Through Collaboration:

Treating a Suite of Upholstered Furniture

Jan Vuori, Senior Conservator - Textiles, CCI

Upon occasion CCI is asked to carry out a treatment that requires expertise outside of our knowledge and experience. These requests provide an opportunity for our staff to collaborate with other conservation professionals, to the benefit of everyone involved. Our staff can develop new skills that further the range of treatment services we offer to clients, and the visiting professionals can learn from our experts. Just such a situation arose when the Ontario Heritage Trust asked CCI to treat a suite of furniture from Fulford Place, a historic house museum in Brockville, Ontario.

Fulford Place is a Beaux Arts style mansion, built between 1899 and 1901, that is filled with items collected during the owner's world travels. Documentary evidence indicates that the aforementioned suite of furniture — a settee, a chair, and a stool — was purchased before 1911. All three pieces are covered with a red wool fabric decorated with figures and motifs reminiscent of ancient Egyptian wall paintings. These are appliquéd in cotton with couched metal thread details. The types of wood in the frames, as well as the construction and stylistic details, all suggest an Egyptian source of manufacture.

When CCI conservators examined the furniture, we found no evidence that it had ever been repaired or restored. The carved and inlaid wood frames were dirty and some of the inlays were loose. The cover fabrics of the armchair and stool were in fairly good condition, with varying degrees of loss from the appliqués, but the settee seat cover was severely disfigured. At some time in the past, an overhead leak had caused wet plaster to drop onto it. The water had spread out from the plaster and caused the red dye to bleed into much of the appliqué. There was also a prominent brown/bleached area on the centre front. The under-upholstery of the furniture consisted of layers of fibrous fillings, sagging jute webbing, and decompressed coiled metal springs.

Upholstery conservator Nancy Britton (from the Metropolitain Museum of Art, New York) examines the Egyptian Revival settee.

Our furniture conservators were well able to treat the wooden frames. Similarly, our textile conservators were confident we could develop a treatment to improve the appearance of the cover fabrics. But what of the complex structure beneath the surface? To deal with this meant venturing into the realm of upholstery conservation, a highly specialized discipline with which we were not familiar.

Upholstery conservation requires a broad knowledge of many materials including textiles, metal, wood, leather, etc. Also necessary is a detailed understanding of how these materials were used, over time and place, to create the complex three-dimensional structures that make up upholstered seat furniture. And perhaps most important is an up-to-date knowledge of how the ethics, principles, and practices of this specialization have evolved over time.

Upholstery conservation is relatively young compared to other conservation disciplines. Before the 1970s, there was little interest in preserving original layers of under-upholstery. In fact, it was normal practice for museums to send upholstered seat furniture to a commercial upholsterer, which often resulted in the piece being stripped down to its frame and rebuilt with modern materials and methods. However, the approach has shifted over time and minimal

intervention has become the guiding principle. It is now essential to document the conservation process and preserve as much original material and construction as possible. To respect these needs while restoring the outward appearance, low-intervention methods continue to be developed.

Recognizing our lack of expertise in upholstery conservation, we approached Nancy Britton, Upholstery Conservator at the Metropolitan Museum of Art, New York to see if she might collaborate on this element of our treatment project. Nancy is an upholstery conservator with many years of experience and numerous publications to her credit. With the support of Lawrence Becker, Conservator-in-Charge at the Sherman Fairchild Center for Objects Conservation at the Metropolitan Museum of Art, Nancy came to CCI from March 31 to April 4, 2008.

CCI conservation scientist Season Tse (left) looks on as upholstery conservator Nancy Britton tries out the CCI textile suction disk.

As Nancy worked with our staff to design a low-intervention treatment plan for the under-upholstery, her professional experience, technical skill, scholarship, enthusiasm, and innate teaching ability made the week fly by. Our staff and interns all benefitted from her hands-on training, discussions, and informal presentations. Nancy also benefitted — learning some new techniques for stain removal and aesthetic reintegration that our textile conservators had developed for this treatment. Having gained first-hand knowledge of the furniture, Nancy was able to continue providing advice via e-mail and telephone even after her return to New York.

The results of this consultation process could not have been more positive, and demonstrate the advantages of building strong professional networks in Canada and internationally. Not only has this suite of Egyptian Revival furniture been restored so that Fulford Place can display it, but CCI has gained a sense of the resources needed to evaluate and undertake low-intervention upholstery conservation. This new area of expertise can now be implemented in other treatments and will allow us to expand the range of services and training we provide to our museum clients. It will also be passed on to others.[1]

Endnote

1. Two papers on the new methods and materials were prepared for the 7th North American Textile Conservation Conference (Quebec City, Quebec, September 30 – October 3, 2009), and the details of the consultation process itself were presented at the 35th Annual Conference of the Canadian Association for Conservation (Vancouver, British Columbia, May 29–31, 2009).

