DAWSON AND HIND

Conservation Issue

VOLUME 9
NUMBERS 2/3

DUGALD COSTUME COLLECTION

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Simon James Dawson was appointed by the Canadian Government in 1857 to explore the country from Lake Superior westward to the Saskatchwan. His report was among the first to attract attention to the possibilities of the North West as a home for settlers. He was later to build the Dawson Route from Lake-of-the-Woods to Winnipeg, Manitoba.

William George Richardson Hind accompanied his brother, Henry Youle Hind, as official artist, when the latter was in command of the Assiniboine and Saskatchewan exploration expedition of 1858. W. Hind revisited the North West in 1863-64 and painted numerous paintings of the people and general scenes.

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Cover photograph courtesy the Dugald Costume Collection

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AIMS OF THE ASSOCIATION

Object
The advancement of museum services in Manitoba by:

a) promoting the protection and preservation of objects, specimens, records and sites significant to the natural and human history of Manitoba.

b) aiding in the improvement of museums in their role as educational institutions

c) acting as a clearing-house for information of special interest to museums

d) promoting the exchange of exhibition material and the arrangement of exhibitions

e) co-operating with other associations with similar aims

f) other methods as may from time to time be deemed appropriate

Invitation to Membership
You are invited to join the Association of Manitoba Museum so as to take part in its activities and provide support for its projects.

Activities and Projects
A number of activities and projects are planned to help the AMM achieve its objectives. These include:

a) the publication of a regular newsletter and/or quarterly to discuss the activities of the museums, provide information on exhibits, and to distribute technical and curatorial information

b) a regularly updated list of museums in the Province, including their main fields of interest and a list of personnel

c) conducting training seminars aimed at discussing problems of organization, financing, managing and exhibitions at an introductory level

d) organizing travelling exhibits to tour Manitoba

e) the completion of a provincial inventory to assist in preserving our cultural heritage

MEMBERSHIP CLASSIFICATIONS

Individual Membership - open to any resident of Manitoba who wishes to promote the aims of the Association, whether or not he or she is connected with a museum. Annual fee - $3.00

Associate Membership - this includes institutions and individuals outside the Province of Manitoba who wish to promote the aims of the Association, whether or not such member is connected with a museum. Annual fee - $3.00

Institutional Membership - this is restricted to museums located within the Province of Manitoba. Annual membership fee is based on the museum's annual budget as follows:

Annual Budget		Membership Fee
100	1,000	$10.
1,001	20,000	15.
20,001	40,000	20.
40,001	80,000	25.
80,001	160,000	30.
160,001	320,000	35.
320,000+		40.

Further information may be obtained by writing to the Secretary-Treasurer, Association of Manitoba Museums, 190 Rupert Avenue, Winnipeg, Manitoba R3B ON2.

Editor's Forum

DIANE SKALENDA
Museums Advisor
Manitoba Museum of Man and Nature

Everyone in the museum community is concerned, or should be, with problems relating to the conservation of their collection. We decided to dedicate this issue to addressing a number of those concerns.

For those of you with problems unique to the care of large pieces of farm equipment, automobiles and locomotives, Murray Frost of the Canadian Conservation Institute has some good advice in his article entitled **The Care and Conservation of Machinery**. This paper is the result of Murray's presentation at the AMM Annual Seminar in the fall of 1979.

We are also pleased to have an article written by Mary-Lou Florian, a Conservator from the B.C. Provincial Museum, on **The Biodeterioration of Museum Objects: An Ecological Approach to Control and Prevention.** Miss Florian demonstrates that proper conservation methods can be employed by even the smallest museum with the most limited funds and resources.

Maurice Mann of the Manitoba Museum of Man and Nature shares with us a conservation exercise he performed on an artifact from the J.A. Victor David Museum in Killarney. **Killarney Tablet: A Case History** documents the process of removing white corrosion from a lead artifact.

The vastness of Manitoba creates problems unique to each region. Terry Patterson, in **Conservation for Manitoba Museums**, discusses how the climatic and geographic variations affect museums throughout Manitoba.

The Museum Technician Trainees at the Manitoba Museum of Man and Nature have their work cut out for them. One of the projects assigned to Susanne Sutherland last spring was to compile a list of supplies for conservation purposes. Working with the assistance of staff from the Parks Canada Artifact Workshop, and the Conservation Lab at the Manitoba Museum, Susanne came up with a fairly extensive list covering all aspects of conservation. This **Conservation Supplies List** contains products designed for basic conservation purposes. However, Susanne suggests that you follow the golden rule of conservation when you are uncertain about a procedure or product, that is *when in doubt—don't.*

What better way to grace the cover of a conservation issue than with a photograph from the marvellous **Dugald Costume Collection**? When the collection was first started in the early 1950's by the Dugald Women's Institute, its purpose was to model a few creations from the past. However, as the collection grew, the philosophy of those responsible for it changed. Today their prime concern is the preservation and restoration of the thousands of beautiful items in their care. The Dugald Fashion Review is still very much in demand. However, thanks to a Young Canada Works Programme grant, the costumes modelled in the Review are replicas produced by students from the School of Home Economics at the University of Manitoba. The original artifacts are in storage awaiting the establishment of the proposed Museum of Costume at Dugald.

Manitobans can be proud of this collection which is one of the finest of its kind in Canada. The dedication and hard work of this small group of women is finally receiving well-deserved recognition. In addition to the many accolades and support they have received nationally, the collection is gaining international recognition. It was recently announced that the Dugald Costume Collection is a 1980 recipient of a Certificate of Commendation from the American Association for State and Local History "for preserving an authentic segment of the social history of Manitoba". We extend our most sincere congratulations and wish them continued success.

B.D.S.

UPDATE:

La Maison Riel/Riel House

Marie Paule Robitaille has recently been named Director of the newly-opened "La Maison Riel/Riel House". This museum is managed and operated by the Societe Historique de St-Boniface, on contract to Parks Canada. It is presently open to the public with the Societe providing bilingual staff to communicate to visitors the cultural, social and economic lives of the Riel and Lagimodiere families in the Red River settlement during the 1880's. Furnishings of the period have been placed in the house and an outdoor visitor area constructed complete with signs detailing the history of the property. Riel House is situated at 330 River Road in Winnipeg.

Manitoba Museum of Man and Nature

The Hon. W.J. McKeag, Chairman of the Board, and Dr. H.D. Hemphill, Executive Director of the Manitoba Museum of Man and Nature, announce the appointment of Dr. Robert E. Wrigley as Museum Director. A Board member from 1978 to 1979, Dr. Wrigley has been Curator of Mammals and Birds at the Museum of Man and Nature for ten years and Chairman of the Natural History Division for the past year.

Plains Historical Museum, Regina

Janice L. Morier, a graduate of the Museum Technician Training Programme and formerly of the St. Boniface Museum, has been appointed Director/Curator of the Plains Historical Museum in Regina, Saskatchewan. Her appointment commenced on September 1st of this year.

Winnipeg Art Gallery Extension Services

The Extension Services of the Winnipeg Art Gallery has a wide selection of exhibitions of works of art which are available to museums for circulation. Information kits are available by writing or calling: Don DeGrow, Associate Curator, Extension Services, The Winnipeg Art Gallery, 300 Memorial Blvd., Winnipeg, Manitoba R3C 1V1, Telephone 786-6641, ext. 54.

Jewish Historical Society of Western Canada

The Jewish Historical Society is pleased to announce the publication of its book *Journey Into Our Heritage: The Story of the Jewish People in the Canadian West*. Written by Harry Gutkin and published by Lester and Orpen Dennys, this interesting chronicle is available at all book stores.

The Society also has available a multi-media education kit on Jewish Life and Culture in Manitoba. It can be obtained by contacting the Department of Education Instructional Media Services in Winnipeg or from the Jewish Historical Society offices.

The Selkirk Avenue Project is an oral history project of the Jewish Historical Society. By interviewing people who lived on Selkirk Avenue in Winnipeg prior to the 1950's, or descendents of those people, the Society hopes to document the life and times of the Jewish north end.

For further information contact the Jewish Historical Society, 402-365 Hargrave Street, Winnipeg, Manitoba—942-4822.

J.A. Victor David Museum

This year the J.A. Victor David Museum opened two new exhibits. They converted two rooms of the museum—one into a General Store, circa 1925 and the other into a Child's Bedroom. The general store contains such items as a cash register, weigh scales, cheese and tobacco cutters; as well as a display of old jars, tins and bottles. Some items from the old post office are also included. The child's bedroom features a crib, high chair, rocking horse, tricycle, and assorted books and toys.

Mennonite Heritage Centre

A new display of heritage photos and artifacts has been placed in the display and mezzanine sections of the Centre. The items relate to Mennonite themes of life and thought. Major contributors are Otto Klassen, a Winnipeg film maker, along with Gerald and Ken Loewen, photographers and graphic artists.

The Centre is open to the public Monday to Friday, 8:30 a.m. to 5 p.m. Admission is free.

Manitoba Agricultural Museum

Manitoba Agricultural Museum: 25 Years of Progress, published in 1979 by the museum at Austin, has travelled around the world. Copies have been sold in England, Australia, the United States and throughout Canada.

The book profiles the Manitoba Agricultural Museum which has one of the largest collections of pioneer agricultural implements in North America. Author Penny Ham of Sidney, Manitoba believes the book's main feature is the many original photographs, circa 1880, showing Manitoba residents using the artifacts described in the text.

This publication is available by writing to the Manitoba Agricultural Museum, Box 10, Austin, Manitoba ROH OCO.

Dugald Costume Collection

NAN SHIPLEY
Free-Lance Writer
Winnipeg, Manitoba

Editor's Note: *The following article first appeared in the May/June 1980 edition of* **CANADIAN COLLECTOR**, *Vol. 15, No. 3, and is reprinted with the kind permission of the publisher, M.F. Goldenberg, of the Denmount Publishing Co. Ltd., Toronto.*

"Seldom does the simple embryonic idea of a dozen country women blossom into one of the greatest projects of its kind in western Canada, but that is exactly what happened with the Dugald Costume Collection."

In 1953, a small group of women, residents of Dugald, a little town eight miles east of Winnipeg, decided to hold a fashion show to raise funds. This turned out to be no ordinary department store affair however—it took the form of models wearing contemporary clothes vying for attention with those attired in the 100-year-old garments of their grandmothers and great aunts. The parade of antique hats and dresses, complete with lavish accessories, was an instant success.

The basic attraction of the display was undoubtedly the fond nostalgia it evoked as well as the sense of history. At the turn of the century, Winnipeg was peopled by men who were making large fortunes in grain, lumber, real estate and scores of other enterprises. These entrepreneurs lived in beautifully furnished mansions, and their stables housed magnificent horses and carriages. There was an enormous amount of entertainment in these houses, and for the innumerable grand balls and dinner parties, the women ordered their beaded satin, net and velvet gowns from Paris, London and New York.

So popular was the first show of these beautiful antique styles, that more were planned, and slowly a collection of costumes began to build up. From the beginning, donations to the collection were generous when it became known that there was a

Modeling costumes, circa 1890, from the Dugald Collection in the parlour of Dalnavert—Macdonald House Museum

An Alice blue silk going away gown worn by a 1916 bride. The model is carrying the original nosegay bouquet and french flowers trim her hat

Grandmother's two piece black corded silk dress with jet trim. The black silk bonnet features a feather trim and widow's veil

centre where great-grandmother's wedding dress, so long treasured, could be modelled on occasion and preserved. Mrs. Wyn Van Slyck, innovator of the idea, took responsibility for these precious items. But the requests for more and more shows—scores in the city of Winnipeg and dozens of small communities—demanded a good deal of time and energy for preparation and transportation. In addition, after each showing the gowns and coats, capes and satin slippers had to be cleaned and often repaired.

It soon became evident that if these irreplaceable items were to survive, proper quarters would have to be found. The Dugald Costume Collection was incorporated and plans have been set afoot for the building of a suitable museum to house the collection. It will not be an inexpensive project as lace parasols, hand-made lingerie, net hats, feathered fans, sable stoles, mink muffs, and ermine mantles require ventilation as well as humidity and temperature control.

Following a visit by Eva Burnham of Ottawa, who inspected the collection and offered valuable suggestions for the care and preservation of delicate items, and Frances Brittain who, with John Hillen of Toronto, gave advice on building plans and design for the proposed museum, the Dugald organization applied for a Capitol Assistance grant from the Federal government to supplement their own efforts to raise funds, and subsequently received a Planning Grant.[1]

At the urging of the National Museum advisors, the authentic costumes were placed in storage. For the past three years, University of Manitoba Home Economics students have been engaged through the Young Canada Works Programme to create enough replicas of the original gowns and accessories so that the popular Dugald Fashion Review could continue.

The greatest difficulty lay in duplicating the fine materials used in the lovely old garments. Jet beads, gold thread and many fine trimmings, were almost impossible to acquire. The search and shopping for such items was undertaken by the president, Mrs. Wyn Van Slyck, and the secretary, Mrs. Beth Cook.

Fortunately Winnipeg has an excellent needle trade industry which supports numerous fabric centres where interest was shown in the search for

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1 *This grant was equally subscribed by the Province of Manitoba and the Federal Government to provide funds to retain the services of a facilities programmer, architect, and design consultant.*

exact duplicates and willing assistance was given. The Fabric Centre and Mitchell's Fabrics supplied most of the materials and trimming, and some fine cotton and pure silk was obtain from Nash James International of Toronto. The women were determined to have the replicas as true to the authentic garments as possible. Only the real costumes will be displayed in the museum.

Some idea of the size of the collection can be seen by the fact that Wyn Van Slyck and her helpers have prepared over 3,000 accession cards. Each contains a history of the piece together with the date of its origin, name of the donor and date of receipt as well as a watercolour sketch. In addition to her work with the collection, Wyn Van Slyck is a well-known Manitoba artist.

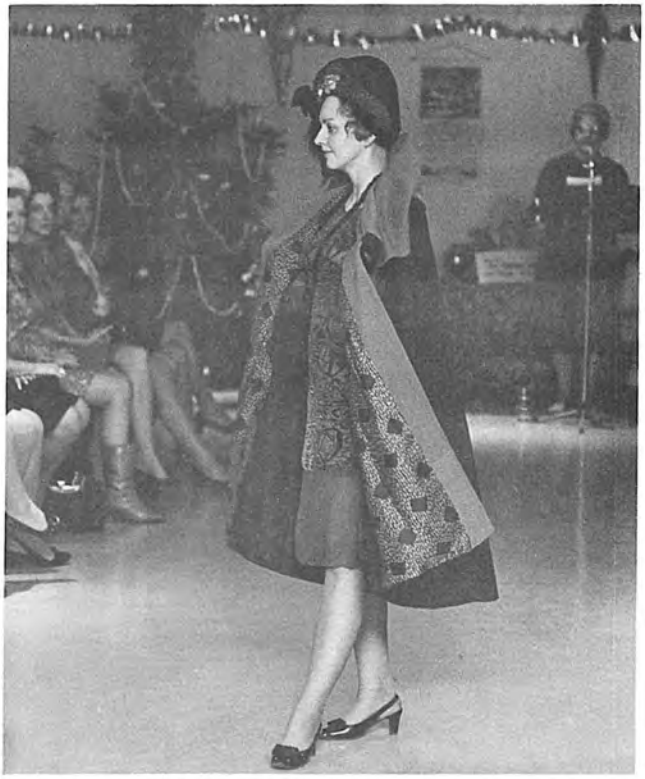
The shows, which now total over 230 since inception, are held in colleges, private clubs, concert halls and churches, and the money raised is the chief source of income for the establishment of the museum.

In addition, for the past three summers Mr. and Mrs. Van Slyck have thrown open their beautiful park-like gardens and home for an extra-special showing of the collection. Here the students from the University of Manitoba who have copied and worked on the replicas move about the crowd. A farmhouse which was built in 1886 and restored by Mr. Van Slyck to its original condition, complete with furnishings of the period, is of added interest at the party where local women are on hand to bake bread and scones on the old wood-range that dominates the large kitchen.

The women who have worked so hard since 1953 on this unique costume collection certainly deserve the gratitude of the nation for their foresight in the preservation of these mementoes and memories of the past.

Fashions from a summer wedding—circa 1910

Typical skating outfit, circa 1889



Beth Cook modelling a navy blue serge cape over a cerise faconne chiffon velvet dress, circa 1926

Ladies from the Dugald Fashion Review modelling night wear circa 1890 to 1900

Mrs. Chas. Cook wearing a black corded silk two-piece dress and matching dolman with jet bead trim, circa 1889

Mrs. Van Slyck modelling a flowered silk dress made by a Winnipeg dressmaker from fabric purchased in Paris c. 1890

Photos courtesy: The Dugald Costume Collection Inc.

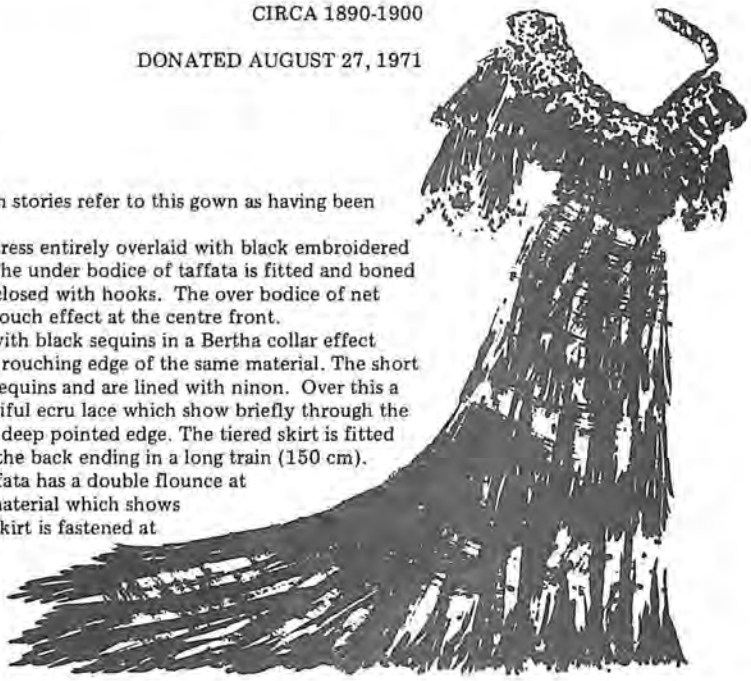
DEL - 37 A & B

CIRCA 1890-1900

DONOR NUMBER - 119

DONATED AUGUST 27, 1971

DONOR – Mrs. D. Ardington
627 St. John's Avenue, Wpg.



Original owner unknown but handed down stories refer to this gown as having been worn in the presence of Queen Victoria.

Two-piece black "paper" taffata evening dress entirely overlaid with black embroidered net generously trimmed with black sequins. The under bodice of taffata is fitted and boned with whale bone stays. The front fastening is closed with hooks. The over bodice of net fastens at the side front and features a slight pouch effect at the centre front.

The low cut neck is elaborately trimmed with black sequins in a Bertha collar effect bordered by a flounce of ninon with a narrow rouching edge of the same material. The short sleeves of gathered net are dotted with black sequins and are lined with ninon. Over this a pleated frill of ecru ninon trimmed with beautiful ecru lace which show briefly through the top frill of black embroidered net which has a deep pointed edge. The tiered skirt is fitted over the hips and at the front with fullness at the back ending in a long train (150 cm). Front measures 99 cm. The under skirt of taffata has a double flounce at the hem trimmed with rouching of the same material which shows between the points of embroidered net. The skirt is fastened at the back with hooks and eyes.

Remarks: A very beautiful gown.
Repaired in 1975.
FRAGILE

The catalogue card describing the gown worn by Mrs. Van Slyck in the cover photograph. All catalogue cards of the Dugald Costume Collection include water-colour drawings of the artifact

Conservation for Manitoba Museums

TERRY PATTERSON
Curator
Transcona Regional History Museum

The proper care of museum artifacts is one of the major responsibilities of the small museum curator. Many things can damage an artifact. Here in Manitoba our harsh climate, along with other environmental facts such as insect pests and industrial pollutants, demands the awareness and concern of those involved in the care of museum collections.

Proper care of the artifacts often entails specialized skills and processes which are termed conservation, preservation, and restoration. Since the terms are often used interchangeably, the following definitions should be helpful.

Preservation is the art of protecting an object from physical and chemical harm.

Conservation is the additional work you do to an object to prolong its life.

Restoration is the art of returning an object to its original state or 'last use' condition.

Per Guldbeck in *The Care of Historical Collections* states that conservation is the intelligent and effective care of the things in the custody of a museum, both while in storage and on exhibition. Only by properly caring for your artifacts can you maintain your integrity as a curator.

The Canadian Conservation Institute Journal puts a wider definition on conservation as study and research; consolidation and stabilization of artifacts; cleaning, repairing and storage; handling and transportation methods; and environmental control. In essence, however, both definitions mean the same.

The first objective in funding and priorities should be the preservation of your collections. For a collection to be useful in research, all available information from the acquisition and documentation (plus any conservation undertaken) must be accessible. Preservation of artifacts on exhibit and in storage is very important, but often overlooked. Funding in this area is seldom available from the usual sources, as it is not exciting copy for public relations items. As a result, conservators are usually pressed into emergency conservation, instead of the day-to-day preservation which is actually more time-saving in the long run. The old adage – an ounce of prevention is worth a pound of cure – is especially true for artifacts.

