An Introduction to Conservation at MOA

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2012

This Conservation Handbook is intended to provide the volunteers at the UBC Museum of Anthropology (MOA) with a basic understanding of conservation. It will briefly discuss key themes, concepts and practices of conservation as well as focus on some of the specific questions you may have about conservation at MOA.

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What is conservation?

The Canadian Association for Conservation (CAC/CAPC 2009) defines conservation as:

"All actions aimed at the safeguarding of cultural property for the future. The purpose of conservation is to study, record, retain and restore culturally significant qualities of the cultural property as embodied in its physical and chemical nature, with the least possible intervention. Conservation includes the following: examination, documentation, preventive conservation, preservation, treatment, restoration and reconstruction."

The conservation staff at MOA are responsible for safeguarding the Museum's collections and ensuring their long-term preservation through both damage prevention and treatment. Conservators at MOA focus on four main areas of collections care and management:

Documentation

Basket photographed with a scale and colour checker.

This involves recording all treatments, cleaning or repairs performed on an object using standardized condition and treatment reports and photography.

Preventive Conservation

Preventive Conservation involves maintaining an environment that will stop, or at the very least, slow down the deterioration

of objects. To do this, conservators monitor and control such factors as light, air pollution, humidity and temperature. Additionally it involves minimizing damage to objects caused by pests.

Treatment

Any method of direct intervention performed when the deterioration of an object cannot be stopped or slowed using external measures (i.e. preventive conservation), or the conceptual or artistic integrity can no longer be appreciated due to a high degree of loss. Treatment may involve stabilization, repair, or in extreme cases restoration. Treatments are cumulative, meaning that with each additional treatment alterations or changes to the piece increase in number, for this reason there is an ethical obligation to minimize the number of treatments performed, as every additional treatment takes the object further away from its original state.

Research

An often overlooked aspect of conservation, research conducted by conservators may include:

- Developing new forms of treatment.
- Testing materials used in treatment, storage or display for suitability and to ensure that they do not produce dangerous by-products.
- Testing conducted to better understand the mechanism of deterioration
- Identification, such as in the analysis of paint samples for their chemical components to determine whether the paint is a historical or modern product.

The Museum Environment

Light

Fading, darkening, yellowing, embrittlement, stiffening and other chemical and physical changes can all be caused by light. Light damage is accumulative and irreversible, although damage can be stopped by removing an object from the light source.

Woven basket showing extensive light damage on the exterior surface of the lid.

Certain colours, dyes, or paints are particularly susceptible to fading. These are referred to as fugitive colours, dyes or inks. Notice the colours on the surface of a basket lid (top left) that has been kept out of the light, compared to its exterior surface, which has been exposed to light while on display (bottom left). You will notice that the purple figure has almost completely disappeared on the outside surface.

Light can also be extremely damaging to the overall stability of an object. Deterioration caused by light includes accelerated aging as well as a weakening of the molecular structure. This is very common in textiles and paper objects. Light is also a catalyst for chemical reactions which can increase deterioration.

It is important to be aware of the types of objects that are light sensitive. Light sensitive objects include: inks, paper, photographs, watercolours, feathers, furs, leathers and skins.

A rule which conservators must always consider every time an object is exposed to light for display or research purposes is known as the Reciprocity Law, which states:

"*Low light levels for extended periods cause as much damage as high light levels for brief periods."*

In order to preserve the collections in storage and on display, conservation staff monitor the light levels (using a light meter), and control the amount of light used to illuminate objects in order to limit the damaging effects of light. Additionally for objects on display, conservators rotate (i.e. remove from display for a period of time) those that are particularly light sensitive.

The visible storage located in the MVG is particularly challenging for conservators at MOA. Most museums have objects on continuous rotations, rarely having objects on permanent display.

The Multiversity Galleries at MOA are unique in that the objects housed in the exhibit cases are permanently on display. These objects are illuminated, from 6:00 am to 7:00 pm for the 20-30 years of their exhibit lifetime. It is therefore the job of conservators at MOA to continuously monitor the effects of light on these collections and assess their condition. Objects that are sensitive to light are rotated on a yearly basis.