A New Tool for Collections Preservation: The Micro-fade Tester

Judith Bannerman, Visiting Fellow, CCI

The micro-fade tester is a relatively new tool for determining the fading properties of works of art, historical objects, collections, etc. As such, it has the potential to assist curators in solving lighting issues, developing display regimes, and establishing storage rotations. This fits in well with CCI's current approach to environmental guidelines, i.e. using risk assessment to ascertain the actual needs of objects rather than adhering strictly to an arbitrary environmental standard.

CCI has been using a micro-fade tester together with our light damage calculator to examine how objects fade over time. The objects that have been tested include dyed porcupine quills, silks, glass beads, dyed cotton, war medals, reel-to-reel tape, vellum, ink, oil paintings, black-and-white photographs, a silk flag, a variety of wood samples with dyed veneers, and plastics.

Figure 1. CCI Visiting Fellow Judith Bannerman uses the micro-fade tester on a silk Canadian flag.

What is a Micro-fade Tester?

A micro-fade tester is a tool that allows the user to carry out accelerated light-aging tests (see Figure 1). The procedure is very rapid and almost non-destructive — it is normally done directly on an artifact and does not require sample removal. The device sends a very intense beam of light to a test area that is 0.3 mm in diameter, and monitors the intensity and spectrum of the reflected light. The reflected light data is collected every 30 seconds over a 10-minute period, yielding continuous measurements of the fading of fugitive colours. The reflectance spectrum is recorded and the fading rate is then compared to ISO Blue Wool Standard cards.[1]

How is Colour Change Measured?

Colour change is monitored by three parameters: **L***, **a***, and **b***.

- **L* is an indication of the total reflected light, and the values produced can illustrate bleaching (decreasing values) or darkening (increasing values)**

  Examples: When we used the micro-fade machine to test porcupine quills dyed orange, the L* value decreased indicating that the quills were bleached by exposure to the intense beam of light. In contrast, when photographs were tested, the L* value increased as the surfaces gradually became darker.

- **a* is indicative of the red–green colour space, with positive values indicating red and negative values indicating green**

  Examples: When we tested the porcupine quills dyed orange (a combination of yellow–red), the a* value was positive, increased over the 10 minutes of exposure, and the quills appeared to be more red. This indicates that the yellow dye was more fugitive than the red, and as the yellow faded it allowed the red to predominate. A test of porcupine quills dyed purple (a mixture of red–blue) also produced a positive a* value, but in this case it decreased over the 10 minutes of exposure and the quills became less red (more blue). The explanation here is that the red dye was more fugitive than the blue, and as the red faded it allowed the blue to predominate.

- **b* is indicative of the yellow–blue colour space, with positive values indicating yellow and negative values indicating blue**

Examples: Most objects have yellowish oxidation layers, waxes, or oils on their surfaces, or actually have yellow dyes and pigments incorporated into them. These typically become more or less yellow when exposed to light, and the change is easily monitored by the micro-fade tester.

An oil painting with a yellow varnish layer showed a distinct decrease in the yellow on exposure to the light beam from the micro-fade tester. A reduction in yellow was also seen in other objects such as black-and-white photographs, where the change could be due to the bleaching of the chemical layer on the surface or simply be part of the aging process of the photograph as a whole.

Once individual colour changes have been examined, the next step is to plot the spectra of reflected light from 400 nm (violet) to 700 nm (red). By comparing plots from different exposure times, it is possible to see the effects of continued light exposure over a period of time. For example, Figure 2 shows a plot of the spectra for a red-dyed porcupine quill after 1 minute of exposure (pink trace) and after 10 minutes of exposure (yellow trace). From this it can be seen that continued light exposure produced losses in the purple–blue region and in the yellow–orange and red regions, but little or no change in the green region.

