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# Newsletter

*Cutting a replacement section through the "sandwich" of paper, tortoiseshell and brass.*

**GERRY HEDLEY**

As this issue was going to press, it was with deep regret that CCI learned of the tragic death of Gerry Hedley of the Courtauld Institute of Art. Gerry has made a significant contribution to conservation and he will be sorely missed by his many friends both at CCI and throughout the conservation world.

## Contents



## Treatment of a Boulle Work Bracket Clock: A Progress Report

*by Laura Nagora, Gordon Fairbairn and Janice Manuel*

In December of 1987, a crate containing a bracket clock arrived in the Furniture and Wooden Objects Section of CCI. This clock, which is owned by the Royal Ontario Museum, is attributed to André-Charles Boulle (1642-1732) who perfected the technique of brass and tortoiseshell inlay. Although the clock carcass is simple in its outline, the decorative ormolu mounts and inlay designs reflect the elaborate baroque style popular during the reign of Louis XIV. It is considered by Peter Kaellgren, Curatorial Fellow in the European Department of the Royal Ontario Museum, to be one of the most important early clocks and pieces of Boulle furniture in Canada.

When this unusual artifact arrived at CCI, it was difficult to believe that the case was originally covered with ornate tortoiseshell and brass inlay, and ormolu mounts. Much of the inlay was loose, detached or missing. Accompanying the case were a number of envelopes containing numerous small sections of inlay, and boxes containing smaller structural elements, brass trimmings and small ormolu pieces. Originally there would have been a bracket on which the clock rested, but the wooden framework is missing. All that remains are the heavy ormolu mounts, which we now believe were part of the bracket.

Examination revealed some puzzling features. Close inspection of the inlay confirmed that some areas had undergone previous restoration. The colour of the brass, and absence of engraving on some brass pieces and the difference in colour and markings of the tortoiseshell are characteristics of the restored areas. The back panel had undergone the most extensive restoration. Missing inlay had been reproduced to complete the designs, and a layer of varnish applied. The varnish had darkened and obscured the beauty of the inlay.

After examining the ormolu mounts, we noticed that the style and motifs of several of the mounts were different from those on the rest of the pieces. By

comparing the nail holes on the mounts to those on the carcass, we discovered that the questionable pieces could not belong on the clock case. These mounts may be part of the missing bracket.

The conservation project promised to be interesting and challenging. Due to its complexity, it also offered possibilities as a useful training project. It is not often we have the opportunity to work on a complex artifact of composite materials that is in such poor condition.

The problems we faced were like stepping stones. One problem had to be taken care of before the next could be approached. The first step was to piece together all detached structural and decorative elements. The clock case is an assemblage of three layers: the wooden carcass, the inlay of tortoiseshell and brass, and the ormolu mounts. Once the placement of these pieces was established, the next step was to find out if all the necessary inlay was present. If not, the missing areas would need to be carefully documented and reproduced. The decision to reproduce the missing areas of inlay created the next problem: what kind of material to use as the replacement — genuine or synthetic tortoiseshell? After researching each material, we decided to use genuine tortoiseshell. The use of synthetic tortoiseshell has several drawbacks: it would necessitate using an irreversible adhesive; it would be difficult to obtain a good colour match; and it would not be possible to reduce the standard thickness of the sheets to the desired thickness. The method of reproducing the intricate designs of the brass and tortoiseshell inlay also posed a problem. The final decision was how to adhere the inlay to the carcass — in particular, what adhesive to use.

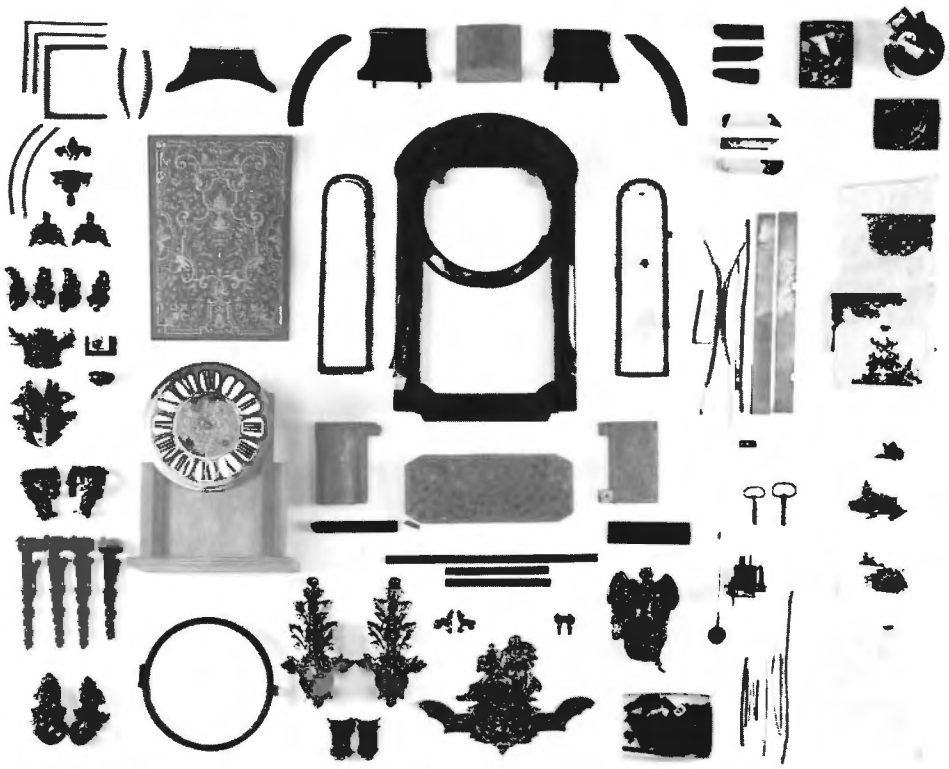
The inlay designs found on a Boulle work clock are usually symmetrical on the left and right sides of the clock case. The design is described as a mirror image, meaning that from a centre-line on the clock case, the design on the left side was identical to that on the right side, but in reverse. Fortunately, the sections of intact inlay provided sufficient information to enable the completion of their counterparts. Each piece of inlay design was copied onto tracing paper and outlined using different colours to identify whether it was original, a previous restoration or a CCI reproduction. These tracings then acted as patterns to reproduce the missing sections of inlay. The difficulty was in finding a technique that could duplicate the flowing quality of the designs.

Before an inlay design could be cut for the clock, the raw tortoiseshell had to be prepared. First, the shell plates were removed from the carapace by soaking the whole carapace in hot water. A hammer and a large spatula were used to pry off the plates, which were then boiled in water to soften them further, dried and pressed flat for at least 12 hours. To match the thickness of the original tortoiseshell inlay, both glass and metal scrapers were used to remove excess material from the plates. Different grades of sandpaper removed any marks left by the scrapers. The shell veneers were then dyed to obtain a close colour match with the original material.

We used the original technique for producing Boulle work designs to reproduce the missing sections of inlay. The extant original inlay sections were adhered onto tracing paper. A sheet of prepared tortoiseshell was then adhered to the underside of the paper, followed by a sheet of brass adhered underneath the shell, creating a four-layer "sandwich". The missing pieces were then created by carefully cutting through the lower three layers using a fret saw and fine jeweller's saw blades. The reproduced sections of tortoiseshell and brass were used to fill in the missing design areas.

The identifying characteristics of the replacement tortoiseshell were its different colour and markings. To identify the replacement brass designs, they were left without the surface engraving found on the original sections. The colour of this replacement brass was closer to that of the original material and therefore identifiable from the previous restoration brass, which also was not engraved.

Simultaneously, research was being carried out to find a suitable adhesive to adhere the inlay to the carcass. Originally, glues were used with additives such as garlic juice and urine to give the



*The bracket clock before treatment.*

glue increased elasticity and improved adhesion to the metal elements. The environmental conditions, particularly low humidity, of North American museums have created problems for Boulle pieces in these collections. In many instances, the inlays have either partially or completely detached because of the embrittlement of the old adhesive. In some recent restorations of Boulle clocks, epoxies have been used in an attempt to overcome this problem. Epoxy was not used for this project because of its irreversibility.

Animal and fish glues were tested under radical relative humidity fluctuations, using glycerine to replace the traditional plasticizers of garlic juice and urine. These tests indicated that sturgeon glue with 5% glycerin provided a strong, flexible bond.

Today, after many hours of work, most of the puzzle is solved and the missing design sections have been recreated. Based on this restoration, the original design of the clock is more fully determined. The clock case is constructed of brown oak, crowned by a pediment on which sits an ormolu female figure. The inlay designs are completely symmetrical and depict entwined scrollwork and foliage, birds and child-like faces. The baroque style ormolu mounts cover much of the clock surface. The use of windows, also a prominent feature of the baroque style, allow better viewing of the highly decorative back panel. The clock is inscribed "De'y Paris" on the back. Its face is engraved brass with Roman numerals on individual enamelled plates. The pendulum has a sun-god motif, a symbol of Louis XIV.

At this stage of the project, most of the inlay has been reconstructed and the design sections shaped by heating and clamping to conform to the various curved sections of the carcass. The next stages will involve correcting the differing thickness of the tortoiseshell and the brass inlay, readhering loose structural elements and adhering all the inlay sections to the carcass. The final step will be to re-attach the ormolu mounts.

One other major decision remains: whether or not to recreate a bracket. Although no elements of the bracket carcass remain, we feel confident that a fairly accurate reconstruction can be made based on the curvature of the remaining ormolu mounts and on evidence from other Boulle clocks with intact brackets.

Treatment of this complex artifact appears simple when summarized here. What is not apparent, however, are the many, many hours of work put into steps such as literature searches, adhesive testing, familiarization with the use and manipulation of tortoiseshell, and the annealing of modern brass sheet to render it suitable for cutting and forming, before conservation could begin. Once the results of all these operations are incorporated into completing the project, we believe that the information will be of great value to conservators involved in future treatments of similar artifacts.•

## Treatment of the Lead Plaque of Jean de Brébeuf

*by Charlotte Newton*

Sainte-Marie Among the Hurons, near the present-day town of Midland, Ontario, was established as a Jesuit mission in 1639. For 10 years it served as a retreat for Jesuit missionaries working in small villages in Huronia and as a centre of French culture in the area. The Hurons were allies and trading partners of the French and had firm control over this area, which was valuable for its strategic location and rich fur trade. Ongoing hostilities between the Huron and the Iroquois reached a peak in 1648-49, resulting in decimation of the once large Huron nation and withdrawal of the French from Huronia. In March 1649 two Jesuit Fathers, Jean de Brébeuf and Gabriel Lalemant, were tortured and put to death by the Iroquois. Several days later their remains were recovered by the Jesuits and returned to Sainte-Marie, where they were interred together. Later the same year, the Jesuits themselves destroyed Sainte-Marie to prevent it from falling into the hands of the Iroquois.

