Symposium 86

The Care and Preservation of Ethnological Materials

L'entretien et la sauvegarde des matériaux ethnologiques

Proceedings

Actes



Editors / Éditeurs : R. Barclay, M. Gilberg, J. C. McCawley and T. Stone

Canadian Conservation Institute

Institut canadien de conservation

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Tsimshian Stone Mask, No. VII-C-329
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FOREWORD

Informal discussions in 1984 at the IIC Conference in Paris and ICOM Conservation Committee Conference in Copenhagen indicated a need for a specialty conference devoted to ethnographic conservation. Conferences related specifically to the care and treatment of this class of materials had been infrequent and never on a level sufficient to attract an international audience. For these reasons the Canadian Conservation Institute decided to host an international symposium dealing primarily with the conservation of ethnographic materials. In addition, it was considered important to encourage presentations from curators where these would have a bearing on the care and handling of materials, and the success of this approach can be judged by the number and quality of papers with a curatorial orientation presented here.

While Symposium 86 was to be held in Canada, a country with a rich legacy of material history and a continuing emphasis on its multi-cultural identity, it was felt important to attract conservators and curators from developing countries as well. Many of these nations have abundant cultural material in collections, to which their curators and conservators bring understanding and commitment and, in many cases, new approaches and rare insights. Every effort was made to encourage attendance and participation of people from these developing nations.

The order and grouping of the papers in this publication differ somewhat from the original format as presented during the Symposium. The editors considered the present format to be more logical for publication. Also, in addition to the papers presented during the programme, we have included in the Proceedings brief resumés of the poster sessions which were presented, and an outline of workshop sessions conducted on an evening during the week at the laboratories of the Canadian Conservation Institute. These workshop sessions proved to be of particular importance; it was the first time many delegates had attended a conference which emphasised practical techniques in a laboratory environment. The organizers would encourage future symposium hosts to consider this vital but under-emphasised area.

The process of editing and preparing 35 papers from delegates in all parts of the world is necessarily laborious. However, the organizers considered it essential to produce the Proceedings as quickly and expediently as possible. The comparatively rapid production of this book required cooperation from all the contributors. We would like to extend our thanks for the friendliness and understanding with which our efforts were met at all stages of the process. We trust that this volume lives up to the expectations of the authors.

Over 175 delegates from ten countries attended Symposium 86 and 35 papers were presented in the four-and-a-half days of the programme. Diversity is perhaps a hallmark of ethnological objects: diversity of materials and manufacturing techniques, intended uses, and ethical considerations for those entrusted with their care and preservation. These proceedings truly reflect this diversity and we hope they will contribute towards the appreciation and care of ethnographic collections throughout the world.

The Organizing Committee,
Symposium 86.

ACKNOWLEDGEMENTS

We would like to acknowledge the assistance of the following organizations and individuals without whom neither the Symposium nor the Proceedings would have been produced:

— Dr. Leo Dorais, Secretary General of the National Museums of Canada
— Mr. R.W. Nichols, Assistant Secretary General (National Programmes) of the National Museums of Canada
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The ideas and opinions expressed in this publication are not necessarily those of the editors or supporting institutions and agencies.

OPENING ADDRESS/DISCOURS D'OUVERTURE

Dr. Léo A. Dorais
Secretary General of the National Museums of Canada

Docteur Léo A. Dorais
Secrétaire général des Musées nationaux du Canada

Ottawa, 29 September, 1986
Ottawa, le 29 septembre, 1986

It is my pleasant duty to welcome you, on behalf of the Government of Canada, to this first international symposium on ethnological conservation to be held in Canada.

Many of you have travelled great distances: from as far away as Australia and New Zealand; from Africa, Europe, South America and the Philippines. Others have come from the United States and from every corner of Canada. We welcome you, and we are happy that you are able to join us in this most important contribution to the preservation of the heritage that enriches us all.

I claim no special knowledge of ethnology, and less of conservation, but I do know something of the power of the cultural heritage. Canada is a country that is predominantly populated by people of immigrant stock, in which we have tried to create, not a melting-pot, but a colourful tapestry that preserves, and in turn is enriched by all our cultures. In that context, ethnological collections take on a special significance, for even though they may represent the achievements of people far removed from us by time and place, they also represent the ancestral heritage of most living Canadians. They are threads in the tapestry we all share, and so they strengthen us all.

That, at least, is the spirit in which we approach this symposium, for it is our belief that there is no more important duty than the preservation of our heritage.

It is also appropriate that you should meet here, in a land that belongs to both the Atlantic and the Pacific communities, yet is rich with its own diverse indigenous cultures.

From ocean to ocean, and north to the Arctic, Canada's native peoples are making a vigorous recovery from the impact of colonization. Cultural revival is playing a major role in that recovery: and much of it has been possible only because the artifacts of the native peoples - from language to totem poles - have survived. The preservation of museum collections has been, and continues to be, one of the keys to that survival.

As the distinguished Haida artist, Robert Davidson, wrote:

> "There was, and to an extent still is, a viewpoint shared by many artists and other people on the coast that the collection of Indian art and artifacts was wrong - another example of exploitation. My feeling about that is the opposite; if it wasn't for the museums and if it wasn't for the anthropologists, I feel the art form would have died completely if nothing has been collected and saved."

Ainsi, votre travail, qui consiste à préserver les collections ethnologiques, est extrêmement important non seulement pour nous mais aussi pour les générations à venir. Ce symposium témoigne de la constante détermination du gouvernement du Canada d'assurer la conservation de notre héritage.

Le symposium a été organisé par l'Institut canadien de conservation, un des programmes nationaux des Musées nationaux du Canada. Les réunions auront lieu ici, aux Archives publiques, mais vous aurez l'occasion de visiter les installations de l'ICC et de rencontrer plusieurs membres du personnel de cet Institut, qui assistent aux réunions avec vous.

We are proud of the CCI, which, in the fourteen years since it was founded, has achieved a high reputation, both nationally and internationally. It has become the essential keystone of a national conservation structure that is unique in its scope, its quality and its adaptation to the needs of this vast and sometimes harsh land.

The CCI evolved from the measures that the government undertook to implement the National

Museum Policy that it adopted in 1972. At that time there were only a few hundred museums in Canada, and less than a dozen trained conservators. Today, very largely because of the federal government's policies, there are some 1800 museums and similar institutions - and almost 300 conservators.

That will tell you that, as a nation, we value our heritage; and that our government has a firm commitment to preserve it. We must, for heritage is one of the vital cornerstones of society, and it is nowhere more important than in a vigorous young society such as ours. It is our heritage that tells us who we are and where we are, and why.

But the facts that I have given you about the growth of the museum movement and our efforts to provide the conservation support that it must have, are only part of the story. And that story is something of an epic. It must be seen against the background of vast distances, a scattered population, and a harsh climate.

La plupart de nos musées sont de petits établissements communautaires aux ressources très limitées, qui s'appuient largement sur le bénévolat. Ces musées ne peuvent espérer posséder un jour leurs propres installations de restauration, et souvent les distances qui les séparent sont si grandes que les mesures de collaboration pouvant exister entre eux ne sauraient être vraiment efficaces. Certaines provinces ont établi ou sont en train d'élaborer des services régionaux de restauration, mais pour la plupart de nos musées de petite taille, la restauration demeure un problème.

Et pourtant, il importe que les collections de ces musées soient protégées. Notre politique a été d'aider les musées en question à s'aider eux-mêmes. En plus de fournir des services de restauration et de recherche, l'ICC offre aux associations de musées provinciales des séminaires portant sur le soin des collections. Deux séminaires ont lieu chaque année dans chaque province et dans les deux Territoires. L'ICC publie également des Notes et des Bulletins techniques sur le soin des collections, qu'il distribue gratuitement à tous les musées.

But those alone are not enough. An occasional training seminar or a package of information received in the mail from a remote central agency will not make conservation a reality for community museums. CCI's solution has been to bring conservation to the very doorsteps of museums.

For the past seven years CCI's five Mobile Laboratories have visited museums throughout Canada, with the result that a widespread awareness of basic conservation has been achieved. We shall continue and, indeed, expand this role in the future, exploring different means. The Mobile Laboratories have served their purpose well and a much more sophisticated museum community has resulted.

It should not surprise you that we are already considering changes in a method of delivering conservation services that has been an outstanding success. Enough of the pioneer spirit survives in this country to influence the way we tackle new challenges; and conservation is one of them. The National Museum Policy of 1972 was a bold step into the unknown, for neither we, nor any other country had ever tried anything like it before. We improvised; we experimented; we made mistakes; and we learned a great deal.

One of the things we learned was that change is inherent in culture. The stable world in which a successful programme could run unchanged for years has gone. Both the community and the governments programmes must be able to accommodate rapid change, and planners must constantly evaluate and adjust their programmes to anticipate it.

During the past two years, the government has examined both the needs of the cultural community and the programmes that we offer; and the National Museums of Canada have themselves initiated a searching review of the National Museum Policy. Broadly speaking, the direction of the CCI seems to be correct. In response to the perceived needs of the community, it has evolved greatly since its inception fourteen years ago. We must continue to look ahead so that we can fine-tune our programmes to anticipate the needs of the future.

For conservation in Canada, the way ahead is clear. The National Programmes are exploring ways to promote conservation and to assist the museum community and the other provincial agencies to establish their own conservation facilities. As that is achieved, the CCI will concentrate increasingly on providing those services that, for reasons of cost or complexity, cannot be duplicated provincially. CCI will undertake specialised conservation treatments and analyses and the research and development of conservation technology, but it will also continue to disseminate information, and to provide training assistance to the community museums.

Nous sommes en train d'élaborer un programme innovateur qui présente sans doute beaucoup d'intérêt pour vous car il peut très bien devenir avec le temps extrêmement utile à la communauté internationale des restaurateurs.

Lorsque la croissance d'une activité intellectuelle est stimulée par l'explosion des connaissances scientifiques, comme c'est le cas pour la restauration; et lorsque nous possédons des techniques de communication permettant le partage de l'information, l'occasion nous est alors fournie d'apporter dans ce domaine une contribution importante.

The Getty Conservation Institute in Los Angeles and two of our National Programmes - the CCI and the Canadian Heritage Information Network - are developing a computerized Conservation Information Network in co-operation with the IIC in London, ICOMOS in Paris and ICCROM in Rome. This will link the databases of participating institutions in such a way that each may contribute and each may access the others.

Earlier, I described the CCI as the essential keystone of a national conservation structure. When I tell you that the National Museum Policy that created it in 1972 visualised it as a service agency that would simply provide routine conservation services to those museums that needed them, you will realise how far it has already evolved toward the true national institute that we intend it to be.

In the short time that was available to me, I have been able only to give you an outline of the progressive and creative character of conservation in Canada today. As you will discover for yourselves, I have only touched the surface. If your symposium reflects the stimulating atmosphere in which its sponsors practice their craft, it will be a memorable experience.

I wish you an enjoyable stay in our Capital and a successful and productive symposium, which I now have the pleasure of declaring open. A tous, bonnes discussions et fructueux séjour dans la capitale canadienne.

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PACKING AND SHIPPING

Packing Anthropological Collections for Transit
D. Piechota
Object and Textile Conservation, Arlington, U.S.A.

The Removal and Conservation of the Painted Bark Panels and Carved Figures from a Papua New Guinea *Haus Tambaran*
D. Lee
British Museum, London, England

PACKING ANTHROPOLOGICAL COLLECTIONS FOR TRANSIT

DENNIS V. PIECHOTA

This paper, which addresses some of the problems encountered when designing shipping containers for ethnographic and archaeological objects being sent on travelling exhibition, is an update of some practices described in "The Care of Cultural Property in Transit: A Case Design for Travelling Exhibitions", **Technology and Conservation**, *vol. 7, no. 4, 1982 co-authored with Greta Hansen. In this paper the following topics are discussed: attempts to control the case environment using humectants, insulators and vapor barriers; tandem cushioning (the use of two cushions in series) and its potential to increase vibration damage; problems encountered in using plastic foams for shock absorption; and the importance of drop-testing the case using a surrogate load that imitates the static stress and balance of the museum cargo.*

1.0 Introduction

Packing is a form of preventive conservation, an extension of storage containerization, and a form of mass, mechanical treatment. It is particularly important that ethnographic objects be given the best care due to the variety of their construction materials, and their fragility.

These problems are most evident when ethnographic artifacts are sent on travelling loans. The rigors of shock, vibration, environmental fluctuation and repeated handling can quickly make their mark on the collection. While the packer's responsibility cannot be denied, the single most important question to be answered is which items in the collection should travel at all. If care is taken to select only robust artifacts the risks of damage will be reduced. Once that decision is made the packer must apply principles of package engineering to the case design and work closely with the exhibition conservator to meet the needs of each object. The conservator will be needed to best express the object's fragility and point out concerns such as the handling of absorbent surfaces and friable pigments.

The author as a private conservator hired to pack collections, often finds himself pushing for the mounting of smaller artifacts. This involves the exhibition designer who will need to integrate the mounts into his concept of the display. Before any cases are constructed or foam is cut, this planning must be well underway, if not completed. Case construction will vary, of course, with the form, size and weight of the artifacts. This paper will cover small to medium-sized, three-dimensional artifacts; ethnographic materials most often sent on loan. However, the same packing principles will apply to oversized items as well.

2.0 An Initial Case Design

In 1981 with the help of Greta Hansen, then an exhibition conservator at the Peabody Museum, Harvard University, the author tailored a case design to meet her specifications. It has served as a starting point for subsequent designs (1). Its primary features will be discussed here together with the subsequent design changes and the reasoning behind them. It should be understood that what follows is not the current design with respect to the cushioning.

The basic case design incorporated the double container concept that is common in museum and commercial packing. The outer case was sheathed with plywood and cleated with 1 x 4 in. (2.54 x 10.2 cm) strips of poplar. It was drive-screwed and glued with a gap-filling adhesive to seal all the joints. The lid was placed on one side and bolted first with threaded inserts, which promptly began to fail, and later with more conventional t-nuts. The inner surfaces of the (outer) case were varnished and then covered with aluminum-clad rigid polyurethane insulation 1/2 to 1 in. (1.27 x 2.54 cm) thick (Figure 1).



Figure 1. A view of the multiple-drawer case without the drawers. This shows the configuration of the shock pads, the aluminum-clad polyurethane insulation and lid gasketing.

The inner drawers were floated on polyethylene foam shock pads on all sides. The drawers were made of 1/2 in. (1.27cm) poplar sides with 1/4 in. (0.64cm) birch plywood top and bottom. These drawers were made in varying heights and were stacked to fill the outer case shock pads. Each drawer was lidded with piano hinging, Velcro closures and rope handles (Figure 2).

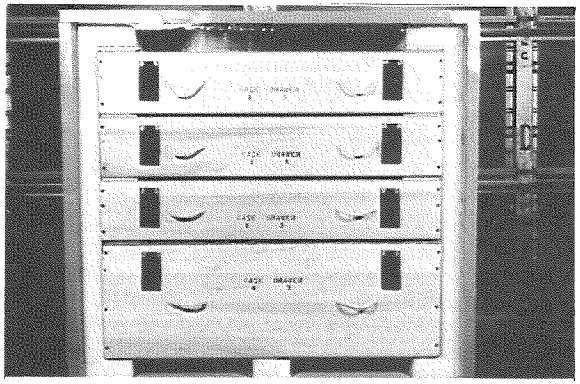

Figure 2. A view of the multiple-drawer case with its lid removed. The same structural configuration has been used for all designs. Lidded drawers are stacked on polyethylene foam shock pads. In recent designs the shock pad thickness has been increased to compensate for the removal of the polyurethane cushioning within the drawers. It has been found in drop-testing that the lowest drawer receives the highest level of shock. The more robust items are consequently packed on that drawer.

This case design has been used for several travelling exhibits within North America including the **Soft Gold** Exhibition which comprised 154 American Indians objects from the Northwest Coast of North America (2). Most of them dated from the 19th century or earlier. The materials included carved and painted wood, leather garments, textiles of wool and cedar bark, soapstone carvings, and featherwork.

Another exhibition the **Cenote of Sacrifice** incorporated 300 gold, tumbaga, jade and wooden objects from the Sacred Cenote of Chichen Itza (3). Up to seven venues were planned for this exhibition.

While the packed objects were different, the shipments were similar in that they were to travel to many North American destinations in potentially any season and could be transported *via* both aircraft and truck.

3.0 Designing Against Shock

Before discussing the cushioning of the case, the forces which act on any shipping case when it is dropped should be considered. As it falls it will accelerate due to gravity and then decelerate instantly upon impact. A shock pulse begins to travel into the cushioning in a matter of milliseconds. The cushioned artifacts take a slightly longer time to decelerate, for at the instant that the outer case hits the ground the artifact is only starting to compress the foam. When the outer case has stopped entirely the object inside continues to move and compress the foam. The shock pulse has been spread out over time. The thicker the cushion, the more time will be allowed for the packed object to slow down. Because of this, the peak force of impact or shock (known as peak shock) will be lowered, though the duration of the shock will be longer when compared with the outside case. Peak shock is measured with a unit designated 'G'. 20 G's means that a force 20 times stronger than gravity has been experienced by the object.

Figure 3 illustrates how an idealized shock pulse varies with time. At point A the outer case hits the floor surface and the cushioning foam begins to compress. At point B the cushioning has compressed to its maximum degree and the packed object experiences the peak force of the drop. From B to C the cushioning is recovering or returning to its original thickness. After C the artifact and cushion rebound slightly and finally come to rest again. Consider the shaded area under the curve: for a given drop height this area will be constant. If one can spread out the pulse duration, the curve will tend to flatten and the peak deceleration will be lowered. When one loads a cushion properly, its thickness will determine the length of the shock pulse; thicker cushions will therefore lower the peak shock or rate of deceleration.

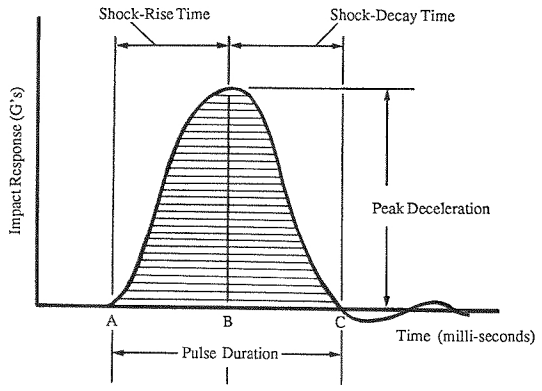

Figure 3. Shock pulse rise and decay time.

3.1 Static Loading and Cushioning Curves

Improper loading of the cushioning is one of the most common sources of error in museum packing. To illustrate this Figure 4 shows three hypothetical inner boxes of a double case. Each is shown with its bottom cushioning only. The boxes are identical in weight, 50 lbs (22.7 Kgm), but are supported by a hypothetical foam having different bearing surface areas (shaded regions). All the cushions are made of the same material. Box A is continuously supported over its entire bottom surface which will be given a value of 150 sq. in. (968 sq. cm). The static load on the foam under it is 50 lbs (22.7 Kgm) divided by 150 sq. in. (968 sq. cm) or 0.33 lbs/sq. in. (0.42 Kgm/sq. cm). Box B is only supported by two shock pads yielding a bearing surface of 50 sq. in. (323 sq. cm). The static load on these cushions is 1.0 lb/sq. in. (0.14 Kgm/14 sq. cm). Box C has been provided with only four corner blocks with a combined bearing surface areas of 20 sq.in. (129 sq. cm) to give a static loading of 2.5 lbs/sq. in. (0.057 Kgm/sq. cm).

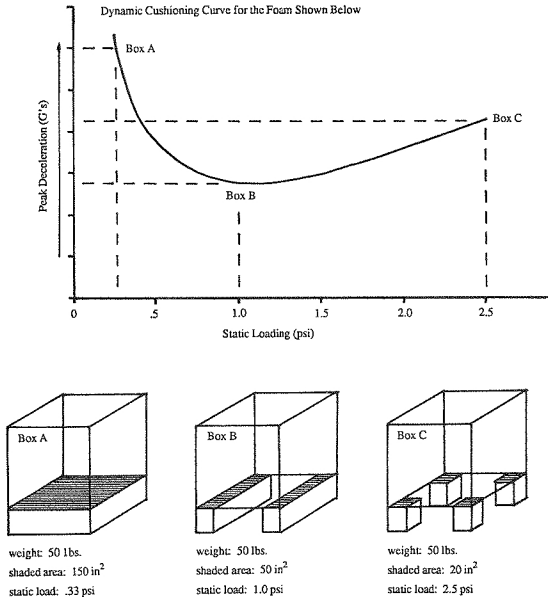

Figure 4. Cushion configuration, static loading and dynamic cushioning curve for a hypothetical foam cushioning material.

Above the boxes is shown a hypothetical cushioning curve for that foam at a particular drop height. It plots the amount of shock (peak deceleration in G's) that is liable to be transmitted to each box at various static loadings. Box A would receive the largest shock because the cushioning will not compress under such a light load. Box C would likewise receive increased shock because the load is too great, causing bottoming. Box B is properly loaded to give the lowest shock. Only if the packer weighs the inner box and its contents and then carefully calculates the correct foam bearing surface using the dynamic cushioning curves, will he reliably mitigate shock in transit.

Even with such careful consideration of static loading (also known as static stress) there are many sources of error and assumptions which must be considered. The balanced configurations of the cushioning assumes that the load is evenly distributed within the box. Often, the weight of an object will not be distributed equally over it's surface area (for example, calumets, adzes, and other composites) and the calculation of average static stress will not be sufficient for good cushioning. If the load is unbalanced there will be an increase in peak shock because each cushion will not compress equally (4). Also, for the configuration under Box B it is assumed that the walls are sufficiently rigid to avoid distortion or buckling during the shock pulse.

Temperature extremes can also affect the interpretation of the cushioning curves. Plastic foams become softer at high temperatures and harden at very low temperatures. This is relevant only if the shipment is expected to travel through climatic extremes such as arctic or desert conditions. Some foams are anisotropic; that is, they exhibit different shock absorbing properties along different axes. A slab of regular cell-size polyethylene foam, for instance, does not give the same curve when tested on its edge versus its flat or skinned surface. It should generally not be used on edge without checking with the manufacturer.

3.2 The Fragility Factor

To use the cushioning curves, the packer first must estimate the maximum shock that an object or collection can tolerate. This amounts to an estimate of the fragility of the object. In museum applications this fragility factor, as it is called, is quite arbitrary. There have been attempts to classify collections according to their materials of construction and then rate the generic materials according to their resistance to various sources of damage. Table 1 shows a classic effort by the late George Stout (5). While such a table is of limited value in assigning a particular fragility factor, it does help the packer to conceive of damage in ways other than simply breakage. Correspondingly, the fragility of an object will be better understood. In order to use the cushioning curves, two target levels of maximum shock are routinely

assigned by the author. 20G's is used for particularly sensitive collections and 40G's for all others. This means that extremely fragile items are cushioned to receive no more than 20G's under pre-shipment test conditions and that all other objects will receive no more than 40G's.

Table 1. (See Reference 4.)

APPROXIMATE RESISTANCE OF MATERIALS

Without Regard to the Form, the State of Deterioration, or the Extent of Restoration
A, Excellent Resistance; B, Good Resistance; C, Fair Resistance; D, Poor Resistance; E, No Resistance

Source: G.L. Stout, Protection of Works of Art (Cambridge, Mas.: 1941.)

MATERIALS / TYPES OF EXPOSURE	Light	Dark[2]	Heat	Flame	Thermal Shock	Blast	Mechanical Violence	Abrasion	Dryness	Dampness	Water	Chemicals	Smoke and Dirt	Gases	Mold	Insects
AMBER	A	A	D	C	C	D	C	B	A	B	B	B	A	A	A	A
CERAMICS																
Glazed	A	A	B	A	D	D-E	E	A-B	A	A	A	A	A	A	A	A
Unglazed	A	A	A-B	A	C	D-E	E	B	A	A[4]	A[4]	A	B-C	A	A	A
ENAMEL ON METAL	A	A	B	A	C	C	D	A	A	A	A	A	A	A	A	A
FILM MATERIAL																
Glue and Gum	B	A	E	D	B	D-E	D-E	—	B	D	E	B-D	A-B	B	D	—
Oil	B	C	E	D-E	B	—	—	—	B	B-C	C	B-C	B-C	C	C	—
Resin	C	B	E	D-E	B	D-E	D-E	D	B	C-D	C-D	B-C	A-B	C	B	—
Wax	B	A	E	E	B	D-E	D-E	E	A	A	A-B	B-D	C	A	B	—
Glass																
Plain	A	A	B	A	E	E	E	A	A	A	A	A	A	A	A	A
Stained	A	A	B	A	E	E	E	B	A	A	A	A	A	A	A	A
IVORY	B	A	D	C	B	C-E	C	B	B	B	C	B	A	B	B	B
LEATHER	B	A	E	D	B	B	A-B	C-D	B	B	C	C	C	C	D	B
METAL																
Bronze and Brass	A	A	B	A	A	B	B	A	A	A[5]	A[5]	C	A	B	A	A
Copper	A	A	B	A	A	B	C	B	A	A[5]	A[5]	C	A	B	A	A
Gold	A	A	B	A	A	B	C	B	A	A	A	A	A	A	A	A
Iron	A	A	B	A	A	B	B	A	A	C-D	A	B	A	B	A	A
Lead	A	A	D	A	A	C	C-D	D	A	B	A	B	A	B	A	A
Pewter	A	A	D	A	A	C	D	D	A	A-B	A	B	B	B	A	A
Silver	A	A	B	A	A	B	C	C	A	A	A	B	A	B	A	A
PAINTING[1]																
Canvas	C-D	C-D	E	D-E	B	D-E	C-D	C	B-C	C	C-E	B-D	C-E	B	C	B
Fresco	A	A	C	A	C	D-E	D-E	D	A	B-C	B-D	B-D	C-D	B-C	B	A
Mud Wall	A	A	C	B	C	D-E	D-E	E	A-B	C	D-E	B-D	C-D	B-C	B	A
Paper	B-D	A	E	E	A	E	B-D	C-E	A	D	C-E	B-D	D-E	C	C-D	A
Vellum	B-D	A	E	D-E	B	D	B-C	D	B	C	E	B-D	C-D	C	C	B
Wood	B-C	B-C	E	D	C	C-D	B-D	C	C-D	D	E	B-D	B-C	B	B	C
PAPER	C	A	E	E	A	C	B-D	B-C	A	C	C-E	C	D-E	C	B	C
PIGMENT																
Inorganic	A	A	A-E	A	A	—	—	—	A	A	A	B-C	—	A[6]	A	—
Organic	C[3]	A	C-E	B	A	—	—	—	A	A-B	B	C-D	—	B	C	—
STONE																
Alabaster	A	A	D	A	B	C	C	B	A	A	A	C	A	B	A	A
Granite	A	A	B	A	B	A-B	A-B	A	A	A	A	A	A	A	B	A
Jade	A	A	B	A	B	B-C	B-C	A	A	A	A	A	A	A	A	A
Limestone	A	A	C	A	B	B	B	B-C	A	A[4]	A[4]	B-C	B	B	B	A
Marble	A	A	C	A	B	B	B	B	A	A	A	B-C	B-C	B	B	A
Quartzite	A	A	B	A	B	A-B	A	A	A	A	A	A	A	A	A	
Sandstone	A	A	B-C	A	A-B	B	B	B-C	A	A	A	B-C	B	A-B	B	A
Slate	A	A	B	A	B	B-C	B-C	A	A	A	A	A	A	A	A	A
TEXTILE	B	A	E	E	A	B	A-B	B-D	A	B	B	C	C-E	B-C	C	B-D
VELLUM	B	A	E	D-E	B	B	B	B-D	B	B	C	C	C	C	C	B
WOOD	A	A	E	D	B	B	B-C	B-C	C	B	B	B-C	B	A-B	B	C

1. In these the resistance is determined largely by the support.
2. Assuming normal room dryness.
3. Except alizarin crimson and a few modern lakes and toners, which are A-B.
4. Unless containing soluble salts.
5. Unless containing hygroscopic copper salts ("bronze disease"), in which case, D-E.
6. Except most lead and copper pigments which when exposed are blackened by hydrogen sulphide, and ultramarine and carbonates which are decomposed by acid fumes.

Table 2.

Approximate Fragility of Typical Packaged Articles

Extremely Fragile
Aircraft altimeters, Winchester hard disc drives ..... 15-25 G's

Very Delicate
Medical diagnostic apparatus, X-ray equipment ..... 25-40 G's

Delicate
Computer display terminals and printers, electric typewriters, cash registers ..... 40-60 G's

Moderately Delicate
Stereos and television receivers, floppy disc drives ..... 60-85 G's

Moderately Rugged
Major appliances and furniture ..... 85-115 G's

Rugged
Table saws, sewing machines, machine tools ..... 115 G's and up

Reprinted from **A Guide to Protective Package Design with Ethafoam Brand Polythylene Foams**, The Dow Chemical Company, Midland, Michigan, USA, 1984, Form No. 172-1150-84.

Table 2 is helpful in putting these levels in perspective. Though it is difficult to compare commercial product fragility with museum artifacts, it is clear that 20 and 40G's are low shock levels. A drop height of only 2 inches on a hard surface can cause an uncushioned object to experience over 50G's.

With the fragility level assigned, one must choose a drop height. Again commercial packaging literature has standardized the probable drop heights a package may be expected to encounter according to the weight of the shipping case. The assumption is that heavier cases will not be lifted as high as lighter ones and that standard industrial handling equipment will be used (see Table 3). This may not be valid for smaller museums. At museums large and small there is the occasional prospect of a heavy case being rolled end over end because of a lack of available staff.

Table 3

Typical Drop Heights

Weight Range Gross Weight in Lbs.	Type of Handling	Drop Height in Inches
0- 10	1 person throwing	42
10- 20	1 person carrying	36
20- 50	1 person carrying	30
50-100	2 people carrying	24
100-250	Light equipment handling	18
250+	Heavy equipment handling	12†

†Palletized products may receive drops of six inches.

Reprinted as per Table 2.

When using the drop height table one should not design for a greater height than indicated without having a good reason. Many foams need to be lightly loaded to perform well during very high drops. Their static loading may be too low to compress the cushioning sufficiently during a low drop.

Having chosen a drop-testing height based on the case weight, and a level of peak G's based on the artifact's fragility, the cushioning curves can now be used to select the type and thickness of cushioning that will protect the artifacts to the required degree.

3.3 Drop Testing

No substitute has been found for drop-testing the cases prior to loading for shipment. By weighting the inner cases one can simulate the weight of the loaded case. In this study both drop and topple testing methods were used and a maximum impact of 20-40 G's was aimed for. Resettable shock indicators that have an error of $\pm$ 10 to 15% are used to measure the shock when testing. These consist of steel balls held within a plastic capsule by the pressure of compressed springs. When an impact above a pre-calibrated G level is received, the spring is dislodged and the level is read visually. Four indicators are used: these are mounted together and calibrated to 20, 40, 70 and 100 G's (6).

This testing has been essential in diagnosing the reasons why a particular design does not perform properly. At times the friction caused by the side

cushions pressing too snugly against the inner case can increase the transmitted shock. In order to compress the bottom cushioning the inner case must first overcome the frictional or shear forces presented by the side cushions. According to Mustin this may add approximately 10G's to the peak acceleration experienced by the inner case (7).

Such indicators are not useful in diagnosing increased shock due to tandem cushioning interactions (8). However, if side cushion friction is not causing a suspected above-level shock, it would be useful to experiment for tandem cushion effects. This is a problem when an artifact's inner cushioning is compressing while the cushion located outside of the inner case is beginning to rebound. The total force experienced by the artifact will be increased in a way that is analogous to a head-on collision between two objects moving in opposing directions. If a single thicker cushion is used, the collision would be analogous to one moving object striking a stationary obstacle. The most reliable way to avoid tandem cushioning problems is to rely on only one foam as a shock absorber and to use the other one as a rigid, non-compressible blocking material.

4.0 Current Case Design

Currently, small artifacts are encapsulated in polyethylene foam inside each drawer or inner case. The charcoal gray polyurethane foam described in the article has been abandoned for several reasons including micro-environmental and vibration concerns (Figure 5). It had originally been chosen to give a two-stage method of shock absorption: each artifact encapsulated within polyurethane and each drawer cushioned on polyethylene foam. But the use of two cushions in series presents potential vibration problems and is an inefficient use of cushion thickness. So, the urethane has been replaced with harder polyethylene foams inside each drawer. For most portable artifacts the nominal 2.0 lb/sq. in. density polyethylene foams such as Ethafoam 220 are too hard for cushioning. Current cushioning curves show that an artifact should have a static stress of 0.75 lb/sq. in. (0.53 Kgm/sq. cm) or more to be cushioned by Ethafoam 220. Most ethnographic objects are in the range of 0.01 to 0.1 lb/sq. in. (0.0007-0.007 Kgm/sq. cm). So, inside the drawers the polyethylene foam acts solely as a blocking or holding agent for the artifacts and will compress negligibly during impact. The exterior cushions are commonly 3 to 4 in. (7.6 to 10 cm) thick and composed of polyethylene or ester-type urethane. The amount of foam is carefully chosen to support the inner case at the optimal static stress.

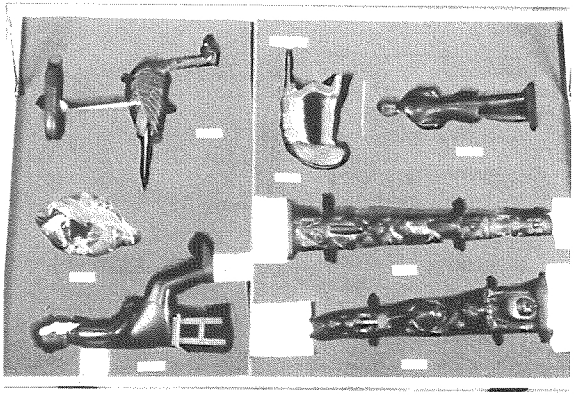

Figure 5. A view of the interior of a drawer where 2.0 lb. ester-type polyurethane was used to cushion each artifact. The white blocks of polyethylene foam cushioned the heavier artifacts along those axes with concentrated weight. This method of inner case cushioning has been abandoned for travelling exhibits because of the difficulty in estimating the center of gravity for complex shapes, in calculating the surface area of those shapes, the outgassing potential of polyurethane and possibility of significant tandem cushioning effects that cannot be diagnosed by simple drop-testing.

5.0 Vibration

While vibration is often presented as a one-dimensional sine curve, it should be remembered that the forcing frequencies from the engine, wheel and chassis of the transporting vehicle are liable to be partially random and generated on all planes, not just vertically. In shipment, vibration frequencies of two to two hundred cycles per second are experienced, and many frequencies may be felt simultaneously. Usually, the force of a vibration is small, under 3G's compared with impact shocks of 20G's and up, but even this level can cause wear and pigment loss when the packed object rubs against its surroundings.

Occasionally, the force can be amplified by the case construction or the object itself. All materials have a natural frequency. This is the frequency at which the object will vibrate freely if struck once. Drums, bells and other percussion instruments indicate their natural frequency with their sound. Objects that do not produce a tone also have a natural frequency. They are said, however, to be damped. An early museum test for determining if a ceramic is high or low fired relies on the fact that low-fired materials are highly damped. When tapped with a fingernail, it will make a dull "thud" while the high-fired object will ring. The trapped air and unfused clay particles damp the low-fired pot and cause the sound to decay quickly.

If the incoming vibration, called a forcing vibration, has an average frequency at or near the natural frequency of a packed object, amplification (or resonance) occurs and each incoming small vibrational shock reinforces the previous one.

Packing foams are chosen because they can absorb shock and also damp vibations over a large range of frequencies. There are some foams that are inappropriate for packing. They tend to be too spring-like when compressed. These will cause the packed object to rebound dangerously after an initial impact. The object will swing back and forth within the foam. Packing foam is formulated to rebound slowly to avoid this. This also affects its performance when vibrating because the incoming vibrations will keep the foam depressed a small amount. The foam does not therefore get a chance to re-expand before the next vibration hits it. Thus a cavity will surround the object when the foam is vibrating that was not there when the foam was at rest. This is an inherent property of packing foams. Damage due to vibration during transit is commonly observed as wear, pigment abrasion and fibre loss. No doubt more serious structural damage such as cracking in wood occurs, but this is difficult to distinguish from other causes such as shock and humidity fluctuations. One suspects that certain forms of cracking in polymeric films may be caused by vibration and not become visible until months or years later.

Overland travelling exhibitions should be packed with the expectation that they will be transported by both land and air. Unforeseen events often have required that one leg of an exhibition travelling by road be sent by air. Furthermore, air shipments often require significant periods of ground transport when the nearest airport is far from the ultimate destination.