Colour change can also be discussed in terms of a fourth parameter — **Delta E*** (the colour difference). Comparing the Delta E* values gathered from a fugitive colour with the Delta E* values for the Blue Wool #1, #2, #3, and #4 equivalent fade rates provides a quantitative indication

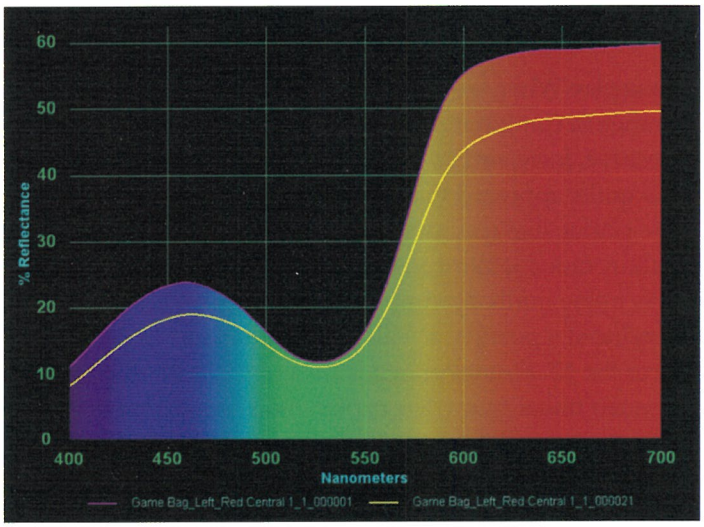


Figure 2. Comparison of the colour spectra of a red-dyed porcupine quill after 1 minute of exposure to the micro-fade light beam (pink trace) and after 10 minutes of exposure (yellow trace).

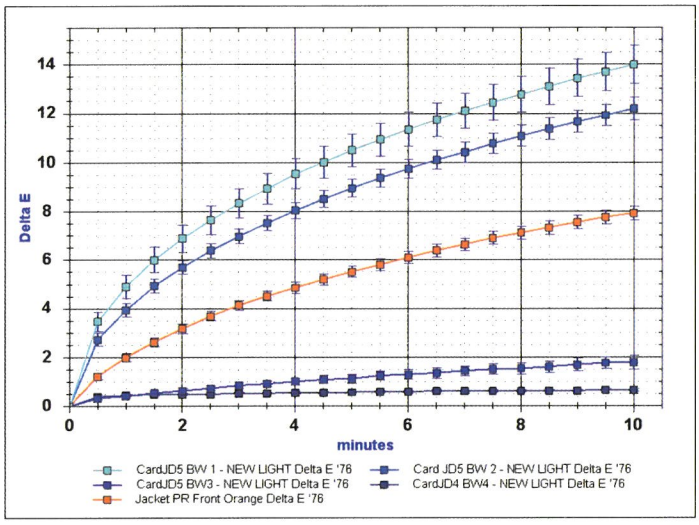


Figure 3. Comparison of an orange-dyed porcupine quill with Blue Wool #1, #2, #3, and #4.

of how fugitive that colour is. This is demonstrated in Figure 3, where it can be seen that the sensitivity of the orange-dyed porcupine quill (orange curve) lies between Blue Wool #2 and #3 (blue curves), which are both fairly fugitive dyes. Therefore, it can be concluded that the orange dye in the quill is also relatively fugitive.

Delta E* can also be used in CCI's light damage calculator to determine the response of a colour over time under specific lighting conditions. For example, if a dyed porcupine quill is analysed using the museum constraints of 80–100 lux exposure for 8 hours a day, 6 days a week, for 313 days a year, the resulting data can be used to generate the expected colour change in 100 years (Figures 4 and 5).

Conclusion

The micro-fade tester could well become the tool of choice for museum conservators and others to identify fugitive dyes, paints, and pigments on historical objects. It can also be helpful in deciding when to remove old varnish layers and when to preserve them. The only drawback at this point is that the testing must be conducted in a conservation laboratory. The next challenge will be to make the tool portable enough that it can be used on-site in the museum.

Endnote

1. The ISO Blue Wool Standard is a universal guide for determining fading rates, and is the common way of measuring light dosage in museums. Each Blue Wool dye has a specific rate of fading ranging from Blue Wool #1 (extremely fugitive dye) to Blue Wool #10 (very stable dye that is insensitive to light exposure).

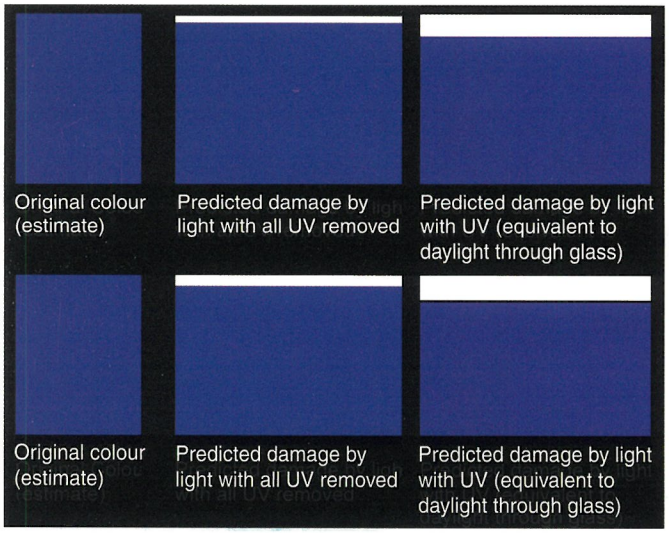


Figure 4. This chart shows the predicted damage of a colour equivalent to Blue Wool #4 after 100 years of exposure to 80 lux (top) and 100 lux (bottom) with UV light removed and with UV light present.