Conservation should be the concern of everyone in the museum, particularly during the following times:

- when shipping and packing
- during exhibit
- when being moved for 'touch' or working exhibits
- any unusual use
- during storage period (under safe conditions)

From the moment an artifact enters the museum, it should be documented from initial condition, through any cleaning or preservation. Every time work is done on an artifact it is important to record what has been done and what materials were used. Photographs provide important records here. Be sure that any repairs undertaken can be undone if necessary. If in future, you find a particular adhesive deteriorates or reacts on the artifact, you will need to know how to reverse the process, thus the importance of documenting all work.

Golden rules in conservation are:

- handle artifacts with both hands low over the working surface
- sit down and work at a table
- use gloves as often as possible
- *when in doubt–don't*

Environmental Factors

Preserving and repairing the artifacts is just one part of the job. The other is understanding the environmental factors that can cause the deteriora-

tion of an artifact. In broad terms one of the most important is climate.

Paul Cormans in *The Conservation of Cultural Property* tells us that "the climate should be considered as the main factor affecting the decay or preservation of cultural property". Thus a look at our province's climate will assist us in studying the conservation and preservation problems facing the varied regions. Manitoba's climate is the second most extreme in the world, with geography affecting the general weather conditions.

Around the shoreline of the Hudson Bay, we find this body of water moves the polar and subarctic climate southward. Through the northern tundra, precipitation (both rain and snow) is light. The annual range is from 15 inches in the north and west of the province, to 20 inches in the south and east. Average precipitation for Churchill is 15.1 inches and The Pas 16.8 inches. At Riding Mountain Park rainfall is 13.3 inches annually with snowfall varying from 49.25 inches above 2165 feet to 9.85 inches at the base of the escarpment. Winnipeg's average precipitation is 19 inches of which 14.8 inches falls as rain, and 51 inches of snow. Through the province, the precipitation during spring and fall is usually in the form of a steady rain for a day or two, while in the summer it often comes as the driving rain of a sudden storm.

Temperatures vary from Churchill with yearly averages of -17°F to +55°F, The Pas from -6°F to +55°F, Riding Mountain from +4°F to +69°F, and Winnipeg from -13°F to +68°F. Temperatures of -40°F are common through the winter. Winnipeg's highest recorded summer temperature reached 108.2°F (11 July 1936) and the lowest was -53.5°F (24 December 1879). The averages shown above are the daily mean, not the overnight low.

The prevailing winds from the west lose their moisture passing over the mountains, and sweep warm and dry air over the prairies. As they reach Manitoba's many lakes, the moisture being absorbed builds up into sudden destructive storms throughout the summer. Tornadoes develop from thunderstorms, and are so common on the prairies that the Queen's Printer has published a book giving precise dates and the descriptions of hundreds of them.

Throughout the winter, the main systems build up in the arctic and sweep down over the southern plains with blizzards, snowstorms and intense cold. Sudden changes of 40 degrees can occur in winter. Between November and March we can expect occasional blizzards with ice storms occuring after January (which is usually the coldest month). As the short spring brings a thaw in April, we find a rapid rise in temperature during May. By June the average temperature is 25 degrees warmer than April. Frost can still be expected up to the end of May. The temperature in July often exceeds 90°F (occasionally 100°F in the southwestern area) bringing drought and/or grasshoppers as well as violent electrical storms, heavy rains and often hail by August. An early frost can be expected in September. Throughout the fall there are long periods of dry sunny weather with mild days and frosty nights.

Within the general weather pattern of the prairies, we can note variations that occur in Manitoba, related to the geography. The hot winds of summer sweep down the prairie levels and over the escarpment suddenly reaching an area of lakes. Here the moisture is absorbed quickly, building massive clouds that erupt into thunderstorms or severe electrical storms that race across the Interlake and into the northeast, or veer off along the southern edge of the province. The Red River Valley is usually hit by heavy rain, hail, or the severe blizzards of winter. Storms build up over Lake Winnipeg, and

Manitoba Museum of Man and Nature

are funnelled through the valley. The escarpment aids in a shift of wind patterns which helps formation of tornadoes in the southwestern part of the province. Hudson Bay's large body of water has a moderating effect on the otherwise extreme climate of the northern interior.

IDENTIFYING REGIONAL PROBLEMS

The Association of Manitoba Museums has divided Manitoba's museums into five different regions. While the effects of both climate and geography overlap, it is possible to recognize the most common problems in each of these regions. *(See Appendix).*

Manitoba North

This region's southern boundary is an east-west line across the province just south of the Lake Manitoba Narrows. There are sixteen museums in this large area. Only three, the Sam Waller Little Northern Museum at The Pas, The Eskimo Museum at Churchill, and the Leaf Rapids National Exhibition Centre are open all year round. For other museums, winter is a major problem. Although the extreme cold is not harmful to many artifacts, there are some materials which will expand and crack when frozen. In confined spaces, the relative humidity will increase. This is probably a benefit in our climate, but should be considered. The artifacts will be subjected to wide variations in temperature through the spring and fall. The greatest variation is in the spring as buildings warm up through the day and cool quickly at night. This fluctuation causes problems with objects made of two or more substances which respond at different rates. The strains which result could be dangerous. Artifacts affected include paintings, wood/metal combinations, and laminated woods. Specimens

Aerial view of Northern Manitoba lake *Manitoba Museum of Man and Nature*

with a high water content, especially organic materials, will be damaged from continuous freezing and thawing. Furniture glues will also change, and lose their adhesive power. The abrupt diurnal temperature changes through spring are more harmful than seasonal variations because of the frequency plus cumulative effect. The continued expansion and contraction within the crystalline or amorphous structure of materials, especially building materials, will lead to "fatigue" and rupture.

Snow buildup provides some insulation for the buildings through winter, thus reducing the variations of temperature inside the building. Snow weight can damage buildings with flat or slightly sloping roofs in protected areas where the wind cannot blow it away. By spring, the accumulation can cause minor flooding or other water damage as it melts. Drifting snow can seep through cracks in buildings around doors and windows. As it comes in contact with artifacts, the added moisture, especially in spring, can be very damaging.

A few museum boards provide for regular checks of the museum buildings and contents, but the majority tend to forget the museum until spring, once it has been closed for the winter.

One *minor* advantage of the extreme cold is the annual killing of any adult insects which have found their way into museums throughout the summer. However, this does not effect the insect larva which is the most harmful.

In the southern part of this region the Interlake area is more moist than the rest of the province (excepting the shoreline of Hudson Bay). Museums at Eddystone, Moosehorn, Ashern, Winnipegosis and Dauphin will have to guard against softening of adhesives, growth of molds and mildews, corrosion of metals, condensation stains, salts leaching out of pottery and ceramics during cold weather, softening and weakening of paper and parchment fibres, and the slackness of the canvas in artwork. In warm weather, insect life cycles may speed up.

Manitoba West

This area of 26 museums is west of a straight line extending at an angle south of Eddystone, including Carberry and Killarney but excluding Austin and Cartwright. Most of this area is part of the Second Prairie Step, including the escarpment, along with the short-grass area of the southwest corner of Manitoba. In the summer it is extremely hot and dry with fairly constant winds. The soil is light and sandy, with few trees, as this region receives the least precipitation of the entire province.

The Souris and Assiniboine Rivers flood to some degree every spring presenting major problems to towns along their banks such as Melita, Souris, and Brandon. Common to the region is a problem with wind and sand. Particularly vulnerable are outdoor collections at Elkhorn (autos), Hamiota (farm machinery) and Shilo (guns). Indoors, the abrasive action of the sand will wear down artifacts as they are dusted. Using a vacuum cleaner carefully during dusting will prevent a redepositing of the sand. An accumulation of dust will act as a centre of deterioration as the particles attract water which catalyzes chemical and biological reactions.

The low humidity will cause the drying out of a wide range of items. Paper and parchment become brittle, glues and pastes dry and lose their adhesive power, wood may warp, and paintings will become taut on canvases. This is probably a major concern at J.A.V. David Museum in Killarney and the Brandon Allied Arts Centre.

Manitoba Central

Between the Red River and the edge of the West and Central regions, we have a variety of conditions facing the 28 museums of this region. A portion of the escarpment is across one corner, the Manitoba Lowland (First Prairie Step) forms most of the area, while another section lies within the Interlake. In the southwestern part, wind and fine sand will affect outdoor collections at Austin and Portage la Prairie, and cause problems with indoor collections as seen in Manitoba West. Through the Assiniboine and Red River Valleys, there is a yearly threat of spring flooding. In flood plains, water penetrates the walls of buildings and can migrate upward by capillary action to heights of six to nine feet above the water table. The incessant yearly wetting and drying of sub-structures and walls lessens the cohesion of the materials, weakens them considerably, and is the beginning of serious structural damage.

Ground water always contains some salts in solution or suspension. Floods will carry these afar, then during the dry weather this gradually moves to the outer layers of walls and structures, evaporates and finally leaves saline deposits on or near the surface. This is one of the causes of deterioration both of the building and its contents.

The Pembina Triangle and the southwestern area have several weather conditions in the summer—high winds, electrical storms, hail and occasional tornadoes—which will pose a threat to older buildings and outdoor displays.

The Historical Museum at Gimli, Marine Museum and Lower Fort Garry at Selkirk, and Red River House at St. Andrews face a high level of humidity. This will be less pronounced in or near the Interlake area, but is still a factor to consider at

Manitoba's desert—the Carberry Sandhills *Manitoba Museum of Man and Nature*

Langruth, Eriksdale, and Woodlands. In the summer humidity can bring increased growth of mold and mildew, accelerated insect life cycles, warping and cracking of laminates, as well as the softening and weakening of papers. Chemical reactions, such as oxidation and corrosion where two metals are in contact, will also proceed faster.

There are a number of museums in isolated areas of this region, most of which close during the winter. The snow build-up on and about buildings can create problems of moisture and weight, especially towards spring. There is a greater temperature fluctuation in spring and fall which cause frost damage and can be disastrous to many materials. Laminates expand and contract at different rates causing glues to change, prints to crack, etc.

Manitoba East

This area with only 15 museums extends from the Red River to the Ontario border. Most of it is on the Precambrian Sheild, with the rest Manitoba Lowland. Here soil does not drift as the Red River clay bakes hard. There is little soil on the shield. We have only one area with sandy loam around Hadashville and Whitemouth which could cause abrasive problems with collections. Museums close to the Red River will be concerned about spring floods, with all the attendant problems. In addition forested areas entrap snow within clearings causing snow build-up also to be a problem in this region.

Winnipeg Region

Of the 23 museums located in Winnipeg, few close for the winter. As a result, climate is less of a problem than pollution in the Winnipeg area. Grant's Old Mill, located on Sturgeon Creek, is the only Winnipeg museum in danger of flooding.

SPECIAL PROBLEMS

In part of the north, we have special problems arising for Churchill, on the coast of the Hudson Bay with its salt-laden air. Salt is hygroscopic and will support growth of microorganisms even in

apparently dry surroundings. This is especially serious in books and papers. However, keeping them covered, or in glass-front cupboards, can avoid this problem. Chlorides are particularly hard on copper, and will affect other metals.

In mining areas underground blasting causes as much vibration as some earthquakes. Fragile artifacts must be securely supported to prevent falls and subsequent breakage. Continuous vibration is hard on the structure of many items, which, in time, can literally be "shaken apart".

Major industries in the mining towns can present other problems. A refinery at Thompson, smelter and refinery at Flin Flon, and a lumber mill and forest product manufacturing centre at The Pas, will all release sulphur dioxide into the air. At one time, sulphur dioxide was used as a cheap fumigant, however, it will tarnish metals as well as bleach wallpaper and fabrics. It attacks paper, causing embrittlement and eventual disintegration of the fibres. As the paper absorbs sulphur dioxide, it combines with moisture to become sulphuric acid which remains in the paper and destroys it. Leather bookbinds are robbed of their strength and pliability by sulphur dioxide which can in time reduce them to powder. Hydrogen sulphide reacts with the white lead of oil paintings to form lead sulphide which darkens to gray or sooty black. It also reacts with all the old metals, forming dark-coloured sulphides. Within the air, the sulphur dioxide combines with moisture to become sulphuric acid—the "acid rain" we hear of which is killing lakes and animal life and damaging buildings. Usually the fumes are blown to another area by prevailing winds, so they would be expended over the shield. Pollutants may, as a result, have an effect in The Pas from the sawmill in Hudson Bay, Saskatchewan.

In larger industrial areas, such as Winnipeg, Brandon and Selkirk, there is also a problem with air pollutants and industrial fumes. In Winnipeg this is monitored by the Committee on Environment which requires an offending industry to shut down until the corrections have been satisfactorily carried out. Sources of sulphur-dioxide include by-products of domestic heating, exhaust fumes from cars and trucks, as well as an assortment of industrial fumes. In most urban areas it is necessary to continually check the collections for signs of corrosion, tarnish, flaking metals or rotting textiles. Complete air conditioning and filtering will eliminate or control the problems, however, the expense is not always felt justified. Museums such as St. Georges, near the paper mill at Pine Falls, may find problems caused by sulphur dioxide and its combinations. Other museums in the eastern region also could face problems of pollution carried by prevailing winds from industrial centres.

Rural areas, or isolated museums in all regions of Manitoba, face problems caused by their locations. During the winter, plus most of the spring and fall, the majority of community museums are closed, with limited or no periodic checking. As a result, problems due to the ravages of weather are often not found until late spring, when damage has already occured and deterioration of the artifacts is well underway. One isolated museum has closed because of vandalism and many others are quite concerned about the problem. In the eastern part of the province many tourist resorts are open in the off season. This factor, combined with good roads and some of the best snowmobile country in the province, creates serious vandalism problems. It is suggested that monthly checks of museums be made, perhaps by members of the board, to spot damage by vandalism and environmental conditions. Resident caretakers seem to be the easiest solution, but often the most difficult to arrange.

ENVIRONMENTAL CONTROLS

The environment of all museums is governed by its sources of heat, humidity and light.

Heat

Hot water or steam heat is said to be the most even heat, however, there is always a concern for water damage due to leaking or burst pipes. As this is a dry heat, moisture must be added to the air. Coal and wood heaters emit soot and smoke and are also fire hazards. Gas heat releases minute amounts of sulphur. Electric heating is another dry heat source. Furnaces providing forced-air heat are the most practical and suitable for museums as most of them can also be fitted for air filtering and humidification.

Temperature fluctuation should be minimal to avoid damage to artifacts. Repeated freezing and thawing is especially harmful. Frost action is second only to sulphates in being the worst enemy of historic objects and monuments. As many materials are hygroscopic, the surrounding moisture is absorbed and released as in a sponge, or is taken up into the molecular structure. Freezing expands the moisture, causing the materials to crack. Marked and abrupt dirural ranges are even more harmful than seasonal fluctuations, because of their frequency and cumulative effect. Thus we will note more damage occuring to the internal structure of artifacts in early Manitoba springtime.

Temperature combined with relative humidity has the most effect on museum objects. In winter,

though the relative humidity outside can be fairly high, the same air heated in a building will show a drop in relative humidity, as the relationship between temperture and moisture has now changed. Correspondingly when the outside temperatures are high, a cooler building will indicate a higher relative humidity than outside without any modification of the air. Some combined effects of temperature and relative humidity are mentioned in the section on Regional Problems.

Humidity

In a museum with good ventilation, the relative humidity will be practically the same everywhere. However, without circulation of the air, sheltered corners or basements could read 10%-20% higher. The annual range of relative humidity in your area is a good level to begin from, but more important are the seasonal or diurnal ranges. The daily maximum relative humidity is reached a little before sunrise, the minimum in early afternoon (opposite to temperature). Variations of 20%-80% over a year are damaging to all materials, especially those with a cellular structure sensitive to moisture. Within an area of high relative humidity, special precautions should be taken against cryptogamic growths (fungus, etc.) as well as damage caused by micro-organisms and insects. Constant excessive dryness can affect hygroscopic organic materials whose cellular structure is liable to collapse.

Humidifiers placed in exhibit rooms where dryness is a problem should help. Pans of water can be placed over radiators in a steam-heated building. A pan of water with a long cloth strip (one end inside the pan, one end hanging free) can be placed in front of a fan to blow the moisture into the room. This could also be placed on a humidifier, to take advantage of the fan inside, and add more moisture to the air where needed.

Excessive humidity can be decreased with the use of silica gel. This is an artificial, neutral product, having the same composition as natural silica but containing innumerable fine pores like a sponge. It can absorb water up to several dozen times its volume. After saturation, if heated above 100°C (180°F), it can be reused.

In general, except for semi-arid areas (south-west corner of the province) where collections have stabilized in a lower relative humidity, the most favourable range is 40 %-60% with 55% as optimum. This figure is usually difficult to attain in heated buildings in Manitoba, and a more realistic 35% should be aimed for as an average.

While discussing the amount of moisture in the air, this is a good place to mention other possible moisture problems. The position of overhead pipes, possible roof leaks, open windows (or a break in one which can admit rain) or flood possibilities should all be carefully considered. Always provide a safe barrier between the potential source of water and the collection.

Light

The choice of light source will depend on two factors—it must not be a major cause of deterioration, yet it must be capable of showing exactly the colour and relief of exhibits. The entire visible spectrum causes deterioration, which increases with the intensity of light and exposure. The shorter wavelengths (ultraviolet) possess the greatest photochemical activity, while the longer (infrared) cause a calorific action. Sunlight with its variation of quality and quantity gives a much more pleasing source of light to the visitor, but does not always show the exhibits to their best and can be extremely damaging to the artifacts. Fluorescent lighting is monotonous, but using incandescent lamps in conjunction can throw shadows and pinpoint features.

The cause and effect relationship between light and deterioration has not been fully documented. There are, however, many examples through observation. Light can cause chemical changes in many objects, primarily organic materials, but even in ceramics and glass. Colour fading is the best known, but light can also weaken fibres. With less than one month exposure to sunlight, silk may lose half its strength. Direct sunlight can be up to one hundred times stronger than artificial light. Diffused sunlight is much more intense than spot-lighting. All light sources emit a certain amount of ultraviolet and infrared radiation.

Manitoba summers are well known for the long sunny days. There are periods when sunlight even comes in through north-facing windows. Thus there is no optimum position for window placement in a building to avoid deterioration from sunlight. The effects can be lessened by:

- using opaque sheets such as aluminum, sheet iron, etc. to redirect the light source thus using the less harmful indirect lighting
- translucent screens (opaline, frosted glass) filter and diffuse the light reducing its intensity
- transparent screens (natural and artificial glass) also filter light to some degree
- ultraviolet filters are available in sheet form for windows, as well as sleeves for fluorescent tubes, which will cut the ultraviolet rays to almost zero
- using special Vari-ray fluorescent bulbs which do not need ultraviolet filters

INSECTS AND PESTS

Special precautions will need to be taken against mice, crickets, beetles and other household pests. Mice (both field and house types) will seek areas for nests, shredding fabrics and paper in preparation. Squirrels may destroy mattresses, pillows and cushions, and also injure woodwork around windows in their attempts to escape. The house rat will destroy fabrics and leather goods. Crickets come in during cool days and will feed on anything, especially wool, silk and cotton. Clothes moths, carpet beetles, silverfish, booklice, carpenter ants and wharf borers can all destroy a major part of your collection if undetected for a season.

[Editor's Note: Further information on this subject is discussed in Mary-Lou Florian's article *Biodeterioration of Museum Objects: An Ecological Approach to Control and Prevention* on page 35 of this issue].

PRESERVATION

Preventative Maintenance

Within the many Manitoba museums, there are a wide range of problems to bear in mind when planning preservation needs. First, a programme of education for all those involved with museums can make them aware of the varied needs of their collections. There is a need for better training in the documentation and storage of artifacts. There should be a survey of the museum's atmosphere, and the results produced by various changes in light, heat and humidity. Once people are aware of the needs of their collections, they can begin to meet those needs as the budget allows.

In order to correctly assess the potential causes of deterioration, you must be thoroughly familiar with the local climatic conditions outside and inside the various rooms and areas of the museum. Regular temperature and relative humidity readings will help you become aware of the phenomena of dryness, humidity, and condensation, how materials react to them, and thus how common sense measures can often be more help than complex and costly solutions.

In caring for a collection there are four main steps to remember:

1. See that each item entering the collection is properly documented, noting its needs regarding repair and preservation.
2. Place it in a safe environment.
3. Inspect it periodically.
4. Provide repeated preservative treatment as necessary.

During step number one, as you identify the needs of an object, you can make a further decision as to the urgency of those needs. Many times a careful cleaning will be all that is required. As you recognize the initial stages of deterioration you can consult trained conservators and reference books to find the remedy most suited to its needs, your capabilities, and the museum facilities. Step number two will theoretically preserve the object, while step number three is a check on its condition.