In 1954, during excavations at Sainte-Marie, a small lead plaque was discovered. The plaque inscribed

> †
> P. Jean de Brebeuf
> brusle par les Iroquois
> le 17 de mars l'an
> 1649

identified this as the burial place of the Jesuit martyrs. The plaque has been on display since 1971 at the interpretation centre of the reconstructed mission of Sainte-Marie Among the Hurons. Several years ago the plaque began to actively corrode, as white corrosion products started to form on the grey plaque. When the extent of corrosion noticeably increased, the plaque was sent to CCI for treatment.

We were unable to find a reason for the plaque beginning to corrode or for the increase in the rate of deterioration. There had been no change in the local environment or the display case in recent years.

The plaque was very heavy for its size, indicating the presence of a good deal of metallic lead. It was dark grey in colour, with an uneven, patchy surface and areas of dark brown discoloration. Black material appeared to highlight some of the incised letters and white fluffy powder covered areas of active corrosion. The corrosion products were identified as basic lead carbonate and possibly lead formate. Basic lead carbonate was also identified in a sample of the black material by Analytical Research Services staff Jane Sirois, Marie-Claude Corbeil and Elizabeth Moffatt. An earlier analysis by Jane Sirois and Judi Miller detected lead acetate. These are the forms of corrosion that normally occur on lead in the presence of organic acid vapours. Basic lead carbonate can protect the lead underneath if it has formed in a homogeneous layer that is strongly adherent. However, in the presence of small amounts of organic acid vapours, basic lead carbonate forms

*Lyndsie Selwyn, conservation scientist and Charlotte Newton examine the plaque during treatment.*

as a loose, non-adherent powder. The organic acid vapours stimulate corrosion and act as a catalyst. Once active corrosion has started, it can continue for a prolonged period in the presence of carbon dioxide alone, the organic acid being regenerated and largely reused as the porous corrosion layer thickens.

We had two priorities in conserving the plaque: to halt the ongoing corrosion and to document the plaque as fully as possible.

The plaque was examined by x-radiography. The incised lettering appeared to be present to varying depths in the metallic lead, not just in the corrosion layer. A number of corrosion pits or casting flaws also showed up on the radiograph, suggesting that a completely stripped surface might be quite pockmarked.

There are several different approaches which have been used for the treatment of lead: stripping the corrosion products by chemical or electrolytic methods; and reducing the corrosion products back to metallic lead by chemical or electrolytic means. It was necessary to remove, decrease or convert the corrosion to allow access to the lead acetates and formates, the source of the ongoing corrosion. Though these are both readily soluble in water, they were not accessible under the carbonate layer.

Before choosing the most appropriate treatment for the plaque, we decided to do a series of experimental treatments on corroded lead samples. The first step was to prepare the corroded test samples. Pieces of lead were prepared to approximately the same size as the plaque, with incised lines or lettering. They were put into a humidity chamber to corrode, in the presence of moisture, carbon dioxide and oak shavings (a source of acetic acid). Needless to say, the lead samples steadfastly refused to corrode for the first several months. After six months, most of the lead samples had at last built up a layer of white lead carbonate and were ready for the experimental treatments.

In the meantime we began to consider our other priority — documentation of the plaque. CCI staff have already benefitted from research on a laser scanner being done at the Photonics and Sensors Section, Laboratory for Intelligent Systems, Division of Electrical Engineering, National Research Council of Canada. (See article elsewhere in the *Newsletter* by Ian N.M. Wainwright and John M. Taylor.) Laser scanning seemed the best way to accurately and minutely record the surface detail of the plaque, and to enable a replica to be made without directly handling the surface. The laser scanner records information on dimension and reflectivity. On the plaque, which is about 9.4 cm by 5.2 cm, the NRC laser scanner was used to record data at 1500 points across the long side and 1000 points across the short side — a total of 1,500,000 pieces of information. The data were stored in a computer, where they could then be manipulated in a variety of ways or used to control a milling or engraving device to produce a replica.

In previous work, NRC had never tried to engrave detail as fine as the corrosion layer of the plaque, so it was necessary to find a suitable engraving material. Several materials were tested, including modern resins, foams and lead. It turned out that there was a low-tech answer for this high-tech situation — plaster. Cast blocks of moulding plaster were found to take a high degree of detail. Though plaster is physically a soft and easily damaged material, it is very stable chemically. Several copies of the plaque were engraved, each copy taking about two days to cut. These plaster replicas can now be coloured to closely resemble the original or can be used to make further reproductions.

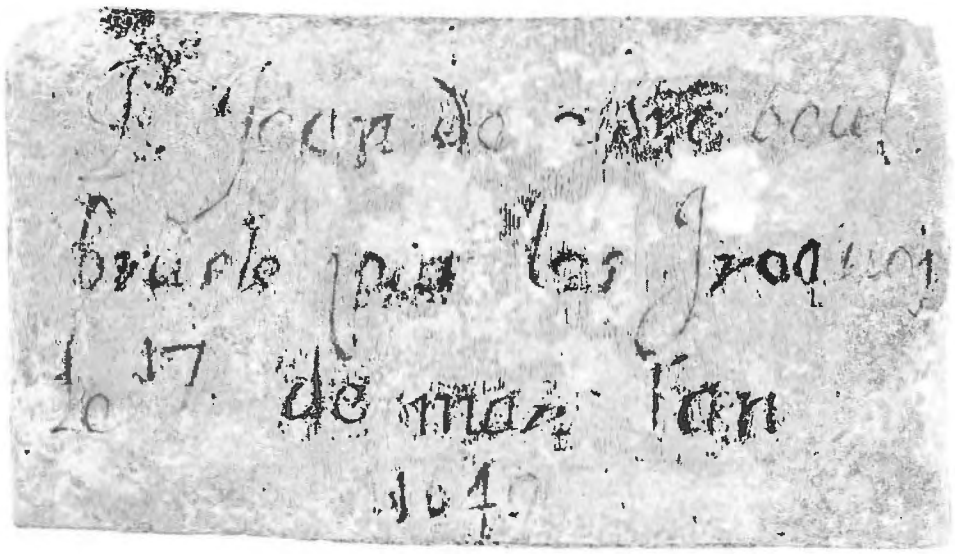
Once the lead test pieces were corroded we started testing several possible treatments: electrolytic consolidative reduction in sodium hydroxide or sulphuric acid electrolyte; consolidative reduction in sodium dithionite (a strong reducing agent); and dissolution of the corrosion products in a chelating agent (DTPA — diethylene triamine pentaacetic acid — or EDTA — ethylene diamine tetraacetic acid). Consolidative reduction is often used on objects in which the surface detail is present only in the corrosion layers and not in the metallic lead. In this case, the only way to save the information on the surface of the object is to convert the corrosion into metal. The corrosion is more voluminous than the metal, so when the corrosion is reduced to metal, the resulting surface has a less compact, lacy appearance — not the original surface. In our trials we found that the electrolytic methods produced unpredictable results. It is also not possible to see what is happening during the process, since the object is sandwiched between layers of sponge to keep the corrosion in place.

The sodium dithionite treatment also results in reduction of lead corrosion to metallic lead. However the newly converted lead did not remain on the object. A dark grey deposit on the

bottom of the treatment container was identified as lead by Jane Sirois. The surface of the test pieces after treatment was uneven in colour, and some corrosion remained in the incised lines.

The best results were produced by cleaning in DTPA or EDTA. We chose DTPA, since it is already used to treat lead objects in the CCI Archaeology section.

The plaque was immersed in a bath of DTPA and almost immediately, it began to react, with small bubbles forming on the surface as the lead carbonate became soluble, releasing carbon dioxide. The uneven discoloration on the surface began to disappear, being replaced by an overall lighter grey colouring. At the same time, the black material highlighting the lettering became more apparent. After about one and a half hours in DTPA, the appearance of the plaque had greatly improved: the lettering was easier to read, and the colour was more even. The lead carbonate layer was much thinner, and the metallic lead was exposed at the corners and in several spots on the surface. We stopped the treatment at this point, because the appearance was better with part of the corrosion layer left in place, rather than completely stripped. Partial cleaning may also have allowed the lead acetates or formates to dissolve.



*The plaque after treatment.*

The plaque was washed in running tap water and in changes of boiled distilled water to remove chemical residues. It was rinsed through acetone, dried and immediately placed in a desiccator containing dried silica gel and activated charcoal.

Lyndsie Selwyn, a conservation scientist in the Conservation Processes Research laboratory at CCI, conducted a literature survey and provided advice and assistance at all stages of the treatment.•

## The Fossil Forest on Axel Heiberg Island

*by Charles Gruchy*

CCI has been involved in the conservation of the Fossil Forest on Axel Heiberg Island since 1987. There are two aspects to our involvement in the project: the conservation of material removed from the site (see "The Conservation of Waterlogged Wood Thirty Million Years Old", David Grattan, *CCI Newsletter*, December 1987) and the stabilization of the site itself. To fully understand site conservation problems, CCI has undertaken a study of erosion of the hill which includes mapping the location of all exposed stumps and logs.

In July 1989, Charles Gruchy, Malcolm Bilz and Carl Bigras, all from CCI, and Alain St-Hilaire, a cinephotographer, returned to the site to determine the amount of erosion that had taken place during the previous year. We also intended to continue mapping stumps and to undertake extensive photodocumentation of the site, from both the ground and the air. We were successful in completing all of our work, not something one can count on when conducting field work in the high Arctic, where weather has a habit of playing havoc with plans.