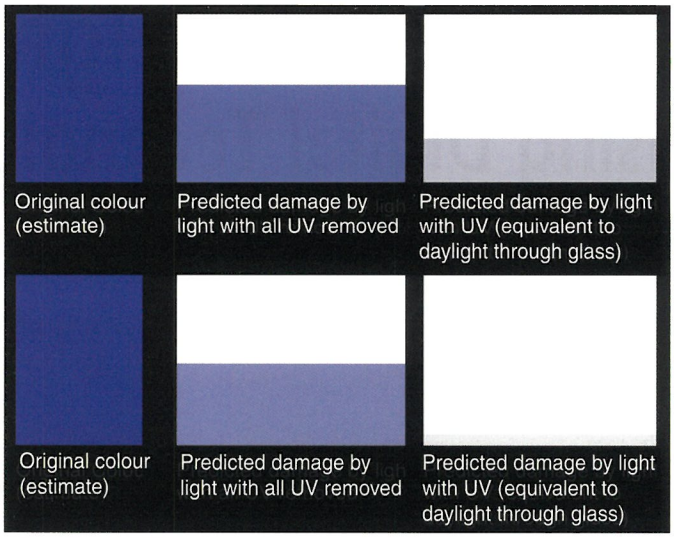


Figure 5. This chart shows the predicted damage of a colour equivalent to Blue Wool #2 after 100 years of exposure to 80 lux (top) and 100 lux (bottom) with UV light removed and with UV light present.

CCI Symposium 2011

Adhesives and Consolidants for Conservation: Research and Applications

SYMPOSIUM 2011

Adhésifs et consolidants pour la conservation : Recherche et applications

October 17 to 22 – Du 17 au 22 octobre

OTTAWA, CANADA

presented by
the Canadian Conservation Institute
in partnership with
Library and Archives Canada

Adhesives and consolidants are an important component of almost every conservation treatment. Symposium 2011 will bring together scientists and conservators from around the world to share their practical and theoretical knowledge about the use of adhesives and consolidants in all areas of conservation. The program will include a mix of lectures, posters, tours, and workshops, and will provide ample opportunity for stimulating discussions. The research and applications discussed at the symposium will help participants to make informed choices of adhesives and consolidants.

Call for Papers

CCI will issue the call for papers for Symposium 2011 in the spring of 2010, with abstracts due by the end of August. Submissions will be solicited on topics such as:

- the suitability of various adhesives and consolidants
- new products, techniques and/or treatments
- adhesive–substrate interactions
- traditional adhesives
- joint design
- adhesive removal
- uniquely Canadian applications

Those accepted will be notified in early October 2010 and will be required to submit the text of their papers in January 2011. Conference proceedings will be available to participants.

Additional Information

Information regarding Symposium 2011 will be posted on the CCI Web site (www.cci-icc.gc.ca) as it becomes available. For detailed questions on the content of the symposium, please contact Jane Down:
E-mail: jane.down@pch.gc.ca
Tel.: 613-998-3721 ext. 160
1-866-998-3721 ext. 160 (toll-free in Canada)

To receive updates on Symposium 2011, subscribe to *CCI e-News* (www.cci-icc.gc.ca).

Let There Be Light:
Using Digital Technology to Aid Conservation Examination

Christine McNair, Conservation Intern – Works on Paper, CCI

Joining an ancient scribal tradition of the Middle Ages with a modern digital method of recording information may seem unusual. However, this is exactly what happened when CCI was called upon to examine a 16th-century liturgical manuscript — the Salzinnes Antiphonal. As documentation proceeded on this large and complex artifact, a database was created to manage the recorded information. The database became an indispensable tool in assessing the condition of the antiphonal and its need for conservation treatment.

An antiphonal is a large book, usually displayed on a lectern, that contains the sung portion of the Roman Catholic Divine Office — a cycle of daily prayers performed by members of religious orders and clergy. The Salzinnes Antiphonal records musical notations on an impressive scale. Perhaps equally impressive were the number of notes required to detail its condition, treatment recommendations, and the invaluable historic information revealed within the book's structure.