This means that the forcing frequencies on objects might be quite wide ranging, with jet engine vibrations in the range of 100-200 Hertz and the chassis, wheel and engine vibrations of trucks in the 2 to 70 Hertz range. We cannot therefore design against narrow frequency ranges as is done in industry unless it is stipulated that only one vehicle type be used for all legs of the travelling exhibit.

What we can do is follow general principles of vibration reduction and choose materials that have good vibration damping properties. One principle is the avoidance of tandem cushioning or the use of two cushions in a series.

Tandem cushioning occurs when both the inner and outer boxes of a double case are cushioned. When cushion 1 is vibrated it will transmit some of this force to the inner box. Cushion 2 will then begin to vibrate, but at a slightly different frequency because the static stress on it will be slightly different from cushion 1. When these two vibrations are in-phase the total amplitude of the artifact's vibration will be increased creating the potential for increased frictional damage. When they are out-of-phase the artifact will experience an increased peak deceleration as it collides with the opposing inner case movement. This could cause damage to the most fragile components of composite objects regardless of whether the case was ever dropped. For a detailed treatment of tandem cushioning see the work of Mindlin (8).

The aim then is to avoid using two cushions, one within another. This does not mean that we cannot continue to encapsulate artifacts in a foam and then float the inner case on a second set of foam cushions. It means that we must choose an encapsulating foam that will be outside the cushioning range for the artifact. The ethnographic artifacts packed by the author have had very low static stresses of the order of 0.01 lb/sq. in. (0.0007 Kgm/sq. cm) to 0.1 lb/sq. in. (0.007 Kgm/sq. cm). These levels are well below those required to deflect a polyethylene foam like Ethafoam 220. If the object is held snugly without compressing the foam, it will not move independently of the inner case. It will only become an independently vibrating mass at very high frequencies.

Polyurethane foams do have one advantage over polyethylene foams in vibration control. They are characterized by two forms of damping: viscous and inherent. Both foams are highly damped due to their ability to disperse the energy away from the source of vibration and then absorb it on a molecular level. This is called inherent damping.

Urethane foams can also absorb vibration energy through viscous damping. Any vibrating body that incorporates a fluid which tends to counteract the motion of that body is said to have viscous damping. Urethane foams, unlike polyethylene foams, are open-celled. As they compress, air must be pushed out and then pulled in during recovery. It is this transport of air that provides the extra viscous damping compared to polyethylene foam.

However, the poor chemical stability of polyurethane makes one question its use even outside the inner case. While it is still an option, engineers

from Barry Controls (9), a vibration control products company, have recommended a completely different cushioning product: the Hardigg Company's Cornermate (10). This is a hollow polyethylene doughnut shape with a small hole in one side. As a shock absorber it has a higher cushioning efficiency than polyurethane and polyethylene foams and it provides both inherent as well as viscous damping when air is forced through the side hole. Although the author has not yet tested this product, it appears, from the manufacturer's technical literature, to be an improvement over polyurethane for chemical stability and over polyethylene foam for shock absorption and vibration control (Figure 6).

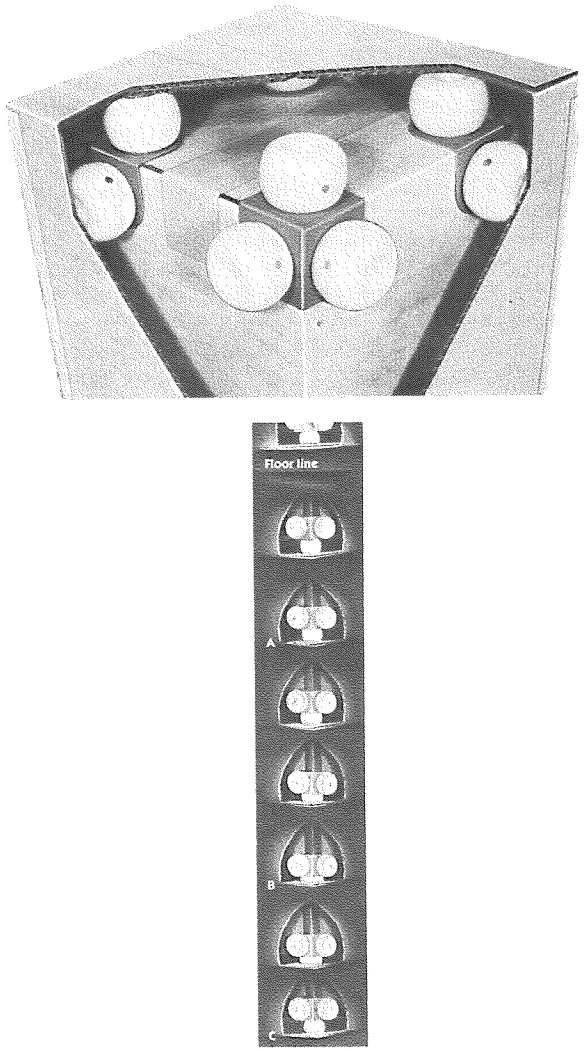

Figure 6. A cut-away view of the Corner-Mate cushioning device and a progressive series of photos, recorded at 1000 fps on 16 mm film during a 30" free-fall drop. The moment of impact occurs at A. The pad has reached its peak deflection at B and has recovered its original thickness at C. Reprinted from: "High-Performance Package Cushioning with Corner-Mate", Hardigg Industries, Inc., South Deerfield, Massachussetts.

6.0 Micro-environment

Most of the changes in the 1982 design were initiated by a desire to upgrade the micro-environment of the case. Initially, it was anticipated that the artifacts would not be left in the cases for more than five days. They were to be removed and placed in appropriate museum storage. However, after each exhibition was completed there was a period of time, sometimes several months, before they could be sent on to the next museum.

The cases occasionally proved to be an irrestible storage location rather than being used just for shipping. With this in mind, the interior case was re-examined. To limit outgassing from the poplar walls the inside surfaces are now lined with a laminated film of polyethylene/aluminum/polypropylene (10) (Figure 7). This is glued to the walls with hot melt adhesive (11). This adhesive, which is used for its good shock resistance at low temperature, is the only one used in the inner case and then it only adheres the bottom and top slabs of foam to the lined bottom and top of the interior case. All the intermediate layers are heat welded with a hot air gun to avoid adhesive outgassing.



Figure 7. A view of a lidded drawer that has been lined with Marvelseal 470 watervapor-proof barrier. It is secured to the wood surface with hot-melt adhesive and taped at its edges with a pressure-sensitive stainless steel tape.

The polyurethane was removed from all inner case designs. Its well-known instability precluded its use as an encapsulation material. Polyethylene foams appear to have the best stability. Dow Ethafoam 220 is the most commonly used regular cell-sized polyethylene foam, and of the mini-cellular foams Voltek's Volara 2A and BXL's Plastazote PO53 are used (11). The Ethafoam 220 which has been cut to 1/2, 1 and 2 in. (1.25, 2.5 and 5.0cm) (12) thicknesses is layered to fill the drawers. The top layer is adhered to the lid so that the artifacts are visible as the lid is opened. The polyethylene foam is carved to fit the object loosely and the walls of each capsule are lined with a mini-cellular foam to lessen the abrasiveness of the cut Ethafoam and fill the gaps around the object.

Some experimentation has been done using pre-conditioned silica-gel strips inside the drawers (13). The cut strips are first pre-conditioned to 50% R.H. before installing them within the inner drawer. They are probably useful for short-term, minor fluctuations only. These are placed in depressions cut into the foam around sensitive organic material. Channels are then cut to connect all the air spaces of each capsule with the strip when the lid is closed. Testing is needed to determine to what extent the strips buffer the enclosed air. The airspace is small, but it is unclear to what degree the volume of enclosed air in the foam should be taken into consideration. Certainly over the long-term the humidity of the air enclosed in the foam will tend to equilibrate with the surroundings by diffusion. In one case where metals were shipped with a desiccant, the Ethafoam 220 was desiccated for four weeks before using it to encapsulate metals. No dimensional change was seen in the foam. Replaceable silica gel desiccating bags were added to each capsule every time the case was repacked. Replacement pre-conditioned silica gel strips are packed with organic materials and installed at each repacking.

Concern for the stabilization of the temperature and relative humidity has led to the use of up to 1 in. (2.5 cm) thicknesses of aluminum-clad rigid polyurethane insulation. This is possible because all of the cushion thickness is now outside the inner drawers and the insulation can be placed around the cushions in greater thicknesses. However, this insulation is prone to outgassing. Gaseous degradation products of polyurethane have been seen to cause the aluminized paper skin to bubble up tautly under high pressure. Recently, there has been some concern raised over the potential of the mini-cellular foam to promote the corrosion of metals. The author has been in correspondence with Sue Blackshaw, the Senior Scientific Officer at the British Museum. In her paper presented with Vincent Daniels, "Selecting Safe Materials for Use in Display..." at the 1978 ICOM Meeting in Zagreb, she tested a mini-cellular foam, Plastazote PO 53 (14). She reported that the material caused no significant corrosion of the silver or lead strips after 4 weeks exposure in a test similar to that described by Oddy. However, the metals were not placed in contact with the foam. Because this author was concerned over corrosion during contact, she kindly repeated the testing with one silver strip touching the Plastazote and another in the air space around the foam. She found that there was "just perceptible tarnishing" of the silver in contact with the Plastazote with no visible tarnishing on that which was out of contact. However, it was her opinion that this level of tarnishing was negligible and that it may well have been due to the absorption of sulphur-bearing gasses on the foam surface from the atmosphere.

The British Museum will continue to use it as a shelf-liner with the shelved objects being kept from contact with the foam. She does not recommend it for long term encapsulation but felt that its use in shipping would be acceptable, if it is lined (15).

Andrew Lins at the Philadelphia Museum of Art performed a test in 1984 on Volara 2A using a sterling silver coupon in direct contact with the foam. He noted tarnishing within two days at 50°C and approximately 100% RH. A control was untarnished, and there was no discolouration where the test coupon did not contact the foam. Lins concluded that the foam at hand should not be used in shipping extremely sensitive black and white photographs from the nineteenth century (16).

The Volara 2A mini-cellular foam needs to be tested more thoroughly. Though it is an all-polyethylene foam, it is manufactured by a different process than Plastazote PO 53. At one of its two manufacturing sites a small amount of sulfur-bearing chemical is introduced as a processing aid at an early stage of its production (17). More specific information is not available for proprietary reasons. We do not yet know how significant a hazard is presented by the sulfur. In the face of this uncertainty I have decreased my use of any of the mini-cellular foams and have turned to Plastazote PO 53 as a capsule liner for use only when abrasion is a significant problem. This is covered with washed, unbleached muslin for metals and other sensitive materials (Figure 8).

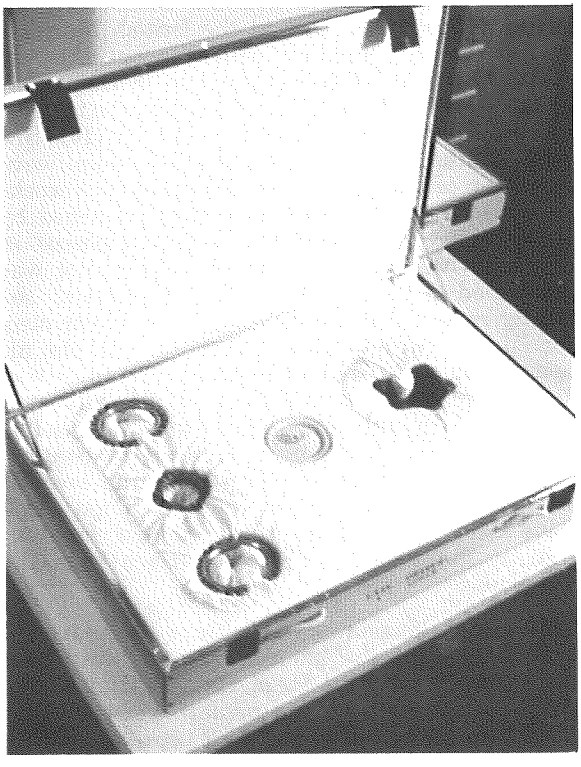

Figure 8. A view of the interior of a lidded drawer using only Ethafoam 220 and muslin. Concerns over the potential for outgassing has led to a decreased use of the mini-cellular foams except when essential for abrasion reduction. The container shown in the center holds extra desiccating silica gel packets to be inserted with each metallic object at each re-packing.

7.0 Conclusion

The application of package engineering principles to museum packing must be done carefully. A poor understanding of the principles can lead to great errors. There have been misguided attempts, for instance, to use undamped springs in place of more traditional cushioning materials. Disastrous damage has occurred when spring-loaded cases were designed without a sufficient knowledge of damping, rebound energy and resonance.

Errors of misapplication are not to be confused with those resulting from the simplification of the parameters of the packing problem. The ability to predict accurately the shock protection levels of our methods will decrease as we simplistically define or model the transit environment. When high-performance cushioning systems are needed industrial and military designers use complex computer modeling to achieve high-confidence levels (18).

Both types of error can be eliminated by testing. Prototype testing of the spring-loaded case would have shown the need for damping. Similarly, laboratory and transit testing allows one to estimate the significance of the error introduced by simplistic or dated modeling of the transit environment. The most beneficial effect of the application of package engineering to museum packing may be that it has shown the importance of testing our designs.

Acknowledgement

I wish to acknowledge the essential advice and support of my wife, Jane Drake Piechota in developing the above packing methods and in preparing this paper.

Further Reading

There is a good deal of literature on packing, though it is at times hard to locate. Of the bibliographies that have been compiled there is a particularly useful unpublished student paper by Denise Thomas containing over 100 entries (19).

There has been a fine series of papers written recently by Sarah Staniforth (20), Timothy Green (21) and Karen Leback (22).They have all tested cases designed for paintings. It is not always advisable to apply data from painting case tests to three-dimensional objects. The highly varied and often composite ethnographic artifacts have their own peculiar problems. Some of these concerns have recently been discussed by Lisa Mibach (23). Still, basic research is needed to test the varied and often conflicting practical solutions that museum packers have evolved as well as to define the specific needs of ethnographic materials.

References and notes

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3. The **Cenote of Sacrifice Exhibition** was organized by the Science Museum of Minnesota in collaboration with the Peabody Museum of Harvard University. It was supported by a grant from the National Endowment for the Humanities and by the Dayton-Hudson Foundation.

4. The weight of an object is often distributed unequally over its surface area. For unbalanced objects such as calumets, adzes, and other composites, the calculation of average static stress will not be sufficient for good cushioning. A good discussion of the methods of overcoming this problem is found in Kenneth Brown's **Package Design Engineering** published by Wiley & Sons, New York, 1958.
5. This table has been copied from the **Report of the Study Group on Care of Works of Art in Travelling Exhibitions of the Museum Exchange Subcommittee of the United States - Japan Conference on Cultural and Education Exchange**, Japan Society, New York, 1980, p. 6. There is also a similar table by Kenzo Toishi on page 7 for Japanese materials and works of art.
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9. Barry Controls publishes a useful discussion of vibration theory as an introductory section to their product catalogue. It can be obtained free of charge by requesting the **Application Selection Guide**, Bulletin C8-184, from the company at 700 Pleasant Street, Watertown, MA, 02172, USA.
10. Marvelseal 470 is the trade name for this watervapor-proof laminated sheeting. It is produced by the Ludlow Corp., Holyoke, MA, 01040, USA.
11. Jet-Melt 3764 hot-melt adhesive is unplasticized and composed of ethylene vinyl acetate resin, paraffinic hydrocarbon wax, and a hydrocarbon resin blended with polyethylene and produced by the 3M Corporation, St. Paul, Minnesota.
12. Volara 2A is a radiation cross-linked polyethylene foam produced by Voltek Corp., 100 Shepard Street, Lawrence, MA, 01843, USA. Plastazote PO 53 is a chemically cross-linked polyethylene foam. BXL Corp. is a subsidiary of Union Carbide. Locally it is supplied by United Foam Plastics Corp., 172 East Main Street, Georgetown, MA, 01833, USA.
13. The silica gel sheets used are sold under the trade name of Art-Sorb and manufactured by Fuji-Davison Chemical, Ltd. They are supplied by Conservation Materials Ltd., Box 2884, Sparks, Nevada, 89431, USA.
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16. Personal communication with P. Andrew Lins, Conservator of Decorative Arts, Philadelphia Museum of Art, Box 7646, Philadelphia, Pennsylvania, 19101-7646, USA.
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L'auteur discute de certains problèmes auxquels il s'est heurté dans la conception de contenants destinés au transport d'objets à caractère ethnographique et archéologique faisant partie d'expositions itinérantes. Il expose les perfectionnements apportés à certaines techniques décrites dans "The Care of Cultural Property in Transit: A Case Design for Travelling Exhibitions", **Technology and Conservation**, vol. 7 n° *4, 1982, qu'il a rédigé en collaboration avec Greta Hansen. Les sujets suivants sont abordés: essais de régulation du milieu ambiant dans les caisses au moyen d'humectants, d'isolants et de pare-vapeur; double coussinage (utilisation de deux couches de matériaux d'amortissement) pouvant causer des dommages par suite des vibrations; problèmes d'utilisation des mousses de plastique pour l'amortissement des chocs; importance de soumettre les caisses à des essais de chute, en utilisant une fausse charge qui imite les tensions statiques et l'équilibre de la charge muséale.*

THE REMOVAL AND CONSERVATION OF THE PAINTED BARK PANELS AND CARVED FIGURES FROM A PAPUA NEW GUINEA *HAUS TAMBARAN*

D.J. LEE

In 1980 the British Museum sent Mrs. D. Starzecka of the Ethnography Department (Museum of Mankind) and D.J. Lee, of the Conservation Department, to the Wosera-Abelam area of the Maprik district of the East Sepik province to collect the figures and panels from a Haus Tambaran. These carved and painted figures and the painted panels had been made for an initiation ceremony about 1975. Since that time they had been virtually abandoned to nature; some figures had been damaged by termite attack. In this paper the problems of packing the figures and panels is explained, and the identification of timbers and fragments, and conservation treatments on return to the conservation laboratory are described. Also included is a short note on the storage, and information for those making ethnographic collecting visits to the tropics.

1.0 Introduction

One of the most valuable experiences for a conservator is the chance to witness the technology of a people on whose material he works. The visit made by the author in 1980 to Sarakim Village, East Sepik Province, Papua New Guinea to collect the figures and panels from a *haus tambaran*, provided such an opportunity. It allowed me not only to care for objects as they were being transported and packed, but also to study the methods of carving and particularly of painting figures and panels. One important aspect was to study damage caused by environmental conditions, including insect damage to wood and bark materials.

The British Museum has very good collections of ethnographic material from Papua New Guinea, but until this collection was made very little from the Wosera-Abelam people of the southern slopes of the Prince Alexander mountains near the north coast existed in the collections (1). This particular area is perhaps the richest in culture and in the production of art objects in the whole of Papua New Guinea. However, what was special about this collection was the fact that it formed a complete unit, being almost the entire contents of an ancestor spirit house (*haus tambaran* in Pidgin English). There are few museums that have a complete assembly of figures from one of these houses, and therefore it was something of an achievement for the British Museum to acquire a related group of carvings.

The *haus tambaran* was rather like a giant thatched ridge tent forming a peak at the front about 8 metres from the ground, then dropping away at the back to perhaps 5 metres (Figure 1). The interior was divided up into various chambers and a ceiling about 3 metres from the ground made it impossible to see into the upper loft. Along each wall the ancestor figures stood in lines shoulder to shoulder, a most unearthly sight in the gloom of the dark interior of the house (Figure 2). In addition to the carvings, paintings on sheets of sago palm bark adorned the front peak of the *haus*, the ceiling, and the walled portions of the interior. These represented ancestors, and were painted in traditional Wosera-Abelam style.

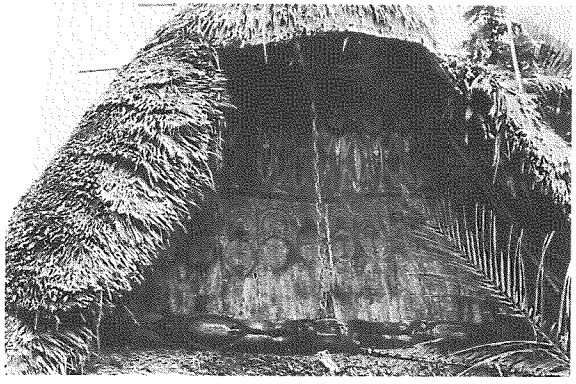

Figure 1. Facade of Haus Tambaran in Sarakim Village, Maprik District, East Sepik Province, Papua New Guinea.

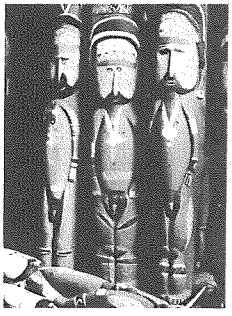

Figure 2. Carved and painted figures in the Haus Tambaran.

2. Technology of Carving and Painting

The carved wooden figures (some as much as 3 metres in height) are produced in a traditional way for presentation to the *haus tambaran* during the initiation ceremony. Strictly conventional Wosera-Abelam carving styles are used, and very little in the way of changes in style is allowed or tolerated. Most carvings are very similar in style and ornamentation. The timber does not appear to be seasoned in any way apart from the initial charring of the surface. Work proceeds using an adze with a modern steel blade (in former times a stone blade would have been used) to fashion the trunk, arms, legs and head of the figure. More delicate work was in former times carried out with a bone sharpened to form a chisel. The bark panels are made from the lower part of the stem of the sago palm leaf, which is dried slowly inside a house and flattened with very heavy stone weights. Before painting can take place, the panels are coated with a grey silt from the sago palm swamps. Perhaps a more important task, and one undertaken in more secrecy was the actual painting of the figures and the sago palm panels. The colours are all produced from local materials. White is calcium carbonate (chalk or weathered limestone). Black is soot (carbon) from inside the house roof. Yellow is ochre earth or possibly ground up sandstone, and red from rotten wood found on the bank of the nearby Nanu River which is allowed to dry and then reduced to ash on a shard of pottery over a fire. The resulting ash when ground up is bright ochre-red. The pigments do have some additions to them. For example, yellow has the addition of the ground root of the ginger plant which produces a vivid yellow dye. Black has the addition of juice from the crushed leaves of a type of *Coleus* plant, which seems to enhance the intensity of the pigment.

Brushes appear to have been made from feathers or fine grass stems, although sometimes artists' brushes were obtained by trade and proved to be very popular with some of the older artists.

3. Environment Conditions, Damage and Condition of the *Haus Tambaran*

Climatic conditions in this part of Papua New Guinea are not at all favourable to the preservation of organic materials. Relative humidity, temperature and the agents of biodeterioration combine to make decay and destruction of protein and cellulose materials a very rapid process.

The painted facade of the *haus* had become almost completely obliterated in the lower registers due to constant washing by rain, where it was not protected by the overhanging eaves. Some loss of pigment may also have been due to wind action. The thatch of the house, too, was in poor condition. In some parts it appeared to show a green mould effect, particularly at the front. Rain, however, did not seem to have damaged the contents of the house to any great degree, apart from one or two rain splashes on figures.

The *haus tambaran* which had been built for an initiation ceremony in about 1975, had been virtually abandoned to nature since then. A great deal of damage had been done to the structure by termites (*Isoptera*) (2,3,4,5,6) that infested the house and had built three large nests in the roof. These nests were made from a mixture of mud and part digested wood fragments. The ancestor figures, resting as they did against the walls of the house, made an ideal bridge between floor and roof for the insects.

Damage to some of the carved figures was so severe they had been removed from the house and put into a small adjacent thatched hut. It is difficult to describe the damage done to the house and figures but it would be no exaggeration to say that the house was, due to termite devastation, very near collapse. Many of the main supporting poles had been completely eaten through at the ground level so that the house was practically standing on its thatch.

On the surface of many of the figures were mud tunnels, constructed by the termites, leading from the damp earth to the nests in the roof. The bases of many of the figures had been eaten away and some figures, although appearing to be in a sound condition, had been eaten away inside leaving only a thin skin of wood at the surface. In these cases the slightest pressure caused the whole surface to collapse leaving a large cavity.

4. Removal of Artifacts, Transport and Packing

The collection was moved by truck from the village to a nearby town and prepared for packing. The first task was to sort the collection making sure that all the carvings had arrived safely. The figures were then lined up along the wall of the storage area, and put into suitable groups for packing. It was important at this stage to dry out the carvings as much as possible and standing them on the concrete base of the storage area helped with this drying process. The additional use of a large electric fan to keep the air constantly moving also proved very useful.

The carvings and other ethnographic specimens were sprayed with the fungicide ortho-phenyl-phenol, to prevent mould growth (7). All carvings, panels and the interiors of packing cases were sprayed with an insecticide aerosol spray containing pyrethrum. The packing cases were made by two local carpenters who constructed sixteen of them in ten days. The large figures were fitted into the cases and held in place by bulkheads nailed across the inside. For padding between the figures, the hessian-like material found at the base of the coconut palm leaf proved to be most useful. This was thoroughly dried out and sprayed with insecticide before being put into the cases. The painted fronts of the panels were covered with 'cling-film', which seemed to work well and kept the painted ochre surfaces from coming into contact and smudging. This created a micro-environment with a consequent risk of mould growth occurring during shipping, but this seemed to be a lesser problem than the loss of pigment due to abrasion. The sea voyage to the United Kingdom took two months.

5. Fumigation

On unpacking, the paintings and carvings showed signs of mould growth. This was probably caused by the wooden cases having been packed into an unventilated metal shipping container in tropical conditions. On some figures the paint was obliterated by mould producing a white, green or brown mycelium. The growth appeared to be more intense on the painted surfaces particularly black, red and yellow. After removal from the shipping container, the specimens underwent fumigation in a vacuum chamber with a mixture of ethylene oxide and carbon dioxide gases. This killed any insects in the artifacts and cases, as well as the mould on the surface of the carvings and panels. Damage by termites appears to have ceased at the time of removal of the figures from the *haus tambaran*.

6. Identification of Materials

6.1 Wood

Two types of timber had been used for carving the figures; both were easily worked (8). One was light yellow in colour and called *Gupi* by the Wosera. The other was white in colour and called *Sirinjui*. Samples sent to the Royal Botanic Gardens at Kew, were identified as *Nauclea sp* (also called *Sarcocephalus*), found in tropical Asia and Polynesia and popularly called Yellow Cheese Wood, and *Funtumia sp* similar to that found in tropical Africa and Malaysia. A sample of timber from which the red pigment was obtained was identified as being from the *Ixonanthaceae* family occurring in Indo-China, Philippines and Borneo.

6.2 Pigments

Samples of the pigments were collected for identification by the British Museum Research Laboratory. These were analysed by x-ray diffraction with the following results:

Red — haematite (Fe_2O_3)

Yellow — silica (SiO_2) containing some organic material

White — dolomite [$CaMg(CO_3)_2$]

Grey — a complex hydroxy aluminum silicate

The black pigment could not be identified by the x-ray diffraction method, but examination under the microscope showed traces of plant material.

7. Conservation

7.1 Cleaning

After experiments had shown that the use of solvents to remove dust and mould growth caused staining to the pigment, it was found that cleaning could be more safely achieved by the use of a selection of small brushes (sable hair, hog's hair and glass bristle) and a small vacuum cleaner (Figure 3). The tube of the vacuum cleaner was placed close to the area being treated, and the dust and mould remains and glass bristles were then removed before they had chance to settle on the cleaned section. An air filter mask and protective gloves were worn during the removal of mould residue, as glass bristles and dust can be harmful if inhaled. The cleaning procedure started with the softer brushes and if these were ineffective, more resilient types were tried. As a final resort, glass bristle brushes might be used. It was inevitable that a small amount of pigment was lost during this process, but working under magnification (2x) helped to identify the moment when all debris had been removed from the surface and the clean pigment revealed. Separate brushes were used for each colour, and these were washed at regular intervals. Some colours, for example red and white, appeared to be rather more fugitive than others while black and yellow were bound more firmly to the surface.



Figure 3. Cleaning the surface of the carved and painted designs.

7.2 Consolidation of pigments (9, 10)

The pigments needed treatment to consolidate the loose and powdery surfaces and the choice of consolidant was governed by four important factors:

i) that the consolidant would be capable of consolidating the pigments at low concentrations;
ii) that the surface texture and colour should not be altered to any significant degree;
iii) that the resin should not absorb dust into its structure;
iv) that the resin treatment should be reversible.

Some methacrylates have low glass temperatures (Tg) or "second order transition temperature". For example, poly N-butyl methacrylate has a Tg of 22°C so that at little above room temperature the resin will become tacky and absorb dust that settles on it. The methyl methacrylates tend to have higher glass transition temperatures, around 105°C, and these are therefore much harder materials.

It was decided to use the methyl acrylate/ethyl methacrylate copolymer Paraloid B72, 2.5% (w/v) in xylene. Some experiments were made using brush application; however, spraying appeared to give a better and more even coverage of the surface (Figure 4). The large figures were treated in a room fitted with extraction fans, and full face masks and protective clothing were worn. Consolidation with Paraloid B72 was successful for the white, yellow and red pigments but because of the organic components in the black pigment, it became glossy. The black pigment was therefore treated with 10% (w/v) Ketone Resin N in white spirit applied with a brush (Figure 5). These areas were then masked off whilst the other colours were sprayed with Paraloid B72 (9,10).



Figure 4. Spraying consolidant onto the painted surfaces of the figures.

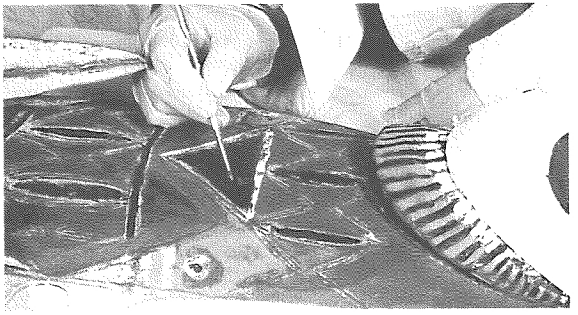

Figure 5. Treatment of the black pigments with 10% Ketone N Resin in white spirit.

7.3 Consolidation of the painted Sago bark panels

After the panels were cleaned using the same method as that for the figures (Figure 6), they were consolidated with a 2% (w/v) solution of polyvinyl butyral (Butvar B98) in ethyl alcohol or isopropyl alchohol with good results. Paraloid B72 proved to be unsuitable for use on the sago bark panels because of the dense nature of the substrate and apparent alteration of pigment colours.

Work is in hand at the moment on the use of the methyl cellulose range of materials, and it is possible that Blanose 7HC or Blanose 7MC



Figure 6. Sago bark panels before and after cleaning.

(refined carboxy methyl cellulose) or Klucel (hydroxy propyl cellulose) may possibly produce equal or even better results. These all dissolve in distilled water with the addition of a few drops of non-ionic detergent and ethyl alcohol to make a 0.5% solution.

7.4 Gap filling

Those figures with termite weakened bases were consolidated by injection with 10% (w/v) Paraloid B72 in xylene (11). This consolidated the mechanically weakened wood. After evaporation of solvent and hardening of the resin the cavities were filled with BPK Dough (Butvar B98, paper dust and kaolin) applied in layers, allowing each to dry before another was applied thus minimising shrinkage. Gaps and cavities on the surface of the carved figures were filled with BPK Dough and coloured to simulate the original surface. Some of the figures had damage to the carved and painted surfaces, especially where termites tunneling just below the surface had left a cavity covered with a thin surface skin. Support was given to the weakened areas by filling with BPK Dough. The surface skin was then fixed in place by nitro-cellulose adhesive. Finally the BPK Dough filling was toned down to simulate the colour of the surrounding area.

8. Storage environment

A great deal of thought and care had to go into the design of the racks and storage fittings to accommodate the figures and painted panels. Of paramount importance were the environmental conditions (12) in which the specimens were to be stored and, for organic materials and particularly wood, a relative humidity of between 50% and 55% was recommended.

9. Conclusion

For the benefit of future Museum expeditions to tropical climates the information and experience gained during the visit described here may prove valuable. Briefly, the important points are as follows. Great care should be exercised when handling termite-damaged specimens for they can be in a very fragile condition. Although insecticides may be locally available, it is safer to take a supply with you as they may not be readily obtainable. In addition, those available overseas may now be prohibited materials in developed countries so it is advisable to be familiar with health and safety requirements for all such insecticides and fungicides. Where specimens with powdered ochre pigments are being collected, thin polyethylene sheet for covering surfaces is a necessity. Large carvings should be fitted into packing cases with bulkheads, so that the objects cannot move during transit.

Climatic conditions (13) should be controlled within the shipping container or packing case if possible. This should be followed by a period of slow acclimatization in the museum store. During this time the relative humidity should be gradually reduced from the high level found in the tropics, to the level of the environmentally controlled museum store in which the objects are to be kept.

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Biographical Notes

David J. Lee was a member of the British Museum ethnographic collecting expedition to Papua New Guinea in 1963-64, and joined the Ethnography Department of the British Museum as Conservation Officer in 1965. He holds the Diploma in Archaeological Conservation of the Institute of Archaeology, London University; the Conservation Certificate of the Museums Association of Great Britain; and is a Fellow of IIC. He has accompanied other British Museum expeditions and acted as a UNESCO adviser in the Maldives, and to the Ford Foundation in Egypt.

His major interests include the conservation of ethnographic wood, particularly from Papua New Guinea and the Pacific Islands, and the conservation of archaeological waterlogged wood including the techniques of wet wood archaeology.

En 1980, le British Museum a délégué Mme D. Starzecka, du Département d'ethnographie (Museum of Mankind) et M. D.J. Lee, du Département de la conservation, dans la région de Wosera-Abelam, dans le district Maprik de la province du Sepik oriental, pour y recueillir les figures et les panneaux d'une Haus Tambaran. *Ces figures sculptées et peintes ainsi que les panneaux peints avaient été fabriqués pour une cérémonie d'initiation vers 1975. Depuis, ils ont été littéralement livrés à la nature. Certaines figures ont été ravagées par les termites. La communication explique les difficultés que présentaient l'emballage des figures et des panneaux et l'identification des madriers et des fragments, ainsi que les traitements de conservation par la suite au laboratoire. Elle comprend aussi un bref commentaire portant sur la mise en réserve des objets, et de l'information à l'intention de ceux qui s'occupent de collectes ethnographiques dans les tropiques.*

FEATHERS

An Evaluation of Feather Cleaning Techniques
S. Wolf Green, P.S. Storch
Texas Memorial Museum, Texas, U.S.A.

Disruption of Feather Structure by Ultrasonic Cleaning in Aqueous Detergent Baths
G.S. Young
Canadian Conservation Institute, Ottawa, Canada

AN EVALUATION OF FEATHER CLEANING TECHNIQUES

SARA WOLF GREEN AND PAUL S. STORCH

There has been very little published about the conservation of feathers. Cleaning techniques that have been reported include washing with a non-ionic detergent in water, cleaning with dry-cleaning solvents and spirit soaps, cotton swabs dampened with water and vacuum cleaners and the results of a series of tests conducted on primary feathers which were examined under magnification to determine whether soils were actually being removed by the techniques which have been proposed.

1.0 Introduction

There has been very little published about the conservation of feathers. Cleaning techniques that have been reported include washing with a non-ionic detergent in water (1), cleaning with dry-cleaning solvents and spirit soaps (2), cotton swabs dampened with water (3,4,5) and vacuuming (3,4,5).

This paper will examine specifically vacuuming and the results of a series of tests conducted on primary feathers which were examined under magnification to determine whether soils were actually being removed by the techniques which have been proposed.