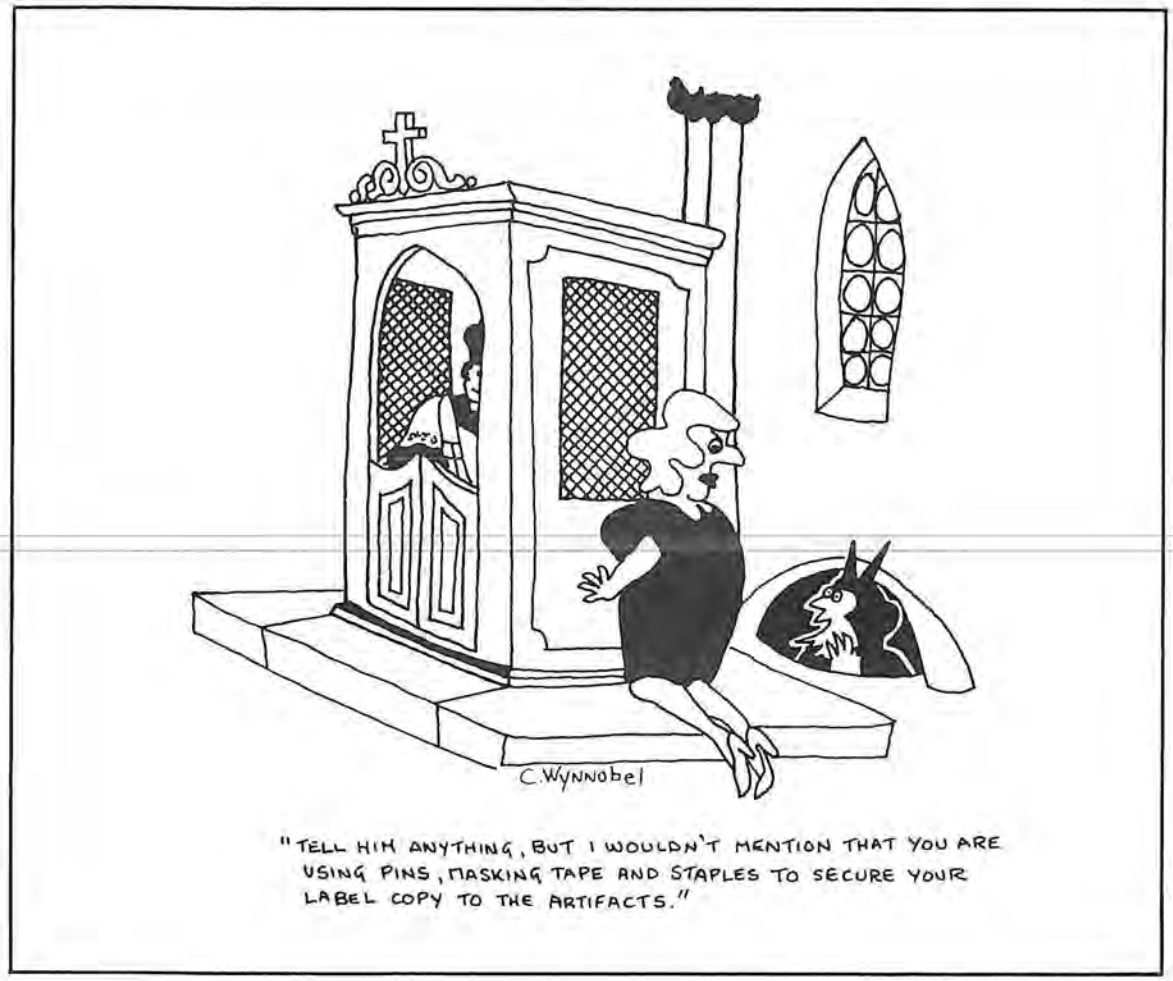
A number of objects need repeated treatments over a period of time to maintain their good health. This includes replacing fumigants in insect collections, herbariums, study skins, and textile storage; replacing alcohol lost through evaporation from preserved specimens in jars; many leathers need a yearly treatment; pages of books on display should be turned monthly; and many metals have a protective coating of wax or lacquer which should be checked for possible replacement.

Where storage conditions are less than ideal, more frequent checks are needed. Items on exhibit should be examined more often than those artifacts in storage.

These four steps are within the capabilities of every museum, no matter how large or small. The amount of time devoted to the care of the collections by those who are responsible will be reflected in the health and safety of the entire collection. This will be especially true if they have the proper training in the philosophies and correct procedures of conservation. Both the care and storage of collections are important. In general, it is considered that only half the space of a museum should be devoted to exhibitions, with the other half left for curatorial functions (office, storage, workshop).

Obtaining monitoring equipment such as a thermometer and hygrometer is a good start for the preservation of your collection. However, such instruments are only effective when the information is recorded regularly. For museums closed over a long period, a high and low recording thermometer set can be useful to chart temperature extremes. Though not as accurate, even a wall-hung wet and dry bulb thermometer can be useful if the variations are recorded. The next step in monitors can be the sling psychrometer and some type of light meter. From the information recorded the curator and board can decide upon priorities for environmental control to attain the best atmosphere for their collections.

As the effects of light, temperature and humidity are known, the curator can begin to assess display and storage areas. Sensitive materials can be moved into darker corners, fragile items can be provided with protection from the public, etc. Storage areas should be checked for water pipes,



outside walls, etc. Basement storage areas should be checked for dampness, vermin, and possible flooding. Windows in storage areas should be blocked off. Adequate shelving is a necessity—painted steel, adjustable shelving is recommended as being most economical in the long run as it is easily manoeuvered and can be changed to fit the needs of the collection.

For the best use of your storage area, after having recorded the daily temperature and relative humidity and compared it with that of outdoors for a one-year period, you can list and quality grade your storage areas. From this you can plan a storage procedure. Keep in mind the uses of the collection, needs for accessibility, storage standards required, security and retrieval time.

Individually wrapping and boxing the items protects them from dust and breakage. Legible content labels make them accessible.

Clothing can be hung on padded wood or plastic hangars and stored in garment bags with paradichlorobenzine. Baskets made for the dishwasher rinse agent (Jet Dry) make ideal containers for moth crystals. The locking arms can be fitted over a hangar and the slotted sides allow the fumes to be released evenly.

Textiles should be stored flat with acid-free tissue in the folds. If room is at a premium, they can be rolled with tissue.

Manuscripts, documents and other paper items should have all pins, staples and rubber bands removed, then stored flat in standard size acid-free boxes or file folders.

Fire extinquishers should be readily available, and of a size that a small or elderly person can handle them easily. Check with the local fire department for the most suitable kinds. There are dry chemical types appropriate for all classes of

fire. Avoid the carbon tetrachloride ones, and be sure to check whether you can have the extinquisher refilled and recharged locally.

Security of the building should also be considered part of the conservation needs of the collection. Doors and windows should be adequately locked and burglar-proofed. Keys should be issued only to certain responsible persons—the fewer the better. It is best to check local conditions with the police and banks, who will have assessed the situation, and can recommend the most practical security measures.

Efficient use can be made of the collections only if time is spent on careful maintenance to prevent deterioration, ensure careful storage, and maintain accurate records.

Be aware of the environment within and without the museum, and the special problems that may arise through the year which could affect some or all of your collections. As the relationship between the season, geographic area and the collections is examined, you will be able to take positive steps in "preventative maintenance".

CONCLUSION

In conclusion, people tend to think that objects in a museum are inert, and that the materials of which they are composed will not change. A short period of inattention, or a sudden shock or variation of the conditions, reminds us they are very much 'alive' and sensitive to change.

Matter possesses an extraordinary capacity to adapt itself to the climate in which it has to live. A long period of deterioration takes place before it reaches this equilibrium. However, once in this state, if the surrounding climate changes, or it is moved to another environment, the process begins once again.

Thus, in order to preserve museum objects, we must not subject them to sharp or sudden variations in the physical climate. As we begin to improve the condition of the museum environment, it must be in a very gradual manner to allow the objects to adapt themselves to the new conditions without undue stress and deterioration.

We can see that the care and keeping of the collections in museums covers a wide range of needs. The regular preventative maintenance should also be considered in light of the outlined regional needs. Seasonal variations in temperature and humidity, general climate and weather patterns, and special problems inherent in the area will each dictate a different pattern of annual and seasonal checks to be carried out within the buildings and collections. An awareness of your own collection and its needs is the basic step towards proper management of the collection. "The condition of an object is the result of the sum total of all its exposure to deterioration factors" (N. Stolow, **Conservation Policy and the Exhibition of Museum Collections**). It is our responsibility to reduce these deterioration factors and thus preserve the health and safety of all the objects in our collections.

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APPENDIX

Manitoba Museums Listed According to AMM Regions

Manitoba West	Manitoba Central	Manitoba East	Manitoba North
Reston	Austin	Emerson	Moosehorn
Melita	Gladstone	Gardenton	Inglis
Waskada	Langruth	St. Malo	Eddystone
Souris	Portage la Prairie	Steinbach	Dauphin (2)
Boissevain	Woodlands	La Broquerie	Grandview (2)
Killarney	Eriksdale	St. Anne	Roblin
Carberry	Gimli	Hadashville	Kenville
Shilo	Teulon	Dufresne	Swan River
Brandon (3)	Selkirk (2)	Cook's Creek	Bowsman
Virden	St. Andrews	Anola	The Pas
Elkhorn	Cypress River	Beausejour	Leaf Rapids
Miniota	Treherne	Whitemouth	Churchill
Binscarth	St. Claude	Whiteshell Park	Ashern
Shoal Lake	Carman (2)	Victoria Beach	Flin Flon
Strathclair	Miami (2)	St. Georges	Winnipegosis
Hamiota	Cartwright		
Rivers	Glenora		
Rapid City	Pilot Mound (2)		
Minnedosa	La Riviere		
Neepawa (2)	Snowflake		
Cartwright	Morden		
Hartney	Winkler		
Spruce Woods	St. Joseph		
Wasagaming	Winnipeg Beach		

Winnipeg

Aquatic Hall of Fame and Museum of Canada
Archives of the Conference of Mennonites in Canada
Mennonite Genealogy Inc.
Dalnavert-Macdonald House Museum
The Fort Garry Horse Museum and Archives
Grant's Old Mill
Historical Museum of St. James-Assiniboia
Ivan Franko Museum
Living Prairie Museum
Manitoba Museum of Man and Nature
Mineralogy Museum
Le Musee de Saint-Boniface
Ross House
Royal Winnipeg Rifles Museum
Seven Oaks House Museum
St. Volodymyr Museum
Transcona Regional History Museum
Ukrainian Cultural and Educational Centre
Ukrainian Museum of Canada
Western Canada Aviation Museum
Winnipeg Art Gallery
Winnipeg Mint
Zoology Museum—University of Manitoba

Care and Conservation of Machinery

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Editor's Note: *The following paper was presented by the author at the Association of Manitoba Museums Annual Seminar held in Brandon in the fall of 1979.*

The theme of this paper is the care and conservation of machinery. To be able to understand this subject, certain principles have to be discussed. Conservation has two main approaches: the first is the control of the environment to minimize the deterioration of artifacts; the second is the treatment of individual artifacts to halt present deterioration and to stabilize and protect the artifacts against future deterioration. These two approaches can proceed most effectively when they are combined: if it is possible to implement only one, then the first preventative approach of controlling the environment will result in the most good for the most number of artifacts at the least cost.

The term *conservation* embodies certain principles that must be adhered to if possible. The first principle is that all treatments must be adequately documented, both successes and failures, as this is the only way that actions can be justified and others learn from our work. The second principle is that whatever treatment is given an artifact, it should be reversible. It should be possible to return an artifact to its pre-stablization condition even after a long lapse of time. This principle must be compromised in some instances, as only an irreversible process may be adequate to conserve an artifact if it is badly deteriorated. The third principle is that, as far as possible, decayed parts of an artifact should be conserved and not replaced. "For obvious cultural reasons, it is far more desirable to retain genuine old fabric and workmanship than to replace it with even the highest-quality modern reproduction fabric." (Waite 1976:218) Further to this point, but from a different perspective, is the view that in some instances, "The significance of a broken object....may lie in the damage it has suffered". (Organ 1976:270).

Some of the perceived relationships between conservation and restoration are as follows. "Restoration is or can be the antithesis of conservation. Conservation is preservation: preserving an object from damage; preventing damage or deterioration

Steam tractor at the Manitoba Agricultural Museum

from occurring, while restoration is concealing damage all too often without thought to the future." (Renshaw-Beauchamp 1979:24) "A specimen may undergo both conservation and restoration, but in all cases the former has priority over the latter. Restoration should never be initiated without conservation." (Hamilton 1976:2) In other words, one should have the knowledge and the training of a conservator to call upon in order to be able to undertake satisfactory restorations, satisfactory in the sense of the three principles of conservation stated earlier. However, most restorers do not have conservation training themselves or someone with conservation training with whom they can consult; therefore their attitude towards artifacts is often as Donald Insall states: "He (the restorer) prefers to see things as they were at what he believes to have been their best moments". (Insall 1976:394) This is not the philosophy of most conservators, "Who seek to maintain the structure of an object as it has evolved, to keep it in good condition and regard recent changes (pre-museum acquisition) within the fabric as being of equal significance to the earliest changes." (Cummings 1976:423) Respect for the aesthetic, historical and physical integrity of the artifact is the basis from which professional conservators work.

Along with the principles of conservation ethics, it is also necessary to understand something of metals and the process of metal corrosion, since the major component of machinery is usually metal.

Metals are generally substances which have a particular luster and hardness, a crystalline structure, high electrical and thermal conductivities, are opaque and possess certain mechanical properties. These mechanical properties include being malleable, ductile and tenacious. One of the most important properties of metals in the context of this discussion is their tendency to form positive ions in solution, as this is the basis of corrosion.

In general, metals are not found in nature—the main exceptions being gold, silver, copper and meteoric iron. Ores are found in nature, ores being minerals composed of compounds of metals with oxides, sulphides, sulphates, carbonates, chlorides or combinations of these metallic compounds. Generally it takes considerable energy to produce metals from their ore minerals and, if left to themselves, the metals naturally revert to compounds by reaction with the environment unless an impenetrable film of oxides, for example, forms on the surface.

The more energy needed to produce a metal, usually the less stable the metal. This is an important fact: metals are always very reactive because of the energy they contain due to production techniques, and they are therefore trying to react with the environment in order to lose that energy. The energy of a metal is of course an inherent property over which we have no control, but something can be done about the latter problem of the metal trying to react with the environment in order to lose that energy. However, before considering how the environment can be modified, a more detailed discussion of corrosion and how metals react with the environment is appropriate.

Usually the two greatest factors in corrosion are water and oxygen. Water by itself will corrode most metals, but usually the water combines with other substances in the environment to form an electrolyte, a solution of high conductivity in which current-carrying ions flow freely, such as sulfuric or hydrochloric acid. Water can be controlled quite easily and prevented from coming into contact with artifacts, but not oxygen.

The reaction of newly-cleaned metals with the atmosphere occurs immediately, usually with the formation of either oxides or sulfides. This kind of corrosion sometimes forms a protective film, which passivates the metal by stopping further reaction. At other times, film formation does not slow down the reaction, but instead the speed of the reaction remains constant or speeds up; the film formed encourages corrosion, rather than retards it.

The primary process of corrosion is electrochemical in nature, the attack being a chemical reaction accompanied by the passage of an electric current. Two forms of electrochemical reaction are galvanic corrosion cells, where two dissimiliar metals are in contact, and concentration cells where the number of ions in solution varies throughout the solution; i.e. differential aeration caused by restricted oxygen availability as around rivet heads or where dew settles on a metal. The purity of a metal is a factor which often dictates how active the metal will be as even in a nominally pure metal, the non-alloying impurities do not crystallize when the metal solidifies, but are found in the grain boundaries. A potential is therefore present across the surface of the metal, creating a vast number of potential corrosion cells which only need to be connected by an electrolyte to become active. If dew settles on the artifact, not only does the galvanic corrosion caused by the dissimiliar metals take place, but differential aeration cells are also set up, compounding the problem.

If museum machinery is operated, certain mechanical causes of corrosion such as crystal deformation, stress corrosion, and corrosion fatique

due to continuous to-and-fro movements can also come into play.

Another form of corrosion is termed stray current corrosion. This form of corrosion should not cause the land-based museum any worry as it occurs when metals are buried in the ground. It can affect ships on the water however. The stray current comes from using the earth as the grounding circuit in electrical wiring installations and from faulty wiring around marinas.

As a point of interest, as far as museums are concerned, not all corrosion is necessarily bad, as some corrosion products actually form a protective film on the surface of the metal and some of these films are considered to enhance the aesthetics of the artifact. An example of this is a green patina on bronze, but in the context of this paper, green bronze is not a desirable attribute for machinery parts. A very important figure is noted below:

"The rate of corrosion of iron and steel increases very markedly above 70% relative humidity. Below that range the corrosion is small even in the presence of atmospheric pollution within ordinary limits." (Wormwell 1973:32).

The control of relative humidity* is a goal that all museums should set. With a RH controlled environment, all artifacts in a museum will have a greater chance for a much extended life.

There are two routes to corrosion prevention that can be taken, both of which are acceptable and complement each other over a short period of time; but in the long run, only one route seems acceptable. The first route is concerned with providing proper environmental controls so that all the artifacts benefit, whereas the second route is concerned with each individual artifact and the provision of an individually-tailored, continuous maintenance programme for each artifact. As usual though, the route which does the most good for the least cost in the long run is the most expensive initially; but if the funds can be found, then the provision of suitable environmental conditions would be the desirable technique for eliminating almost all corrosion.

To explain why the option of continuous maintenance is not acceptable over a long term, ponder the following statements. John G. Waite's earlier assertion bears repeating here: "For obvious cultural reasons, it is far more desirable to retain genuine old fabric and workmanship than to replace it with even the highest-quality modern reproduction fabric." This applies to all museum artifacts. A similar view is expressed in the Spring 1979 issue of **Museum Round-Up** in an article written by Per Guldbeck: "The more I get my hands on the artifact, the more it's a reflection of me and my approach to the artifact, and less the intent of the original artificer, artist or cabinetmaker". If artifacts are not protected from the environment, then the only means of protecting them may be a continuous maintenance programme, but this is unacceptable because each time the artifact is treated, recorrodes, is then recleaned and recoated, less and less of the original artifact—and original workmanship—remains. As well, this method of protecting every artifact individually with coatings and paint is very time-consuming and, in the long run, more expensive than providing proper shelter and an adequate environment. If proper environmental conditions are provided, then an artifact in a stable condition could go directly onto display, into storage, undergo conservation, or, depending on the curator, undergo conservation and restoration. However, once these functions have been performed, it should not be necessary to repeat them for many years. This does not hold true if the artifact is operated: operation presents a different set of considerations, which will be discussed shortly.

Because many mechanical artifacts are large, look substantial, and may have lasted a century or longer already while being exposed to the Canadian climate all that time, the immediate impression many people have is that these artifacts may last forever. Depending on the local climate, some of these artifacts may last a fair while longer; but in most parts of this country, the climate is very severe at least part of the year, with average RH figures above 70%. Is it acceptable to have just the basic shell of the artifact left, or is it proper to request that all detail be preserved also? My feeling is that machinery should look as if it has just finished working for an owner who looked after his equipment, but who did not baby it. Moving parts should still move and not be painted shut. Polished surfaces should be shiny and not rusty. The only way to maintain the integrity of an artifact in this fashion is to house it properly. If this is done, the only problems affecting the artifact will be those caused by people handling it; in the case of machinery, it often means people climbing on the artifact.

Because of the size of these artifacts, the buildings to house them have to be specifically designed for ease of access, high floor loadings and ease of movement. Many heavy machinery collections cannot be housed in existing structures because of these requirements; therefore new structures must

Relative Humidity is defined as the ratio, expressed as a percent, of the absolute humidity of sampled air to that of air saturated with water at the same temperature.

Hart Parr Gas Engine and Threshing Machine *Manitoba Agricultural Museum*

be constructed, greatly increasing the probability that proper environmental conditions can be attained and maintained. One of the most important guides that can be provided to conservators, architects and building engineers are recording hygrothermograph charts from previous years, and all institutions should have these—especially those considering upgrading, expansion or new facilities. They are invaluable for determining if and how much humidification/dehumidification is required and how much buffering is provided by the present building. Even if a new facility is planned, charts from the old building will be helpful with regards to local climate and how well the existing structure and heating/ventilating equipment control the environment. A psychrometer will have to be purchased in order to maintain the accuracy of the chart recorders and to carry out spot checks throughout the building.

If it is not possible to become involved in a major building programme, consider having an architect design a structure that can be improved step by step, based on the following recommendations. The least acceptable, poorest display/storage allowable—the minimum every museum should meet—is a weatherproof roof, with the artifacts well back from the eaves so that windblown rain will not strike them. This shelter must also have a raised platform which incorporates a vapor barrier for a floor so that the artifacts are not sitting on damp earth, and the floor must be sloped so that no standing puddles of water develop. It is also advisable that the artifacts be placed on stands that give proper support and remove the weight of the artifact from any wheel bearings and tires, if so equipped. The stands will also keep the artifacts out of puddles should the floor get wet accidentally. This shelter does not protect artifacts from wind-blown snow, freezing temperatures, dew, relative humidity extremes and fluctuations, nor all the effects of light, but it is a significant improvement over having artifacts sitting outside without any protection whatsoever from the elements.

The first improvement would be to enclose the building on the side where the most snow drifts in and on the sides where direct sunlight hits the arti-

facts. At this point, it would be advisable to install a recording hygrothermograph in the building, as with some of the sides enclosed, it will have started to modify the environment to which the artifacts are exposed. It may prove necessary to provide additional ventilation, possibly with a fan. It may be required at this time to provide lighting. The recommended lighting for display would be background lighting with fluorescents and track lighting with incandescent floods, not spots, for highlighting. The maximum lux level should be 300 lux if paint and decals are not original and if no organic materials such as rubber, leather or wood are present. Very susceptible materials should not be subjected to more than 50 lux; most artifacts require levels of 150 lux: this should be the level to which to aim. The building and the lighting fixtures should be so designed that birds will not be able to nest in or on them.