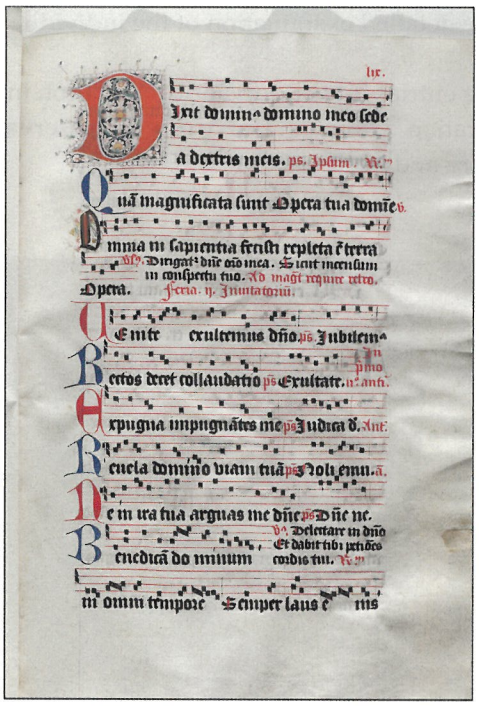
The detailed documentation of a complex artifact is always a time-consuming process. For the antiphonal, this involved recording the material composition, physical characteristics, and condition of each page, as well as any details relating to the creation of the manuscript itself, e.g. notations from one scribe to the next or corrections in the musical score. Such detailed multi-page documentation has traditionally been recorded using either textual notes or hard copy checklists. While both are valid ways to track information, it can be difficult to pull out overall issues or concerns when faced with a bulk of non-searchable text.

CCI decided to try another approach to capture the vast amount of data generated by the examination of the antiphonal — a searchable database on a Lotus Notes platform. This database was developed by Jean Bisson (Manager of Information Systems at CCI) in collaboration with Sherry Guild (Paper Conservator at CCI), who designed the searchable data fields. Because it was essential that the criteria for description used consistent terms, many of the subject fields in the database were designed with check boxes or predetermined answers.

CCI conservation intern Christine McNair examines a page of the antiphonal under the microscope at the Library and Archives Canada Preservation Centre in Gatineau, Quebec.

Thanks to the generous support of Library and Archives Canada, the initial examination of the antiphonal and the first phase of its documentation were carried out at the Preservation Centre in Gatineau, Quebec (GPC). The collaboration with the conservators at the GPC was invaluable and brought the two institutions into a close working partnership. Each page of the antiphonal was carefully examined using the naked eye and the microscope, and all tears, stains, or accretions were recorded and graded according to severity.[1] The information gathered during this detailed page-by-page examination was entered into the database using a dedicated laptop computer. When the examination was finished, the database held a complete record of all documentation — in a very user-friendly format!

For example, because the database is searchable, it is possible to find information such as "How many leaves are creased?" almost instantaneously rather than having to search through a stack of textual notes. By simply entering the question in the search field, it can easily be determined that there are 106 leaves with creases. By further refining the question, additional information on how severe the creases are and whether they are causing issues for the manuscript is just as easy to obtain.



A page of the antiphonal with the musical score, a large elaborate initial, and several small azurite, vermillion, and foliated initials.

The database also makes it possible to query codicological information (i.e. the notations such as page numbers, quire numbers, catchwords, placement/colour of the initials, rubrications, and editor's corrections). This information is often difficult to access in a bound illuminated manuscript, but the antiphonal's notations are clearly visible. Taken individually, these notations might not provide a researcher with much information. However, when viewed collectively, they can offer unique insight into the production of the manuscript. The documentation of the antiphonal provided an opportunity to record these details.

A secondary database was created for documenting the quires. In this one, it is possible to record the thickness of the parchment leaves, the structure of the quires, and the sewing. There is also a special field to render a diagram of each quire's structure. This provides an overview of the book's sewing structure and physical construction.[2]

When the initial examination and documentation were completed, the antiphonal was transferred to the Paper Laboratory at CCI for the preparation of a full condition report including treatment recommendations for the client.

The Salzinnes Antiphonal

The Salzinnes Antiphonal belongs to the Rare Book Collection of the Patrick Power Library at Saint Mary's University in Halifax, Nova Scotia. As one of very few illuminated manuscripts held in a Canadian collection, it is an artifact of national significance.

The Salzinnes Antiphonal has likely been in Canada for more than 150 years. However, there was no significant research into it or its origins until Judy Dietz, former Curator of the Art Gallery of Nova Scotia, chose it as the subject for a Master's Thesis completed in 2006. As a result of her research, we have learned some details of the book's provenance.

This magnificent manuscript was created for the Abbey of Salzinnnes, a Cistercian convent near Namur, Belgium and may have been commissioned in celebration of the community's 350th anniversary in 1554–55.