2.0 Preliminary Cleaning Methods

Using cleaning techniques suggested in the literature on feather conservation, a series of primary wing feathers from a single specimen were examined by scanning electron microscopy (6) to evaluate physical changes in the feathers resulting from the cleaning techniques. Prior to analysis, each treated sample was cut down to an approximately 3x3cm size in order to fit on the stage. Each sample was coated with a 20 A of gold in a Pelco Sputter Coater after being attached to the stage with contact cement. The specimens were examined in a Jeol JSM-35C scanning electron microscope at aperture 2 in the secondary electron mode, with an accelerating voltage of 25 KV using a tungsten electrode source (cathode). A simplified description of feather structure is seen in Figures 1 and 2. In addition to an untreated control feather, eight variations of technique were evaluated as follows:

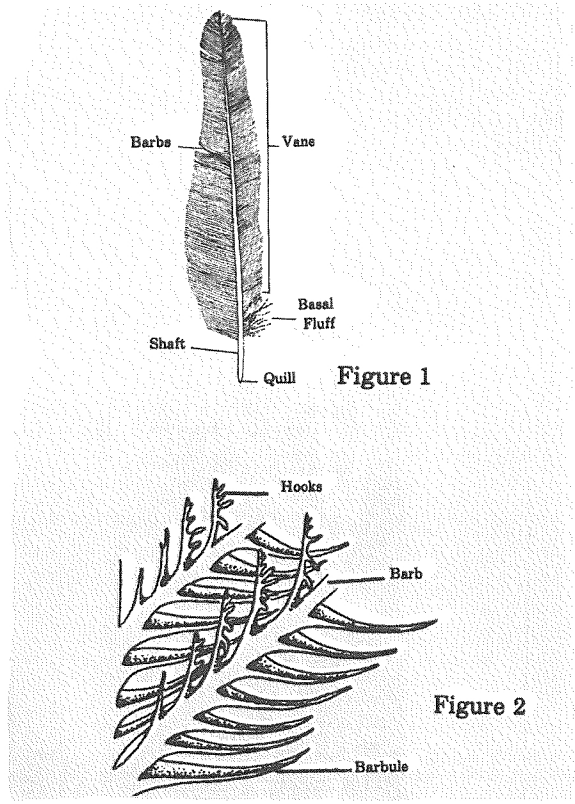

Photo Credit: Hal Storey

Figures 1 & 2

1. Control.
2. Vacuuming through a fiberglass screen.
3. Vacuuming with gauze placed over a standard plastic tip.
4. Vacuuming with a micro-tip.
5. Misting the feather with deionized water and vacuuming with a micro-tip.
6. Cleaning with soft brush dampened with deionized water.
7. Cleaning with cotton swab dampened in 3% non-ionic detergent/deionized water solution, followed by deionized water rinse.

8. Misting the feather with ethanol and vacuuming with a micro-tip.

9. Cleaning with 3% non-ionic detergent/ethanol solution, followed by ethanol rinse.

The vacuuming was done with a dental evacuator made by Dri-Clave Mono Vac, available from Columbus Dental, 1000 Chouteau Avenue, P.O. Box 620, St. Louis, MO 63188 (Figure 3) using either a standard plastic tip with a 1.5 cm opening, or a micro-tip designed for oral surgery (Figure 4). The results of the tests are summarized in Table A.

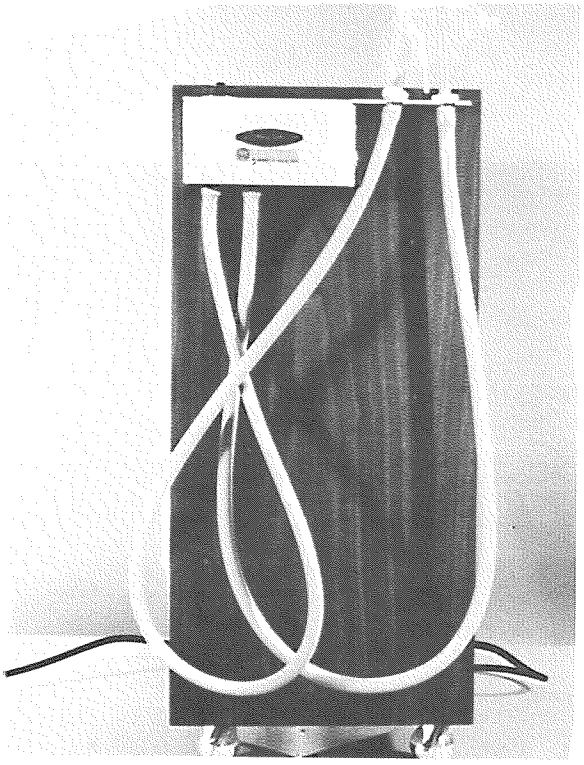

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Figure 3

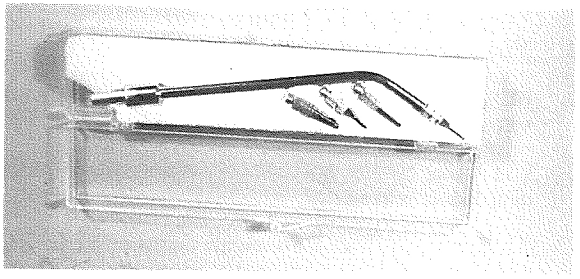

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Figure 4

2.1 Results

As a result of tests shown in Table A it was concluded that the cleaning techniques which caused the least amount of physical change to the feather were dry vacuuming using a surgical micro-tip and dental evacuator at power 2.5 or less, or vacuuming with the standard plastic tip covered with gauze.

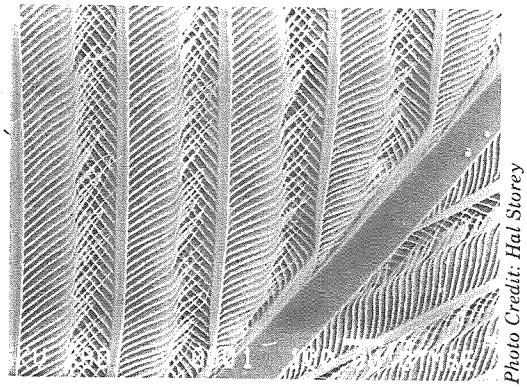

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Figure 5

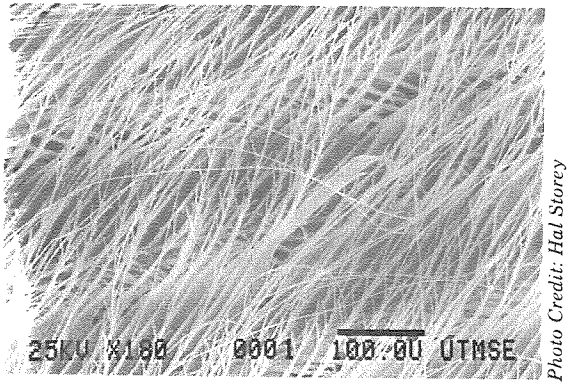

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Figure 6



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Figure 7

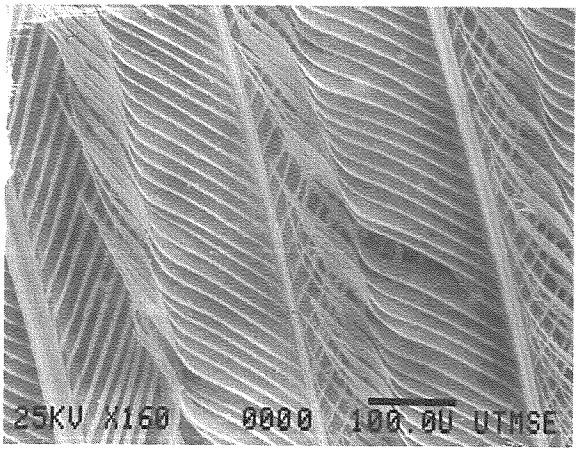

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Figure 8

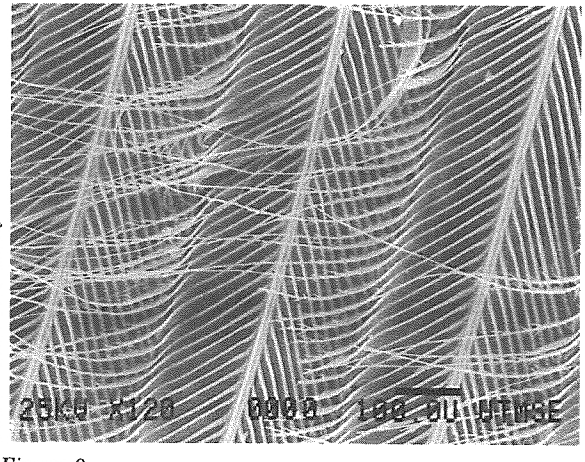

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Figure 9

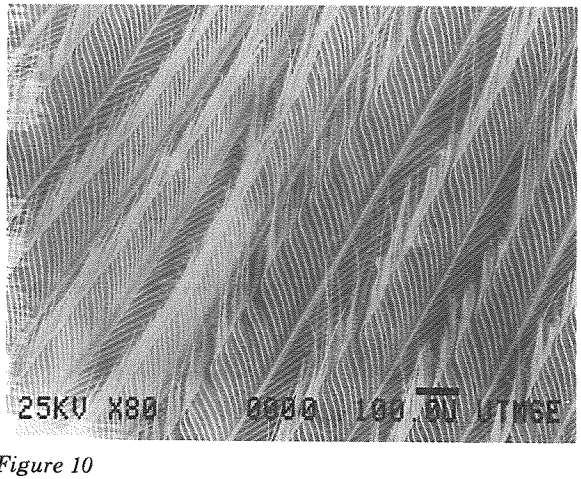

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Figure 10

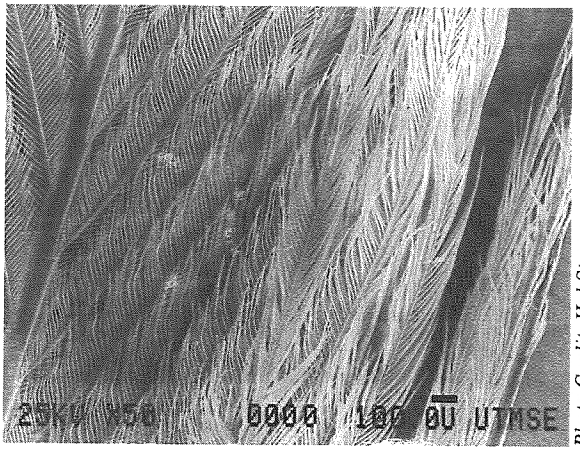

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Figure 11

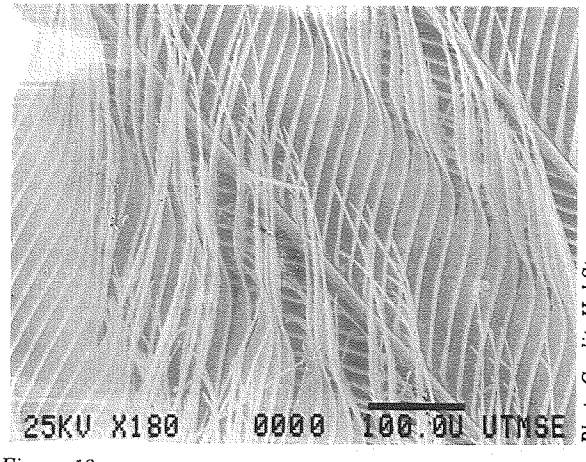

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Figure 12

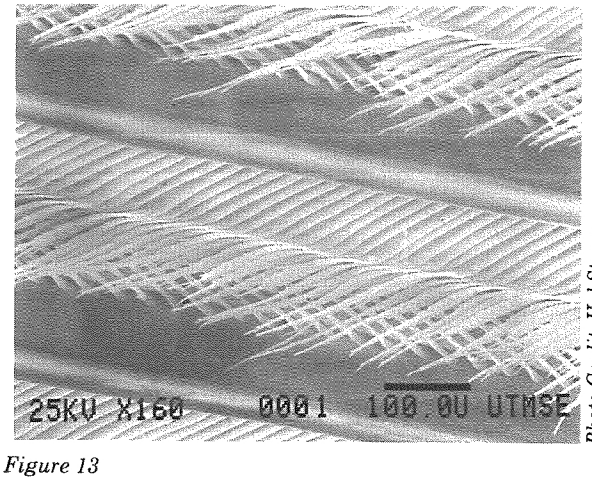

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Figure 13

Table A
Physical Effects of Cleaning on Primary Feathers

Feather	Visual Observation	SEM Observation	Figure
1.	(control)	—	5
2.	edges of feather barbs tend to pull through holes in screen at power 2.5	evident disorganization of barbs and barbules and disarticulation of hooks	6
3.	appears effective with no evidence of disarticulation	minor disarticulation of barbules	7
4.	appears effective with no evidence of disarticulation	negligible disarticulation of hooks	8
5.	appears effective with no evidence of disarticulation	water allows hooklets to disengage; vacuum then disarticulates some barbules	9
6.	appears to mat barbs	matting extends to hooks for complete disarticulation of feather	10
7.	severe matting of feather	severe matting extends to hooks which have been completely flattened	11
8.	some distortion at feather edge	some disarticulation of barbules equivalent to no. 5	12
9.	severe matting of feather	matting extends to hooks for complete disarticulation of feather as with no. 6	13

3.0 Specific Cleaning Methods

Having determined the vacuuming methods which produced the least physical changes to the feathers, a second series of feathers was examined to determine the effectiveness of these two methods in removing particulate soils. Three additional primary wing feathers from the same specimen were dusted with fuller's earth*, and then tapped gently with a fingernail to remove the excess. After vacuuming, the feathers were examined by scanning electron microscopy to evaluate the effectiveness of the techniques. In addition to an uncleaned control, two variations of technique were evaluated as follows:

1. Control.
2. Vacuuming with gauze placed over a standard plastic tip.
3. Vacuuming with a micro-tip.

* Hydrated aluminum silicate

3.1 Results

The results of these further cleaning methods are summarized in Table B. While the vacuuming techniques do not appreciably effect the feather in any physical manner, they are not wholly satisfactory in removing particulate soils.

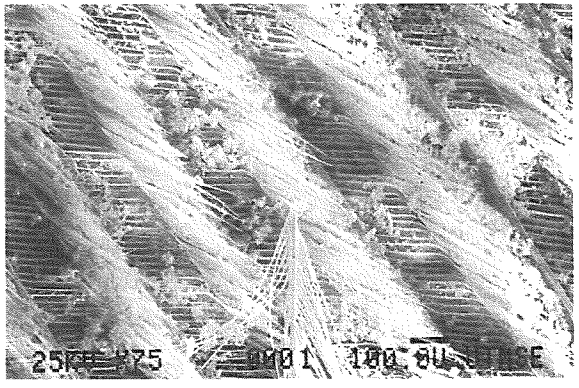

Photo Credit: Hal Storey

Figure 14

Table B
Effectiveness of Vacuuming Methods on
Removing Particulate Soil

Feather	Visual Observation	SEM Observation	Figure
1.	—	—	14
2.	appears effective	appears to remove about 75% of particulates	15
3.	appears effective	appears to remove slightly more of the particulates than method no. 2	16

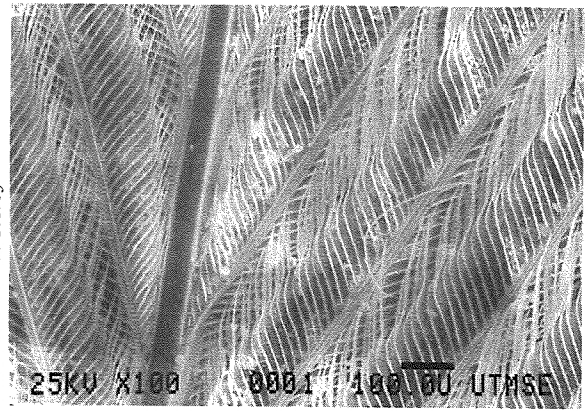

Photo Credit: Hal Storey

Figure 15

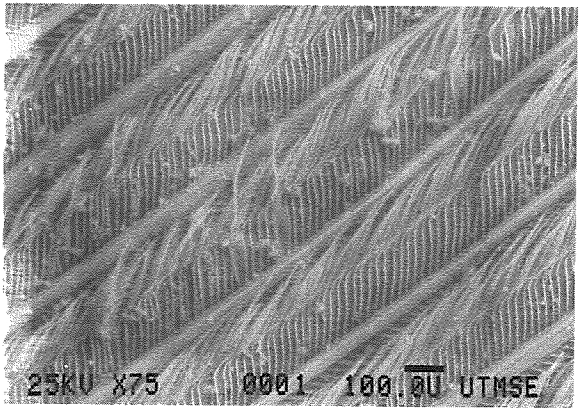

Photo Credit: Hal Storey

Figure 16

4.0 Summary

While vacuuming techniques are not wholly satisfactory for adequate removal of soils, they are still the only techniques which do not cause major physical changes in feathers. Unfortunately, many museum specimens are affected not only by particulates but by greasy accumulations, as with study skins or whole mounts. Clearly, the use of grease-cutting solvents and/or detergents causes physical changes in the feather which result in disarticulation and damage. The problem demands further research and creative suggestions for a solution.

Acknowledgements

The authors would like to acknowledge the work of Judith Levinson and Marion Kaminitz who have also been studying this problem and are continuing research on other potential cleaning methods. Nancy Odegaard has also recently noted the potential for the use of the dental evacuator for cleaning feathers in a short article in the **Ethnographic Conservation Newsletter** of the Working Group on Ethnographic Materials of the ICOM Committee for Conservation (June 1986). During the Objects Specialty Group session of the 1981 annual meeting of the American Institute for Conservation of Historic and Artistic Works Ron Harvey and Nancy Odegaard introduced the dental evacuator as a tool for conservation laboratories and described its value for cleaning basketry materials.

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Biographical Notes

Sara Wolf Green graduated from George Washington University with a Bachelor of Arts degree in Anthropology and Art History. She received her Master of Arts degree from the same institution in Special Studies in Ethnographic and Archaeological Conservation. She has worked as a conservator of ethnographic materials and textiles at the Smithsonian Institution's Anthropology Conservation Lab, the University Museum (Hampton University), the Fiji Museum, and currently at the Materials Conservation Lab of Texas Memorial Museum at the University of Texas at Austin, where she is the Senior Conservator.

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On trouve très peu de documentation au sujet de la conservation des plumes. Les techniques de nettoyage documentées comprennent le lavage à l'eau avec un détergent non ionique, le nettoyage à sec à l'aide de solvants et d'essences de savon, le nettoyage au moyen de cotons-tiges imbibés d'eau ou d'un aspirateur. La communication porte surtout sur le nettoyage à l'aspirateur et sur les résultats d'une série de tests menés sur les plumes primaires qui ont été examinées au microscope pour établir si les techniques proposées enlevaient efficacement la saleté.

DISRUPTION OF FEATHER STRUCTURE BY ULTRASONIC CLEANING IN AQUEOUS DETERGENT BATHS

GREGORY S. YOUNG

An experimental cleaning method, combining ultrasound with selected anionic and nonionic detergent baths, was investigated for a number of feathers taken from mounted birds and from feather-decorated Maori dress and objects. Examinations for disruption of barbs and barbules were carried out using scanning electron microscopy (SEM) and spectrophotometry. New Guinea Pigeon feathers lost a structural blue component of their colour with just one minute of ultrasonic washing (40 to 60 kHz). Combined with this, cracking of feather barbules was revealed by SEM. The loss of the distal portion of most barbules on Australasian Harrier feathers was also seen, but the agent for this was not identified with certainty. The colour of these feathers was not altered. The microscopic appearance of four other types of feathers was not changed by ultrasound during cleaning, although submicroscopic damage in all of the feathers could not be ruled out. Additional research was recommended to characterize the influence detergent, species and deterioration have towards the breakdown of feathers in ultrasonic baths.

1.0 Introduction

Ultrasound can be employed on metal objects, particularly ones with fine, ornate surface detail which by conventional methods is difficult to clean. It has been used for separating and then cleaning ancient bronze coins held together in large concretions (1) and has been used on stone (2), glass (3) and clay tablets (4).

More recently, recommendations have been made for the use of ultrasound to clean bone and leather excavated from wet sites (5,6). This paper concerns its use on another material, the keratinous tissues of ethnographic featherwork.

A large collection of feather-decorated artifacts of Maori (New Zealand) origin required cleaning before being placed on display (7). The great number of artifacts and a limited amount of time for treating them ruled out the usual methods of cleaning — brushing, vacuuming, and localized wetting and blotting or occasionally immersion (8, 9, 10, 11, 12). Ultrasonic cleaning was seen as an expiditious alternative; one which had already been tested on featherwork (3), although only in a limited way.

In order to evaluate the suitability of ultrasonic cleaning, experimental washing treatments were performed by Barton and Weik (1986) at the Auckland Institute and Museum on several types of feathers in aqueous detergent baths. The following discusses the results of scanning electron microscopical and visible spectrophotometric examinations which were volunteered by the Canadian Conservation Institute (CCI) to document the physical effects of ultrasonic action on the colour and anatomy of the feathers.

2.0 Experimental

Covert and flight feathers of six bird species were tested by Barton and Weik in the washing experiments. The feathers were taken from mounted birds in the Ornithology Department of the Auckland Museum as well as from the Museum's collection of Maori artifacts. Table 1 lists the feathers received from Barton and Weik which were included in the present study conducted by CCI.

Six aqueous detergent baths (see Table 1) were tested in the washing experiments. Formulas A, B, and C were mixtures consisting of anionic surfactants (with the addition of a nonionic in Formula B), plus polyphosphate to boost cleaning and to soften the treatment water, and lastly, carboxymethyl cellulose to improve the suspending and emulsifying power of the baths (14). The other three wash baths were simpler mixtures containing nonionic detergents.

All the feathers were treated in approximately the same manner - by immersion in one of the

Table 1
Feathers treated by Barton and Weik (1986)
and included in CCI's microscopical examinations

No.	Type of feather	Detergent Bath	Ultrasound Duration (min)
1.	New Zealand Pigeon	Lissapol N 2.5%	4
2.	Australasian Harrier	Lissapol N 2.5%	4
3.	New Guinea Victoria Crowned Pigeon	Extran AP42 No. 0.1%	5
4.	NGVC Pigeon	Extran AP42 0.1%	30
5.	Silver Pheasant	Extran MA02 No. 2.0%	5
6.	New Zealand Pigeon	Extran MA02 2.0%	5
7.	NGVC Pigeon	Formula A[1]	1
8.	NGVC Pigeon	Formula B[2]	1
9.	NGVC Pigeon	Formula C[3]	1
10.	NGVC Pigeon	Formula C	2
11.	NGVC Pigeon	Formula C	3
12.	NGVC Pigeon	Formula C	4
13.	Indian Blue-Cheeked Barbet	Formula B	2
14.	IB-C Barbet	Formula B	4
15.	IB-C Barbet	Formula C	2
16.	IB-C Barbet	Formula C	4
17.	Australian King Parrot	Formula B	2
18.	AK Parrot	Formula B	4
19.	AK Parrot	Formula C	2
20.	AK Parrot	Formula C	4

(1) Formula A
1g/1 sodium lauryl sulphate (fatty alcohol sulphate)
1g/1 sodium polyphosphate
0.1g/1 carboxymethyl cellulose

(2) Formula B
1g/1 sodium lauryl sulphate (fatty alcohol sulphate)
2g/1 alkyl polyglycol ether
2g/1 sodium polymetaphosphate
0.2g/1 carboxymethyl cellulose

(3) Formula C
1g/1 Hostapon T (oleyl methylaurid sodium salt)
1g/1 sodium polymetaphosphate
0.1g/1 carboxymethyl cellulose

No Extran AP42 (paraffin oil and nonionic detergent)
Extran MA02 (anionic and nonionic detergents and sodium phosphate)

Lissapol N (nonionic; alkyl phenol polyglycol ether)

detergent mixtures contained in an ultrasonic tank (40 to 60kHz, 23°C). Immersion time was usually for one to five minutes. Afterwards, the feathers were rinsed with distilled water for ten minutes and dried either with the cool breeze of an air gun or by drip drying at room temperature (7).

2.1 Scanning Electron Microscopy (SEM)

SEM was used to survey the feathers for surface damage. Small samples containing four or five juxtaposed barbs interlocked by hooks (hamuli) and barbules were excised from the New Guinea Victoria Crowned Pigeon (N.G. Pigeon) feathers

listed in Table 1. These were adhered to carbon planchets and sputter-coated with gold and palladium. Single barbs were excised from the feathers of the Barbet (Indian Blue-Cheeked Barbet), King Parrot (Australian King Parrot), New Zealand Pigeon, Australasian Harrier, and Silver Pheasant (see Table 1), and were prepared in a similar manner.

2.2 Visible Spectrophotometry

The uniformity in the size and colour of some of the feathers allowed the use of spectrophotometry in the visible range to document colour changes resulting from treatment. Spectra were recorded from four segments of a N.G. Pigeon tail feather. One segment was unwashed and three others were washed in Formula C (Table 1) with ultrasound for one, two, and three minutes. In a second series of measurements, spectra were recorded of three Barbet tail feathers, one unwashed, one washed in Formula C for four minutes, and one washed in Formula B (Table 1) for three minutes.

2.3 Results and Discussion

After treatment, visual examination by Barton and Weik in Auckland revealed that most of the feathers appeared to have been essentially unaltered in terms of their colour and physical appearance. However, there were a few important exceptions. At the CCI, additional visual study confirmed these observations, and microscopy revealed some additional information about the changes that had occurred to some of the feathers.

2.3.1 Feathers Containing Structural Colours

The most significant of the alterations was the loss of the structural blue sheen (see Appendix 1) of the N.G. Pigeon feathers. Visible spectra (Figure 1) of three areas on one N.G. Pigeon feather record a drop in the reflectance of the blue region. The three areas were washed in Formula C with 1, 2, or 3 minutes of ultrasound. A fourth spectrum (asterisk) records the sustained blue reflectance of an unwashed area on the feather. The spectra show that the structural blue of the feather was quickly lost and that little or no additional alteration in colour occurred beyond one minute or even with three minutes.

Because a structural colour was lost, physical disruption was expected. Microscopy revealed surface cracking in the same distal portions of the barbules that had originally emitted the blue sheen. The amount of cracking increased with longer wash times, so that four minutes of ultrasound produced worse destruction than did just one minute (Figure 2). For comparison, Figure 3 is of uncleaned barbules containing no cracks.

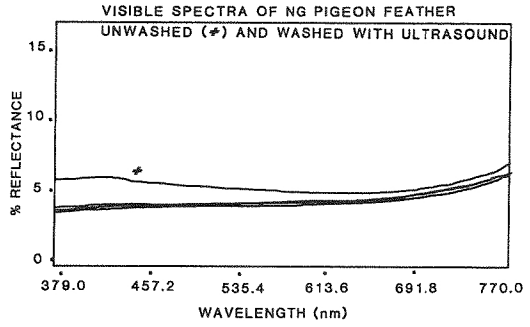

Figure 1 Visible spectra of four areas on a New Guinea Pigeon feather.

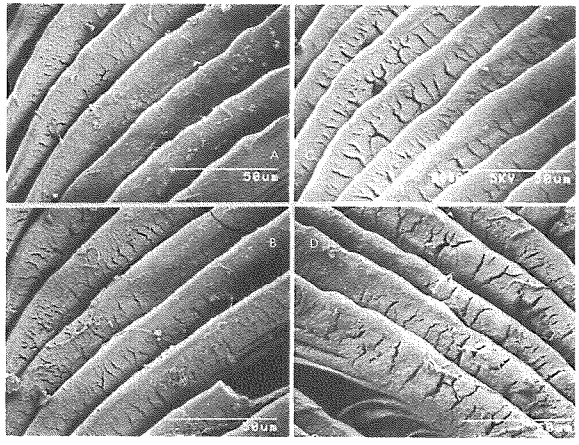

Figure 2 New Guinea Pigeon: cleaned in formula C with A - 1 min, B - 2 min, C - 3 min, and D - 4 min of ultrasound.

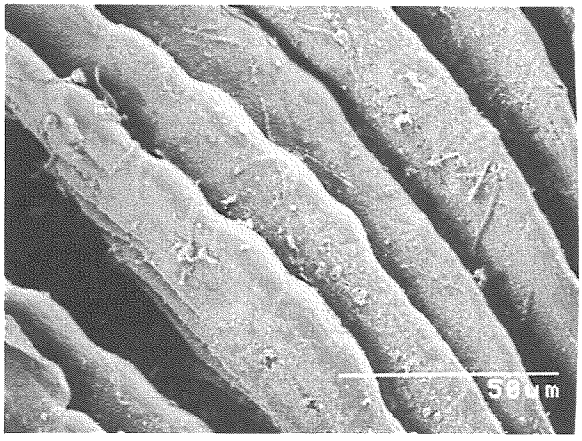

Figure 3 New Guinea Pigeon - uncleaned.

Although cracking was indicative of the destructiveness of ultrasound on the N.G. Pigeon feathers, it was probably not responsible for the loss of the structural blue sheen and was actually just an associated effect of the ultrasonic wash. Cracking occurred at the microscopic level, but destruction of the sub-microscopic physical organization of the feather's tissues (15) must have occurred to cause the loss of the blue sheen. This was supported by the fact that although one minute of ultrasound produced comparatively less cracking, it caused a substantial loss of the blue as was seen in the spectra of Figure 1.

Cleaning time was apparently not the only factor that influenced the degree of disruption that took place. Although inconclusive there was some evidence to suggest that the detergent also influenced the amount of damage that occurred during washing. The barbules of the N.G. Pigeon feather that was ultrasonically cleaned in Extran AP42 (Table 1) for five minutes (Figure 4) held damage equivalent to about only one minute of ultrasonic cleaning in Formula C (Figure 2). Figure 4 also shows extensive damage resulting from 30 minutes of ultrasonic washing in the bath of Extran AP42.

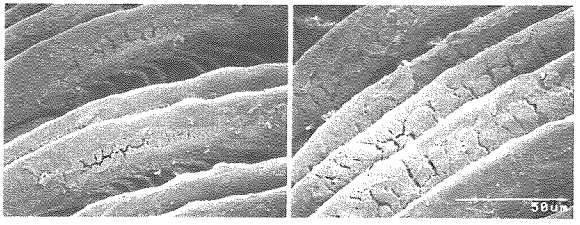

Figure 4 New Guinea Pigeon: Cleaned in Extran AP42 with 5 min (left) and 30 min (right) of ultrasound.

Although additional controlled studies must be conducted to confirm a variable effect by different types of detergent, the present results are not surprising considering the great difference between these two bath formulations. Extran AP42, consisting of paraffin oil and nonionic detergent, was a mild formulation having a lower wetting and cleaning power (surfactancy) compared with the anionic detergent (oleyl methylaurid sodium salt) in Formula C (14). Formula C had a higher dissolving power for oils and dirt and had a greater ability to wet materials. These effects probably gave the Formula C wash bath more access to the fine structure of the feathers which, in turn, allowed the ultrasonic bath to act with more force on the feather tissues.

Other factors probably contributed to the variability in disruption. For instance, little is known about the deterioration of the feathers. Because of this, it was not possible to draw clear conclusions about the influence of the various detergents, and correspondingly to make recommendations about the six detergents based on the results obtained. Any future study of cleaning should include appropriate controls for variations in the deterioration of the test materials.

The microscopic examinations next concentrated on the effect of ultrasound on the structural green of the Barbet feathers. The spectra of two of these feathers are compared with a third unwashed Barbet feather in Figure 5. One was washed for three minutes in Formula B (Table 1) containing the anionic and nonionic detergents and the other for four minutes in Formula C (Table 1) containing the stronger anionic detergent. This time, virtually no loss of structural colour was detected. Moreover, the lack of any colour change indicated that no physical damage had occurred to the tissues that emitted the structural green located in the barbs of this particular species. In association with these results, microscopy revealed no surface damage to either the structural-colour-emitting barbs or to the barbules (Figure 6).

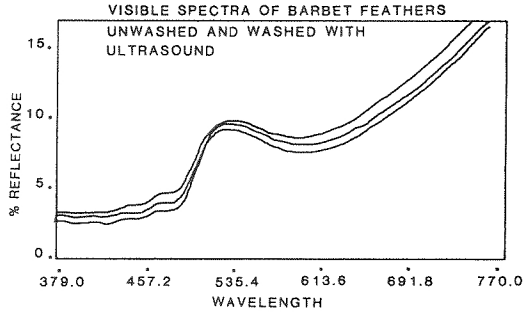

Figure 5 Spectra of two cleaned Barbet feathers compared with one unwashed feather.

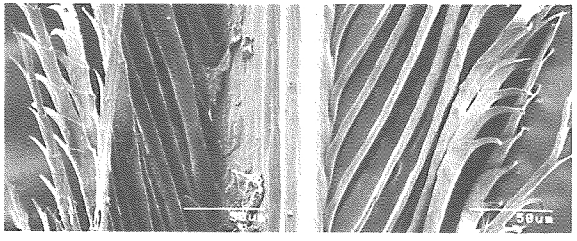

Figure 6 Indian Blue-cheeked Barbet: Left - uncleaned, Right - cleaned in Formula C with 4 min of ultrasound.

It is interesting to note that a colour change only occurred on feathers that emitted a structural colour from their barbules - the N.G. Pigeon feathers. All of the other feathers in the wash tests that emitted structural colours did so from

their larger, more robust barbs. As with the Barbet feathers, their colour was not visibly affected by ultrasonic cleaning. Because only one feather was included in the tests that emitted structural colour from barbules, it is not possible to draw general conclusions about the relative susceptibilities to ultrasound of these sorts of feathers compared with feathers that emit structural colour from barbs. However, these results do encourage additional investigation in this area.

2.3.2 Feathers Containing No Structural Colours

Dye-coloured feathers of four additional species included in the wash tests were examined by microscopy. Damage that may have resulted from ultrasound was found on one of them - the Australasian Harrier feathers (Figure 7). The tips of most of the barbules in this feather were detached and lost. Unlike the N.G. Pigeon, the disruption in the Harrier did not produce a colour change, because no structural colour was involved.

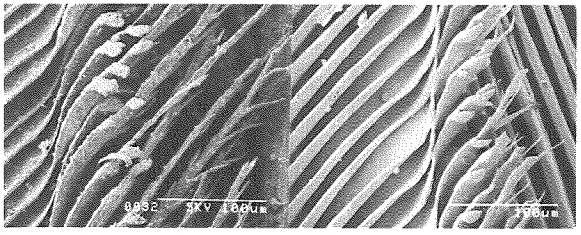

Figure 7 Australian Harrier: Left - uncleaned, Right - cleaned in Lissapol N with 4 min of ultrasound.

Ultrasound was held responsible for this damage, but only with qualification. This was because no correlation could be established between the duration of cleaning and the degree of damage, as occurred for the N.G. Pigeon feathers. Material loss was more prevalent in the ultrasonically cleaned feather than in the uncleaned control included in the study, but this may have been the case prior to any testing. In a preliminary sense only, the nearly complete loss of the distal portions of the cleaned barbules suggested that handling and treatment were indeed responsible.

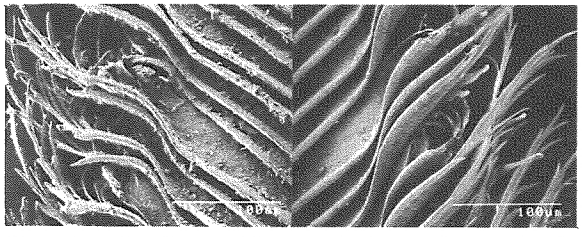

Figure 8 New Zealand Pigeon: Left - uncleaned, Right - cleaned in Lissapol N with 4 min of ultrasound.

Feathers from the three remaining species - New Zealand Pigeon (Figure 8), King Parrot (Figure 9), and Silver Pheasant (Figure 10) - showed no visible effects of ultrasound at the microscopic level. Microscopically, Barton and Weik (1986) reported the unhooking of adjacent barbs in the King Parrot feathers; the shape of these was drastically altered after four minutes of ultrasound.

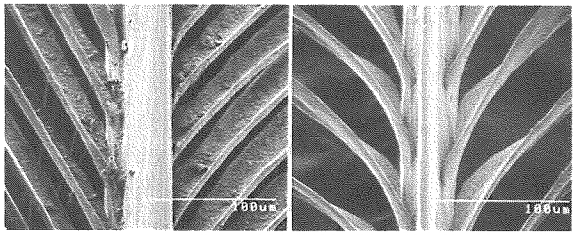

Figure 9 Australian King Parrot: Left - uncleaned, Right - cleaned in formula C with 4 min of ultrasound.

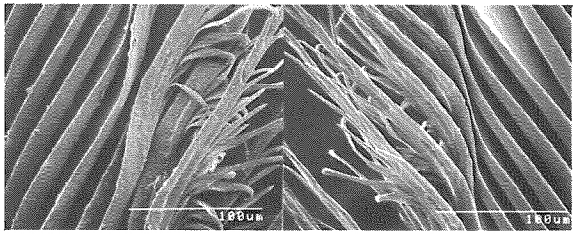

Figure 10 Silver Pheasant: Left - uncleaned, Right - cleaned in Extran MA02 with 5 min of ultrasound.

2.3.3 Cleaning

Many of the detergents, in combination with ultrasound, appeared to remove much of the surface dirt from the feathers (Figures 7-10). It was impossible, however, to rank the ability of the detergents to clean without taking into account the amount of disruption that occurred with each. Because disruption was probably a function of feather species and state of deterioration (two uncontrolled variables in this study) as well as the detergent, it seemed inappropriate to rank the suitability of the detergents for cleaning feathers. Additional testing is needed.

