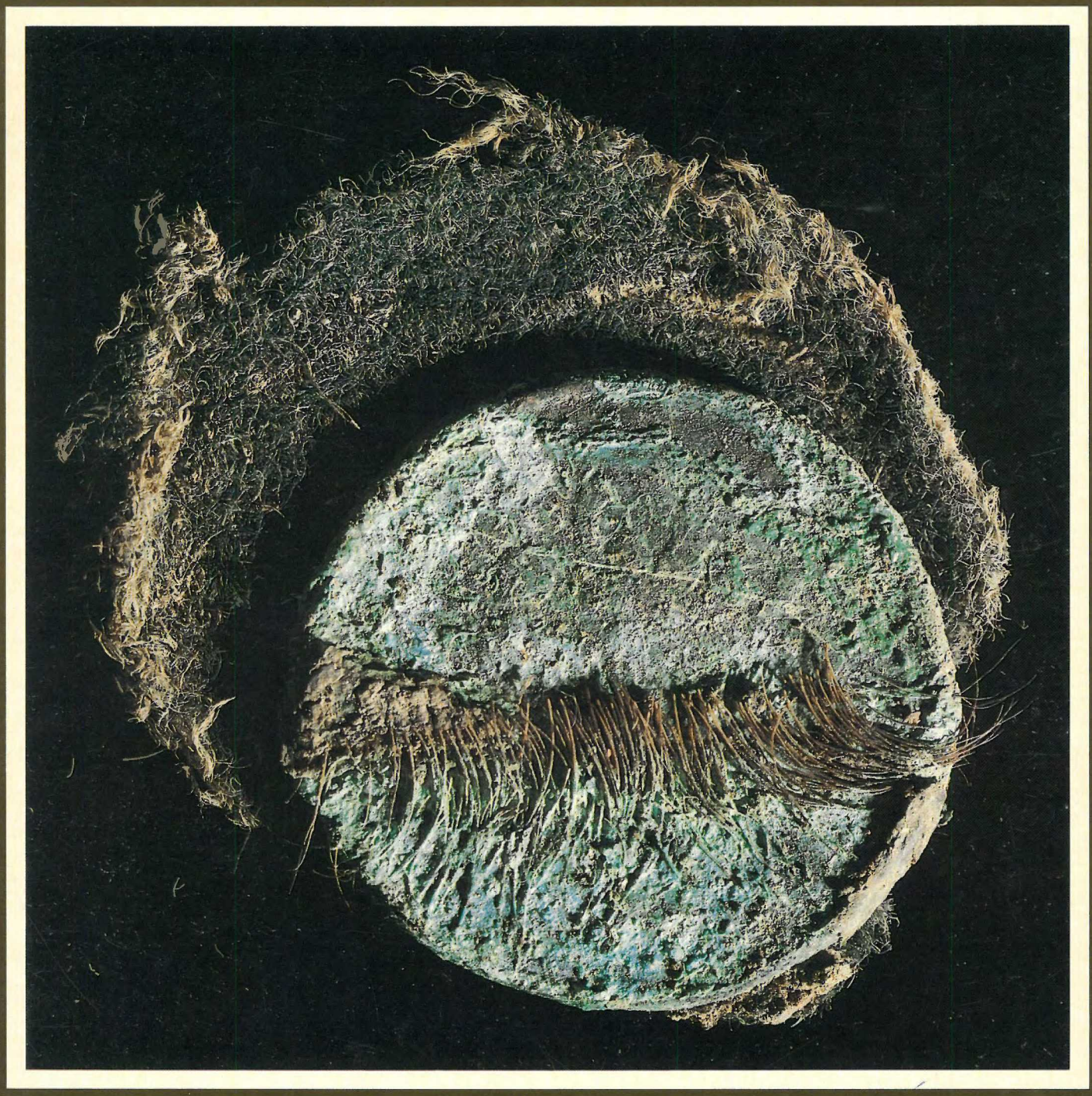
CCI

The Journal of the

Canadian Conservation Institute

Volume 4/1980

National Museums of Canada



CCI Journal

Canadian Conservation Institute
National Museums of Canada

Volume 4

VOLUME 4

CANADIAN CONSERVATION INSTITUTE

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Editor and Layout Designer: Janet K. Denton

Printed by Canadian Government Printing Office, Bruce Broadfoot, Planner.

To Order Publications: See page I.

International Standard Serial Number: ISSN 0380-9854

COVER: *Two corroded discs buried on a dead man's eyes. . . a fascinating tale of history and the modern conservator/scientist as detective and interpreter. See story on page 21. Photograph by James Stark.*

It was with much sadness we learned of the passing of our old friend Per Guldbeck. Our profession has lost a great conservator, but an even greater human being. To Jan and the children, we all extend our deepest sympathy. This issue of the Journal is dedicated to the memory of Per Guldbeck.

Photo by Wilfred Bokman

Brian V. Arthur, Director-General

"...Closer collaboration"

The view that bigger is not necessarily better has often been expressed regarding conservation organizations. This point of view has arisen, I believe, because of the loss of contact between conservators and curators, as well as between conservators and collections, and especially when the laboratory is divorced from its parent collection. Much of our energy at CCI has been devoted recently to closing this gap, and with the establishment of a Regional Directorate as part of the Conservation Services Division, we have made a *de facto* recognition of this need for closer collaboration.

We believe that by providing a mobile laboratory service for all Canada's regions, we will be putting the conservators where they are needed most urgently at this moment—on the doorsteps of museums, archives and galleries across Canada. But the new mobile laboratory service described in this issue of the Journal is only one part of a new outward-looking initiative on the part of CCI, howbeit a most important part. The others include a much improved education and training service and a broader editorial policy regarding the increased production of Technical Bulletins. These, we hope, make a much more viable regional service to our clients.

Brian V. Arthur

Photo by James Stark

Conservators and staff who took part in the summer '79 pilot project of CCI's Mobile Conservation Laboratory service to Atlantic Region museums. Back row, left to right: Charles Hett, Brian Arthur, Director-General and Cliff McCawley, Assistant Director, Regional Services; Front row, standing, left to right: Bob Arnold, Ralph Eames, Eva Burnham, Charles Brandt, Ann Krahn, Bob Barclay and Don Murchison; Kneeling: Tom Stone, conservator who outfitted the labs; J.P. Roussel, Accommodations Officer and Michèle LaRose, Training and Information Co-ordinator.

NORTHWEST COAST MASKS:

by R. Scott Williams

In 1976, four Northwest Coast masks (see Figure 1) were offered to the National Museum of Man (NMM) in Ottawa. According to the information provided, they had been in the possession of a family for years, and the grandfather was believed to have picked them up while traveling in British Columbia between 1910 and 1920. It was also thought that they had originally been found on a beach and that this accounted for their extremely weathered and degraded appearance.

As can be observed in the photographs, very little of the original paint remains. The wood surface has the characteristic dark brown colour of wood which has been exposed to damp conditions and partially decomposed; and in some areas, the wood is severely cracked or worn right through.

Despite the fact that the Group-of-Four Masks (or Four Masks) looked old, NMM's curators thought that they were close in style to modern 'Ksan masks. Consequently they were curious: were these genuine early masks (late 19th or early 20th Century), or were they modern masks, legitimately purchased from contemporary artists and subsequently cleverly faked to make them appear old?

To help resolve the question, the museum asked the Analytical Research Services Division of the Canadian Conservation Institute (CCI) in Ottawa to analyze the paints and wood in order to determine if the masks were, indeed, early or modern. In performing scientific attribution studies such as this, analysts must be able to compare the material found on the objects in question with those known to have been used on comparable authentic works. In some cases, reference information is available from published analytical studies. When it is unavailable, or perhaps only partially available, a suite (selection) of objects must be obtained from well-documented authentic collections and analyzed alongside the objects in question to obtain the necessary comparative data.

Fish oils and dog salmon

There is some information in the literature on the subject of materials thought to have been used on Northwest Coast masks. For example, in 1913, Boas mentioned the use of chewed "spawn of the dog-salmon" as a medium with charcoal to make a paint for wooden bowls. Leechman (1932) and Holm (1965) described a similar paint medium. (The medium is the organic component mixed with pigments to prepare paints.) Leechman also suggested the use of greases, glues and resins, while Gunther (1966) mentioned the use of fish oils. Concerning pigments, Mungo Martin, a native carver, is quoted by Holm (1965) as saying that the Kwakiutl had "no good red, only brown like rust" until the Hudson's Bay Company introduced "China red (vermilion) in paper packages". It was also thought that various copper pigments, such as copper oxides (Hawthorne, 1967), sulfides (Holm, 1965) and urine-corroded copper (Inverarity, 1971) could have been used.

As mentioned, these are examples of the media and pigments which are thought to have been used on Northwest Coast artifacts. Unfortunately, we were unable to locate any published analytical data on actual analyses of masks in the literature. From previous experience in analyzing a wide variety of other types of museum objects, we know that it is not uncommon to find materials present in early objects other than those described in the literature and claimed to have been used according to recipes handed down from generation to generation.

Accordingly, we advised NMM that it would be necessary to examine the pigments, media and wood on a collection of well documented masks, as well as the four in question, to obtain more definitive information. However, this required time—more time than the museum had available to close on the purchase of the masks.

Despite this, NMM decided to acquire the masks and have CCI proceed with the investigation. If the masks proved to be genuine, nothing would be lost and a considerable amount of information on masks obtained. If they were found to be modern, the knowledge that artificially-aged masks were being produced would be important both to NMM and other museums in Canada; as well, having examples of such forgeries would be useful in future evaluations.

Laboratory studies: salmon eggs help crack the case

To help initiate the laboratory studies, the nine Reference Masks—five Haida and four Tsimshian—were obtained from NMM (see Figure 2). These masks were all well documented and had been collected be-

Opposite Page

Figure 1: *The National Museum of Man (NMM) requested that the Analytical Research Services Division of the Canadian Conservation Institute examine a "Group-of-Four" Northwest Coast Indian masks to determine their authenticity. The analysis of various factors considered and compared during the ensuing investigation is charted in Figure 3. The NMM acquisition numbers are used as references in that chart to these masks: a) "Starving Man", 79/24/1; b) "Hawk", 76/24/2; c) "Beaver", 76/24/3; and d) "Human", 76/24/4.*

salmon egg paint unmasks fakes

a. *b.* *c.* *d.*

Photo by James Stark

Above: *The inside, back of the "Hawk" mask in the Group-of-Four (76/24/2). Concentric, circular holes and markings suggest some form of auger bit had been used to hollow out the beak, a rare feature in old masks.*

Below: *The interior of the "Human" mask (front view shown in Figure 1d, 76/24/4) shows a pattern of splits occurring extensively over its surface, cutting across—not following—the wood grain, thereby suggesting these are artificially produced.*

tween 1879 and 1911. They were selected because they exhibited a wide range of colours (necessary for pigment identification) and because the small samples needed for analyses (about the size of the period at the end of the sentence) could safely be removed. At the same time, a sample of salmon eggs was obtained from British Columbia; this was chewed and used to prepare standard media samples for test analyses.

The paint samples were analyzed by x-ray diffraction to identify the crystalline pigments and by diamond cell infrared spectroscopy (Laver and Williams, 1978) to determine the medium and to provide additional information on the pigments. The wood species were identified by microscopy.

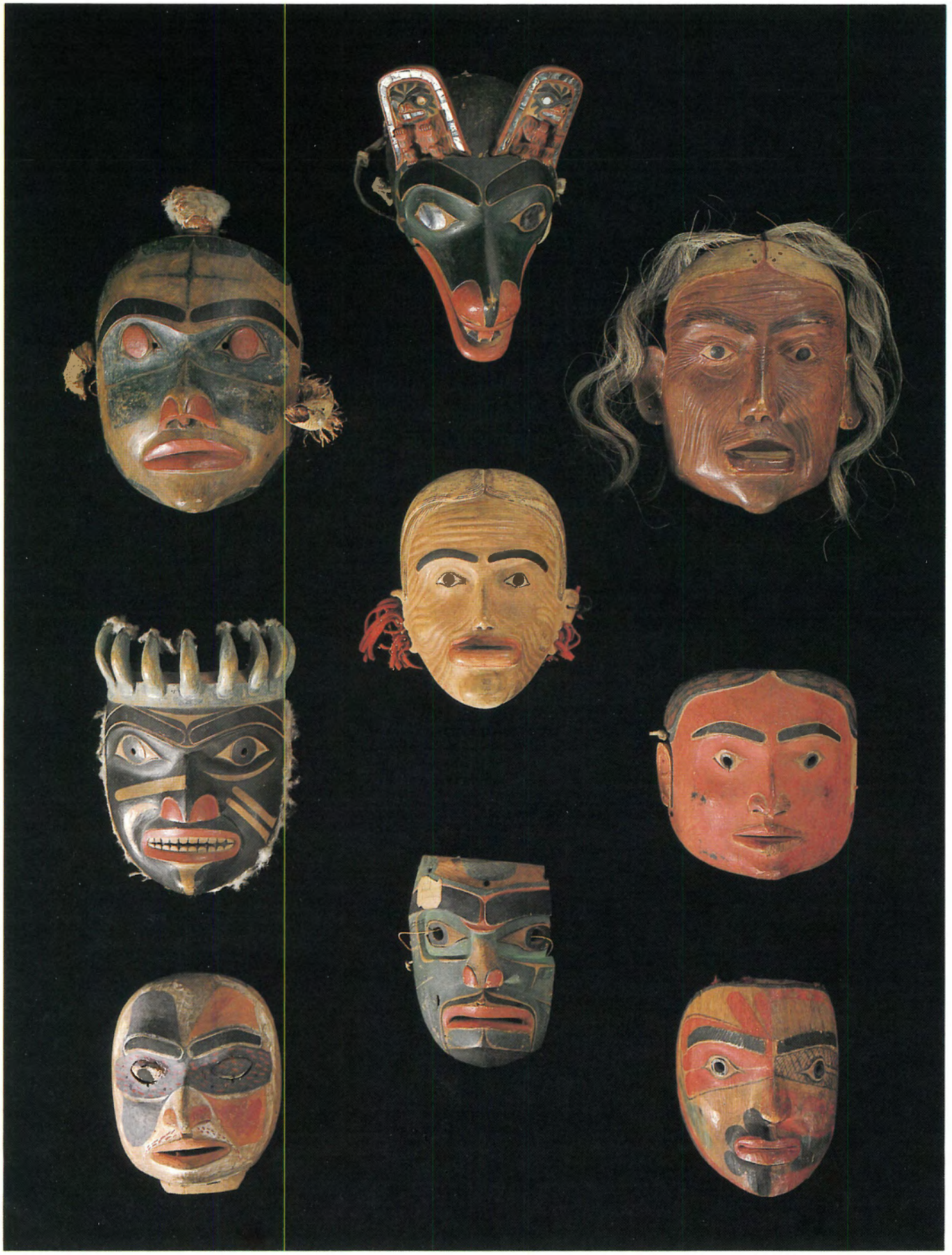
The results of the analyses (see chart, Figure 3) show some interesting and significant differences. First, a proteinaceous salmon egg medium was identified as the only medium present on all of the nine Reference Masks. In contrast, an acrylic medium which was first introduced into commercial paints in 1953, and used frequently in contemporary paints, was present on all the Group-of-Four Masks (see Figure 4). This is a significant result for two reasons: it provides an indication that the Group-of-Four Masks are of relatively recent origin and supports historical accounts of the use of a salmon egg medium in early Northwest Coast native paints.

Significant pigment differences are also apparent, particularly in the reds and whites. In agreement with the historical account of Mungo Martin, discussed earlier, red vermilion was present on all nine Reference Masks. Vermilion was not found on any of the Four Masks, but instead, a pigment introduced in 1926—cadmium red lithopone—was present. In the white pigments, titanium dioxide (Rutile), which came into use in the 1920's, was present on two of the Group-of-Four Masks. Lead-based pigments, such as lead chromate, red lead and lead white, were found on the Reference Masks—but not on the Four Masks. As lead-based pigments are seldom used in the contemporary pigment market, because of safety reasons, the above finding provides a further indication that the Four Masks are more recent in origin than the Reference Masks.

Somewhat to our surprise, no copper pigments, particularly greens or blues, were found on the Reference Masks, in spite of references in the literature.

Opposite Page

Figure 2: *These nine well-documented masks were obtained for comparative purposes from the collections of the NMM. They were examined to provide information about materials actually used on authentic pieces. Materials identified as such are shown in the analytical chart in Figure 3 and can be compared to the Group-of-Four. (NMM acquisition numbers and collection dates for these masks are given here and used as references in Figure 3.) The first five are Haida: a) "The Chief", VII-B-4, 1879; b) "Wolf", VII-B-5, 1879; c) "Kilora's Wife", VII-B-6, 1884; d) VII-B-11, 1879; and e) VII-B-8, 1884. The last four are Tsimshian: f) VII-C-317, 1911; g) VII-C-325, 1911; h) VII-C-326, 1899 and i) VII-C-327, 1899.)*



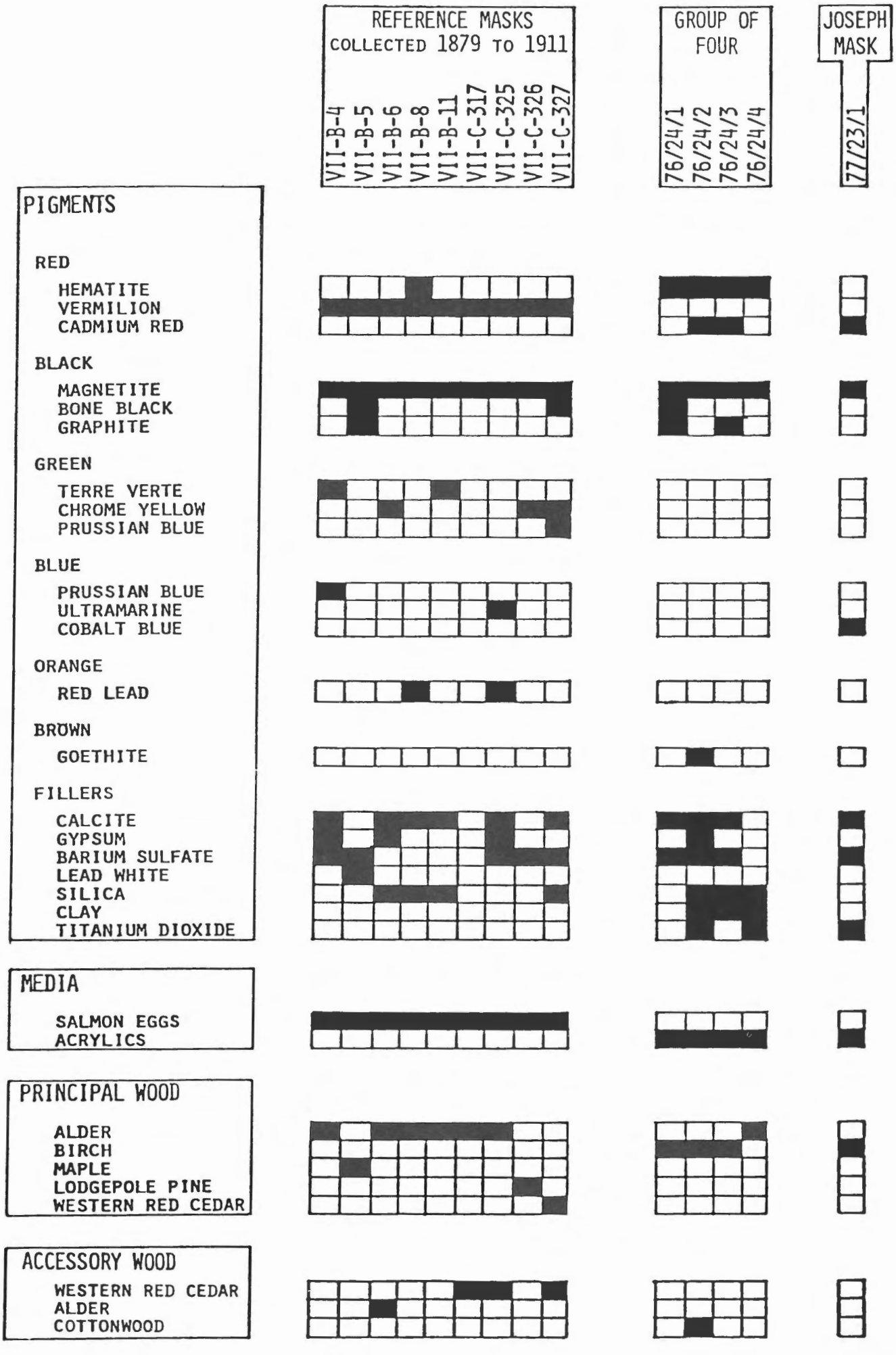
Left to right:

a, b, c

d, e, f

g, h, i

Photo by James Stark


REFERENCE MASKS
COLLECTED 1879 TO 1911
VII-B-4
VII-B-5
VII-B-6
VII-B-8
VII-B-11
VII-C-317
VII-C-325
VII-C-326
VII-C-327
GROUP OF FOUR
76/24/1
76/24/2
76/24/3
76/24/4
JOSEPH MASK
77/23/1
PIGMENTS
RED
HEMATITE
VERMILION
CADMIUM RED
BLACK
MAGNETITE
BONE BLACK
GRAPHITE
GREEN
TERRE VERTE
CHROME YELLOW
PRUSSIAN BLUE
BLUE
PRUSSIAN BLUE
ULTRAMARINE
COBALT BLUE
ORANGE
RED LEAD
BROWN
GOETHITE
FILLERS
CALCITE
GYPSUM
BARIUM SULFATE
LEAD WHITE
SILICA
CLAY
TITANIUM DIOXIDE
MEDIA
SALMON EGGS
ACRYLICS
PRINCIPAL WOOD
ALDER
BIRCH
MAPLE
LODGEPOLE PINE
WESTERN RED CEDAR
ACCESSORY WOOD
WESTERN RED CEDAR
ALDER
COTTONWOOD