The music and text are written in iron gall ink on parchment and the score lines are inked in vermillion. In addition to the liturgical music, the manuscript contains numerous red vermillion, blue azurite, and foliated initials (decorative plant designs in green, pink, and yellow) as well as historiated initials that show select scenes from the Bible or iconic images from a saint's hagiography.

Six vibrant full-page illuminations illustrate the *Adoration of the Magi*, the *Baptism of Christ*, the *Agony in the Garden of Gethsemane*, the *Resurrection of Christ and the Road to Emmaus*, the *Christ in His Majesty and the Assembly of Saints*, and the *Holy Kinship*. The illuminations include portraits of nuns who are identified by name (a very unusual feature). Although the Abbey of Salzinnes no longer exists, Judy Dietz was able to study the convent records and confirmed that the nuns portrayed were actually living in the region at the time of the book's creation.

This antiphonal was brought to Canada by Bishop William Walsh, the first Archbishop for the Catholic Diocese of Halifax, during the colonial enfranchisement of the Roman Catholic Church in the early 19th century. As such, it is an important source for research in Canada and embodies topics such as the history of books; illuminated manuscripts; political and religious studies; historic bookbinding structures; 16th-century art and music; religious orders; and (perhaps the most interesting to a modern perspective) the role of women in the 16th century.

Having the documentation in a searchable database is invaluable during this process — allowing conservators to provide specific information about the composition and condition of the antiphonal much more efficiently than if the documentation was in checklists or pure text.

This project demonstrates how technology can be used to survey a complex historic artifact, particularly when technological and conservation skills are paired. One caveat, though. Because of the transient nature of electronic information, it is important to create a hard copy of the documentation to ensure its long-term availability. For the antiphonal, a hard copy of the entire database is being provided to the client and a copy is being kept at CCI.

Endnotes

1. I did the detailed examination of the individual pages.

2. I did the entries for the quire documentation in collaboration with Lynn Curry (Book Conservator at Library and Archives Canada).

My Post-Graduate Internship at CCI: Invitations to Collaborate

Marie-Catherine Cyr, Conservation Intern – Fine Arts, CCI

Editor's Note: As part of its learning opportunities programming, CCI offers paid internships to recent Canadian graduates of conservation or science programs. These post-graduate internships provide full-time employment for a period of one year, and allow interns to participate in day-to-day lab activities as well as special projects such as publications, workshops, conferences, and information requests from clients. They serve as a bridge between academic studies and professional practice, and help to ensure that the heritage community has access to fully trained conservation specialists. A limited number of internships are offered each year, with the call for applications in the early spring.

CCI conservation intern Marie-Catherine Cyr removes varnish from Marcelle Ferron's Untitled *(1955).*

After graduating from the Master of Art Conservation program at Queen's University (Kingston, Ontario) in 2007, I was thrilled to join CCI's Fine Arts Laboratory as a conservation intern. Although I had gained experience working on paintings from a range of time periods and with a variety of media and supports, I was seeking an opportunity to carry out in-depth research to complement a conservation treatment. This is exactly the type of work done at CCI, where conservators and scientists are keen to support each other's work.

Collaboration is one of the program's strengths. Although my internship is in the Fine Arts Lab, I have had the opportunity to associate with other CCI conservation labs as well — working in tandem on particularly complex projects, observing important treatment steps being carried out, and receiving instruction on how to use certain tools and equipment. I have even been consulted on projects in other labs, allowing me to offer insight based on my own experience. CCI scientists have been equally generous in sharing their expertise with me, always being willing to analyse samples, explain the analytical process, and interpret the results. CCI scientific and conservation staff have also organized demonstrations and workshops (occasionally with the assistance of outside professionals) especially for the interns.

These presentations have covered a broad range of topics: use of a borescope; consolidation using an ultrasonic mister; 3D scanning and image processing; preparation of pigments used in medieval manuscript illuminations; mannequin-making; and packing and transportation of works of art to mention a few.

In addition to these collaborative activities, I have, of course, carried out treatments in the Fine Arts Lab. One project in particular has been the highlight of my internship, the treatment of a painting by Quebec artist Marcelle Ferron. I have a special interest in modern and contemporary art, and two paintings by Ferron that were awaiting treatment at CCI immediately caught my attention. Both had been created in the 1950s during her prolific "Paris Period" when she was defining her style and gaining international recognition. They showed different aspects of her methods and style, and exhibited unique conservation challenges. After some initial reading about Ferron and her materials, I realized that very little conservation-driven research was available about her works. One of the paintings — *Untitled*

(1955) — was a prime candidate for such a project, and CCI gave me the necessary support to carry it to completion.