3.0 Conclusions

The investigation by Barton and Weik in New Zealand included approximately 40 wash tests with seven species of feathers. CCI's microscopical study looked at approximately half of the washed samples. The investigation showed that under specific conditions ultrasound was indeed destructive to one type of feather even when used for as short a time as one minute, and it was probably responsible for the disruption to another

type. Based on this, CCI is satisfied in concluding that ultrasonic cleaning can adversely affect feather structure in an unpredictable way, and this uncertainty makes its use on feathers inadvisable.

The evidence permits little more to be concluded in terms of characterizing the effects of ultrasound. Other factors concerning feather structure and the ultrasonic bath need to be investigated further. Feather deterioration has already been mentioned; the feathers used in the present research were between 60 and 100 years old. Ultrasonic frequency is another factor. Research outside of conservation suggests that the lower frequencies in the sonic and lower ultrasonic ranges (10 to 80kHz) cause visible damage to native cellulosic and proteinaceous textile fibers (16) whereas the higher frequencies approaching 175kHz leave the fibers undamaged. Therefore, different frequencies should be investigated for feather cleaning. Moreover, use of an ultrasonic probe should be compared with that of an ultrasonic tank. Such things as the depth of the wash bath and the position of the feather within the bath are expected to influence to some degree the amount of disruption that occurs. Lastly, studies should be carried out on the solvency effects of various detergents and on soaking time.

Appendix 1

Structural Colours

Half of the six types of feathers in the study not only contained natural dye colours but also contained structural colours. As the term suggests, structural colours result from a physical organization of minute air sacs in the keratinous tissues of some feathers which cause selected wavelengths of light to be scattered and reflected (15). A blue colour is usually seen if natural pigments are not also involved. This scattering mechanism for producing colour is different from the usual situation where a colour results from the absorption of selected wavelengths by naturally occurring melanin and carotinoid pigments (and the feather tissue itself) and the reflection of the remainder of the visible spectrum. One way to identify structural colours is to look at a feather with transmitted light. Viewed in this way a feather's structural colours disappear and what remains are the colours reflected by the dyes.

Another interesting point about structural colours is that they can originate from different anatomical structures of feathers. Species plays a major role in determining exactly which structure will emit these colours. For instance, the structural green (a combination of structural blue plus a yellow pigment) of Barbet feathers emanates from the feather's barbs. In contrast, the structural blue on a New Guinea Pigeon feather emanates from the feather barbules.

The other colours, the blacks, browns, and oranges in the collection, are derived from pigments.

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Biographical Notes

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Une méthode de nettoyage combinant les ultrasons avec certains bains de détergents anioniques et non ioniques a été mise à l'essai sur plusieurs plumes provenant d'oiseaux empaillés ainsi que sur une robe et des objets ethnographiques maoris ornés de plumes. Il s'agissait de déterminer au moyen de la microscopie électronique à balayage (MEB) et de la spectrophotométrie dans le champ visible si les barbes et les barbules avaient été endommagées par suite de l'utilisation de cette méthode. Des plumes provenant du pigeon de Nouvelle-Guinée ont perdu une composante bleue de leur couleur après avoir été plongées pendant une minute seulement dans un bain traversé par des ultrasons (40 à 60 kHz). En outre, le MEB a révélé que plusieurs barbules s'étaient fendillées. Il semble que les dommages soient plus ou moins grands selon la composition du détergent. On a aussi constaté que les pointes de la plupart des barbules sur les plumes du busard australasien manquaient, mais on n'a pu identifier avec certitude l'agent qui était à l'origine de ce dommage. La couleur des plumes en question n'a pas été altérée. L'aspect microscopique de quatre autres types de plumes n'a pas été modifié par les ultrasons durant le nettoyage, mais il n'est pas exclu que chacune des plumes ait subi des dommages imperceptibles par le microscope. Il a été recommandé que l'on fasse des recherches supplémentaires pour déterminer si le détergent, l'espèce à laquelle appartient l'oiseau dont les plumes font l'objet de tests et l'état de détérioration de l'objet peuvent contribuer aux dommages que l'on observe sur des plumes nettoyées par la méthode des bains ultrasoniques.

SKIN AND LEATHER

Traditional Ways of Processing and Preserving Leather in Kuonku
B. Ceesay
Museum and Antiquities Division, Banjul, The Gambia

Technology and Conservation of Five Northwest Coast Head-dresses
C. Del Re
University of Pennsylvania, Philadelphia, U.S.A.

Conservation Techniques for Ethnographic Leather Artifacts: Application to the Paul Kane Collection
C. Collins
Manitoba Museum of Man and Nature, Winnipeg, Canada

Ethnographic Skin and Leather Products: A Call for Conservative Treatment
T. Raphael
National Park Service, U.S.A.

TRADITIONAL WAYS OF PROCESSING AND PRESERVING LEATHER IN KUONKO, A VILLAGE IN THE SANDU DISTRICT, UPPER RIVER DIVISION OF THE GAMBIA, WEST AFRICA

BABA A. CEESAY

Amongst the Wolof, Fula and Mandinka of the Gambia the art of leather working is relegated to a caste called Ude, Granke or Karanke in the respective ethnic groups. Kuonko, the focus of this study, is a village of Fula composition in the Sandu District, Upper River Division of the Gambia. As to when leather-working came to be the predominant occupation of its people, there is still no certainty, but it is evident that the readily available raw material — animal hide — is a consequence of the good grazing land in its vicinity which has nurtured and continues to nurture a large stock of cows, sheep and goats. With the passage of time, the processing of the raw material and the utilisation of the product for its various present uses — dresses, bags, shoes, etc. were evolved. At present, the products of this relatively under-developed community look attractive and durable to the eyes of the visitor or person not too knowledgeable about the art. However, the western visitor who returns home with a local leather bag or pair of shoes will soon notice various shortcomings in the artifact he has come to cherish as the product of a struggling third world people. The aim of this study is to look into the production process used by these artisans, with the objective of appraising the conservation, care and preservation techniques employed, and by so doing bring to light shrotcomings which, when overcome, will result in the increased efficiency of the art in this rural community. However, due to limitations imposed by time and finance the study was not as comprehensive as was first envisaged. It, therefore, dwells at greater length on the practical side of processing and conserving leather with the aid of a questionnaire.

1.0 Introduction

In the Senegambia area the art of leatherworking, like smithery, is relegated to a caste respectively called *Ude Karanke* or *Garanke* in the *Wolof*, *Mandinka* and *Fula* ethnic groups - the main ethnic groups of the area. Leatherworkers are to be found in almost every town and village, also travelling frequently throughout the country in the exercise of their art.

This study is limited to leatherworking as practiced in a small village of *Fula-Mandinka* composition in the remote interior of the Gambia - Kuonko, located in the Upper River Division of the country, about 400 km from the capital, Banjul. The village has a population of approximately 733 people, 60% to 70% of whom are engaged in some form of leatherworking after harvesting at the end of the rains and all through the dry season.

Sandu, the district in which Kuonko is located, has the largest cattle, sheep and goat population in the country, providing abundant raw material. The excellence of this thriving local leather industry is recognized all over the country and provides the main leather artifacts for exhibition in the Gambia National Museum (Appendix B).

As to when and how leatherworking became the predominant preoccupation of the people of Kuonko, apart from farming, there is still no certainty. However, the excellence of the village's products only came to the fore in the late 1960's when artifacts were gathered for a museum collection. Since then various missions have been to the village either to study the art in its local environment or assist in its more efficient operation. In the process outside influences, either western or from the neighbouring areas, have come to make their mark on the traditional ways and means of processing and preserving leather in this rural community.

2.0 Traditional Leather Processing

Various ways of processing hides and skins into leather have been identified. The differences lie basically in the agents used for dehairing and tanning. However, the efficiency of each stage in the process depends on how long a particular hide or skin is steeped in a particular solution, which in turn depends on the type of hide and its thickness. In general, thicker hides require a longer time in each solution.

Whether a particular hide or skin passes through all the processing stages depends to a large extent on the use to which it will be put. Thus, hides and skins that are meant to be used as

praying mats are not dehaired as the hair acts as a form of cushion for the limbs of the user against the hard ground. Therefore such hides and skins do not have to pass through the dehairing process.

For rawhide to be converted to leather that is non-putrescent and impervious to water the following processes must be observed in chronological order:

1. If the hide is not newly flayed it must be soaked in water to render it pliable.
2. The hide is then dehaired in one of the following ways:
   a. Steeping in a solution of water and 'sula-selo' *spathodea campannlata* (African Tulip Tree) for two days. The solution is processed by pounding or cutting to pieces the capsule and seeds of the plant to minute proportions and soaking them in a jar of water for some time. The hide is then steeped in the concoction for two days after which it is removed and the hairs are scraped off with a knife. Alternatively, the dregs of the solution can be spread on the hide allowing part of the solution to seep through. Both techniques have the effect of loosening the hairs making them easier to scrape off.
   b. Steeping the hide in a solution of water and wood ash for two nights. This also renders the hairs easily removable with a scraping instrument.
   c. Steeping in a solution of white lime - calcium carbonate ($CaCO_3$) and water can act as the dehairing agent. The solution is usually prepared by reducing oyster shells to powder by heating and mixing them with water in a clay jar. The hide is steeped in this solution overnight and the hairs are scraped off the following morning.
   d. Burying the hide in the ground for up to three days and then scraping off the hairs. The hide starts putrefying, loosening the hairs from their follicles, rendering them removable even with the fingers.
   e. Steeping in a preparation from the suro plant - *ficus gnaphalocarpa* (sycomoros). Its bark is beaten to loosen the strands. It is then placed in water for two days after which the hide is steeped in the resulting solution for two nights. Scraping is then done with a knife.
3. Having dehaired the hide, the next stage is thorough washing, eradicating all traces of the dehairing solution. Washing is usually done in a clay jar as iron containers could cause irremovable stains on the hide which is now semi-tanned.
4. Fleshing - All non-leather forming substances such as muscle and fat are removed with a knife. It is noteworthy that this can be done either at this stage or prior to dehairing. The hide is spread on the bare ground, or at times on a mat, and the feet are used to stop it from moving, whilst one hand stretches it and the other does the scraping with a knife. It is perhaps the most tedious stage in the process, the hide being very slippery at this time. This done, the hide is again washed to prepare it for the next stage.
5. The hide is placed in wet coos/millet bran for a day. This causes it to partly putrefy, at the same time softening it and increasing its thickness. Following this it is again washed to prepare it for actual tanning.
6. Three different tanning agents have been identified:
   a. *Bano-Acacia Nilotica Adansonii* (Red Thorn Tree). The pods are very rich in tannin. In fact, it is one of the chief tanning agents in West Africa but has no commercial importance in the Gambia, where the tree is not widespread.

      In tanning with this agent, the pods are pounded and mixed with water in a jar. The hide is then steeped in the concoction for two days or more depending on its thickness. Whilst in the solution it is turned from time to time, stretching it and rubbing it between the hands to allow maximum penetration of tannin into the hide. When effectively done this renders the hide non-putrescent, makes it softer and more pliable, and increases its tensile strength.
   b. Tanning can also be effected by the *Fara* plant (*Bauhinia thoningii*). The bark of the plant is said to contain up to 20% tannin. In tanning, the bark is beaten to a pulp, loosening the strands which are then soaked in water. The hide is then steeped in this solution for two days or more, allowing the maximum penetration of tannin into it. Whilst in the solution it should also be turned at intervals, stretched and rubbed between the hands.

c. *Mangi*, or *Rhizophora racemosa* (Red Mangrove), is also used for tanning although usually together with one of the above-mentioned tanning agents. This is probably because its tannin content is very low. The bark is reduced to pulp, mixed with either *Bano* or *Fara*, and soaked in water. The hide is then placed in the solution for at least two days during which it is turned at intervals, stretched and rubbed between the hands.

7. Tanning, like all the other stages, is followed by washing to remove all traces of the tanning solution. The tanned product - now leather - is then hung to dry or staked to the ground. It is then beaten with a specially designed wooden implement to cause the layers to adhere to each other. The beating also renders the leather impervious to water and more pliable.

3.0 Colouring

The processed leather assumes an off-white or light brown colour depending on the tanning agent. However, this colour can be further brightened by immersing the leather in another solution of fresh (newly-cut) *Bano* and water for at least ten hours. The fresher the *Bano* the brighter the colour of the leather.

Most of the colours used on manufactured leather products are now imported. However, some traditional colouring methods are still extant:

a. Black
The concoction that makes up this colour is called *gujumba* by all leather workers of the previously mentioned ethnic groups. It has some peculiar cultural overtones in that its secrets could only be divulged to members of the same caste. According to all the informants it is a bad omen to spill *gujumba* to the extent that sacrifices have to be carried out by the parents of a child who accidentally spills the solution. Some even say that blood must be spilled for his or her salvation; i.e. killing of either a fowl, sheep or goat is necessary if ill-fortune is not to befall the culprit.

Gujumba is prepared by mixing pounded coos/millet with water, iron, lime, sugar, vinegar, *bano*, soot, and salt. The mixture is thoroughly boiled until the best part of the water evaporates leaving it in paste form. It is then left to cool and is ready for use. it is usually applied with a stick that has cotton wrapped round it. The colour when thoroughly applied cannot be rubbed off, but it is noticeable in the Gambian National Museum collection that with the passage of time it gradually fades. This is probably due to the effect of exposure to light in the Museum environment. However this fading effect is hardly noticeable in charms and armulets owned by individuals, which items are the most often coloured with this concoction. This is probably because charms are usually worn under the clothes with therefore little exposure to light.

b. Red
The colour is arrived at by thoroughly boiling the bark of the *Mangi* (Red Mangrove). The greater the quantity of mangrove bark the darker the colour.

c. Brown
A mixture of *Mangi* and groundnut shells is thoroughly boiled to give a brown liquid.

4.0 Preservation

According to the informants, conservation goes hand-in-hand with processing. Though it cannot be said that any one stage in the processing of the skin is intentionally designed to preserve the leather, it is understood that a well processed leather will ensure its chances of survival with proper care and handling. In this respect it is generally understood that fresh skins, when properly processed, will last longer than old skins, and that skins from healthy animals are better for leather manufacturing than those of old or diseased ones. All this is probably because a good hide when properly cured is less attractive to bacteria.

To the *Ude* however, conservation to a greater extent depends on the care or handling of a certain item by the owner which, in turn, depends upon how responsible the owner is and what understanding he has of the shortcomings of leather products. He is also aware that adequate care demands that contact with moisture should be avoided. Thus leather items are hung on strings around the work place or on walls at home to facilitate maximum air circulation. However, when there is a need to secure particular items from illegal expropriation, these are mostly put under lock and key in a wooden box which is regularly opened for airing and inspection. The wooden box could be treated with local insecticides to reduce the chances of infestation.

Another storage method is to put the leather in a completely closed nylon bag. Such a container prevents moisture or insects reaching the leather.

However, leather artifacts can be made to last longer by the following rudimentary methods:

a. Making whatever article one desires whilst the leather is in its wet state.

b. Dipping the leather in a mixture of kerosene and oil. This neutralises the scent and distracts insects.

c. Applying local insect repellants. The application of these insecticides to leather is presently being studied by the conservator at the Gambia National Museum. However, the greatest impediment is to render them colourless so that they will not stain the leather when applied to it.

   Bano apparently has the function of an insect repellant. The informants in this study are convinced that once soaked in such a solution leather can rarely get infested.

d. When mould appears on leather, it is simply dusted off and the leather allowed to air dry.

e. Stains can be dealt with by simply changing the colour of the leather. For example when black stains occur the leather is coloured with *gujumba*.

   Judging from the variety of repairs usually requested by owners of leather objects, it is evident that destruction of a particular item usually results from over-use, poor handling or poor workmanship. For example if the string used for sewing together two pieces of leather is made of cotton, it is likely to get damaged before the leather itself, necessitating re-sewing.

5.0 Conclusion

In general, traditional leather processing as practiced in Kuonko is a rather tedious exercise requiring a great amount of human energy. To the majority of informants this exertion constitutes the main problem, leaving their hands well-wearied at the end of the day. The problem is partly a result of inefficient tools. Tools like knives and scrapers made by local blacksmiths, if available at all, are often rudimentary, thus imposing the need for better equipment.

There is also the problem of availability of raw material - the hides and the plants used in processing. With hides the centralization of slaughtering by the Livestock Marketing Board and the opening of a new leather processing plan has adversely affected the local industry as the Board's policy is more export-oriented. As to the plants used in dehairing and tanning, much is left to the vagaries of nature since the majority are not domesticated or economically viable species.

When all these basic problems are overcome, one can envisage an increased efficiency and greater productive capacity for the leather-working industry in Kuonko.

APPENDIX A

TRADITIONAL LEATHER PROCESSING CHART

Steps	Agent/Plant/ Tool	Scientific and Common Name	Part Used	Method	Remarks
(1) Dehairing	Sula-Selo	**Spathodea Campanulata** (African Tulip Tree)	Pods and seeds	The capsules with seeds are cut into pieces or pounded, soaked in water and spread over the wet hide. It is left there for a day or two and then removed.	
	Wood Ash	(Ash)		The ash is mixed with water in a jar. The hide is then steeped in the resulting solution for two nights.	
	White Lime	Calcium Carbonate (Quick Lime)	Oyster Shells reduced to powder	It is mixed with water in a jar and the hide is steeped in the resulting solution for two to three days.	
	Earth	(Soil, Mud, etc.)		The hide is buried in wet earth for two or three days.	A less tedious process as the hairs are easily removable by hand without any instrument.
	Suro	**Ficus Gnaphalocarpa** (Sycomoros)	Bark	Bark pounded and soaked in water for two days. The hide is then steeped in the resulting solution for two nights.	

APPENDIX A CONTINUED...

Steps	Agent/Plant/ Tool	Scientific and Common Name	Part Used	Method	Remarks
(2) Washing	Water	Water		The dehaired hide is washed in water to remove all traces of the dehairing agent. Also done at the end of every stage.	The product at this stage can be used in making drums.
(3) Fleshing	Knife or Scraper			The hide is spread on the ground, is drawn taut by use of the feet to stop it from slipping. One hand stretches it and the other does the scraping.	A rather tedious exercise as the hide is slippery and hard to grip properly. Fleshing could also be done prior to dehairing.
(4) Softening and Thickening	Coos-Millet		Bran	Millet bran is soaked with water and the hide is buried inside. It should be completely covered with this for a day.	This thickens the hide, at the same time making it soft.
(5) Tanning	Bano	**Acacia Nilotica Adamsonii** (Red thorn)	Capsule and seeds Contain tannin	Pounded and mixed with water in a jar. The hide is then steeped in the solution for two days during which it is turned from time to time, stretched and rubbed between the hands.	These plants contain an average amount of tannin. Frequent turning, stretching and rubbing allows the maximum penetration of tannin into the hide. Effectively done, it renders the hide non-putrescent, soft and pliable.
	Fara	**Bauhinia thomingii Piliostigma Thoningii**	Bark (contains up to 20% tannin)	The bark is pounded and mixed with water in a jar. Hide steeped in solution for two days during which it is turned, stretched and rubbed between the hands.	
	Mangi	**Rhizophora Racemosa** (Red Mangrove)	Bark (contains tannin)	The bark is reduced to pulp and mixed with water in a jar. The hide is then steeped in the solution for two days and above.	Usually it is mixed with either 'Bano' or 'Fara' as its tannin content is very low.
(6) Compression	Hard wood — specially carved in a round form.			The leather is spread on a hard surface and is thoroughly beaten with this wooden instrument.	This sticks together the different layers of the hide and also increases its pliability.
(7) Drying				The leather is spread on the ground or hung over some non-metallic string to dry under the sun and air.	
(8) Lubrication and Preservation	Oil and Kerosene		The two liquids are mixed together in a clay jar.	The leather is steeped in the solution for about an hour.	This prevents putrefaction, and increases the leather's tensile strength.
	Groundnut paste/butter			A light film of the paste is spread on the surface of the leather.	Brightens the leather, making it water-resistant and shiny.

APPENDIX B

1. Decorated Bottles
2. Ritual Masks
3. Jewelery Container's
4. Hand-bags
5. Swords and Knife Sheaths
6. Walking stick decorations
7. Pouches for gunpowder, tobacco and snuff
8. Shoes - slippers and sandals
9. Decorated bows and arrows
10. Horse whip
11. Saddles
12. Armulets
13. Prayer mats
14. Bellows

APPENDIX C

DRAFT QUESTIONNAIRE

Name of informant:

Age:

Home Address:

Date:

PROCESSING

1. How long have you been engaged in leatherworking?
2. Did you inherit the profession?
3. What type(s) of object(s) do you make?
4. Do you process the hide yourself?
5. What materials (substances) do you use in processing hides?
6. What process(es) do you employ?

   a.
   b.
   c.

7. Do different hides undergo different ways of processing?
8. What peculiar problems do you encounter in processing hides?
9. Do you repeat any stage if not well done?
10. Do the process(es) have any colouring effect?
11. How do you come to your colours?

    a.
    b.
    c.

CARE AND CONSERVATION

12. Do the process(es) also serve as a means of Conservation?
13. How do you make leather more durable?

    a.
    b.
    c.

14. Do the process(es) have any colouring effect?
15. How do you store your leather?
16. Do you encounter any problems in storage?
17. a.
    b.
    c.
18. How do you treat infested leather?

    a.
    b.
    c.

19. How do you clean stained/dirty leather?

    a.
    b.
    c.

20. How often do owners of artefacts return for repairs?
21. What problems do they usually come with?
22. To what extent is durability dependent on type of hide?
23. Do you recognise any taboos in leather craft?
24. Do the inscriptions used for decoration have any special significance?

Chez les Wolof, les Fula et les Mandinka de Gambie, l'art du travail du cuir est confié à une caste appelée Ude, Garankee ou Karanke selon les différents groupes ethniques. Kuonko, qui fait l'objet de cette étude, est un village composé de Fula et situé dans la région de Sandu, division upper river en Gambie. On ne connait toujours pas la période exacte à laquelle le travail du cuir est devenu l'occupation principale des habitants de ce village, mais il est évident que le matériau brut disponible sur place, à savoir la peau de certains animaux, est une conséquence des bons pâturages de la région qui ont nourri et continuent à nourrir un troupeau important de vaches, moutons et chèvres. Avec le temps, le traitement des peaux brutes et l'utilisation des produits finis sous forme d'objets variés — robes, sacs, chaussures — ont beaucoup évolué. A l'heure actuelle, les produits de cette communauté relativement sous-développée semblent attrayants et durables aux yeux du visiteur ou d'une personne qui n'a pas une connaissance approfondie de cet artisanat. Cependant, une fois rentré chez lui, le visiteur occidental découvrira très vite plusieurs défauts dans un sac en cuir local ou une paire de chaussures qu'il a commencé à chérir comme des produits d'un peuple du tiers-monde. Le but de cette étude est donc d'examiner les méthodes de production de ces artisans en vue d'évaluer les techniques de traitement, de conservation et de préservation employées et d'en révéler les défauts afin de les corriger et d'aboutir à un meilleur rendement de l'artisanat de cette communauté rurale. Cependant, en raison de restrictions financières et de manque de temps, le champ de cette étude n'est pas aussi vaste que prévu. Par conséquent, on insiste davantage sur l'aspect pratique du traitement et de la conservation du cuir à l'aide d'un questionnaire.

TECHNOLOGY AND CONSERVATION OF FIVE NORTHWEST COAST HEAD-DRESSES

CHRISTINE DEL RE

Very little conservation literature addresses the problems of treating composite objects and even less of it addresses those associated with the cleaning of fur-bearing pelts. In an effort to redress the balance in this area of conservation, this paper presents case studies on the technology and conservation treatment of five ermine-skin dance head-dresses of the Northwest Coast Tlingit Indians. A brief discussion of the ethnographic use of these objects is included. Although the head-dresses are made of a number of materials (wood, abalone, feathers and baleen to name only a few), the paper focuses on the problems of cleaning a swan or eagle down and fur-bearing pelts (the ermines). Based on previous experience with fur cleaning, which is also discussed, a satisfactory treatment method for cleaning the fur and down was developed. While the treatment of the head-dresses was successful, the materials and techniques used are by no means definitive. Limitations, questions and suggestions for future research conclude the paper.

1.0 Introduction

In 1986-87, the University Museum of the University of Pennsylvania will celebrate its centennial year. As part of its centennial celebration, the Museum will present a major exhibition entitled "Raven's Journey: The Heritage of Alaska's Native People". This exhibition - which will feature 350 ethnographic objects from the Museum's collections - will examine the physical and spiritual adaptations of late 19th- and early 20th-century Eskimos, who lived along Alaska's northern and western coasts; of Athabascans, who dwelt in Alaska's interior; and of Tlingit, who resided in forested coastal and riverine environments of southeastern Alaska (1). Five ermine-skin dance head-dresses of the Northwest Coast Tlingit Indians, which were conserved for this exhibition, will be the focus of this paper.

These dancing head-dresses are all part of the Shotridge Collection of the University Museum. They are all Tlingit in origin, having been collected in and around Sitka by Louis Shotridge between 1918 and 1926. To quote the exhibition proposal: "Shotridge, a Tlingit from Kluckwan, Alaska, was hired by the University Museum in 1911. Between 1915 and 1932, he purchased Northwest Coast Indian objects for the Museum. His work among the Tlingit is controversial, for he was not content to buy objects used in everyday life, but sought to acquire items that were spiritually and ceremonially important to various clans. Shotridge collected over 300 objects for the Museum, many of them superb ceremonial and prestige items" (2). These head-dresses are among them.

Before discussing their material composition and technology, a quotation from Bill Holm describing the ceremonial use of these pieces is necessary:

> "From the farthest Northwestern reach of Tlingit country southward along the coast to the middle of Vancouver Island, dancing chiefs wore head-dresses as elegant as rich material and sculptor's skill could make. Tradition assigns various places of origin to the dancing head-dress, but it must have originated in the north, and the dance with its head-dress spread southward along the coast."
>
> "The dancer appears with blanket and apron and often a raven rattle. Knees are slightly bent with the legs spread, he jumps on both feet - short jumps - to make the rows of ermines covering his back jump in turn. The crown of sea lion whiskers holds a loose fluff of eagle down when the dancing begins. The whiskers rustle and clatter as the dancer bobs and tosses his head shaking white wisps of down through the crown of whiskers to swirl around his dancing figure. The white down means peace, or welcome, to the guests at a potlatch. Chiefs dance to greet canoes and visitors dance in turn. The swirling down from all their head-dresses drifts shoreward in the wind and over the host and his tribe on the beach. In its rich composite of materials, no Northwest Coast object expresses the ideas of rank and heredity, supernatural power and aesthetics so well as the dancing head-dress" (3).

2.0 Materials and Technology

Holm continues: "The features of the Tlingit dance head-dress are the same wherever it is worn: an upstanding circlet of the long, springy whiskers of the Steller's sea lion; a cylindrical frame - usually made of strips of whale baleen lashed together with sinew and sometimes covered

with cloth - from the back of which hangs a long cloth panel covered with rows of white ermine skins. Fastened to the front of the baleen framework is a hardwood plaque, most often of maple, which is painted and inlaid with abalone shell. This plaque, or frontlet, is carved to represent a crest of a mythical character. Sumptuous materials surround the frontlet. Often the crown is covered with a band of swan skin, luxuriant with white down; or ermines flank it. On Haida and Tlingit head-dresses, the baleen cylindrical frame is often covered with rows of orange and black, spear-shaped tail feathers of the red-shafted flicker, and the wooden frontlet has a band of iridescent green and black mallard head-skin at its base" (4).

These head-dresses will now be examined more closely, in terms of the materials and techniques that the Tlingit used to make them.

The first object is the Thunderbird Dance head-dress. The carved wooden frontlet is painted blue-green, brown, red and black, and inlaid with abalone shell, six pieces of which are missing (Figure 1). These are probably secured to the wood with pitch - a material often used as an adhesive (5). The frontlet is securely held to the baleen framework with sinew, and is surrounded on three sides by red wool trade cloth. Both sides of the frontlet are flanked by upside-down ermines stiffened inside with what appears to be brown paper and sewn with beige cotton thread to the red trade cloth. Below the frontlet is a male mallard head skin (6) sewn with sinew to a piece of buckskin which is in turn sewn onto the buckskin cap. Around the cap is a baleen framework made of hoops and vertical stakes lashed together with sinew. Around the top edge of the baleen framework are sea-lion whiskers, below which are two rows of flicker feathers (one of which is hidden behind the swan's-down collar). Both of these materials (feathers and whiskers) are lashed in position with sinew. The flicker feathers that have been protected from fading are a brilliant orange. The swan's-down collar is secured to the baleen with beige cotton sewing thread. Inside the baleen framework and behind the wooden frontlet is an enormous amount of eagle down, still in position (Figure 2), and an old piece of newspaper.

Four of the five head-dresses have the additional feature of flappers sewn onto the top of the cap. These are located in the cavity with the eagle down, and help it fly out during the dancing. This particular head-dress features a flapper made from a piece of cardboard with "J.P. Coats Best Six Cord Spool Cotton" written on it.

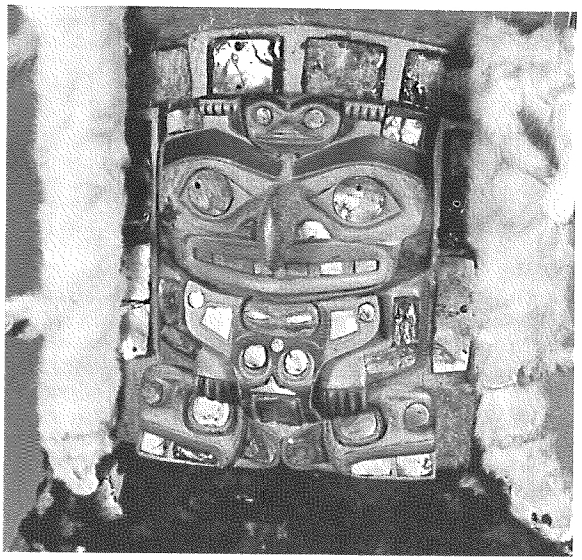

Figure 1. Thunderbird Dance Head-dress — close up of frontlet.

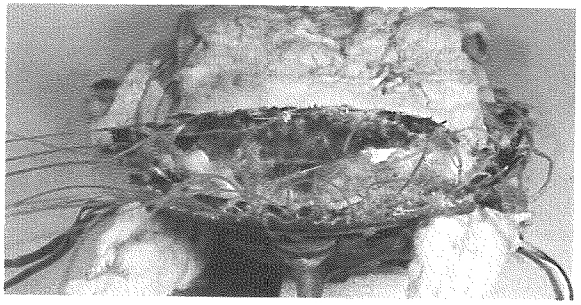

Figure 2. Thunderbird Dance Head-dress — eagle down still in position behind frontlet.

Attached to the rear of the baleen collar is a rectangular piece of beige canvas fabric. Sewn to this is a coat of ermines - i.e. the ermines have been split the length of their undersides and sewn together at the edges. This coat, made from approximately 30 ermines, is sewn with beige cotton thread and is then stitched to the beige canvas with the same cotton thread. In addition, a group of six whole ermines is stitched in the center on top of the ermine coat. They have had red pigment applied to them. Aside from possible use as a tanning agent (7), there is no ethnographic explanation for the presence of this pigment on these ermines.

The Bear and the Wolf, the second head-dress, is similar to the first. A carved wooden frontlet is painted black, blue-green (very little of which remains), and red (which appears to have been repainted), and decorated with abalone inlay.

The frontlet is secured to a muslin cap - which has a wool trade cloth lining - with cotton cord, and is surrounded with red wool cloth on three sides and with worn black velvet/velveteen on the bottom edge. A row of flicker feathers stands above the red wool at the top. The upside-down ermines seem to be stiffened with thin pieces of wood, and are stitched to the red wool with cotton cord. On this head-dress the baleen framework is covered with beige cotton muslin and stitched with beige thread. This object has a leather flapper and two rows of flicker feathers as in the first example along the back - in this case sewn to the muslin with beige cotton thread - and the usual crown of sea-lion whiskers which also poke out from the muslin.

Along the lower edge of the baleen collar is a ruff of swan's down - more soiled than on the first head-dress (Figure 3). Below this is the canvas fabric onto which are directly stitched with cotton thread 14 rather bedraggled-looking ermines. One of the ermines on this trailer had been trapped while between his brown summer coat and white winter coat.



Figure 3. Bear and Wolf Head-dress — swan's down ruff.

The Peace or "Child-of-Moon-Center" head-dress has a buckskin cap and ties stitched with sinew (Figure 4). The frontlet is painted blue-green, red and black elaborately decorated with large plaques of abalone (three pieces of which are missing), and attached to the baleen framework with copper wire inserted through holes (Figure 5). Flanking the frontlet on either side is a row of flicker feathers sewn with modern sewing thread and sinew and kept in position with pitch (Figure 6). This head-dress has the usual sea lion whiskers and baleen framework, all secured with sinew thread. While this head-dress lacks red wool, flappers, swan down and mallard skin, it has a train of 38 ermine skins in 4 rows (Figure 7). These are attached with sinew to a piece of baleen which in turn is sewn with sinew to a rectangular piece of canvas fabric. The canvas is sewn to the baleen framework with cotton sewing thread.



Figure 4. Peace Head-dress — before overall.

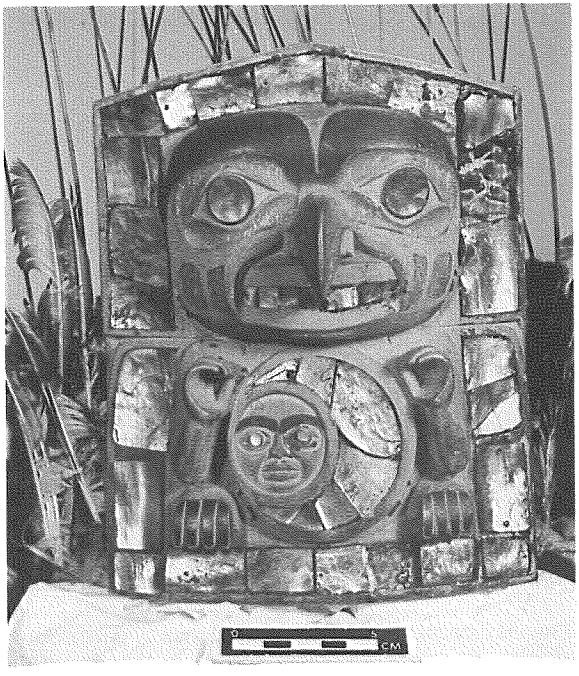

Figure 5. Peace Head-dress — close up of frontlet.

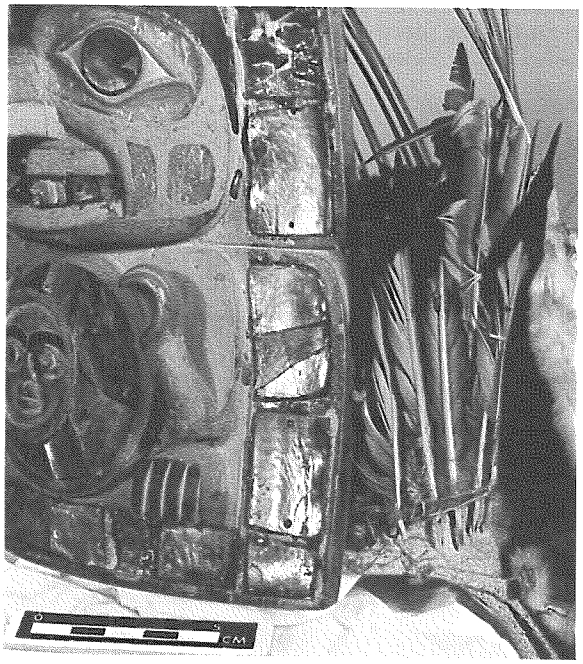

Figure 6. Peace Head-dress — flicker feathers with stitching.



Figure 7. Peace Head-dress — before of ermine trailer.

The Mystery of the Sea head-dress repeats most of the features already seen in the previous pieces. A carved frontlet is painted blue-green, black, red (which appears to have been repainted) with faint traces of white. It is decorated with abalone, some of which is missing. This frontlet is held to its buckskin cap with buckskin ties at its base. It has the usual red wool, ermines, and split mallard heads flanking the frontlet, and a crown of sea lion whiskers. This object has two special features. One is a native repair of the proper left side of the frontlet. The split in the wood has been repaired with sinew stitched through holes and a strut which supports the break, secured with metal staples. The usual baleen framework and flicker feathers secured with sinew are visible at the back. However, stitched to the inside of the baleen collar with cotton thread is an uncut sheet of the **New York Semi-Weekly Tribune** dated January 24, 1888. This is the second head-dress that has an ermine coat, this time probably containing 30-40 skins (Figure 8). Like the other, it is stitched with cotton thread and is in turn stitched to a muslin backing.