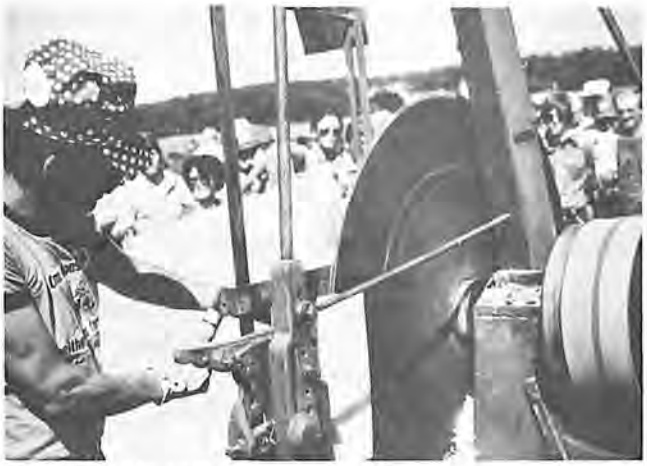
Next in importance in upgrading the structure is completely enclosing and insulating it. This order for implementing each of the minor components of the steps is not rigid and can be altered to suit individual circumstances. For example, the roof could have been insulated and lighting installed during the initial construction. With the building enclosed and insulated, the maximum in passive buffering of the outside climate would be achieved. Before adding active modification of the climate, a decision on the future utilization of the structure will have to be made: whether it is for display or for storage and whether it is open year round or not. Once this decision is made, various alternative solutions are available. If it is to be a year-round display structure, a complete climate control system will be required. If only open seasonally, or if used as a storage facility, there are two possible systems that might work to control the relative humidity within the museum. High and low RH and the fluctuations between these extremes are among the most destructive of the forces working on artifacts, other than direct exposure to the elements. At high RH levels, corrosion of metals occurs, and mould growth will take place on wood and other organic materials. At low RH values, organic materials become brittle and can shrink and crack.

The following two systems of RH control will be useful in only certain climates and at certain times of the year, but they are an improvement on being unregulated all year round. These systems do not take into account the comfort of museum workers or visitors. The first system, designed and being tested by the Canadian Conservation Institute, employs electric heaters or heat pumps which, instead of being controlled only by a thermostat, are also connected to an electronic humidistat. Usually a maximum temperature of 20°C and a minimum temperature of 5°C are set on the thermostat, and it is only at these two extremes that the thermostat has priority. Between these extremes, the humidistat has priority on the operation of the heaters, a maximum RH allowable, usually in the 50-55% RH range, being set on the humidstat; the heaters turning on when the RH reaches that level and warming the area just enough to prevent the RH from rising any higher. This system is especially good for completely metal collections, but composite artifacts may suffer since too low a RH is particularly bad for organic materials and this system has no provisions for raising or maintaining a minimum RH. Ceiling fans should operate constantly with this system in order to prevent pockets of high or low RH air from forming. This system is essentially for the control of spring, fall and winter RH levels in areas of the country such as the Maritimes, southern Ontario and the coastal areas of British Columbia.

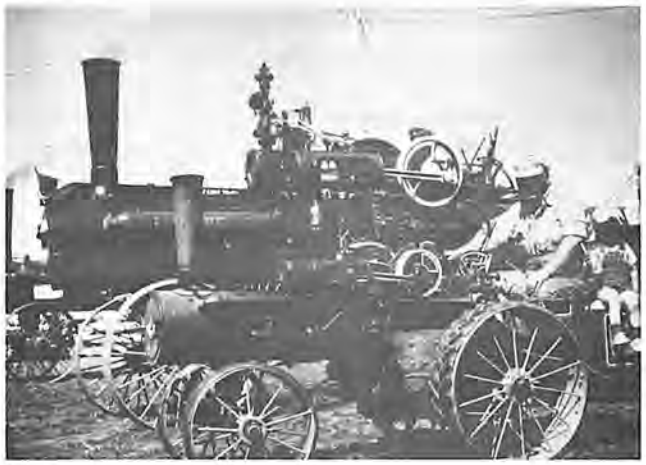
The second system, as yet untried, requires a large outside daily variation in RH, high R-value insulation, ductwork and a fan. The system is comprised of two air inlets, one inside the building and one outside, both controlled by humidistats. If air of the proper RH value when the temperature difference is compensated for is available from outside, then the fan draws mostly outside air in, with only enough return air to check the building RH. If air of the proper RH is not available outside, the outside inlet shuts and the air in the building recirculates until the outside air again becomes acceptable. To function effectively, the building should not be subject to diurnal temperature fluctuations, therefore, the need for high insulation values and low air infiltration rates. This system is best suited for spring, summer and fall operation in areas such as the Prairies and the interior of British Columbia. Both these systems have their drawbacks, but the operation of them would not be expensive, nor would the initial cost, and they would be an improvement over unregulated RH and stagnant air for at least part of the year.

The final step in the upgrading process would be to incorporate a complete environmental system into the building with air conditioning, heating, humidification and dehumidification, or any combination of these depending on the readings recorded by the hygrothermographs.

The figures given as the Relative Humidity readings most suitable for the storage and display of machinery have been chosen with practicality of implementation as a major criterion, due to the size of these artifacts and the severe climatic ex-



Shingle Mill in operation at Austin



Scale Model of Case Steam Engine

tremes reached in various parts of the country. No special RH considerations have been placed on machinery other than to say that if the RH conditions required by the organic components of the machinery can be met, then the metal components should be stable also. The recommendations most commonly given are that the winter RH setting be a minimum of $38^{\pm}3\%$ RH and the summer setting be $55^{\pm}3\%$ RH with $^{\pm}5\%$ RH allowable occasionally, and that the change between summer and winter settings occur at 5% RH per month (See C.C.I. T.B. No. 5). For metals, the $55^{\pm}3$ or 5% RH is too high if they are sodium chloride contaminated, 50% RH should be the setpoint. To protect against ferrous chloride ($FeCl_2$) and ferric chloride ($FeCl_3$) corrosion is very difficult—if not physically and financially impossible—in certain parts of the country, where high summer RH readings are a fact of life. Since these compounds are hygroscopic* at RH readings of under 56%, a RH of less than 30% would be required for storage if the iron was to be considered stable. If the salt-contaminated artifact has organic components, these could suffer irreversible damage if exposed to a RH low enough to protect the iron from corrosion. In the case of salt-contaminated artifacts, it is imperative that the iron salts be eliminated and/or inhibited so that the artifact can be safely stored in the $38\text{-}50^{\pm}5\%$ RH range. This requires specialized conservation techniques which will not be discussed here.

Sulphur dioxide is a major atmosphere pollutant which will attack iron in the presence of moisture by forming sulphuric acid, one example being acid rain. A RH of approximately 60% is required to begin this process, but once started, the artifacts will not be protected by moving into a drier, cleaner atmosphere until this electrolyte is washed off. The recommended maximum allowable RH should be 55%, the setpoint of the system being 50% if SO_2 contamination is prevalent in the vicinity of the museum.

With the environment controlled, it is possible to concentrate on individual artifacts and the conservation treatments applicable to machinery. Unfortunately, quick, simple, easy, inexpensive, foolproof, universally applicable treatments that can be recommended to everyone are not available. All the following treatments are slow, tedious hand processes that are not universally applicable, as each artifact has its own individual needs; but these treatments, or a slight modification of the treatment, should be useful in many instances. If unsure of the treatment or suitability of a treatment, either do nothing, or, better yet, consult with someone more knowledgeable in this field.

One solution that is relatively quick and provides significant protection for artifacts that cannot be placed under permanent cover is that of using tarpaulins to cover artifacts in storage and during those periods of the year when the seasonal museum is closed. If meant to last as a reuseable cover specific to one artifact, then sixteen ounce neoprene-covered nylon tarpaulins could be utilized to good effect. With all tarpaulins, make sure the closures and stitching are able to withstand the climate that they will be exposed to. If unspecific, shorter-term protection is required, then the reinforced, woven-polyethylene type tarpaulin may be adequate, and in areas where rain and mould growth is not a problem, canvas may be sufficient. It is best to build a lumber frame around the artifact, so that the tarpaulin does not rest or rub against the artifact, and any guy ropes should also be positioned to clear it. The framing should be de-

**Hygroscopic: materials which take up and retain moisture*

George White 80 h.p. Steam Engine

Rumley Twin Cylinder Steam Engine

signed so that water runs off the structure and does not collect. The tight wrapping of artifacts is usually not recommended because a microclimate with a high RH reading can readily form under the tarpaulin; and it is impossible to visually monitor the artifact. With the tarpaulin acting as a shelter, problems such as wind continually blowing sleet or rain against one side of the artifact can be noticed, and the tarpaulin rearranged accordingly.

Once the processes of corrosion have been slowed down by these suggested shelters and an adequate environment, the next step is to remove any rust on the artifact. Iron is the main component of most mechanical artifacts, with other metals usually forming only a small proportion of the bulk.

Many commercial methods of removing rust from metals are available, but most of these are unacceptable for museum artifacts for a variety of reasons. One such process not recommended is sandblasting, for the following reasons: even the mildest abrasives tend to be too harsh, and besides removing rust, they also pit the metal surface; the surface gloss (appearance, reflectance) of an artifact is completely altered, to a matt finish; sandblasting is messy and the abrasive gets into all the bearings and on other working surfaces which requires the complete disassembly of the artifact just to make it moveable without grinding itself up; if other surfaces, which do not require cleaning, are not properly protected from the abrasive, they too will become pitted; sandblasting can alter the surface hardness of an artifact by shot peening the surface; and very importantly, the artifact must be passivated immediately upon completion of sandblasting as the surface is very reactive when stripped by this method, which should be undertaken only on days when the RH is low.

Other methods of cleaning include: the wire-wheel, which is even more abrasive than sandblasting; sandpaper, which also removes too much artifact; angle grinders, which are difficult to control and do not work on complex shapes; and chemical methods. Chemical methods are not always looked on favourably because: it is difficult to control the amount of material removed; it is difficult to remove all traces of the chemicals used and this can lead to further rusting in the future; the traces of chemicals can upset future analysis of the metal; washing the artifact in water to remove chemical traces can change its colour, and creates the problem of drying the artifact afterwards—the only effective drying method being solvent drying, which is both expensive and dangerous with items of the size contemplated here; and finally, chemical methods sometimes require a large investment in equipment. Phosphoric acid is the active component in most commercial rust removers and in some undercoating paints: this acid is an example of a chemical method which can cause erroneous analysis findings in the future, especially in cast iron.

A recommended method of cleaning iron and steel if organic materials are not present is the use of wet steam. If steam is available, it is an effective method of removing old grease and dirt as well as loosening and softening the rust coating. Care must be taken, however, not to allow the steam to condense and collect as water on horizontal surfaces. Equipment with asbestos or wooden lagging should not be steam-cleaned because the lagging absorbs moisture and would then maintain a very high RH for a long time right up against metal surfaces. Composite artifacts require great care in cleaning in order to prevent damage to organic components.

Rumley Oil Pull Gas Engine

To remove heavy rust deposits, an effective but slow and noisy method is with a "needle-descaler". This is an air-powered tool which bounces steel needles against the surface of the artifact. Some marking of the artifact can occur, it most certainly cannot be used on thin gauge materials; but it is gentler than sandblasting or right-angle grinders; control is provided by varying the angle of attack, and it works well on complex, irregular shapes, such as around and over rivet heads.

Bare metal is not a prerequisite of the following suggested treatment. Tannic acid reacts with iron to form a protective, passive layer. When initially mixed up, the tannic acid solution is yellow-brown in colour, but when vigorously brushed on iron, a colour change to blue-black occurs when the application is successful. Usually this coating is not sufficient protection for iron by itself and further protection is given by coating with microcrystalline wax, or with an appropriate paint system, depending on the curator and the artifact. A lacquer has not yet been developed which is acceptable for use on iron. The lacquer may crosslink and become insoluable, or it may yellow, or it cannot follow the cyclic heating/cooling movements of the metal substrata. Wax is less permeable to water vapor than lacquers: the surface appearance is more controllable and it is more easily reversed. The amount of gloss a wax surface has is determined by its hardness and the amount of buffing it receives. A benefit of tannic acid and wax in treating artifacts is that any fresh outbreaks of rust will be readily noticed against the blue-black coloured treated surface.

It now becomes necessary to become philosophical and to try to give guidance on the question of when to repaint and when to try to preserve what paint may still survive. This decision is mainly controlled by the board of trustees, the director, and the curator; but they can be influenced if the third principle of conservation and the relationship of conservation and restoration is explained: then it should appear clear that conservation of any remaining paint should have priority over restoration (repainting). If the decision is made to maintain as much of the original paint as possible, then great care in cleaning rusty areas must be taken, as the needle descaler is also an excellent paint remover. Cleaned areas should be tannic acid treated, undercoated and inpainted to match the rest of the artifact, or—if the appearance of the tannic acid is acceptable—waxing should follow. The wax will enliven paint that remains and if sufficient original paint remains, the viewer's eye will fill in the missing areas with the proper colour. It is not possible to define a rule for when to repaint based on how much paint is left; each case must be judged individually, as the use to which each artifact will be put is unique. However, one rule that holds true for all restorations (repaintings) is this: when the original paint is being stripped, photographs and samples of the paint layers that are found are kept, their location on the artifact noted, and the chips stored with the documentation on the artifact so that in the future, the paints can be analysed if so desired.

For cleaning brass/copper, do not use "Brasso"; it is very abrasive and leaves a corrosive residue which is difficult to remove. A "magic wadding" type of product, such as "Nevr-Dull", is easier to control with regards to the amount of shine imparted to the artifact, and is also less abrasive. Mild inert abrasives in a volatile solvent are the major components of "Nevr-Dull". Microcrystalline wax with 5% of benzotriazole added is the recommended method for protecting copper compounds, not lacquers.

If artifacts are to be operated, modern lubricants should be employed, as many of the lubricants for pre-1900 and even later machinery such as steam traction engines were based on animal fats

that contain acids detrimental to bearing surfaces. One must realize when operating gasoline-powered machinery that the formulation of gasoline has changed substantially in the past 80-odd years, and one must investigate thoroughly which fuel now available will be best for the engine. The main dates for changes in the formulation of gasoline are: up till 1919, simple fractional distillation produced straight chain gasolines with a low boiling point, excellent for hand-cranking; in 1919, thermal cracking produced gasoline with higher boiling point components which meant that intake manifolds had to be heated to ensure proper fuel vaporization; and in 1923, the discovery of the anti-knock ability of tetraethyl lead was made. Over the years, the octane rating of gasoline was raised, as were the compression ratios of engines.

The decision to operate artifacts is a very serious one that must be made only after significant background research, thought, discussion and soul-searching has taken place. Is operation of the original essential, or will a model or replica provide the same information? It is possible to operate an original if you have duplicates in your collection; the policy should be that the dupliate in the worst condition is the one chosen for operation, and the artifact in the best condition is kept as original as possible.

The consequences of operation can be disasterous. I know of a 1900 Benz automobile that had been stored since 1910, and which was run by the museum that now owns it in a 1978 vintage car rally. Firstly, the leather upholstery was in no condition to be sat upon, and secondly, the drivetrain of the vehicle was badly damaged during the run and had to be welded and remachined. Was the exposure to the public during the rally worth the loss of the original workmanship that has occurred? This seems a very sad fate for an unrestored automobile which had only been used for 10 years and stored for 68. Museum breakages are inexcusable unless the museum staff and board of directors/trustees know exactly the risks they are taking and can justify these risks to themselves, the public and, more importantly, to future generations. The reasons for the board's and staff's decision on operation should be recorded and made available to the museum community for study. If museums attend static display events such as auto shows, boat regattas and aircraft displays, they should do so with the intent of educating the public in what should be appreciated about the artifacts on display. The points of appreciation should include original paint, upholstery, finish and workmanship, and not the artificial super-detailing of the restorers. Prizes should be for the best original condition and not for the best restoration. As stated above, museums should not be involved in operating unique originals unless they have duplicates, in which case they can restore the operating duplicate, and advertise it as such.

I hope that reflection on and discussion of approaches to machinery collections has been stimulated by this paper and that some of the suggestions as to how to preserve your collection are within the means of your museum.

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Case Single Cylinder Rear Mount 110 h.p. Engine

SOURCES OF SUPPLY

Hygrothermographs

Recommended model for heated areas:
Belfort Electric Drive 30-Day Chart

Carleton Instruments Ltd.
2414 Holly Lane
Ottawa, Ontario
K1V 7P1
(613) 731-4703

Recommended model for unheated areas:
Weather Measure Clock Drive 8-Day Chart

Cole-Parmer Instrument Company
7425 North Oak Park Avenue
Chicago, Illinois 60648
(312) 647-0272

Psychrometer

Bendix Psychron

Aviation Electric Ltd.
200 Laurentien Blvd.
Montreal, Quebec
H2M 2L5
(514) 744-2811

Aviation Electric Pacific Ltd.
4820 Hoffar
Richmond, B.C.
V7B 1B2
(604) 278-2184

Luxmeter

Gossen Panlux
(Many photographic stores)

Ceiling Fans

Union Fans

Union Ventilation Systems Ltd.
2217, De la Metropole
Longueuil, Quebec
J4H 3W2
Call toll-free 1-800-361-4419 for local dealer

Needle Descaler

Nitto Jet Chisel Model JEX-24 is probably the most versatile. Call the national distributor to find a local dealer.

Strongside Ltd.
52 Carrier Drive, Unit 4
Rexdale, Ontario
(416) 675-3470

Benzotriazole

Available at many photographic stores

Microcrystalline Wax

Microsere Microcrystalline Waxes

(Try local fuel distributors for Gulf and Imperial, or the following)

International Waxes Ltd.
50 Salome Drive
Agincourt, Ontario
M2S 2A8
(416) 293-4151

Magic Wadding

Nevr-Dull

Canadian Tire Stores

Tannic Acid

Fisher Scientific
18 Plymouth Avenue
Winnipeg, Manitoba
633-8880

Photos Courtesy: Manitoba Agricultural Museum at Austin

Killarney Tablet: A Case History

MAURICE MANN
Conservation Technician
Manitoba Museum of Man and Nature

A training experience of mine has given me new hope for the conservation and preservation of a metal I know will have been as much a concern to others as it has been to me.

Lead artifacts in collections vary from lead shot of various calibre, lead weights, bullet heads, etc., and the title artifact—the J.A. Victor David Museum small replica La Verendrye Tablet.

Through the Museums Advisory Service our Conservation Department at the Manitoba Museum of Man and Nature was asked if there was anything that could be done for the white corrosion on the tablet at the J.A. Victor David Museum in Killarney. I had wanted to find an answer to the question of lead deterioration because of the same white corrosion appearing on some lead shot from our Native Ethnology collection (artifact number 4044—a shot pouch). One or two other lead artifacts in our collections and exhibits were also affected by this deteriorating factor—white corrosion.

Delays in communicating with the Canadian Conservation Institute in Ottawa conveniently timed the question of treatment with my pending short-term metals internship with the CCI. Though iron, silver, tin, copper and brass were also touched upon, I feel the urgency of relaying the fact that lead, though not considered as precious as silver or as common as iron and their respective problems of tarnish and rust, must be given equal attention to stabilize and return an aesthetic appearance to the artifact.

In determining the identify of the visible deterioration called white corrosion, otherwise known as lead carbonate, reference to *"Plenderleith and Werner"*, p. 280, Table V. Lead and tin alloys, the artifact condition is thus described:

1. corroded (lead carbonate)
2. mechanically sound
3. superficial corrosion

Initially, the solution chosen from the selection of treatments listed included:

1. chemical method – (2b) chelating agent
2. mechanical cleaning – (5d) glass-brushing
3. protective finish – 6(a) wax

The corrosion is caused notably by organic acids, i.e. tannic acid in oak storage or exhibit cabinets. Carbon dioxide in distilled water has been noted by Plenderleith and Toracca in the *Conservation of Metals in the Tropics*, **UNESCO, Museums and Monuments XI**, page 248. Freshly de-aerated distilled water should be used in treatment processes.

Should you have specific lead items that appear whitish, consult with the Museums Advisory Service or the Conservation Lab at the Manitoba Museum of Man and Nature.

CASE HISTORY

The treatment described here as a case history is to imply three things:

1. A **Condition Report** of an artifact before treatment is a pre-requisite to good museum records practice.

2. A **Treatment Proposal** is developed to anticipate problems before they occur and to ensure that a correct procedure is followed.

3. The actual treatment is logged in a **Treatment Record** to confirm the proposed treatment and to log any observations pertinent to the success of the treatment.

CONDITION REPORT KILLARNEY TABLET

Date: October 1st, 1979

Face Side – minor white corrosion to 100% of the surface
Reverse Side – appears stable, no white corrosion effect

TREATMENT PROPOSAL KILLARNEY TABLET

Proposed Treatment – Step 1

October 4th, 1979 – Analysis of metal

Analysis Received: October 19th, 1979

Analysis of Metal Object
(As per CCI Memorandum dated October 19th, 1979, File Reference: No. 0,000, 273 ARS 1681)

Replica of La Verendrye Tablet.

By energy dispersive x-ray analysis (EDX), the metal was identified as a lead (Pb)–antimony (Sb) alloy. While quantitative analyses were not performed, Pb is the major constituent.

A quick check in the *History of Technology*, Vol. IV, pp. 120-21, shows that lead-antimony alloys are used for a variety of purposes, one of which is to improve the fusibility of metals for casting. Possibly this was the case here.

Proposed Treatment: Step 2

October 19th, 1979:

A – treat with a chelating agent D.T.P.A.–41 (5% solution) (pH level of approx. 13) buffered with D.T.P.A. (to a pH level of 6).

B – preserve with a wax such as Multi-wax ML445.