This work of art is interesting from both art history and conservation perspectives. It is a small (44 cm by 52 cm) oil painting on canvas that is adhered to plywood. Ferron had attached the canvas to the board with an epoxy adhesive after she had begun painting, and then resumed applying the paint with both a palette knife and a brush in an abstract motif of blue, magenta, purple, green, and white strokes. *Untitled* shows the first signs of Ferron's later vivid and energetic compositions where the design is blurred around the perimeter and the negative space is occupied by white. It is also one of the few remaining examples of her use of plywood as an auxiliary support.

Untitled had come to CCI for treatment of the many "bumps" (deformations) of the paint and canvas, the latter having largely come away from the plywood board. In addition, the originally vibrant colours were obscured by a discontinuous yellowed varnish and assorted stains. The painting's owner (The Ottawa Art Gallery) had kept it in storage for more than 10 years due to its unstable condition, but now wanted to display it.

To design a treatment for this painting, I first wanted to understand the artist's techniques and motivations, identify her materials, and discern the conservation challenges associated with her work. To this end, I carried out historical research, held discussions with a gallery owner and Ferron's daughter, asked CCI's Analytical Research Laboratory to conduct analyses, consulted conservators outside CCI who were familiar with Ferron's paintings to learn more about the conditions that were common in her work, and above all, examined many of her other works.

The treatment procedure that my supervisor (fine arts conservator Wendy Baker) and I eventually decided upon preserved the artist's intent, her materials, and the visual characteristics of her technique. All original elements were retained. I began by constructing a handling frame to protect the painting. I next re-adhered the separated canvas to the board by drilling very small holes in the plywood to inject adhesive and then setting the canvas in place. I was able to reduce or eliminate the deformations of the canvas with an alternating series of moisture and heat treatments to the painted surface. Finally, I removed the visually disruptive yellowed coating and re-varnished the surface with a more stable coating.

The support of CCI conservators, scientists, and documentation staff was instrumental in obtaining the information I needed to design and carry out this conservation treatment. CCI also made it possible for me to present an account of this project at the 35th Annual Conference of the Canadian Association for Conservation (CAC) in Vancouver, British Columbia, in May 2009, and to write a paper that will be submitted to the *Journal of the CAC*. The most important and exciting outcome, however, is that this painting will once again be accessible to the public.

Needless to say, my internship has been very enriching on a professional level. However, I have learned just as much on a personal level. The genuine interest and passion of my colleagues for their work has been inspiring, and their doors have always been open to me. Finally, I would like to extend special thanks to Julie Stevenson (CCI's energetic Learning and Development Officer), who has made it a personal goal to ensure all interns enjoy a fun and rewarding experience at CCI.

Asking the Question: How Much Protection Do Flexible Arms and Slot Hoods Provide?

Michael Harrington, Manager, Preservation Services and Training, CCI

Upon completion of a massive renovation project on its main building in Ottawa, CCI faced an important question regarding the safety of the new and upgraded laboratory systems: Did the local exhaust systems (flexible arms and slot hoods) we had installed in the laboratories deliver enough protection for our staff to work safely with the solvents commonly used in conservation processes?

Flexible arms and slot hoods are both "source capture devices", i.e. they capture noxious fumes as the fumes are released. Flexible arms (referred to as "elephant trunks" or by the name of the manufacturer) can be found in conservation labs all over the world. They are typically used to pick up solvent fumes from cleaning, consolidation, and finish removal operations in cases where fume hoods are too small or impractical. Slot hoods are not nearly as common as flexible arms. However, following some innovative work done at the Parks Canada Ontario Service Centre in Ottawa, we decided to install some slot hoods in our labs. They have proven versatile at capturing fumes for specific operations.

When fume hoods are used for conservation work, they provide "containment", i.e. the entire object, the materials used, and any fumes generated are contained within the fume hood cabinet. Testing parameters for fume hoods are well established and continually upgraded, so it is possible to make sound assumptions about the level of protection fume hoods provide. However, no equivalent standards exist for flexible arms and slots hoods. To find out how effective these devices would be in our labs, we needed to pose a question most practitioners are reluctant to ask:

> What level of hazard, as expressed by the Threshold Limit Value (Occupational Exposure Limit) [TLV (OEL)] of the solvents and chemicals that we wanted to use, could flexible arms and slot hoods safely accommodate in our specific laboratory situation?

In our search for the answer, we consulted with experts across North America and worked closely with an industrial hygienist to examine the question, develop an appropriate testing protocol, design a training program on the correct usage of these devices, and deliver this training to all laboratory staff and interns at CCI. Our goal was to create general usage guidelines, based on the TLV (OEL) of the materials commonly employed by conservators, for the flexible arms and slot hoods in the CCI facility. We also wanted a procedure to determine if new chemicals and mixtures can be used safely with our lab systems.