Figure 8. Mystery of the Sea Head-dress — ermine skin coat trailer.

The Hunting Thunderbird - the last of the head-dresses - is a peculiar piece. It contains the usual dance head-dress elements, but is very untidy in appearance and exhibits either abuse through use or simply sloppy workmanship. The carved frontlet - which expresses the strength of the Thunderbird by depicting him tearing a whale in two - is painted a dark blue-green (which overlies

a lighter blue paint layer), red, black and cream. It is decorated with the usual features: abalone plaques, a red wool trade cloth border, upside-down ermines and flicker feathers. Beige cotton sewing thread, cord and sinew secure all of these elements to the underlying buckskin cap, which has an interior lining of muslin. The male mallard skin at the base of the frontlet is secured with cotton cord. While some sea lion whiskers are present, they are fewer in number and more straggly in appearance than the usual full crown.

The framework at the back, made of baleen hoops and wooden vertical stakes lashed together with cord, is collapsed and distorted. It is filled with an enormous amount of eagle down. The baleen framework also conceals three down flappers: two are made from large red feathers cut to a point, and one of buckskin. These are all secured with cord.

Attached to the top of the baleen framework - rather than at the bottom where it usually is - is the familiar rectangular piece of beige canvas fabric. Stitched directly to it with cotton sewing thread are 14 ermines.

3.0 Conservation

Given the number of materials that comprise these objects, the head-dresses presented a broad and varied range of conservation problems.

The frontlets were dusty and dirty. The paint on some of them was flaking. The abalone plaques were grimy, and a few of them had an excessive amount of adhesive on them. The flicker feathers were faded, dirty and broken, and many required strengthening, straightening and rearranging. The mallard skins were all dusty and in fragile condition. One of the circular baleen supports needed reshaping, as did all of the head caps and a few of the ermines.

The major conservation problem, however, was the cleaning of all the ermine skins themselves. They all were soiled and grimy, and had a grey and dirty appearance. The greasy dirt that was evident when they were handled was probably due to ethnographic use and inadequate storage conditions at the Museum. The swan's-down collar on one of the head-dresses was so dirty that an attempt had to be made to clean it.

Minor questions requiring consideration included the cleaning of the sea lion whiskers and the red wool, and the rearrangement of the whiskers. As with most conservation procedures, tests and investigations were carried out on one or two of the objects to establish a satisfactory series of techniques. These were then used on the rest of the objects, as they did not require individual treatments.

3.1 Sea Lion Whiskers

A test cleaning of the sea lion whiskers was done with a small amount of deionized water on a cotton wad held with the fingers, which was then gently wiped along the whiskers. Very little dirt was removed, indicating that they were not in need of cleaning; this idea was therefore abandoned. Discussions with the curators and a study of some ethnographic sources revealed that the sea lion whiskers were in fact correctly arranged as they were, so there was no need to rearrange them.

3.2 Red Wool

The red wool which partially bordered four of the five frontlets had a significant amount of fur and eagle-down residue on it. Since these materials were on the wool as a result of ethnographic use of these head-dresses, a curatorial decision was made that the red wool should not be cleaned at all, so as not to remove any of the physical evidence of ceremonial use.

3.3 Mallard Head Skins

The iridescent green and black mallard head skins were lightly brushed to remove surface dust. All of the mallard skins had sustained serious carpet beetle damage and were therefore losing feathers whenever they were handled, no matter how carefully it was done. While not an immediate problem, since only two or three little wisps flew off each time they were handled, it was of great concern. Injection consolidation of the skin to stabilize the feathers or use of a crepeline sandwich to contain lost feathers were both considered, but these ideas were abandoned in favor of careful and minimal handling, and construction of protective storage mounts in future.

3.4 Wooden Frontlets

The painted wooden frontlets that could sustain the treatment were carefully and gently dry-brushed to remove surface dust and dirt. Gentle rolling with a saliva-dampened swab on the painted areas followed brushing to remove any residual dirt. However, not all of the frontlets could be dry-brushed. On three of them, paint required consolidation due to excessive flaking. Two coats of a 2% solution of methyl cellulose in water were brushed on to consolidate the paint, and allowed to air-dry between coats.

3.5 Abalone Plaques

The abalone plaques were cleaned with saliva on swabs followed by ethanol. The ethanol removed the yellow-brown residue on the surface of the plaques, representing the excess pitch used to secure them in position. Two of the plaques fell off during cleaning and were re-attached with 50% Acryloid (Paraloid) B-72 in acetone (8).

3.6 Flicker Feathers

While the flicker feathers appeared dirty, a test cleaning of three feathers removed very little dirt, and did nothing to improve their appearance. It also proved impossible to actually clean the feathers, since they were all sewn at least halfway up the length of the quill, either to fabric or to the circular baleen support. Part of the reason that the feathers looked dirty was because they were so badly faded: cleaning could never restore their original brilliant colour. Where possible, most were simply smoothed over, straightened, and rearranged along the shaft, using either saliva-dampened fingers or a brush moistened with deionized water along the length, with a paper towel held against the back of the feather. Where they were split, damaged or about to break, the quills were reinforced with adhesive (20% Acryloid B-72 in acetone was chosen). Whenever possible, reinforcements and repairs combined a secondary support system - either goldbeater's skin or nylon monofilament - with the above adhesive.

3.7 Buckskin Caps

The three buckskin caps were reshaped by misting with 50% ethanol in deionized water only enough to allow for reshaping, and then left to air dry on Ethafoam supports. A number of ermines were flattened by a 10-minute exposure in a high humidity chamber and gentle clamping between two pieces of acid-free cardboard. Attempts to reshape the distorted baleen circular supports to all met with failure.

3.8 Ermines

The major conservation problem of these headdresses was the cleaning of the ermines, some 100-125 of which required treatment. The author's previous experience with fur cleaning served as a starting point for the treatments. Since there was little conservation literature to refer to (9), in 1983 a procedure was developed for cleaning fur on other Eskimo artifacts. (Accounts of other treatments have been published since (10).) The procedure was designed to remove the dirt trapped in the grease on the fur, as in the present circumstance. Under the fur section to be cleaned a sheet of Mylar is first placed (to serve as a barrier) and then a number of paper towels. Stoddard solvent is then applied to the fur with a squeeze bottle, and is worked through the fur with either a tissue or a brush. The idea is to flush the solvent through the fur, thereby dissolving the greasy dirt on the fur and driving it into the absorbent paper below. The fur is then tamped dry with lab tissues.

Before treatment tests were begun, a thorough investigation of the ethnographic literature was done to determine the probable tanning/curing procedures used on small fur-bearing animals such as ermines. This search produced very little information. The sources seem to indicate, however, that washing followed by softening through scraping, or chewing to soften and remove fat, are two possibilities (11, 12). Without proper analysis, there is no way to determine which method may have been used.

Before conservation, the fur felt greasy and looked very dirty. The skins were flexible and felt soft and supple, although a little bit crinkly. Tests were done on two ermines using the Stoddard solvent cleaning method described above. One extra ermine from storage was also cleaned by partially dipping it in solvent. The partial dipping treatment produced very unsatisfactory results. It obviously dried out the skin too much, making it somewhat crunchy to the touch. The two ermines cleaned with Stoddard solvent appeared not to have been cleaned at all.

Since a spirit-soluble soap was evidently needed, Vulpex (13) in Stoddard solvent was tested at a number of concentrations: 2%, 5% and 10% v/v. Cleaning with the lowest concentration was a success, and this was selected as the cleaning agent. Further tests were done on one row of ermines: all were cleaned with the 2% Vulpex in Stoddard solvent. Each ermine was rinsed with an increasing number of rinses to determine how many were needed to remove all the Vulpex and soil residue. These tests showed that a minimum of four rinses was necessary to restore a very soft, luxuriant feel to the furs.

The cleaning procedure used on all the ermines was as follows: Ermines were backed with absorbent paper towelling and Mylar; a 0.5-3% solution of Vulpex in Stoddard solvent was worked through the fur with brushes, followed by gentle tamping with lab tissues; the furs were then rinsed with Stoddard solvent, also worked

through with brushes and tissues, and left to air-dry (Figure 9). Rinsing continued until the fur felt soft after treatment. This usually required three, four, or as many as six rinses, depending on the ermine. The need for adequate rinsing cannot be overemphasized: insufficient rinsing leaves the fur with a very harsh, almost soap-like feel. The process represented a continual compromise between improved appearance and an effort not to dry out the skin or fur. Following cleaning, rinsing and drying, each ermine was individually fluffed by hand, by gently working it through the fingers from tail to head, to restore some loft to the fur. If the furs are not re-fluffed, they remain matted down following solvent cleaning.

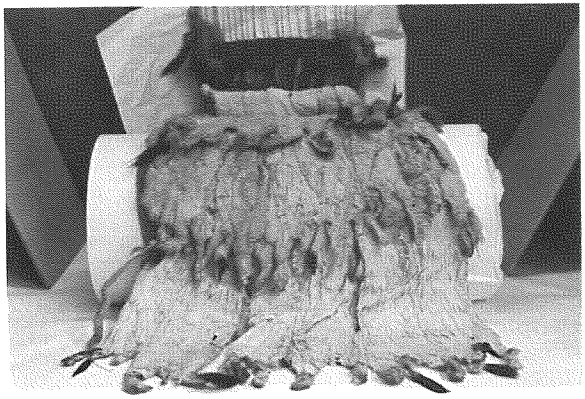

Figure 9. Thunderbird Dance Head-dress — partially cleaned ermines.

It should be noted that early on, it was discovered that the feet and tails were attached to the body by such a tiny piece of skin that they were easily removed during teatment. The tails and feet were not therefore cleaned at all, in order to keep them attached.

Many of the ermines had suffered from rather severe carpet beetle damage. This was not readily apparent until the fur fluffing stage, at which time gentler methods were used.

3.9 Swan's Down

The swan's down was cleaned using the same methods as set out for the ermines: the Stoddard solvent had to be flushed through the wispy down collar to release the greasy dirt from it. As it would have been impossible to rinse the down adequately, and since the extra cleaning effectiveness that Vulpex provides was not needed, this substance was ruled out from the start. If a decision had been made to take the down collar off the object, the cleaning procedure would have been very different, and no doubt much easier. But removal of the down collar was considered an unethical step, and the treatment was developed around its rather difficult placement.

Experience with a small piece of down on a shaman's amulet had shown that it could safely be cleaned with solvent, and would fluff up again nicely after drying. This first test piece of down was small enough to be partially dipped and brushed with solvent. However, this method of solvent application proved impractical with the head-dresses.

Two methods of solvent application were tried: spraying and brushing. Spraying was chosen since brush application tended to remove some wisps of down. Once the Stoddard solvent had been sprayed on, it had to be removed very quickly to keep it from migrating farther into the down than necessary. Fortunately, the soil on the down was limited to its outer edges. The solvent-dampened down was tamped quickly and gently with tissues held in both hands. This tended to depress and squash the down, but it quickly revived when left in the draw of a fume hood. The procedure was laborious and time-consuming, but can produce quite satisfactory results.

4.0 Areas for Future Research

While the results of the treatments were satisfactory and successful, the materials and techniques used are by no means definitive. Involvement in this project has raised many questions which are presented to the ethnographic conservation community for future research and analysis:

- Can analytical techniques be developed to determine the type and degree of original tanning done to a skin? This would be especially useful when ethnographic information is lacking.

- Is there another material that can be used for spirit cleaning, with a lower pH than Vulpex? The idea is to reduce the number of rinses needed, thereby reducing the trauma the skins are exposed to during cleaning.

- Can Vulpex be buffered to a neutral pH and still clean effectively? Can the pH of the fur be neutralized after cleaning with Vulpex by rinsing with a slightly acidic spirit solution? It has been suggested that a 1% acetic acid spray can effectively neutralize the pH of the fur (14). Has anyone tried this? Is there a residue left on the fur in spite of rinsing? A scanning electron microscope study might answer this question.

Recent communication with a dry-cleaning specialist has identified two industrial detergents used for fur cleaning: G 7-11 from Imperial Chemical Industries and Aerosol OT from Allied Chemical. Both have lower pH's than Vulpex (15). If anyone has used these, the author would appreciate hearing of their work. It is hoped that a less traumatic, more efficient method to clean swan's down will be developed, and that research can find a way to stabilize deteriorating mallard skins.

The curators of the exhibition and the author would gratefully appreciate any references that have escaped our research on the subject matter contained in this paper.

5.0 References and Notes

1. This quotation is taken from the **National Endowment for the Humanities Grant Proposal** written by S. Kaplan for the exhibit, for which the author is grateful.

2. *ibid*

3. Holm, W., **The Box of Daylight** (Exhibition catalogue). Seattle Art Museum and University of Washington Press, Seattle and London, (1983) 19.

4. *ibid.*

5. *ibid. 22.*

6. February 1986 - Feathers identified by Roxie C. Laybourne, Smithsonian Institution, as male mallard.

7. McClellan, C. **My Old People Say: An Ethnographic Survey of Southern Yukon Territory**. National Museum of Man Publications in Ethnology, no. 6, in parts. National Museums of Canada, Ottawa, (1975) 256, 260.

8. Koob, S., "The Use of Paraloid B-72 as an Adhesive: its Application for Archaeological Ceramics and Other Materials", **Studies in Conservation**, 31 (1986) 7-14.

9. Velich, R., "The Repair and Cleaning of an Old Painted Buffalo Robe", **Curator**, VIII/4, (1965) 319-324.

10. Garbin, M., "Conservation at the German Leather Museum", **Leather Conservation News**, 2(2), (Spring 1986) 14-15.

11. McClellan, 263-264.

12. de Laguna, F., **Under Mount Saint Elias: The History and Culture of the Yakutat Tlingit**. Smithsonian Contributions to Anthropology, vol. 7; in 3 parts. Smithsonian Institution Press, Washington DC, (1972) 423, 425.

13. Vulpex liquid soap is potassium methyl cyclohexyl oleate. It has a pH of 10.5-11.5, and is available through Conservation Materials Ltd., 240 Freeport Blvd., Box 2884, Sparks NY 89431, (704) 331-0562.

14. Winz, M., Personal communication, Sept. 1986.

15. *ibid.*

6.0 Further Reading

Kaplan, Susan and Kristin Barsness, **Raven's Journey: The Heritage of Alaska's Native People** (Exhibition catalogue). University Museum, University of Pennsylvania, Philadelphia (1986).

Shotridge, Louis, "War Helmets and Clan Hats of the Tlingit Indians", **Museum Journal** (Philadelphia) 10(1-2) (June 1919) 43-49.

Swanton, John R., **Tlingit Myths and Texts**. Smithsonian Institution, Bureau of American Ethnology, Bulletin 39. Washington DC, Government Printing Office, (1909).

Biographical Notes

Christine Del Re is a native of Chicago, where she earned her BA in Classical Civilization at the University of Illinois. She then spent 3 years at the Institute of Archaeology of the University of London, England, receiving a B.Sc. in Archaeological Conservation and Materials Science. Following contractual appointments at the North Carolina Museum of Art in Raleigh North Carolina, and at the Mississippi River Museum in Memphis, Tennessee, Ms. Del Re became Assistant Conservator at the University Museum of the University of Pennsylvania, in 1982. She has been Associate Conservator at the same institution since 1984 and now has extensive experience in the conservation of both archaeological and ethnographic materials.

En conservation, la documentation néglige souvent les problèmes relatifs au traitement des objets composites et surtout ceux qui ont trait au nettoyage des fourrures. Pour tenter de corriger ces lacunes l'auteur présente des études de cas sur la technique de fabrication et les traitements de conservation de cinq coiffures cérémonielles en hermine fabriquées par les Tlingit de la côté ouest. Une brève explication de l'utilisation ethnographique de ces objets est aussi présentée. Les coiffures se composent d'un certain nombre de matériaux (bois, ormeaux, plumes, fanons de baleine, pour n'en nommer que quelques-uns), mais la communication porte essentiellement sur les problèmes de nettoyage du duvet de cygne ou d'aigle et des fourrures (hermine). A partir d'expériences antérieures en matière de nettoyage des fourrures, qui seront aussi présentées, une méthode satisfaisante de traitement des fourures et du duvet a été élaborée. Le traitement des coiffures a donné d'excellents résultats, mais les matériaux et les techniques utilisées ne sont pas entièrement au point. L'exposé se termine par une discussion des limités, des questions et des suggestions relatives à la recherche future.

CONSERVATION TECHNIQUES FOR ETHNOGRAPHIC LEATHER ARTIFACTS: APPLICATION TO THE PAUL KANE COLLECTION

CATHERINE COLLINS

The collection of the Manitoba Museum of Man and Nature contains about 70 artifacts collected by the painter Paul Kane in his travels across Western North America between 1846 and 1848. In preparation for exhibit, six native-tanned leather garments have undergone conservation treatment. This paper focuses on the techniques used to repair and restore the leather, particularly with regard to the mechanical damage. The garments were acquired by the Museum in 1941 from the descendants of Kane's patron. The family displayed them at the summer cottage and permitted their use as costumes. For 10 years the artifacts were a highlight of the Museum's Grasslands Gallery. Once brightly coloured with pigment and quillwork the garments had faded and the surfaces accumulated soot, dust, stains and paint. Most items had also sustained mechanical damage in the form of tears, nail holes, detached hairlocks and losses of leather. A number of techniques are described in restoring the appearance of the damaged areas. Depending on the stiffness of the damaged hide, the tears were mended with either "hairsilk" (multistranded silk) or Jade 403 with a backing of non-woven polyester. Some tears were mended with "hairsilk" alone. Small losses were compensated with backings of Pellon in-painted with watercolours. A large loss in one legging was replaced with English chamois held in place with "hairsilk" and toned with watercolours applied by spattering. Several different techniques were used to reattach hairlocks. This paper illustrates all of these techniques in detail.

1.0 Introduction

The collection of the Manitoba Museum of Man and Nature in Winnipeg contains about seventy artifacts collected by the painter Paul Kane in his travels across Western North America between 1845 and 1848. Kane used the artifacts as props and study specimens for his later studio paintings of Indian life. The conservation of the collection began in 1986 in preparation for an exhibit. As of September six leather artifacts have been conserved. This paper focuses on a number of the techniques used to repair and restore this group of leather garments; namely shirts, leggings, and a dress decorated with quillwork, glass beads, and pigments.

2.0 Description of the Garments

All of the garments were collected from the Northern Plains region and are made from unsmoked native-tanned deer or elk hides assembled with sinew threads. The three shirts are made in the "binary" style (1) from two three-quarter sections of hide forming the sleeves and body (Figures 1,2,3). Each has several forms of decoration including self-fringes along the sides, lower edges, and sleeves, rectangular appliqué panels of dyed porcupine quillwork on the front and rear chest, and fringes of hairlocks running down the front sides of the arms, along the armscye seams and around the neck opening. The techniques used to dye, flatten and attach quills are described in detail by W.C. Orchard (2). All three shirts share painted elements in the form of parallel dark brown bands called "coup" stripes painted on the front and back upper body and down the arms. One shirt has painted battle scenes on the body pieces, one is uniformly reddish brown and the third has green ellipses on a background of black dashes. Two shirts also have panels of blue, green, black, and white opaque glass trade beads sewn with lazy-stitch to leather strips which are sewn to the sleeves over the shoulder seam. In decorating the shirts, it is interesting to observe that there was little concern for symmetry.



Figure 1. H4-4-2 Northern Plains shirt, painted throughout and having various decorative elements including porcupine quill panel on chest, hairlocks, hide fringes and pony heads.

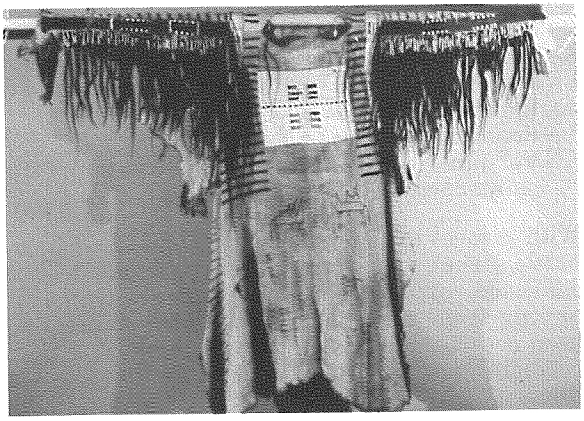

Figure 2. H4-4-4 Northern Plains shirt showing painted scene, coup stripes, quillwork panel and hairlocks.

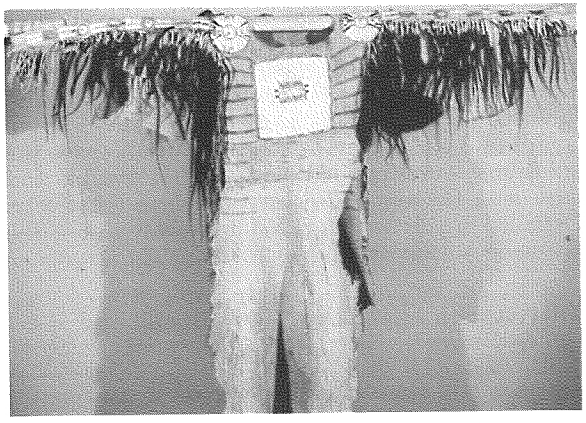

Figure 3. H4-4-6 Northern Plains shirt with painted decorations and coup stripes, porcupine quillwork panels down arms and on chest and circular sections at shoulders as well as hairlocks.



Figure 4. H4-4-1 Front of Dress showing decorative elements of stroud and porcupine quill wrappings on fringes across chest.

The dress of the collection (Figure 4) is the same one depicted in the Kane portrait of Cun-ne-wa-bum, "One-that-looks-at-the-stars" (3). It is made in "binary" or "deertail" style from two complete hides sewn with the hindquarters forming the neck, shoulders and sleeves and the forequarters along the lower edges (4). The edges of the hindquarters are folded down on the outside and clipped to form fringes along the shoulder seam. Self-fringes decorate the lower edge and sides of the body. Circles of red stroud with bead margins and paired hide fringes decorate the lower body portions. The largest decorative elements are two rectangular panels made from pairs of leather fringes wrapped in dyed porcupine quills.

The leggings are each formed from a single hide folded tubewise and sewn along one side with sinew. The two pairs have similar decorative elements including self-fringes along the top edges, thigh flaps, and ankles, dyed porcupine quill panels down the outsides of the legs, and quill-wrapped hairlocks down one side of the panels. One pair was decorated with red paint and a series of horizontal dark brown "coup" stripes in the area between the top flap and ankle. The other pair has horizontal stripes on the inside portion of the legs with a pattern of vertical dashes on the opposite sides.

3.0 Condition of the Garments

All the garments were in a worn condition when collected. This was apparent from the ends of many seams which are stained and loose from wear, from stretched portions of skin and from stains from body fluids. Many of the garments have traces of red ochre in the interior arising from pigment applied to the wearer's body.

The condition of the hide supports varies from garment to garment and also within each garment. The fringed areas are typically brittle. In some areas the weight of the garment has caused stretching of the skin; for example, next to the sides and in the skin under the arms. The dress and one shirt (H4-4-2) (Figure 1) and pair of leggings (H4-4-3) (Figure 5) have tack holes surrounded by traces of iron corrosion along the folded areas indicating that these items had been mounted on a wall sufficiently long enough to cause stretching of the hide around the holes and rusting of the tacks. This same shirt and pair of leggings have the largest number of tears: shirt (H4-4-2) has two tears in the front left arm, a U-shaped hole in the reverse of the same arm, and three tears in the reverse right arm; leggings (H4-4-3) have an extensive set of irregular tears in the thigh area next to the fold, and in the thigh flap

with a piece of skin roughly 130 cm^2 missing in the thigh of H4-4-3. All garments are soiled from wear and exhibition. The dress is spotted with the brown paint used on its mannequin from a former display. The shirt (H4-4-4) (Figure 2) has splashes of a transparent brittle grey material across the lower half of the front as well as black smudges down the shoulder fold-lines. In general the painted areas of the skins are faded. By comparing with the colour of the hide in the interior, the exterior surfaces of the skins are also seen to be faded.

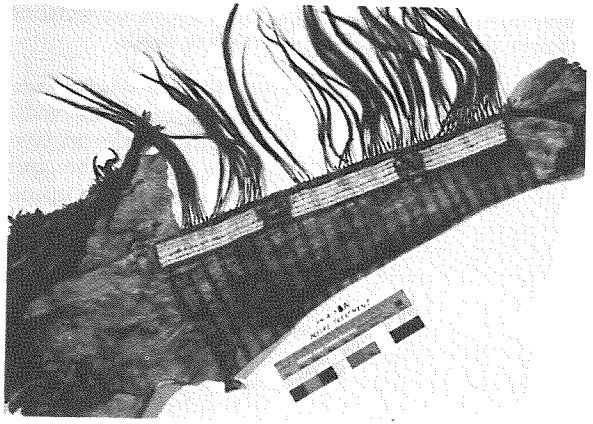

Figure 5. H4-4-3A Northern Plains leggings, before treatment showing missing area in thigh and damage to thigh flap.

Both the beaded areas and quillwork in the panels and hairlocks are covered with a layer of water-soluble grime. The sinew threads used to hold the beads on shirts (H4-4-2) and (H4-4-4) have broken in places, causing localized losses of beads. There are places on the leggings and shirts where the leather strips holding the hair-locks have broken off next to the garments, as well as spots where the quill-wrappings are loose and partly lost. In leggings (H4-4-3) the exposed leather parts of the hairlocks are extremely weak and easily broken as the leggings were handled. The quillwork panels has small areas of abrasion and loose and missing quills. Although the quillwork is dry and brittle, its condition is stable. The dyed quills are faded.

4.0 Treatment of the Garments

The choice of treatments was guided by the principle of minimum intervention and the fact that the garments were worn. At the same time, the treated artifacts should be capable of with-standing handling for exhibition. The following treatment was proposed for all six artifacts.

1. Clean the beads and quillwork
2. Secure the loose beads
3. Secure the loose quills in the appliqué panels and on the hairlocks
4. Repair the tears in the hide
5. Reattach any loose hairlocks
6. Vacuum-clean the unpigmented areas and the painted areas where the pigment is secure.

With respect to the dress, and shirt H4-4-4 (with battle scene), an additional step was added. This consisted of removing the superficial stains arising from exhibition. Once these stages had been completed, some additional work of a more cosmetic nature was undertaken on selected areas.

4:1 Cleaning of the Beads and Quillwork

The soiled quillwork and beadwork were cleaned with one of three agents: dilute (less than 1% by volume) Orvus WA paste in distilled water, saliva, or a mixture of equal parts ethanol and distilled water with 3 drops of ammonium hydroxide per 100 ml of solution. In all cases the solutions were applied with cotton swabs and care was taken not to wet the areas too freely. Distilled water was applied by swab where the Orvus WA solution had been used.

4:2 Attachment of the Loose Beads and Quillwork

Loose beads were anchored in one of two ways. Beads next to the broken ends of sinew threads were adhered with Jade 403 poly (vinyl acetate) emulsion then the bare end of the thread was stitched down with undyed hairsilk. In places where the original thread was fragmented and likely to break, the carrier thread was replaced with doubled no. 50 cotton thread in a light brown colour. The loose ends of quills used to wrap hairlocks and quills lifting away from the appliqué panels were readhered with drops of Jade 403.

4:3 Removal of Accretions from the Dress and Shirt (H4-4-4)

All of the methods used to remove or lighten superficial accretions were carried out mechanically as it is inadvisable to wet native-tanned hides with organic solvents or water. The black smudges along the shoulder fold-lines were lightened using a Stadler-Mars vinyl eraser on the shirt and a glass bristle brush on the dress. The glass bristle brush fibres were left quite long to allow for a softer brushing. This method also

lightened several stains on the dress, including the ring-shaped marks and corrosion stains around the tack holes. The paint spots near the neck of the dress were picked off the surface of the skin using a scalpel and tweezers. The sugary grey stains on the front of the shirt were removed using the end of a wooden applicator stick carved to resemble a small chisel. No foreign materials were applied in an attempt to soften the rigid water-stained areas of the hide as it was felt to be unnecessary.

4:4 Repair of Tears and Losses in the Hide

To repair tears, reinforce weak areas, and replace losses, a number of techniques were devised. The choice of a particular method was governed by the strength and stiffness of the hide around the damaged area.

In the areas where the skin was brittle and stiff the tears were realigned then held in place with pieces of Pellon adhered to the reverse with Jade 403. Pellon is a spun-bonded fabric made from polyester by Dupont. Spun-bonded fabrics are typically formed from molten polymers extruded through spinnerets to form a web which is sealed at fibre crossover points by heat and pressure (5). The resulting web has high strength in all directions, is non-ravelling and can be made in various weights depending on the density of fibres in a given area.

A medium weight non-fusible grade of Pellon was selected as a backing material. The addition of the web plus adhesive did not noticeably affect the drape of the hide as it was already stiff. The edges of the polyester web were feathered by tearing. Pieces applied to the reverse side of a tear were left white. When the web was applied to visible areas the Pellon was inpainted with watercolours. The feathered edge helped to blend the patch and the watercolours were found to dry quickly with little penetration through the Pellon into the skin.

In places where the hide was more flexible but stretched or weak, the Pellon was applied to the reverse side of the skin using couching stitches of undyed hairsilk, a multi-stranded silk thread. The piece of Pellon was attached to the rear of the skin, then the tears were stitched closed, or the edges of a hole stitched down with whip stitches. The finest needles available were used (Size no. 12 sharps) to minimize the size of the holes. The Pellon which showed through holes was inpainted to match the surrounding hide. The drape of the hide was not affected by the reinforcement using Pellon. This method was used to repair and reinforce the tears and holes on the rear sides of the sleeves of (H4-4-2), the heavily-painted shirt, and tears in both sets of leggings.

In the areas where the hide was flexible, soft, and strong, it was possible to mend the tears inconspicuously using hairsilk alone. The method used was as follows:

— torn edges butted together
— seams tied together at frequent intervals (0.75 cm or less) with No. 50 white thread (Figure 6)

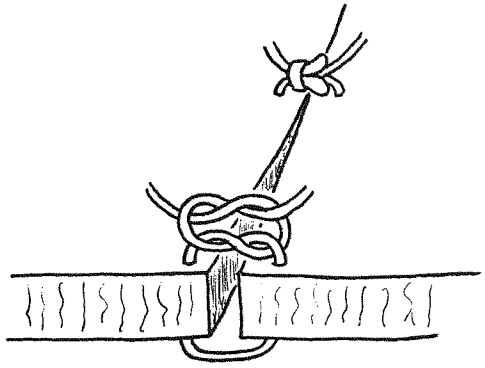

Figure 6. Edges butted together with No. 50 reef knot sutures.

— tear closed with whip-stitch from the front side with hairsilk
— white threads removed
— reverse side of the tear whip-stitched with hairsilk (Figure 7)

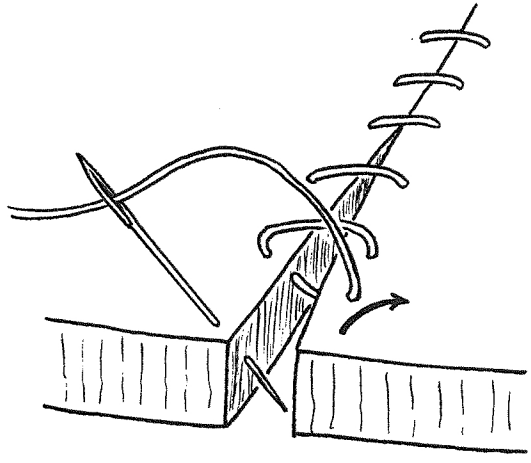

Figure 7. Whip stitches sewn through upper part of skin using hair silk.

This method worked well on areas where both sides of the skin were visible and was used to repair tears in the legging flaps on H4-4-3. The resulting mends were virtually invisible.

This last method was also used to apply an insert of chamois to the large hole in legging H4-4-3A, and smaller inserts of the same into the flaps of both leggings. English chamois was used because the drape and surface texture resembled the hide of the legging. The chamois pieces were cut to fit the holes exactly, and held in place with ties of white thread. The patches were whip-stitched in place from the front and back with undyed hairsilk. Although the colour of the chamois was probably close to the colour of the original hide, it was too bright to match the hide in its faded condition (Figure 8). Also, the legging had traces of red ochre paint around the holes. Using red ochre and black watercolours, the chamois was tinted by spattering the paint with a toothbrush, taking care to mask the legging. An airbrush could also be used. The interior surface of the patch on H4-4-3A was left unpainted to indicate that this area of the legging had been restored (Figure 9).

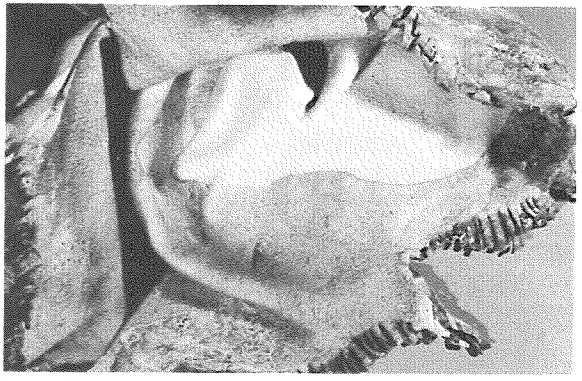

Figure 8. H4-4-3A Reverse side of chamois patch without toning, area above scale has piece of inpainted polyester web reinforcing weak area next to edge of thigh.

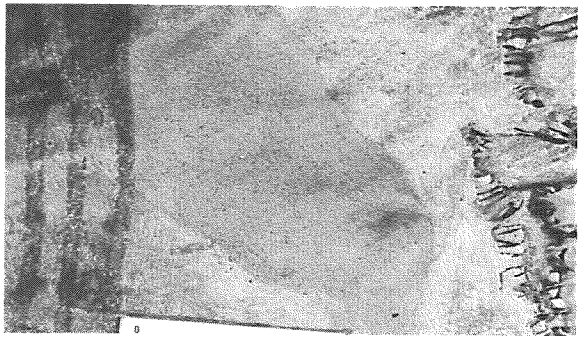

Figure 9. H4-4-3A Close up of toning chamois patch in thigh of legging.

4.5 Repair and Restoration of the Hairlocks

On two of the shirts H4-4-2 and H4-4-4, and the pair of leggings H4-4-3, it was necessary to reattach loose hairlocks. These had usually snapped off next to the quill wrappings. In the case of the leggings H4-4-3, there were 26 detached hairlocks. Loose hairlocks were attached to new strips of chamois above the wrappings. The technique used was as follows:

- top centimetre of quill wrapping peeled back to expose the old leather
- old leather cut off at an angle
- new strip of chamois of appropriate width cut, with one end also cut at an angle
- scarfed ends of the old and new leather strips adhered with Jade 430
- new join with the quills wrapped and adhered with Jade 403
- proximal end of the new strip fed through the hole in the legging
- New strip knotted in the inside of the legging.

On shirt H4-4-2 there were extensive losses of the quill wrappings. These were imitated with wrappings of coloured threads.

4:6 Repair and Restoration of the Fringed Panels on the Dress

The two quill-wrapped fringed panels on the chest had some mechanical damage. Scattered throughout the panel were spots where the quill wrappings were missing. In the front panel there were 16 places where the fringes had come loose from the two horizontal narrow leather strips which formed continuous bands at intervals of one-third and two-thirds down the length of the panel. The fringes were normally attached to these strips with lashings of sinew thread, but in these places either the thread had snapped, or the fringes and sinew had come loose owing to breakage of the horizontal strip. This had occurred in three places.

First the horizontal strips were repaired using tiny patches of gut applied with Jade 403. These small repairs were barely visible - the gut dried transparently and with a matte surface. Then the fringes were retied to the horizontal strips with doubled no. 50 light brown cotton thread. The appearance of missing sections of quill wrappings was restored using wrappings of no. 50 cotton thread in colours chosen to match the dyed quills.

5.0 Conclusion

As each item was treated, extensive records were kept of the condition and the specific areas of repair and restoration. These records will be of great significance if the garments are redisplayed and some are selected for travelling exhibition. This paper has focussed on the methods which the author believed to be appropriate from the standpoint of "minimal interference" on items in this condition.