Our preliminary data suggest that natural erosion processes are removing as much as 1% to 2% of the soil each year and that this rate may be significantly increased by human activity. As the soil is eroded, no protection remains for the waterlogged frozen stumps and logs, which rapidly dessicate, split apart and finally are moved off the hillside by wind and water. We have now mapped 500 stump and log locations over the full extent of the hill, which is approximately 1200 meters long, 300 meters wide and up to 150 meters high. Extensive photodocumentation was carried out and particular attention was given to the areas in which erosion markers had been placed in 1988.

Logistical support for our studies has been provided by the Polar Continental Shelf Project of the Department of Energy, Mines and Resources. They operate a sophisticated air transport system throughout the high Arctic and maintain regular radio contact with parties in the field. Although no day in that environment can be called typical, the following excerpts from my diary give a flavour of a day at Geodetic Hills.

*July 7, 1989*

Took the weather at 0600 — it's a chilly +5°C and threatening rain or snow, but

at least the wind is down. Radio schedule at 0700 and inquired when BWP [helicopter] would be in to pick up Alain so he could return to Resolute. Jim agreed that because of threatening weather, it would come to Geodetic Hills before going to move Tony's camp at Hotweather Creek. Breakfast was up to Malcolm's usual high standard of cooking. BWP arrived at 0845 and Alain left, a happy man with some good film footage.

...Moved the theodolite to triangulation point 4 to reconfirm angle to 6 — it *was* wrong; what the hell did I do? I wonder if I screwed up any more? Well, at least that one's right now.

...Mapped a line across to 2 and worked out a strategy to map the stumps east of the heart rot zone. There must be fifty stumps there that weren't visible last year. Wind is up enough to rattle the theodolite. Carl went down at 1600 to begin supper and Malcolm and I put cairns on the terraces to begin mapping from.

*Surveying at the Fossil Forest site.*

We went down at 1730. Cottage roll, wax beans and mashed for supper — damn good. Radio schedule at 1900 — weather deteriorating — snow squalls and high winds. Did some calculations on our measurements — they look good — maybe I haven't screwed up as badly as I thought. Read till 2230 and to bed.•

## NRC's Laser Scanner for Recording and Replication

*by Ian N.M. Wainwright and John M. Taylor*

Registration and recording are essential functions of every museum, art gallery, archaeological dig and biologists' field trip. Careful documentation of origin and provenance adds immeasurably to our understanding of the symbolic and aesthetic function that a work of art served in the past. Artifacts whose position and level at an archaeological site are not carefully recorded are often of little use in understanding the chronology of occupation of that site. For centuries, botanists, zoologists and mineralogists have depended on meticulous drawings and photographs for the huge task of identifying and classifying natural science specimens. To the conservator, photographs, as well as detailed written records, are vital for monitoring processes of deterioration and the effect of treatments on the appearance of artifacts and paintings.

Photography is still the mainstay of conventional museum and conservation recording. In fact, we have all become so familiar with black-and-white and colour photography that we sometimes forget how complex the process is which enables us to record objects and scenes with such fidelity. Conservation scientists have quickly latched on to new methods for examining objects, some quite complex and sophisticated. One of the most widely used is x-radiography. X-rays were first trained on pigments and paintings almost immediately after their discovery by Roentgen in 1895 and are now commonplace in museum laboratories. Double paintings, fakes, pentimenti and defects are often quickly revealed in this way. Ultra-violet and infrared radiation are also widely used in the study of paintings. Less familiar is neutron activation autoradiography, in which a painting is irradiated with thermal neutrons in a nuclear reactor, making atoms in the paint temporarily radioactive. As the atoms decay they emit electrons at different rates, allowing researchers to record the distribution of different pigment constituents in a painting.

Most recording techniques render a three-dimensional object — and even paintings and drawings are not perfectly flat — as a two-dimensional image. Stereo photography and radiography allow us to see the depth dimension and to make some measurements of it. Numerical topographical data can be compiled with stereophotogrammetry, an approach now routinely used to record heritage architecture and other structures. Holographic interferometry has been used to detect defects in panel paintings and the pattern of vibration in violin soundboards.

For many museum applications, what is needed is a fast and accurate means of recording detailed three-dimensional data from objects. There are millions of artifacts and specimens in museums of widely varying shape, size, colour and surface texture: paintings, sculptures, ceramic shards, fossils, delicate mineral specimens, toads, fish, corroded metal

artifacts and textiles. Once recorded, there is the further requirement of being able to make comparisons between objects and, sometimes, to make replicas.

This need is not unique to museums of course. Industrial and medical applications also call for accurate recording and this has given rise to the burgeoning fields of digital image processing and machine vision. The new technology has many uses: automating the process whereby a robot arm selects parts from a bin on an assembly line; sorting and grading lemons; monitoring wear (corrugation) of railway tracks; inspecting and welding in hazardous environments; fabricating of prosthetics; measuring the propellers of large ships for accuracy.

At the National Research Council of Canada (NRC), engineers in the Photonics and Sensors Section of the Laboratory for Intelligent Systems (Division of Electrical Engineering) are at the forefront of the latest developments in this area. They have designed and developed a laser scanner or 3-D range imaging sensor.

CCI has been working with the NRC group to explore applications of the laser scanner in the recording of museum objects. In 1986, an experiment was conducted by Hymarc Engineering Ltd, a firm that had developed a commercial version of the NRC laser scanner design. With the assistance of curatorial staff of the Canadian Museum of Nature and the Canadian Museum of Civilization, archaeologists and conservators, a selection was made of specimens and artifacts that could be scanned with the system. We wanted to know how acquisition of the data would be affected by colour, texture and surface topography. The objects scanned were extremely varied: a severely corroded cruciform artifact from the Ferryland site near St. John's, Newfoundland (see "The Cross from Ferryland", by Judith Logan, in *CCI Newsletter*, December 1987); fragments or arti-facts of waterlogged wood, copper, ceramic, stone, bone, abalone and argillite; the tibia and molar of a mammoth; a preserved toad; and the face of a human volunteer.

There are now several prototypes of the NRC laser scanner as well as industrial versions. The basic principle of operation is similar in the different designs. Some are for applications where high speed of data acquisition is important. In others, the design of the optical components and scanning mechanism provides optimum spatial resolution. A pure red laser beam from a helium-neon laser is focused to a fine spot by a lens. The laser beam scans in a regular raster pattern across the surface of the object being recorded. How is this done? There are several mechanisms. We want to record the x, y and z co-ordinates of each point on the surface of the object. To scan in the x and y directions, the laser beam is deflected along one or both axes by mirrors. The mirrors are driven by galvanometers. In the high-speed prototype, it is deflected by a rapidly rotating pyramidal mirror. In the high-resolution prototype, the entire camera is moved along a gantry. Another approach, which is appropriate for the human face, sculpture, masks and the like, is to scan the laser along a vertical axis while rotating the object through 360 degrees. Measurement of the depth — or range — is accomplished simultaneously. The laser beam reflected back from the object is focused through a lens onto a position-sensing detector. Depth (z axis) is calculated by triangulation from the angle of the scanning laser beam and the position of the reflected beam on the position sensor. The speed and accuracy of data acquisition are extraordinary.

A few applications illustrate how the laser scanner can be used for recording, comparing artifacts, and replication. The Canadian Museum of Civilization has in its collection a stone mask obtained by a traveller in 1879 from the Tsimshian village of Kitkatla near the mouth of the Skeena River in British Columbia. There are only two such stone masks in the world. The other was collected in 1872 from a second village, Metlakatla, and is now in the Musée de l'Homme in Paris. The two masks are by the same artist and, in fact, as was discovered in the early 1970s, they fit together, one inside the other. There is considerable interest in the possibility of sharing replicas of the masks so that visitors to the museums in Ottawa and Paris can see them together. Neither can be moulded using conventional methods because the stone is porous and there are areas that have been painted. A replica of the Ottawa mask had been made previously by Tom Sawyer of Heritage Recording and Technical Data Services (Public Works Canada/Canadian Parks Service), Topographics Ltd of Toronto and CCI's Stan Frydryn. They used a non-contact, photogrammetric approach, which, while very successful, required many