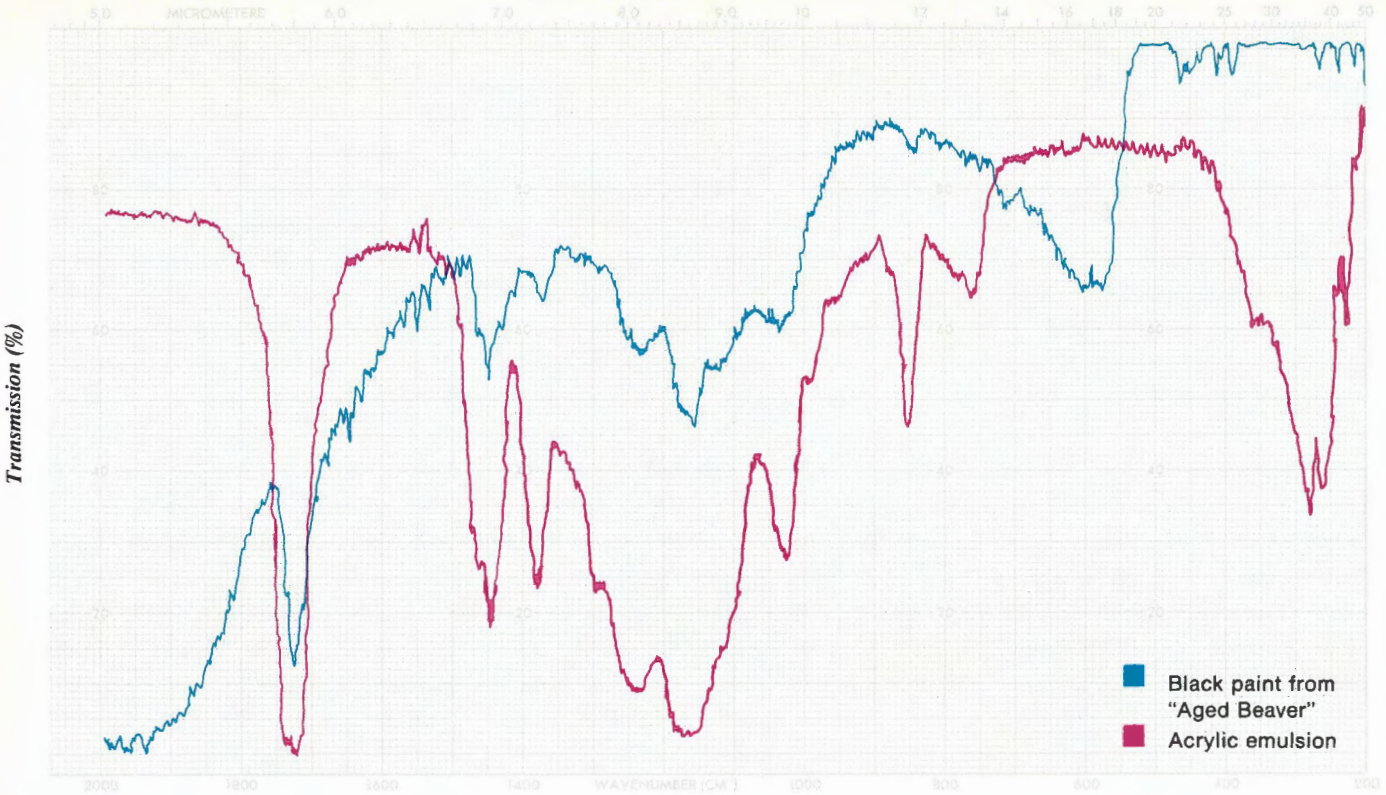


Figure 3 Left: *This chart presents the data for pigments, media and wood species found on all the masks studied and compared. The solid entries indicate a particular material is present. Similarities within a group with respect to containing a particular material are indicated along a horizontal row. Of particular note are the entries for red pigments, media and the birch and alder woods. It can be seen that the Group-of-Four Masks are distinctly different from the old Reference Masks, but very much like the recent Alfred Joseph "Beaver" mask.*

Figure 4 Above: *Infrared spectra show a sample of black paint from the "aged Beaver" from the Group-of-Four (76/24/3, blue trace) and a sample of a modern acrylic emulsion (red trace). This shows the similarity between the media. By comparing infrared spectra of a variety of traditional media with modern paint vehicles, it was possible to determine the medium used for the paints on each mask. All masks in the Group-of-Four and the Alfred Joseph "Beaver" mask had media with spectra like those shown here and are thereby identified as acrylics. The spectra of the media on the nine Reference Masks were dissimilar. Their spectra were like that of salmon eggs and thus were identified as such.*

Instead, such 19th Century trade pigments as Prussian Blue and ultramarine were present. This indicates that these pigments were traded on the West Coast during, and likely before, the 1879-1911 period when the Reference Masks were collected. It would perhaps be worthwhile to examine additional Northwest Coast artifacts, possibly from an earlier period, to determine if copper pigments were used and, if so, what they are.

The wood analyses also provided some interesting differences. Alder was found to be the predominant wood on the Reference Masks, while birch was used for three of the Group-of-Four Masks. Although too few masks have been examined to establish statistically significant differences, the trend is in agreement with the pigment and medium data. To support this observation further, birch had been previously identified as the wood used on 18 of 28 modern 'Ksan masks (NMM, 1972).

Wood deterioration: natural or artificial?

As previously mentioned, the Four Masks have a dark brown appearance of degraded wood. While chemical analyses were in progress, examinations were performed on the wood to determine if this colouration was the result of natural decay or if it had been artificially produced.

Considering the supposed history of the Four Masks, which suggested they were found on a beach, a natural wet environment was implied. Biodeterioration would most assuredly be involved under these conditions and a few of the surface features suggested this. When we examined the microscopic features of the wood, however, biodeterioration ultimately did not appear to be the degrading force. Additionally, no traces of sand, dirt or mud were found lodged in any of the cracks. The distribution of fungi filaments and a large number of spores in the histological preparations from the masks suggested a surface mold only. Surely, had this been a wood-destroying fungus, it would have easily found its way through the total thickness of the masks, particularly if they were situated in a wet environment. No portions of the masks were more than one centimeter (½-inch) thick. Their surfaces would be totally accessible from both sides, with the exception of painted areas. Thus, a rot fungus would encounter little inhibition or resistance in its invasion of the wood.

This argument presumes that the wet conditions were warm enough and oxygenated enough for typical fungal growth. It is well known that a wooden stake or post will rot most readily at the ground surface level and less above or below. If the masks were found on the

Photo by James Stark

Figure 5 a

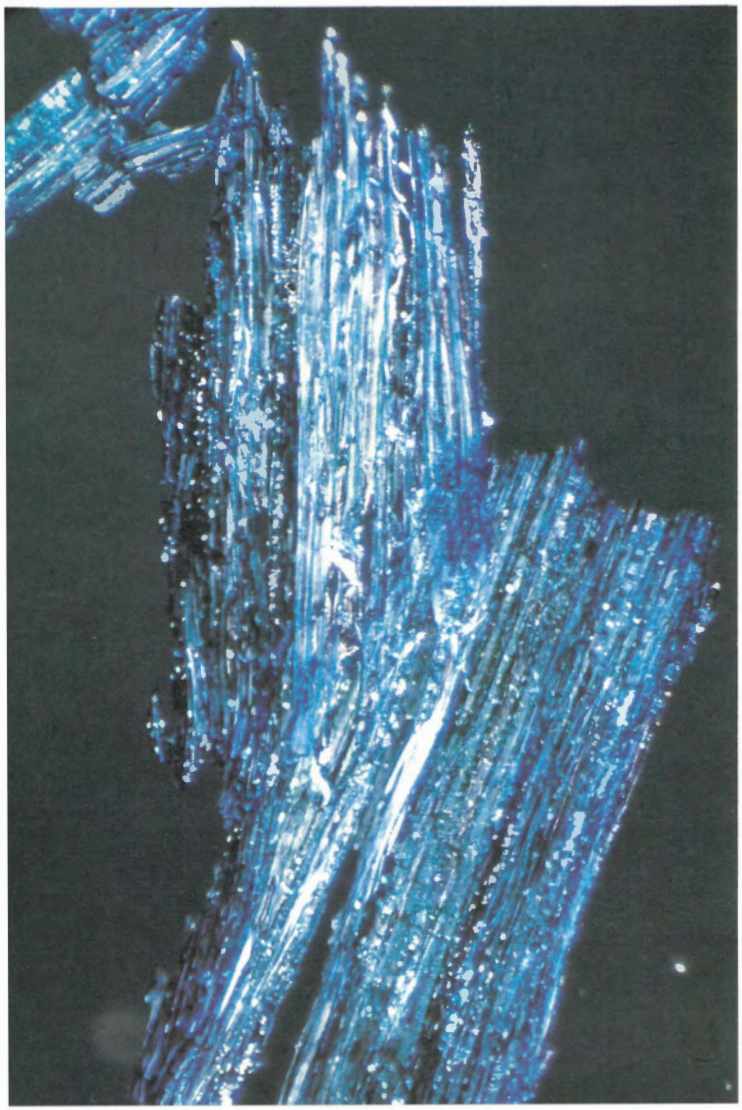
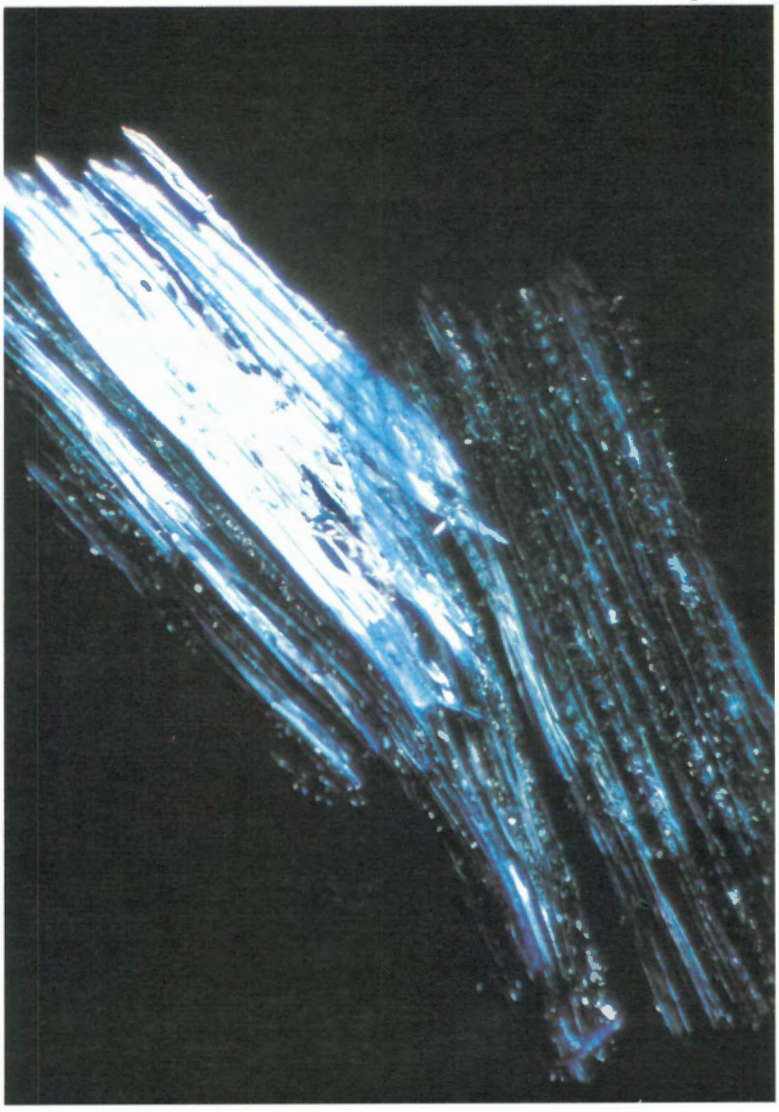


Figure 5 b



Opposite page, top: *Scott Williams, CCI Conservation Scientist, examines masks.*

Opposite page, bottom:

Figure 5: The association of crystals with areas of deterioration can be seen here. This micrograph shows a thin section of wood taken from the "Starving Man" mask (see Figure 1a, 76/24/1) in cross-polarized light. On the right (see Figure 5b), the specimen has been rotated counter-clockwise through 45% from the point of maximum extinction shown on the left (see Figure 5a). The areas of deteriorated wood remain unchanged (dark), while areas of undeteriorated wood become very bright. By carefully examining these two views, we see that in areas of deterioration, there are large numbers of white speckles. On closer examination, these were determined to be calcium-containing, rod-shaped crystals.

ground as reported, the chances of rot developing rapidly should have been very good.

One mask (see Figure 1a, "Starving Man," 76/24/1) showed cracking (brash fracture) perpendicular to the grain of the wood. This is one feature of soft rot; one of three major types of wood deterioration, including white rot and brown rot. The area, when more closely examined by light microscopy, revealed the same tendency to crack at the cellular level. Although fungal hyphae were present, they did not show the pattern of cell wall dissolution characteristic of soft rot fungi in softwoods or hardwoods. The cell walls showed a very uniform thin appearance. Further investigation revealed that these areas had an unnatural, high concentration of calcium-containing crystals—possibly calcium oxide (lime), calcium hydroxide or calcium carbonate. These crystals were most intimately associated with the deteriorated areas, to the point that a wood cell with normal wall thickness containing no crystals was frequently adjacent to a deteriorated, thin-walled cell having a great abundance of crystals (see Figure 5).

Although some other interior cell wall surfaces were rough and cracked, showing an uneven thickness in cross section, no microbial activity was seen. More particularly, neither were bacteria which are the agents in ponding procedures where wood is stored in water to increase its permeability to preservatives.

Could the Four Masks have found themselves in a weathering or degrading environment that did not favour wood-destroying microorganisms? Their present superficial decay might suggest so. However, their dark brown colour would contradict this possibility. In normal weathering, darker woods initially lighten and lighter woods darken. Ultimately, the exposed surfaces of all woods turn a silvery-gray colour, similar to the patina seen on telephone or totem poles.

As weathering continues, the cementing materials in the wood break down and cells flake away, exposing wood cells underneath. This deterioration, although inevitable, is very slow and a piece of wood can last for hundreds of years. If alternate wetting and drying is introduced, checks or splits will develop because of stresses produced during swelling and shrinking.

All the masks have splits which penetrate many cell thicknesses into the wood. In the "Human" mask, (see Figure 1d, 76/24/4), they occur almost too extensively over the entire surface compared with the other masks. In the "Starving Man" mask (see Figure 1a, 76/24/1), they occur at an inappropriate orientation, 90 degrees to the grain of the wood (this area corresponds with the presence of the calcium crystals). Additionally, there was no enhancement of wood grain, normally caused by differential swelling and shrinking between earlywood and latewood of each growth ring and preferential loss of the former with continued weathering.

As a result of these studies, it can be concluded that the wood deterioration is not natural; rather, it has been produced artificially—possibly by the action of calcium-containing chemicals, in one instance; or by heat, as from a torch, to produce the dark colouring, in another.

Visit to 'Ksan

At this stage, laboratory examinations had shown that the Four Masks were modern—at least produced after the introduction of acrylic paint media in 1953—and that they had been artificially aged.

The next significant development came from NMM's Richard Inglis. During a visit to the Institute, he discussed the work with one of CCI's scientists,* and offered to take photographs of the masks to British Columbia to show to contemporary West Coast carvers. During his visit to 'Ksan, two of the masks were recognized by artist Alfred Joseph: the "Starving Man", carved in 1972 (see Figure 1a, 'Ksan #112) and a "Beaver" mask, carved in 1973 (see Figure 1c, 'Ksan #174), one of several similar beaver masks carved by him. A third "Hawk" mask (see Figure 1b) was thought to be from 'Ksan, but could not be verified, and a fourth "Human" mask (see Figure 1d) was not thought to be a 'Ksan mask at all.

Largely out of curiosity, another example of a Joseph "Beaver" mask (see Figure 6, 77/23/1) was brought to the laboratory for examination alongside its "aged" brother (see Figure 6, 76/24/3). It is interesting to note that originally the two masks would have been quite similar in appearance: this illustrates the extent to which the Four Masks have been artificially aged.

As shown in the analytical chart (see Figure 3), the pigments and medium in the new Joseph "Beaver" mask are identical to those in the Four Masks. The wood is also birch. Additionally, Alfred Joseph had carved his name on the rear of the proper ("as attached to the body") left ear of the new "Beaver" mask (see Figure 7a). However, his signature was not on the "aged Beaver" mask, and appeared to have been removed with sandpaper (see Figure 7b).

Old tricks, new answers

As those in the museum community are well aware, this is a new version of an old trick. Similar to burying a new pot in the ground to give an appearance of an aged, more valuable artifact a few years hence, or adding an important signature to an ordinary painting,

*Mary-Lou Florian, formerly with CCI, now with the Conservation Division, British Columbia Provincial Museum.

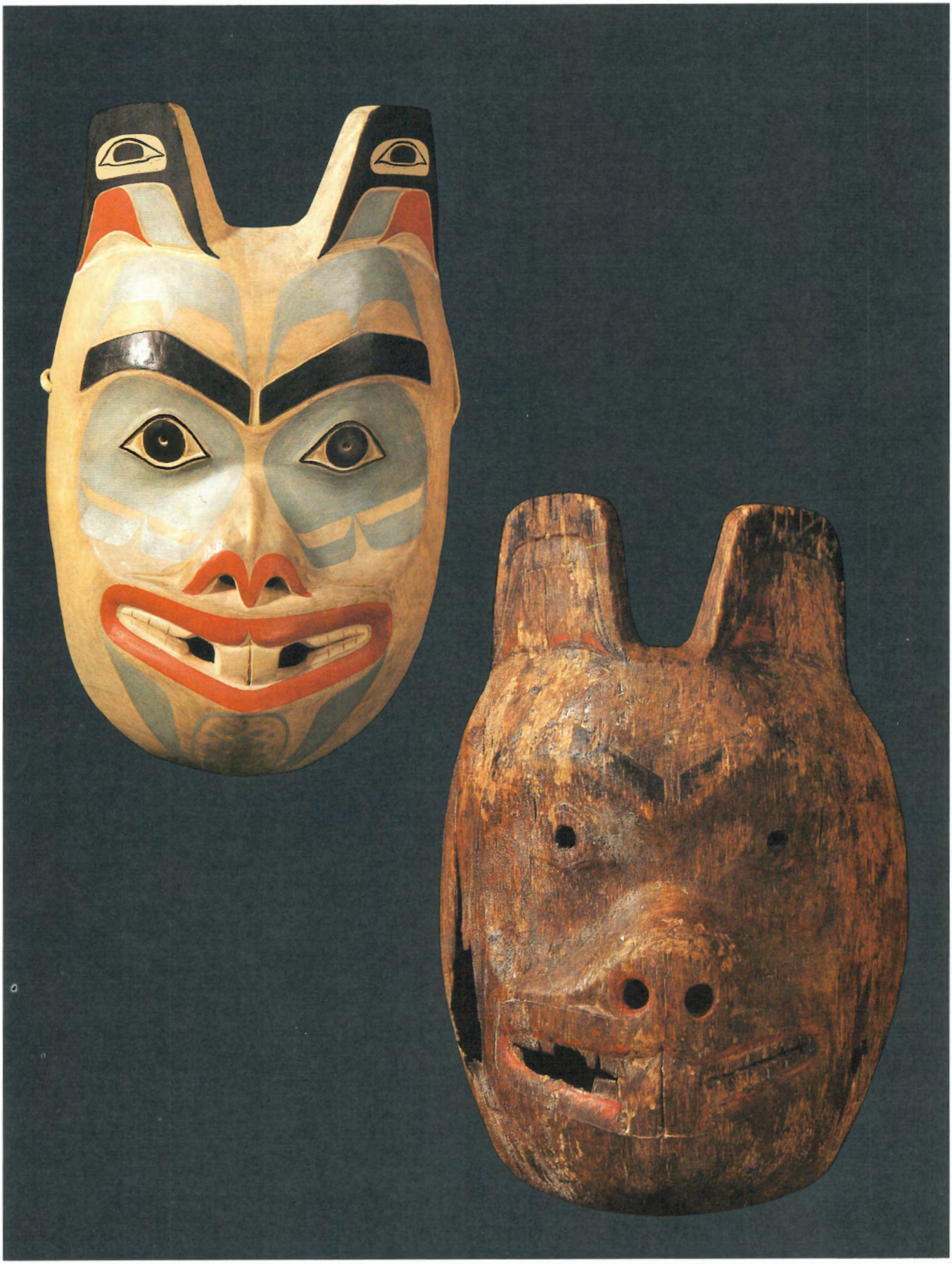


Photo by James Stark

Figure 7 a

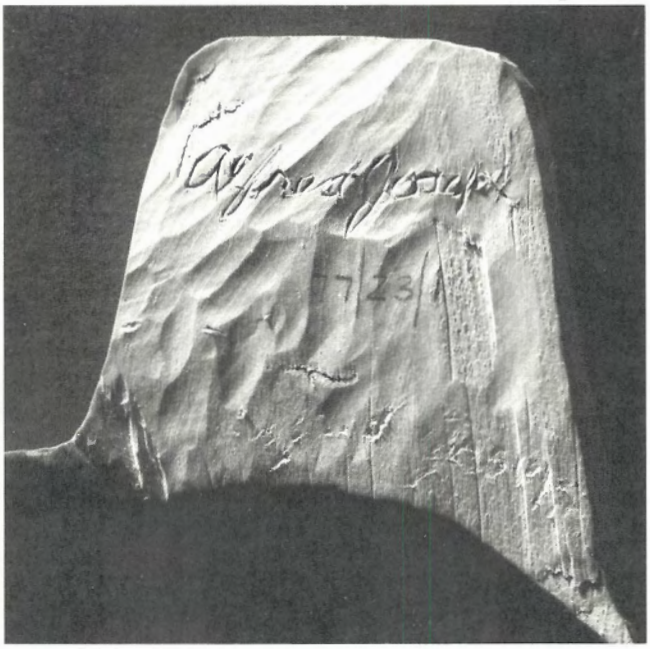


Figure 7 b

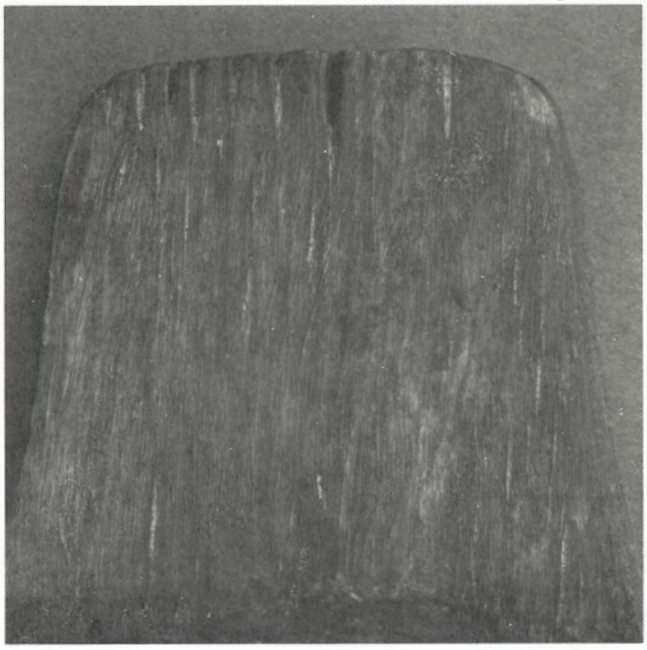


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Figure 6: *These masks were both recently carved by Alfred Joseph, an artist at 'Ksan in British Columbia. The mask on the right, one of the Group-of-Four, has been artificially treated to make it appear old, while the mask on the left has not been abused. The materials used in both masks are given in the analytical chart (Figure 3) and are nearly identical. Left, new "Beaver" mask, 77/23/1; right, "aged Beaver" mask, 76/24/3.*

Figure 7: *Left, the tool marks and signature of Alfred Joseph, B.C. artist, as they appear on the back left ear of the new "Beaver" mask (77/23/1). Right, the back left ear of the "aged Beaver" mask (76/24/3). Here one can see neither gouging tool marks nor signature; but instead, a relatively smooth surface with concentric curved striations like those produced with sandpaper. This supports the idea that an authentic recent mask has been obtained, then subjected to abuses—including signature removal—to make it appear old. This is a common ruse to increase an object's value to collectors.*

these masks have been legitimately purchased from the artists, aged, then passed to the museum community as supposedly genuine old artifacts. We are not aware of the extent of this practice with other masks, or indeed, other West Coast artifacts; however, we feel the museum community should be aware of this possibility.