TREATMENT RECORD

CANADIAN CONSERVATION INSTITUTE
Archaeology/Ethnology Division

CCI NUMBER: 0000 273

Lead Tablet, Killarney Museum
(Manitoba Museum)

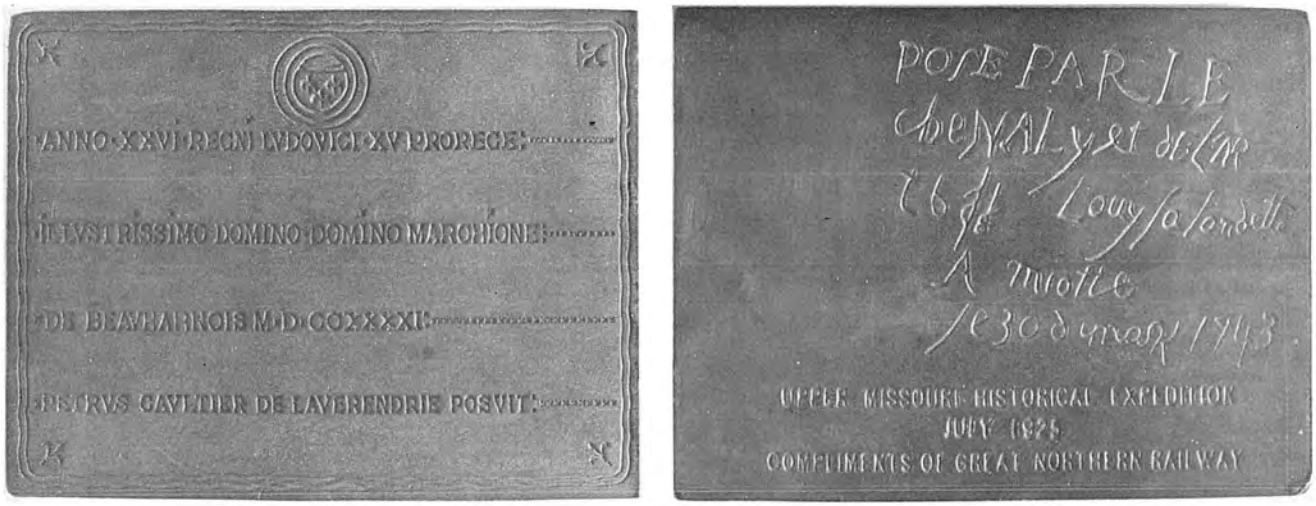
	Date		Hours	Initial
OTTAWA	24/9/79	Documentation	:20	MEM
		Analysis Preparation	:15	MEM
	17/10/79	Photograph: Before	:15	MEM
	19/10/79	D.T.P.A.–41 (pH-13) prep. of 50% solution in distilled water buffered with D.T.P.A. to a pH of 6.	:15	MEM
	22/10/79	8:00 a.m. – Preheated solution in lab oven at 40°C, 30 mm.	:15	MEM
		8:32 a.m. – Tablet into solution, brushed with soft fibre brush gently, immediately, to rid lead surface of air bubbles.	:05	MEM
		8:43 a.m. – Rebrushed table while in solution, returned to oven for 10 minutes. 8:50 a.m. – " " " 9:03 a.m. – " " "	:10	MEM
	22/10/79	9:15 a.m. – Experimentally glass bristle brushed tablet – (too coarse)	:10	MEM
		9:18 a.m. – Rebrushed tablet while in solution, returned to oven for 20 minutes		
		9:43 a.m. " " "		
		9:55 a.m. – Acetone bath, after table allowed to cool while in solution. 10:25 a.m.–Removed from bath to dry on filter paper propped up over edge of dish, then set down in dish and covered.	:10	MEM

Completion of Treatment to continue at Manitoba Museum–Winnipeg

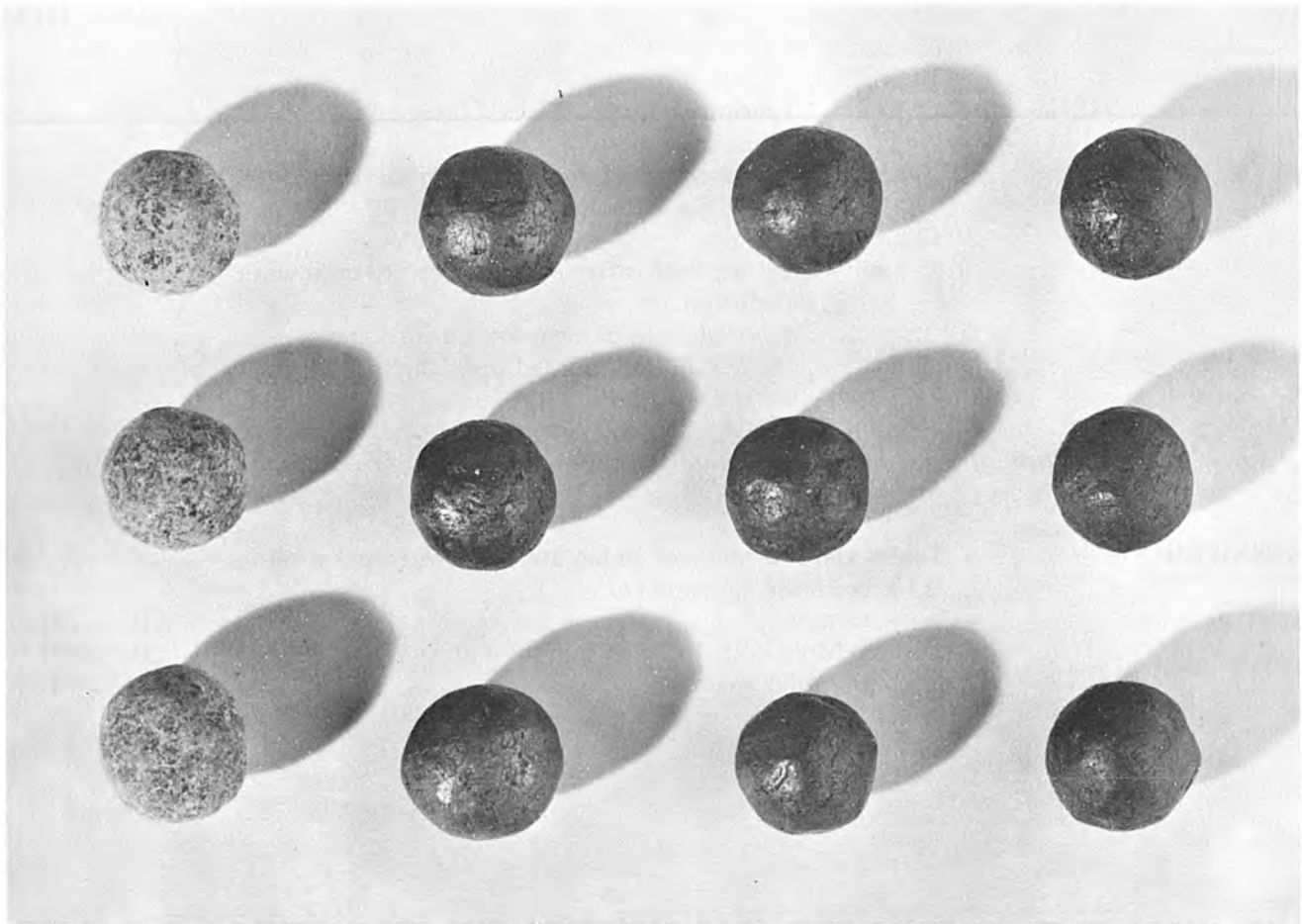
WINNIPEG		– Tablet allowed to "age" in lab atmosphere, monitoring it for aesthetic appearance.		
		– Warmed tablet.	:15	MEM
		– Applied Multi-wax 180M in shellsol with swab.	:15	MEM
		– Allowed tablet to cool.	:15	MEM
		– Completion of files.	1:00	MEM
		Total Time:	3:5 hours	

Treatment by:_____ Date:_____

Approved by:_____ Date:_____



Small replica of Tablet deposited to mark territory explored by Francois, son of Pierre de la Verendrye, March 30, 1743. Found near Fort Pierre, South Dakota in 1913 (original tablet 8½ x 6½ inches). On one side inscription, printed carefully in Latin, was prepared in France, to mark the explorations of an elder brother in 1741. The inscription scratched on other side, adapts it for use of younger brother in 1743.



This lead shot was treated similarly to the La Verendrye Tablet. An additional effect of each set of shot treated was the degree of darkness in colour achieved. This can be used to advantage so as not to have an entire collection of lead artifacts appear aesthetically sterile.

Biodeterioration of Museum Objects

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Editor's Note: *The following article was first published in the British Columbia Museums Association publication,* MUSEUM ROUND-UP, *No. 72, Fall 1978, and appears with the permission of both the author and the editor.*

Biodeterioration of museum objects is the deterioration of their material by biological organisms. The material may be organic such as feather, paste, or inorganic such as rock, glass and metal or even synthetic such as plasticized polyvinyl chloride film. All these materials are biodegradable by organisms. The main organisms are fungi, yeast, bacteria and insects. Occasionally higher plants and animals may be involved. Biodeterioration in nature and in the museum is an ecological problem. It is the result of the interactions of the biodeteriorating **organism(s)**, the artifact **material** and the physical and chemical aspects of their **environment.**

In terms of conservation of artifacts to control or prevent biodeterioration, the complete ecological picture should be looked at. Take for example an artifact—a northwest coast Indian cedar bark grave shroud. In the temperate rain forests, in place on the grave, the shroud will eventually completely deteriorate by the interaction of bacteria and fungi and the physical environment. In a controlled museum environment, 21°C and 50% relative humidity (RH), biodeterioration will be arrested because the fungi and bacteria require a higher RH for growth. In this case a biocide is not necessary. If the RH is not controlled and should reach 70% the fungi may again become active and in this case the use of a biocide could be warranted.

Another example of the need to look at the overall ecological aspect before conservation processes can be logically applied is the case of a limestone gravestone encrusted with lichen. Lichens are reported to cause pitting and disintegration of the limestone. In the churchyard, the lichen will grow slowly, but in the museum where light levels and RH are too low to support growth the lichen will die or remain inactive. No further damage will occur and there is no need to remove the lichen except for aesthetic purposes. These two examples illustrate physical aspects of the museum envirnonment which control the growth of biodeteriorating organisms.

Often in a biodeterioration situation, a whole hierarchy of organisms are interacting. Such an example was discovered on a water-colour painting which was transported from South America to Canada in the hold of a ship. Even though the packing case was well constructed, the high humidity and temperature in the hold of the ship for a prolonged period of time allowed fungi to grow on the surface of the water colour. In the controlled environment of a museum the painting was examined and exoskeletons of beetles and mites were found among the fungi filaments. The beetles were identified as fungi-eating beetles and the mites a common pest of the beetles. In this case, the presence of the beetle does not warrant insecticide treatment. The fungus cannot grow in the 50% RH of the museum, thus neither the beetles nor the mites can live. The disfiguring fungus would be killed and removed by normal cleaning of the painting, therefore a fungicide is unnecessary.

For both insects and micro-organisms it is necessary before treatment to determine if they are the causative agents of deterioration. The presence of an organism does not necessarily mean it is the culprit; it may be just an innocent bystander. Thus, identification of the organisms that cause deterioration of museum objects is a prerequisite before logical methods of control or eradication can be undertaken. Selected articles and texts which will assist in identification are given in the accompanying annotated bibliography.

Microorganism

In the case of microorganisms it is not essential to know the name of the microorganism, but it is essential to know if it is bacterium, yeast or fungus. The fungi commonly met with in the museum world are normal airborne fungi which cause surface mould *mildew*. Rarely do they stain artifacts; the colour of the spots is caused by the colour of the vegetative spores or conidia which can be readily removed when the material is dry.

The knowledge of the basic biological requirement for growth of the microorganism is essential to determine logical eradication and control methods. Biological requirements mean such things as **water, oxygen, nutrients,** and **temperature,** and pH (acid or base) **tolerence.**

The water or moisture relation is the most important growth parameter. Bacteria and yeast require water in which to grow, while fungi spores can germinate on materials held as low as 70% RH. Growth of fungi on different materials depends on the regain ability of the material; that is, the amount of moisture in the material when at equilibrium with the RH of the air. This moisture is called equilibrium moisture content (EMC). Cotton has a greater regain ability than wool; cotton held at 80% RH will support fungus growth while wool needs 90% RH before fungus growth will occur. Papers respond the same way; the greater regain ability or absorbency of the paper, the lower the RH required to support growth.

Wet artifacts when first brought into a controlled environment of a museum may take time to reach EMC. During this time they are vulnerable to fungus growth. In an experiment with vegetable-tanned leather, fungi spores on dry leather required 90% RH for germination whereas wet leather held at 74% supported fungus growth. This illustrates the problem of wet materials which have not reached EMC.

Bacteria and fungi associated with wood deterioration are not a threat in the museum in which the RH is below 60%. Wood-rotting fungi require a moisture content of 20-25% for growth. At 21°C and 50% RH the EMC of wood on an average is around 10%. Thus, rarely do wood-rotting fungi present a problem in museum objects, but they are a problem in wooden buildings and wooden artifacts in outdoor displays where EMC may rise above 25%.

One cannot be complacent even if the museum environment is 50% RH. One must be aware of the variability of EMC of different material and the moisture content of materials when first brought into the museum before EMC is reached. Soiled areas on artifacts or material containing humectants such as mucilaginous gums, sugars or glycerine, or salts which absorb moisture readily may produce microenvironments on the material which could encourage fungus growth. Also small microenvironments may occur in controlled environment rooms. Cooling air will increase the RH; for example, air at 20°C and 50% RH if cooled to 15°C will have 62% RH. An example of this arose in a herbarium in a museum with excellent environmental control. A stack of herbarium sheets with seaweed specimens was placed near metal air outlet vents on a working table. Cooled air going through the metal vents caused the vents to become cold, and this in turn caused a microenvironment with higher RH than the overall room. The mucilaginous content of the seaweed has a higher regain ability and enough water was absorbed to support fungus growth, which in turn attracted and supported a small population of book lice.

Oxygen is essential and always present in the museum environment; thus its removal to control biological organism is impossible. In special display cases or storage, artifacts may be sorted in an inert gas but this is usually to prevent chemical deterioration by oxydation.

The **nutrients** or the substrate in museum artifacts which are required by microorganisms for growth may be any organic material, such as carbohydrates (starch, cellulose, sugars), protein, and fats. These nutrients besides being a component of an artifact may also occur in the surface dirt.

Microorganisms have broad tolerance to **temperature** and **pH.** There are specific differences, but generally they remain viable from freezing temperatures to 50°C. Lethal temperatures are above 50°C and optimum growth occurs around 25°C on an average for airborne contamiment that would cause most problems in museums. Again, generally speaking, a range of pH4—pH11 will support the growth of microorganisms.

On reviewing the parameters of growth of the microorganisms it is apparent that logical control or prevention of their growth could be obtained by **control of moisture.** Usually water, per se, required for bacteria and yeast growth, is present in the museum only as solutions being used for conservation treatment or restoration; i.e. starch paste, protein glues and aqueous cleaning solutions. If the cleaning solutions, etc., are to be stored for longer than 24 hours, they should be prepared aseptically and kept sterile so they do not have microorganisms incorporated in them. In most cases fungi, mildew or mould (all three are synonomous terms) can be controlled on materials at EMC with air below 70% RH.

SUMMARY OF LIFE CYCLES OF COMMON MUSEUM PESTS

COMMON NAME	SCIENTIFIC NAME	NO. OF EGGS LAID	INCUBATION PERIOD	DURATION OF LARVAL STAGE OF NYMPHS	DURATION OF PUPAL STAGE	DURATION OF ADULT STAGE
Webbing Clothes Moth	*Tineola biselliella*	100-300	4-21 days	5 weeks to 2 years (larvae)	2-3 weeks	1-4 weeks
Case Making Clothes Moth	*Tinea pellionella*					
Black Carpet Beetle	*Attagenus piceus*	20-100	1-3 weeks	66-250 days (larvae)	1-3 weeks	4-6 weeks
Varied Carpet Beetle	*Anthrenus verbasci*					
Common Carpet Beetle	*Anthrenus scrophulariae*					
Furniture Beetle	*Anobium punctatum*	30	2-4 weeks	1-4 years (larvae)	2-8 weeks	3-4 weeks
Silverfish	*Lepisma saccharina*	100	20 days	90-120 days (nymphs)	—	Up to 3 years
Firebrat	*Thermobia domestica*					
Book Lice	*Liposcelis divinatorius*	200	—	12 days (nymphs)	—	Unknown

Summary of the number of eggs laid and duration period of the various stages in the life cycle of common museum pests. The values are average values which will vary considerably with temperature, humidity, and food availability.

Insects

Unlike microorganisms on which the identification to the genus-species level is usually unnecessary, it is essential to identify the insects. Identification of the insects will tell one if they are misplaced from their natural environment or whether they are museum or household pests. An example of this is the case of the "gilded cocoon". On examining a polychrome and gilt wooden religious sculpture, a cocoon was found in the crevices of the Saint's flowing garment. In the cocoon was a dead larva. The larva died before pupation. Among the delicate threads of the cocoon were incorporated fragments of paint and silver gilt. It is a common practice for many cocoon-building insects to incorporate part of the environment into the cocoon for camouflage. The damage done by this cocoon-making larva was minor. The larva was misplaced. It most likely entered the church in a bouquet of flowers, fell on the sculpture and there tried in vain to complete its life cycle.

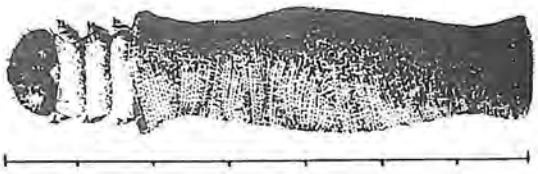
The insects most commonly associated with museum objects are the clothes moths, carpet beetles, furniture beetles (wood borers), silverfish, firebrats and book lice. Insects are divided into two groups according to their type of life cycle. If eggs, larvae, pupa and adults are formed, the life cycle is called "complete metamorphosis"; if only eggs, nymphs (immature adults) and adults are formed it is called "incomplete metamorphosis". Moths and beetles have complete metamorphosis and the silverfish, firebrats and book lice have incomplete metamorphosis.

Moths and Carpet Beetles

The adults of beetles and moths do not cause damage. Their only function is sexual reproduction, thus the perpetuation of the species.

There are two common species of clothes moths in Canada: the webbing and the case-making clothes moth. Most larvae are small white worms with brown heads. They may cause extensive damage to materials left undistributed for long periods of time. The presence of the webbing clothes moth larvae can be identified by the stringy silken tubes on the material, and the case-making moth larvae by the small compact larval cases.

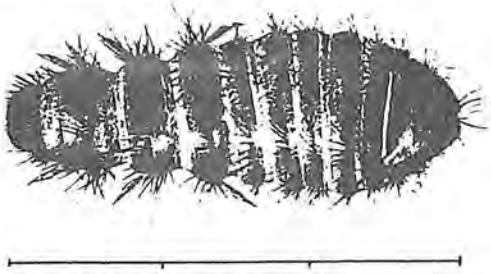
Larva, Common Clothes Moth **6mm**



Larva and Case, Casemaking Clothes Moth **7mm**

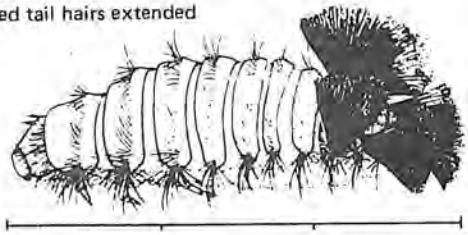
Clothes moth larvae eat a wide variety of animal products including all kinds of woolens, furs, feathers, blankets, carpets and rugs, upholstered furniture, piano felts, and museum specimens of animals and birds.

A — at rest tail hairs down

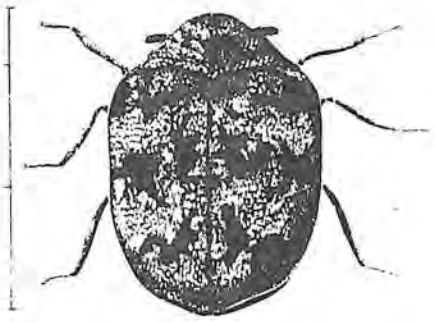


Larva, Varied Carpet Beetle **3mm**

B — disturbed tail hairs extended



Larva, Varied Carpet Beetle **3mm**



Adult, Varied Carpet Beetle **2.5mm**

There are three species of carpet beetles commonly found in Canada: the Varied, Common and Black carpet beetle.

Carpet beetle larvae are yellow to brown in colour and are densely covered with fine dark hairs. Unlike clothes moths, the carpet beetle larvae move about and thus their damage is not localized. The larvae shun the light and will shelter by baseboards, in floor cracks and heating ducts, or in almost any undisturbed place where lint collects. The larvae feed on keratin protein of woolen materials, furs, feathers, hair used in upholstering, horn, bristles and tortoise shell. In addition they will eat leather, silk, linen, rayon, jute and woods which are incorporated with animal glues.

The Furniture Beetle (Wood Borer)

There are two common wood-boring beetles—the Powder Post and Furniture beetle. The true Powder Post beetle *(Lyctus ssp.)* attacks mainly sapwood in unseasoned hardwood. There they feed on the stored starch in the sapwood. Thus, they are a threat to poorly seasoned hardwood floors and tools, etc., but rarely to old museum objects. False Powder Post beetles may attack the softwoods pine and fir.

Powder-Post Beetle

The Furniture beetle larvae *(Anobiid spp.)* attack both hard and soft woods. They are able to digest cellulose and prefer old wood. The female lays eggs on the end grain of old flight holes or on unpainted rough surfaces. The emergent larva chews into the wood below the egg case and tunnels up and down the grain of the wood. The tunnels are filled with powdered wood fibers and faecal pellets. The faecal pellets are cigar-shaped, whereas the faeces of the Powder Post beetle larvae are soft and silky. The larva pupates just below the surface of the wood in an oval chamber. The emerging adult chews through the surface of the wood to make the flight holes. The adults do not feed, are nocturnal, and thus are rarely seen.