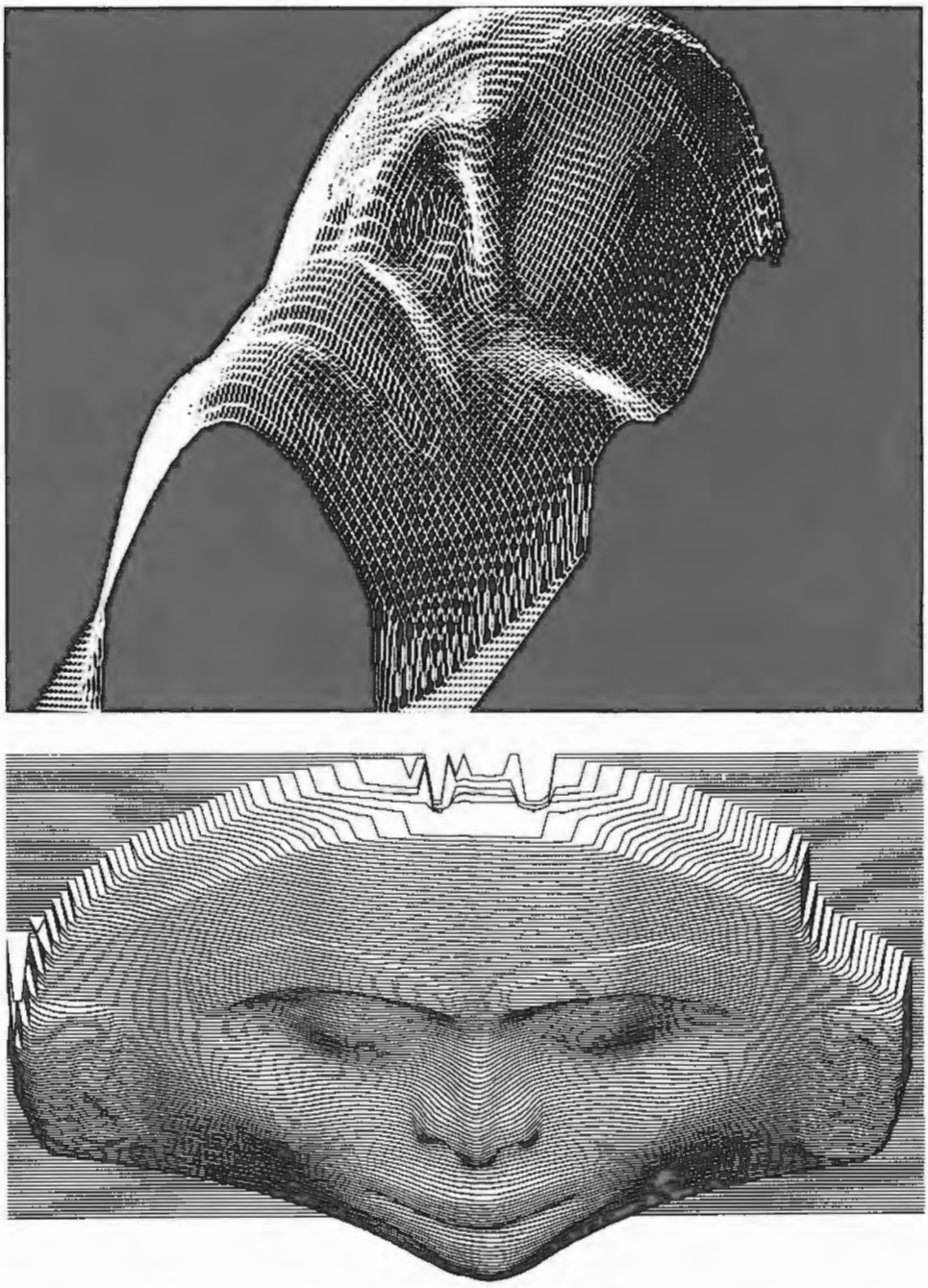

*Luc Cournoyer (left) and Marc Rioux adjust and calibrate the NRC laser scanner using a cadmium/helium RGB laser for the simultaneous acquisition of both 3-D and colour data.*

hundreds of hours to accomplish. Could the laser scanner be used in the future to improve the speed and accuracy of the process? To answer that question, a monochrome version of the mask replica was recorded as several million computer bytes of data representing the x, y and z co-ordinates of the surface. The data were then passed to a computer programme which was used to control a five-axis milling machine at NRC's Manufacturing Technology Centre. The result was a highly accurate replica in rigid polyurethane foam made without risk to this unique artifact. A three-dimensional representation of the mask can also be recreated on a computer screen, where the illusion of shading, movement and rotation can be created. Some day it may be possible to view computer-generated images of the twin masks as they might once have appeared together.

A second example is that of a lead plaque discovered at Sainte-Marie Among the Hurons during excavations in 1954 (see the article by Charlotte Newton elsewhere in this *Newsletter*). Here, again, replication by conventional means was out of the question. The laser scanner offered the ideal answer.

Another application of the procedure is in the fabrication of supports for fragile objects that have a very complicated shape. For example, one of our test specimens was a delicate tube of fulgurite, a mineral formed when lightning strikes and fuses sand. Or consider the case of fragile shirt and pantaloons from the 16th century Basque whaling station site at Saddle Island, Red Bay, Labrador. Or imagine a narwhal tusk, very long, and with a corkscrew-like form. Constructing a support for such artifacts requires many hours using traditional methods. In the future, it might be possible to fabricate supports, in less time, that closely conform to the shape of these objects. Another potentially useful application is in making realistic faces from life for exhibit mannequins.

The laser scanner in its present form records both three-dimensional data and the intensity of the reflected monochromatic laser beam. An even more powerful tool for the museum world would be a system that simultaneously records the colour and dimensions of an object. With funding from the French-Language Centres of Excellence Development Program of the Department of Communications, Réjean Baribeau is currently addressing this problem in collaboration with Marc Rioux and others at the Laboratory for Intelligent Systems. The project is being conducted under the auspices of CCI, NRC and Université Laval. The research will use a "white light" source consisting of a krypton laser emitting spectral lines of several different wavelengths (colours). A number of theoretical and practical questions will be addressed. Museum applications of a colour and dimension measurement and imaging system are almost unlimited. Among them is the potential for accurately monitoring dimensional, structural and colour changes to assess the effects of environ-



*3-D and intensity data obtained by laser scanner can be represented graphically in a number of ways using digital image processing techniques as illustrated by these examples of sub-sets of the data obtained from the mask.*

*Stone mask collected at the Tsimshian village of Kitkatla by Israel Wood Powell in 1879. (Canadian Museum of Civilization; Accession Number VII-C-329). A replica of the mask rather than the original was used to obtain the experimental results illustrated here.*

*A numerical control (NC), five-axis milling machine at NRC's Manufacturing Technology Centre was used to fabricate a polyurethane foam replica of the front section of the mask using 3-D data from the laser scanner.*

ment, treatment and transportation on paintings and artifacts.

**Further Reading**

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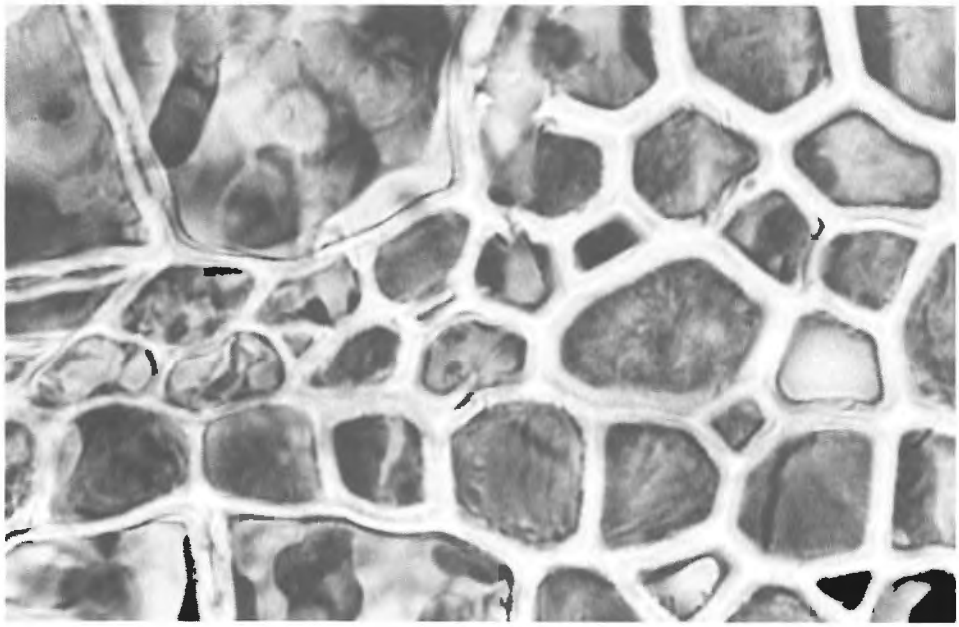
Taylor, J.M., I.N.M. Wainwright, F.R. Livingstone, M. Rioux and P. Boulanger. 1987. "Applications of a Laser Scanner to the Recording and Replication of Museum Objects." In *Proceedings, 8th Triennial Meeting, ICOM Committee for Conservation*, Sydney, Australia, 6-11 September 1987, 93-97.•

## Microscopy and Archaeological Waterlogged Wood Conservation

*by Gregory S. Young*

Excavations in Canada have yielded large quantities of wooden artifacts and structural timber from shipwrecks such as the *San Juan*, a 16th-century Basque whaling ship, which sank in Red Bay harbour, Labrador, in 1565, and the *Machault*, an 18th-century French supply ship, which burned and sank in the Restigouche River bordering Quebec and New Brunswick. Future shipwreck excavations will surely yield many more wooden artifacts of significance to Canadian maritime history. Two candidates lie on the bottom of Lake Ontario.

Since 1973, there has been eager contemplation towards raising, preserving, studying and displaying two warships, the *Hamilton* and the *Scourge*, involved in the War of 1812 between Canada and the United States. Both ships were merchant schooners converted by the Americans and used in battle. The *Scourge* was originally the Canadian-made *Lord Nelson*, which was seized by the United States two weeks before the war began. Both ships sank in western Lake Ontario in 1813 during a sudden storm. Today, they sit on their keels 88 meters below the surface, the cold fresh water keeping them in an excellent state of preservation.



*A light photomicrograph of cobalt thiocyanate-stained, high molecular weight, solid polyethylene glycol residing in wood cell cavities.*

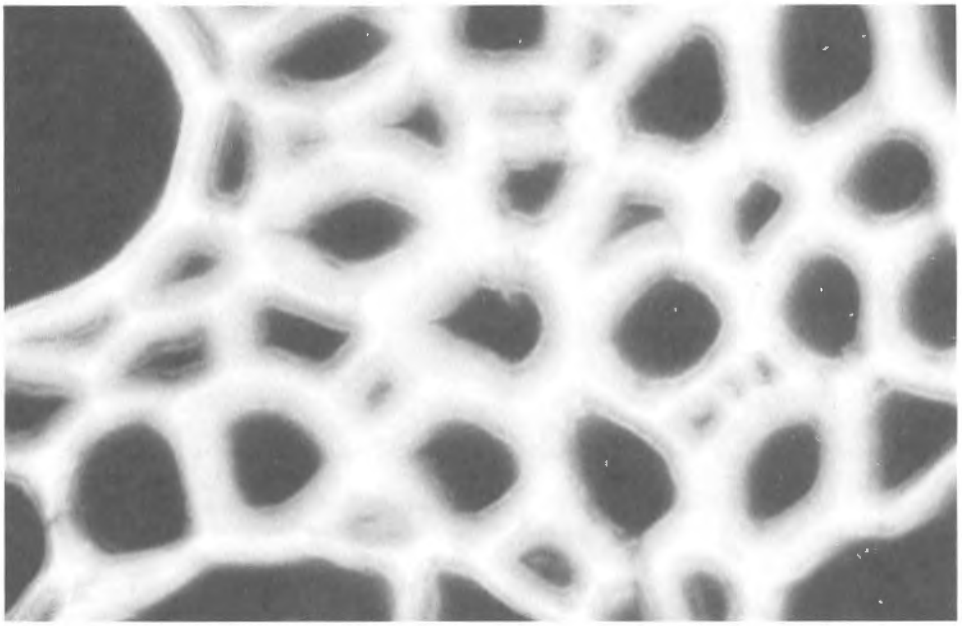
The wood that makes up sunken ships and much of their contents is, of course, water-saturated. The major concern in the conservation of this material is the prevention of cracking, warping and, under conditions of extreme deterioration, disintegration of the wood when it is dried. To arrest these processes, popular treatments incorporate the use of a water-soluble polymer called polyethylene glycol, PEG for short.