In addition to the value of curatorial footwork, we hope this article has illustrated the value of scientific analysis in the determination of authenticity and in the identification and documentation of materials used in authentic works.

Acknowledgements

The author wishes to acknowledge the work of his colleagues, who participated equally in this study: Marilyn Laver, Greg Young, Neil Adair, Mary-Lou Florian and Wilfred Bokman. Also acknowledged is the assistance of Richard Inglis and Denis Alsford of the National Museum of Man in Ottawa.

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HAIDA *conservation basketry*

by Tom Govier

Ethnographic collections contain many objects constructed from materials of plant and animal origin. These materials are very resilient at first, but in time become brittle and inflexible. Unless adequately supported in storage and on display, distortion will occur and an object's fabric will begin to break down.

The construction of these necessary protective supports often requires considerable care and attention on the part of museum staff and is often a neglected aspect of their work. Yet when objects have not been properly cared for, they present a formidable challenge to the conservator.

Such was the case with this beautifully constructed "Rain Hat", purchased in 1899 from the Haida Tribe of the Queen Charlotte Islands, British Columbia by Andrew Alfred Aaronson, a dealer of the period, and now in the collection of the National Museum of Man (NMM) in Ottawa.

When the Canadian Conservation Institute (CCI) in Ottawa received the hat for treatment, it was in very poor condition. Made of woven strips of spruce root, there is three-strand twining on the crown and skip-stitch twining on the brim. The shape was badly distorted with breaks around the brim and on the crown. An attempt in the past to hold all the loose pieces of basketry together by stitching had probably prevented the complete breakup and loss of the hat. Patches of brown cloth had also been stitched in place over four gaps where small areas of basketry were missing. However, the use of stitching as a repair method for basketry is not a good idea generally, as the needle causes physical damage and the thread strains the brittle basketry and may cause it to break.

The painted decoration on the hat appeared to be in surprisingly good condition, but the design was obscured by black thread from the previous repair stitching and the misshapen form of the hat. The true shape would be a high crown sloping gently down and outwards to the brim.

To regain the original form, a considerable amount of reshaping was necessary. This was achieved by moistening the hat's fibres with water, and in some instances steam, after paint layers were tested to ensure they would not be affected by moisture. The dampened fibres relaxed, enabling distorted areas to be carefully reshaped.

The broken edges were realigned so that repairs could be carried out when the basketry had dried and "set" in the required position. Several separate moistenings and repositionings were necessary in the badly distorted areas in order to achieve the correct shape.

To hold the basketry from sagging out of position while it was drying, balsa wood stretchers were pegged around the brim rather like the spokes in an umbrella. When a resemblance to the original shape had been

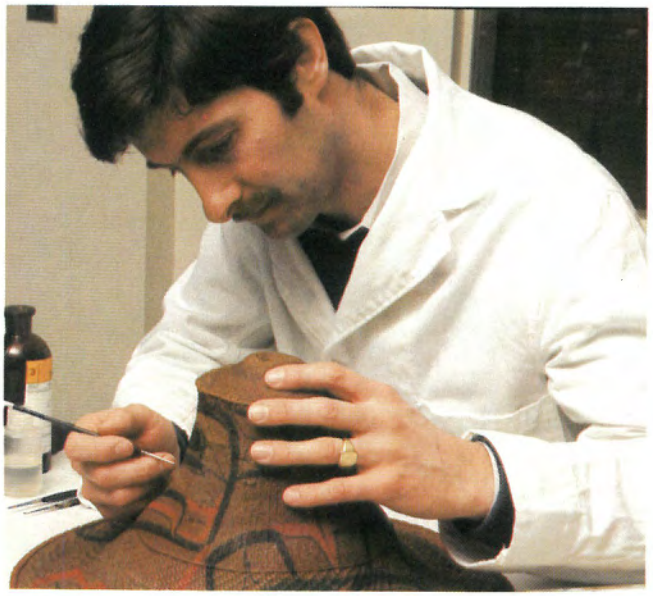
b.

c.

e.

Photos by James Stark and Bob Higham

HAT: *of an 1899 rain hat*



a.

attained, the stretchers were removed and a polystyrene form was cut to fit inside the crown. The polystyrene was covered with acid-free tissue paper and fitted into the crown, allowing handling and pinning to be carried out during repairs.

In consultation with the museum curator responsible for the artifact, a decision was made to restore the missing areas of basketry in order to protect and support the hat's jagged edges. This was done on the lower half of the hat by fitting into place shaped pieces of rattan, purposely dyed and coloured to *almost* match the original material. This ensures that future generations of historians and curators can differentiate between the original hat and any restorations.

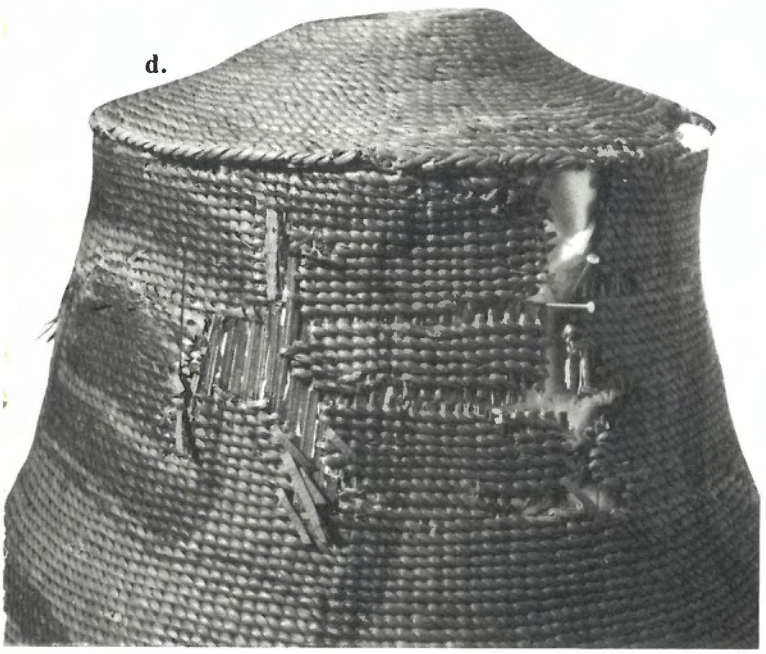
Missing areas on the crown were restored by using a base of rattan cane strips fixed vertically in the gaps with polyvinyl acetate adhesive. The rattan strips were then overlaid with dyed paper strips, one end of which was stuck in position using cellulose nitrate adhesive. After the adhesive had dried, loose ends of the paper strips were cut to length and stuck down.

This technique had the effect of simulating the weave of the hat.

When repairs were completed, a thin wooden disc was cut to fit beneath the brim. The wood was joined to the polystyrene packing used to support the crown. This mount provides a firm support for the hat, both for storage and display.

The "Rain Hat" is now back in the collections of NMM. Now that it has been restored and is being properly cared for within an ideal environment, the hat should last a very long time.

d.



a. CCI Conservator Tom Govier, inpainting the repair area of the Haida Rain Hat.

b. Haida "Rain Hat" from the Northwest Coast of Canada. Collection, National Museum of Man in Ottawa. Prior to 1965 this hat had been sadly neglected, resulting in a distorted shape and loss of sections of weave. At some time in the past, breaks had been patched and stitched together; while this helped to prevent further loss, later the stitching had pulled and split the basketry.

c. After the stitching and cloth patches were removed, the hat was reshaped to its original form. The missing areas of basketry were then restored.

d. The crown of the "Rain Hat" being repaired and restored. Breaks have been temporarily pinned to align the edges while missing areas are reconstructed. On the hat's left side, to copy the weave, rattan upright strips have been fixed in place and are being overlaid with dyed paper strips, cut to length and stuck in position.

e. "Rain Hat" after conservation treatment. The hat is resting on a polystyrene form fixed to a disc of thin plywood to protect the brim. This mount will be a permanent support.

REGIONAL SERVICES:

"helping museums help themselves"

by J. C. McCawley and P. R. Ward

Photos by James Stark and Bob Higham

During the past two decades there has been a tremendous expansion in the growth of Canadian museums and their collections. Unfortunately, but perhaps not so surprisingly, the financial and human resources needed to take care of these collections have lagged far behind.

However, the mere handful of conservators working in Canada during the sixties were well aware both of the immediate and much more threatening future problems facing our collections, and they pressed hard, at all levels, for an increased commitment to conservation.

In 1971, at the conference "Consultation I: Museums 70+", a National Museum Policy was defined for the first time. Then Secretary of State, Gérard Pelletier, announced a series of projects which were to become National Museums Programmes.

Among them was the promise to establish a Canadian Conservation Institute (CCI). A little more than a year later, this was done. The plan, as it emerged in 1972, was to fulfill part of the Government's dual call for increased access by the Canadian public to the collections and preservation of them at a central conservation headquarters in Ottawa, which would then control and direct five Regional Conservation Centres. These would be located in British Columbia, The Prairies, Ontario, Quebec and the Atlantic Provinces.

By 1974, two modest centres, one in Moncton and one in Vancouver, had been established to help serve the needs of the Atlantic and Pacific regions. This was followed in 1977 by a very small facility in Quebec.

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a. Philip Ward, right, Director, Conservation Services, and Cliff McCawley, Assistant Director, Regional Services, both of CCI, discuss the itinerary of mobile labs as they travel to museums across Canada.

b. Janet Denton, Editor, oversees production of publications.

c. Michèle LaRose, Training and Information Co-ordinator, speaks to conservators during a training session.

d. James Stark, CCI photographer, instructs mobile lab staff in photographic techniques to be applied in documenting before and after treatments of artifacts.

The conservation needs of the other regions were met by the comparatively small staff at CCI headquarters in Ottawa.

Continued fiscal restraint prevented establishment of the other centres and, indeed, eventually resulted in the closure of the Atlantic and Pacific centres in 1979. This decision was taken when National Museums of Canada (NMC), as other Government departments and agencies, was faced with substantial budget reductions. However, regional conservators' positions could be accommodated at CCI headquarters, thus avoiding conservation staff layoffs.

Following the closure of these labs, CCI's role was re-examined. One recommendation considered, that of establishing a mobile conservation service, had been first suggested early in the life of CCI as a useful adjunct to the services of the Regional Conservation Centres. Indeed, in 1977 just such a service was proposed to NMC's Board of Trustees. It was postponed then as an idea awaiting additional resources — and its time. Now, with the regional labs closed, the time seemed at hand for CCI, in consultation with the regional advisory committees, to operate Mobile Conservation Laboratories that would provide conservation assistance in each region of Canada, with particular emphasis upon smaller institutions.

So in January 1979, approval was given for a pilot project of one mobile laboratory to provide a

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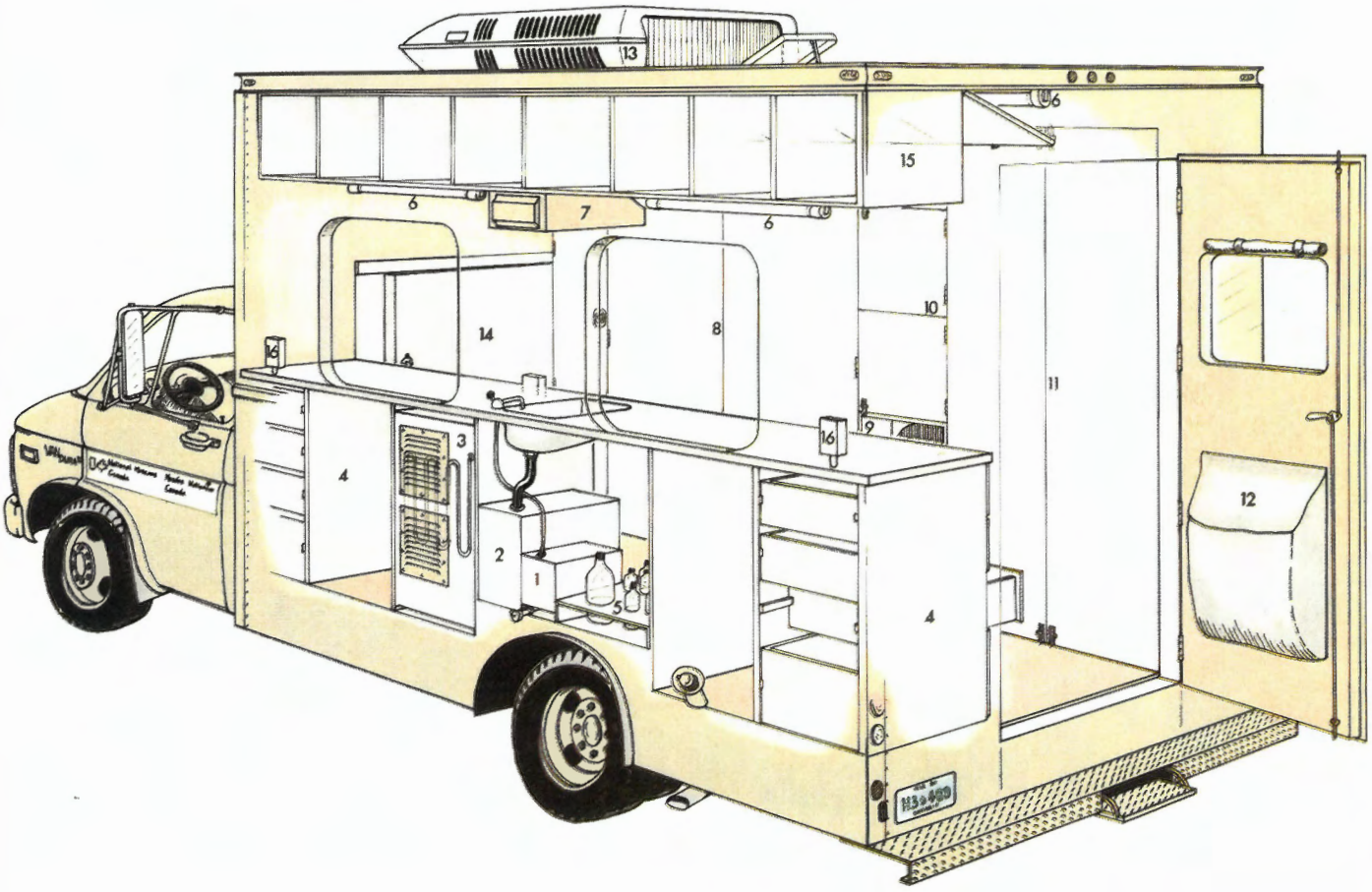
Five new mobile laboratories are now travelling to museums across Canada. They have been modified somewhat from this prototype as a result of the experience gained in 1979.

1. *Five gallon water tank connected to manual pump on sink.*
2. *Ten gallon waste holding tank with outside drain.*
3. *Refrigerator with 12V DC or 120V AC power supply for storage of epoxies, photographic film, other items.*
4. *Storage drawers for small tools, materials and equipment. One lower drawer contains books, reports and technical information.*
5. *Storage for solvents and waste cans.*
6. *20W Cool White fluorescent light fittings with added ultra violet absorbing tubes.*
7. *Fume extractor, portable model to be used in museums also.*
8. *Bulk storage wall cupboards for mat board, paper, plastic sheets, stock of wood, other items. Photographic backdrops, mat cutter included.*
9. *Circulation fans: now replaced by a fan system in the air conditioner.*
10. *Storage cupboards for environmental monitors, 35mm projector, microscope, weighing scales, other items.*
11. *Bulk storage wall cupboards for vacuum cleaner, wood and metal working tools, water hoses, other items.*
12. *Fire blanket in canvas pouch.*
13. *Air conditioning unit - 11,000 BTU's cooling and 5,600 BTU's heating.*
14. *Sliding door to driver's cab.*
15. *Ceiling storage units for conservation supplies - including waxes, adhesives, polishes and soaps.*
16. *120V AC double wall sockets.*



Drawing by R. L. Barclay

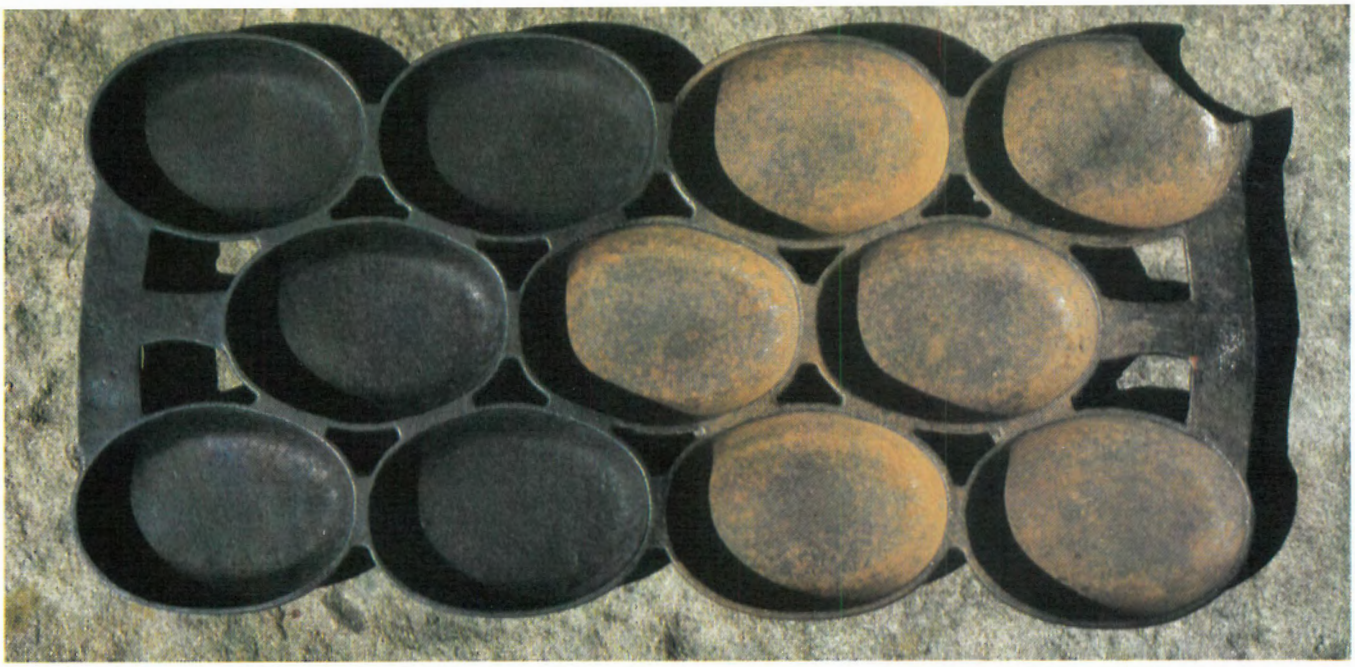
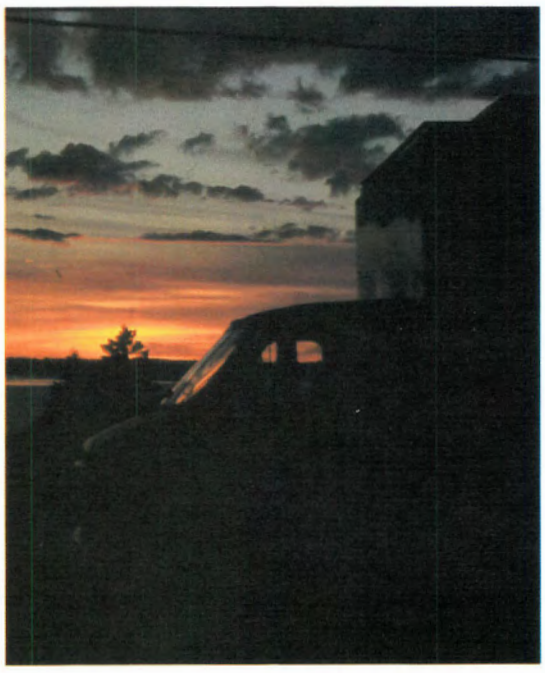


Photo by Brian Arthur

1. Right

2. Left
3. Middle
4. Right

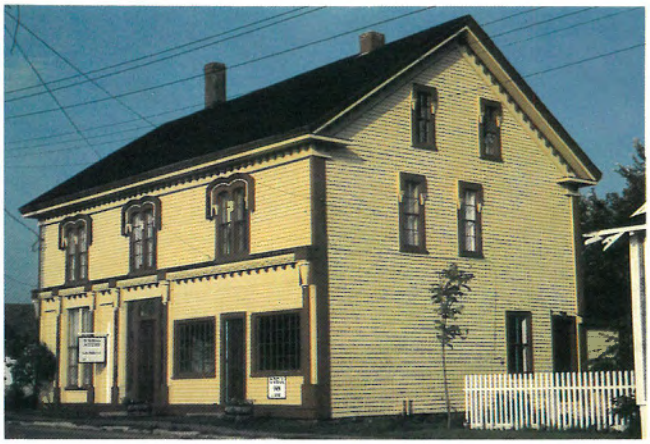
1. *A cast iron muffin tray shows the vivid contrast between surface rust and its treatment with tannic acid in this before and after treatment photo. Collection, Albert County Historical Society Museum in Hopewell Cape, N.B.*
2. *Peter Vogel, CCI Chief of Fine Arts, consults with Juanita Brittain, Curator, Hector Centre Trust in Pictou, N.S.*
3. *Bob Barclay, CCI Conservator, cleans, repairs and removes corrosion from a nautical sextant during a mobile lab visit to Hopewell Cape, N.B. in the summer of 1979.*
4. *Conservators visit museums across Canada on mobile laboratories such as this to assist in the care of artifacts.*

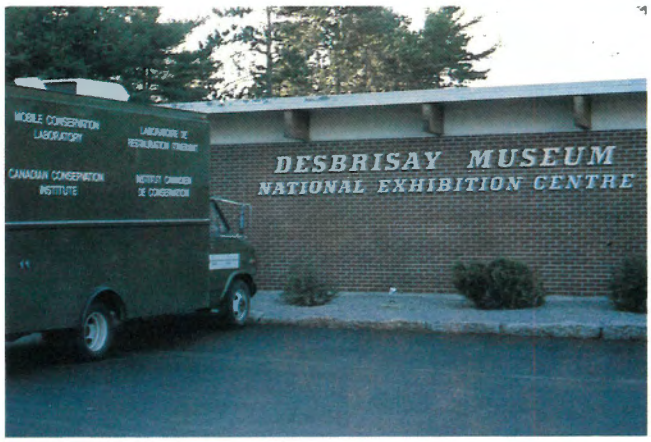


5. Left
6. Middle
7. Right

8. Left
9. Right

10. Top to bottom:





conservation service in the Atlantic Provinces of Nova Scotia, New Brunswick and Prince Edward Island during the following summer. A vehicle was completed in haste, itineraries arranged, and the service inaugurated by then Secretary of State, David MacDonald on 13 August 1979. It was the first such service in Canada; despite a lack of experience, it proved an outstanding success.