A great deal of damage by the furniture beetle is observed on many wooden artifacts but in the museum with a controlled environment rarely, if at all, are viable larvae observed. On the other hand, it is difficult to determine if there are viable larvae present in the interstices of wood; even the presence of fresh grass may be misleading, and may only be the result of vibration.

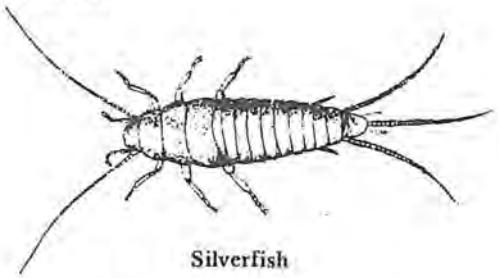
Because the larvae are protected in the interior of the wood, fumigation treatment has limited value. Control by infra-red heat and microwave have been successful in industry (in wood which does not contain metals) but these methods cannot be used on delicate museum objects.

If viable adults or larvae are observed, the control treatment must be devised for the specific artifact. No general treatment can be suggested. It would be ludicrous to think that a woodworm-infested polychrome icon could be treated by the same method as an infested ox bow.

Occasionally museum artifacts brought in from tropical countries may be infested with an active colony of tropical wood beetles. Repeated cyclic freezing and thawing of the artifact for 24 hours will cause these tropical beetles to go into metabolic shock and die. Of course great caution must be taken to prevent condensation on the artifact or sudden moisture content changes. Also the dimensional changes caused by temperature changes must be considered to determine if the artifact can undergo this method of eradication of insects. Rarely will these tropical beetles attack other wood in the museum environment.

Silverfish, Firebrats and Book Lice

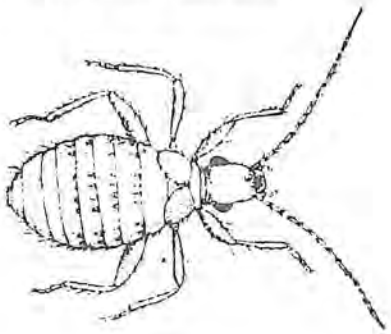
These insects do not have larvae or pupae in their life cycle. The eggs hatch into nymphs which look like miniature adults. The nymphs molt several times before they become sexually mature adults. Both nymphs and adults could cause damage. Silverfish and Firebrats feed mainly on starch, sugar, and protein sizes, gums and glues. They also damage cotton, linen and artificial silk that has been sized.



Silverfish

Book Lice are frequently found among the pages of old books that have been undisturbed for a long time. Sometimes they occur in great numbers in buildings, especially in dark, warm, damp rooms and in newly-constructed buildings that have not completely dried up. They may cause alarm by swarming over floors, walls and furnishings. They may cause damage to protein glue,

starch paste, paper backing and bindings of books but it is believed that the insects are feeding on mold growth on these materials.



Book Lice

All three of these insects require warm temperature and high humidity for normal development. Their presence is an excellent indicator of a moist microenvironment some place close by, such as a leaky pipe, flower pot, sink area, etc.

Summary of Life Cycles

The duration of the different stages of all the insects mentioned varies considerably with temperature, humidity and food available. Table 1 summarizes the life cycles, using average times for duration periods.

INSECTICIDES

It is important to know some details of the life cycle of the insects to be eradicated before a logical choice of insecticide can be made. An ideal insecticide should get rid of all stages in the life cycle. It should kill or repel adults, interfere with egg laying, prevent egg hatching, kill larvae, kill pupae, and persist to prevent reinfestation. To find one to do everything is almost impossible because different insecticides vary in poisoning effect and mode of action.

The poisoning effect of physical poisons such as inert dust, oils, abrasive powders is as an asphyxiant. Protoplasmic and respiratory poisons destroy enzyme systems in body cells. Nerve poisons destroy the nervous system.

There are four basic modes of action of insecticides: stomach, contact, residual and fumigant. Many insecticides have more than one mode of action.

Stomach Insecticides have to be eaten and thus are applied on surfaces or as food bait. These have little use in a museum. Food baits are often recommended for silverfish, but since they are blind and cannot smell its use certainly is suspect.

Contact Insecticide must contact the insect body. The hard wingcovers of beetles and the hairs on larvae may protect them from the necessary body contact of this type of insecticide. Contact insecticides are useful for quick control of crawling or flying insects.

Residual Insecticides are those whose poisoning action persists for a prolonged period after application. DDT, which no longer can be used without a special permit, had great value in its residual effect.

Fumigants are those insecticides which are highly volatile or are themselves gases and enter the insects through their breathing systems. Some may also act as contact poisons.

There are many insecticides recommended commercially for the eradication of insects. The common ones used in the museum world are Paradichlorobenzene (PDB) (mothballs), Pentachlorophenol (PCP), Dichlorvos, Pyrethrins, and Diethyl diphenyl dichloroethane.

It is impossible to recommend the use of any insecticide without knowing details of the artificial material, insect and environment. *The following selected information on the above common insecticides is presented only to show the need for awareness of the many aspects of the insecticides or commercial preparations before their use.*

Paradichlorobenzene

Occasionally polyvinylchloride garment bags with PDB are used for storage. Tests on 12 commercial brands of garment bags showed that approximately 90% of the PDB had escaped from the bags in 28 days; the thickness of the vinyl made no difference. Also 28 days was required for complete kill of clothes moth and carpet beetle larvae. An airtight acrylic container and metal container were also tested and obtained 100% kill of black carpet bettle larvae in 3-6 days and webbing clothes moth larvae in 10 days.

These tests show that we cannot be complacent, and just because garments are stored in bags we cannot assume that they are protected. A lot of damage can occur before the larvae are killed and, because the PDB escapes, reinfestation can occur. Air-tight containers seem to be the answer, but it has been reported that high concentration of the volatile PDB in air-tight containers may cause damage to some museum objects. The tests were undertaken by Dr. Hanna Jedrzejewska of the National Museum in Warsaw and reported in an unpublished paper which showed that PDB, PCP, DDT, Para-

chlorometacresol and Thymol cause deterioration of some materials common to museum objects. She attributed the damage to acid damage. In summation, Dr. Jedrzejewska states: "The results of this study demonstrate the unquestionable necessity for precise testing of every preparation used for the disinfection of antiques and for museum premises and equipment", and she states further, "a particularly urgent problem also is the finding of disinfecting agents which are less dangerous to antiques than chlorinated hydrocarbons".

Pentachlorophenol

Pentachlorophenol has alternative commercial names, PCP, Penta, Penchlorol, Dowicide 7, Dowicide G, Santophen 20, Santobute, and chlorophen. The alternative names and history, physical, chemical and biological properties are given for most biocides in Agriculture Canada Publication 1093 *Guide to the Chemicals Used in Crop Protection 1973*, 6th Edition. Pentachlorophenol is commonly used for timber preservation. It has both insecticidal action against wood boring insects and fungicidal action against fungal rots. Pentachlorophenol is readily absorbed through the skin. Thus objects treated with this biocide should be clearly marked to protect those who may handle them in the future.

Dichlorvos (Vapona)

Dichlorvos is a contact and stomach insecticide with fumigant action. It is important to read the label of any pesticide product and to use it only in accordance with the directions on the label. All pesticides are registered by the Federal Government Pest Control Products Act. It is an offence under this act to use a registered product under unsafe conditions. The label on "Vapona No-pest Strip", a Shell Corp. product, states that only one strip should be used per 1,000 cubic feet and additional strips should be placed 10 feet apart. Scientific literature reports that Dichlorvos can inhibit an enzyme necessary for normal liver function. Placing more strips than one in the prescribed 1,000 cubic feet presents a health hazard to man. In the museum these strips have doubtful application because, as the label states, they are for control of flies and mosquitoes and other small flying insects.

Pyrethrins

Pyrethrins act as contact poison. The hard wing covers of beetles and hairs of larvae may prevent the poison from contacting the soft body. The larvae of clothes moths and carpet beetles are heavily haired, thus pyrethrins have limited use in museums. They are usually recommended as knock-down sprays for quick control of crawling and flying insects. They are weak and often after knock-down the insect may revive. Pyrethrins are yellow in colour and may cause staining; thus they should not be sprayed on the artifact but only the insect.

Diethyl diphenyl dichloroethane

Diethyl diphenyl dichloroethane is used in commercial moth-proofers. It has its main value in its residual effect. It is important to read not only directions on labels but also tables of contents. Most aerosol sprays have a solvent which may cause staining. The common solvent is petroleum distilate, which is considered to be volatile but should be tested before use.

In summary from the above selected information on the few insecticides:

- Alternative or trade names, history, physical, chemical and biological properties of most insecticides are published in Agricultural Canada publication 1093, *Guide to the Chemcials Used in Crop Protection, 1973*, 6th ed.
- All pesticides are registered by the Federal Government Pest Control Products Act. It is an offence under this act to use a registered product against the directions on the label. Most insecticides are hazardous not only to the insect and artifact, but also to man.
- It is essential to know the action of the insecticide and some details of the life cycle of the insect before the insecticide can be logically used.
- Many insecticides cause deterioration of some materials common to museum objects and must be tested prior to use.
- It is important to read the table of contents on commercial products. Such things as solvent for insecticide or propellents may be damaging to the artifact.
- Artifacts treated with a residual insecticide should be clearly marked to alert people who may handle it.

Fumigant

The common fumigants used in the museum world are the volatiles, PDB crystals and the gases ethylene dichloride, methyl bromide and ethylene oxide used in commercial fumigation chambers. Of these gases, the commercial preparation of ethylene dichloride is no longer available in Canada. Methyl bromide has been shown to have damaging effects on the keratin protein contained in furs, feather, woolens, on all rubber-containing materials, on viscose rayon, and on papers and leathers in which a sulphur-containing process was involved in

fabrication. Because of this damage methyl bromide is no longer recommended for fumigation of museum artifacts.

Ethylene oxide mixed with 90% carbon dioxide is used in place of methyl bromide. There has been no recorded damage to museum artifacts by ethylene oxide even though it is very reactive. It will react readily with water to form ethylene glycol, which is water soluble. Objects to be fumigated should be at EMC with 30%-50% RH for effective fumigation and to prevent formation of ethylene glycol. Ethylene oxide is a small molecule and has great penetration. Materials tightly packed or wood or leather goods are easily fumigated but require a period of time after the fumigation for the freeing of the gas before handling. The length of time should be specified on the label of the product.

If museum artifacts require fumigation and it is to be done by a commercial firm, make sure the firm is reputable and the staff knowledgeable of your specific needs. A handful of dead insects is no compensation for a destroyed artifact.

In the event that an isolated colony of carpet beetles or clothes moths is discovered, caution must be taken to prevent the spread of insects. A contact spray will inactivate the flying and crawling insect. Isolate the infested article in a sealed plastic bag. If treatment cannot be undertaken immediately, place the bagged artifact (if it is not damaging) in a deep freezer to inactivate the insects. A thorough cleaning of the storage area of the infested artifact is essential. A residual insecticide could be used on shelves or drawers, etc. It is impossible to outline all the steps to be taken and recommend insecticides because each situation is unique. The above are only a few points again presented to make one aware of the tangential aspects of an isolated infestation.

This all paints a dim picture for the use of insecticides. The best approach to insect eradication is good housekeeping. Prevention is the answer to the problem. In reality it is an ecological approach, preventing environments conducive to growth of insects.

The following is a list of preventative measures in reference to good housekeeping:

1. Ensure that moths and carpet beetles and any other insects are not brought into the museum in packing cases of newly-acquired objects.

2. Periodically examine susceptible material, especially in storage areas. Set up a schedule and checklist to ensure thorough and regular examination.

3. Air and brush susceptible material regularly.

4. All garments which can undergo drycleaning should be drycleaned by a reputable firm.

5. Keep susceptible material off the floor.

6. Do periodic, thorough house-keeping—vacuum cracks, baseboards, etc. Use a vacuum with disposable bags and burn the vacuum bags after use.

7. Remove birds' nests in attics or around the building.

8. Remove all dead insects (cluster flies) from the windows.

9. Eradicate bats.

10. Keep humidity below 60% RH.

11. Repellents can be painted on baseboards, table legs, etc., and insect traps can be used. Consult government publications for recommended methods.

In final summary, the purpose of the paper is to bring a keener awareness and understanding of the overall aspects of biodeterioration. Biodeterioration is an ecological problem involving the interaction of the biodeteriorating organism, the artifact material and the physical-chemical aspects of their environment. Control and prevention of biodeterioration can be most logically accomplished by control of the environment of the artifact to prevent the formation of environments conducive to the growth of microorganisms or insects. This can be done most logically by environmental control in museums and good housekeeping. Biocide treatment or fumigation should be used only as an emergency measure.

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The Boston Experience

TERRY PATTERSON
Secretary
Association of Manitoba Museums

A REPORT FROM THE AAM/CMA JOINT CONFERENCE, BOSTON, JUNE 7-12TH, 1980

A few days prior to the Boston Conference, I discovered that my grandmother had grown up in that city. She was born in Nova Scotia, and raised a family in Calgary, Alberta – in between the two little was known to me. While checking addresses and names of distant relatives known to have lived in Boston, I discovered my grandmother's home address. What a joyful surprise! Later, as I walked through Boston reading the Jubilee signs, I felt they also included me when they said, "America—your mother wants you home for her birthday".

In my fifth year as secretary of the Association of Manitoba Museums, here I was present at the American Association of Museums 75th Birthday Party and Boston's 350th....all portents to the most memorable time of my life. During the conference, many buttons were distributed, sold and exchanged. For me the most apt was one from the B.C. Provincial Museum stating "I've had a Mammoth Experience". This I wore for an entire week following the conference, as advance answer to queries of "How was the trip?".

To be in one place with almost 3,000 other museum people, to share museum-related ideas and comments with perfect strangers (and be understood), to meet people who have merely been names in museum publications and discuss mutual concerns—all were experiences I will never forget. The entire week can be compared to an intensive workshop on all facets of museum operation, including evening activities, mealtimes and 'free' periods. Wherever I went I collected brochures, pamphlets and other literature from workshops, exhibitors, and other museums. New products, new methods of display, different ideas for programming; plus a variety of publications available by and for the museum world were not only useful references—but an education in itself.

Terry Patterson representing the Association of Manitoba Museums at the AAM/CMA Conference in Boston

There were over 2,600 delegates registered, of whom about 220 were Canadian. Though many Canadian museums were within motoring distance, an analysis of the delegates and their affiliations was interesting. From the Canadian delegates, 45% were from large museums or federal agencies, 20% from medium to small museums, and 5% were Association representatives.

The Canadian contingent did not include many from small museums. This was understandable due to the cost, but the insights would be particularly valuable to smaller museum personnel.

A fairly new committee in the AAM is the "Small Museums Committee", composed of personnel from smaller museums who banded together so their voices would be heard within the AAM. Though our Association of Manitoba Museums is primarily composed of members from small museums, I believe such a group of Canadians could be effective. The prime factor is one of communication amongst small museums. At present, I do not believe the average Canadian museum workers are filled with the same drive and outgoingness as their American counterparts—which is a definite requisite for such a group to be successful.

Arriving in Boston Friday evening at sunset, I took a taxi to my designated dorm. The driver was interesting and pleasant and assisted me with strapping my luggage on a folding carrier. As he drove away, I entered the door of the building to be greeted with a large sign for AAM/CMA delegates. This informed me that I was one of many people reassigned to other quarters. Directions were clear, but it was a long haul dragging luggage for three blocks.

Saturday, June 7th, was cool and rainy. As I was not required at meetings, I decided to explore the city. Starting at "Jubilee 350" Headquarters in the City Hall, I noted the many walking tours available and decided to leave those for better weather (which did not arrive until too late). I decided to tour City Hall and an exhibit entitled "Gateway to the Sea" which depicted Boston's history in paintings, maps, and photographs. Later I explored a famous meeting hall (Faneuil Hall) which is said to be the starting place of the American Revolution. Now it is a collection of booths which offer for sale foods of many ethnic origins, with an open area set aside to sit and enjoy your purchases. Quincy Market nearby was full of shops offering hand-crafted, specialty, and imported items of all kinds. One could spend several days, and a small fortune, exploring all the shops, booths and stalls in this area.

A nearby theatre offered a one-hour multimedia presentation on past and present Boston entitled "Where's Boston?". This was a fascinating exposition of the many facets of Boston the average tourist might miss; though I heard several comments that it was of more interest to Bostonians. I felt it added interest to the whole trip.

Late in the afternoon I walked around the City Hall area viewing several historic buildings; then took the subway to the convention area, where the tallest building in Boston offered meals with a panoramic view of the city. Rain clouds obscured the upper portions of the building, so I left that also for another day. Instead, I located the registration area, then headed back to the dorm to sort out the day's brochures and purchases.

The first meeting on Sunday was scheduled for 1:30 p.m. so I started the day with a visit to Trinity Church in downtown Boston. One of the former rectors was the famous Phillip Brooks, and several interesting stories centered around him during the guided tour of the church, which followed the service. In this beautiful church, a number of stained glass windows were created with the assistance of an unknown designer—Louis Tiffany.

I walked several blocks to the hotel, arrived at the CMA President's Meeting at 1:30 p.m. as scheduled, only to find that the meeting was just resuming after a lunch-break. An information package I never received had shown the meeting was scheduled to begin at 10 a.m. I found the remaining agenda and discussion quite interesting and valuable.

After the meeting, I completed registration, then returned to the dorm to drop my notes and briefcase before attending the evening's special dinner. I had chosen to join the "Small Museums" group expecting a speaker, etc., but found it was more of a "get together". However, I did meet most of their organizing committee and found that small museums everywhere have difficulties in making their needs and ideas known to larger organizations.

The American Association of Museums Annual Meetings are usually very large and offer seminars and workshops in a great variety of topics to accommodate people from every discipline and size of museum. Physical distribution of bodies is a major problem, and sufficient meeting rooms must be made available. This part of the planning was excellent, with meeting rooms in the hotel or within walking distance.

Moving the masses presented many problems. A professional tour guide company was in charge of bus arrangements to and from several events. I felt this was a disaster most of the time. Perhaps they had not realized how many people were involved. A valiant attempt was made to co-ordinate

Lynn Ogden, Executive Director of the Canadian Museums Association, greeting fellow Canadian and American colleagues at the Boston Conference *T. Patterson*

Museum Technician Trainees Susanne Sutherland, Margo Flewelling and Maureen Matthew *(foreground)* **enjoying the Victorian Picnic** *T. Patterson*

trips, but there were many glaring errors—including a bus driver who did not know his way around Boston.

An event on the first day, "Behind the Scenes in Museums", became so disorganized that many people went to museums not of their choosing because destinations were not clearly marked on the buses. Once at the museums, few had a chance to look "behind the scenes", while most were left to wander the exhibit halls as tourists.

Things improved later in the week. A trip to the Franklin Zoo for a Victorian Picnic was very efficient, including a police escort through rush-hour traffic (perhaps practice paid off).

After Monday's meetings and workshops, I looked forward to the evening clambake. Being on one of the later buses, I may have missed the information regarding harbour cruises, etc. In any event, I arrived at the Navy yards, followed the crowds to a massive meandering line up across the lawn in front of a lovely house. (I never did find out the background of the house, but was quite concerned to see the lawn being beaten down by the crowds of cold, hungry people). Far out of sight, large tents had been erected over long tables, though there was not enough room for everyone. Possibly earlier plans depended on fair weather, with people eating the meal on the grass. But the rainy, cool weather had persisted. The lines were disorganized, problems arose with the lobster pots (the fire went out at one point), and the clams were rather sandy and cooled too quickly for pleasurable eating. Due to the rain and wind, I was more impressed by the steaming bowls of delicious clam chowder.

Harbour cruises were announced before many people had been served. As did many, I left to get on the only trip to designated areas, without a satisfying meal. Meeting friends who had not picked up the cruise passes, I remained behind to chance a later trip. At this time I found that alternative food of corn-on-the-cob, watermelon and lobster had been available somewhere else. (Recalling Christ's miracle of feeding the 5,000, I think His greatest feat was doing it with only 12 volunteers).

The week encompassed too many seminars, lectures and events to attend, so one was constantly making choices. I tried to concentrate on topics relevant to small museums, as well as see the exhibit halls (products for museums) and resource rooms (publication and information exchanges). The notes and pamphlets I brought back will provide several months reading and study material.

The "Grande Finale" of the week, a Victorian Picnic, was a feast for the senses. The bus trip was good, and the weather cooperated turning seasonably warm and sunny, allowing people to wander through the grounds of the Aviary during the excellent musical programme. My compliments to the planners! The box lunch with colour-coordinated flowers, ribbons, serviettes and plates, plus fancy salad 'boxes', brought us a glimpse of the joys of gracious living in that favourite of eras. A number of people dressed in costume (both authentic and concocted), which added atmosphere.

I gathered a few costume bits from home, and topped it off with a hat adorned by fresh flowers. While riding the subway from the dorm to the departure point, I received many stares. By the end of the evening after both hat and flowers had wilt-

ed, I felt like Eliza Doolittle, as she first met Professor Higgins. Riding in a cab to the dorm, the driver informed me I would have been quite safe in that get-up on the subway-just another of Boston's strange characters!

Some interesting highlights:

- Welcoming signs for AAM/CMA delegates near the airport.
- Flags at half-mast for the duration of imprisonment of Americans in Iran.
- Efficient rapid-transit system, with the occasional singing conductor
- New buildings with the silhouette of the old building painted on the facade.