To treat smaller wooden objects, PEG is dissolved into a treatment bath in which the wood is submerged. Over time, the concentration is raised, and the PEG

substitutes increasing amounts of the water held in the swollen wood. After substitution reaches an appropriate level, controlled drying removes the remaining water. PEG remains behind, filling the space originally taken up by the moisture. This preserves the water-swollen dimensions of the wood and, thus, prevents cracking, warping and disintegration.

During the late '70s and most of the '80s, CCI made a leading contribution in treatments research for waterlogged wood through the efforts of David Grattan (Conservation Processes Research [CPR], CCI) and Clifford Cook (formerly of CPR, now with Historic Resource Conservation Branch, Canadian Parks Service). One major line of their research was to characterize the way PEG treatments succeed in imparting dimensional stability. The distribution PEG achieves in wood was thought to have a significant influence on stabilization. Therefore, with the hope of obtaining direct visual evidence of PEG distribution, microscopical analysis was undertaken on the treated wood samples used in David Grattan's research.

To detect PEG in wood a new microscopical method was developed that uses a colorant (cobalt thiocyanate) to stain PEG blue without staining the wood in the absence of PEG. The stain also reduces or quenches the natural fluorescence of wood — seen with an ultraviolet fluorescence microscope — when the stain combines with any PEG residing in wood cell walls. With this stain, Ian Wainwright (Analytical Research Services, CCI) and I showed in 1982 that low molecular weight, liquid forms of PEG can diffuse into the wood cell walls of aspen and cottonwood during soaking treatments and that the higher molecular weight, solid forms cannot. This information confirmed conclusions made by David Grattan and by scientists in the wood products industry concerning the importance of PEG distribution. The combined research shows that liquid PEGs are able to substitute the water bound up in the swollen wood substance of cell walls and that nearly complete dimensional stabilization results when most of the cell wall contains PEG. The solid PEGs are unable to substitute bound moisture. When this moisture is lost during the drying process, shrinking, cracking and warping can occur even though these higher molecular weight PEGs may reside in the cell cavities of the treated wood.



*A fluorescence photomicrograph of wood treated with high molecular weight, solid PEG. The cell cavities are filled with stained PEG, but neither the stain nor PEG fluoresces and therefore the cavities appear dark. The wood cells walls fluoresce strongly, indicating no infiltration by PEG and therefore no substitution of bound moisture.*

Beyond these original observations, Ritchie Sims (Auckland, New Zealand) and I provided visual evidence in 1989 of the influence of (1) deterioration, (2) PEG concentration in treatment baths and, most significantly, (3) wood species on the efficacy of PEG treatments. Deterioration greatly improves the ability of all higher molecular weight PEGs to infiltrate wood cell walls and substitute bound moisture. However, most excavated waterlogged wood is only moderately deteriorated. While many cells in such wood show varying amounts of deterioration, a major proportion of cells are often relatively undeteriorated. Consequently, the accessibility for the diffusion of PEG into these cells remains similar to that found in the cells of new wood of the same species. We showed that some woods, including white oak, various cedars and white ash, allow very little PEG into the cell wall, not even the low molecular weight, liquid forms when conventional (30%-35%) concentrations of PEG are used in soaking baths. These woods, therefore, are more difficult to stabilize. Other woods, including aspen, cottonwood, alder and spruce, permit much greater infiltration of PEG into cell walls, and this explains the comparative ease with which these stabilize.

The microscopy also revealed a problem with a research method that has been used intermittently over the past 40 years in wood/PEG studies — research that involves the use of thin (approximately 3 mm), cross-sectioned wafers of wood to study treatments. This type of sample contains an overwhelming percentage of disrupted wood cells. This artificially raises cell wall accessibility, thereby increasing the dimensional stability achieved. As a result, such research must be viewed with caution when attempting to apply it to practical conservation problems.

There are many uses for the microscopical staining procedure in further research and in conservation practice. For example, treatments that combine low and high molecular weight PEGs have been under investigation in several countries. As well as for treatments which use just one type of PEG, the stain is well suited to studying the distribution achieved by these so-called double-PEG combinations. Treatments can take several months for small artifacts and up to 10 to 30 years for whole ships. The

microscopy can provide an accurate and comparatively inexpensive way of monitoring the progress of such long-term treatments.

The conservation of related waterlogged materials from shipwrecks, such as rope and cork, could also benefit from microscopical study. The nature and chemistry of cork has been investigated in conservation by Tom Strang (Environment and Deterioration Research, CCI) and Mark Gilberg (formerly of CPR, now with The Australian Museum), and it is now time to study treatments for this material, including those using PEG. Microscopy can serve this material, and others, as well as it has wood.

**Further Reading**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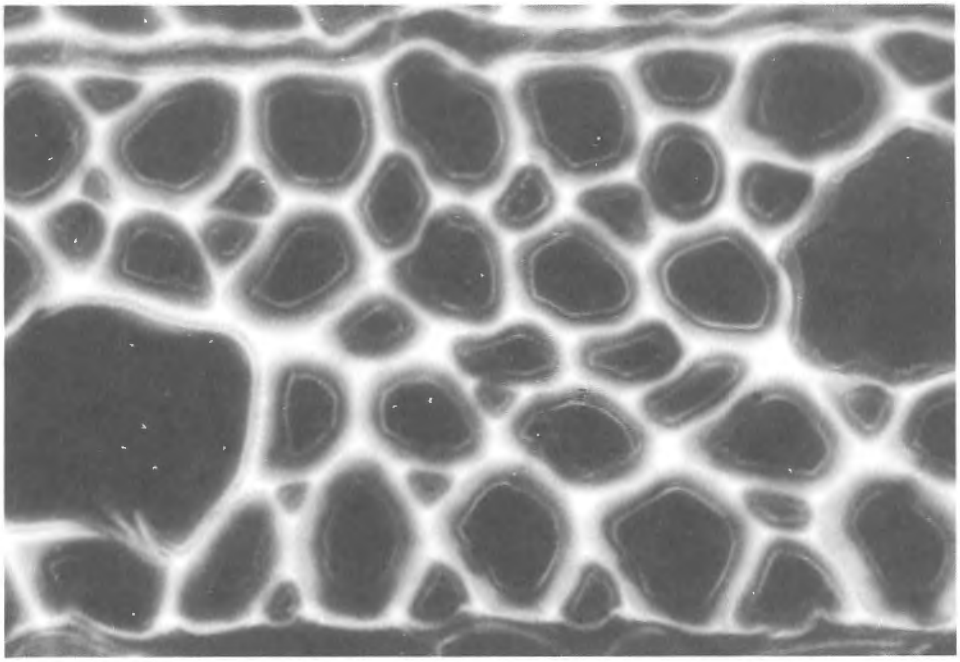

*A fluorescence photomicrograph of wood treated with low molecular weight, liquid PEG. The wood cell walls show reduced fluorescence after staining, indicating the presence of PEG and therefore the substitution of bound moisture. This infiltration of the wood leads to nearly complete dimensional stability.*

## Reflections

*by Philip Ward, FCMA, FIIC, FRSA*

The other day, two weeks before I was due to retire, I dropped in for a friendly chat with the boss, fully expecting him to say, "Pull up a chair, have a beer and let's shoot the breeze"; but no such luck. Instead he reminded me that elderly conservators who are about to drop off the perch are expected to pass on pearls of wisdom to the younger generation. "Write some reflections for the *Newsletter*," he said.

Well, wisdom is not my strong suit, and the only reflections I had in mind at that moment concerned a sunny hillside on an island overlooking the Pacific. When I looked at the capable and highly qualified young people around me — far better qualified than I ever was — I wondered what on earth I could tell them. We have come so far since I was young (I was, once) that the conservators of my generation sometimes feel a bit redundant.

Yet, come to think of it, there are some things that haven't changed. I had the rare good fortune to begin my career under the guidance of three of the founders of our profession — Plenderleith, Werner and Organ — and though many of the techniques they taught me have become obsolete, the principles have not. Thirty-two years have passed since Plenderleith's Conservation of Antiquities and Works of Art was published, and the diagnostic information it contains has been expanded by much valuable research (a large part of it by CCI), but it has not changed any of the fundamentals.

I had a graphic illustration of Plenderleith's teaching about bronze corrosion in the very year his book was published. I was helping my Keeper arrange a case of Chinese bronze mirrors when he asked me to hand him a large, heavily corroded T'ang fragment. He held out his hand, and, unthinking, I placed the fragment on his palm ... and the fragment exploded.

Knowing about the bad habits of Chinese bronzes didn't help me much when I came to Canada and settled in Victoria. I discovered that I was not only

the only conservator west of Toronto, but I was also responsible for the care of one of the world's greatest Northwest Coast collections. I knew nothing about such things, but there was worse to come. One day the Provincial Archaeologist asked my advice on pictographs. I did know what a pictograph was, but that was all. I had never seen one.

It seemed there were many well documented examples in British Columbia and they were fading. The province was concerned that amateurs were beginning to experiment with some bizarre remedies, and it was difficult to show that they would damage the pictographs when the authorities couldn't explain the fading either. The Provincial Archaeologist's exhaustive search of the literature had found nothing on the chemistry of pictographs, so I was dragged off into the bush to see for myself.

It was clear that they had been drawn on the rock face with lumps of soft, dry natural haematite, usually from local deposits; in several instances we were able to compare the pictographs with haematite from the probable source. Always the fresh material was brighter than the pictograph. I had never heard of natural iron oxide fading, yet there was something about those drawings — a slightly hazy, milky quality — that was somehow familiar.

Eventually the penny dropped. The haematite in the pictographs had exactly the same visual qualities as the red iron oxide in fresco paintings. Then my art training came to the rescue: I realised that the succession of chemical reactions that bind pigments to the plastered wall in fresco could occur naturally in a drawing on a limestone rock face in a damp climate. And why would the "fading" be a problem with pictographs when it does not seem to affect frescoes that are probably older? Because the process stops when a fresco dries, while it continues indefinitely in a pictograph exposed on a damp rock face, slowly burying the drawing under an ever-thickening layer of calcite. Five years later CCI was founded and one of the first projects that John Taylor and Ian Wainwright undertook was a study of the chemistry of pictographs which, fortunately, confirmed my guess.