Relative Humidity

Relative Humidity or RH is the amount of moisture present in the air at a specific temperature compared to how much moisture the air could hold when saturated. RH is expressed as a percentage.

Sources that can affect changes in RH include exterior humidity levels, rain, bodies of water, pipe systems, wet mopping and even people.

Incorrect or widely fluctuating RH is implicated in the deterioration of almost every material type including both organic and inorganic objects. Organic objects sensitive to changes in RH are called *hygroscopic*.

High levels of RH may cause an increase in chemical reactions, as many chemical reactions require water. High RH can lead to *corrosion* in metal objects, *efflorescence* on ceramics or glass, and mold growth on organic objects. High RH levels have also been implicated in increased insect and pest activity.

Haida pot (1441/1) showing active corrosion.

Extremely low RH levels can cause shrinking, cracking, and warping in wood and ivory. Low RH may also cause stiffening or flaking of paint, photographic surfaces and adhesives. Low RH can also lead to the *desiccation* of plant material such as that used in basketry.

Rapidly fluctuating RH levels will cause hygroscopic materials to swell and contract as the water content changes. These dimensional changes will eventually lead to damage and deterioration.

Different material types preserve better at different levels of RH but a standard RH has been set for general museums with mixed collections: 50% RH with fluctuations of 5% either way (i.e. 45%-55% RH). For collections of metal objects, a lower RH around or below 30% is ideal, as this will control the development of corrosion.

Conservators at MOA used silica gel, a material that acts as a humidity buffer, which will add or release moisture to maintain a desired RH. You may have seen small boxes of silica in some of the drawers containing metal objects in the Multiversity Galleries. This has been done to help lower the RH levels to protect these objects from the effects of corrosion.

To learn more about silica gel and its uses refer to:

- ***CCI Technical Bulletin 10: Silica Gel***

Temperature

Extremes in temperature and rapid fluctuations can directly affect collections in a number of ways.

Higher temperatures cause chemical reactions to increase. In particular paper and photographs as well as early plastic are very susceptible to high temperatures, which will cause increased deterioration.

A rule of thumb when dealing with temperature is that chemical reactions double with every increase of 10^{o}C.

Warmer temperatures promote increases in biological activity. Insects will consume more and breed more quickly. Mold will also grow at increased rates within certain temperature ranges. Higher temperatures can also cause certain materials to soften, or adhesive and lacquers to fail or become *viscous*.

Recommended conditions in museum spaces where visitor or staff comfort is a factor is 18-20^{o}C, with minimal fluctuations (i.e. +/- 2^{o}C). However maintaining a temperature between 15-25^{o}C is the acceptable standard for general museums with mixed collections. In areas such as storage rooms, where the comfort of staff is less of a concern temperatures can be kept at lower levels, although maintained above freezing.

Most material types do well at lower temperatures however certain materials such as plastics, modern paints and coatings may become stiff or brittle as temperatures decrease.

Air Quality

Deterioration caused from impurities or pollutants in the air can be extremely damaging to collections. These pollutants come from contaminants produced both inside and outside the museum.

Main culprits include:

- Sulphur dioxide, hydrogen sulfide and nitrogen dioxide from industrial pollution, the burning of fossil fuels, and car exhaust.
- Formaldehyde, formic and acetic acid from a variety of construction materials.
- Ozone from photocopiers and printers.

These gaseous pollutants are reactive chemicals that can attack objects within the museum's collections. For example, when sulfur or nitrogen compounds are combined with moisture (e.g. due to incorrect or high levels of RH) they form

sulfuric and nitric acids which cause deterioration in a variety of objects.

Indoor air pollutants mainly come from building materials including: wood and wood by-products (e.g. plywood), fabrics, carpeting, glues, paints, varnishes, and cleaning products. It is for this reason that materials used in the construction of storage and display cases and cabinets at MOA are extensively tested, to ensure that they do not off-gas harmful pollutants.