The vehicle is essentially a light truck consisting of a 4 × 2 chassis which can accommodate a body approximately 14 feet long, 8 feet wide, and 7 feet high. It is climate-controlled and equipped with work benches, fume extraction, sink and other equipment necessary to carry out basic conservation treatments. (See illustration on page 15 for detailed layout of the mobile laboratory.)

The objective of the Mobile Conservation Laboratory service is two-fold: to provide 1) emergency or short-term, on-site basic conservation treatments, and 2) conservation advice and information to museums, galleries and other cultural institutions on the handling, storage, display and transportation of artifacts.

This second area of service includes:

- assistance in developing plans for improved storage, display, packing and shipping of artifacts. A report and additional advice and recommendations for improved care of the collection is supplied to an institution after the lab's visit,
- help in identifying objects in need of more complete treatment, and preparation of condition reports;
- provision of information regarding sources of funding, supplies and expertise;
- measurement of temperature, relative humidity and light levels in storage and display areas and recommendations for improvements.

During its ten-week tour in the summer of 1979, the mobile lab visited 23 institutions, where a total of 304 artifacts were treated. In addition, as an evaluation later showed, the other services were heavily utilized.

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5. *Mobile lab conservators monitor environmental factors, such as light and humidity levels, within museums. Here, an interior setting at O'Dell House in Annapolis Royal, N.S.*
6. *Ann Krahn, CCI Conservator, Archaeology, examines a cast bronze figure in the mobile lab to determine whether or not corrosion is occurring. Prevention of the deterioration of artifacts is an important element in the work of conservators on the lab as they visit museums across the land.*
7. *Mobile laboratories under construction.*
8. *Five Mobile Conservation Laboratories visit museums across Canada, while one remains on call for emergencies.*
9. *One of the mobile labs travelling across the country.*
10. *Atlantic Region museums the mobile lab visited in the summer of 1979: (top to bottom) O'Dell House in Annapolis Royal, Cape Sable Historical Museum in Barrington, Desbrisay Museum in Bridgewater — all in Nova Scotia; and the Albert County Historical Society Museum in Hopewell Cape, New Brunswick.*

"It is our hope this may encourage more museums to employ conservators."

Photos by James Stark

Of especial value was the establishment of a direct contact between conservator and museum staff. This communication, through on-the-spot training lectures and slide shows for museum staffs, provides access to education and training services not normally available to many institutions. Most importantly, it goes some little way towards developing the kind of conservation support that museums most require: preventative conservation, and the ability to anticipate and eliminate potential damage.

Such was the success of the pilot project that permission was granted by NMC's Board of Trustees to purchase five more vehicles and to extend the service to all regions of Canada.

Conservation Internships

As part of NMC's long term initiative in conservation, the Museum Assistance Programmes have introduced a Conservation Internship Programme, which will provide a unique opportunity for junior conservators to experience two quite distinct types of training. At CCI headquarters in Ottawa, under the guidance of experienced conservators, the intern will gain knowledge of more lengthy and complex treatments. In addition, each intern will spend time on a Mobile Conservation Laboratory, gaining direct knowledge of regional conditions. Up to ten internships will be offered annually, and each may be renewed a second year.

Top:

CCI, in concert with National Museums of Canada's Training Assistance Programme, selected conservation-trained Canadians from all regions of the country to assist in its Mobile Conservation Laboratory service. They, along with other CCI conservators, will travel to museums throughout Canada to conduct on-site examinations and treatments of artifacts, monitor museum environments for light and humidity levels, give lectures and workshops for museum staff, advise on the storage, display and shipping of artifacts, as well as to help museums identify objects requiring more complete treatment in CCI's headquarter laboratories. Standing with Cliff McCawley, Assistant Director, Regional Services are: (back row, left to right) Valerie Thorp, Terry Charbonneau, Valerie Dorge, Sandra Lougheed, Margaret Meikle and Joy Pennick; (front row, left to right) Janice Antonacci, Debra Stewart, Susan Cross and Louise Fox.

Bottom:

Extreme left: *CCI conducts a workshop to give practical experience and guidance in good conservation techniques.*

Middle: *Eva Burnham, right, Chief of Textiles at CCI, instructs Margaret Meikle on textile conservation practices. Meikle participated in the apprenticeship programme at CCI before joining the mobile conservation lab team.*

Right: *CCI Technical Bulletins detail scientific and/or basic information relating to effective and sound preventive conservation measures, of use to curators and conservators. As well, CCI publishes an annual Journal addressing aspects of the conservation profession.*

One of the important, if less obvious aims of the programme is to bring together a number of elements which it is hoped may lead to an improvement in the conservation capacity of Canadian museums. While introducing curators — often for the first time — to the advantages of having conservators working in their museums, the programme also provides ten young conservators with a unique opportunity to gain experience that will make them especially valuable employees for Canadian museums. It is our hope this may encourage more museums to employ conservators: the one essential element that is missing from what is otherwise the most advanced, best integrated national conservation programme.

CCI Training and Information

Over the past few years, more and more museums have demanded consultations, publications, advice and training. While the need for repair and restoration remains undiminished, maturing museums wish more personal contact—more visits, more surveys, more publications which speak to their specific needs, and most of all, perhaps, more workshops and seminars.

In response to this demand, in June 1978, CCI established an energetic Training and Information Programme which has gained widespread acceptance by the museum community. This programme attempts to make conservation information, advice and expertise available to museums in a number of ways: regional workshops, symposia, seminars and lectures; internships and advanced level training; consultation and publications.

CCI staff work closely with museum, gallery and archive associations across the country in preparing and presenting workshops and seminars, usually in concert with the annual meetings of provincial museums associations. During the past year, CCI staff participated in training sessions for a wide variety of associations—including the Alberta Museums Association, the Association of Manitoba Museums, the Ontario Museums Association, la Société des musées québécois, the Ontario Association of Art Galleries, the Atlantic Provinces Art Gallery Association and the Canadian Library Association. At these sessions, use is made of a series of slide kits which are constantly being developed for training purposes. These range from overviews of CCI and conservation to more specific areas, such as textile and painting conservation.

Advanced level training is offered by CCI in the form of working internships—not to be confused with the Conservation Internship Programme already described. Here conservation students, conservators and conservation technicians employed in museums, galleries, libraries or archives are welcomed and encouraged to update their skills by working at the Institute under the guidance of experienced conservators. Interns must arrange their own funding and normally are expected to spend at least a six-month period of continuous training.

By hosting symposia, which bring together conservators and other specialized professionals from a particular field, CCI provides a forum at which many participants meet their colleagues for the first time. Such a forum also allows for immediate dissemination of information and expertise. For example, at an April 1979 CCI symposium, conservators from the United States, Europe and across Canada discussed the care and treatment of paper and books in cultural collections. This past July, the Institute held another symposium in Ottawa on "The Conservation of Furniture and Wooden Objects".

To supplement the training and information effort, a well-established series of Technical Bulletins will continue, detailing basic conservation, care and storage of collections, and scientific information of use to curators and conservators. As well, this fourth Journal is part of an annual series that presents articles by conservators and conservation scientists on various aspects of conservation and related topics for the curator. All CCI publications are free.

"Helping museums help themselves"

The newly created Regional Services Directorate—with its Mobile Conservation Laboratory service, accelerated publications programme and strengthened training and information organization—will go a long way towards providing the personal services so much desired by museums across the country. Together with the two traditional services, Conservation Research and Conservation Services, Regional Services will supplement, rather than reduce, CCI's service to Canadian museums.

In essence, Regional Services at CCI is seen as a very positive step towards "helping museums help themselves".

MOBILE LABS:
". . . a giant step forward by CCI"

As part of a pilot project, the Canadian Conservation Institute sent a Mobile Conservation Laboratory to the Yarmouth County Museum in Yarmouth, Nova Scotia during the summer of 1979. The lab visited 22 other institutions in the Atlantic Region as well. We asked Yarmouth curator Eric J. Ruff to give us his reaction and evaluation of the mobile lab's visit to his museum. Following are his comments.

Guest Editorial by Eric J. Ruff

While the Mobile Conservation Laboratory is not the answer to all the curator's conservation problems, it is a giant step forward for the Canadian Conservation Institute (CCI). It's a step which might help to diminish the loss incurred by the removal of the regional laboratories.

This curator's anger over the Moncton lab's closure was certainly softened by the visit September 1979 of the mobile lab. "How can we be of help?" were among the first words I heard from conservators Ralph Eames and Don Murchison. A short tour of their lab was followed by a more lengthy tour of the Yarmouth County Museum, my pride in our establishment diminishing as I showed them our "conservation problem areas". Ralph just rubbed his hands and said, "That's what we're here to help with!"

For three days, the laboratory remained parked in the museum driveway—three days filled with activity and long, long hours of work. What was accomplished? Well, readings were taken—temperature, relative humidity, light readings, ultra-violet levels; all were noted and commented upon. Our thermohygrographs were rejuvenated and calibrated. Discussions on these and other matters were held between the conservators, myself and Yarmouth County Museum trustees.

Paintings and artifacts were checked and a list of problems drawn up, along with a list of priorities for treatment: some of the priorities established earlier could not be accomplished due to limited time, space, equipment and the speciality of the conservators. Work then began on stretching canvasses, patching paintings, reframing an early Yarmouth sketch, reapplying paint to a polychrome sculpture as well as cleaning and restoring portions of several sextants and octants.

All the while, a great deal of dialogue was taking place—explanations of causes and effects of deterioration, reasons for types of treatments and suggestions for better conservation techniques. The three days proved to be an intensive learning seminar for this curator.

Photo by Fred A. Hatfield

Mutual Understanding

The learning experience was not all one sided. Over the past several years, conservation has been preached to the curator, but his problems have seemingly not reached conservators. When the curator is on his home ground, he can point out the difficulties caused by lack of funds, proper equipment or adequate storage space. He can show the conservator the real world of museums where, by necessity, the optimum climatic conditions cannot always be maintained. The curator can explain museum diplomacy, which requires a recently acquired artifact to be displayed even though it cries out for treatment. He can explain why small museums have to display their treasures even though conservation work should be done, and why paintings cannot always be taken down and stored flat until, perhaps years later, CCI has time to restore them.

This improved mutual understanding of each other's work can only lead to better relationships between museum staffs and those of CCI.

All of the above formed an important part of the Conservation lab's visit to Yarmouth. But what was best about the visit? The work accomplished! The lab allowed us to have many minor restorations done, restorations which are not major conservation problems. Given the large number of major restorations required by any museum, many smaller ones do not even get near the priority list, let alone on it, but they are problems nevertheless; problems which, if left unattended, would only increase in nature. These were the types of restorations carried out, items which normally would not be sent to CCI.

Lab "a success"

In conclusion, then, the lab's three-day stay was a tremendous help. As far as the Yarmouth County Museum is concerned, the Mobile Conservation Laboratory concept is a success.

But, Canadian Conservation Institute, don't rest on your laurels: all that is required now is to find the money to equip enough mobile labs to be able to visit each museum for at least three days twice a year—anything short of this will not be enough. You're on the right road though!

Above: *CCI Conservators Ralph Eames, left, and Don Murchison, middle, discuss treatment of a naval sculpture with Yarmouth County Museum Curator Eric J. Ruff.*

UNEARTHED COINS:
a pennyworth of history

by Charles Hett

In December 1979, workmen digging a trench for a power line on the south side of St. John's harbour in Newfoundland came across a human skeleton. As is usual when this happens, police and archaeologists were called in to determine the date and circumstances of the burial, by now considerably disturbed.

In this instance, two corroded copper alloy discs were found with some organic material still intact. Memorial University of Newfoundland's archaeologists, after examining these discs in their laboratory, were fairly certain that they were coins. They also found textile fragments on one side and what seemed to be eyelash remains on the other—evidence they had been placed on the dead person's eyes.

There is always a temptation to clean artifacts immediately upon excavation. This is particularly true of coins which may provide a date or country of origin for other materials within their archaeological context. Whilst cleaning might often help to provide this type of information rapidly, on occasion it destroys other important information with equal rapidity. The advantages of restraint on the part of the archaeologist in awaiting cleaning and of thorough non-destructive examination can be seen with the example of these coins.

Dating the coins

Shortly after excavation, the coins were sent to the Canadian Conservation Institute (CCI) in Ottawa for further examination.

As a first step, the discs were radiographed to try to establish a date of origin. Interpretation of the radiograph indicated that they were George III half pennies, one Irish and one English. Although no date could be read, the British coin originated between 1770 and 1775, while the Irish coin was of a type issued only in the years 1775, 1776, 1781 and 1782.

The adhering fibres were sampled and examined under a microscope. Indeed, each coin bore a row of human eyelashes on one side; from the almost intact arrangement of the hairs, it was discernable that the coins had been placed on closed eyelids and that the colour of the pigment granules in the eyelashes, observed under high power mignification, showed that the individual had been red-haired. Additional microscopic comparisons with eyebrow and eyelash hairs from black, brown, red and blond-haired persons confirmed these conclusions.

The cloth preserved on the opposite sides of the coins was identified as wool.

Wool shrouds

In looking at these coins, what can be made of the preserved organic remains? The wool on one side can be interpreted as the remains of a shroud: that it should be made of wool can be seen as a result of a 1666 British act of Parliament. This act stated that all persons should be buried in a shroud of wool rather than a linen shroud, as previously had been the case.

Previous page: *Coin as excavated (2x magnification), showing the lashes and textile remains. Photo taken in raking light to heighten details. Photo by Bob Higham.*

a. Diagram of obverse.

b. Diagram of reverse.

Both of the above are identifying marks for the type of coin.

c. Radiograph of coin. The photograph shows King George's head and the inscription. Both are easier to see from this angle. The crowned harp can be viewed in a sharper perspective if the page is turned upside down.

The purpose of this legislation was to increase the supply of linen available to the paper industry. The interests of wool merchants were probably also taken into account. Evasion of this act was frequent; it was amended in 1678 and 1680, adding a provision that a certificate must be given by a relative of the deceased in the form of an affidavit declaring that a woolen shroud had been used in the burial. The act was finally repealed in 1814.

Superstition and practicality

The custom of placing coins upon a dead person's eyes has been widespread in time and area. It was common in Roman Britain, and continued in Britain until a generation ago; it continues to this day in Ireland.

In antiquity, superstition may have played a part: a belief that money facilitated the departed soul's journey. Practical reasons for using coins also existed. Since it is seemly to have the deceased's eyes closed, coins weighed down the lids so that they would not open during *rigor mortis*.

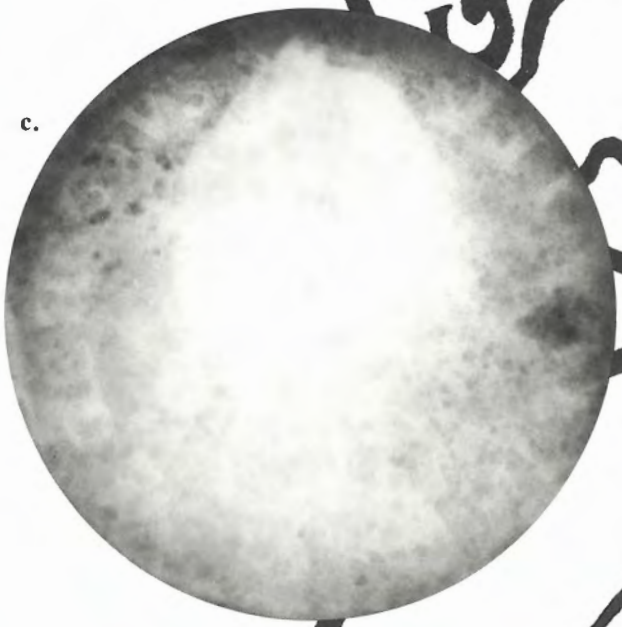
Copper salts and corrosion often inhibit biological activity enough to allow preservation of organic materials close to them in burial, exactly as happened in this example. In obtaining all the necessary information by non-destructive methods, it is possible to retain the physical integrity of a fragment, and therefore the story it tells. In this case, the coins portray an anonymous burial, with no marker remaining to say who it was that died in this port, far from his native land, a little over two hundred years ago.

Many disciplines involved

This case also illustrates that even in as straightforward an example of conservation work as this, several disciplines are involved: the curatorial, as well as the work of the archaeological, radiographic, chemical and biological sciences. On the basis of the contribution and requirements of these specialists, the conservator is in a position to determine the correct approach to examination and treatment.

a.

c.



b.

SCIENTIFIC ANALYSIS: *more to*

by Wilfred Bokman

When paintings arrive at the Canadian Conservation Institute in Ottawa, they are immediately examined, using a variety of scientific techniques, to assess their condition and to document the extent of any earlier restoration work. In the process, occasionally we obtain some exciting and entirely unexpected information. For example, we may discover an underlying painting completely different from the surface version; compositional changes made by the artist as he painted; or, on a few, changes commissioned by owners years after the artist's death.

Such detection adds considerably to knowledge of a painting's history. It also provides unique, unexpected interest for the museums or galleries involved, and their public.

At the same time, it provides the scientist an exciting challenge to extract as much information from a work of art as is possible.

As an illustration of just such routine examinations leading to unforeseen, fascinating results, "case histories" of three paintings follow.

"Portrait of a Lady" by Cranach the Elder*

In the early stages of restoration of the 16th Century panel painting, "Portrait of a Lady" by Lucas Cranach the Elder (1472-1553), conservators in CCI's Fine Arts Division observed that a large oval-shaped repair had been made in the vicinity of the proper ("as attached to the body") right arm (see Figure 1). One conservator, Patrick Legris, had previously examined photographs of other Cranach paintings and noted that the artist had painted a number of themes depicting a decapitated head on an oval-shaped silver platter, similar to "Salome with the Head of John the Baptist" (see Figure 2). The oval-shaped repair outline on the painting suggested to Legris the possibility of a substantial compositional change. He wondered if the original composition was similar to other of Cranach's themes. Could it be the "Lady" was originally holding a platter with a decapitated head? If so, its present composition is substantially different than that intended by Cranach.

As a result of Legris' observations and subsequent consultations with the Winnipeg Art Gallery, it was decided to perform more extensive scientific examinations of the painting to determine, if, in fact, a change had been made and, if so, the extent of any remaining original design.

Subsequent examinations, indeed, have shown conclusively that a compositional change had been made in the area shown in Figure 3. Quite probably, the "Lady" was originally holding a large oval-shaped platter, somewhat similar to the painting illustrated in Figure 2. Unfortunately, the original design of the platter had been almost completely removed, with the exception of a few remaining details. However, these traces do suggest that a decapitated head could well have been included on the platter. Further, pigments on the original areas of the painting are consistent with those known to have been used during Cranach's lifetime. All this information on the compositional change and pigment data contributes substantially towards the attribution of the work as an authentic Cranach painting.

How did we arrive at this conclusion? From results which came not from just any one examination technique alone, but rather by slowly piecing together information from several different sources. To show this process at work, it is interesting to examine the results from each technique.

X-Radiography

A radiograph is similar in nature to a medical or dental x-ray. In all radiographs of paintings, design features made up of heavy element pigments (containing such high atomic number elements as lead, tin and mercury; e.g., white lead, lead-tin yellow and vermilion) are the most pronounced or visible on film. These heavier elements strongly absorb x-rays; hence, a sharp image is produced on the film. In contrast, design features made up of light element pigments (such as ochres, organics and calcium) are relatively transparent to x-rays; hence, the radiographic image detail is considerably reduced.

In the composite radiograph of "Portrait of a Lady" (see Figure 4), one looks through the painting and the vertical and horizontal wooden slats of the cradle.

The following features can be observed:

a. The area surrounding and including the proper right arm is barely visible in contrast to the remainder of the painting. This indicates that different, lighter atomic number pigments have been used in this area.

b. The embroidery design on the sleeve near the left wrist continues *under* the fingers of the right hand, suggesting that the right hand is a later addition. Differences in details of the two hands are also evident.

c. The embroidery design on the proper right sleeve is absent from the shoulder down, as is the lower segment of the chain. Again, this is due to use of different pigments in the two arms and in the upper and lower portions of the chain.

*This Cranach painting is part of a collection held by the Winnipeg Art Gallery. "Portrait of a Lady" was donated to the museum by Lord and Lady Gort.

Figure 2 Right: *"Salome with the Head of John the Baptist" by Cranach the Elder. Bob Jones University Collection of Sacred Art, Greenville, South Carolina, USA.*

a painting than meets the eye

Electron Emission Radiography

The painting was examined next by electron emission radiography. In this technique, the image on the film is produced by electrons emitted from the pigments. It provides very detailed recording of the surface features and is also very sensitive to pigment differences. As in x-radiography, the higher atomic number pigments produce the strongest image. As shown in Figure 5, we observed the following:

a. In the waist area, a distinctly oval-shaped outline is visible extending up under the proper right shoulder, suggestive of a platter. The right arm and embroidery elements are less well defined due to differences in pigments.
b. The first finger of the left hand was straight rather than slightly bent, as depicted before treatment (see Figure 1). This suggests that originally the hand was supporting a platter.
c. Beyond the right elbow, no design elements are visible. This shows that the original pigments in this area (and also beneath the arm and waist) have been completely removed. It is significant to note that, had this area been merely overpainted or not so thoroughly removed, the original design elements would have shown through.

Ultraviolet Fluorescence Photography

At this point, other than an outline of an oval shape in the waist area, and a change in the proper left hand fingers, no original design features had been revealed by the x-radiography and electron emission examinations. Further, we had drawn a blank in the area of the painting to the left, just above and slightly below the proper right elbow.

Fold-Out

Figure 1: *Overall photograph after removal of facing tissue used to consolidate the painting in transit. Collection of the Winnipeg Art Gallery, donated by Lord and Lady Gort.*

Figure 3: *This outline, showing the altered area, is a composite tracing of Figures 5 and 6.*

Figure 4: *Composite overall radiograph before treatment. The panel was extended at the top and the right hand side, causing the composition to slide downward and across in the frame. Note also the fibrous material-probably flax-used by the artist as a reinforcement of the groundlayer.*

Figure 5: *Electron emission radiography, detail during treatment. The positive image is a contact print from the radiographic film.*

Figure 6: *Ultraviolet fluorescence colour photograph, detail during treatment after removal of the black overpaint. The paint design does support the theory that this could be another Cranach painting of a decapitated head on a platter, and might be detailed enough to facilitate further study.*

So to investigate further, the overpaint was carefully removed from the area surrounding the elbow, down to the original ground layer. This area was then examined by long wavelength ultraviolet photography, whereupon some of the original compositional features were finally revealed.

As shown in Figure 6, two fluorescent colours are visible—light blue and yellow. The light blue originates from the calcium carbonate in the ground. We believe that the yellow—which shows the design features—originates from the oils of the original paint media which have been deeply absorbed into the ground and therefore not completely removed. No pigments are left; if so, as discussed above, they would have been detected by electron emission.

A close examination of Figure 6 shows the following features:

a. The left hand side of the oval shape (or platter) is apparent just beyond the elbow. The oval ends abruptly at the edge, suggesting that the panel could have been shortened on this side.
b. An outline of a thumb is visible just above and to the left of the elbow. This indicates that originally the right hand was supporting a platter (similar to the left hand) and that the right arm was not originally in its present position.
c. Immediately above the elbow, some very faint design elements are visible which appear to be hair detail. If so, this would indicate that a head had been included on the platter in the original composition.