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Biographical Notes

Catherine Collins is a graduate of the Queen's University, Kingston, Master of Art Conservation Programme. She has had experience with archaeological conservation both in Canada, with historical material from Upper Fort Garry, and in Italy with Estruscan artifacts. She spent one year as an objects intern at the Indianapolis Museum of Art. Since 1980 she has worked in Winnipeg at the Manitoba Museum of Man and Nature. Here she divides her time between her managerial functions, as Head of the museum's conservation lab, extension services for the Manitoba Heritage Conservation Service, and the care of the museum collection.

La collection du Musée Manitobain de l'homme et de la nature contient environ 70 objets recueillis par le peintre Paul Kane au cours de ses voyages dans l'ouest de l'Amérique du Nord entre 1846 et 1848. Six vêtements autochtones en cuir sommairement tanné à l'huile ont subi des traitements de conservation en vue d'une exposition. La communication porte essentiellement sur les techniques utilisées pour réparer et restaurer le cuir, en particulier dans le cas de dommages mécaniques. Le musée a acquis en 1941 ces vêtements qui étaient devenus la propriété des héritiers du protecteur de Kane. La famille les exposait à la maison d'été familiale et permettait qu'on les utilise comme costumes. Pendant 10 ans, les vêtements ont constitué l'attraction principale dans la Grasslands Gallery, au musée. Autrefois vivement colorés de pigments et de broderies en piquants de porc-épic teints, les vêtements s'étaient fanés et étaient devenus couverts de suie, de poussière, de taches et de peinture. La plupart des articles présentaient des dommages mécaniques sous forme de déchirures, de trous causés par des clous, de boucles de cheveux détachées et de lacunes dans le cuir. Un certain nombre de techniques ont été utilisées pour rendre leur apparence première aux endroits abîmés. Selon la rigidité de la peau abîmée, les déchirures ont été fermées au moyen de fil de soie à plusieurs brins ou de Jade 403 et renforcées de polyester non tissé. Certaines déchirures ont été réparées simplement avec du fil de soie. Les petites lacunes ont été comblées au moyen de renforts en Pelon retouchés à l'aquarelle. Une importante lacune dans une jambière a été remplacée par du chamois anglais cousu au fil de soie et aspergé d'aquarelle. Plusieurs techniques différentes ont servi à rattacher les boucles de cheveux. L'auteur de la communication expose toutes ces techniques en détail.

ETHNOGRAPHIC SKIN AND LEATHER PRODUCTS: A CALL FOR CONSERVATION TREATMENT

T. RAPHAEL

This paper briefly explores some of the more important manufacturing technologies represented in major ethnographic collections and attempts to illustrate the important role skin products have had in many societies. The technical portion of the paper is intended not to offer more "recipes", but instead to document what the various "recipe" interventions of the past have done for and to ethnographic collections. This is accomplished by a survey of the results of years of "non-conservative" care and treatment of skin materials in our collections. The final section of this paper examines the safer options available at present. It outlines a "preventive conservation" approach and challenges both curator and conservator to achieve preservation goals employing actions which will not only remain reversible, but also unregrettable.

1.0 Introduction

It is no coincidence that ethnographic collections are filled with skin and leather artifacts. These materials have supplied the basic fabric from which virtually all societies have produced a myriad utilitarian and decorative objects. A great variety of physical and aesthetic characteristics has been achieved and a high degree of permanence obtained as a result of simple, yet ingenious, processing methods by indigenous peoples.

Ethnographic collections constitute an irreplaceable cultural resource. They form a record of past and present human behaviour and require specialized attention if they are to be preserved for the future. Unfortunately, the treatment of ethnographic skin and leather has remained largely unscientific and unsystematic. The reasons for this are many. As conservators, we have a poor understanding of the technologies involved in native tanning and processing and of the complex deterioration processes which occur. Until recently, limited scientific support has been directed at this group of materials. As a result, treatments are begun without clearly identified objectives, and success or failure is impossible to measure. Because of these factors, and my experiences, I have concluded that the museum field must become much more cautious with regard to interventive treatment of these ethnographic materials. Skin and leather products are particularly prone to depreciation as a result of inappropriate treatment.

2.0 A Field in Transition

Progress in the treatment of native skins and leather has been slow. Few studies have been published in the literature specifically with regard to the treatment of native skin and leather artifacts. Attention has primarily focused on skin products associated with the decorative arts, rare books and manuscript collections. Until relatively recently, conservators have had to rely upon a handful of works that are now 15 to 30 years old; Stambolov (1), Waterer (2), Reed (3) and Plenderleith (4). Although not yet widespread, there have been rapid developments in the field since 1980. Significant progress has been made in identifying and solving the problems associated with the treatment of native skin and leather artifacts. Examples can be cited from numerous countries (5-14). A thorough bibliography is included in **Recent Advances in Leather Conservation** (5). In addition, seminars and conferences have been sponsored which have sought to integrate international expertise in leather chemistry with native technology and conservation.

Until there is a more widespread understanding of native skin and leather artifacts, a conservative approach should be taken in our efforts to preserve them, with a greater reliance upon preventive conservation practices. Conservators must become more cautious of unwarranted intervention; become familiar with the benefits of limited interference; proceed slowly and cautiously when interventive treatment is required; use a methodical approach in the preservation of these collections; and finally, adopt and develop preventive conservation procedures with which they can be confident.

A similar sentiment has recently been expressed by Hans-Christoph von Imhoff, with regard to the treatment of cultural materials in general:

"If the conservator is the person who works on our material heritage and who conserves it, he is also, the one who can ruin it, if not the object at least part of the information written into it — information which is possibly not yet readable" (15).

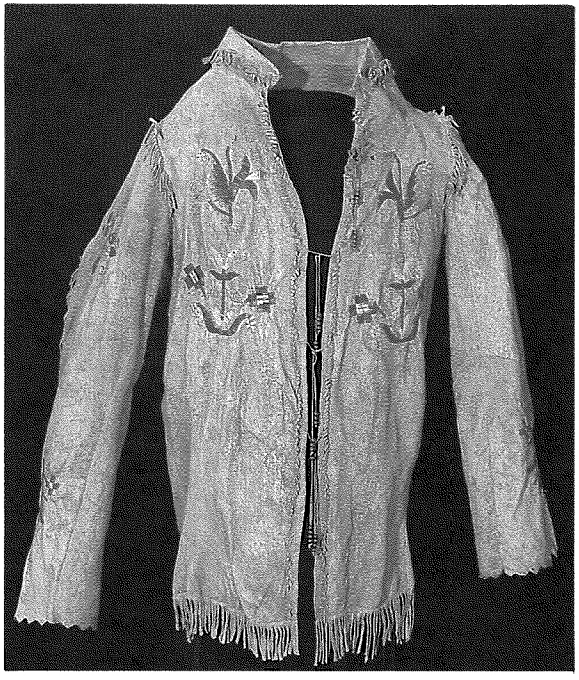
Von Imhoff describes conservation as a "highly qualified humanistic profession with enormous responsibilities and which demands a basic capacity for judicious interpretation" (16). Sadly, it has become evident that as the legitimate defenders of the world's silent heritage, perhaps ethnographic conservators have not been sufficiently conservative in the safeguarding of these resources, and perhaps in the zealous youth of our profession, we have allowed many of these artifacts to be threatened with ruin under our own hands. We have underestimated our requirement for judicious interpretation.

3.0 Preventive Conservation

Future progress in this field will obviously depend on the broadening of scientific capabilities and the development of new technologies, yet the simple exercise of re-evaluation of past treatment must not be overlooked. It would be very useful to know more about the success or failure of treatments performed during the past 20 years. It was the opinion of nearly all the conservators attending a recent workshop on native tanned leather artifacts that the majority of the interventive treatments they evaluated were unsuccessful. The group also agreed that most laboratory treatments had not been based on sufficient technical knowledge and experience, thus resulting in complications for later preservation processes. The conservators generally agreed that the greatest threat to ethnographic skin artifacts was the museum staff itself, followed by the unsuitable exhibit and storage conditions provided for these collections.

The responsibility of preserving museum objects is shared between curatorial and conservation staff and clearly the safest approach is to make preventive conservation the pivotal feature of any conservation programme. Deterioration of skin and leather products can and should be halted through the control of the museum environment, rather than treatment of the object itself. This approach is both cost-effective and less hazardous to ethnographic collections in general. Several conservation laboratories which deal frequently with these materials have recently changed their emphasis accordingly from benchwork to environmental control and the provision of protective supports for their collections.
A preventive conservation programme for skin and leather products should focus on the following activities:

1) environmental monitoring and control
2) identification, monitoring and eradication of museum pests
3) condition surveying of objects
4) upgrading of storage systems
5) review of exhibition planning
6) design and fabrication of individualized exhibit mounts and storage supports for objects
7) education and training of staff



Oglala Sioux Indian Jacket, belonging to American Horse, ca 1870. James H. Cook Collections, Agate Fossil Bends National Monument. Buffalo hide, decoration — dyed porcupine quill embroidery. Delicate surface features — applied yellow ochre, penciled patterns of original embroidered designs.

4.0 Deterioration of Skin and Leather

4.1 Inherent Instability

Many ethnographic objects are inherently unstable due to the sensitivity and reactivity of various skin components, or because of the interaction between them and other composite parts. In many instances degradation is inevitable.

— When relative humidity is not controlled, dimensional shrinkage, splitting and deformation of skin products will occur.

— The physical stresses generated as a result of fluctuation in humidity increase when skin products are fastened to substrates which respond differently to moisture loss or gain.
— When skin and metal surfaces are in direct contact corrosion is accelerated because of the high moisture content (12-19% by weight) and acidity (pH 3-6) of skin materials. This, in turn, results in further degradation of the skin.
— The initial processing of some skin and leather products can introduce compounds which lead to internal degradation. The use of certain tannages, oils and preservatives can be at conflict with long-term preservation of the object thus rendering it inherently unstable. Conditions such as "red rot", the formation of surface spews, metallic stearates or salt efflorescence are examples of common processing problems.

4.2 Exhibiting Skin Artifacts

The improper or inappropriate display of skin products is perhaps the major cause of damage to these objects.

— Open exhibits do not provide skin objects with the necessary protection afforded by storage and exhibit enclosures. These exhibits create a serious maintenance problem because of the rapid accumulation of soils and susceptibility to vandalism and theft. Changes in relative humidity have direct access to the objects exhibited in the open, as do all damaging pests.
— Tightly sealed exhibit enclosures must be constructed of inert materials to avoid the concentration of potentially harmful substances such as the vapors from organic acids, sulphur materials, from fluctuating external humidity as well as provide a micro-climate which can be more easily adjusted.
— Rapid fluctuations of relative humidity in exhibits fatigue skin and leather products, eventually weakening them and affecting their moisture regain capability. Atmospheres containing less than 40% RH force the artifact to give up its inherent moisture.
— Excessive exhibit lighting promotes photo-oxidation, embrittlement, and desiccation while temperature changes bring thermally sensitive fatty substances to the surface.
— The stress on exhibited objects is greatly reduced when original straps, thongs and handles are not used to support the object's own weight. Three-dimensional objects should be supported internally if necessary and external exhibit mounts should be custom designed and padded with inert materials like polyethylene foam or polyester fiber batting.
— Fastening systems should not include nails, tacks, wires or screws but should rely on protective designs and less harmful methods, such as Plexiglas clips, fabric ties, and polyester (Mylar) bands. Diverse materials should be isolated from contacting skin and leather products by the use of inert barriers like polyethylene and polyester sheeting.
— The structure of certain animal skins is unsuited for certain uses. Some hair and fur skins naturally have limited breakage resistance, others fall out easily as the hair follicle muscle becomes loose due to desiccation. The entire grain layer of certain animal skins will loosen and slip over time, separating neatly at its grain junction.

5.0 Review of Conservation Techniques

5.1 Cleaning

The cleaning of ethnographic skin and leather artifacts is a controversial topic because it is a hazardous procedure. The possible removal of important material and information, and the unknown long-term effects of various cleaning procedures on skin artifacts are central to this controversy. Caution should also be exercised since so many of these objects have been treated with insecticides like arsenic, D.D.T. or mercuric compounds.

— Curators and conservators must first determine whether cleaning is even necessary. It is advisable that a clear purpose be established for each individual case and the advantages of cleaning be carefully weighed.
— When cleaning is required the gentlest method should always be selected. In the past, conservators have relied on unsystematic cleaning traditions which have included commercial suede cleaners, corn meal, air abrasive powders, and highly alkaline leather cleaners (like Vulpex and saddle soap). Mechanical cleaning processes have proven safer and less hazardous to the skin or hide and should be relied upon; contamination of these materials with chemical reagents must be avoided.

— Vacuum and forced air cleaning are widely regarded as the safest procedures, assuming the material is in a stable condition and fragile decorative surfaces are not present. A vacuum cleaner with adjustable suction power can be employed over a nylon screen to efficiently remove most airborne surface accumulation. Care should be taken when using compressed air to avoid embedding foreign particles deeper into the skin fibres.
— Drafting powders and artist's erasers can deposit a considerable amount of particulate material deep into the fibrous network of more porous skin surfaces. Tests have shown most powders to contain sulphur and corrosive contaminants as well as colouring agents, abrasives and plasticizers. Their use should be avoided.
— Strong alkaline cleaners which include saddle soaps are inappropriate for use on ethnographic skins and leather products because they alter the material's pH and its shrinkage temperature and may react with existing preservatives and tanning agents. Most paste or liquid cleaners also leave behind a considerable amount of residue since the object usually cannot be thoroughly rinsed.
— Organic solvents, including commercial drycleaning solutions, should not be used routinely for cleaning skin and leather as they are potentially very hazardous to objects. Organic solvents and water can easily remove original oil, fat and tanning components. The reaction to solvents of aged skin and leather is unpredictable with shrinkage, deformity and discolouration often resulting.

5.2 Softening and Reforming

Many laboratory treatments are aimed at softening and reforming skin and leather artifacts. It is only infrequently possible to regain permanent flexibility, and the results of such treatments are primarily cosmetic. Most of these treatments have included the misuse of various lubricants and leather dressing formulas. The risks involved in such treatments are rarely carefully weighed, especially since flexibility is not a required characteristic of most museum artifacts.

— There are many different reasons why skin artifacts become stiff or embrittled and many of these conditions are irreversible, such as: the permanent loss of moisture, polymeric cross-linking, oxidation of oil or fat components, excessive heating or impregnation with foreign substances.
— Many of these artifacts were not intended to be flexible and were originally processed accordingly. In some instances stiffness may be a result of original usage and should therefore be considered of potential historical importance.
— Most corrective treatment has traditionally relied on the introduction of moisture, humectants, or oils and fats. Temporary softening can often be gained by procedures which swell or lubricate the fibers. However, there is much debate about whether skin materials would be better left without this temporary intervention. Quite often the haphazard application and the quantity and quality of the reagents has complicated subsequent preservation efforts.
— Closely regulated humidification can be used effectively in the removal of some deformities in skin products which are in good condition, yet increased contraction can result upon drying. Heat produced from steaming can be very injurious and periods of humidification longer than twenty-four hours cause a risk of micro-oganism attack.

5.3 Repair

As skin products become weakened by the physical, chemical and biological processes of deterioration, they become prone to tearing, splitting and losses. The repair and mending of this damage requires considerable experience and can be extremely hazardous to the artifact if performed incorrectly. Such treatment should only be attempted by conservators familiar with leather and skin.

— The recommended non-interventive approach to these problems is to immobilize the object in a non-stressful position. The provision of internal and external support is usually effective in providing protection to the damaged area.
— Mechanical sewing techniques and rivetting, or the application of adhesives have been commonly employed to repair skin artifacts. These methods are relatively irreversible interventions which should only be used as a last resort.
— Adhesive mending and backing systems which employ heating of skin products will cause damage because of the artifact's low shrinkage temperature. The introduction of adhesive solutions usually discolours and stiffens the affected area and complicates its future deterioration. When adhesive applications are required, materials should be selected which are easily removable (such as

starch paste) and which supply the minimum bond strength necessary. Natural and synthetic backing supports add bulk to the artifact, reducing its free movement and obscuring one of its surfaces.

— Stitching of skin and leather with natural or synthetic threads is rarely necessary and is appropriate only when the skin is in good condition. The perforations introduced weaken the area and the tension from the threads may place additional stress on the damaged area.

6.0 Conclusion

The deterioration of ethnographic skin and leather products occurs as a result of many factors, not the least of which is intervention during conservation treatment. It is time to take a careful look at how the museum field has been treating skin and leather artifacts. There is clearly a need for such a wide scale re-evaluation of conservation techniques and practices. Until we have a better understanding of these materials and more proven treatments, conservators and curators alike should refrain from unwarranted and hazardous treatments. Preservation of these valuable collections can be effectively achieved by non-interventive means. By attention to correct environment, storage, display and handling, conservators may provide their collections with the passive protection they require.

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Biographical Notes

Toby Raphael is a graduate of the University of California where he received Bachelor of Arts Degrees in Visual Art and Latin American Studies. He received his Master of Art Degrees in Museum Studies with a specialization in Anthropological Conservation from George Washington University, completing internships at the Smithsonian's Anthropology Conservation Laboratory and the National Center for Restoration, Mexico City.

His international research into the conservation of leather objects, supported by the National Museum Act, led him to organize the American Refresher Course "Recent Advances in Leather Conservation" and co-found the publication **Leather Conservation News**. Toby is presently Ethnographic Conservator for the U.S. National Park Service.

L'auteur de la communication décrit brièvement certaines des principales techniques de fabrication qu'on retrouve dans les grandes collections ethnographiques et tente d'illustrer l'importance que les objets en peau présentaient pour bien des sociétés. La partie technique de la communication vise non pas à donner d'autres "recettes", mais plutôt à documenter les effets des diverses "recettes" d'intervention sur les collections ethnographiques. A cette fin, les résultats de plusieurs années de soins et de traitement "non conservateurs" des peaux de nos collections sont examinés. La dernière partie de la communication comporte une analyse des options les plus sûres qui s'offrent à nous actuellement. On y propose une attitude de "conservation préventive" et on incite les conservateurs et les restaurateurs à atteindre des objectifs de préservaton en ayant recours à des mesures qu'ils pourront inverser et ne regretteront jamais.

CONSERVATION IN THE CULTURAL CONTEXT

Conservation and Cultural Centres
G. Cranmer-Webster
U'Mista Cultural Centre, Alert Bay, Canada

A Discussion on the Use of Museum Artifacts by their Original Owners
M. Clavir, A. Shane, E. Johnson
Museum of Anthropology, University of British Columbia, Vancouver, Canada

Hands Across the Border: Conservation, Politics and Ensuing Dilemmas
K. Berrin
M.H. de Young Museum, San Francisco, U.S.A.

The Native North American Approach to Conservation
L. Mibach
Intermuseum Conservation Laboratory, Oberlin, U.S.A.

The Repatriation and Treatment of Native American Objects
T. Raphael
National Park Service, U.S.A.

Discussion of the Report on Ethnographic and Archaeological Conservation in the United States
B. Raphael
Museum of New Mexico, Sante Fe, U.S.A.

CONSERVATION AND CULTURAL CENTRES: U'MISTA CULTURAL CENTRE, ALERT BAY, CANADA

GLORIA CRANMER-WEBSTER

The attitudes of museum custodians and native North Americans to artifacts of native origin are compared and contrasted with reference to the U'Mista Cultural Centre in Alert Bay, British Columbia. The condition of some artifacts from the Potlatch Collection, returned to its Kwakiutl owners by the National Museums of Canada, is described. The need for basic training in conservation techniques is mentioned and a plea is made for better access to collections of ethnographic material, particularly by native craftsmen.

1.0 Introduction

Firstly, I would like to thank the organizers for inviting me to this Symposium which I have enjoyed so far. I was particularly interested in David Lee's presentation on the Papua New Guinea *haus tambaran*. It is good to know that our artifacts at the British Museum are also being well taken care of at the moment. Before getting into my presentation I would like to comment on Dr. Dorais' quotation of a statement by Robert Davidson, something to the effect that... "without Museums and anthropologists Northwest Coast cultures would have disappeared..." or some awful thing like that. Well this may be true for some parts of the Northwest Coast, but as far as I am concerned it gives museums and anthropologists more credit than they deserve. Although the title of my paper is **Conservation and Cultural Centres**, as it says in the programme, that was just something to get the conference organizers off the phones, because they kept asking for a title. I really don't know a great deal about cultural centres outside of the one that I work in, the U'mista Cultural Centre. Many of the Symposium delegates may not know very much about that one. During the course of the Symposium I will be showing a video presentation entitled **A Box of Treasures**. We at the U'Mista Cultural Centre are pretty proud of this production. It has been shown on national CBC Television and has won two major awards in the United States. In many ways this video presentation summarizes the activities of the U'Mista Cultural Centre and gives an insight into our history and aims for the future. In particular, it highlights the Potlatch Collection, removed from our custody in the 1920's and only now in the process of being returned.

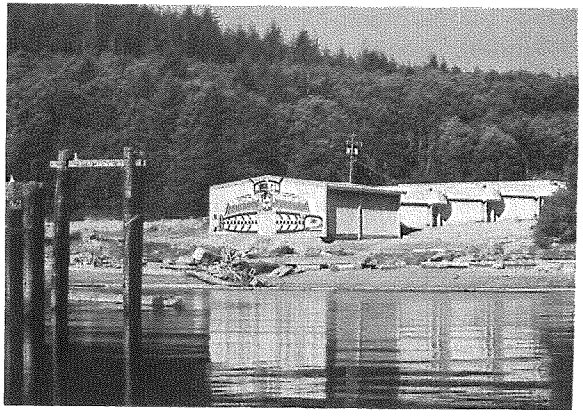

Figure 1. The U'Mista Culture Centre at Alert Bay

2.0 Conflicting Viewpoints

I once heard a curator at a museums conference complain that the only thing that would make conservators really happy is that they be allowed to pack up all artifacts in black boxes, seal up the boxes and store them away for ever. That may be an exaggeration. Perhaps the curator had lost an argument with a conservator. The point, nevertheless, is that we know what conservators do or try to do; that is, preserve objects for as long as possible. But, diametrically opposed to this is the general Indian view as I know it, which is that objects are created to be used and when those objects are damaged or worn out, they are thrown away and new ones are made. This applies to everything from small masks to large totem poles. For example, many Indian people feel that once a pole has served its purpose it should be allowed to go back into the ground. I think this attitude has a lot to do with the way Indian people look at the objects. The objects themselves are not important; what matters is what the objects represent. They represent the right to own that thing, and that right remains even if the object decays or is otherwise lost. I also think that this view is sometimes related to the poor quality of certain masks and other artifacts, and I think, once more, that this has to do with not so much what the object looks like, but what it represents.

So somewhere between these two opposed views is our Cultural Centre and probably others like it. We spend enough time in the museum world to appreciate the importance of saving and preserving material, but we often do it in communities where the other point of view prevails.

3.0 The Potlatch Collection

When the National Museum of Man (now the Canadian Museum of Civilization) returned the Potlatch Collection to the U'Mista Cultural Centre, some of our people assumed that the masks were being returned for our use. I never thought I would say this, but in a way it was fortunate that the collection was returned in such terrible shape, because we were able to convince people that the objects were much two fragile to be used. When I say terrible shape, I will give you an example. One of the pieces that was returned was a whale mask, which fits over the entire body, the tail of which was broken. When it arrived at the British Columbia Provincial Museum in Victoria the two broken pieces were held together with rubber bands!

Conservation at the National Museum of Man in 1979 was not great but we are certain it is better now. Because of the condition of the Potlatch Collection our Center was visited three years ago by the Mobile Conservation Laboratory of the Canadian Conservation Institute. We are grateful for the treatment provided by conservators Bob Barclay and Janet Mason during the three weeks they were with us. They probably saw things in our Cultural Centre that they had not seen in any other institution they had worked in; for example 20 Indian ladies making 1200 sandwiches for a potlatch. That is not the usual sort of thing that goes on in museums, but it does illustrate the fact that we are not just a museum - we are a fully active cultural centre.

The collection that was returned had suffered through 60 years of neglect at the National Museum of Man, and I fully expect that when the rest of the collection is returned by the Royal Ontario Museum and the Museum of the American Indian we will once again need the services of qualified conservators. Negotiations with the Royal Ontario Museum are nearly complete but none have started yet with the Museum of the American Indian.

4.0 Preservation and Access

One of the topics suggested to me for this Symposium was the importance of preserving ethnographic collections. We all know that there are some areas in this country, and probably in countries around the world, in which a lot of cultural material has been lost, mostly to museums. Clearly the preservation of ethnographic collections is very important. But of equal importance in this country is the access to those collections by native people, particularly the carvers, for study purposes and, in special cases, for loans of material for ceremonial occasions. I know that for the CCI Mobile Laboratory conservators the opportunity to attend a potlatch while they were working in the U'Mista Cultural Centre gave them a different perspective on the material with which they were working. There should be some way that other conservators can work on site and thus have similar experiences. This might be possible through the loaning of ceremonial objects. Of course conservators may have to fight with curators to decide who gets to go.

5.0 The Need for Training

The need for conservation treatment of repatriated objects points to another need in centres such as ours: training for local people in basic conservation techniques. I was really interested to hear about the Maori Building Restoration project that has been described by Anne Geelen in this Symposium. In our part of the Northwest Coast we do not have a lot of large, traditional buildings left to worry about. But there are smaller artifacts, especially the ones being returned by large museums.

6.0 Conclusion

It has been a great pleasure attending this Symposium and gaining an understanding of the viewpoints of the conservation profession. Of particular interest to me were the papers which dealt with the conservation of cultural property in association with the original owners. This kind of dialogue is to be increasingly encouraged in the future.

Finally, I would like to make a request of conservators. I know that you are involved in planning travelling exhibits including designing the crates and cases. In our Centre we have a small all-female staff, so wrestling 400 lb. travelling exhibit crates off freight trucks is not our favourite job. I would guess that most small museums and cultural centres are much like ours. All women, small staff; so please attempt to work on lighter travelling exhibit cases.

Question:

I was wondering whether the material that has been returned to your museum had its title of ownership actually transferred to your museum, or are the pieces on long-term loan from the Canadian Museum of Civilization?

Answer:

I guess it depends on who you are asking. I think the National Museums Corporation considers it a long-term loan. We consider the title as having been returned to the people along with the pieces.

Question:

As far as reproducing artifacts that are in your collection, do your people feel that the actual image is owned by the people and that making reproductions of the objects would not be appreciated?

Answer:

I think that's part of it. The other part of it has to do with a kind of competition that exists in the Northwest Coast market. Our own carvers have a hard enough time to stay in business and some of us really object to people who are not from our area, who are not Northwest Coast, competing with those who have the right. Those who traditionally make that kind of thing. And there is some argument about that. The Director of the Museum of Anthropology at the University of British Columbia has called me a cultural imperialist because I feel that way, but I just feel that there has been enough exploitation, and that there should be something left to the people.

Question:

Do conservators come and discuss with you or ask your advice about treatment on materials; ways that they can treat the objects?

Answer:

Sure. We are happy to help in whatever ways we can. I'm not quite sure how at this point, because we have not done much conservation work on our own.

Biographical Notes

Gloria Cranmer-Webster graduated from the University of British Columbia with a Bachelor of Arts degree in Anthropology. Prior to returning home to Alert Bay in 1975, she was an assistant curator at the Museum of Anthropology and instructor in Anthropology at the University of British Columbia. She has been curator of the U'mista Cultural Centre since 1980 and has worked on films produced by the Centre, as well as editing a language book series for use in local schools.

L'attitude des responsables de musée à l'endroit des objets d'origine autochtone est ici comparée à celle des autochtones en prenant comme exemple le centre culturel U'Mista d'Alert Bay, en Colombie-Britannique. Il est question de l'état de certains objets de la collection Potlatch retournés à leurs propriétaires kwakiutl par les Musées nationaux du Canada. L'auteur aborde également la formation de base qui s'impose en conservation et souhaite un meilleur accès aux collections ethnographiques, en particulier pour les artisans autochtones.

A DISCUSSION ON THE USE OF MUSEUM ARTIFACTS BY THEIR ORIGINAL OWNERS

MIRIAM CLAVIR, ELIZABETH JOHNSON, AUDREY SHANE

Museums on the West Coast regularly receive requests from native artists or their families to borrow back objects for use in ceremonies and public presentations. In this paper the conservator and two curators from the University of British Columbia Museum of Anthropology discuss the Northwest Coast Indian concept of rights and privileges related to regalia, as well as other reasons for the Museum's positive but cautious policy towards such requests, including the historical significance added to the pieces used. In addition, the question of whether this policy creates a double standard towards requests from non-native people, both in artifact handling and research resources will be addressed. Other issues which form part of the discussion include: copyright; unsolicited repairs or alterations to artifacts being done by artists or their families; requests for use of valuable contemporary artworks; requests for old material and a policy for their use; and ways of diminishing the use vs. damage vs. preservation problem.

1.0 Introduction

Elizabeth Johnson

We will be referring to the University of British Columbia (U.B.C.) Museum of Anthropology where we all work. I would like to give just a brief introduction to the museum so that you know something of the context about which we are speaking. Located in Vancouver, on the coast of British Columbia, it is a university museum with quite a small staff. There are fourteen permanent members of staff as well as occasional students and other people working with us on contract. Our collections include ethnographic and archaeological material. The archaeology collections consist of about 80,000 pieces, most of which are from within British Columbia. The ethnographic collections include about 20,000 pieces of which about one third derive from the Northwest Coast Indians of the coast of British Columbia immediately around us. The remainder of the collection comes from all around the world, from East Asia, Oceania, Central and South America, and so on. The Museum was formally established as a Museum of Anthropology in the 1940's and from that time on we have worked very closely with native people of the Northwest Coast.

At present we often have public programmes at which native people are speakers or give performances. We also hold public events of various kinds, including totem pole raisings. At various times in the course of the history of the Museum we have been able to encourage the work of native carvers and other artists who have been working on the premises of the Museum, and whenever possible we try to provide facilities for them. We also have a programme in which native high school students are hired to work at the Museum and do interpretive work on the collections for the public.

In addition, we frequently have exhibits of the work of individual native artists. Last year we had three such exhibits showing the work of the Haida artist Bill Reid, the history of Cowichan Indian knitting, and the revival of Salish weaving at Musqueam.

One particular feature of the Museum of Anthropology which you may have heard about is our visible storage system, in which the majority of our ethnographic collections are stored on public view. One of the justifications for having this system was to make the traditional heritage of native people of the area readily available to them so that they could have access to this material without having to go through formal procedures and appointments and so on, and could study it as they wish.

The subject of this discussion is the question of loans. The collections of the Museum of Anthropology include a number of contemporary pieces done by living artists. We are building these collections all the time. The kinds of pieces we are talking about include such objects as masks, a painted dance screen, and a dance costume. These materials are generally either purchased directly from the artist who made them or sometimes indirectly through dealers.

It occasionally happens that we have requests for loans of this material, perhaps four or five times per year. These requests normally come to me initially as Curator of Collections. The requests for loans are for various purposes. Sometimes they are for use within a traditional context. Sometimes they are for uses which I suppose you would call a traditional kind of use but in a less

traditional kind of context, that is to say dance performances which sometimes take place within the Museum itself, and sometimes in other locations. For example, there were such performances going on at Expo 86 in the summer. Sometimes the requests are for exhibits elsewhere - for display in art galleries and other contexts.

Our response to these requests has always taken into consideration our history and our present policy of cooperating as closely as possible with the native people in British Columbia; so we consider each request carefully. In order for permission to be granted it has to be agreed to by a curator, the conservator, and the director. This is our usual procedure. It is our standard practice to make such loans whenever we can possibly do so. Over the past few years, in response to this need, we have developed a policy through consensus among the staff, after a great deal of discussion. We presently have a written policy in this area, although it is still evolving. There are still changes we would consider making to it.

The main points of this policy are as follows. First, that in general we would allow use either in the Museum or through short-term loan out to native individuals or groups when applications have been made. Second, that the decision whether or not to loan is made with reference to the nature of the intended use and with consideration for the safety of the intended object. Third, that the loan will be made when it is feasible for staff to schedule it, and preferably with at least one week's notice. Fourth, that the intended use of the object and any additions or changes to be made to it should be stated in writing and that our standard loan procedures are to be followed. Fifth, that when the objects are returned they should be packed as they were when they were sent out on loan. Sixth, we require that transportation be the responsibility of the borrower and that the borrower is responsible for the cost of insurance. Finally, we ask that information on the way the objects were used be provided by the borrower so that this can be added to our permanent records on the objects.

I should point out that for us to make these loans is contrary to our usual loan policy, which is that we don't normally loan to individuals. We loan only to other institutions with acceptable environmental conditions (except for occasional exhibits of contemporary native art) so we are making exceptions in these cases. I should note also that we do make exceptions for native people with respect to outside loans to the Museum as well. We normally do not accept long-term loans. However, we have provided museum storage conditions for regalia which belongs to native families and bands.

The results of our present practice with regard to loans of Northwest Coast artifacts are, I think, that in general the borrowers have found the policy to be satisfactory. We feel that it is worthwhile and important, not only because it is meeting a need on the part of the borrowers, but also because the artifacts themselves, which were new and without histories to start with, have thus gained the validation of being used in an appropriate context. We feel that this adds greatly to their history and is an important justification for our policy.

Audrey Shane

On the Northwest Coast of North America, images of certain beings are associated specifically with particular family lineages. These images represent inherited rights and privileges. They were received from distinguished ancestors, displayed by each current heir for validation by his peers at a public ceremony, and could only be used by those who had thus established their rights.

The foregoing statements apply to events in a conveniently nebulous time frame known as the "ethnographic present". This is a device which allows ethnologists to describe societies as functioning wholes, and furnishes reference points. Thus when we look at the older individual pieces in our collections, we place them in a cultural context which relates to the composite picture formed by a number of ethnographic descriptions, or "ethnographic presents".

In many areas little remains today of the groups so described, or of their inherited privileges, although some have vigorously maintained their traditions. The gradually growing interest in the products of contemporary Northwest Coast artists over the last 30 years has stimulated change and innovation in the way Northwest Coast images are represented. A trend towards what one might call generic rather that specific images is perceptible; a relaxation of the boundaries of ownership.

While awareness of, and sensitivity to, traditional rights and privileges would be imperative if we were to lend old artifacts for ceremonial uses, these considerations seldom are restrictive in the case of contemporary artifacts. Even if we think of the contemporary pieces as lacking the precise sort of rights and privileges inherent in many of the older pieces, we still must acknowledge that the museum has acquired these new pieces as artistic products of merit, warranting museum

shelter. If this shelter involves usage in an appropriate cultural context, the object may then be at the starting point of a new kind of tradition, one which will see the artist's descendants returning to study, admire, and request a loan in turn.

Miriam Clavir

I want to consider one of the realities of this issue of loaning back contemporary objects for use in ceremonies. From my point of view as a conservator, our policies are not preventing damage from taking place to the objects.

To quote from the drafts of the **Canadian Code of Ethics for Conservators**, "Conservation is the means by which the true nature of a cultural resource is respected and preserved". Our policies are drawn out of this respect, but they do not preserve the objects.

Some of the problem lies with the loan policy itself. It was originally intended for contemporary artists so that they could borrow back pieces they have made to use in traditional ceremonies, in which it would be their right to use or dance the piece. As has already been mentioned, this adds considerably to the ethnogaphic significance of the piece. The requests for use of objects have come, however, for more than just traditional ceremonies. Artists have asked to borrow back their pieces to dance at a gallery opening or, for example, for 25 performances at EXPO 86. Can we draw a line? It is very difficult to draw a meaningful line (at least to the person who has created the object) when the performance, of whatever nature, is significant for that person.

Whether used in traditional ceremonies or not, however, it is not unusual for the objects to come back to us with unwanted additions or alterations, or sometimes damage.[1]

Concerning the use of museum objects - are we playing favorites with one group of people? Namely, are we giving special privileges to the Indians of the Northwest Coast?

[1]Slides were shown. The question of whether the artist does the repair was raised, as was the problem of hasty repairs done to enable a performance to continue. In addition, with regard to damage stemming from use in a traditional ceremony, the conservator stated that beyond expressing concern for the safety of the piece beforehand, she would not presume to interfere with its use in a traditional ceremony.

Because really two-thirds of our collection comes from other parts of the world. For example, we have a collection of Russian-style icons by an artist who paints in the traditional style. If the daughter of the artist wanted to borrow back these icons for a family reunion, for example, would we allow it? No, we wouldn't, I would think. Let me illustrate my point about use, with respect to handling, with another example. If a Chinese artist wanted to come in and handle some fragile jade pieces, what would be our policy? While I think that the Museum of Anthropology makes every effort to let Indian carvers and weavers and other artists handle and examine closely what they're interested in, is it fair if we don't allow the same privileges to non-Indians? But, are we protecting the artifacts if we do allow a lot of handling by everybody?