The City of Boston, being a National Historic Park, has a number of interpretive tours and guides available. It is a city in which you need to allow lots of time to sight-see with good walking shoes and good weather. "Walking tours" are clearly indicated with billboard-size maps along the way to help you find your bearings. This year, celebrating its 350th birthday, there are extra events planned for visitors. However any time is a good time to visit the "birthplace of America". This Canadian intends to return.

I would like to thank the Council of the Association of Manitoba Museums for assisting me with the expenses, to travel as their representative, and I hope that some of the information I have brought back to share will prove to be of value.

Regional Spring Seminars

NORTHERN REGION April 19th, 1980

The Swan Valley Museum was the host of this year's spring seminar for the Northern Region. It was held on Saturday, April 19, in the Swan Valley Museum. The seminar was well attended with 36 participants representing eight different community museums.

The seminar took place in the afternoon with registration and opening remarks from 1-2 p.m. The first speaker was Gilbert Comeault, Assistant Archivist of the Manitoba Provincial Archives in Winnipeg. Mr. Comeault spoke on the use and kinds of material contained in the Provincial Archives, its services to the public and how to go about making the best use of time spent in the Archives. Following coffee and dainties supplied by the Swan Valley Museum, Mrs. Elaine Blair of Minitonas gave an informative talk on Depression Glass—going into detail on the various areas of manufacture and colours. The Museums Advisory Service consisting of Warren Clearwater and Diane Skalenda completed the formal portion of the seminar with an open problem-solving session and discussion period.

Participants adjourned from the lecture room and for the next hour enjoyed talking with old and new acquaintances as they toured the several buildings which make up the museum complex. The seminar officially ended with a delicious supper in the United Church Auditorium catered by the local church group.

Warren Clearwater

Guest speaker Gilbert Comeault, Assistant Archivist, in conversation with Gwen Palmer at the Northern Seminar

Mrs. Elaine Blair of Minitonas conducting a workshop on Depression Glass at the Northern Seminar

Margo Flewelling

WINNIPEG REGION **April 25th, 1980**

A classroom at the Manitoba Museum of Man and Nature was the site of this year's Winnipeg regional seminar.The seminar took place on Friday, April 25th with registration beginning at 9 a.m. Considering the number of museums in the region, attendance was slightly disappointing with only 23 people representing 10 museums. Those attending, however, were treated to several very good sessions.

First speaker following the opening remarks by Tim Worth, President of the AMM, was Jan Morier of the St. Boniface Museum. Jan gave an excellent talk on museum exhibits—demonstrating various props, backgrounds, label types, etc. which are inexpensive but still very professional in appearance. Following coffee, Ann Hitchcock of the Museum of Man and Nature gave a most educational lecture on a topic very dear to most museums—grants and fund-raising. She stressed the importance of proper procedures in filling out grant applications as well as the various types of grants from federal, provincial, local, municipal, multi-cultural and private sources. Participants were left to choose their lunch at one of the many restaurants in the area surrounding the Manitoba Museum. Following lunch, Tom Nickle, Administrative Director of the Manitoba Museum, surprised more than one participant with facts concerning insurance on community museum buildings and artifacts. Tom also answered many individual questions concerning legal aspects of the museum field. The sessions ended with a lecture on the importance of museum security by Warren Clearwater of the Museums Advisory Service. Both external and internal security were discussed including types of electronic alarm systems, locks, guides, and visitor flow in a museum, etc. Following the lectures, participants were free to tour the galleries of the Manitoba Museum.

Warren Clearwater

Tom Nickle and Margo Flewelling of the Museum of Man and Nature discussing insurance coverage for museums
Maureen Matthew

WESTERN REGION **May 15th, 1980**

A mini-seminar for the Western Region of the Association of Manitoba Museums took place at the Miniota Community Hall on Thursday, May 15. Some 45 people attended, representing 12 museums in this part of the province, with Mrs. Ruth Stewart of Killarney, Regional Councillor, acting as Chairlady for lively discussions and demonstrations throughout the day-long seminar.

Miss Maureen Matthew, Museum Technician Trainee at the Museum of Man and Nature, gave a paper on museum gift shops, dealing with all of the pros and cons of selling gifts and souvenirs in museums. The assembled group benefited by her past experiences in several small museums, her advice being to sell only those items which relate to one's particular kind of museum. Books and post cards and hasti-notes are amongst the most sought-after items by the visiting public. The Beautiful Plains Museum of Neepawa is now in its tenth printing of their popular *Doo Dad Book*, which is compiled of reprints of a popular comic strip of the early 1900's. The Virden Pioneer Home is in its fourth printing of the popular *Granny's Cook Book*, compiled from recipes, household and etiquette hints all taken from their collection of hundred-year old cookbooks in the museum.

After a delicious hot noon meal catered by a Miniota ladies' group (who also served excellent coffee and home-made cookies throughout the day) the meeting heard from Warren Clearwater, Museums Advisory Service, Museum of Man and Nature. His topic was "The Care of Slides and Photographs in Your Museum", and his advice was eagerly sought by those in attendance, for it would seem that all museums, large and small, are collectors of priceless historical photographs of every description in various states of repair. All of these must be handled, preserved, and exhibited with the

least possible damage or wear. Mr. Clearwater urged that museums attempt to make reproductions of their photographs so that the originals can be properly filed and preserved. There are many advantages of having reproductions made as they may be used in travelling exhibits, local displays and copies in any number may be printed for the use of the donor or his family. As well, copies may be sold in the museum gift shop and have proven popular souvenir items. He stated and demonstrated that reproductions can often be made much clearer than the original with the use of high-contrast film. He also demonstrated methods of aging the reproductions, with the use of strong or weak solutions of tea, to give them the sepia tones of early photography. Mr. Clearwater outlined the finer points of storing original photos, of handling them with care and caution, as he said that hands and fingers cause more damage to photographs than anything else. Mylar envleopes, file covers and glass frames will all preserve original photos, while tacks, tapes and adhesive tapes must not be used in mounting or preserving photos. Always use a soft lead pencil for adding identifying notes on the backs, not pens or inks. A systematic filing system must be planned, for easy access to any photograph, and as well, the negatives must be filed accordingly. A question and answer period followed in which Mr. Clearwater offered his expertise to many queries.

Another interesting session was chaired by Tom Nickle and Margo Flewelling from the Museum of Man and Nature, their topic being insurance for community museums, and in which they dealt with flood and fire damage, and the importance of having adequate insurance coverage for all museums. They also pointed out the importance of having photographs taken of museum artifacts and filed in a safe place away from the building. With pictures of the artifacts the work of an insurance adjustor is lightened and there is no further proof needed of ownership. Proper detailed identification of each item in a museum is most important, and Miss Flewelling pointed out that the more descriptive information there is in the records, the easier it is to make insurance claims. She advised that all such information be obtained at the time the item is donated. Mr. Nickle stressed the importance of evaluating artifacts although admitting that this often presents a complex problem. He said, however, there are reputable dealers, authoritative publications, and other sources to tap when evaluating antiques and collectibles. Some kind of verification is required by insurance companies on articles valued over $200 and Miss Flewelling stressed that museums use the basic W5 questions when making descriptive records—What, When, Who, Where, Why...**What** was the item used for; **When** was it used; **Who** made use of it; **Where** was it in use, and **Why** was it used (or why was it given to the museum).

At the conclusion of the last session, a pleasant walk about a block down Miniota's streets led us to the Miniota Municipal Museum, a two-story building which formerly housed the Municipal offices, with living quarters on the second floor.The second floor has been refurbished to depict the home of a family of the early days, while the first floor exhibits the extensive displays of fossils, Indian artifacts, and historic items, with Mr. Bob Clarke as the genial curator. Prior to viewing the museum, Mrs. Ruth Stewart, the Chairlady, expressed her pleasure at the excellent turnout and for the fine organization of the seminar which was handled by Mrs. O'Callaghan, Mrs. Clarke and their committee. She also announced that the annual meeting of the Association of Manitoba Museums will be held in Brandon. She also asked for a volunteer museum to host the next mini seminar in the central region, to which the Strathclair Museum group replied. A telegram of good wishes for a successful seminar was received from the Daly House Museum in Brandon, with regrets that they could not attend.

Grayce M. Hegion

Diane Skalenda explaining the structure of a press release at the Central Regional Seminar *Maureen Matthew*

CENTRAL REGION May 21st, 1980

Wednesday, May 21st saw the last of the regional seminars to be held—that of the Central Region. This seminar was hosted by the Treherne Museum with the sessions taking place in the Legion Hall in Treherne. The seminar was well attended with 41 people representing ten community museums.

AMM Councillor, Henry Marshall, welcoming participants to the Central Regional Seminar at Treherne *M. Matthew*

Warren Clearwater of the Museums Advisory Service demonstrating a Deadbolt Lock System *M. Matthew*

Following registration, opening remarks and greetings were extended by Mr. Henry Marshall, Councillor for the region, and Mr. Brooking, Mayor of Treherne and Vice-President of the Treherne Museum. First speaker on the afternoon agenda was Warren Clearwater of the Museums Advisory Service. The topic covered was "Museum and Artifact Security". Several examples of various doors, windows and padlocks were also available for examination by seminar participants courtesy of Noble Locksmith of Winnipeg. Next on the agenda, after coffee, was a session constantly of interest to community museums—that of how to get publicity for your museum. The topic was covered by Diane Skalenda of the Museums Advisory Service. Diane covered such areas as the press release, public service announcement, posters, media kits, etc. A question and open discussion period following Diane's session brought forth several queries from participants for the Museums Advisory Service. A tour of the Treherne Museum was then enjoyed by all—despite the +35°C temperature outside. The successful day was brought to a close with a delicious dinner held at the Legion.

Warren Clearwater

"OH! I'M GLAD IT'S YOU PROFESSOR VINCENTI. YES, AS A MATTER OF FACT I WAS JUST INFORMED THAT OUR TEXTILE DEPARTMENT HAS FINALLY REMOVED THOSE NASTY STAINS FROM THAT SHROUD THAT YOU LEFT WITH US. PROFESSOR? ARE YOU STILL THERE?"

SUPPLIES LIST

INTRODUCTION
- Why a list of conservation supplies?
- How the list was put together.
- Some notes concerning the list.

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Compiled by:
SUSANNE SUTHERLAND
Museum Technician Trainee
Manitoba Museum of Man and Nature

WHY A LIST OF CONSERVATION SUPPLIES?

- Primarily to give museum curators the names of suppliers of products and equipment to meet the preservation needs of museum collections.

- To aid curators who are looking for products which they can safely use on artifacts.

- To provide names of products used for storage, packing, environmental and safety equipment desirable for the security of collections and as orientation towards setting up a basis conservation programme.

HOW THE LIST WAS PUT TOGETHER

- Suppliers on the list were chosen because their products could be obtained in Winnipeg or within the province of Manitoba. This was not possible to achieve for all supplies. It is hoped that the prices and discounts quoted will make the products within easy reach of museum budgets! **Prices, of course, are subject to change.**

- Access to the supplies was also considered important. Consequently all local and provincial companies were contacted. Museum curators may deal directly with the suppliers.

- Advice on materials and suppliers was sought from the staff of the Parks Canada Artifact Workshop, and the Museums Advisory Service and Conservation Department at the Manitoba Museum of Man and Nature.

- Some products and suppliers were included from the *Museum and Archival Supplies Handbook* published by the Ontario Museums Association. Also using a similar format provided a simple and straightforward way of presenting the supplies list.

SOME NOTES CONCERNING THE LIST

- If you have any questions and/or suggestions regarding the products and their uses, please do not hesitate to call the Museums Advisory Service at the Manitoba Museum of Man and Nature.

- The list contains products designed for basic conservation purposes. If you have artifacts requiring special treatment, contact the Museums Advisory Service.

- **The author does not guarantee or assume liability for the products named.**

- As always when lists are published some items are likely to be outdated or taken off the market. In some instances, there may be chemical changes in the composition of supplies which could render them unsafe for conservation purposes. Again, if you have any questions about a product, contact the Museums Advisory Service.

- And lastly – don't be afraid! Try your hand at cleaning documents and labels, removing corrosion from fine silver, applying a protective layer of wax to delicate artifacts, or reorganizing your storage area.

- Do abide by the Golden Rule of Conservation

WHEN IN DOUBT – DON'T

SUPPLIES AND EQUIPMENT

Artifact Maintenance

CERAMICS AND GLASS

Fisher Sparkleen
No. 4-320, 3¼ lb box—$5.83 (12/pkg. $46.63)
Use:
To remove stains from glass, clean glass objects for exhibit purposes.
Supplier:
Fisher Scientific
Note:
Concentrate form—used in small quantities.
Recommended by:
Parks Canada Conservation Lab.

FEATHER AND FUR

Corn Meal
Use:
Cleaning feathers and fur. Absorbs moisture and cleans.
Supplier:
Available at grocery stores.

FURNITURE

Goddard's Cabinet Maker's Wax (lemon)
4½ oz.—$4.80 (12/case—$34.92)
Use:
For fine woods, leather and furniture
Supplier:
Cowling & Braithwaite Co., Ltd.
Recommended by:
Parks Canada Conservation Lab.

LEATHER

British Museum Leather Dressing
No. 2418, 1 pint—$9.75
Use:
To give flexibility to leather, bookbindings, pouches, belts, purses, bridles, etc.
Supplier:
Conservation Materials, Ltd.

Saddle Soap
40 oz. can—$1.
Use:
To clean leather
Supplier:
Canadian Tire Corporation

Lexol
Use:
An emulsion used to soften stiff leather.
Supplier:
Canadian Tire Corporation.

Goddard's Saddler's Wax
4½ oz. (12/case—$34.92)
Use:
Cleans, polishes, and protects fine leather, saddlery, shoes, luggage, leather upholstery.
Supplier:
Cowling & Braithwaite Co., Ltd.
Recommended by:
Parks Canada Conservation Lab.

MARBLE

Goddard's Marble Polish
4½ oz. (12/case—$34.92)
Use:
Polishes and protects natural and synthetic marble, stone, slate, ceramic porcelain and formica.
Supplier:
Cowling & Braithwaite Co. Ltd.
Recommended by:
Parks Canada Conservation Lab.

METALS

Magic Wadding (all purpose metal polish)
5 oz. wadding—$2.39
Use:
Cleans and polishes silver, gold, brass, pewter, steel, copper, aluminum, chromium plate, all metals. Removes rust and tar from automobiles.
Supplier:
Canadian Tire Corporation
Recommended by:
Canadian Conservation Institute

Anti-Tarnish Tissue
Flat ream, 20" x 30" sheets—$12.60 + FST
Use:
Storage—wrap silver in acid-free paper then in anti-tarnish paper.
Display—place paper inconspicuously in exhibit cases. Paper absorbs hydrogen sulphide from air. Do not put in direct contact with silver.
Supplier:
Burco Jewellers Tools

Goddard's "Glow" Metal Polish
2.8 oz. (24/case—$16.20)
Use:
This cream is good for polishing metal and chrome items. Can be used to remove lightly-corroded areas on metal objects.
Supplier:
Cowling & Braithwaite Co. Ltd.

Goddard's Silver Cloth
9" x 12"
Use:
Impregnated with polishing agents to clean lightly-tarnished silver, silver plate, and gold.
Supplier:
Cowling & Braithwaite Co. Ltd.
Recommended by:
Parks Canada Conservation Lab.

Typewriter eraser, similar to fibreglass 'eraser'
Use:
To remove mild corrosion on large surfaces.
Supplier:
Available at stationery stores.

Brush, glass filament "adjustable fibreglass eraser"
1 brush—$1.40, set of 2 refills—$.70
Use:
Remove corrosion and dirt from metal surfaces
Supplier:
Burco Jewellers Tools
Note:
Very harsh.

Glass Scratch Brush
Glass bristles bound in cord that unwinds as bristles wear.
7" x ½" dia.—$3.40
Use:
Same as fibreglass brush. Softer and more control. Do not use on intricate or fine silver.
Supplier:
Burco Jewellers Tools
Note:
Use masking tape around cord to prevent it from unwinding.

Amo-dent Liquid Soap
1 gal.—$11.10 (5 gal.—$10.25/gal.)
Use:
Cleaner for removal of superficial rust from metal objects.
Supplier:
G.H. Wood & Co. Ltd.
Note:
Discount 20% on 5 gal. size.

Goddard's Long-term Silver Foam
6 fl. oz. (12/case)—$24.48
10 fl. oz. (12/case)—$24.40
Use:
Removes tarnish and polishes to a mirror finish. For large intricate and ornate silverware.
Supplier:
Cowling & Braithwaite Co. Ltd.
Note: Use plastic gloves while cleaning

Solvol Autosol
No. 4306, 2.8 oz.—$2.60
Use:
Removes rust and corrosion. Lightly abrasive cream used for high polish finish on metals.
Supplier:
Conservation Materials Ltd.
Recommended by:
Parks Canada Conservation Lab.

"Staon" Liquid Stove Polish
Use:
After rust has been removed, put on cold stove with cloth. Remove surface dirt and dries quickly.
Supplier:
G.H. Wood & Co. Ltd.
Recommended by:
Parks Canada Conservation Lab.

"Staon" Paste Stove Polish
Use:
To clean and polish stove while stove is warm. Adds protective coating. Does not remove rust.
Recommended by:
Parks Canada Conservation Lab.

PAPER

Staedtler Draftsman's Eraser
$1.75 each
Use:
To clean surface dirt from paper objects.
Supplier:
Fraser Art Supplies
Note:
Test small area first.

Wei T'O (Deacidification Solution)
No. 2008 Solution No. 2 — $15.
No. 2010 Solution No. 3 — $16.
No. 2011 Spray No. 11— $10.
Use:
To neutralize acids present. To prevent development of acids in future. To reduce rate of oxidation attack on paper. Works off foxing (brown stain).
Suppliers:
Canadian Tire and hardware stores — $6.50
Conservation Materials, Ltd.
Wei T'O Associates (offers 10% discount on six bottles and more).
Note:
Solution No. 3 is less toxic than Solution No. 2. Solution No. 2 is faster drying, has less tendency to dissolve soluble inks.
Both No. 2 and No. 3 can be applied by dipping, spraying, soaking, brushing and roller coating.
Solution No. 11 — Spray: good for small jobs. Spray gun with power canister replacement.

Acid-Free Barrier Paper
25" x 38" sheets — $.18 each
Use:
As interleaving between prints and drawings, photographs stored loose in their containers, and for lining storage boxes.
Supplier:
Artists' Emporium
Note:
Interleaving will provide a barrier to acid migration.

Acid-Free Matt Board
40" x 32" — $11.25
40" x 60" — $22.95
Discount: 10 sheets minimum order
Use:
Matting prints, watercolours, pastels, drawings, and textiles.
Supplier:
Fraser Art Supplies

Acid-Free Matt Board
40" x 32" — $10.85
40" x 60" — $22.45
20% discount applied to quantity of 20 sheets.
10% discount to museums.
Colours: White and Cream
Supplier:
Corner Art Store

Acid-Free Matt Board
Bainbridge Alpha Matt
32" x 40" sheets — $5.68 each
Discounts on orders over 25 sheets
Available in 16 pastel colours.
Use:
For framing prints, watercolours, pastels, original documents and photographs. Also for mounting textiles.
Supplier:
Artists' Emporium
Note:
Alpha Matt is made from pulp therefore has a life expectancy of about 200 years.

Acid-Free Matt Board
Bainbridge Alpha Rag
32" x 40" sheets – $7.28 each
Discounts on orders over 25 sheets
Available in white only.
Use:
Provide a matt and backing support for prints, original photographs and documents, textiles, watercolours, and pastels.
Supplier:
Artists' Emporium
Note:
Alpha Rag is made from 100% cotton therefore is considered to have a life expectancy much longer than Alpha Matt.

Acid-Free – Peterborough Museum Board
4-ply grey, cream, white and neutral colours
32" x 40" sheets – $8.25 each.
Discount: 10 sheets minimum order.
Use:
Mounting textiles, prints, drawings, watercolours, pastels.
Supplier:
Fraser Art Supplies

Acid-Free – Peterborough Museum Board
32" x 40" – $3.25
20% discount – quantity of 20 sheets or more
10% discount to museums.
Supplier:
Corner Art Store
Note:
Available in 30 different colours.

Acid-Free Blotter
32½" x 49¼" sheets – $3.75 per sheet
Use:
After washing paper artifacts and delicate textiles, place on blotter to absorb moisture.
Can also be used as a backing for watercolours.
Supplier:
Artists' Emporium
Note:
Blotters not presently in stock but will be ordered upon demand of such. These blotters while more expensive than regular blotter papers have the advantage of being reusable if desired.

Acid-Free Blotter "Cosmos"
24" x 38" – $1.20 per sheet
Supplier:
Fraser Art Supplies

Mulberry Paper
Use:
To make hinges for fastening prints, drawings, documents to backings; also use with wheat starch paste to back and repair weak areas of paper artifacts.
Suppliers:
Artists' Emporium
Corner Art Store
Fraser Art Supplies

Wheat Starch (Paper Adhesive)
1 lb. wheat starch – $.50
Use:
Wheat starch paste needed to repair paper artifacts and attach mulberry paper hinges.
Supplier:
Health Food Stores
Recipe:
1 part starch
2 parts water
Leave for 24 hours; drain off water; add fresh water to make a thin paste consistency; heat to boiling (stir occasionally); let cool.
Paste should be smooth.

PHOTOGRAPHS AND NEGATIVES

"Dust Off"
Pocket size spray can, 3 oz.–$2.95
Junior size, 8 oz.–$4.95
Discount on $100. of materials.
Use:
Dust off negatives and photographs.
Supplier:
Sam the Cameraman

Negative Storage Envelopes
Glassine negative filing leaves
7 strips per sheet, 25 sheets–$7.50
Plastic negative filing leaves
7 strips per sheet, 10 sheets–$3.95
Supplier:
Sam the Cameraman
Note:
Envelopes can be stored in 3-ring binder.
Discount on $100. of materials.