Although some of the original composition was found, unfortunately there was not enough left to reconstruct the design on the platter. Consequently, the Winnipeg Art Gallery decided to leave the painting's present composition.

Pigment analyses gives some answers

Some interesting information was obtained from the pigment analyses. The pigment lead-tin yellow (Type 1) was identified as the yellow pigment used on the original segment of the chain, the embroidery design on the dress and Cranach's monogram. Lead-tin yellow was used in European paintings exclusively between 1300 and 1750, and most frequently in the 15th to 17th Centuries.

As Cranach was active during the 16th Centry, the presence of lead-tin yellow places the painting in the correct period.

In contrast, the yellow used in the inpainted area is a mixture of zinc white (introduced in 1834) and chrome yellow (1818). Accordingly, the compositional change could have been made anytime after the first half of the 19th Century.

"A Conversation"

Unexpected findings are not confined to Master paintings of such an early period as "Portrait of a Lady". In October 1977, CCI was asked to advise on the painting "A Conversation", by Vanessa Bell. This important and comparatively recent work belonging to the Courtauld Institute of London was part of a loan exhibition touring major galleries across Canada and the United States. (See Figure 7). Due to a sagging canvas, a crack had developed and some paint loss had occurred. "A Conversation" was removed from exhibition and sent to the Institute.

Figure 7 Below: *"A Conversation", painted by Vanessa Bell in 1913. She painted the frame, as well, a popular concept with the Omega Workshop's artists. Collection of the Courtauld Institute, London.*

At first glance, the problem seemed to originate from a loose canvas, but further examinations revealed — literally — a possible "underlying" cause. Using the recently developed Infra Red Reflectography technique, in addition to X-radiography, we scanned the painting with a closed circuit television unit, employing an infra red sensitive vidicon. Indeed, the work had been overpainted quite extensively by the artist. One of the more dramatic modifications (shown in Figures 8 and 9) is the proper right hand of the figure on the right holding a cane which was later thinly overpainted.

Such observations are naturally of importance and interest to art historians engaged in a study of a certain school or artist, but they also point to an inherent weakness of the painting, from a conservation point of view. Some of the changes might have been carried out on freshly-dried paint layers; others, much later. This could possibly result in a stratification of layers, each drying at a different rate. As a result, the bonds between the earlier and later paint layers would be weakened, causing top layers to flake off easily if the canvas should become slack.

"Le Mariage mystique de sainte Catherine de Sienne"

The discovery of a double painting — a more recent painting over an older one — is a relatively rare occurrence. The information may be of unexpected value to the art historian.

Such was the case with the unattributed 17th Century painting, "Le Mariage mystique de sainte Catherine de Sienne" (see Figure 10) from le Musée d'art de Joliette in Québec. It was examined in preparation for an exhibition entitled, "Le musée d'art et la recherche scientifique" held at the museum in February and March, 1980. The exhibition was prepared by students from the Department of Art History at the University of Montréal, with scientific assistance from the Institute.

Upon close inspection, the painting exhibited a "craquelure" (pattern of cracks), which was overpainted and which did not seem to belong to the composition. An examination by x-radiography indicated an underlying painting with no resemblance to the present composition (see Figure 11). At present, art history students are studying the two paintings in an effort to reveal further information on the origins of each.

These three "case histories" have shown, I hope, the fascinating, and valuable, discoveries the curator/scientist may happen upon. Through scientific analyses, we can sometimes verify that, indeed, there is more to an artifact than meets the eye.

Page 29 and below:

Figures 8 and 9: *Composite print taken from the television screen (infrared reflectography)—Figure 8. This same detail is shown differently by x-radiography—Figure 9—due to the paint layers responding differently to that radiation. Observe the detailed brushwork.* ***Detail in painting below.***

For photos, see Fold-Out:

Figure 10: *Overall photograph of "Le Mariage mystique de sainte Catherine de Sienne": Musée d'art de Joliette, Joliette, P.Q. (Front page, Fold-out.)*

Figure 11: *Composite radiograph, depicting a half kneeling figure behind a praying stool and holding a cruxifix. A skull, symbolic of "memento mori", is visible in the right hand lower corner. (Back page, Fold-out.)*

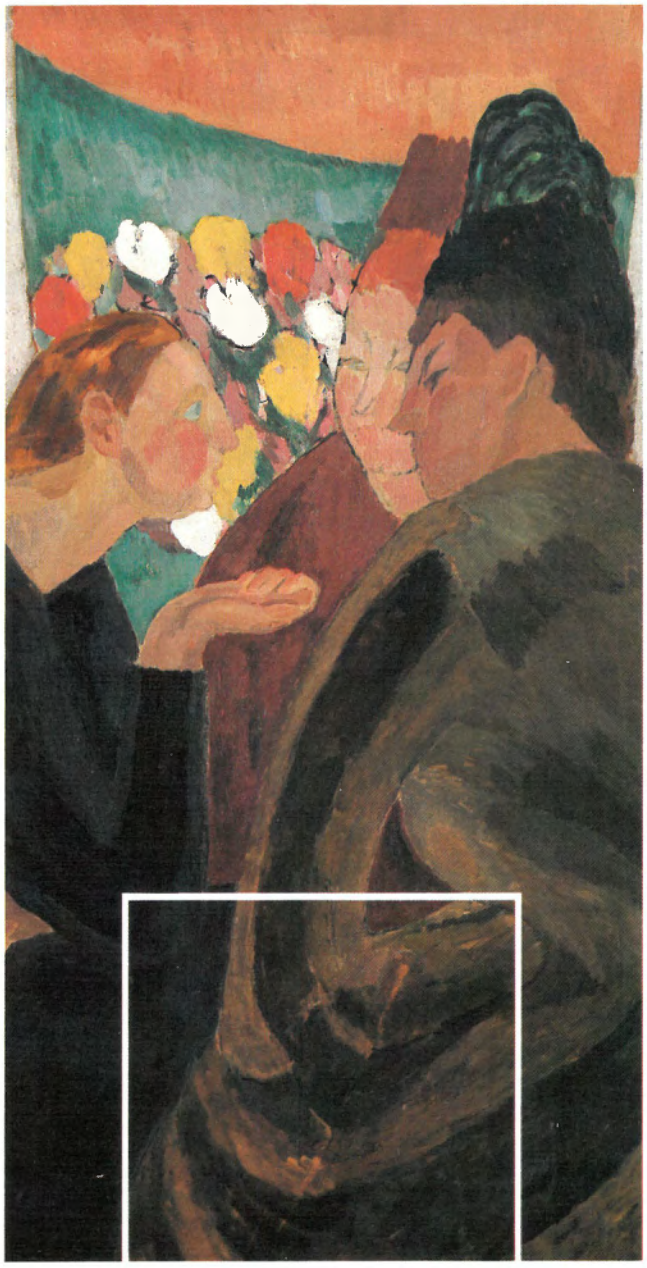


Figure 5

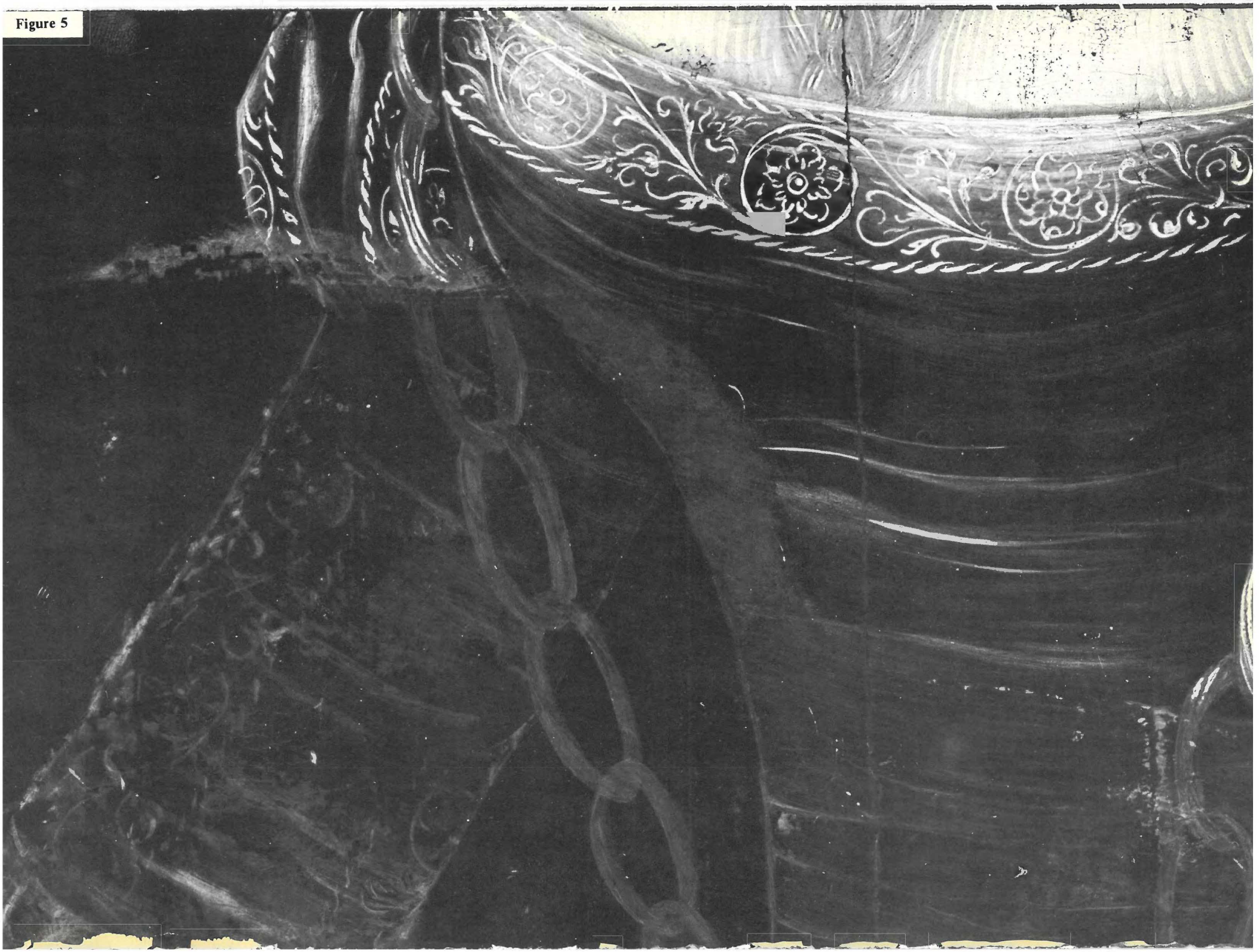


Figure 10

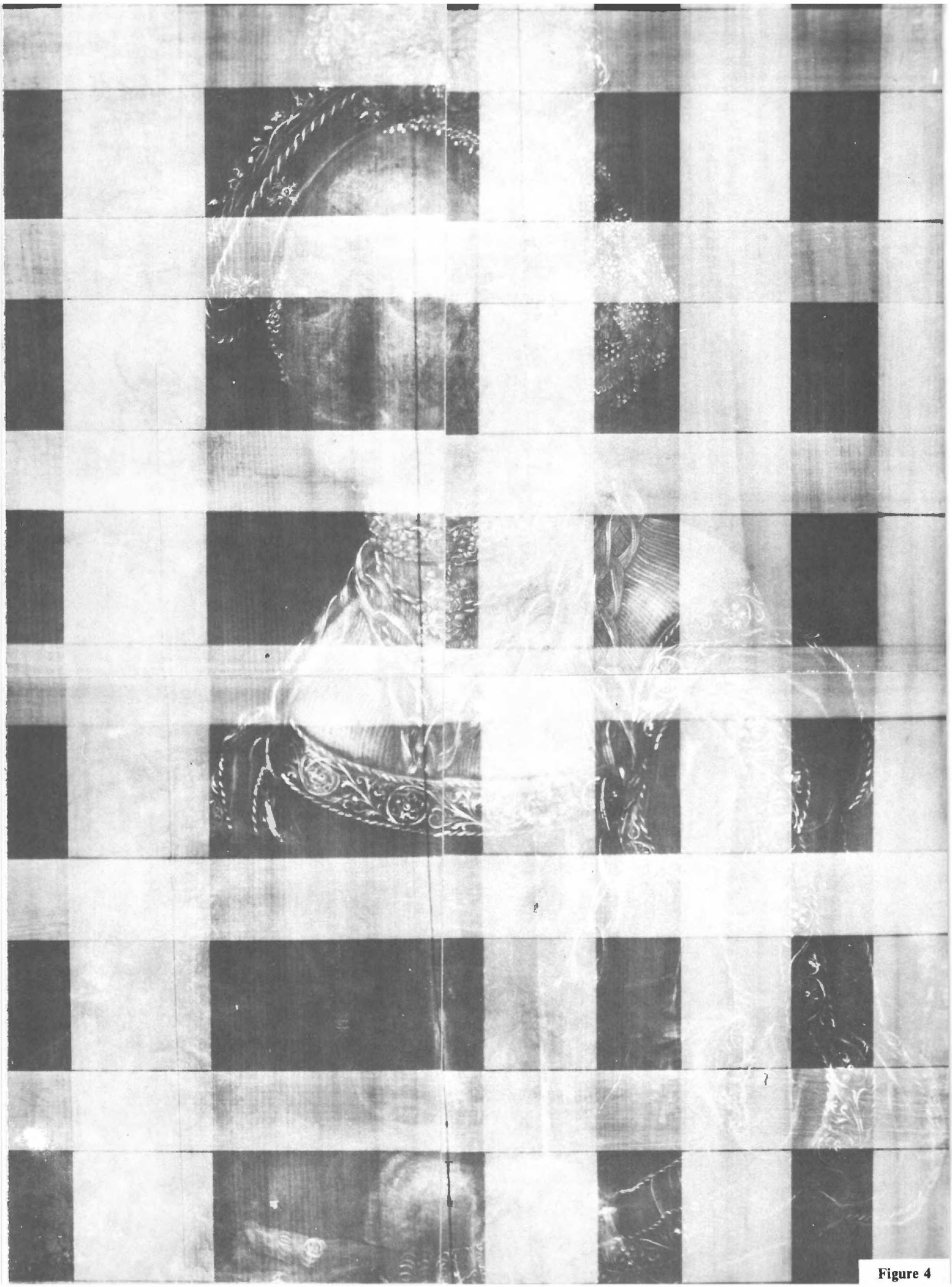


Figure 4

Figure 3

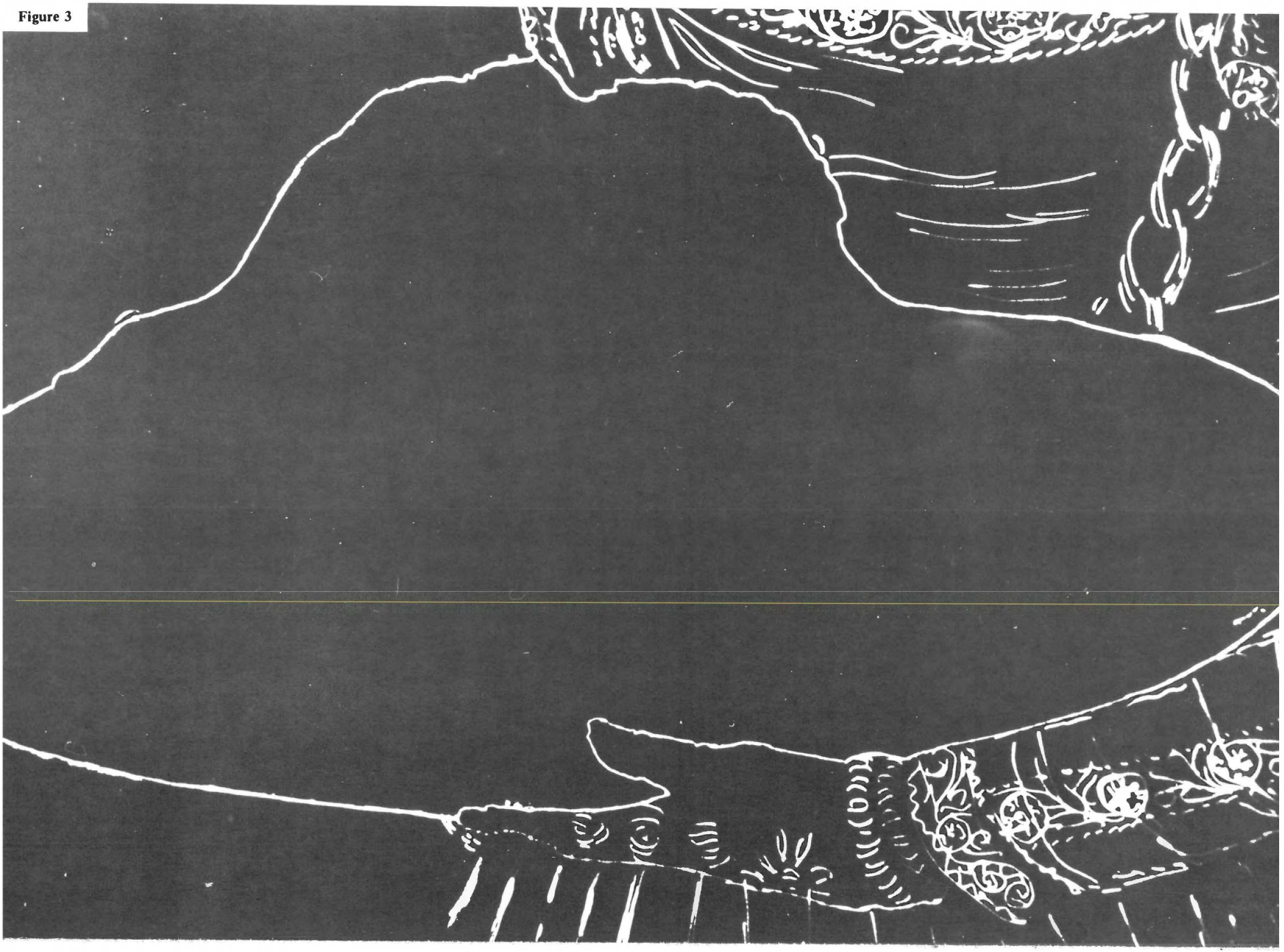


Figure 1

Figure 6

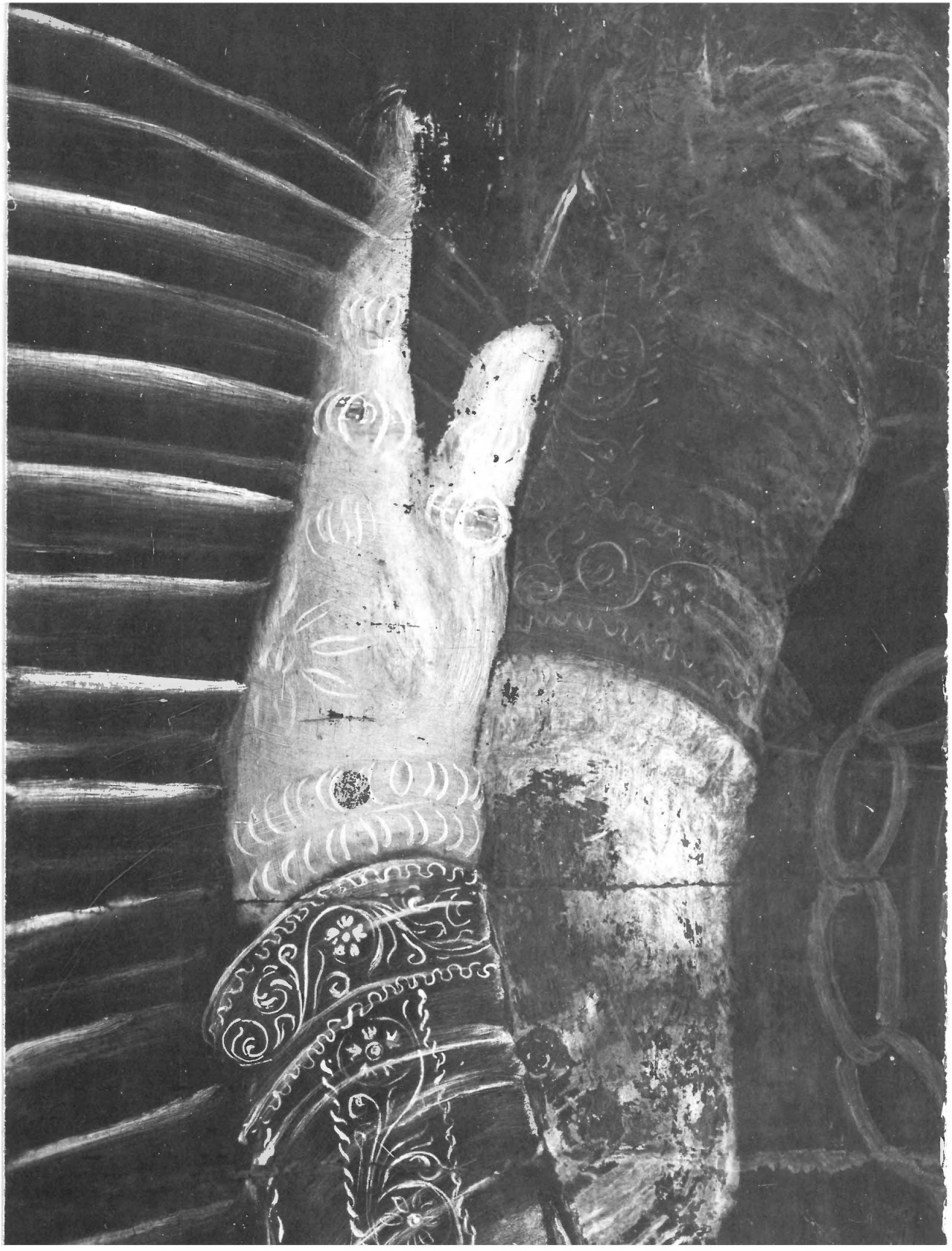


Figure 11

Figure 8

Figure 9

AUBUSSON TAPESTRY:
gift maps National Capital Region

by Sharon Little

On December 5, 1950, a beautiful Aubusson tapestry, woven by la Société Braquenié in France, was given to the people of Canada. His Excellency Hubert Guérin, French Ambassador, presented the tapestry to the then Canadian Prime Minister Louis S. St. Laurent in the House of Commons. It was a woven map of the 900-square-mile (1,448 sq. km.) National Capital District and surrounding countryside, its parkway system and tourist routes.