Elizabeth Johnson

I am most closely involved in responding to requests for access to the collections, and I would have to admit that we do have differential standards with regard to allowing a degree of handling. If native artists come in I'm more likely to allow less restrictive handling than I would perhaps to the Chinese artist who came in. One reason for this is that these people are very often engaged in actually making and replicating the kinds of objects to which they wish to have access and I think they often have less opportunity for access to old examples of these objects than do people in other parts of the world. As they're engaged in making the objects, they need the kind of information which is gained by handling and examining them closely. For example, the other day we had a group of women from the Musqueam Reserve, which is very close to the Museum, who were engaged in the revival of Salish weaving. They wanted to examine our Salish blankets, of which we have a few examples. In order to replicate them they needed to examine them very carefully to see how edges were finished and so on. I permitted this because the work they are doing is very important. I think there are arguments that can be made for giving favored access to Northwest Coast people for our Museum. One is that we are located in their traditional territory and they are certainly an important part of the community which we serve. Another reason is that it can be argued that they have been deprived of their material and non-material culture to a greater degree than many of the other people who are represented in our collections. I would argue, for example, that they have been deprived to a greater degree than the East Asian people whose material culture is also

represented in our collection. It can also be argued that we are unlikely to have similar requests from other people from other parts of the world, who have also been so deprived. Amazonian people, for example, are unlikely to come and make the same kinds of requests of us.

With regard to the loans that we have been discussing, the objects which are under discussion are new and at present don't have their own histories, and so, as I mentioned, by making these loans they begin to acquire histories, which is an important point in itself. There is also the consideration that these new pieces contain relatively little information compared to the old objects in our collections, so if they are to be damaged or even lost, there is less to lose than there would be if an old piece were lost. So I think all these points are important and need to be weighed in making the kinds of decisions which we are so often making.

Audrey Shane

Our treatment of contemporary artifacts could make a great deal of difference to the Museum if we haven't in fact secured copyright on them. Canada's copyright laws are presently being revised and there have been very strong proposals to safeguard the rights of artists over their works. I'm not suggesting that any ethical, properly trained conservator or curator would deliberately bend, fold, staple or mutilate a work of art, although we may hang it upside down by accident. In the context of ethnographic objects, whether an object is a work of art often seems to depend on what is a rather crude separation between utilitarian and non-utilitarian function. Obviously this is too big a problem for us to discuss in detail here, but there are many ethnographic artifacts which have great aesthetic appeal and just happen incidentally to be useful. I'm thinking here for example of a wonderful paper-thin hollow rattle in our collections which is in the shape of a clam shell. It is a product of a contemporary Northwest Coast artist. I would be very unhappy to see that damaged in any way. I think you could argue that it is in fact a work of art. Some of the conceptual fences that we have built in the past around what is a work of art in an ethnographic context and what is not a work of art are full of holes. How can we decide just what will be defined as a "work of art" under the new copyright laws? The situation could arise, to take an extreme example, where the right of a conservator to repair an object without the permission of the artist or his or her heirs could be in doubt. It would seem that one thing we ought to do when acquiring a contemporary piece of ethnographic work would be to negotiate a fair copyright agreement with the artist. In this aspect, as well as in many of the others already mentioned, it's important to have a policy covering our loan back situations. It should be emphasized again that we're still evolving this policy and we're seeking to ensure the ultimate safety of the object by means compatible with what we see as our community obligations.

Elizabeth Johnson

I think there are certain problems with our policy as it exists now and these sort of things need to be worked out both with our own staff and in consultation with the people who borrow the objects from us. Miriam mentioned some of these problems and the fact that damage can result when the objects are out on loan. There are also problems, for example, with regard to the question of scheduling because of the constraints under which the borrowers are operating. They may make sudden demands for use of an object and we often don't have a week's notice to properly prepare the loan. The request may come very suddenly. This means that we have to rush. This creates problems for staff because of the other pressures of our work.

The question of alterations being made to the objects is another problem. In spite of the request for written details in advance this has not always happened and things do come back changed in various ways so they can actually be used for dancing, for example. Such an example is the Thunderbird costume that came back to us in a damaged condition. One ankle had split and had been hastily repaired. Or objects come back with additional harnesses and straps and things added so they're secure for dancing. Another question is how objects are packed for return to us. However, the people who borrowed them may be working under difficult conditions. These difficulties could be overcome, as Miriam mentioned, if we were able to send staff out with each loan but we do have a very small staff. We don't have the financial resources to cover staff time which could be quite substantial in order to do this.

One of the things we've been doing recently is talking with other local museums which are also involved in the same ongoing practice of loaning from their collections for native use. One of these museums is the Campbell River Museum, a relatively small community museum on Vancouver Island, which is very actively involved in the local native community. Their policy, first of all, is that they loan only for traditional use, not for

use which would be considered to be commercial, although it's not actually easy to draw a line between the two. It's a very important part of their reason for existing because they are a community museum and they do attend community events, including native potlatches. It's an important part of their ongoing activities that they be involved in these things. Their policy is also that staff always accompany these loans, so that museum staff can then unpack and pack the objects afterwards and bring them back to the museum so they're not dependent on the borrowers to do this. Of course this is facilitated by the fact that they're working in a relatively limited local area whereas we may be loaning to people some considerable distance from our museum.

The Ethnology Division of the British Columbia Provincial Museum also makes loans regularly from their collections, but they have special collections for which they obtain funding in order to create replicas of old pieces which are loaned out regularly for use at potlatches. They have created a special collection for this purpose. But they will also loan contemporary pieces from their general collections to the artists who made them. They also have a few old pieces which they loan and which were purchased for his purpose. For example, they have a Chilkat blanket which has had extensive restoration and which can be loaned for actual use. But their policy is always to send a staff person to accompany the loan and also to record the event. This relates to their ongoing research of recording local potlatches, and so they allot funding as part of their research budget for this. Like the Campbell River Museum, they loan only for traditional uses although they define this very broadly. They define it as including performances in a non-traditional context, but not such commercial uses as advertising, for example. They did point out that there is some disagreement amongst their museum staff, among curators and also between curators and conservators, regarding the whole problem of damage resulting from use. There are some staff members who feel that the object should remain as it is and are very distressed when damage actually occurs. There are others who feel the importance of the object acquiring a history is perfectly legitimate. So I think perhaps we could look at this, consider the general question of whether the wear and tear which results from authentic use would even be defined as damage at all.

Miriam Clavir

I would just like to underline one point. I think we do the best we can with any money that is available to us, but that if we are talking about the practicalities of our policy, I think that one of our basic practicalities is that we don't have enough money to send a staff person with the loan, and we don't have a museum van for transportation. I would like to ask Audrey: if we accept that there is some damage to the objects which may take place during use by the artist, do we also accept that we should pay a fair market price initially for these pieces?

Audrey Shane

Yes, we certainly should, why not? Our intention is to acquire an object of good quality for our collections. We have said that we considered the usage of that object in an appropriate cultural context to be permissable in certain circumstances. That's our decision and I don't see that it has any bearing on what we paid for it; nor do we have any reason to expect the artist to discount his work for that reason. Usage of the object after we purchase it doesn't in fact vary as widely from usage of our old pieces as you might assume from our discussions. This is because our old objects are also made available to students under controlled handling conditions within the museum. As a curator, I feel this is an important function of the museum. All the preventive measures and repairs in the world are of little use if no one is allowed to learn from the object, and I think tactile experience is an important part of this learning. These are concerns of the curator which have to be balanced with concerns of the conservator.

Miriam Clavir

I'd like to emphasize that certainly any handling by students is under very controlled conditions in the museum, and I think that it's interesting here to differentiate between access to the objects and use of the objects. Let me just go back to the **Code of Ethics**. As I mentioned earlier, in one of the drafts conservation is defined... "as the means by which the true nature of a cultural resource is respected and preserved". And to continue on in that paragraph it reads... "this true nature includes evidence of its origins, original construction of materials of which it is composed, its setting and subsequent use". The **Code** doesn't say when that use ends. It's a question that usually doesn't come up. Also, we have as a definition of the responsibility of a conservator that the conservator should constantly strive to maintain a balance between the cultural needs of the society and the preservation of cultural property. There is on the Northwest Coast a continuing cultural context for these pieces.

To go back to the question of conservation versus access: what I would like to propose is that maybe conservators should look at these contemporary Northwest Coast artifacts not as we have normally been trained to look at them but more as building conservators have been trained to look at buildings. Buildings will be restored to be used, and compromises will be made, because, for example, of the present-day fire codes or because of the new use pattern with the new visitor volume. Some wear and tear on the building is inevitable because of its use. Maybe these contemporary Northwest Coast artifacts are like buildings in that we have to look at use and the compromises that it involves within ethical boundaries. Let me close by reading out the purpose of conservation which again the IIC-CG has endorsed in its **Code of Ethics**. It says that... "the purpose of conservation is to study, record, retain and restore the culturally significant qualities of the object with the least possible intervention". So if this is the purpose of conservation, not just to preserve, but to retain or restore the cultural significance of the objects, then ultimately we are also giving some thought to a larger and very relevant contemporary issue which is that of the role of Canadian museums as keepers of artifacts for native Canadians. I think that conservators, because of our over-riding emphasis on preservation, really have to start thinking seriously about these issues.

Questions from the floor

1. Alice Hoveman

I'm from the State Museum in Juno Alaska, and so I'm faced quite often with this situation as well, so I have lots of questions. The first one is, when someone is requesting to borrow these materials, do you provide them with any sort of hands-on training as far as the individual objects that are being loaned are concerned. For example, what special requirements might there be as far as handling those specific objects?

Johnson

We haven't done that. It might be a good idea, but I find it a little bit awkward because they're usually the people who have made them. But I have sometimes pointed out weaknesses that I have noticed in the objects.

Hoveman

What about materials that have been donated to the museum. Do you lend those materials out, and would there be some kind of conditions surrounding that particular artifact as far as its being donated by a particular individual?

Shane

I don't believe we would lend out anything that came from a donor. We're talking here about material we acquired directly from the artist or purchased through a dealer, but it would be the work of an known contemporary artist.

Hoveman

I think you just barely touched on this subject, but what if the conditions are not met that you've stated in your policy. Is there any sort of refusal to allow those individuals to borrow those materials again until they have met certain conditions or shown that they can be responsible in their handling?

Clavir

Well, it is written into our policy that we will not loan again; however, I'll admit it's one of those things that's very difficult to enforce and it's very awkward to act like police in these situations. It's the working out of these practical problems that I think is a very interesting part of all this.

Hoveman

What about the different cultures? Would someone from your local area be allowed to borrow Tlingit materials or are you restricting the borrowing of the materials to the individual families that have the right to wear those materials?

Shane

I think that up to the present time we certainly have understood this to be a loan back to the artist who produced the piece. Now, as I said, in contemporary Northwest Coast material, it is sometimes very difficult to identify any specific heritage content. We examine each case on its own merits, but so far we certainly haven't lent anything back in the way you suggest and we'd be reluctant to do so.

Hoveman

We've had a request for a loan over the summer from the Department of Education and a white filming crew that were doing an Alaska history production. The white crew had consulted with the Tlingit people in the sense that they had the Alaska Heritage Foundation consult with them on making sure that they had followed traditional patterns and they were using accurate information. What they wanted to borrow was parkas, and Athabaskan clothing and Eskimo clothing so that they could make this really look good. I

have a lot of theater background and know how actors handle props and we don't feel that our collection consists of props for a filming production, so we were fairly heavy-handed and not appreciated over the summer.

When you take loans in for storage, do you require any kind of fee? Are the people expected to pay for insurance and transportation when they borrow objects and when they make a loan in for storage?

Johnson

For the long-term loans we do ask them to maintain their own insurance. We don't take responsibility for insurance and transportation. We say that we will guarantee the best storage conditions that we can and store them as we keep our collections, but they have to provide insurance.

Hoveman

My last question is, do you have any policy regarding repatriation of collections, so that we may have our Tlingit materials back?

2. Gloria Cranmer-Webster

I also would be interested in hearing the answer to that last question.

Shane

Sorry Gloria, I'm not here to discuss that topic.

Cranmer-Webster

I just have a couple of things I'd like to say. I think it was Miriam who asked the question, is it fair that you have a loan policy for Northwest Coast people or BC Indian people that differs from your policy as it relates to other ethnic groups? I don't know that it has anything to do with fairness at all. The reputation of the Museum of Anthropology is based on the Northwest Coast collections and consideration to Northwest Coast people. I think a lot of these problems you created yourselves. Why can't you just say No. If your policy is this, and people want this stuff, they should ask a week in advance and if they ask 24 hours beforehand, why can't you just say no? I mean, if you have bought these objects at a fair market price, it's yours to decide how it goes out and about the conditions under which it goes. One of the things our Board of Directors decided very early on was that we ought to accept pieces for storage. We don't call them loans. We just take care of them for people in the area who still own the masks, blankets or whatever. This is because our Board says that we know all of us live in these little villages, where protection is not satisfactory, and we ought to be able to provide this service. We don't loan those things without the permission of the owner and we don't loan contemporary objects. We do not have a budget to buy those kinds of things. I really think you need to look at your loan policy relating to Northwest Coast people again.

Shane

I think what you are advising us to do is stiffen our backbone, and we might just have to do that.

3. David Lee

Can I just share an experience with you that I had when I first went out to Papau New Guinea in 1964 collecting in the field? It was my first trip and I was but a young man then, and time has taken its toll. It was very interesting. We spent six months in a mountain village collecting artifacts and this village had a very interesting ancestor spirit house with carved and painted walls in the front which were still in use by the people for various ceremonies. Of course being collectors we were very keen to get our hands on this, as you well understand. What we did was to get round it in a very interesting way. We asked them to carve a series of boards in the style of the house boards and paint them and carve them, and we'd make a film of this as it was going on. It was very useful from the technological point of view seeing painting being done on the carving. Now it was very interesting because when we came to the end and we said look we will buy some of the boards that you have made, they said "Oh! hang about. Some of the boards on our house were badly damaged by termites so we'll put the boards we carved in place, you can have the old ones". So we got round it that way, but we were very conscious of the fact that we would take away these original boards and maybe muck up their ancestor spirithouse. And we felt that we didn't really want to interfere with the culture and so we got around it by asking them to make a duplicate set which we were going to buy, but which then in the end they kept. But the other thing about it is that this house was covered with a series of about 20 boards and we only bought a series of about two or three to give us a general idea of the design and style, and the house was left intact when we left the village. Sadly, a year later, another museum came and bought the whole lot. So what I'm saying is I think perhaps duplicates could be made and these be used in your situation and you keep the old ones.

Johnson

Again that's a solution that requires money. It requires funding. But it's an excellent solution, one we would like to implement.

4. Tom Stone

I'm interested in the numbers involved here. Approximately how many items each year would you loan out in this fashion?

Johnson

It hasn't been a very large number to date, maybe ten to fifteen per year. It's not a large programme.

Clavir

But then also if you have one item that goes through 25 dances, as at Expo 86, does that count as 25?

Stone

Of that number loaned out each year, how many are actually damaged in one form or another? What percentage?

Johnson

In terms of actual damage, there have been really only a few pieces. There have been alterations of the kind we talked about, but I don't think you would call those damages. Not very many.

5. Ann Howatt-Krahn

My question relates to collecting data regarding the manufacture of these pieces. It seems a really excellent opportunity to interview the artist and to get a sense of what kind of materials were used and how they were applied. I was wondering if you have a programme where you collect that data during or after purchasing a piece?

Johnson

We do have a form for that purpose and which we like to have filled out as much as possible, particularly if the artist can tell us, for instance, what kind of paint was used.

Krahn

Do you find that you get the kind of information you want on a form? I know sometimes with contemporary works that are of a two-dimensional nature, it's sometimes very difficult to get specifics or critical details.

Johnson

Yes, it's difficult to get and I wouldn't say that we get it all the time, by any means.

Krahn

I guess my other question is related to the decision, or that is to say, the criteria for traditional use. If I understood correctly, different institutions have different criteria. Some would interpret the idea of traditional use relatively loosely compared to your policy. Is that so? For instance, the BCPM you mentioned, if I understood you again correctly, had a fairly broad definition of traditional use in your opinion and I'm wondering, how the artists feel about this policy, and if they in fact might consider that policy and it's limitations in the choice of whether or not they really want to sell the piece to a particular institution. In other words, how do the artist's feel? What have been your observations regarding how the artists feel about this idea of traditional use?

Johnson

I don't think we've actually discussed the question of the definition of traditional uses with any of the artists involved. I think, as we do discuss our policy with them more, that's an important aspect to be discussed. I think that there have been cases in which the artists have preferred to sell their pieces to the museum rather than elsewhere because they know that they can have continued access to them, so that has been an important part of their decision of where to sell their pieces.

6. Michael Connolly

I'm so upset about this whole thing. I really don't know where to begin, but I fought a similar battle. I'm a generalist conservator in a fine art museum and I fought a similar battle with a decorative arts curator. We had a discussion with a full curatorial division and my point of view is that once a piece is accessioned by a professionally paid curator, its status changes. Its status changes forever unless it's going to be deaccessioned. A lot of decorative arts pieces are made for utilitarian uses and they were being constantly pressed into utilitarian uses in the museum. I reminded the curator that ownership is responsibility and it is her or his decision what kind of legacy they want to pass on as a professional curator. Now if they want to pass on a bunch of altered, mutilated damaged objects, they're fooling themselves if they think that the museum is going

to let them have those choices. I think that your audience is much larger than the 10% population of native Americans in that area. You're serving western Europeans, Americans, Canadians, all kinds of people, so you've got to understand who the audience is you're trying to address and what your purpose is. I realize as a rule the politically touchy situation because you're trying to generate the contemporary collection from people who are living and manufacturing these pieces for your collection, but I feel that you purchase a piece in good faith. I don't understand why an artist would want to sell a piece to a museum, then have it back. Also, I'm curious as to whether you document very carefully these accumulated damages and alterations? Someone like myself (a conservator) might not understand this continuing deterioration as a native may understand the context of its ceremonial use, and why it would have accumulated that damage. I feel the same as Gloria (Cranmer-Webster) did; you have really created a lot of problems for yourself. I think that you're really confusing the issue of whether (you know I don't want to really be hard about it) you're operating some costume shop rather than a museum in some cases. If your ultimate goal is to preserve a costume for posterity, for the broad spectrum of mankind, then to cater to a small specialty group, I think is really defeating the purpose.

Shane

Well, let me make two points here. One is that in an ethnographic collection we sometimes, when looking at older pieces, will make an extra effort to acquire a piece which has been repaired. Now this will have an indigenous repair on it and we consider that adds to the ethnographic information available to us that's inherent in the object. I can see why you might think that we are not taking our responsibilities as professional curators seriously if we allow any outside handling of our artifacts. What we're looking at here, I believe, are pieces we have acquired that we feel should have some use. If we were to think of them as simply enshrined, brand new and unused, that kind of a piece is not as interesting to an ethnologist as a piece which has somehow been part of the life of its people. So it is not an exact parallel with the kind of collections that you deal with. Now, we have a real problem, I think, in this whole thing in coming to a decision on when in the life of any particular piece that we have acquired in this way, it is in fact time to say "you are retiring". You're retiring to our museum with some sense of having been of value to people who made you. You are retiring now to be cared for, and I realize that for conservators this is very difficult to accept. You may quite justifiably feel that as curators we've handed you problems you didn't need to have, but nevertheless the piece is now retiring and will in future be consulted only as a study piece. We have not determined where or when we should draw this line, but I really would like to emphasize that there are differences in the way we approach the objects in our collections.

Clavir

I'd just like to add that for me one of the fascinating questions in all of this, is the question of why are we preserving objects. When I went back to the **Code of Ethics**, it was stated (at least in the drafts) that we're preserving objects not just for posterity but so as to retain or recover their cultural significance. This has particular appropriateness perhaps with our collection and with regard to the Northwest Coast because it is a continuing living cultural context and so that's a question that I would like us to really start thinking about.

Johnson

I think Audrey's phrase "part of the life of the people" is very appropriate not just for the objects that we're talking about but also for our museums that are located in these contexts, that we are part of ongoing living cultures, we're involved in ongoing dialogues about this among other various questions. We need to be very aware of this.

References

1. **Code of Ethics and Guidance for Practice**, International Institute for Conservation - Canadian Group, 1986, p. 6.

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Assistance rendered to some of the authors by Air Canada is gratefully acknowledged. The paper has been transcribed from a recording made at that time; the informal tone of the discussion has been maintained in this version.

Biographical Notes

Miriam Clavir has worked in ethnographic and archaeological conservation since 1971, first in the Royal Ontario Museum, then with Parks Canada in Ottawa and Quebec City, and since 1980 with the UBC Museum of Anthropology. She now teaches conservation courses for students working with collections, as well as managing the conservation function at the Museum.

Audrey Shane graduated from the University of Manitoba in 1942 and was subsequently employed there as a demonstrator in the Faculty of Architecture and Fine Arts for three years. She resigned to take up a career as a mother, which kept her occupied for the next 30 years. Returning to studies, she received B.A. and M.A. degrees in anthropology from the University of British Columbia. Since 1975 she has worked in the UBC Museum of Anthropology as both archivist and curator.

Elizabeth Lominska Johnson has been Curator of Collections at the UBC Museum of Anthropology for the past eight years. She was previously employed at the Vancouver Museum as Public Programmes Coordinator, and at UBC as Coordinator of the China Resources Project. She received her doctorate in anthropology from Cornell University in 1976, and has done field research in Hong Kong.

Les artistes autochtones ou leurs familles demandent souvent aux musées de la côte ouest de leur prêter des objets dont ils ont besoin pour des cérémonies ou des manifestations publiques. Le restaurateur et deux conservateurs de l'UBC Museum of Anthropology discutent des droits et des privilèges des Amérindiens vis-à-vis leurs objets de cérémonie, ainsi que des raisons justifiant la politique ouverte mais prudente du musée à l'égard des demandes de prêt des autochtones, y compris la valeur historique plus grande des pièces utilisées. En outre, nous abordons la question de l'injustice que cette politique pourrait créer à l'égard des personnes qui ne sont pas autochtones, tant pour la manipulation des objets que pour les ressources destinées à la recherche. D'autres questions sont aussi traitées: droits d'auteur; réparations ou modifications des objets qu'effectuent de leur propre chef les artistes, leurs familles ou leurs descendants; demandes d'utilisation d'oeuvres d'art contemporaines de grande valeur; demandes de prêt de pièces anciennes et politiques relatives à leur utilisation; et solutions du conflit entre utilisation et préservation.

HANDS ACROSS THE BORDER: CONSERVATION, POLITICS, AND ENSUING DILEMMAS

KATHLEEN BERRIN

Numerous ethical issues were raised and cultural differences were heightened as American and Mexican conservators recently worked together on a joint international project. The purpose of the project was to preserve and protect a major collection of rare and exceptionally fragile pre-Columbian mural fragments which had been donated to the Fine Arts Museums of San Francisco. The project involved a team of American and Mexican conservators working together in a public conservation exhibition format. This paper presents the following topics: brief descriptions of the collection needing treatment and the Bilateral Agreement signed between the Fine Arts Museums of San Francisco and Mexico's National Institute of Anthropology and History; meeting of the conservators concerning areas of disagreement and cultural differences in approach; the negotiation process; the reconciliation process; and, finally, the future of the fragments and the limits of object care.

1.0 Introduction

In 1976 The Fine Arts Museums of San Francisco received a bequest of over seventy fragments of painted wall murals (1), ranging in size from several inches to fourteen feet in length and dating to about A.D. 400. The fragments originally had been removed from the national archaeological zone of Teotihuacan, Mexico (2). The donation of these wall paintings was completely unexpected by museum officials, who were astonished at the size and scope of the collection.

Out of concern for the extreme fragility of the murals, the unknown circumstances surrounding their removal from Mexico, and the pressing responsibility to preserve these great treasures, The Fine Arts Museums contacted Mexico's National Institute of Anthropology and History (INAH) (3) to develop a cooperative programme for the murals' custody and care. In 1981 a Joint Agreement between The Fine Arts Museums and the INAH was signed, in which both institutions resolved to "work together, within the scope of their respective powers... to unite their efforts and respective capacities for the purpose of preserving these Teotihuacan Murals." In this Joint Agreement three points related to the conservation effort:

1. A minimum of 50% of the murals would be voluntarily returned to Mexico by The Fine Arts Museums once conservation work had been completed on the entire collection.
2. The INAH would send highly qualified staff to San Francisco for the purpose of assisting The Fine Arts Museums in restoring the murals.
3. The Fine Arts Museums would pay the expenses for the restoration of all the murals in the collection.

The joint nature of the project was particularly notable. It was hoped that the negotiation of this unprecedented Joint Agreement would provide nations around the world with a model for dealing with the complicated issue of the care and restitution of cultural patrimony. The ideal scenario was to be a true collaboration, joining "hands across the border", to resolve the complex problems of the murals' preservation and display. This paper describes this complicated undertaking and attempts to realistically assess some of the problems and issues involved in joint conservation projects of an international nature.

2.0 Condition of the Murals

A brief description of the condition of the murals is required to understand the different approaches of the American and Mexican conservation teams.



Figure 1. Teotihuacan mural fragments composed of thick volcanic ash backing, thin layer of lime, and paint layer. Photo by James Medley.

Teotihuacan murals in general are constructed in three parts: a support layer from 2-5 inches in depth composed of volcanic ash and clay aggregate, which was originally applied to the stone building wall, a ground layer of thin, dehydrated lime on which the pigments are applied, and the paint layer, which is composed of mineral pigments and applied with a true fresco technique.

Although the murals in this particular collection appeared to be stable and were certainly in good condition compared to other fragments of their type, they had seriously deteriorated in archaeological burial and during and after excavation. The so-called excavation had been done by looters who had little regard for anything but gouging out the most saleable portions of the painted walls. While some of the fragments were contiguous, many more did not fit together and had to be treated as individual paintings.

Several other generalities can be made about the condition of the fragments in the collection. The support layer or "backing" was inconsistent in thickness, composition, and strength. Because some of the larger fragments weighed several hundred pounds, there was the ever-present danger in lifting them that they would easily fracture under their own weight. The edges of all the fragments were friable and susceptible to further damage. In some cases the thinly applied lime layer had lifted away from the backing. The surfaces of all the murals to varying degrees were obscured by dirt, incrustations, deposits of salts and carbonates, root damage and, occasionally, mold. Restorations had been applied to some of the fragments by a former owner.

3.0 History of the Cooperative Programme

In our initial evaluations of conservation needs for the mural collection we were grateful for the advice of Robert Sonin, a conservator specializing in pre-Columbian art. Also during the late 1970s, the time of negotiations for the Joint Agreement, Mexican conservators were the acknowledged experts on the treatment of Teotihuacan murals. Very few of these murals exist in the United States, Canada, or Europe; hence very few conservators in these countries have ever worked on them. It is estimated that there are at least five hundred Teotihuacan murals in the National Museum of Anthropology in Mexico City, and it is assumed that most of these have been treated by Mexican conservators at the Churubusco Center.

The Churubusco Center was founded in 1966 as INAH's main facility for the restoration and preservation of all objects of national patrimony of Mexico. Soon thereafter a UNESCO Convention was held at Churubusco Center in which Paolo and Laura Mora presented their methods of restoring the Italian frescoes that had been damaged after the floods occurring in Florence. Mexican conservators, particularly Professor Sergio Arturo Montero, who was one of the founders of Churubusco Center, took the Italian techniques and adapted them to Teotihuacan mural paintings (4). The Mexican adaptation involved the radical removal of *all* original backing down to the thin lime layer, and the complete replacement of the backing with a new permanent support composed of polystyrene pearls with epoxy resin. For cosmetic purposes the exposed epoxy edges and back were covered with a mixture of polyvinyl acetate adhesive and ground original backing. The resulting mural was much thinner and lighter and showed no tendency to crumble. Murals could be easily handled or stored without fear of breakage and occupied very little space.

Shortly after the Joint Agreement was signed, The Fine Arts Museums received funds from the Andrew W. Mellon Foundation to support a full-time conservator for the project. Jackie Heuman took on this post, working closely with Elisabeth Cornu, the Museums' Decorative Arts Conservator who had been actively involved in the murals project. It was at this point that alternative methods of mural treatment that did not involve removal of all the backing were contemplated. It was hoped to maintain the integrity of entire fragments as much as possible, with a solution which would be both aesthetically pleasing and provide for the possibility of scholarly study in the future (i.e. access to the backing). Jackie Heuman consulted with conservators in North America and Europe in order to develop a solution to the backing problem that would preserve the murals as pieces of wall rather than flat paintings.

In 1981, Paul Schwartzbaum, then Chief Conservator of the Murals Department at ICCROM (5) was invited to examine the Teotihuacan mural fragments in our museum. During consultation he strongly recommended *against* removing the mural backing, stating that the adapted-Italian techniques of Mexican conservators seemed to him unnecessary; there were no problems of humidity or water damage, and the component parts of the murals, in his opinion, were strong and stable. He recommended that we remove as little of the backing as possible, and suggested we embed the fragments in a framework of foam to provide a display method (6).

Paul Schwartzbaum's remarks helped support the direction of our thinking and encouraged us to pursue alternatives to the Mexican method. We knew it would be necessary to articulate this difference of opinion to the Mexican authorities, and propose an alternative solution for treatment.

In November 1983 Stephen Mellor replaced Jackie Heuman, joining The Fine Arts Museums just six months before the Mexican team was scheduled to come to San Francisco for the collaborative work. Celebrations were being planned with high ranking officials and civic leaders in San Francisco and Mexico to inaugurate the joint conservation project which had been planned as a public conservation exhibition for the education of museum visitors. Even though we did not yet have the solution to the backing problem we were seeking, as Paul Schwartzbaum's system was not completely adequate for our purposes, there were strong political pressures to maintain a May '84 opening date. Moreover, due to limited space in our permanent conservation lab, we had only been able to work on the smallest fragments. The sooner we created a new working lab, in an upstairs gallery, the sooner we would be able to gain valuable hands-on experience with the larger fragments.

Our desire to evolve a different method of treatment was first discussed on an administrative level in January 1984 when the Museums' Deputy Director for Exhibitions and Education, Thomas K. Seligman, went to Mexico City to meet with INAH Director Enrique Florescano Mayet and others. Following these talks, the museum conservators prepared a written proposal explaining their concerns and suggestions for alternate treatment. In the "Technical Proposal" prepared by Kathleen Berrin and Stephen Mellor in January 1984, we cited principles from a major UNESCO publication (7) and the following specifications for work:

1. Conservation treatments must be as reversible as possible.
2. The original mural should be left intact, with minimal deletions to the backing, in order to preserve the integrity of the fragments, maintain surface texture and aesthetics, allow for future scholarly study, and preserve the fragment's space and undulations, providing clues to the original architectural context.
3. The mounting or support system that was to be developed should allow for easy assembly or disassembly of individual fragments, as more information might become available about their relationship in the future.

The proposal then explained the general guidelines of a unique mounting system developed by Stephen Mellor, consisting of a custom-fit framework fabricated from extruded aluminum alloy structural members. The framework which would follow the perimeter of each fragment, or interlocking series of fragments, would be constructed with welded joins and include structural clips for support (8).

Since 1979 we had been working with several different INAH conservators who had been assigned to the project (9). The final INAH choice of conservator for the joint conservation effort was Professor Sergio Arturo Montero, the primary developer of the Mexican technique of backing removal. A reply proposal from Professor Montero (February 3, 1984) agreed with the UNESCO principles we had cited, but reiterated that the elimination of the backing was nevertheless required or the painted surface of the mural fragments would be seriously at risk. He asserted that the backing did not provide any cohesion and crumbled easily, and that it was impossible to introduce adhesive between the lime layer and backing. Not only would the paint surface be at risk when the mural was vertically positioned, but retaining the backing would mean placing excessive weight on the fragments, exposing them to accidents and severe difficulties in handling.

In order to reconcile these differences, a meeting of conservators was proposed in San Francisco. At this meeting the murals were again examined and a compromise was developed. We agreed to try to preserve part of the backing around the edges of the larger murals, and to preserve the backing of the smaller fragments in total. Experiments would also be carried out with an aluminum honeycomb support with epoxy foam for the backing. The following month our conservators made a return visit to Churubusco Center to observe the Mexican methods firsthand and refine plans for the upcoming joint conservation exhibition.

In May 1984 the joint conservation effort began in the form of a public exhibition with speeches by the Mayor of San Francisco, civic leaders, and officials from Mexico (10). The exhibition was located in two prominent galleries. In one gallery an enclosed working lab had been established behind large Plexiglass windows, where visitors could actually watch the treatments take place. In the other gallery narrative label panels, photographs, an audio-visual presentation and other didactic components explained the story behind the murals and the joint conservation effort.



Figure 2. Speakers at the opening of "Murals from Mexico: an Exhibition Demonstrating Techniques of Preservation" included INAH Director Dr. Enrique Florescano Mayet, San Francisco Mayor Dianne Feinstein, and The Fine Arts Museums President of the Board of Trustees. Mr. Leonard Kingsley. Photo by James Baldocchi.

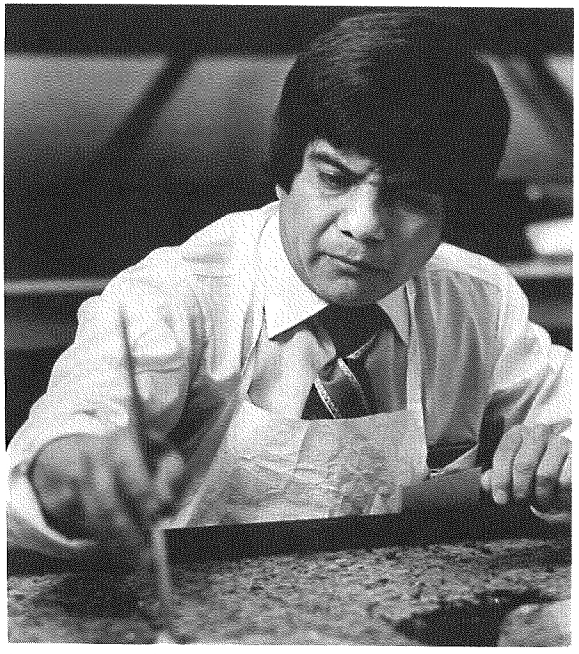

Figure 3. INAH conservator Roberto Peralta Barcenes at work on a Teotihuacan mural. Photo by Kaz Tsuruta.

Professor Montero had brought two technical assistants from Mexico (11). Stephen Mellor and Elisabeth Cornu formed the American team. For this first collaboration, the Mexican team would remain in San Francisco for five weeks. Following the opening festivities, we quickly began the task at hand. We all wanted the conservation effort to be a true collaboration, and despite our different opinions we hoped to work together to evolve a new and better system for the murals' preservation. Although we thought we were in essential agreement with the compromise treatments we had planned, three basic differences in approach arose as we got into the process:

— First, the very nature of the project, as stipulated by the Joint Agreement, required that there could be no one "side" that led the conservation effort. If disputes arose, they were supposed to be resolved in a cooperative manner. If this did not work, the problem would be considered at a jointly constituted administrative level. The lack of a single designated leader in the lab caused uncertainties and a lack of operational clarity.

— Second, definite communication problems existed. None of the Mexican team spoke English. On the American team the only person who could speak sufficient Spanish to understand the various sensitivities and technical points was Elisabeth Cornu, and it became her job to serve as both translator and mediator for the ensuing discussions.

— Third, there were significant differences in working style. Mexico is a country with a great wealth of objects and archaeological treasures. Mexican conservators are trained to work at a very fast pace because of the pressing nature of the many urgent conservation projects in Mexico. They are given very broad training to prepare them for diverse field situations. They do not have the luxury to do painstaking work and analysis and are trained to be resourceful, to do whatever required attention as quickly and efficiently as possible, and then move onto other projects.

For our part, however, the Teotihuacan murals were a new and fascinating type of object. Our goal was not to "finish the job" but to research, document, analyse, and find the very best solution to the backing problem. Our working pace was slow and exacting. We were extremely concerned with testing and analysis. The Mexican team put less emphasis on this as so many murals had already been treated in Mexico, and there seemed to them no need to view the San Francisco murals as unique examples. Moreover, Stephen Mellor's deliberations on the support system seemed to them excessive. Professor Montero joked that his intense work and refinements on the support system was "like building the Golden Gate Bridge".

During those early weeks of collaboration, three murals were selected for initial treatments. One fragment was to be treated completely by the Mexican method, another fragment was to be treated by a variation on the Mexican method, and a third fragment was to be the most experimental of all - it was to feature the mural edges left completely intact, removing only a portion of the backing in the center.