Today, Canadian conservators rarely have to take such chances, but there are still gaps in our knowledge. I sometimes wonder if we have taught younger conservators to be too dependent on scientific support. Of course we should never commence treatment until we have all the available information about an object, but available is the operative word. I have known conservators who have refused to treat a commonplace but rapidly deteriorating object until they could get a complete and detailed analysis, even though the object would deteriorate significantly before the analysis could be obtained. That is wrong. In urgent situations we should be ready to extrapolate from the known and to trust our judgement. Museum conservators often have to intervene on the strength of adequate but incomplete information; perhaps it is because I was a museum conservator for most of my career that I feel strongly about it.

Working in a museum certainly influences one's point of view. A friend (not a conservator) who served for almost 40 years in major museums used to say that a curator was the most dangerous animal you could have in a museum. I would not go quite as far as that, but I do believe that the inadequate training of curators in conservation is perhaps the greatest threat our collections must survive.

My complaint about curatorial training is that it is almost always deficient in the fundamentals of materials science, on which good collection care rests. Curators will protest that that is why they employ conservators, but they will also continue to control the fundamental decisions that determine the welfare of their collections. I believe that the universities should offer courses in the care of collections (handling, environmental control and the properties of materials) and that museums should demand such qualifications in recruiting curators.

A related belief that arises from those years of working in museums is my firm conviction that conservation is as much a branch of museology as is curatorship and that it is just as important. Indeed, if curators are not trained in the care of collections, the logical alternative is to view conservation and curatorship as two sides of the same coin. The curator is concerned with (and trained in) the intellectual aspects of the collection; and the conservator, with the physical.

There are several reasons why that idea has been slow to take root. Conservation is still relatively new to Canadian museums, and conservators do not help their own cause. Far too few are active in the provincial museum associations and even fewer in the Canadian Museums Association (CMA). Instead of talking to museologists, we talk to other conservators.

That neglect of our museological colleagues brought us close to disaster a few years ago, when the recommendations of a major review that would have virtually destroyed Canada's conservation capability (which is the best in the world) were initially supported by the CMA. That wasn't malice, it was indifference (and a little greed, perhaps), but the truth is that we had been so invisible that they simply took us for granted.

Conservators ... wake up !

What else worries me about conservation in Canada? I think the most troubling thing of all is its slow spread in large and medium-sized museums. I don't criticise the small museums; there are hundreds that genuinely could not justify employing a conservator, but there are many larger ones that should. We know the reasons: shortage of money; reluctance to increase staff; the conviction that CCI will do it; and sheer indifference. We also know the excuses (which are just that): "conservators won't leave Ontario"; "they're overpaid"; "you can't find one when you need one"; and "they interfere with the legitimate rights of curators".

Meanwhile, the restorers of Canada's small private sector are struggling to survive. Why have the large and medium-sized institutions not taken the obvious course — employ a conservator, well-qualified in preventive conservation, at senior curator level to direct all the museum's preservation activities (including storage and handling) and to

contract out treatment (i.e.,"restoration") to the private sector? That would be economical in so many ways. The museum would have to employ only one conservator, who, being at a senior level, could relieve the curators of some of their unwanted responsibilities. The museum would not need to build and equip treatment facilities. With some modest equipment, the conservator would be able to monitor the condition of the collection and its environment and avoid expensive problems by anticipating them. Finally, the museum's "restoration" contracts would be supervised by someone who knows the conservation field and could ensure their satisfactory completion. Some such compromise may be the way of the future ... but that is for others to know. There is one other thing that I do know. It is that conservation need not be as expensive as many believe it to be. Good collection care and basic treatments can usually be provided with simple tools, as the CCI's mobile labs proved. That hasn't changed since the day I started with a few crude hand tools and a bag of dental plaster in a corner of a British museum basement, so many years ago.

One thing that has changed is that conservation has grown from a small craft into a profession. With its expansion, those who seek promotion must assume more and more administrative responsibilities. This is a universal problem, but it seems to be worse in Canada than elsewhere. It is a tragic waste of talent in a field that is so rich in technical and innovative ability, but is not necessarily well endowed with administrative skills.

Although I like to imagine that I have been a good enough administrator to get by, I am much more comfortable as a planner and builder. Indeed, a wish to escape the conventional career path was one of the very things that brought me to Canada, to a small provincial museum that was just about to stumble into the 20th century. The years that followed were the most chaotic, exhausting and rewarding — but also the happiest years — of my life. If I have any regret about conservation today, it is that such opportunities have almost vanished. That they should was inevitable when the museum field stabilized after the rapid growth of the '60s, but I still believe that even in the public service, it should be possible to devise some way to reward our most gifted people without burying them in paper. Surely we can create a parallel career path that will allow professionals to go on doing what they do best?

I have one final conviction. It is that there is no more valuable and satisfying career than conservation. I am not saying that I would willingly do it all again, but I can't think of anything I would rather do. When I look at the younger Canadians who have followed my generation into this very rewarding profession, I know that its future is in good hands — and I am grateful for having been able to work in such good company.•

## Internships and Fellowships

In response to the diverse training requirements of the conservation community in Canada and abroad, the Canadian Conservation Institute offers Internship and Fellowship programmes. The following individuals have recently participated or are currently involved in one of these programmes at CCI.

**Internships**

**Ina Janssen**, Paintings Restorer, Altonaer Museum, Hamburg, Germany, November 1989 to April 1990, Fine Arts Section.

**Christian Welker**, Student, Fachhochschule Koln, Secretariat of Conservation, Cologne, West Germany, March to August 1990, Ethnology and Furniture and Wooden Objects sections.

## Who's Who at CCI

*by Cliff McCawley*

# *Gordon Fairbairn*

*Senior Conservator, Furniture and Wooden Objects*

Gordon Fairbairn began whittling wood when he was seven years old. Today, some 50 years later, he is still working with wood and still in love with this ubiquitous material.

As Gordon describes it, it was almost inevitable that he train to become a cabinet-maker and woodcarver. There were three tradesmen in the small village in England where he grew up: cabinet-maker, blacksmith and wheelwright. It was to the cabinet-maker that Gordon went to have his youthful interest and burgeoning talent developed. The training obviously told, for today Gordon is Senior Conservator of Furniture and Wooden Objects at CCI. It is interesting to note that Gordon's father and grandfather were ships' carpenters, employed to make the rich panelling and furniture for luxurious ocean liners, and that Gordon's own son Neil has also followed the family tradition of working with wood, being a furniture restorer and gilder.

After his training and several years working on restorations and reproductions, Gordon was called up to serve for

two years in the British Army. Following this hiatus, Gordon undertook training in metalworking, toolmaking, pattern-making and welding to be able to work in both wood and metals. He emigrated to Canada in 1969. For three years he was self-employed doing restoration work and gilding, and teaching adult education courses.

From 1972 to 1977 Gordon was employed by the House of Commons. First he worked on the restoration of furniture and gilded objects, then, when on the staff of the Stone Carvers Division, he designed and constructed furniture. Anyone who has been present when the legislatures of the Yukon and Northwest Territories are sitting will have seen evidence of Gordon's superb handiwork. The Clerk's table for the Yukon Legislature was designed and constructed by Gordon. It is approximately 12 feet long and made of white oak. The Legislature of the Northwest Territories sits in several different sites and must take the official impedimenta with it. Gordon designed and built the Speaker's chair so that it could be easily disassembled and transported. It is a masterly fabrication of Canadian white ash.

In 1977, with a wealth of experience already behind him, Gordon joined CCI, and since that time many artifacts have benefitted from his ministrations. Be it working alone or as part of the teams that treated "Sally Grant", the 11-foot-high wooden figure representing justice that once graced the roof of the courthouse in Brockville, or the complex juxtaposition of brass and tortoiseshell on the Boulle clock described elsewhere in this *Newsletter*, Gordon Fairbairn brings to it the same effort, skill, commitment and experience; whether adapting conventional techniques to specific problems, or devising completely new ways of doing things.

It would be wrong to suppose that Gordon spends all of his time working on artifacts. When meeting in Gordon's office, one is constantly interrupted by the telephone. Conservators, curators and volunteers from the very large to the small, often isolated, museum, and the general public, continually find their way to Gordon for help and advice. Invariably, he has the answer without recourse to books or manuals. Many of these contacts were made when Gordon did mobile lab duty; I know from when I ran this very successful CCI initiative that Gordon gained great satisfaction from the intimate contact with museums. Contacts he strives to keep.

It has been said that a specialist for furniture conservation needs well over 150 divergent job skills to deal effectively with the great variety of materials encountered in furniture. Gordon is very clear that his main aim is to pass on to others as many of these skills as possible. To that end, he has always placed great emphasis on training. He has given hands-on furniture conservation workshops in the conservation programs at Queen's University and Sir Sandford Fleming College, and at the Smithsonian Institution. Workshops in gilding, organized by Gordon and offered at CCI and elsewhere, have been highly successful. But, undoubtedly, the aspect of his work both past and present that gives Gordon the most satisfaction is the one-on-one training of people who wish to become furniture conservators. During a recent lunch together, knowing that I would be writing this short article, I prompted Gordon into talking about himself and his career. He concentrated on himself for only a few minutes before talking of the people he had trained in the lab at CCI: a person now working at the Royal Ontario Museum; one who is presently being sought by a large museum in the United States; and one of his most recent interns, who, because of her talent for gilding, has gone to spend six months at the Victoria and Albert Museum in London, working with probably the best gilder in the world. Gordon's greatest pride is that he has trained 20 people over the years and they are all still working in conservation. Obviously the enthusiasm and many hours of his own time he has put into the job of training people has paid off.

Over the past 14 years I have escorted a great many people on tours of CCI laboratories. My favourite stopping place, and often theirs, is the Furniture and Wooden Objects laboratory. Because, not only are there usually several pieces of furniture of special interest, often in intriguing states of déshabillé, there is also Gordon Fairbairn! With his wry sense of humour and accommodating manner, Gordon, in just a few minutes of explanation about the problems and solutions for a particular piece, can pass on his enthusiasm for what he does and his genuine love for furniture, and, coincidentally, give the visitor a real feeling for how important the role of conservation and the work of CCI really is.