This gift was made "in recognition of the fact that Jacques Gréber, one of France's most emminent city planners, was retained by the Canadian government to direct the planning of the future development of the Dominion Capital."[1]

A description of the tapestry, written at the time, states:

> "The tapestry, eight feet wide and ten feet high, was made in Aubusson, famous since the middle ages as one of France's carpet and tapestry weaving centers. It was woven by the firm of Braquenié, founded in 1824 and still directed by descendants of the family. Four craftsmen worked on it for a period of nine months, weaving some 250 silk and wool colours into the intricate pattern. Canadian autumn shades predominate, and to enable the tapestry makers to dye their materials to the exact tints, a collection of leaves in their varied fall colouring was sent from Canada to Aubusson.
>
> "Bordering the map of the region are the coats of arms of the ten provinces and the arms of the Dominion, all woven in heraldic colours. The coats of arms are linked by a pattern of maple leaves, into which are woven the names of the provinces and of their principal cities. At the bottom, in French and English, appears the title 'NATIONAL CAPITAL REGION, map of the touristic parkways, and of the protected natural scenery, as proposed in the master plan.'
>
> "The original drawing, or 'cartoon' for the tapestry, as it is known in the craft, was executed in water colour at half full scale by Jacques Gréber during one of his visits to Ottawa to work on the completion of the master plan."[2]

Changes in the area since this time are depicted in the comparison of three figures: Figure 6, a map of the region in 1945;[3] Figure 7, the tapestry in 1949; and Figure 8, a map of the region in 1976.

Condition of the Tapestry

Due to environmental conditions, the Aubusson tapestry (see Figure 1) had become dusty and dirty over the years. An inadequate mounting device had caused distortion. Glue residues were present around the upper edge, from improper attachment of the supporting sleeve system. There were various soil marks: 12 dark spots on the bottom left-hand side; a dark line along the edge where the New Brunswick and Prince Edward Island crests were located; and another soil mark, 20.0 cm (8.0-in.) in length, near the Saskatchewan crest.

Hence in December 1977, the tapestry was brought for treatment to the Canadian Conservation Institute (CCI) by the National Capital Commission (NCC), which is responsible for assisting the development, conservation and improvement of the National Capital Region.

In preparation for treatment, a test was made of all the colours in the tapestry, including the yellow silk thread used in the borders and written inscriptions at the base of the tapestry. A few drops of orvus detergent and deionized water were placed onto the threads, then blotted out with chromatography paper. The yellow dye of the thread "bled" easily, or was extremely fugitive. Therefore, the yellow stains along the base of the tapestry resulted from just such fugitive "bleeding" at some previous time when, by accident, water damaged the tapestry.

The backing fabric (see Figure 2) of the tapestry was very dirty. The extent of the water damage was clearly visible from the remaining water stains at the base of the fabric. The fabric was in a fragile condition, as evidenced by areas of fibre weakness along the hemlines, and four tears from the fractured warp ends (threads) of the upper left corner. (Length of tears: 2.5, 7.0, 16.5 and 22.0 cm; or 1.0, 2.8, 6.6 and 8.8-in.)

The backing fabric also did not offer full protection to the tapestry, as it was between 13.0 and 18.0 cm (5.2 and 7.2-in.) shorter than the tapestry itself. This was due mainly to the construction of the supporting sleeve system, which rose above the top edge of the tapestry. This system consisted of three bands of woven bast fibre onto which three cotton bands were glued to the exposed surface of the sleeve, most likely for aesthetic purposes. The sleeve was then stitched to the tapestry with a machine-stitched line of linen thread along the top outermost border, and a hand-basted line of cotton thread along the top edge of the crest border.

Photo by Bob Higham

Figure 7: *Proper side of tapestry after conservation treatment.*

Figure 8: *"MAP OF NATIONAL CAPITAL REGION", CANADA 1976. Produced and printed by the Surveys and Mapping Branch, Department of Energy, Mines and Resources.*

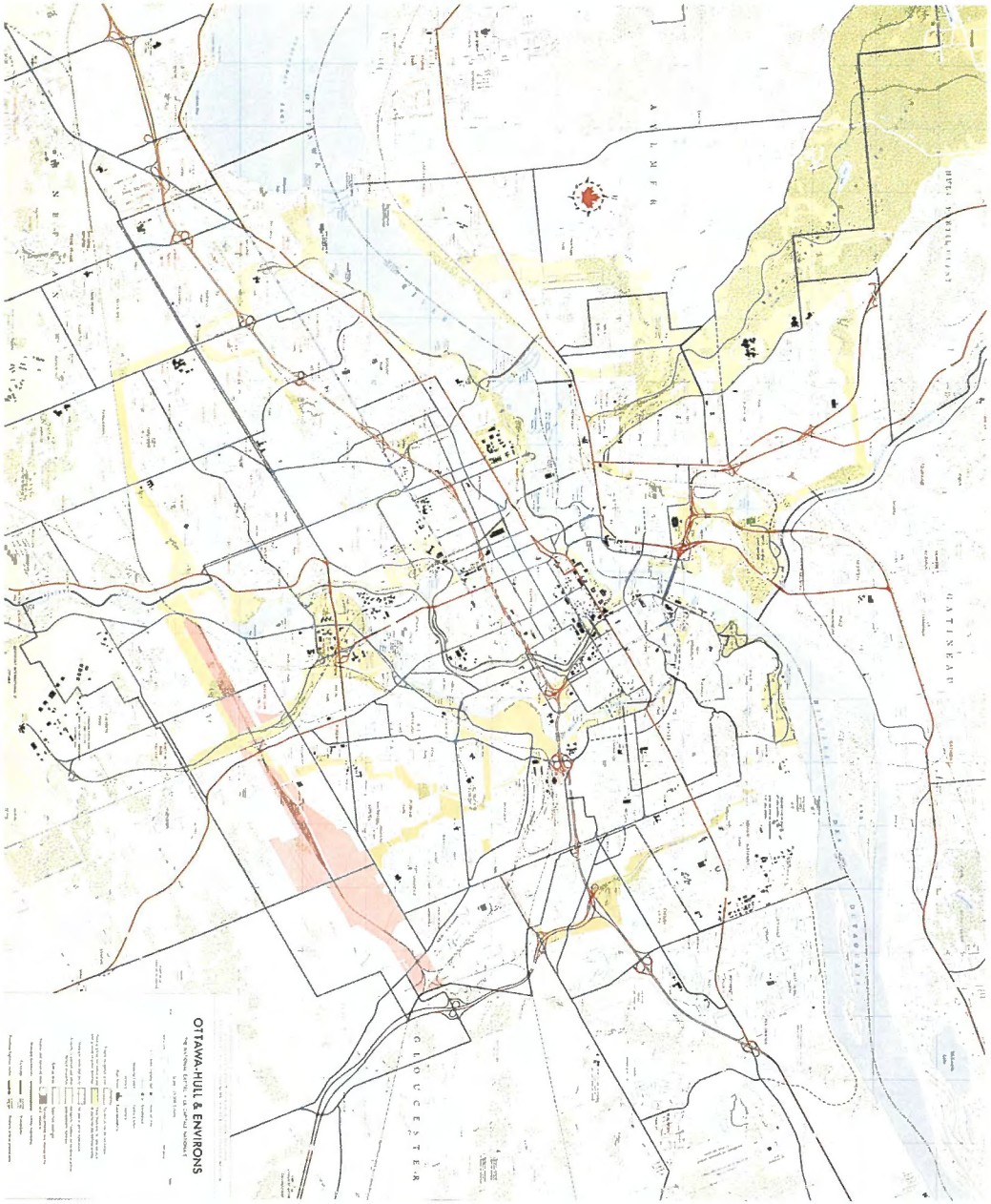


Figure 6: *"URBAN AREA OF THE NATIONAL CAPITAL REGION IN 1945" (Gréber: 1950).*

Photos above and opposite page by Bob Higham

Figure 1: *Proper side of tapestry before conservation treatment.*

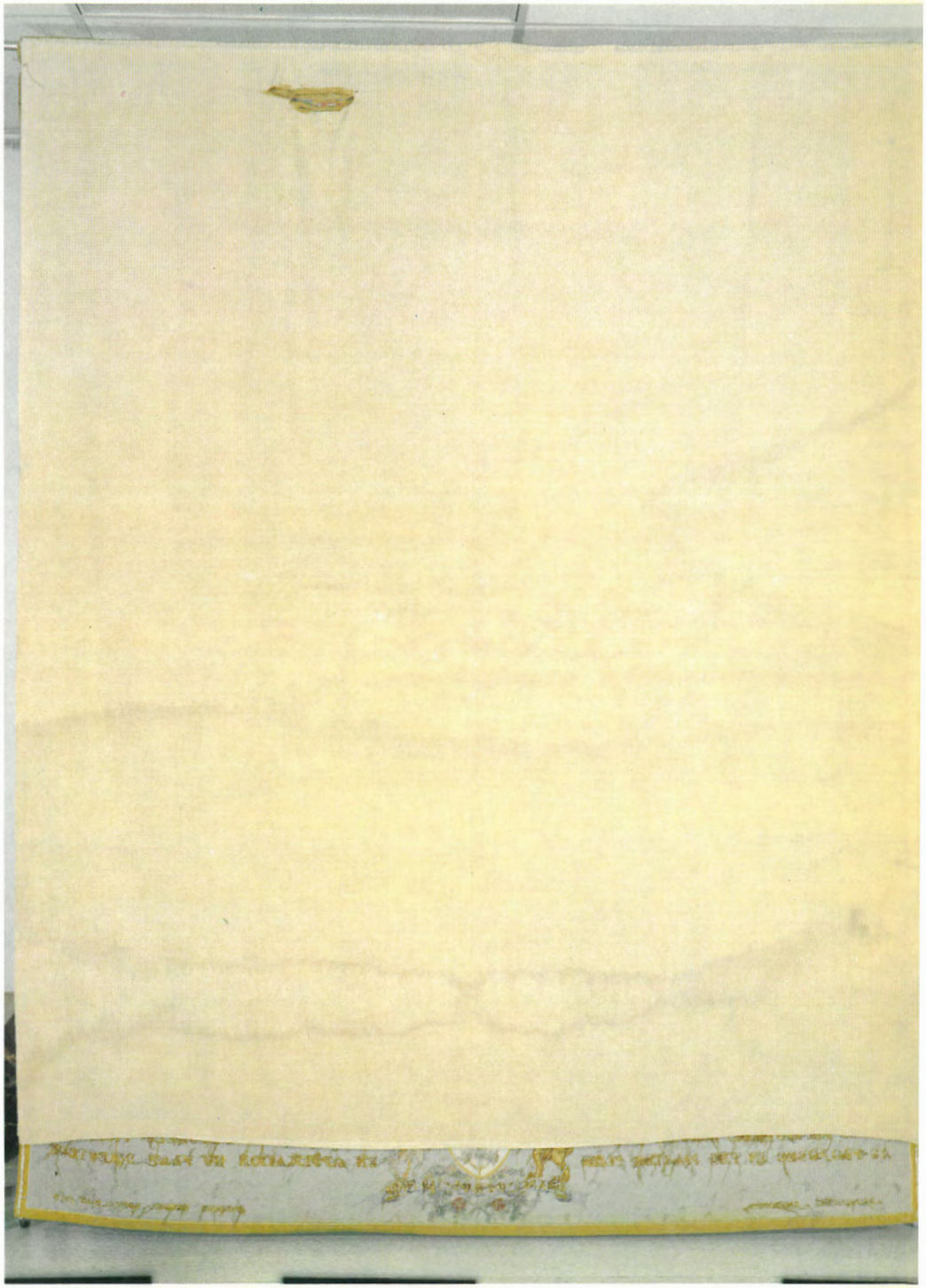


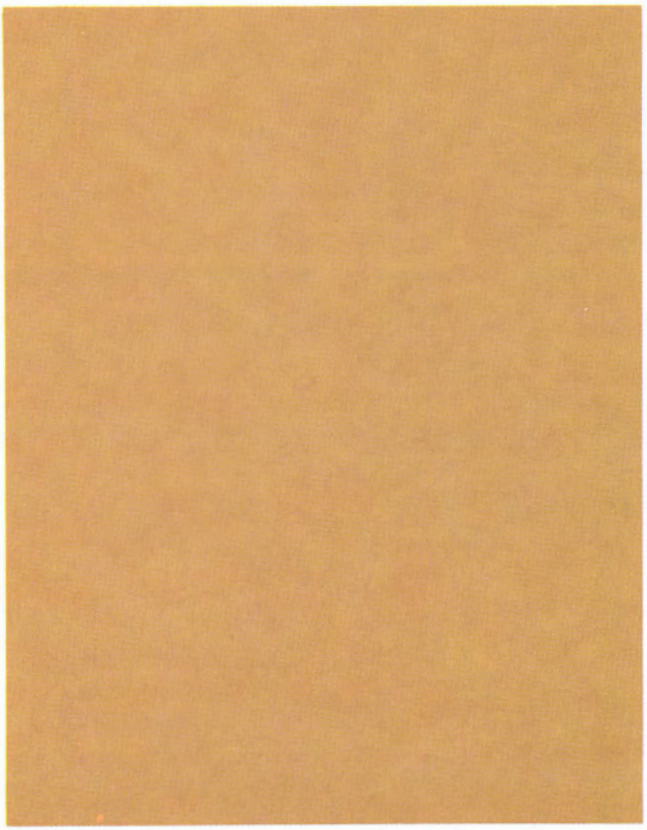
Figure 2: *Reverse side of tapestry before conservation treatment.*

3.

4.

5.

9.



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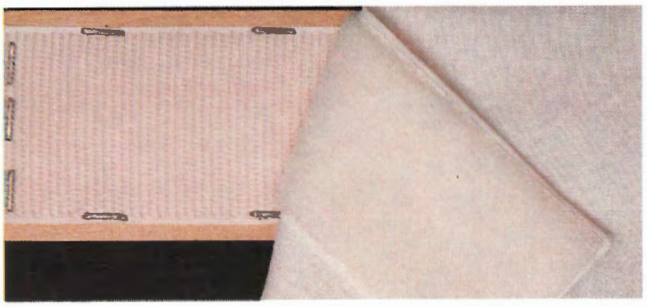


Photos by James Stark and Bob Higham

Figure 3: *Conservators blocking out the tapestry.*
Figure 4: *Sharon Little researches tapestry's history.*
Figure 5: *Air drying with hair dryers and fans.*

Figure 9: *Reverse side of tapestry after treatment.*
Figure 10: *Example of Velcro support system.*

Treatment of the Tapestry

The treatment of the tapestry involved four major stages: removal of the lining and preparation of the tapestry for cleaning; cleaning and blocking out of the tapestry; fabrication and application of a new lining; and finally, attachment of a new mounting (support) system.

First, the lining and its sleeve were unstitched. This was difficult, as excess glue had adhered to areas of the lining—mainly those along the upper edge—to the tapestry. Some of this was easily removed mechanically with a small metal spatula, but the remainder had become embedded into the fibres of the tapestry. However, water used in the washing process would swell the glue and allow easier removal.

Final preparation before cleaning involved vacuuming both sides of the tapestry to remove loose dirt and dust.

The washing process then began by soaking the tapestry in tap water for approximately one hour.[4] This allowed complete saturation of the fibres and soil particles by the detergent solution, thereby ensuring a more thorough cleansing later. During this soaking period, the tapestry was agitated by hand to facilitate the movement of dirt and fugitive dye from the silk thread into the water solution.

Following soaking, the tapestry was given three baths in solutions of tap water and a neutral synthetic detergent, which does not react with salts in the water to form a scum. Between the first and second baths, excess water was drained off and the detergent foam massaged by hand (and by sponges, for an equalized pressure) into both sides of the tapestry. This ensured full saturation of the tapestry.

After the detergent baths, the tapestry was rinsed several times in tap water, then in a final rinse of distilled water. Excess water was removed by rolling the tapestry in white cotton terry towels. (100% cotton is preferred, as it is most absorbant.)

The tapestry was then blocked out on soft board that had been measured off in 5 cm (2-in.) squares and covered with heavy transparent plastic. Sturdy stainless steel T-bar pins—of good quality, to prevent rust stains during the drying process—held the tapestry in position.

Due to previous distortion, in combination with the natural relaxation of the fibres during washing, a considerable amount of physical effort was required during the blocking (see Figure 3) to speed up the drying process and therefore prevent the development of mold growth and bleeding of the fugitive yellow dye. Hair dryers and fans were rotated about the tapestry (to avoid hot spots) until the tapestry was uniformly dry (see Figure 5).

Lining and mounting system

A lining affords great protection to the reverse side of a tapestry (see Figure 9). The same lining may act as a device for the attachment of a mounting system while preventing distortion when the lining is stitched to the vertical sides of the tapestry.

A light green-beige coloured lining fabric was chosen, for aesthetic reasons, to blend with the colours of the tapestry. Physically, the fabric was strong while light in weight. The natural fibre content (100% cotton) would create a "breathing barrier" between the tapestry and a wall, yet reduce the static attraction of dust—two important factors not found with synthetic fabrics.

The lining fabric was washed and rolled out on a smooth table to air-dry without wrinkles or creases. The narrow width of the fabric required that two selvages—outer edges finished so as to prevent ravelling—be machine-stitched together.

The lining was then stitched to the top of the tapestry with a strong 100% dye-fast cotton tread. For greater support of the tapestry when mounted, a 5 cm (2-in.) hem was turned under, across the top. The two vertical edges of the lining were stitched to the tapestry, leaving a 2.5 cm (1-in.) hem. To facilitate proper draping of both the lining and the tapestry, a triple (15.25 cm or 6.0-in.) hem was stitched across the lining's bottom edge, but not attached to the tapestry.

A 5 cm (2-in.) width of black looped Velcro was stitched with cotton thread along the lining's top edge. Hooked Velcro was then stapled (again, stainless steel staples to prevent rusting) to a Verathane-painted board measuring 5.0 cm in width, 1.3 cm in thickness and 244.0 cm in length (2.0 × 0.5 × 97.6-in.). The board was then screwed to a wall, and the looped Velcro on the lining pressed to the hooked Velcro on the board. (See Figure 10.)

This type of mounting allows equalized support to the full width of the tapestry, as well as an approximate 5.0 cm (2.0-in.) leeway for adjustments in height or even draping. For observation purposes, the tapestry hung for approximately a week to ensure that the lining was not hindering the proper draping of the tapestry.

After receiving conservation treatment, the tapestry was returned to the National Capital Commission. It hung within NCC's Visitors Reception Centre in the Rideau Club in Ottawa—a testament to the many changes that had occurred over the years in the region.

Then on October 23, 1979, the unthinkable happened: the Rideau Club was gutted by fire and the tapestry destroyed along with it. Yet those areas of its map that have become a part of our daily landscape still remind us of the thoughtfulness behind the gift.

Acknowledgements

During the early months of 1978, the Aubusson tapestry received conservation treatment in CCI's textile laboratory.

The author wishes to thank Ms. M. René de Cotret, Secretary to the Advisory Committee on Arts, NCC, for providing the historical information; and Mr. Dan MacKay, Head, Historical Geography Unit, Department of Energy, Mines and Resources, for providing the maps of the National Capital Commission.

References

[1] Anonymous, France Presents Canada with Valuable Aubusson Tapestry of Map of National Region Showing Parkways and Tourist Routes (Ottawa, Ontario: National Capital Planning Committee, 1950).

[2] Ibid.

[3] Gréber, Jacques, Plan for the National Capital, General Report (Ottawa, Ontario: Edmond Cloutier, 1950).

[4] In this instance, a stainless steel sink (measuring 1.75 × 3 metres or 5.74 × 9.84 feet) was used. This sink was custom made for CCI's Textile Laboratory. Alternatively, one could have a sink constructed of poly-vinyl chloride (P.V.C.).

NATURAL FREEZE-DRYING: *saving*

by J.C. McCawley and D.W. Grattan

One hot afternoon in early July 1978, a telephone call was received at the Canadian Conservation Institute (CCI) in Ottawa. The caller, a Madame Hélène L'Écuyer, was seeking advice about the remains of a waterlogged dugout canoe found in a sandbank fronting her cottage property on Lac à la Truite near Gracefield, Québec. Madame L'Écuyer, who was concerned for the safety of the canoe, sought assistance in the pages of the telephone directory. Eventually, she reached CCI.

It is generally accepted that all archaeological finds must be reported to the appropriate authority, and thus we contacted the Ministère des Affaires culturelles, of the Québec provincial government. Of first concern was the safety of the canoe; a team of conservation scientists and conservators negotiated the dirt roads of the Gatineau to secure the canoe underwater until more positive steps could be taken.

A few days later, the CCI team, now strengthened by Charles Martijn and two other archaeologists from the Direction de l'archéologie et de l'ethnologie in Québec City, revisited the site to make a survey and transport the canoe back to the CCI in Ottawa. With wood fragments that might have been part of the original structure, the canoe was wrapped first in several layers of wet towelling and then in a thick cocoon of "bubble pack". This would protect it from vibration damage during transport.

If wood, which has become waterlogged during burial or immersion, is allowed to dry out without treatment, it can shrink, crack, twist or suffer other deformities.[1] Therefore, the canoe had to be kept wet until treated, in order to prevent likely damage to a potentially important artifact, and until a decision could be made as to its future. To achieve this, it was immersed in water in a polyethylene-lined, coffin-like wooden box.

The Conservation Processes Research Division of CCI was, at that time, investigating the use of natural freeze-drying for the conservation of waterlogged wood. The main thrust of the research was to find a technique suitable for treating large timbers for which few practical methods are available.

Freeze-drying and sublimation

In the freeze-drying process, water in the wood is frozen and then removed as a vapour without changing into the intermediate liquid state. It is the movement of liquid during the drying process that damages an already weakened internal structure. By keeping the wood frozen during drying, not only is structural integrity maintained, but there is no liquid water present to cause this type of damage. This phenomenon is known as sublimation.

time, money and a waterlogged canoe

Freeze-drying is used extensively in the food-processing industry and normally requires the use of freezing chambers, vacuum systems and other sophisticated equipment. Obviously, equipment of sufficient volume to accommodate large timbers would be extremely costly.

However, freeze-drying can be achieved without the use of expensive equipment, simply by allowing the temperature of the frozen wood to rise above that of the surrounding air by one or two degrees. The conditions necessary to achieve this are found in the winter climate of many parts of Canada: temperatures that stay below zero for several months keep the wood frozen; many hours of bright sunshine per day warms the wood; a low humidity allows an efficient drying atmosphere for the wood; and finally, wind helps remove water vapour from around the wood. Natural freeze-drying is often seen in action when snow banks begin to disappear during periods of cold and sunny weather, without any sign of melting taking place.

Previous winter experiments[2] into this method had proved quite successful and, after discussions with Charles Martijn and CCI conservators, it was decided to treat the canoe over the approaching winter months using natural freeze-drying. This, if successful, would save considerable cost and time, and was thought worth the slight risk involved.