One way the conservators at MOA deal with damaging pollutants is by placing activated carbon among objects known to off-gas. Activated carbon is a pollutant scavenger that has a molecular structure that traps damaging off-gases. You may have noticed small boxes containing activated carbon in some of the drawers in the MVG.

Dust

Far more obvious than gaseous pollutants are particulate pollutants or dust. Quickly recognizable, dust can cause a number of problems.

Particulate pollutants or dust are solid particles suspended in the air and come from both indoor and outdoor sources. Common pollutants are: dirt (including *silica* particles), soot, ash, skin cells, pollen and grease.

Silica particles can be extremely damaging as they are abrasive and can scratch or abrade the surface of an object.

Particulates like pollen, and skin cells can be attractive to pests, as a food source.

Dust is also dangerous for collections because it can attract moisture and gaseous pollutants to the surface of objects,

which can allow for chemical reactions (noted above) to occur directly on an object.

Pests

Pests in museums that can cause damage to collections are called biological agents and include: insects, fungi and vertebrates such as mice and birds. Damage caused by these biological agents are results of their feeding or nesting behaviour. Additionally certain types of pests may attract other types by providing a food source, or an ideal habitat. Examples include mold-attracting insect activity, or the nests of vertebrates creating an ideal habitat for breeding insects. Organic objects in collections are directly affected by pests. Pest populations within museums are controlled and monitored through an Integrated Pest Management program (IPM). These programs provide strategies for controlling and monitoring pest populations. This may include:

1. Controlling environmental factors to ensure that they are not desirable to pests. For example, cooling a room to below 15^{o}C is often effective in slowing or stopping the growth, feeding, and breeding of insects.
2. Establishing good housekeeping practices and building maintenance.
3. Placing traps around the storage and display areas to help monitor and track pest activity.
4. Establishing food and drink free zones in any space in which collections are housed either for storage or display.

There are a variety of pests which are extremely damaging to collections. Some common pests, and those occasionally dealt with by conservators at MOA include:

Carpet beetles in the larvae stage of their lifecycle feed on a variety of materials including: fur, feathers, wool, hair, and skins. The larvae are hairy in appearance and leave casings as they grow into adulthood.

An adult Carpet beetle (*Anthrenus)*, note the indicative grey and gold scales.

Clothes moths in the larvae stage of their lifecycle feed primarily on soiled woolens, but are also known to feed on silk, felt, fur, feathers, and hairs. They feed or graze on the surface of the material infested.

Example of an adult case-bearing (Tinea pellionella) clothes moth.

Example of a cocoon spun by the larvae of the case-bearing clothes moth.

Clothes moth casings found in a hide and fabric doll after freezing.

Molds are fungi that can cause extensive damage and even disintegration of organic materials. They are also attractive to certain insect species which feed on fungi.

Silverfish will consume fabrics, paper, glue and paste in book bindings. As omnivores they will eat both protein based materials as well as cellulose. They prefer environments that are dark and damp.

Example of an adult silverfish (CCI 2012).

Spiders, although they are the most visible of the insects that can be found in museums they are not directly damaging to collections (other than causing some modest soiling), and are referred to as a non-pest insect. Their presence is indicative of other insect pest activity.

Woodboring beetles including the furniture beetle and the powder post beetle are some of the most destructive pests. In the larvae stage of their lifecycle these insects feed on wood and given enough time, can reduce it to a mass of fine powder. The presence of the furniture beetle only becomes apparent after 2-3 years when they emerge from the wood as adults, leaving behind an indicative pin hole opening in the object. The larvae of the powder post beetle however, leave an indicative fine powder around the object damaged. Similarly the adult powder post beetle will also leave an exit hole in the damaged object

Example of an adult furniture beetle (CCI 2012).