To assess the exposure to airborne contaminants, we had staff members wear monitoring devices (battery-operated sampling pumps) while conducting conservation work

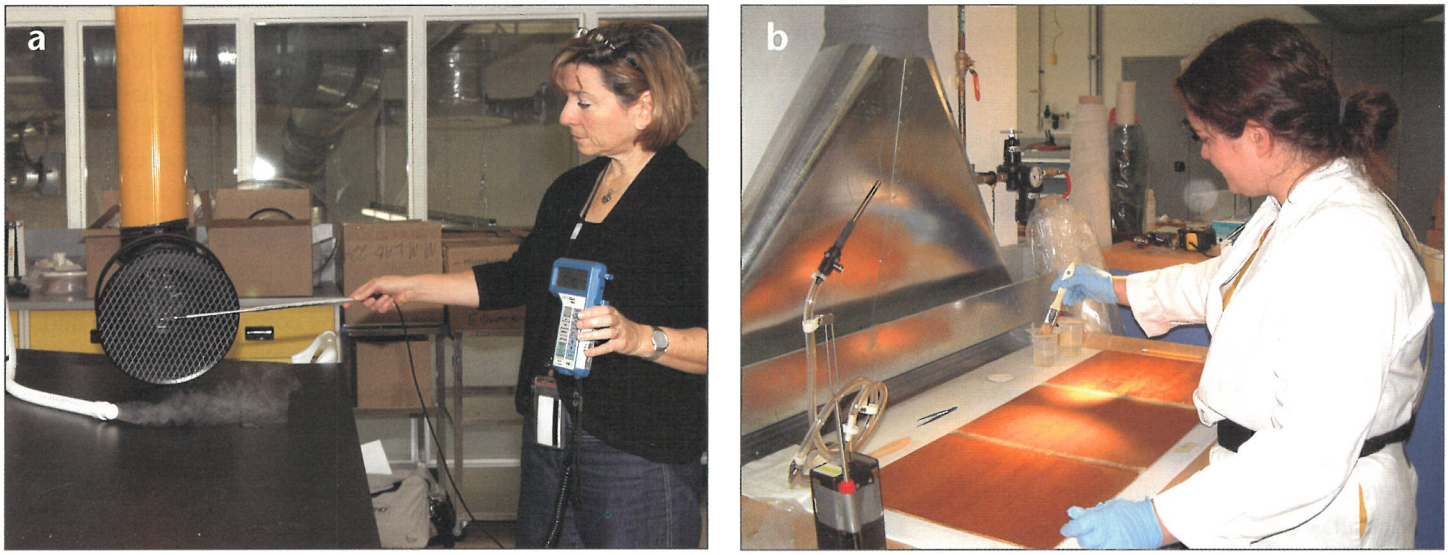
CCI conservation scientist Paul Marcon observes the airflow into a slot hood.

using the flexible arms and slot hoods. Twenty-eight tests were conducted, some under "normal practice" conditions and some under "reasonable worst-case" scenarios. The samples collected were subsequently analysed following established methods, and the results were combined with the volume of air sampled to give time-weighted averages for the chemicals tested. The findings were encouraging. The flexible arms and slot hoods proved to be very good at capturing solvent fumes if used appropriately.

Once we knew how effective these local exhaust systems were, we were able to design a training program for all staff on how to work with them and to broaden the range of solvents that can be used. A technique we developed to allow easy visualization of the airflow into the devices proved to be a powerful training tool. All CCI staff and interns now complete comprehensive training on the use of fume hoods, flexible arms, and slot hoods before they are authorized to undertake laboratory work.

As a result of all this effort, CCI has been able to set workable material toxicity levels. While staff continue to use the lowest-toxicity alternatives possible, they now know exactly when flexible arms or slot hoods can safely meet their extraction needs, and when the toxicity of the chemicals demands that the treatment or process be moved to a fume hood or spray booth. This knowledge will ensure they always have appropriate protection from the negative health effects of many common materials in conservation laboratories.

It is important to note that the exposure limits we have established are specific to CCI's laboratory systems. Other labs could have very different results. To determine safe levels for a particular lab, similar tests would have to be carried out in that facility.



Source capture devices in action. (a) CCI conservation scientist Jane Sirois measures the airflow in a flexible arm. (b) CCI conservation intern Amanda Salmon applies varnish to a sample board while monitors measure the effectiveness of this bench-mounted slot hood in capturing the fumes released.