It is said that the strength of an organization lies with its people. With people of the calibre and commitment of Gordon Fairbairn, CCI's future should be bright, indeed.•

## Announcement

At its 16th General Assembly in Rome, the seat of ICCROM, Charles Gruchy, Director-General of CCI, was elected President for the session held 7-9 May. He presided over the meeting of the 82 member states during its discussions of the proposed program, the budget and the election of Council for the biennium 1990-91. Gruchy was re-elected to the Council and also elected its chairman. The two vice-presidents of the Council are Panu Kaila (Finland) and Abdelhamid Bouchemal (Algeria).•

## Comings and Goings

**Judy Logan** is replacing Krysia Spiridowicz at Queen's University while Krysia is on sabbatical from January to April 1990.

**Valerie Dorge** returned to CCI in November after a two-year leave of absence as a Mellon Fellow at the Detroit Institute of Arts.•

# CCI Assists Dryden Air Crash Investigation

*by David Tremain*

Since 1983, the Canadian Conservation Institute has been freeze-drying logbooks and other documents recovered from the wreckage of aircraft, for the Canadian Transportation Accident Investigation and Safety Board (CTAISB). When such material arrives at CCI, it is usually frozen and wrapped in plastic film. It is immediately placed in one of our freezers to await freeze-drying in a vacuum freeze-drying unit. The mate-rial tends to be extremely fragile, and sometimes the paper is badly charred. Often there are fragments of twisted metal embedded in the paper; sometimes the documents are coated in mud.

The documents are freeze-dried in one of two Virtis freeze-dryers. Drying takes place at a temperature of between –20°C and –25°C and at a very low pressure of about 100 milliTorr. As the artifacts dry, the pressure will decrease to about 20 milliTorr. The documents are weighed at various intervals to determine the degree of dryness. The freeze-drying process usually takes about a week, depending on the quantity of material. Once dry and fully equilibrated with the laboratory temperature and relative humidity, the documents are returned to the CTAISB for examination.

About a month after the Air Ontario Fokker F-28 crash at Dryden, Ontario, on March 10, 1989, CCI received a request from the CTAISB to freeze-dry aircraft logbooks recovered from the crash site. The logbooks had been frozen and were enclosed in plastic bags inside a cardboard box. On arrival at CCI, the box was placed in the freezer.

Before freeze-drying, all the items were given a limited examination and inventoried. Although their condition did not allow for very positive identification, it appeared that all the items were severely charred. The items were weighed to keep a check on the release of moisture and then transferred to a vacuum freeze-dryer.

Four days later, when freeze-drying was completed, all items were removed from the dryer and reweighed. On examination of the material, it was immediately apparent that no handling was possible unless something could be done to consolidate the severely charred paper. Furthermore, most of the edges of the logbooks appeared like ash. Their condition was discussed with Dr David Grattan, Senior Conservation Scientist in the Conservation Processes Research (CPR) laboratory of Conservation Research Services at CCI, who suggested consolidation of these items with Parylene.[1] This would then allow easier separation of the pages in the charred book blocks.

*Charred aircraft logbooks before treatment.*

*A charred logbook after parylene treatment.*

Initial tests with Parylene had been carried out on charred samples of paper provided by the RCMP Central Forensic Laboratory's Document Section. The results indicated that the technique was successful and according to the RCMP's initial tests, they found that there was no interference with the infrared analysis techniques used for deciphering lettering on charred paper. Our proposal was to be easier to handle and the results seemed very satisfactory, so it was decided to proceed with the remainder of the charred material. This work was carried out by Margaret Morris, who had been hired on contract to work on the Parylene project at CCI.

When the material, that had been Parylene coated, was examined by John Garstang, it was agreed that I should attempt to separate individual pages from some of the documents, such as the pilot's personal flying log. These pages could be analysed in the RCMP's Document Section by infrared lumines-

cence and fluorescence using a video spectral comparator, ultraviolet light and transmitted light. The pages were separated using scalpels and spatulas and placed in plastic sleeves so that they could be more easily handled. Some documents required further Parylene coating after this initial separation. An attempt was also made to separate severely mould-damaged pages from the pilot's clipboard using moisture vapour from an ultrasonic humidifier.

The documentation we have retrieved may help investigators determine possible causes of the accident, by providing information on the fuel and maintenance state, weight and balance calculations, or the physical and mental state of the pilot. When all this information is added to the physical examination of the aircraft, a more complete record of the accident can be established.

Later, the author was informed that one of the documents which had been separated could be very useful to the judicial enquiry (it related to Air Ontario's de-icing policy). On April 5 of this year, the de-icing document was reported in the national press. It was described by the inquiry lawyer as "crucial to the inquiry". Since this information is now in the public domain, it is possible to reveal what the document said. The document was a confidential letter addressed to the pilot of the aircraft from an Air Ontario company executive which stated:

"[No] Air Ontario aircraft will attempt to take off with any snow-ice accumulation on the flying surfaces which would, (i) cause an unsafe condition to exist; (ii) cause passenger anxiety...".

In conclusion, without the use of Parylene on these severely charred pages, it would have been impossible to separate them without causing further damage. Some problems were still encountered during separation, but their consolidation was sufficient to allow the CTAISB investigators to retrieve evidence, which proved useful to the enquiry. It now means that, through CCI's assistance to the CTAISB, Canadian aircraft investigators may have set a precedent for the recovery and stabilization of future material recovered from aircraft. The publicity these procedures have received within the air accident investigation community has already attracted the attention of agencies in the United States, United Kingdom and France.

[1]At the time, a study of Parylene was under way in the CPR laboratory of CCI using a Parylene coater on loan from the Union Carbide Corporation. (See "Parylene at CCI" David Grattan, *CCI Newsletter*, February 1989, p. 16.)•

## Survey of Irganox-Stabilized Dammar Varnishes

*by Bob Arnold*

Over the past year the staff of the Fine Arts Section of Conservation Services have been visiting museums and galleries across the country to examine paintings, treated previously at CCI, to which dammar varnish stabilized with Irganox 565 had been applied. The purpose of these examinations was to verify whether or not any degradation, specifically yellowing, has occurred in these varnishes over the years.

The impetus for our concern over Irganox-stabilized dammar varnish arose as a result of recent research carried out by Dr Rene de la Rie while working at the Metropolitan Museum of Art in New York. The results of his research, recently published in *Studies in Conservation* (33(3), August 1988), indicate that under the extremely high illumination and ultraviolet levels used in Dr de la Rie's experiments, Irganox 565 did not prove to be an effective antioxidant for dammar varnish films and, in fact, increased the rate of yellowing of the varnish.

The Fine Arts Section at CCI had used Irganox 565-stabilized dammar varnish as early as 1977. As a result of Dr de la Rie's research however, and even though Irganox 565 may stabilize varnishes under conditions where UV radiation is not present, we have discontinued its use until further testing of the stabilized varnish under normal museum lighting conditions can be carried out.

Part of this assessment involves the examination of paintings, previously treated at CCI, to which dammar varnishes containing Irganox 565 had been applied. To date, some 23 collections have been visited and 35 paintings examined. The oldest Irganox-stabilized dammar varnish was applied in March of 1977; the most recent, in February 1988.

When possible, each painting was removed from its frame to compare the appearance of the varnish in the area exposed to light with the area hidden by the rebate of the frame. In addition to a visual examination of each painting, colour readings were taken at strategic locations on each painting, using a Minolta CR-231 Chroma Meter. (It is our intention to repeat these readings every few years in the identical locations on these same paintings to determine if any detectable colour change is occurring in the varnish.) At the same time we obtained any information available regarding the lighting conditions under which each painting has been exposed since receiving treatment at CCI.

At present, results are still being reviewed. No evidence has been found to indicate that a detectable colour change has occurred in any of these varnishes. Future readings using the Chroma Meter should quantify any changes that might be taking place. Over the next year we hope to carry out a more detailed examination and testing of several of these paintings, and in future years will continue to monitor the appearance of all of the paintings in this group.•

## CCI Services: Seminars, lectures, workshops and visits

To respond to specific needs within the museum community, CCI offers, in cooperation with provincial museum and art gallery associations, workshops, seminars and lectures related to the conservation and care of museum and art gallery collections. CCI staff also participate in, and present lectures to, meetings of professional groups and associations.

### October 1989

Joe Dorning attended annual conferences for the Museum Association of Newfoundland and Labrador held in Harbour Grace, Newfoundland, the Ontario Museum Association in North Bay, Ontario, and the Alberta Museums Association in Grande Prairie, Alberta.

Nancy Green attended the Association of Manitoba Museum's annual conference and general meeting in Dauphin, Manitoba.

David Grattan gave a lecture, "Parylene and the Fossil Forest", at a conference for Canadian high school teachers: "Science Teaching in the Future".

### Proceedings from *Symposium 88* on Audio Cassettes

CCI is now accepting orders for the complete set of audiotapes (19 cassettes) of the proceedings of *Symposium 88*, The Conservation of Historic and Artistic Works on Paper, held in Ottawa, Canada, October 3-7, 1988. The cost for this set of tapes is $150.00. Cheques should be made payable to the Receiver General for Canada. Payment must accompany each order.

Send all orders to:
*Extension Services*
*Canadian Conservation Institute*
*Department of Communications*
*1030 Innes Road*
*Ottawa, Ontario, Canada*
*K1A 0C8*

Tours of the Institute were arranged for the science teachers of Ontario and a group of arts conservation students from Queen's University, Kingston.

A seminar for curators and conservators was held at the National Gallery of Canada (see *CCI Newsletter*, Autumn/Winter 1990). Debra Daly Hartin gave the paper "An Historical Introduction to Conservation". Stefan Michalski led a thought-provoking discussion after his presentation "Time's Effects on Paintings". Helen McKay and Colette Naud also attended and assisted with the organization of the seminar. John Taylor discussed "Scientific Examination of Paintings — Potentials and Limitations". A paper by Charlie Costain and Paul Marcon dealt with "Packing and Transport of Paintings". Tom Stone contributed to the discussion on copyright issues: "Copyright — A Conservator's Point of View". Proceedings of the seminar are being edited by Ian Wainwright, CCI and Barbara Ramsay-Jolicoeur of the National Gallery of Canada and will be available soon.