Past treatments for objects infested with pests has included the use of pesticides containing toxic and poisonous substances such as arsenic and mercury. Today the use of pesticides as a type of treatment is avoided as it has been found that *heavy metals* used in this historic form of treatment continues to pose a health risk, even decades later.

To learn more about heavy metals in collections see:

- ***CCI Notes 1/7 Mercury in Museum Collections***
- ***CCI Notes 1/8 Lead in Museum Collections and Heritage Buildings***

Today conservators at MOA use **freezing** to treat insect infestation, a form of treatment that became popular in the 1990s. Most museum insect pests must be cooled to well below 0°C to completely kill the insect population in a reasonable amount of time.

Freezers with a temperature range of -30 °C to -40 °C are ideal for museum use. At MOA the protocol is freezing at -30°C for two weeks.

To learn more about freezing as a treatment for pests see:

- ***CCI Notes 3/3 Controlling Insect Pests with Low Temperature***
- ***NPS Conserve O Gram Number 3/6 An Insect an Pest Control Procedure: The Freezing Process***

Handling & Mounts

Equally important to protecting objects from the detrimental effects of the museum environment is ensuring they have adequate physical protection through safe handling procedures. Proper handling is essential for preservation. Objects should as a rule be handled as little as possible, and should only be handled in safe and clean environments.

One way that conservators at MOA insure that objects are safely handled is through the construction and use of object mounts. Mounts are designed and constructed of *inert* conservation grade materials that are known to be safe and not produce harmful off-gases. They use gentle pressure to hold objects in place without causing damage.

Example of a MOA object in a black tray mount with upright supports.

The black foam trays used in the multiversity galleries provide proper support to the objects and allow them to be moved from one location to the next, and to be handled by researchers without being touched directly. These black tray mounts also provide added stability during a seismic event, and even limit damaging vibrations caused by the opening and closing of the drawers in the MVG.

Example of a MOA object in a black tray mount using a sinking technique.

White tray mounts or Hospital mounts can also be found in the MVG. Serving a similar purpose to the black trays, these mounts are used to safely contain damaged or deteriorated objects without using a pressure fit. The white lining also allows conservators to easily see any additional loss of material.

Example of a white tray mount, using the sink technique for a fragile piece of basketry.

Earthquake mitigation is another important aspect of conservation at MOA. Conservators must devise ways to safeguard collections from damage caused by earthquakes that are not harmful or damaging to the objects in storage and on display and that does not interfere with visitors' appreciation of the pieces.

Masks hung in the galleries have individually fitted brass mounts which utilize previously existing holes to provide proper support.

Example of mask mounted on a rigid brass mount.

Objects on shelves that are non-porous such as fine ceramics, glass, and metal pieces, and do not sit in black trays or individually designed mounts, are waxed down using a clear utility wax. The wax is a reversible method of stabilizing the objects in the cases during a seismic event.

Small bead of utility wax placed on the base of a large ceramic jar that sits on glass shelf in Malaysian display case in MVG.

Mounts for Totem Poles and Cedar Carvings

All the totem poles and cedar carvings housed inside MOA and outside on the grounds are secured using individually made mounts, providing stability and protection in the case of a seismic event. Objects and carvings are never altered to fit a support; the support is always built around the object, using existing openings to secure the mount. Mounts are specific to individual poles as the design is dependent not only on the condition of the pole but also on the individual features of the pole. Conservators at MOA worked alongside mount-makers to determine the best type of mount for each piece.

Wood carvings mounted outside are placed in the ground with loose stones around the base to increase water drainage and limit vegetation growth. Wood carvings should never be set in concrete as this will limit water drainage, which can speed deterioration. Additionally as the wood swells and contracts with the changes in the weather the concrete will prevent this natural movement from occurring and the carving may suffer damage.

One type of support used for the outdoor totem poles.

Objects on Display

Rotation

Only objects determined to be stable enough to sustain display are put out in the galleries. Certain objects, although stable enough to be on display, are still sensitive to certain environmental conditions such as light. Objects with sensitivities are put on a rotation schedule.