TEXTILES

Orvus Paste 1502 (Detergent)
No. 2168, 1 pint—$3.50 (1 quart—$6.00)
Use:
Neutral detergent recommended for washing textiles and rugs with distilled water. Removes common dirt and stains but not stubborn stains.
Supplier:
Conservation Materials Ltd.
Note:
Orvus paste comes in concentrate form, therefore is very economical.

Goddard's Spot Remover Spray
Case of 12 (5 oz.) cans—$19.37
Use:
Cleans most types of fabrics.
Supplier:
Cowling & Braithwaite Co., Ltd.
Recommended by:
Parks Canada Conservation Lab.

Ivory Soap Flakes
Use:
With distilled water for washing cotton and linen. To wash dirt and/or mildew from old work/farm boots.
Supplier:
Available at grocery stores.

Polyester Fibrefill (Padding Material)
Thin, 60" wide— $.70 yard
Thick (2"), 60" wide—$2.50 yard
Use:
To pad supports for textiles.
Supplier:
Mitchell Fabrics Ltd.
Note:
10% discount.

Pantyhose
(Used—clean)
Use:
Like polyester fibrefill.

Felt (Synthetic)
Non-acidic
Use:
Textile support material for storage and exhibit purposes.
Supplier:
Mitchell Fabrics Ltd.

Cotton Thread
Assorted colours
Use:
Repair cotton textiles, sew on labels, mounting for exhibits.
Supplier:
J.P. Coats and Co.

Cotton Thread
6-strand—$.40
6-strand, twisted—$1.25
Pearl cotton, No. 3—$.70
Stout (soft)—$1.75 spool
Soft matt—$.40 skein
Use:
Sew on labels to textiles. Repair.
Supplier:
Leonida's Embroidery Studio Ltd.

Silk Thread
Cards of 4½ yards
Use:
Repair silk textiles, sew on labels.
Supplier:
Leonida's Embroidery Studio Ltd.

Environment

FUNGICIDES AND PESTICIDES

Lysol Spray (Orthophenylphenol)
Use:
Can be used as a disinfectant to treat mold and mildew (leather, fur, fabrics, rugs).
Supplier:
Available at grocery, drug and hardware stores.

Vapona
Use:
For use in storage drawers to protect artifacts from infestation. Long lasting.
Warning:
Contains dichlorvos
Contact the Conservation Lab of the Manitoba Museum of Man and Nature for specific directions on the use of Vapona.
Supplier:
Canadian Tire Corporation.

HUMIDITY TESTING AND CONTROL

Environmental Monitoring Kit
Use:
Contains instruments for measuring temperature and relative humidity, light levels, and ultraviolet levels.
Supplier:
Canadian Conservation Institute
Note:
Available for one-month loan periods, free of charge. Museum responsible for return postage.

Relative Humidity Indicator Strips
Accuracy approximately 5%
10 to 100% range
25 per package—$12.
10 per package—$6.
Use:
To obtain a general indication of levels of relative humidity throughout the museum.
Supplier:
Conservation Materials Ltd.

Silica Gel
1 lb.—$9.85
5 lb.—$30.20
Use:
To help stabilize exhibit case interior.
Supplier:
Fisher Scientific

Silica Gel
2 lb.—$18.64
Use:
As above
Supplier:
Canlab (Canadian Laboratory Supplies)

Silica Gel
S160 Tell Tale mesh.
"Reagent ACS"
5 lb.—$49.05
Grd. 42 6-16M
Use:
As above.
Supplier:
Fisher Scientific
Note:
Can be reused, place in oven to dry out (colour changes from blue to pink).

LIGHT TESTING AND CONTROL

Ultraviolet Filter Sleeves
4 feet—$1.
Use:
To protect artifacts from ultraviolet rays.
Supplier:
Solar Screen

Criticolor Fluorescent Tubes
(Without ultraviolet radiation)
Size 18" to 8'
Wattage varies
Use:
Exhibit and storage lighting
Supplier:
Verd-a-ray
Note:
Guaranteed six to seven years.
Recommended by:
Parks Canada Conservation Lab.

TEMPERATURE TESTING

Dial Thermo-Hygrometer
No. 4902—$71.
(Price includes shipping and custom charges)
Use:
To record temperatures and relative humidity inside individual cases.
Supplier:
Conservation Materials Ltd.
Note:
Contact the Manitoba Museum of Man and Nature Conservation Department for calibration in 12 months to confirm accuracy. Service charge $5.

Indoor Thermometer (Highly Accurate)
Yellow/white polysturene—$2.89 each
Use:
Calibrate Celsius and Fahrenheit readings.
Supplier:
Canadian Tire Corporation.
Note:
Maximum error of 1°C.

Clinical-style Thermometer with ring
112mm. long; red or mercury—$5.11
Double scale Fahrenheit and Celsius ranges
Available are -10°C to 110°C/20°F to 220°F.
Use:
Could be suspended in storage area or discreetly in exhibit area.
Supplier:
Canlab (Canadian Laboratory Supplies).

Wall Mount Thermometer
No. 2237-5—$17.39
Range 0-180°F.
Use:
To record daily museum temperature.
Supplier:
Canlab (Canadian Laboratory Supplies)

Lab and Workshop

EXAMINATION EQUIPMENT

Pocket Magnifiers
6x (magnification), 10x
(Folds into durable small case)
Use:
For close examination of artifacts to determine the amount of wear or damage (for treatment purposes).
Supplier:
Carl Zeiss Canada Ltd.
T. Eaton Company—Optical Department

Linen Tester Magnifying Glass
5x, No. 40646—$11.45
6x, No. 40030—$10.25
9x, No. 40031—$9.85
Use:
Counting threads in textiles, for examining printing, stamps, engraving.
Supplier:
Edmund Scientific Company
Note:
Handy scale on base, folds flat.

ColorpHast pH Indicator
100 strips per box—$3.55
pH 2.5-4.5
pH 4.0-7.0
pH 6.5-10
Use:
To obtain pH levels of paper materials.
Supplier:
Conservation Materials Ltd.

GENERAL SUPPLIES

CM Bond W-1 Adhesive
No. 2308, 1 quart—$4.95
Use:
Excellent all-round white adhesive.
Textiles, wood, paper, etc.
Supplier:
Conservation Materials Ltd.

Pritt Glue Stick
pH 10.0
Small—$.99
Jumbo—$2.59
Blisterpack—$1.09
Use:
Nontoxic, water soluble. (Dried adhesive can be dissolved in cold water). Cardboard, fabrics, photographs, and styrofoam.
Supplier:
Corner Art Store
Fraser Art Supplies

Cheese Cloth
Thin 36" wide—$.39
Heavyweight (like unbleached cotton)
36"wide—$.75
Use:
To apply creams to delicate artifacts.
Supplier:
Mitchell Fabrics Ltd.
10% discount.

Q-Tips Cotton Swabs
Use:
May be used to gently clean surface dirt from paintings, stains on paper items.
Supplier:
Available at grocery and drug stores.

Distilled Water
4 litres—$2.15
Use:
Washing fine textiles
Supplier:
Check your local drugstore
Also available from the Conservation Lab at the Manitoba Museum of Man and Nature.

Disposable Copolymer Gloves
No. 3112, sizes 6-8, Box of 100—$6.50
No. 3113, sizes 8½-10½, Box of 100—$6.50
Use:
Excellent for protecting objects from hand-caused contamination of oils and perspiration. Clear plastic.
Supplier:
Conservation Materials Ltd.

White Cotton Gloves
1 pair—$1.50
Use:
Handling artifacts to prevent oils and perspiration from touching objects. Do not use to handle slippery objects such as porcelain and glass.
Supplier:
Sam the Cameraman.

Goat Hair Brush
No. 5—$5.95
No. 12, $9.50
Different sizes available.
Use:
To dust intricate artifacts, to get at dust in cracks of furniture.
Supplier:
Corner Art Store
10% discount to museums.

Kraft or Wrapping Paper
Use:
Dust seal and protective backing for framed prints, paintings, photographs, drawings, and documents. Secure with masking tape for temporary backing or fasten with white glue for a permanent bond.
Supplier:
Available from stationery or art supply stores.

Puncture Board
Use:
Dust seal and protective frame backing. Cut 3-4 holes in board so as to allow the canvas to breathe. This board can be fastened to a stretcher with screws.
Supplier:
Artists' Emporium.

Sheet Cardboard
Use:
Dust seal and protective frame backing. (See puncture board for instructions).
Supplier:
Artists' Emporium.

Styrofoam Boards (Foamcore and Featherweight)
Use:
Dust seal and protective frame backing. (See puncture board for instructions).
Supplier:
Artists' Emporium.

SAFETY EQUIPMENT

Fire Extinguisher
A-B-C, Class Multi-purpose
Dry clean
5 lb. with wall bracket—$27.90 + P.S.T.
Supplier:
Chubb Fire Security

Safety Glasses
1 pair glasses—$2.79
Use:
Wear while removing heavy rust and corrosion from moveable gun parts.
Supplier
Canadian Tire Corporation

Storage

STORAGE MATERIAL

Ethafoam 221
500 sq. ft., ¾" thickness—$100. plus freight.
Use:
Drawer liners for delicate artifacts. Lining and packing material for travelling exhibits.
Supplier:
Plastifab

Mastercraft Mothballs
Naphthalene, 15 oz.—$.99
Use:
Textile conservation. Place at bottom of garment bag so fumes go upward. Must be changed every four months to be effective.
Supplier:
Canadian Tire Corporation

Resealable Polyethlene Bags
Zip-lock bags
2" x 3", 500/pkg., 6503-01—$15.70
3" x 5", 500/pkg., 6503-U—$20.90
5" x 8", 500/pkg., 6503-21—$27.90
8" x 10", 500/pkg., 6503-04—$34.88
12" x 15", 250/pkg., 6503-05—$48.83
Price plus transportation costs.
Supplier:
Comeau Technique Ltd.
Available at grocery stores (not heavy duty)

Unbleached Cotton
Width 36" x 84"—$1.10 to $2.95
Different weights
100% cotton muslin, 50" wide—$1.25/yard
Use:
To cover supports for costumes for storage and exhibit purposes.
Supplier:
Mitchell Fabrics Ltd.
10% discount

Strathmore Bristol Board
100% rag
1 ply, 23" x 29"—$1.30
3 ply, 23" x 29"—$3.90
Use:
Lightweight folders; shelf and drawer liners, interleaving; as protective folds in storing maps and large papers in roll form.
Supplier:
Fraser Art Supplies

Acid-Free Barrier Paper
40" x 32"—$1.00
Use:
Heavy duty interleaf paper. Used for making medium weight folders.
Suppliers:
Fraser Art Supplies
10% discount (100 shts. minimum order)
Corner Art Store
20% discount (20 sheets or more)

Acid-Free Barrier Paper
25" x 38"—$.18/sheet
Use:
As interleaving between prints and drawings, photographs stored loose in their containers; lining storage boxes.
Supplier:
Artists' Emporium
Note:
Interleaving will provide a barrier to acid migration.

Cotton Twill Tape
White, $.10 per yard.
Use:
Fasten around textile and lightly tie in place.
Supplier:
Mitchell Fabrics Ltd.

Cardboard Tubing
Empty foil or wax paper rolls
Use:
Put together with tape to accommodate length of textile to be stored. Wrap textile around the tubing and roll up keeping the artifact smoothly in place.

Wood Dowels
½" fir, 12 foot lengths—$.14 per foot
Use:
To support cardboard rools on wich textile is rolled.
Supplier:
McDiarmid Lumber

PACKING MATERIALS

Lense Tissue (Acid-Free)
24" x 36", 500 sheets—$57.43
Use:
Protect delicate artifacts and textiles.
Supplier:
Andrews/Nelson/Whitehead

Acid-Free Barrier Paper
32" x 40"—$1.00
10% discount to Manitoba Museums
20% discount if 20 or more sheets ordered.
Supplier:
Corner Art Store

Bubble-pak (Air Cap)
1 roll 375' long x 48" wide x ¼"—$98. + FST
Rolls can be cut to 24" or 12" widths.
Use:
Packing artifacts for travelling. Can also act as padding for textile support.
Supplier:
Tri-Star Marketing

Styrofoam Granules "Peanuts"
Min. 20 cu. ft. per box—$19.55 + FST
Use:
Packing material that is lightweight, smooth surfaced, non-dusting, reusable, and absorbs shocks.
Supplier:
Tri-Star Marketing

BOXES, ENVELOPES AND FOLDERS

Florist Boxes with Telescoping Lid
52" x 20" x 10"—$2.00
Use:
Storage of parasols, stocking, gloves, textiles and costumes.
Supplier:
Florists Supply Co., Ltd.
Note:
Not acid-free, therefore, line with acid-free materials, e.g. acid-free folder stock.
Discount price—$1.50 each.

Archival Book Boxes
Standard sizes.
Supplier:
Smith, Irwin and Conley

Document Storage Boxes
Coroplast (corrugated plastic)
15¼ x 10¼ x 4½—$3.95 each
Minimum order—2 boxes
Supplier:
Conservation Materials Ltd.

Archival Storage Envelopes
Acid-free, white, ungummed top flap
9" x 12" and 9½" x 14"—$.19 to $.21 each
Supplier:
Subcon Industries

Document Preservation Folders
Acid-free liner with three flaps
Letter and legal sizes
$.95 to $1.20 each
Minimum order 50 folders
Supplier:
University Products Ltd.

Strathmore Bristol Board 100% Rag Folders

1 ply, 23" x 29"–$1.30
3 ply, 23" x 29"–$3.90

Use:

Lightweight folders; shelf and drawer liners, interleaving; as protective folds in storing maps and large papers in roll form.

Supplier:

Fraser Art Supplies

Acid-Free Archival Quality File Folders

(Bristol)
22" x 30", 100–$60.
24¼" x 30", 100–$60.

Supplier:

Lowe Martin Co., Ltd.

From the collection of the Manitoba Museum of Man and Nature *C. Douglas Smaill*

Miscellaneous

Microcrystalline Waxes
Renaissance Wax—No. 3950
Can (320 ml.)—$9.
Use:
"All-round excellence and versatility"
Wood, metals, marble, onyx, shell, stone, ivory, plastic, leather, paper. Protects from fingerprints and heat.
Supplier:
Conservation Materials Ltd.

Film—Documentation
3 or more rolls, discount $.30 off each roll
20 or more rolls, discount of $1. off each roll
Supplier:
Sam the Cameraman

Syringe, Rectal
3-4 oz—$2.50
Use:
Same as ear syringe and "dust off", to remove dust particles from negatives.
Supplier:
Available at most drugstores.

Syringe, Ear
Large size, 3 oz.—$1.89
Use:
To spray air onto negatives so as to remove any particles of dust.
Supplier:
Available at most drugstores.

Steel Wool
000, 0000 (fine)
Use:
To remove corrosion and give a smooth finish on metals and wood, e.g., archaeological materials, furniture.

Towelling (white)
36" wide—$3.95 yard.
Use:
To polish metal objects.
Supplier:
Mitchell Fabrics Ltd.
10% discount.

Dental Pick (Used)
Use:
To remove rust from artifacts.
Supplier:
Contact a local dentist.

Felt
White, 48" wide—$4.50
Use:
Exhibit purposes, use to pad coat hangers for storage and exhibit of textiles.
Supplier:
Creative Fabrics.

LIST OF SUPPLIERS

Andrews, Nelson, Whitehead
31-10 48th Avenue
Long Island City
New York, N.Y.
11101

Telephone: (212) 937-7100

Burco Jewellers Tools
20 Temperance Street
Toronto, Ontario
M5Y 1Y4

(416)-862-1655

Chubb Fire Security
830 King Edward
Winnipeg, Manitoba

774-1871

Corner Art Store
101-288 Notre Dame Avenue
Winnipeg, Manitoba

943-5595

Cowling & Braithwaite Co. Ltd.
1050 McNicoll Avenue
Scarborough, Ontario
M1W 2L8

(416) 499-5814

Creative Fabrics
1609 Pembina Highway
Winnipeg, Manitoba

284-8686

Canadian Laboratory Supplies (CanLab)
590 Moray Street
Winnipeg, Manitoba

885-6606

Conservation Materials, Ltd.
340 Freeport Boulevard
Box 2884
Sparks, N.V.
89431

Comeau Technique Ltd.
1260 Richmond Street
Section 3J
Montreal, Quebec
H3K 2H2

(514) 933-6205

Canadian Tire Corporation
700 St. James Steet
Winnipeg, Manitoba

772-0361

Carl Zeiss Canada Ltd.
7-1433 Niakwa Road
Winnipeg, Manitoba
R3L 3G5

253-2319

Dover Pad Ltd.
57 Colville Road
Toronto, Ontario
M6M 2M2

Edmund Scientific Company
3500 Bathurst Street
Toronto, Ontario
M6A 2G6

(416) 787-4584

Fraser Art Supplies
294 Edmonton Street
Winnipeg, Manitoba

942-6476

Fisher Scientific Co., Ltd.
18 Plymouth Avenue
Winnipeg, Manitoba

633-8880

Florists Supply Co. Ltd.
35 Airport Road
Winnipeg, Manitoba

632-1210

G.H. Wood & Co. Ltd.,
100 King Edward
Winnipeg, Manitoba

774-1839

Hollinger Corporation
3812 S. Four Mile Run Road
Arlington, Virginia
22206

(703) 671-6600

J.P. Coats and Company
112 Market Avenue East
Winnipeg, Manitoba
R3B OP4

Leonida's Embroidery Studio Ltd.
18-222 Osborne Street
Winnipeg, Manitoba

284-8494

Lowe Martin Co., Ltd.,
363 Coventry Road
Box 8707
Ottawa, Ontario
K1G 3M4

(613) 741-0962
Toll-free: 800-267-3652

Mitchell Fabrics Ltd.
637 Main Street
Winnipeg, Manitoba

942-6327

Mohawk Finishing Products
505 Clayson Road
Units 1 and 2
Weston, Ontario
M9M 2W7

(416) 745-9012

Plastifab
625 28th Street, N.E.
Calgary, Alberta

(403) 273-0996

Sam the Cameraman
510 Portage Avenue
Winnipeg, Manitoba

783-7228

Subcon Industries
230 Bayview Drive
Units 9 and 10
Barrie, Ontario
L4N 3X3

(705) 728-5081

Smith, Irwin and Conley
Box 456
Smith Falls, Ontario
K7A 3K7

(613) 283-5222

Solar Screen
53-11 105th Street
Corona, New York
11368

(212) 592-8222

Tri-Star Marketing
1658 Church Street
Winnipeg, Manitoba

633-2281

University Products Inc.
PO Box 101
South Canal Street
Holyoke, Massachusetts
01040

Toll-free: 800-628-1912

Verd-a-ray
c/o J.E. McMaster
307 Dufferin Avenue
Portage la Prairie, Manitoba
R1N OV8

857-4437 (call collect)

Wei T'O Associates
Park Forest
Illinois

Notes to Contributors

We invite you to submit articles for publication in the **Dawson and Hind.** We would appreciate if you would bear in mind the following guidelines:

1. We would prefer all articles to be **typewritten** and **double-spaced.** We realize this is not always possible; and under such circumstances we will accept handwritten articles only if they are legible and double-spaced.

2. As a rule of thumb, articles should be a **minimum** of four double-spaced pages; or a **maximum** of 20 double-spaced pages.

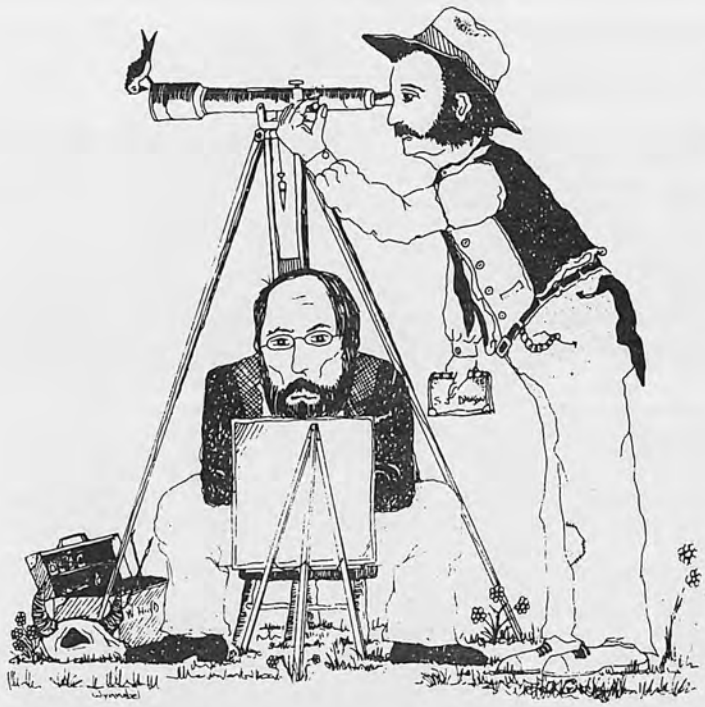
3. If possible and appropriate, we welcome photographs to complement articles. Black and white photographs are the most suitable for reproducing although colour photos can be used.

4. Please **do not cut or crop** photographs.

5. All photographs must be identified.

6. Photographs will not be returned unless requested, in writing, by the contributor.

7. Should an article include a bibliography, please list author, title, publisher, location and date of publication (as well as name of journal, if applicable).



S.J. Dawson and W.G.R. Hind

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