Eva Burnham presented a lecture, "Textile Conservation at CCI", at the Department of Foods and Nutrition/Home Economics programme of the California State Polytechnic University in Pomona, California. She also attended a meeting of the Costume Society of America held in Portland, Oregon.

Carl Schlichting accompanied a delegation of craftspeople and government officials from the U.S.S.R. on a tour of various Arctic communities at the request of the Prince of Wales Northern Heritage Centre. A one-day workshop was held at CCI to discuss materials and conservation problems.

Judy Logan gave a presentation at the Ontario Museums Association annual conference in North Bay. The paper dealt with the problems surrounding the neglect of archaeological materials in storage and the responsibilities that archaeologists should assume in relation to the collection of materials in the field.

Judy Logan, Jeremy Powell and John Taylor spent a day at Atomic Energy of Canada Limited in Chalk River, Ontario where neutron radiography was done on a harpoon gun found at Cape Haven, Baffin Island, and belonging to the Prince of Wales Northern Heritage Centre. This specialized analysis was necessary to determine whether there were any organic materials associated with a bomb lance present in the barrel. The analysis of the gun demonstrated how this technique could be used in the conservation field.

#### Seminars

"Care of Mixed Collections"
Helen McKay and Barbara Tose
at the Allied Arts Centre
Dauphin, Manitoba

"Basic Care of Archaeological Collections"
Judy Logan
at the Saskatchewan Museum of Natural History
Regina, Saskatchewan

"Construction of Mannequins for Historic Costumes"
Eva Burnham, CCI and Colleen Day, the New Brunswick Museum
at the New Brunswick Museum
Saint John, New Brunswick

"Stable Materials for Storage, Display and Packing"
Scott Williams
at the Royal Ontario Museum
Toronto, Ontario

#### Workshops

"Gilding Workshop"
Gordon Fairbairn, CCI, Deborah Bigelow, conservator, Newburgh, New York, and Malcolm Green, Victoria and Albert Museum, London, England
at CCI, Ottawa

### November 1989

Tours of the Institute were arranged for students of the museology certificate courses of Université Laval, Québec, the library science faculty of the Université

du Québec and the museology program of the Université du Québec à Montréal.

Stefan Michalski gave a one-day workshop at the Metropolitan Museum, New York, on the subject of display case design for libraries and archives. While in New York, he also gave a lecture on preventive conservation to the New York University conservation programme.

Jane Down gave a lecture on CCI's Adhesive Testing Programme to the Master of Art Conservation students of Queen's University, Kingston.

A tour was arranged for participants of the Senior Management Orientation Course of the Department of Communications.

David Grattan presented the paper "Parylene and the Fossil Forest" at a meeting of the Crystallography Society in Ottawa.

Peter Vogel was invited by the Hochschule Fur Bildende Kunste in Dresden, East Germany, to attend a symposium on conservation. Peter presented a paper on CCI's activities past and present including the Mobile Lab Programme and case histories of treatments of numerous paintings carried out at CCI.

Helen Burgess and David Grattan attended an Art and Archaeology Technical Abstracts editorial board meeting in New York.

David Hannington and Helen Burgess attended a week-long course on "Preventative Care of Historical Photographic Prints and Negatives" at the Getty Conservation Institute, Marina del Rey, California.

Colette Naud attended a conference in Paris, "Journées de la conservation", organized by l'Association des restaurateurs de formation universitaire.

Charlotte Newton presented a lecture on "The Conservation of Archaeological Leather" to students of the Master of Art in Conservation programme, Queen's University, Kingston.

SEMINARS

"Basic Care of Archaeological Collections"
Judy Logan and Tara Grant
at the Tyrrell Museum of Palaeontology,
Drumheller, Alberta

"Conservation préventive pour les collections mixtes"
Colette Naud and Carole Dignard
at the Société historique de Saint-Boniface, Winnipeg, Manitoba and
at the Centre culturel de St Paul
St Paul, Alberta

"Atelier de conservation et restauration d'oeuvres d'art sur papier"
David Tremain, CCI, and Susanne Holm, Centre de conservation du Québec
at the Centre de conception graphique
Montreal, Quebec

"Storage and Display of Historic Textiles"
Eva Burnham and Jan Vuori
at the P.E.I. Council of the Arts
Charlottetown, Prince Edward Island

"Care of Furniture and Wooden Objects"
Gordon Fairbairn and Janice Manuel
at the Saskatchewan Western Development Museums (Saskatoon Branch)
Saskatoon, Saskatchewan

"OMA Participants Course"
Tom Stone, CCI and Sandra Lougheed, Ministry of Citizenship and Culture, Government of Ontario
at CCI, Ottawa

## December 1989

Eva Burnham, Valerie Dorge and Gordon Fairbairn responded to an emergency at the Historic Naval and Military Establishments in Penetanguishene, Ontario. Rapid fluctuations in temperature had resulted in the formation of condensation within the building. The team was able to stabilize the collection, but several artifacts were brought back to CCI for further stabilization and treatment.

## January 1990

Carole Dignard, Valerie Dorge, Ela Keyserlingk and Colette Naud conducted a conservation needs survey at the Musée des Ursulines and the Musée des Augustines, Hôtel Dieu, Quebec City.

Stefan Michalski attended a two-day planning session for the course "Consolidation of Painted Ethnographic Artifacts" to be held June 10-30, 1990, at the Getty Conservation Institute, California.

Dr. Patrick O'Keefe, Associate Professor of Law in the law faculty at the University of Sydney, Australia, visited CCI as part of his field research for a book on copyright in the arts.

Helen Burgess attended the Canadian Pulp and Paper Association meeting in Montreal and participated in a session on deteriorating books.

David Grattan attended a moderators meeting of ICOM's Preprint Review Committee held at the Getty Museum in California. The moderators were reviewing all papers for ICOM's Committee for Conservation Ninth Triennial Conference to be held in Dresden, East Germany.

SEMINARS

"Disaster Planning and Preparedness for the Small Museum"
Mary Peever and Wanda McWilliams
at the Prince of Wales Northern Heritage Centre
Yellowknife, Northwest Territories

"Using Polymers and Plastics in Conservation"
Scott Williams and Jean Tétreault
at the Saskatchewan Museum of Natural History
Regina, Saskatchewan

## February 1990

Chuck Gruchy, Charles Costain and Paul Marcon attended meetings in London, England concerning a packaging symposium to be held in the fall of 1991 in the United Kingdom. The purpose of the trip was to meet with

European researchers and representatives of fine art shipping companies, as well as to provide an opportunity for the host institutions, the Smithsonian Institution, the Tate Gallery, the National Gallery of Washington and the CCI to collaborate on the planning for the symposium.

The Ottawa Crystallographers Society visited CCI and John Taylor addressed the group on "Applications of Science in the Examination of Works of Art".

A group of teachers from across Canada who design teaching programmes at the secondary school level were given a tour of the facilities at CCI.

Eva Burnham attended a symposium on Upholstery Conservation held in Colonial Williamsburg, Virginia.

Dr Shirley Thompson, Director of the National Gallery of Canada, was given a tour of CCI.

Sherry Guild and Terry Keith visited the Library of Parliament to examine Volume 3 of Audubon's Birds of America, which will soon come to CCI for conservation treatment.

SEMINARS

"Disaster Planning and Preparedness for the Small Museum"
David Tremain and Janet Mason
at the Musée Héritage Museum
St. Albert, Alberta

"Construction of Mannequins for Historic Costumes"
Ela Keyserlingk and Amanda Gray
at the Perth Museum/Matheson House
Perth, Ontario

"Stable Materials for Storage, Display and Packing"
Scott Williams and Jean Tétreault
to members of IIC-CG, Atlantic Group
Halifax/Dartmouth, Nova Scotia

## March 1990

David Hannington presented "Conservation and Security" to the Ontario Association of Archivists in Thunder Bay, Ontario.

Deborah Robichaud and Joe Dorning attended the Canadian Museums Association trainers workshop held in Montréal, Quebec.

Assad Nasser, a conservator with the Hamilton and Scourge Project, visited CCI to obtain information for a new laboratory which their organization will soon establish.

A workshop for Canadian conservators on "New Techniques in the Cleaning of Paintings and Polychrome Sculpture" was held at CCI by Richard Wolbers, Associate Paintings Conservator, Winterthur Museum and adjunct professor, Art Conservation training program, University of Delaware.

Sherry Guild attended a workshop on "The Paper Suction Table: Treatments, Techniques, Fabrication and Theory", sponsored by the Smithsonian Institution's Conservation Analytical Laboratory.

David Grattan gave the lecture on "Parylene and the Fossil Forest" at the annual dinner of the Canadian Institute of Surveying and Mapping.

SEMINARS

"Artifact Mounting Workshop"
Bob Barclay and Carl Schlichting
at the Dawson City Museum
Dawson, Yukon

"Care of Furniture and Wooden Objects"
Valerie Dorge and Janice Manual
at the Dawson City Museum
Dawson, Yukon, and at the Kelowna Centennial Museum
Kelowna, British Columbia

"Emergency and Disaster Preparedness for Museums"
David Tremain and Deborah Stewart
at the Musée Acadien
Miscouche, Prince Edward Island

"Storage and Display of Historic Textiles"
Ela Keyserlingk, CCI, and Jane Holland, Maritime Museum of the Atlantic
at Antigonish, Nova Scotia•

*Symposium 91*
**Saving the Twentieth Century**
**Sauvegarder le XX^e siècle**
The Degradation and Conservation of Modern Materials
La dégradation et la conservation des matériaux modernes

CCI is organizing a symposium from September 16 to 20, 1991, in Ottawa, Canada. The conference theme will be the conservation of objects made from modern materials. The focus will be synthetic and modified natural polymers, metals and composites.

Conservators and scientists will address conservation practices, as well as scientific aspects of the degradation and stabilization of modern materials.

A formal call for papers will appear at a later date; however, preliminary submissions of papers are welcomed.

To receive further details write to

*Cliff McCawley or David Grattan*
*Symposium 91*
*Canadian Conservation Institute*
*Department of Communications*
*1030 Innes Road*
*Ottawa (Ontario), Canada K1A 0C8*

Canadian Conservation Institute
Department of Communications
1030 Innes Road
Ottawa, Canada
K1A 0C8
Telephone: (613) 998-3721
FAX: (613) 998-4721

Canada