Textile and paper objects are rotated most often. Objects that are extremely light sensitive are placed in drawers where they are and exposed to light less frequently than those placed in the display cases.

Cleaning

Cleaning is an important component of preventive conservation and a regular task for collections staff. Cleaning can involve simple dry procedures such as brushing and vacuuming to remove dust, or may involve the use of solvents. However before any cleaning is done two questions must be asked:

1. Does cleaning truly need to be done?
2. If so, how far should it go?

Preserving our Unique Collections

Who decides what is conserved?

Conservation treatments performed on objects at MOA are primarily exhibit driven. This means that objects that are intended to go on display in upcoming exhibits are placed at the top of the list for examination and, if required, repair and treatment.

In addition objects going away on loan receive top conservation priority, to ensure that they are in their best condition prior to departing MOA. Similarly, new acquisitions may undergo treatment prior to being put away in permanent storage.

Objects that have suffered damage are also treated on a case by case basis, particularly if they are objects that are out on display.

There is a practical consideration to be made in terms of the need for immediate treatment. Damaged or deteriorating objects that are not immediately required for research, loans or display, and are in stable condition are documented and treated once objects requiring immediate attention are looked after.

It is important to note that the majority of a conservator's time (approximately 90%) is spent doing preventive conservation, as it is far more economical to prevent damage than repair it.

Images showing the removal of organic matter using wooden picks so as not to damage the surface.

One of the most recognized features at MOA are the beautiful totem poles and cedar carvings that stand both inside and outside the Great Hall.

Conservators at MOA have established a yearly maintenance program to help in the preservation of the outdoor poles and cedar carvings. A major component of this program is the removal of organic matter including vegetation and moss. Additional treatment or stabilization is determined on a case by case basis.

Carvings and poles housed inside also undergo regular assessment, and are cleaned to remove particulate pollutants from the surface.

Preservation Problems (Outside)

An example of radial splitting in wood.

Cracks and Splits are a part of the natural life cycle of poles and other wooden pieces. The western red cedar used for the poles is an extremely soft wood prone to splitting, particularly along the grain. Poles always develop splits and cracks to some extent directly after being carved mainly from changes in the water content of the wood. Wood being a hygroscopic material means that poles and carvings remain susceptible to splitting throughout their lifetime, due to changes in their water content. Even when wood is carved dry, the changes in water content that the wood experiences seasonally as it sits outside will cause splitting.

Weathering or erosion caused by rain, wind and particulates carried in the wind can remove up to ¼ inch every hundred years. *Photochemical* degradation can also occur. The wood surface may take on a silver-gray colour, which occurs as the soft *earlywood* wears away and the harder *latewood* becomes exposed. Although it is only a few millimeters thick, this silver-grey layer is more resistant to biological attack than non-weathered wood.

Notice the silvery hue to this weathered pole, indicative that the earlywood has been

One way that conservators slow weathering and deterioration is by capping the upper portions of the poles, where end-grain is exposed to

moisture and the elements, with copper or aluminum sheeting. This helps limit the amount of moisture that penetrates the wood (that could increase the rate of deterioration.

Biodeterioration includes damage caused by biological agents such as bacteria, fungi, insects and other organisms. Of these, fungi cause the most damage to wooden carvings. Because fungi do not contain chlorophyll, the substance in plants that allows them to produce energy from the sun, they require other organic material to live. Fungi can break down the cellulose in the wood causing deterioration.

Moss growth above the eyes and on the nose of a figure on one of MOA's Haida houses. This plant growth is removed by conservators at MOA as a preventative measure against biodeterioration

Plants, moss and lichen are another biological agent that can cause biodeterioration of carvings and poles. Root systems from plants create pathways for water to enter, allowing for more rapid deterioration. As the plants grow they can also cause splitting as their root systems spread.

Vertebrates Biodeterioration at MOA includes damage caused by different bird species. One of the poles on the property has suffered extensive damage due to the feeding activity of woodpeckers. This damage is due to the presence of an insect infestation in the wood that provided a readily available and irresistible food source for the woodpeckers. In order to limit the damage caused by the woodpeckers the

infestation was controlled and copper sheeting wrapped around the previously infested areas.