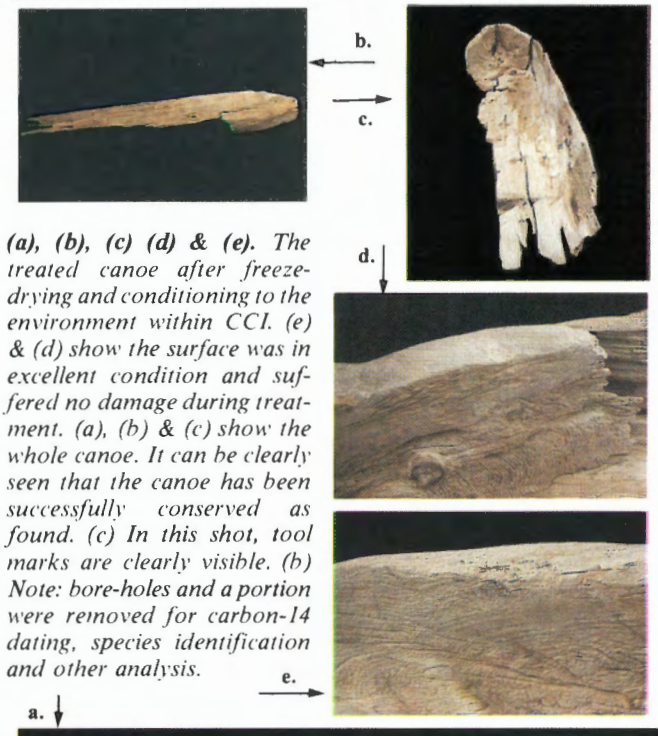
"Bubble packs" and a roof-top shelter

The treatment began. For two months, the canoe (approximate dimensions 9′ × 2′ or 3 × 0.6 meters) lay safely in its tank of continuously circulating, filtered water. To reduce evaporation and formation of surface bacteria, a "bubble pack" cover floated on the water surface; this, in turn, was covered with a layer of aluminum foil to keep out light and halt the growth of algae.

Earlier work on vacuum-freeze-drying[3] suggested that the best results were obtained if some of the water in the wood was first exchanged for the synthetic organic polymer, polyethylene glycol 400 (PEG 400), and this has since been shown to be equally valid for natural freeze-drying.[4] Polyethylene glycol seems to help the freeze-drying process in a number of ways. It maintains the wood in an expanded state after drying, preventing post-dry cracking and keeping the wood in a flexible state. It also appears to have the ability to prevent damage from ice crystals during the freezing process.

It was decided to follow this procedure with the canoe by soaking it in a bath of PEG 400 15% w/w[5] for three months. Before this was done, sampling showed the wood to be relatively sound with a quite degraded and soft surface. (The more degraded the wood, the greater damage to the wood on air-drying.) The species was white pine. A 20g portion was also removed at this

The treated canoe:



(a), (b), (c) (d) & (e). *The treated canoe after freeze-drying and conditioning to the environment within CCI. (e) & (d) show the surface was in excellent condition and suffered no damage during treatment. (a), (b) & (c) show the whole canoe. It can be clearly seen that the canoe has been successfully conserved as found. (c) In this shot, tool marks are clearly visible. (b) Note: bore-holes and a portion were removed for carbon-14 dating, species identification and other analysis.*

Previous page: *A dugout canoe, found resting on the sandy bottom of Lac à la Truite in July 1978. Mary Peever, CCI Conservator, holds a colour scale at the far end of the canoe, mostly sunken, indicating its waterlogged condition. The bow (?) is partly out of the water, its wood surface covered by a layer of algae and showing some surface damage from wetting-and-drying cycles.*

Right Top: *Having been immersed in an aqueous PEG 400 solution for three months, impregnation was complete. Pre-frozen in powdered carbon dioxide at –78° C and in a protective wrapping of several layers of bubble pack, the canoe was transported one cold December afternoon to a specially designed shelter.*

Right Bottom: *Freeze-drying shelter on CCI's roof in Ottawa, in which the canoe spent three winter months in 1978-79. The shelter, about three times longer than the canoe, ensured good protection from the elements. Its open ends and side louvres, which could be opened, allowed good air circulation. The louvres were closed in bad weather.*

Extreme Right: *The canoe inside the freeze-drying shelter. CCI Scientist Cliff Cook is installing the canoe within the wide-meshed net which was suspended from a load-transducer by means of a wooden beam and a block and tackle. This allowed good air circulation all around the canoe, and enabled weight measurements to be made easily.*

stage for radiocarbon dating, since the presence of PEG would affect the accuracy of the measurement.

Following the PEG impregnation, the canoe—wrapped in a polyethylene sheet—was removed from the tank and placed in a box lined with "bubble pack". Powdered solid carbon dioxide, at a temperature of –78° C, was then packed around the canoe, which was allowed to freeze overnight. On the following day—December 26, 1978—it was transported carefully to the roof of the CCI building, where it was to remain throughout the winter.

The canoe was wrapped in a wide mesh net and suspended inside a specially built shelter to protect it from snow and freezing rain. The shelter was 18′ (6 metres) long, 4′ (1.2 metres) wide at the base, and 6′ (2 metres) high. The walls were hinged, transparent, louvred panels, which could be open or shut according to weather conditions.

To monitor the progress of the treatment, accurate weight measurements were frequently taken, something quite difficult to attain in cold weather. Loss of water progressed steadily for 66 days until March 3, 1979, when the daily maximum temperature began to rise above freezing and the relative humidity became very high. The canoe was brought inside on this date, by which time it had lost 34% of its water. The results of this and more comprehensive studies show that complete drying is unnecessary. The removal of the first 30-60% of the water or ice leaves an object in a stable condition. During loss of the remaining water, in the laboratory, the object does not change in appearance or dimensions to any significant degree. It continued its drying at a relative humidity of 55% and temperature of 20° C. The canoe reached an equilibrium with its environment in mid-May 1979, when it weighed 23.7 kg (52.3 lbs.) compared to its initial 54.3 kg (119.7 lbs.) in the wet state.

Less time, less cost, more preservation

The canoe is now in storage in Québec City, awaiting a decision as to where and how it should be displayed. Members of the "Direction de l'archéologie et de l'ethnologie" are now able to have freedom of access to the canoe to aid them in their research into the occurrence of dug-out canoes in that area of Canada.

The finished canoe had a very pleasant light colour and suffered no cracking, checking or shrinkage, whereas if it had been simply allowed to dry-out naturally, it is quite certain that wide cracks and much unsightly surface checking and shrinkage would have appeared. Indeed, it might even have been unrecognizable as an artifact; a unique and irreplaceable object could have been lost.

This conservation treatment took one third the time of the conventional slow impregnation method,[6] at a fraction of the cost. Since all of the equipment used may be purchased at any lumber or hardware store, and since the PEG 400 impregnant is a cheap and readily available chemical produced in large quantities for the cosmetics industry, this method could be readily and rapidly established at nearly any location in Canada. (Union Carbide will ship orders of the chemical across country[7].) Not only would it be an ideal way of coping with a difficult archaeological wet site, but, more importantly, it makes possible the preservation of much valuable archaeological material for the future. Previously there had been no method and little hope.

For a discussion of the scope and limitations of this method, please see Reference 4.

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[5]PEG can be a waxy solid or a viscous liquid, depending on the grade. PEG 400 is an oily liquid.

[6]This consists of the slow replacement of waterlogging water with PEG-540 blend (a grade of polyethylene glycol which is a soft, creamy solid). The object is immersed in a solution of gradually-increasing strength and temperature over a period of two years. It then needs a further period of conditioning outside the tank.

[7]For locations west of Ontario, Union Carbide agents are Harrison and Crossfield in Vancouver, B.C. Call Mr. Vic Perrer at 604-525-8411. For locations east of Québec, Harrison and Crossfield are situated in Dartmouth, Nova Scotia. Québec and Ontario are serviced through the Montreal office. Contact Richard Benoit, Union Carbide 10-555, Metropolitan East, Montreal, Québec, H1P 1A1. As of March 1980, Union Carbide priced the PEG 400 chemical at 69¢ per pound for a 400-lb. drum.

RED BAY:
unique site tells of Basque whaling

by Robson Senior

Forty wooden beads, seven glass beads, a few fragments of wood, a piece of thread wrapped in silver foil: these are all that remain of one of the first rosaries ever brought to Canada.

The rosary — along with a crossbow fragment and a debased silver coin — is one of the more interesting objects among the thousands of red roof tile fragments, nails and spikes being unearthed by archaeologists on the shore of Saddle Island, in the mouth of the harbour of Red Bay, Labrador. Indiscriminate searches in the area might have bypassed the delicate object; it could have been lost forever. But to the trained archaeologist, such a find is the reward for long hours of patient excavation.

And that's exactly what Canadian archaeologists have been doing since 1977: patiently excavating, over months and years, the extremely important area of Red Bay. It has been a collaboration of many disciplines and many groups: archaeologists from the Parks Canada Marine Archaeology Section, staff and students from the Memorial University of Newfoundland (MUN) anthropology department, historians, conservators, biologists and many others.

Red Bay is considered an important archaeological site for Canada precisely because it affords a rich glimpse of this country's past involvement in the whaling industry and the Basques who brought it here.

Basque whalers use Labrador's coast

In the past, the rugged southern coast of Labrador, with its seemingly countless bays and inlets, has been inhabited by many different peoples, who came to take advantage of the bountiful wildlife in and around the Strait of Belle Isle. Seal, caribou and salmon provided food and clothing for Indians and Eskimos for almost nine thousand years. Even today, small scattered communities along the coast depend on fishing for their livelihood.

However, today the main interest is in the four-hundred-year-old objects left by Basque whalers from northern Spain. Sixty years before Samuel de Champlain made his historic voyage up the St. Lawrence River, Basques were crossing the stormy North Atlantic. They came to Terranova (the "new found land"), to hunt for large herds of whales reportedly sighted by earlier European explorers. The lucrative profits obtained from whale oil more than compensated for the risks and hardships faced by these early entrepreneurs.

The long tradition of Basque whaling began approximately one thousand years ago along the Bay of Biscay. Historians consider the Basques to have been the first to develop whaling into an industry, using extracted oil as an important trade item.

They hunted the Right Whale, whose migrations brought it close to the shore of the Bay of Biscay. Right Whales were so named by whalers because they are slow swimmers and were fairly easily overtaken by the whalers in their small shallops. Also, they floated when killed, unlike most other whales, which sink unless inflated with air. In other words, they were the "right" whales to pursue.

Approaching one of these huge whales—up to 60 feet long—in order to attack it with a small harpoon, fastened to a shallop with a long length of rope, must have made the heart of even the most seasoned hunter pound. After the whale was harpooned, it often towed the boat many hours before tiring. Hunters sometimes found themselves far from shore before they were able to kill the whale with repeated thrusts from sharp lances.

These hardy men were not always the victors; they sometimes lost their lives trying to land the stricken beast. Documents relating to the history of whaling contain numerous illustrations of the dangers of approaching a whale during its death throes.

With a dead whale in tow, the men rowed back to shore. The whale's carcass was stripped of its blubber and rendered into oil by boiling it in large cauldrons. Then stored in wooden casks, the oil would be sold locally or exported to other European markets.

From whaling to shipbuilding

At about the same time as the early explorers' reports of Terranova, the right whale became a less frequent sight in the Bay of Biscay, forcing the Basques to look further afield. By the 1540's, Basques were exploiting large herds of whales in the waters off Terranova; by the 1570's, they were sending out 20-30 ships a year. Whale oil became the third leading Basque export behind iron and wool.

The decline of Basque prosperity in the whaling industry began during the 1580's, when more and more of the ships destined for Terranova were pressed into service by the Spanish monarch, Philip II, for naval warfare. In the defeat of the Spanish Armada in 1588, many of these ships and large amounts of invested capital were lost. By the 17th century, few ships were sent overseas and the Basque whaling monopoly was seriously threatened by the Dutch and British.

The presence of the Basques on the eastern coast of Canada during the 16th century is acknowledged in most Canadian history books. The Basques are usually

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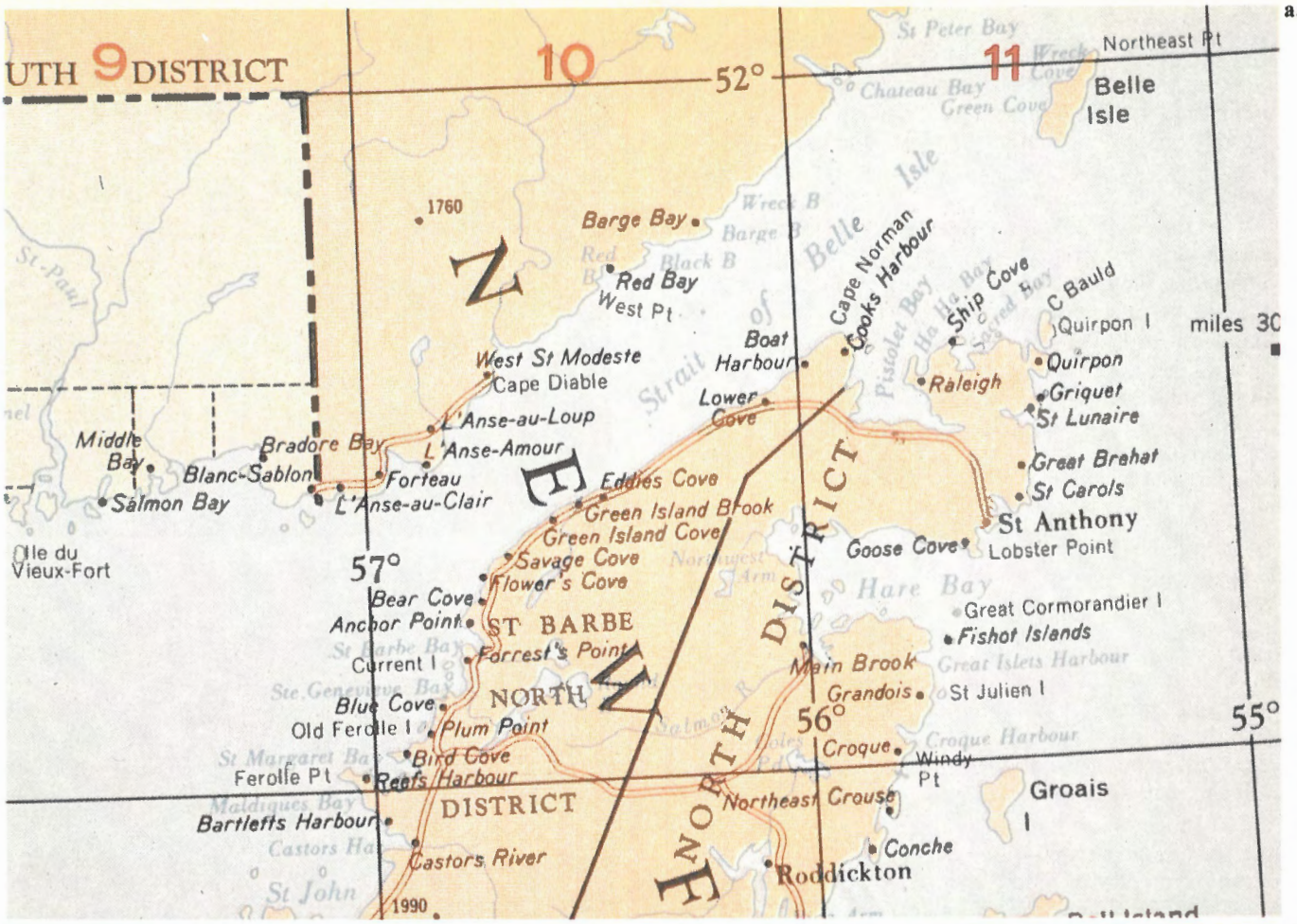

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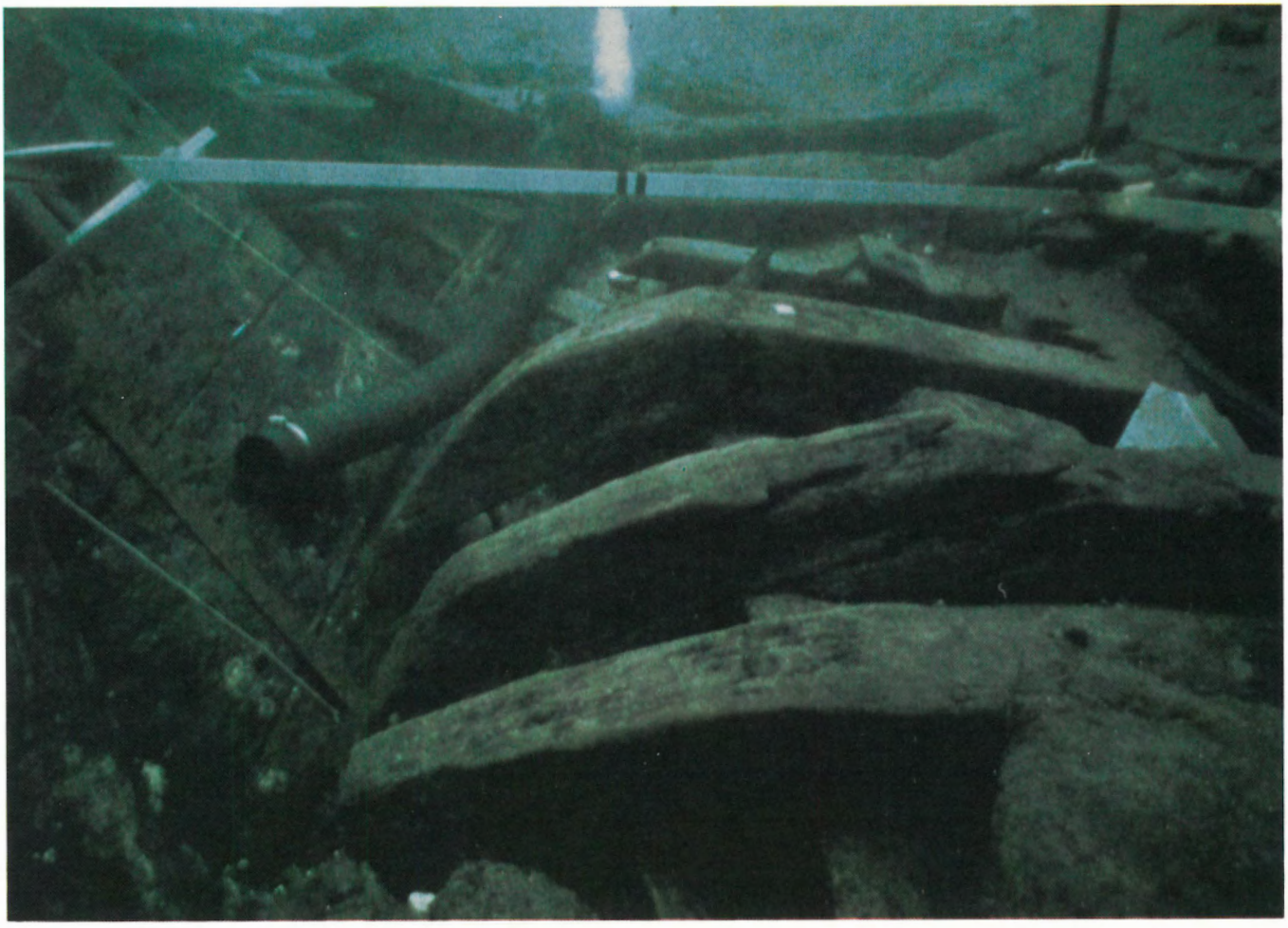


Photos courtesy of Parks Canada

mentioned in context with other early explorers, and receive only brief mention because, until recently, very little information was available on their activities in Canada.

Since 1973, Selma Barkham, an historian with the Public Archives of Canada working in Northern Spain, has found literally thousands of documents relating to the past Basque whaling industry in Labrador. Ships sent to Labrador were heavily insured against loss or damage, she has found. Due to the high cost of buying and outfitting a ship, a number of different parties would put up capital: this eventually led to endless lawsuits and counter-lawsuits between owners, captains and harpooners.

Mrs. Barkham labouriously sifted through many such judicial records in the archives of the Corregidors in Guipúzcoa and the archives of the appeal court, the Real Chancelleria at Valladolid. Among them she found insurance policies, cargo charters, agreements with coopers and the oldest known Canadian will, written in 1577. In these and other documents are included: equipment and supply lists for outfitting a whaling ship; a ship's crew size and cargo capacity; names of owners, captains, home ports, and harbours used in Labrador; as well as amounts of oil taken back to Spain.

In a lawsuit dated 1566, the captain of a ship of 425 tons cargo capacity, one Miguel de Cerain, claimed reimbursement for 6,000 roof tiles he was forced to leave in Terranova when he had to depart suddenly because of ice forming in the harbour. A harpooner, Simon de Azcoltia, in an earlier document dated 1564, describes standing "beside the cabin made for the boiling down of whales". Small excerpts such as these shed light on a small chapter of Canadian history.

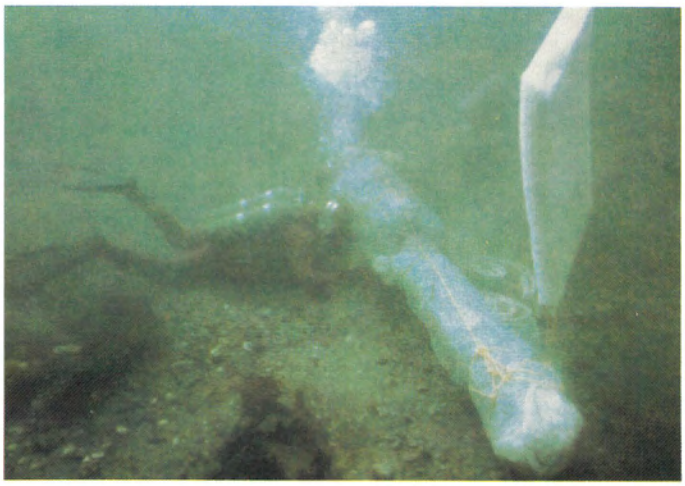
Roof tiles, nails and clay were also brought to Canada by the Basques, who used them in building whaling stations to which hunters would return each summer. Mrs. Barkham identified sites in Labrador for many of these stations, including two which appear repeatedly in documents and are considered the largest such stations: *Xateau*, the present day Chateau Bay, and *Butus* or *Buturus*, now know as Red Bay.

Important archaeological site

In 1977, a survey of the south coast of Labrador confirmed the location of many of the stations. Archaeologists from MUN and the Royal Ontario Museum, with the assistance of Mrs. Barkham, her son, daughter, and the Graham Rowley family, conducted this survey.

Preliminary excavation in the vicinity of the present town and on Saddle Island, followed by excavation concentrated on Saddle Island, under the direction of Dr. Jim Tuck of MUN, confirmed by 1978 the archaeological importance of the area. A significant factor in establishing this was the excellent preservation—afforded by the water-saturated peat soil—of metal and organic artifacts.

Dr. Tuck, well aware of the conservation problems associated with wet objects, requested assistance from the Canadian Conservation Institute (CCI) in



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Photos courtesy of Parks Canada

a. ***Previous page:*** *Map showing the location of the Red Bay archaeological site. Whales would come through the narrow Strait of Belle Isle, where the Basques would hunt them.*
b. ***Previous page:*** *Collapsed stern of the wreck, showing the ribs and some of the outer hull planking. Photo by P. Waddell. Courtesy of Parks Canada.*
c. ***Left top:*** *Packing and wrapping the ship's capstan underwater in preparation for its raising.*
d. ***Left bottom:*** *Ship's capstan after removal of the concealing sediment. Photo by D. Pagé. Courtesy of Parks Canada.*

Photos by Bob Higham

Coin found at Red Bay during the summer excavation in 1979. Cleaning allowed conservators to identify the coin as being struck in the 16th Century during the reign of Philip the II, King of Spain. ***Left,*** *before treatment;* ***Above,*** *after treatment.*

Ottawa. A conservator from CCI's Archaeology / Ethnology Division arrived on site shortly thereafter, assisting in the care of objects after excavation. Many objects were sent to CCI later for research and conservation work.

Sunken Basque ship found

In the fall of 1978, a second group of archaeologists from the Marine Archaeological Section of Parks Canada, led by Robert Grenier, arrived at Red Bay to search for a sunken Basque ship. Mrs. Barkham had uncovered documents referring to the San Juan, a ship blown ashore and wrecked in 1565. It carried a cargo of 250-300 tons and a crew of about 75. The Basques had salvaged part of the cargo, some food supplies and the ship's sails.

On the third day of searching, marine archaeologists spotted the outline of a few ribs and cask-staves in the fine silt in 12 meters of water. Located just off the north shore of Saddle Island, it was right in front of the trenches dug a month earlier by Dr. Tuck's team!

Work over the next few weeks revealed many more cask-staves, hoops and cants (heads), floor timbers, an anchor and a capstan. Many of the objects recovered indicated that the wreck was, indeed, from the 16th century and, most likely, Basque.

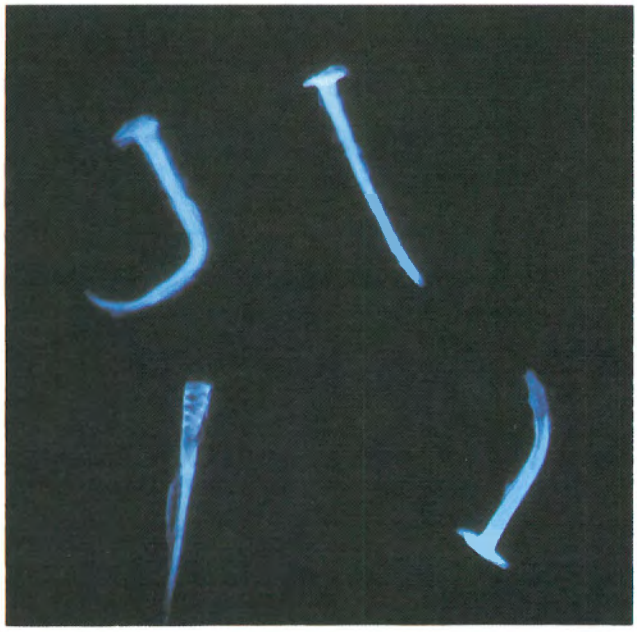
Summer of '79

In the following summer of 1979, two excavations took place at Red Bay: a two-month excavation of the land site by Dr. Tuck, and a more extended season of work on the shipwreck by the underwater research unit of Parks Canada.

By this time, Red Bay was awash with archaeologists, historians, conservators and, on occasion, journalists and photographers. The villagers, however, soon got used to the bright orange jackets and green mechanic's overalls worn by many of the newcomers.

The land excavation crew consisted of 15 excavators, a surveyor, photographer, registrar and two CCI conservators. The local school house provided this crew with living quarters, a conservation laboratory, two darkrooms and an office with a microfilm reader, used by Mrs. Barkham to continue her research.

Throughout July and August, the land field crew continued to excavate the three areas where work had begun the previous summer. After stripping an area of sod, the excavators recorded and removed thousands of roof tile fragments overlying almost the entire site. Only whole or reconstructable tiles were returned to the lab. The rest were counted and piled for later reburial, which will protect the tiles from destruction by the elements or souvenir collectors and will allow the possibility of future research.



Top Left:
CCI x-ray of four objects, all originally believed to be spikes. However, radiography showing the hidden features of the lower left item indicated it was not a spike, but was probably used for an entirely different purpose, as yet unknown.

Top Right:
Tom Daly, Conservator from Parks Canada, readies wooden cask hoops excavated by Parks Canada for CCI to x-ray. Joints of the hoops, used to hold staves together, were covered by lashing. Radiography allowed researchers to see the notching and other detail of the joints without removing the lashing, thereby receiving some information on the techniques used at the time.

Bottom:
Archaeologists excavating and recording one of the ovens found at the Red Bay site. Note the red roof tiles cover almost the entire area.

Underneath the roof tiles, other objects from Basque occupation slowly emerged. These objects were photographed and drawn onto a site map before being sent to the lab for registration and conservation. The photographer also took aerial photographs from a 30-foot bipod, later to be assembled into a photomosiac of each area. The entire island was surveyed and a contour map drawn.

Though the three areas being excavated were not completed during the 1979 field season, walls and related structural remains indicate that two of the areas were at one time ovens for rendering the whale blubber. Over 2000 ceramic fragments from cooking and storage containers, the rosary, coin and other personal objects have led Dr. Tuck to conclude that the third area was used for more domestic activities, such as living quarters for high ranking officers. Field records, photographs, maps and other objects will be used by archaeologists in further analysis of the site.

Treatment preparations

The diversity of excavated materials (metals, wood, baleen, glass and ceramics, leather and textiles) and environments (dry, wet, frozen) presented a number of problems for the conservators. Their methods of handling, storage and subsequent treatment had to be prepared before excavation began.

Experience gained from the previous summer's work did enable conservators to plan accordingly. For example, they learned to operate a portable X-ray unit: all metal objects were radiographed on site to determine the extent of deterioration and to expose any features hidden by corrosion products. Perishable items, such as waterlogged wood and baleen, were placed immediately into water-tight containers that had been constructed on site. Iron objects were stored in a corrosion-inhibiting solution of 1% sodium hydroxide.

Some treatments were conducted in the field lab, including restoration of roof tiles and stabilization of iron and copper artifacts. However, the majority of objects were returned to MUN in St. John's or CCI in Ottawa for treatment.

Conservators also worked with archaeologists out on the site. Delicate objects such as the rosary were block lifted, a special technique of removing objects from the ground, and later excavated in the lab under a microscope. Special supports also had to be made for objects too fragile to support their own weight.

Unique archaeological site

Parks Canada archaeologists continued to uncover the shipwreck. Such underwater excavation and recording is slower and more difficult than land excavation; near freezing temperatures constantly hampered divers.

The majority of objects recovered were cask staves, hoops and cants. Because of their large numbers, the casks were recorded and analyzed on site, then stored in large tanks in Parks Canada's field lab; most were reburied at the end of the season for the same reasons as previously stated.

1.

2.

3.

Photo series:

1. *A fragile large knife requires a special lifting technique.*

2. *CCI Conservator Charles Hett prepares the knife for removal, covering its surface with an overlay of gauze and adhesive, and dislodging the soil an inch or two around it to create a pedestal of soil.*

3. *Removing the knife on its pedestal.*

Two large objects, the capstan and anchor, were also raised in 1979. They were wrapped under water by Parks Canada conservators, as a first step to ensure safe holding, packing and transportation of the artifacts back to Ottawa.

Other objects recovered included two pulley blocks from the ship's rigging and remains of a one-gallon cask. Work on the hull of the ship itself must await further excavation in coming years; however, the results should prove exciting and should reveal valuable information on the rapidly changing marine architecture of this period.

There are many years of excavation and research ahead. The rich potential of both the land and underwater sites and their relationship to each other, as well as the unusual wealth of historical documentation, combine to make Red Bay a unique site in Canadian archaeology—and a great challenge for conservators.

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4. *The knife is then placed on a rigid support in an inverted position—gauze-side down, soil on top. All this is then bound together and packed for transferal to the field lab.*

5. *After cleaning in the field lab, a support is molded to the shape of the knife, thereby ensuring its safety during further handling, transportation and treatment.*

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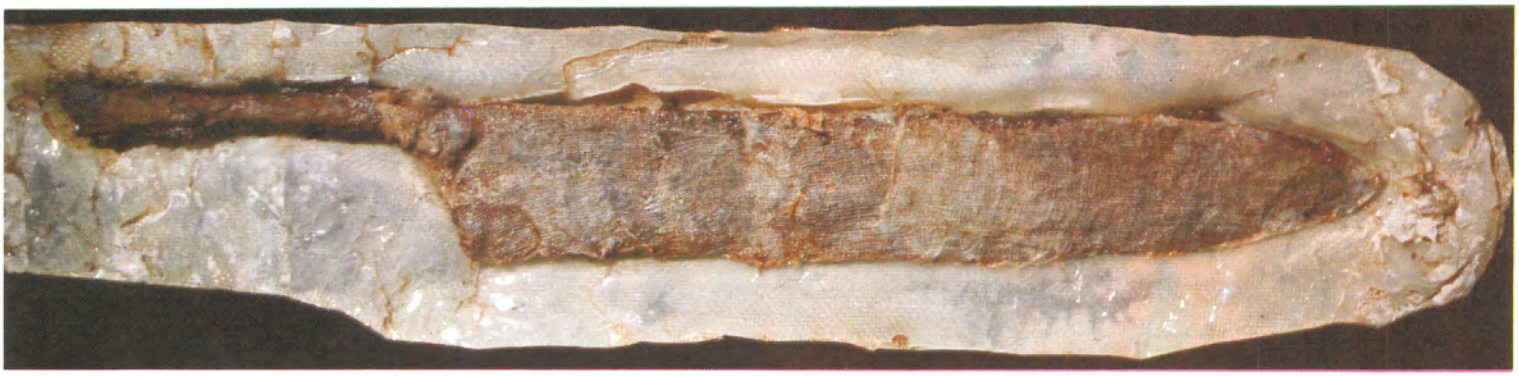


MONITORING KIT:
environmental controls save artifacts

by Raymond H. Lafontaine

Photo by James Stark

Lafontaine analyses scientific data on environmental factors.

For many years now, museums, art galleries and archives across Canada have been told that the preservation of their collections depends largely on the environmental conditions which exist within their institutions. As a result, museum personnel—such as curators, conservators and even managers—are becoming conscious of the importance of environmental control in their buildings.

Attitudes towards comfort or convenience within museums, therefore, have shifted slightly away from the public and more towards the artifact.

This is not to say that public acceptability is not considered. However, certain compromises must be made, sometimes at the expense of the public, in order to safeguard artifacts. For example, illumination levels recommended for museums are sometimes criticized by the public as being too subdued. In many situations though, a low light level is the only method of preserving the colours of the object.

The damaging effects of a bad environment on artifacts and art objects are well known. We have no doubt all seen how extreme dryness can cause the cracking of wood or how bright lights can fade highly sensitive watercolours.

Unfortunately, intuitive statements—such as "These lights appear to be too bright" or "It seems awfully dry in this exhibition room"—are not sufficient to determine the exact environmental control requirements. Reliable and accurate data is absolutely necessary for the designer, engineer or conservation scientist to assess the urgency and extent of any existing environmental problems. Only then can he determine the exact solution to the problem.

In most situations, monitoring environmental parameters requires expensive equipment, often beyond the reach of the average institution. Although inexpensive instruments do exist for such measurements, they are often insufficiently accurate or lack the sensitivity to measure levels normally encountered in museums.

How can the institution whose budget does not permit acquisition of expensive monitors determine the conditions in its building? The Canadian Conservation Institute has recently initiated a programme by which museums, art galleries and archives can borrow for periods of two or three weeks the necessary instruments to carry out precise environmental measurements. The Environmental Monitoring Kit, as it is called, incorporates the necessary instrumentation to measure the four most important factors:

1. Relative Humidity
2. Temperature
3. Illumination
4. Ultraviolet radiation

The kit, shown here, consists of four instruments and related accessories: the Bendix "Psychron" psychrometer, the Beckman "Humi-chek", the Gossen "Panlux" electronic luxmeter and the Crawford UV Monitor type 760. Also included are spare batteries, calibrators for the Humi-chek, psychrometric slide rule, screwdriver and, of course, an instruction manual.

The manual is written in such a way that untrained personnel can obtain accurate and meaningful readings. Nevertheless, unforeseen problems can arise, in which case we would ask the institution to inform us and we will try to correct the situation.

To obtain loan of the Environmental Monitoring Kit, a written request must be sent at least a month prior to the loan period stated in the request. Send to:

Environment and Deterioration
Research Division
Canadian Conservation Institute
National Museums of Canada
1030 Innes Road
Ottawa, Ontario
K1A 0M8

A loan-of-equipment agreement form will then be sent to the institution for signature, to be returned to CCI.

In the event that a kit is unavailable for the period requested, the intended borrower will usually be contracted by telephone in order to arrange an alternate time period.

The terms of the loan agreement are clearly indicated on the loan-of-equipment agreement form and read as follows:

> "It is understood that proper care and maintenance of the equipment will be carried out by the borrow-

er during this period. Any damage to the equipment will be repaired or the instrument replaced at the expense of the borrowing institution. Transportation and insurance costs will be paid by the borrower unless otherwise noted. An insurable value of $1,200 must be declared to the carrier. Extension of the loan period shall be considered only if the request is made at least two days before the scheduled date of return."

We hope these conditions are well understood and completely agreeable to future borrowers.

CCI's Mobile Conservation Laboratory also carries an Environmental Monitoring Kit, used to monitor conditions in the institutions visited. Their personnel have the chance to examine the kit closely and observe how the instruments function. This should make it much easier for them to use the instruments when and if they borrow a kit at a later date. Indeed, they should seize this opportunity to learn how the kit can help them improve environmental conditions in their museum.

For situations where continuous monitoring of relative humidity and temperature is required, CCI can also loan recording thermohygrographs. Not part of the kit, these can be borrowed for periods of one or two months, depending upon demand. Again, a written request should first be sent to CCI.

The availability of Environmental Monitoring Kits and thermohygrographs from CCI is yet another step in trying to improve the environmental conditions within Canadian museums, art galleries and archives. Obviously, we hope that more and more institutions will acquire their own instrumentation and therefore the possibility of establishing a continuous year-round monitoring programme. Nonetheless, we can safely say that the feeling for conservation and preservation in Canada is indeed well-rooted and constantly growing.

a.

b.

Environmental Monitoring Kit:

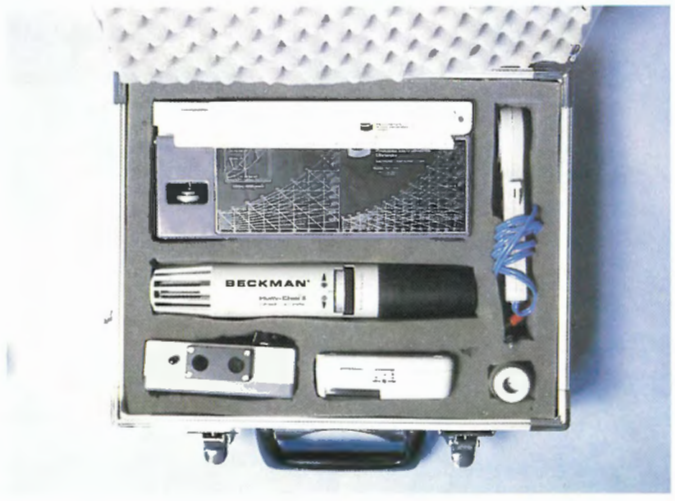
a. A thermohygrograph being set up in a museum. This instrument is used for continuous monitoring of relative humidity and temperature. While not part of the Environmental Monitoring Kit, one can be borrowed from CCI.

b. Raymond Lafontaine demonstrates how to measure light levels using the Panlux Luxmeter, available in the Environmental Monitoring Kit. Lafontaine is Chief of the Environment and Deterioration Research Division at the Canadian Conservation Institute in Ottawa.

c. The Environmental Monitoring Kit.

d. Top graph: Erratic changes in environmental factors, such as humidity and temperature levels. Large or extreme fluctuations are detrimental to artifacts.

Bottom graph: Constant values indicate minimum changes in humidity and temperature levels, which is to be desired. Also critical is the level of humidity itself.



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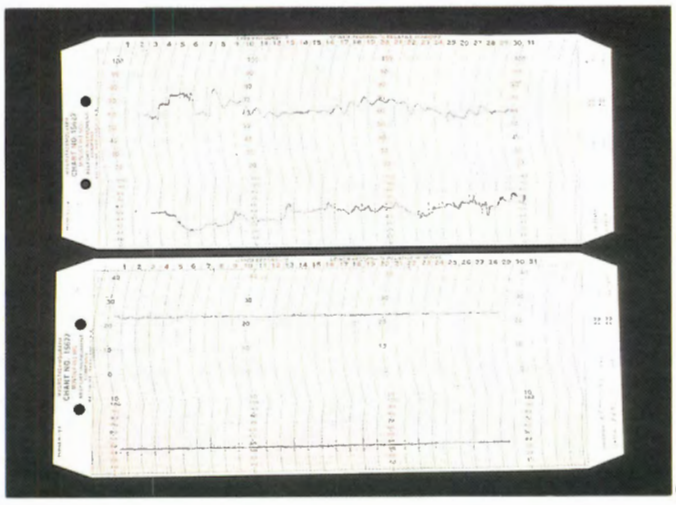

d.

Photos by James Stark

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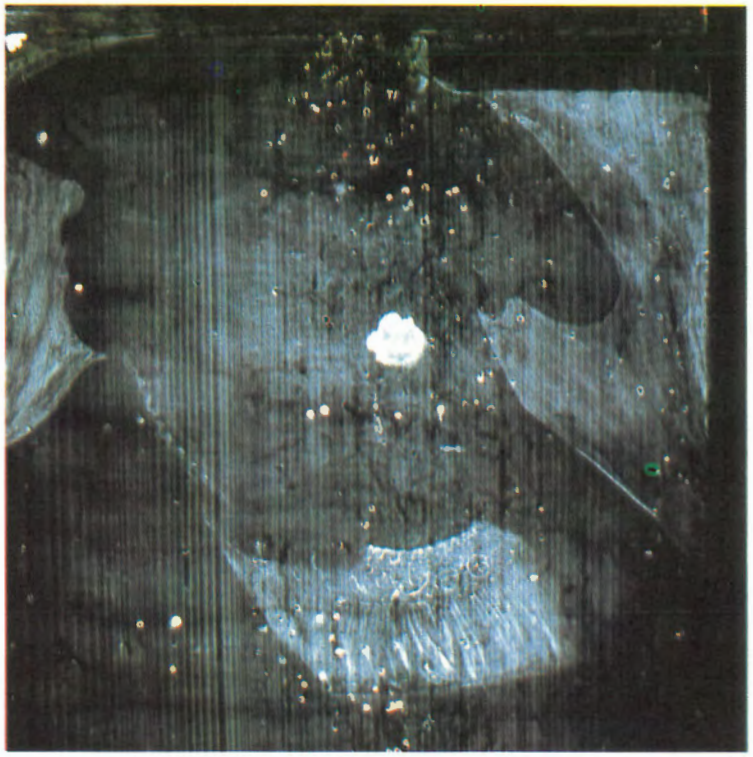
(Continued/Suite, page IV)

a.


Johans der Erst/ Churfurst
vnd Hertzog zu Sachssen.
Ich meines lieben bruders end/
Bleib auff mir das gantz Regiment.
Mit grosser sorg vnd mancher fahr/
Da der Bawr toll vnd törcht war.
Die auffrur fast jnn allem land/
Wie gros fewer jm wald entbrend.
Welches ich half dempfen mit Gott/
Der Teutsches land eret aus not.
Der Rottengeister feind ich war/
Hielt jm land das wort rein vnd klar.
Gros drawen/bittern hass vnd neid/
Vmb Gottes worts willen ich leid.
Frey bekand ichs aus hertzem grund/
Vnd personlich selbst ich da stund.
Vor dem Keisar vnd gantzen Reich/
Von Fürsten gschach vor nie des gleich
Solchs gab mir mein Gott besunder/
Vnd vor der welt was ein wunder.
Vmb land vnd leut zu bringen mich/
Hoffe beide freund vnd feind gewislich.
Ferdinand zu Römischem König gemacht
Vnd sein wahl ich allein anfacht.
Auff das/das alte Recht bestünd/
Jnn der gülden Bullen gegründ.
Wiewol das grossen zorn erregt/
Mich doch mehr recht denn gunst beweg
Das hertz gab Gott dem Keisar zart/
Mein guter freund/zu letzt er ward.
Das ich mein end jm frid beschlos/
Hast sehr den Teuffel das verdros.
Erfarn hab ichs vnd zeugen thar/
Wie vns die schrifft sagt vnd ist war.
Wer Gott mit ernst vertrawen kan/
Der bleibt ein vnuerdorben man.
Es zürne Teuffel odder welt/
Den sieg er doch zu letzt behelt.

b.



c.

Everything has been thought of before. The difficulty is to think of it again.

Tout a déjà été pensé. Le difficile est de le repenser.

Johann Wolfgang von Goethe

It is a combination of many disciplines and technologies that informs the modern archaeologist/conservator/scientist, but all refer to ancient practices and thereby make the past live again.

a. *Panel (after treatment): Portrait of John I of Saxony by German artist Lucas Cranach the Elder (1472-1553), dated 1538. Oil on Panel, Collection of the Winnipeg Art Gallery. Actual size: 375 x 235 mm or 15 x 9.4 inches. Critics hail Cranach's "attentive awareness of the spirit of his time", "intuitive grasp of contemporary spiritual reality" and "tautly disciplined style". (E. Ruhmer,* **Cranach:** *Phaidon Press.)*

b. *Radiograph (before treatment): Wood-boring insects have undermined the beechwood panel, later replaced by a balsa wood base. Also note: a red wax seal, attached to the painting's reverse side by a previous owner, and dense white dots—worm holes filled by the artist while applying the groundlayer (thus not a newly-cut panel).*

c. *Split frame (before treatment): Left, normal colours; Right, UV photo shows aging varnish layer, which emits a yellow-green fluorescence under irradiation. Previous paint retouches are visible, as are cracks in the facial area which follow a system of wood-boring insect channels.*

C'est en faisant appel à toutes sortes de disciplines et de techniques que l'archéologue-restaurateur-scientifique moderne arrive à réunir toute l'information dont il a besoin. Mais il s'agit là des descendantes d'anciennes pratiques, qui font ainsi revivre le passé.

a. *Le panneau dans son cadre (après traitement): Portrait de Jean 1^er^ de Saxe, daté de 1538, par l'artiste allemand Lucas Cranach l'Ancien (1472-1553). Huile sur panneau, collection de la Galerie d'Art de Winnipeg. Dimensions: 375 x 235 mm (15 x 9.4 pouces). Les critiques reconnaissent ordinairement chez Cranach «la conscience attentive de l'esprit de son temps et son style fort discipliné» (E. Ruhmer,* **Cranach:** *Phaidon Press).*

b. *Radiographie (avant traitement): des insectes foreurs ont miné le panneau de hêtre que l'on devait plus tard remplacer par une base en bois de balsa. On remarquera également le sceau en cire rouge fixé au verso de la peinture par un ancien propriétaire, ainsi que les trous de vers, indiqués par les points blancs, que l'artiste avait bouchés au moment où il appliquait la couche de fond (il ne s'agit donc pas d'un panneau taillé récemment).*

c. *Avant traitement: à gauche, photographie en couleurs normales; à droite, photographie à l'ultra-violet montrant la couche de vernis vieillissant, qui émet sous irradiation une fluorescence jauve-verte. On aperçoit les retouches faites à la peinture antérieurement. Les craquelures que l'on aperçoit dans la région du visage, proviennent d'un réseau de minuscules tunnels insectes.*

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***(RF) Textes accompagnés d'un résumé en français/ French Abstract.**

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