A Pileated Woodpecker feeding on the pole that sits outside of the MOA gift shop.

Additional damage has been caused by the nesting activities of various bird species. The nests provide ideal habitats for insect and parasitic activity, and the fecal matter of birds is not only unsightly but can be slightly corrosive.

Example of damage caused by the feeding activities of the woodpecker.

Insect Biodeterioration is another issue for poles and carvings on display outside. Species known to have caused damage to the wooden carving and poles at MOA include the carpenter ant and termites. Both insect species will eventually cause the weakening and collapse of the wood if left unchecked. Telltale signs of their occupation are the presence of insect casings and fine wood particulates (i.e. fine sawdust), which is ejected as the workers excavate through the internal

Note the fine sawdust around the base of the pole, indicative of insect activity.

structure of the wood. Conservators at MOA have used a borate (a wood preservative used to protect against insect and fungi attack) solution to control infestation and stop insect damage.

Paint Loss occurs through the natural weathering of the carvings. Additionally photochemical breakdown of the paints can occur, as can bleaching by sunlight. The loss of paint can speed deterioration as the paint does provide a protective coating to the wood.

Vandalism and Physical damage unfortunately continues to be an issue for carvings on display. Cases of damage caused by vandalism are recorded and photographed and placed within the specific piece's file.

Preservation Problems (Inside)

Although cedar poles and other wood carvings kept indoors are better protected from the outdoor elements and extreme changes in temperature, damage and loss can still occur. Additionally many of the items have spent part of their lives outdoors, thus examination prior to entering the building must be done to determine whether there is current or ongoing fungal or insect activity. If none is found the weathered condition of these objects can be considered stable. Although the pieces may not appear in the best condition, their current condition is culturally significant and part of the object's history.

Splitting of indoor poles is part of the natural life cycle of wooden objects. However with the RH and temperature being

regulated, splitting should be fairly controlled, as long as extreme fluctuations are kept to a minimum.

Fading is still an issue for poles and carvings on display inside the Great Hall. Although damage to the painted surfaces should be minimized, being protected from the external elements, the colours on the poles are still susceptible to light damage.

Physical Damage in this case refers to the damage that people can unknowingly or even knowingly cause to items on display. Wood objects are particularly susceptible to the oils carried on people's hands, being extremely porous.

For more information on the care of totem poles see:

- ***CCI-Notes 6/7 Totem Poles Displayed Indoors***
- ***CCI-Notes 6/8 Totem Poles Displayed Outside***

Glossary

corrosion – Degradation of metal caused by electrochemical means, resulting in the formation of mineral encrustations.

dessication – Dryness resulting from the removal of water.

earlywood - Wood cells produced at the beginning of a tree's growing season and generally light in colour. Also referred to as springwood.

efflorescence – Crystalline or powdery crusts formed on the surface when hygroscopic salts within the body of the object migrate with moisture to the surface.

hygroscopic - A material that readily gives off or takes on moisture.

inert – Lacking active properties, particularly a usual or anticipated chemical or biological action

latewood - Wood cells produced later in the growing season. These cells are smaller and have thicker cell walls than earlywood cells.

photochemical – Relating to or caused by the chemical actions of light.

silica – A hard, unreactive, colorless compound that is found naturally in sand and quartz and used in the production of ceramics, glass and abrasives.

viscous – having a consistency between a solid and liquid.

For More Information:

If you have additional questions please feel free to contact:

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Useful conservation links are:

The Canadian Conservation Institute: CCI
www.cci-icc.gc.ca

The International Institute for conservation of Historic and Artistic Works:
www.iiconservation.org

The Getty Conservation Institute:
www.getty.edu/conservation/institute/index.html

National Parks Service conservation information:
www.cr.nps.gov/museum/publications/conserveogram/cons_tot.html

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