Ultimately, however, none of these treatments proved to be satisfactory for our purposes. The honeycomb framework with epoxy foam simply was not feasible. Our conservators found it difficult to control the foam as expertly as the Mexicans. After five intense weeks of experimentation we were still pondering the problem. The Mexican team left San Francisco and continued to try to devise the best possible support system for the entire mural. We promised to keep Professor Montero informed of our progress. He planned to make a return visit to San Francisco in the next few months.

As the weeks went by and we worked to perfect our solution we became more convinced that the Mexican method was unsuitable for our purposes. And correspondingly, the Mexican team was understandably more and more concerned with getting the work done. We appeared to be at a standstill because no tangible results or final treatments were being accomplished. Professor Montero still believed the best treatment to be the removal of all the backing and wanted to create an assembly line system, treating all the murals efficiently, with standardized procedures.

The polarization of viewpoints had again to be reconciled through administrative channels. The INAH representative Joaquin Garcia Barcena (Director of Pre-Hispanic Monuments) came to San Francisco to meet with Thomas K. Seligman and Kathleen Berrin to mediate the situation. In the event our differences could not be resolved, we also planned to negotiate the final list of murals that would remain in San Francisco and those that would be returned to Mexico. If necessary, the Mexican conservators could work on their murals and we on ours. By this time, however, Stephen Mellor had completed the design of the support system and Professor Montero surprised us by making a concession, but not without conditions.

A jointly authored proposal entitled "Support for the Conservation of the Teotihuacan Mural Paintings (February 7, 1985)" was the outcome. In it, Professor Montero emphasized that:



Figure 4. Stephen Mellor and Kathleen Berrin of The Fine Arts Museums of San Francisco examing mural fragments. Photo by David Powers.

> "although the idea of conserving all the structural components is in agreement with the general theoretical principles of conservation... it must be noted that from a technical point of view it is not possible to guarantee by this procedure the long-range conservation of the painting itself, which has precedence in relation to the conservation of the rest of the materials... Taking into account the Museums' interest in conserving all components of the murals and the extreme precautions that would be taken in storing and handling the murals, a solution can be accepted in which... an adequate protection is furnished to (the murals). This solution is valid also for the part of the collection that will be returned to Mexico, since it will mean safety in packing and transportation, and being independent of the mural fragments themselves, *once they are in Mexico, further work can be carried out on them, according to the procedures previously developed at Churusbusco.*"

The main body of the proposal described in detail the aluminum framework support system (12). A final paragraph in the proposal acknowledged that:

> "some murals may require special considerations in their treatments and several choices in specific details may be possible. If we cannot agree on a technical point, then the opinion of the conservator to whose institution that particular mural will ultimately be disposed will be the opinion which is followed in treatment."

The technical assistants from Mexico (13) again returned for the second five-week period in June and July 1985, and by that time the mural collection had been divided into those murals that were to be returned to Mexico and those that were to remain in San Francisco. Within the "glass fishbowl" exhibition laboratory, because

of differences in working style, they worked on their murals and we on ours. Lesley Bone, a conservator who spoke fluent Spanish, was now added to our team. The Mexican team finished their fragments earlier than expected. As the murals returning to Mexico would eventually receive the "Mexican treatment" at Churubusco Center, they had streamlined the support system to some extent under the direction of Professor Montero.

The murals returning to Mexico were exhibited at the National Museum of Anthropology, in February, 1986 (14). At this writing, we do not know whether these murals have had their backing removed at Churubusco. We continue to work on the murals that have remained in San Francisco and will exhibit selections from the collection beginning in Spring 1987.

4.0 Conclusion

This experience was obviously very challenging for everyone concerned, and it illustrates some of the difficulties involved in international conservation projects. At least three conclusions can be drawn from our efforts:

— First, while we had originally hoped our collaboration would fit an ideal "hands across the border" model, it does not necessarily follow that collaboration is synonymous with *agreement*. There were differing cultural approaches and institutional needs throughout that we had not realized initially. One remarkable aspect of the collaboration which evolved was the surprising degree of honesty with which both sides sought mutual understanding and reconciliation. This obviously required great sensitivity, patience, and determination on the part of everyone, and of course there were taxing moments. But everyone sincerely tried their hardest to work together, and did so with a mixture of candor, vigor, and sensitivity.

— Second, I believe that given the provisions of the Joint Agreement and the openness of exchange, this conservation project produced the best possible treatment for the murals collection. In the ongoing dialogue both sides received important insights and had to question or even defend assumptions they had long taken for granted. Positions had to be well-articulated. As a result, both sides were challenged to do their very best work and reconsider aspects of treatment that might have otherwise gone unscrutinized.

— Third, with international conservation projects it is important to acknowledge that there will rarely be a single, best solution to an object's display or treatment. We were unable to convince the Mexican team that the removal of the backing was, in our opinion, an unnecessarily extreme measure that failed to preserve the integrity of the objects. The Mexican team was unable to convince us that our solution would, over time, present dangers to the painted surface and create impractical handling and storage problems. Given the differing needs of our respective institutions and cultural differences in approach, it was appropriate to have two solutions. Whether or not it would have been better to have acknowledged those differences earlier, rather than try to force a single mutually satisfactory solution, is left open to question.

Acknowledgements

Kathleen Berrin wishes to thank the following individuals for critical comments and help in preparing the manuscript: Lesley Bone, Elisabeth Cornu, Renée Dreyfus, Ann Karlstrom, Karen Kevorkian, Stephen Mellor, Thomas K. Seligman, and Ellen and Klaus Werner. She is especially grateful to Lesley Bone for presenting the paper on her behalf at Symposium '86 in Ottawa.

Notes

1. Harald J. Wagner, a San Francisco resident, died in 1976. He stipulated in a handwritten will that his collection of wall paintings from Teotihuacan be left to the de Young Museum of The Fine Arts Museums of San Francisco. See Braun (1982) for background on the murals bequest and subsequent negotiations with Mexico.
2. Pronounced "Tay-oh-tee-wah-kan," the Teotihuacan culture wielded tremendous religious and political power throughout Middle America in its time (B.C. 100-A.D. 750). The site of Teotihuacan today is a major tourist attraction and national Mexican symbol.
3. INAH is the branch of the Mexican government responsible for the conservation, protection, and study of all archaeological and historical objects and monuments in Mexico.
4. Several hundred mural paintings have been removed from the site of Teotihuacan by the INAH.
5. ICCROM is UNESCO's International Center for Preservation and Restoration in Rome, Italy.

6. See Schwartzbaum (1980).

7. Citation from "The Conservation of Wall Paintings" by Philippot and Mora in **The Conservation of Cultural Property**: "The transfer of a wall painting is a major operation, an extreme procedure which can only be justified when, after exhaustive study, it is decided that the work cannot be saved by any other means" p. 169.

8. This ingenious method required the mural to be displayed at an angle, cradling the mural back towards the wall, so as not to endanger the painted surface.

9. INAH conservators designated to work on the project prior to Professor Montero had included Victor Rios, Alejandro Rojas, and Carlos Chanfon.

10. "Murals from Mexico: An Exhibition Demonstrating Techniques of Preservation" took place at the M.H. de Young Memorial Museum from May 2, 1984 - October 30, 1985. The exhibition was supported by Citicorp, the Mortimer Fleishhacker Foundation, the National Endowment for the Arts, the Andrew W. Mellon Foundation, the California Arts Council, and the W.K. Kellogg Foundation. For more information about the conservation exhibition see Berrin (1984).

11. The first two technical assistants were Armando Soto Calderon and Roberto Peralta Barcenes.

12. For a broader discussion of this system and the conservation effort in general see Bone (1986).

13. The two technical assistants for this phase were Roberto Peralta Barcenes and José Claudio Maldonado.

14. "Ceremonia de Recuperacion de Frescos Teotihuacanos" opened at the National Museum of Anthropology, Mexico City, February 19, 1986.

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2. Bone, Lesley, "Teotihuacan Mural Project," **W.A.A.C.** 8, no. 3 (September 1986), pp. 2-7.

3. Braun, Barbara, "Subtle Diplomacy Solves a Custody Case," **Art News** 81, no. 6 (Summer 1982), pp. 100-103.

4. Gaulin, Mayi, "Interview with Professor Sergio Arturo Montero," Department of Africa, Oceania, and the Americas, The Fine Arts Museums of San Francisco, May 13, 1984.

5. Montero, Sergio Arturo, "Un Nuevo Soporte para Pinturas Murales," **Boletin del INAH**, 1967, Churubusco Center, Mexico, D.F., pp. 27-34.

6. Mora, Paolo, Laura Mora, and Paul Philippot, **Conservation of Wall Paintings**, London; Butterworths, 1984.

7. Schwartzbaum, Paul, "Third International Symposium on Mudbrick (Adobe) Preservation," Ankara, ICOM/ICOMOS, 1980.

8. UNESCO, **The Conservation of Cultural Property**, Paris, 1968.

Biographical Notes

Kathleen Berrin is Curator of Africa, Oceania, and the Americas at The Fine Arts Museums of San Francisco, and has had curatorial responsibility for the Teotihuacan murals project since 1976. Although her research interests focus on the arts of the South Pacific, she has also developed innovative participatory projects to activate the art museum experience. She has had a long-standing interest in ethnographic conservation and is currently editor and contributor to a book about the Wagner Collection of Teotihuacan Murals soon to be published by The Fine Arts Museums of San Francisco.

La collaboration récente de restaurateurs américains et mexicains dans le cadre d'un projet international a soulevé de nombreuses questions de déontologie et a fait ressortir des différences culturelles. Le projet avait pour but de préserver et de protéger une importante collection de fragments d'une peinture murale précolombienne, rares et extrêmement fragiles, offerts au Fine Arts Museums of San Francisco. Une équipe de restaurateurs américains et mexicains ont travaillé ensemble dans le cadre d'une exposition publique de conservation. La communication porte sur les sujets suivants: brèves descriptions de la collection traitée et de l'entente bilatérale signée par le Fine Arts Museum of San Francisco et l'Institut national d'anthropologie et d'histoire du Mexique; réunion des restaurateurs afin de discuter des sujets de désaccord et des différences culturelles manifestées dans les attitudes face aux traitements; processus de négociation; processus de réconciliation; et l'avenir des fragments et les limites quant au soin des objets.

THE NATIVE NORTH AMERICAN APPROACH TO CONSERVATION

LISA MIBACH

In the process of searching for traditional manufacturing cleaning and mending techniques used by the native people of North America on their objects, the author discovered an ethical system and maintenance procedures which closely parallel (and of course precede) those used by conservators. These include certification of trained annual inspectors, pest control methods, and selection of treatment materials according to the compatability of their chemical and physical properties with those of the object to be treated and its environment. This system serves as a reference in establishing contact with traditional native elders for information useful in the preservation of native North American artifacts.

1.0 Ethical Distinctions in Ethnographic Conservation

This conference has marked a time of introspection into the characteristics which distinguish ethnographic conservation from other branches of our discipline.

We have considered the ethical restraints which characterize this speciality. The **Code of Ethics** of the International Institute for Conservation - Canadian Group has reminded us that preservation has a purpose beyond itself: that we preserve in order to retain cultural significance. We know that our work should not destroy components invisible to the eye, whether these be the electromotive motility on which is based the analytical determination of species, or spiritual power.

We have acknowledged that the treatments we use may vary according to the intended end use of the object; that is, treatment may be different depending on whether the object will go into storage or on display.

Extending this concept, we have discussed whether our treatments may prejudice the future use by indigenous peoples of artifacts for which our institutions may be only temporary custodians. Because of unsettled legal issues, we cannot continue to ignore the living peoples who give the artifacts a cultural context simply because it is not geographically convenient.

2.0 Technical Problems in Ethnographic Conservation

Documentation by ethnographers of the materials and techniques used in the manufacture, maintenance, and repair of objects is often absent, incorrect or misleading. Research into the technologies of metals and ceramics has provided a basis for the development of treatments for archaeological artifacts, but parallel research into ethnographic materials has been largely limited to superficial biological or botanical identification. This leaves us with an inadequate knowledge of constituents on which to base judgements of how and what to clean, whether cleaning may remove components essential to physical integrity or future analysis, and whether original characteristics such as flexibility can or should be restored.

Because of these gaps in our knowledge of the materials which may be present, our ability to choose appropriate materials for treatment is severely limited.

We have also realized that the materials we use in well-equipped institutional laboratories are not always well-suited to the adaptation of treatments for local use in developing countries or by indigenous groups seeking to preserve their own cultural holdings.

3.0 Approaches to Ethnographic Conservation

We share with archaeological conservators a scrupulous concern that our work not prejudice future scientific analyses, which may be carried out at submolecular levels. We share with conservators of modern art the delicate diplomacy of negotiating for the conservation work we feel is required with living artists who may not share our philosophy of preservation.

What is less well realized is that many of the approaches which we have developed for the maintenance of collections materials have long been in use among native groups.

An understanding of these native methods may assist those conservators in a position to develop contacts with elders of native groups in order to fill in some of the gaps in our knowledge (1).

In both Native and non-Native groups, the repair and maintenance of everyday objects, which may be discarded when worn out, is left to those laymen who demonstrate acceptable levels of skill. But in both societies, the maintenance and preservation of those objects deemed to be of high cultural significance, and important enough to be preserved for future generations, are reserved to specially trained groups.

Many Native groups retain an ecological approach to preservation, which holds that certain objects should be allowed to deteriorate when their usefulness is finished. This view is not shared by museum personnel, whose goal points in the opposite direction. This divergence lies outside the scope of this paper, which focuses on those objects which are meant to be preserved.

In non-Native society, the conservation of museum collections is largely restricted to trained conservators; among Native groups the highest cultural significance and maintenance is restricted to those who receive special religious training.

4.0 Training

Among both groups, selection for training may be by the advice of elders, or motivated by a personal vision. Both lead either to formal training and certification or peer acceptance of skills gained through apprenticeship to an accepted master.

A career in conservation may be suggested by academic advisors or by personal discovery, followed by university training and some form of certification by academic degree or by professional examination.

Among Native peoples likely candidates may be watched and selected by elders or motivated by a vision or strong personal desire. For example, among the Blackfoot a woman may be chosen to enter the holy guild which makes and maintains quillwork, then trained in the proper procedures and judged by guild leaders. A man may wish to gain the status conferred by ownership of a particular religious object and performance of the duties associated with it; he may acquire the object through payment to the current owner. This is ostensibly for the object, but is also for the training required to use and maintain it properly.

5.0 Maintenance

Conservators and curatorial technicians examine objects closely to determine their condition, and record this observation in a ritual termed "condition report". This is normally done when ownership of the object is transferred to the museum. Access to the object is normally restricted to trained museum personnel or researchers. Further inspections indicate when cleaning or repair is necessary. These inspections are typically carried out before an object is exhibited to the public.

In the Native context, examination is done when ownership of a sacred object is transferred. Access to sacred objects is restricted to those qualified and trained for their use. Owners of sacred bundles open them at specified times; inspection is carried out according to a specified procedure or "ritual". This ritual is also carried out when the object is to be viewed by others. In all cases, maintenance repair is restricted to selected and specially trained personnel.

5.1 Pest Control

In museums pest control is achieved by inspection, storage in containers constructed for the purpose, and isolation in special rooms away from sources of contamination. Aromatic repellants such as paradichlorobenzene and naphthalene may be included in the storage containers. Fumigation with smoke or gas has been carried out.

Similarly, bundles of objects sacred to Native people are stored in special containers, traditionally hung away from sources of contamination. Aromatic plants, such as alpine fir, sage, or poplar fungus, may be included in the container to repel pests. Religious items are regularly purified in the smoke of sweetgrass, pine needles, or sage.

5.2 Selection of Materials

In conservation, treatment methods proceed from gentlest to more aggressive, and materials are selected for long-term stability, and for their physical and chemical compatibility with the object.

This appears to be equally true in all cases known to the author of materials selected by Native people as well. For example, cleaning of tanned hides proceeds from mechanical cleaning with poplar fungus or sandstone to washing with water.

The use of sinew thread is an example of a material chosen for its physical characteristics. Even today it is preferred as a thread by experienced workers for sewing hide, because it expands when wet to plug the needle hole and prevent entry of water.

Although animal fat may be introduced during hide tanning to increase the resistance of footwear to moisture, the use of leather dressing and waterproofing materials has not been found to date by the author. Extra footwear is carried instead. This may be because such dressings would interfere with the evaporation of perspiration. This plays such a significant role in preventing frostbite that in Northern Canada, Native-tanned hide footwear is sought by non-Natives as well.

The one exception to this suggested to the author, was the use of rendered skunk oil for dressing rawhide containers of sacred objects. It is not known for sure whether this information was part of a favored Native game of teasing overly inquisitive Whites, but during cross-checking inquiries, a Northern Cree who still lives in a largely traditional way suggested that skunk oil might be used because unlike fish oil, goose grease, or bear grease, it does not yellow over time and remains fluid even at cold temperatures. These reasons for choice closely parallel those used by conservators.

6.0 Conclusion

Barring accidents or unfortunate conservation treatment, and given reasonable storage conditions, artifacts made and maintained by Native people have survived well and, in some cases, better than their counterparts made with European technologies. This argues well for traditional Native knowledge of the properties of the materials they used.

It appears that the ethical systems and maintenance procedures used by conservators are closely paralleled and preceded by those used by Native people.

These similar thought patterns may serve as connecting points between conservators and Native peoples as we seek to improve the quality of care we provide to ethnographic objects.

We must not miss the opportunity to learn from Native people whenever we can. We must also stimulate materials research so that we may develop stable materials and treatments which will be compatible with the objects we seek to preserve and which we can return to indigenous groups who are assuming responsibility for collections in their own museums.

References

1. This information is derived from conversations with Native people from many different groups, but particular help has been given by Mrs. Victoria McHugh, Blackfoot, Gleichen, Alberta: Mr. Kenneth Goodwill, Sioux, Standing Buffalo Reserve, Saskatchewan, and Mr. Edward Lavallee, Cree, Slave Lake, Alberta (all in Canada). The validity of this information cannot necessarily be extrapolated to other groups, and any errors of interpretation are solely the responsibility of the author, who thanks her friends for their generosity and patience.

Biographical Notes

Elisabeth Mibach has a B.A. from the University of California, Berkeley in Art History. She had training in conservation in Italy and at the Smithsonian Institution. She has been Archaeological Conservator in Italy, Yugoslavia and Iraq from 1966 to 1970. She was Objects Conservator at the Conservation Analytical Laboratory, Smithsonian Institution, from 1970 to 1972, Assistant Chief, Conservation Division, National Historic Parks and Sites, Parks Canada, Ottawa from 1972 to 1976 and Chief at the same institution from 1976 to 1978. She was Conservation Consultant to the Smithsonian Institution and U.S. Park Service in 1979 and Conservator at the Provincial Museum of Alberta, Edmonton, Canada from 1980 to 1985 and Chief Conservator from 1985 to 1986. She is now Director of the Intermuseum Conservation Laboratory in Oberlin, Ohio.

Dans le cadre de ses recherches sur les techniques traditionnelles de fabrication, de nettoyage et de raccommodage utilisées par les autochtones nord-américains sur leurs propres objets, l'auteur a découvert des principes déontologiques et des méthodes d'entretien qui ressemblent beaucoup à ceux de nos restaurateurs et qui les ont évidemment précédés. Citons par exemple les certificats délivrés aux inspecteurs spécialement formés, les méthodes de lutte contre les insectes et le recours à des matériaux compatibles avec les propriétés chimiques et physiques ainsi qu'avec le milieu ambiant de l'objet à traiter. L'existence de ces principes facilite les rapports avec les aînés des groupes d'autochtones lorsqu'il s'agit de savoir comment sauvegarder les objets d'origine autochtone.

THE REPATRIATION AND TREATMENT OF NATIVE AMERICAN OBJECTS

T. RAPHAEL

The conservation of native American materials is an increasingly sensitive area. In some cases direct repatriation of material has been proposed. A resolution relevant to this issue was recently passed by the National Congress of American Indians, and controlling legislation has been introduced in the United States Congress. This paper discusses the ramifications of the relationships between museums and native North Americans people and quotes extensively from documents published recently on the subject.

1.0 Introduction

Conservators who work on Native American materials are involved in a very sensitive activity. Because of their work on these culture-related, ethnic artifacts they become principal players in a very important and controversial issue: the use and treatment of American Indian grave offerings and sacred materials.

As ethnographic objects conservators we are compelled to learn more about relevant Native American concerns so that we are well informed on pertinent Native American museum issues. This subject is not new but rarely finds its way into the formal considerations and topics of conservation discussion. This will change, however, as these issues have recently gained much more attention and museums are seriously reviewing their relationships with contemporary Native populations.

In September 1986, a resolution relevant to this topic was passed by the largest organization representing North American Native people. The National Congress of American Indians (NCAI) held its 43rd Annual Convention and addressed the issue of "the insensitive treatment of Native human remains and sacred objects and the repatriation of certain materials to tribes." (Resolution 43-86-57-CC is printed in full in the Appendix).

Pursuant to this issue, Senator J. Melcher (D-Mont.) introduced legislation in the United States Congress late in 1986 that would require institutions holding Indian materials to resolve, within one year, tribal requests regarding sensitive cultural objects. If agreement was not reached within one year a carefully selected mediation board would resolve the dispute and its arbitration would be binding.

2.0 Background Summary From Recent Literature

More than 500 Indian Tribes are recognized by the US Federal Government, each of these tribes having a separate Government and diverse religious practices. A concept held in common, however, is that the remains and belongings of the dead, and sacred materials in general, need to be treated with respect (1).

These tribes have had a special relationship with the museums of the United States since their inception. The relationship has been both beneficial and antagonistic - a kind of "love-hate" relationship. During crisis periods in North American history as the Federal Government actively sought to separate the Indian from his religion and way of life, museums assisted the tribes in preserving their culture from complete extinction. Collections obtained from those eras remain important today - to both Native Americans and other Americans alike (2).

Instances have occurred throughout American history in which the Indian owners of sacred materials turned them over to museums, often with the accompanying legends, songs and ceremonies, because of the lack of interested successors to the cultural tradition. Museums were seen as places of safekeeping in the face of zealous missionaries who attempted to destroy sacred objects as symbols of Indian "heathenism". Sacred objects were also acquired by the government as spoils of war and Indian objects were frequently stolen, others being sold by Indians who did not have title to them (3).

The rocky relationship between museums and Native Americans was one of the focal points of the American Indian Religious Freedom Act (AIRFA) of 1978. Section One of the act provides:

> On or after August 11, 1978, it shall be the policy of the United States to protect and preserve for American Indians their inherent right of freedom to believe, express, and

exercise the traditional religions of the American Indian, Eskimo, Aleut, and Native Hawaiians, including but not limited to access to sites, *use and possession of sacred objects*, and the freedom to worship through ceremonials and traditional rites (4).

The appendices of the AIRFA report contain examples of specific problems regarding the handling by museums of Native artifacts. They include display of skeletons, improper display and handling of sacred artifacts, possession of stolen items and requests for the return of certain ceremonial objects. Recommendations in the report have considerable potential applications for federal museums and can serve as standards for non-federal museums as well. The recommendations direct that:

a. Federal museums should decline to acquire for their collections objects known to be of current religious significance to American Indian, Aleut, Eskimo or Native Hawaiian traditional religions, and should inform such Native American tribal and religious leaders of the presence on the market or in non-Native hands of such objects as come to their attention.

b. Federal museums should return to the tribe or origin objects in the museum's possession, as to which unconsenting third parties assert no ownership interest, that were used or valued for religious purposes at the time of their loss from an American Indian tribe or Native American community, and were alienated from that community contrary to standards for disposition of such objects then prevailing in that community, provided that the successor or modern tribe or community requests them as needed for current religious practice.

c. Federal museums should consult traditional Native religious leaders for guidance as to the museums' practices regarding exhibition and labeling, conservation, and storage of Indian, Eskimo, Aleut and Hawaiian sacred objects in their possession.

d. Federal museums should facilitate periodic ritual treatment by appropriate religious practitioners of sacred objects in their possession, at the request of such practitioners (5).

3.0 Statement by the National Congress of American Indians (6)

The National Congress of American Indians, the oldest and largest membership organization representing American Indian and Alaska Native governments and peoples, is vitally concerned about the preservation of Native governments and cultures. Native peoples have suffered greatly from the collection and subsequent misuse of Indian artifacts by non-Indian people and institutions. While we are not advocating the wholesale clearance of museums and other institutions of Indian artifacts, we believe that often those who are engaged in collecting and conserving items of Native cultures do not have an appreciation for the fact that there exists today in the United States over 500 Indian tribes (American Indian and Alaska Native), with as many separate dialects and languages. The native peoples of today have had, and continue to have, their graves, grave offerings and sacred objects routinely taken away and placed in institutions for the benefit of narrow and non-Native interests.

The National Congress of American Indians advocates for changes in federal laws which will remove human remains as "archaeological artifacts" under the Archaeological Resources protection Act, which will allow Indian tribes to run their own historic preservation programs free of state control, which will require states to consult with tribal people about projects which would potentially affect Indian interests, for a process which will provide for return of human remains and sacred objects to tribes and which will provide for protection of grave sites and grave offerings on all lands.

We recognize and appreciate that museum collections of Indian artifacts are, when properly interpreted and presented, beneficial to Indians and non-Indians in understanding Indian history. Too often, however, the notion of preserving an object is the ultimate goal. Preserving a pipe in an institution can, for instance, bring harm to a tribe when that pipe is needed for use in a particular Sundance.

The National Congress of American Indians calls on museums and other institutions which maintain Indian collections to inventory their collections with regard to human remains, sacred objects and grave offerings. These inventories should be made available to tribes. With regard to sacred objects, tribes should be consulted concerning which object, or types of objects, are needed for religious usage. With regard to repatriation, museums should bear the burden of proof concerning possession - both legal and ethical possession - and should be willing to repatriate items of special cultural or historical importance to tribes. Frankly, education is better served by a blank space in a display case with an

explanation of why a human skeleton or sacred item has been removed than by the display of that item.

There should also be consultation with Indian people about the display of objects. Most Indian peoples have strong views about the display of certain items. For instance, great offense is taken at the display of Indian remains. Fortunately, most institutions have discontinued the display of human remains, although the Smithsonian Institution is a shameful exception to this practice. The Smithsonian Institution has the human remains of 14,000 American Indians (plus an unknown number from Alaska) and has hundreds of Indian human remains on display on the second floor of their Natural History Museum.

There is no single approach to the rsolution of the dispossession of a major part of the cultural artifacts of Indian tribes. Indian tribes and organizations will need to negotiate individually with institutions, but some changes in federal and state laws will enhance the position of Native peoples.Because Indian tribes differ as much or more than countries in Europe differ among themselves, we cannot provide a single definition of what constitutes a sacred object. What Native peoples do have in common is the absolute commitment to survival as independent governments and cultures. People in the anthropological professions must rcognize that they are dealing with objects of living cultures, cultures which have different perspectives than the dominant Western European culture of the United States. We are not well served by the preservation of objects in non-Indian institutions when those objects have been stolen or are necessary for our cultural survival. In many cases true preservation is possession and use by Native peoples.

Appendix

Resolution-43-86-57 (Adopted by the 43rd Annual National Congress of American Indians Convention, September 26, 1986, Phoenix, Arizona.)

Resolution rejecting the federal laws which define indian and native burial sites, human remains and grave goods as "archaeological resources".

Whereas, Indian and Native governments and people gathered in Phoenix, Arizona, for the 43rd Annual Convention of the National Congress of American Indians, in order to promote the common interests and welfare of American Indian and Alaska Native peoples; and,

Whereas, for well over a century the prehistoric and historic remains and grave goods of Indian Native people have been removed from federal and state lands and from private lands and Indian lands, and these human remains and grave goods have been curated and stored in federal institutions such as the Smithsonian Institution and other federal and state museums, universities and other institutions; and,

Whereas, this insensitive treatment of Native remains and associated grave goods has been facilitated and encouraged by the antiquities laws and policies of the federal government. While facially intended to prevent the wanton looting of Indian and Native graves and other cultural sites, these laws actually condone and permit these same activities by the physical anthropological and archaeological community in the United States, by defining these sites as "archaeological resources" and by allowing materials to be disturbed and removed therefrom and to be stored in museums and other institutions. These laws have trampled on the religious and cultural rights and group rights of Indian and Native people; and,

Whereas, as a direct result of federal antiquities laws and policies, today the remains of more than one-half million Native people and associated sacred grave materials remain curated, stored or on public display in museums, universities, and other institutions in the United States, and,

Whereas, the federal antiquities laws and policies do not give appropriate recognition to the significance that historic and sacred properties hold for Indian and Native people living today; rather, these laws seem to subordinate the traditional religious beliefs and practices of today's Indian and Native people to the scientific study of the past and the burdens on religious practices that result from this subordination of interests constitute violations of the First Amendment to the Constitution of the United States; and,

Whereas, traditional Indian and Native people believe that continuing to allow this manner of disrespectful treatment of human remains and associated sacred grave materials destroys the spiritual balance of life and the spiritual balance of nature. It is the belief of Native people that this disrespect violates the spiritual laws of nature and the Creator and that if this disrespect continues all humankind and all living things will suffer.

Now, therefore, be it resolved that the National Congress of American Indians rejects the federal laws which define Indian and Native burial sites,

human remains and grave goods as "archaeological resources" and which permit the continued curation, storage and display of these sacred materials in museums, universities and other institutions. Federal laws must be changed to reflect Indian and Native religious and cultural rights to determine the treatment and disposition of these materials.

Be it further resolved, that NCAI take appropriate actions to seek the comprehensive revision of federal laws relating to these sacred materials and properties, and that this comprehensive revision must establish appropriate roles for Indian and Native governments and for traditional cultural and religious leaders. The comprehensive revision of federal laws and policies must be based upon a recognition of the significance that historic and sacred properties hold for living Indian and Native peoples; protection of sacred properties and access to these properties for religious purposes must be assured.

Be it finally resolved, that NCAI supports the efforts of Indian and Native governments and organizations to reclaim and protect their national treasures and cultural patrimony.

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4. **American Indian Religious Freedom Act**, Partially Codified at 42 U.S.C. 1996 (1981) (emphasis added)
5. Echo-Hawk, Walter R., op. cit., 440.
6. Statement prepared for **CCI Ethnographic Conservation Symposium '86**, by National Congress of American Indians, 9/86.

La conservation des objets fabriqués par les autochtones d'Amérique voilà une question de plus en plus délicate. Dans certains cas, il a été proposé de repatrier carrément ces objets. Une résolution à cet égard vient d'être adoptée par le National Congress of American Indians et un projet de loi a été présenté au Congrès des États-Unis. Cette communication examine les ramifications des relations entre les musées et les autochtones nord-américains en citant abondamment les derniers documents publiés sur le sujet.

A DISCUSSION OF THE REPORT ON ETHNOGRAPHC AND ARCHAEOLOGICAL CONSERVATION IN THE UNITED STATES

BETTINA RAPHAEL

In recognition of the neglect suffered by anthropoligical collections, the National Institute for Conservation published the results of two years of work by a study committee in a report entitled Ethnographic and Archaeological Conservation in the United States. A companion document entitled A Suggested Curriculum for Training in Ethnographic and Archaeological Conservation *was published at the same time. This paper summarizes these reports and details the responses to certain points which resulted from its presentation at Symposium '86.*

1.0 Introduction

In 1984 the National Institute for Conservation (N.I.C.) published a report entitled **Ethnographic and Archaeological Conservation in the United States**. This publication was the result of two years of work by a Study Committee made up of practicing professionals in the fields of ethnographic and archaeological conservation and materials science (1). As Chairperson for the Committee, I want to make conservators and museum professionals aware of this publication. Copies of the report, and a companion document published at the same time, **A Suggested Curriculum for Training in Ethnographic and Archaeological Conservation**, can be obtained from the NIC in Washington, D.C. (2).

Recognizing the neglect that anthropological collections have suffered and noting the lack of any formal recognition for these subdisciplines of conservation, the NIC Committee in its report sought:

"1) to define the scope of ethnographic and archaeological collections and to identify the nature and urgency of their preservation needs; 2) to define the discipline of ethnographic and archaeological conservation and to explain how the approach, practice and requirements of this specialized field differ from those of other branches of conservation; and 3) to examine the state of the art of ethnographic and archaeological conservation and to recommend programs for its development."

The following are some of the general principles and conclusions set forth in that document:

"1) Ethnographic and archaeological collections, which are located in various institutions, storage repositories and in their natural environment, constitute an irreplaceable cultural resource. These collections, which form a record of past and present human behavior, require specialized attention if they are to be preserved for the future.

5) The methods and extent of conservation treatment applied to these artifacts will vary and will be determined by factors such as the kind and quantity of artifacts to be preserved and their original environment, their cultural modification and future function (e.g. study, materials analysis, exhibition, education or reference).

6) Because of the size, diversity and history of neglect of ethnographic and archaeological collections, their conservation requires an approach, treatment and ethics different from those applied to other types of collections. Because ethnographic and archaeological objects are collected, used and preserved as documents of culture, the potential research and information value of an object or group of objects is of paramount importance. Thus, the primary goal of ethnographic and archaeological conservation is to stabilize and preserve the object at the time of collection and not necessarily to return it to its original condition or to restore it for its aesthetic value.

39) The curation and conservation of ethnographic and archaeological collections must take into consideration restrictions on the handling and use of sacred or sensitive objects as recommended or ascribed to by the native peoples from whose cultures the objects originate."

In addition to discussing the historic context and nature of ethnographic collections in the United States, specific areas in need of development are explored in the publication:

- Education and Training
- Research (Conservation Methods and Materials, Materials Analysis)
- Dissemination and Exchange of Information
- Conservation Services and Facilities
- Funding

Although the publication addresses these issues with regard to collections in the United States, the description of needs and recommendations set forth may prove useful to conservators and museums in other countries. Some topics might serve as a focus for future discussions by broader based organizations such as the ICOM Working Group on Ethnographic Conservation, which may also wish to undertake a similar study of an international scope dealing with practical, philosophical and ethical concerns related to conserving ethnographic materials.

Since 1981, when the Study Committee began its work, the discipline of ethnographic conservation has grown significantly. An increasing awareness in the museum and conservation communities of the importance of these anthropological collections and their pressing preservation needs is also evident. However, many of the problems outlined in this document are still relevant and have no easy solutions, especially in those countries where funding is limited and there is an absence of trained conservators.

With the evolving field of anthropological conservation have come new perspectives and concerns, not all of which were addressed in the publication. Some new issues were raised during the discussion of the report at Symposium '86, and these are summarized briefly below:

1. The report did not deal with the issue of training of indigenous people, whether in the United States or abroad, in the care and conservation of their own cultural materials. Native Americans along with many societies, particularly in Third World countries, represent the living cultures behind many of the artifacts now housed in museum collections. These cultures can contribute enormously to our understanding of the technology, use and meaning of the objects and they should play a significant role in preserving and interpreting both traditional and modern materials.

2. In order for many developing countries to preserve their collections, conservation procedures must be adopted which take into consideration the materials, technology and economic conditions available to these specific museums. Information on "low-tech" collection care, simple preventive maintenance measures, and training programmes for regional or provincial museums should be developed to meet these needs.

3. A question was raised about the wisdom of linking archaeological and ethnographic conservation together when addressing the preservation needs of collections and in proposing programmes for training and organizing conservators. A participant at the Symposium observed that the two subjects are often approached quite differently in Europe, and that attitudes toward preservation of the materials could be different as well. The merging of conservation specialties might seem inappropriate there, while the academic standing of anthropology in the United States may foster a similar attitude toward the use of artifacts by both ethnologists and archaeologists, and thus, perhaps encourage a greater consistency in the approach to their conservation.

4. It was pointed out that some larger conservation facilities organize conservation work according to material type; i.e. wood, metals, organic materials, etc. Concern was expressed by some participants that this leads to regarding objects from a material rather than a cultural perspective. It was observed that this approach, along with the lack of training opportunities specifically in ethnographic conservation, may mean that conservators will lack an anthropological understanding. Thus, treatment and care of artifacts will not be guided by an understanding of how the objects were manufactured and used in their cultural context.

5. Finally, concern was expressed that there is a danger of conservators becoming too specialized in subdisciplines which deal only with archaeologists or anthropologists, thus losing their grounding as conservators. In answer to the issue of over-generalization, a conservator of organic materials at the Symposium felt strongly that no conservator in any field should be forced to work on material he/she does not feel trained for. It was mentioned that if we over-specialize we lose our professional identity, our ability to take political stands in our museums and also our facility to learn new conservation techniques.

Notes

1. Members of the Study Committee: Bettina Raphael, Alexandra Allardt, Heather Lechtman, Carolyn Rose, Katherine Singley.

2. National Institute for the Conservation of Cultural Property c/o A & I 2225, Smithsonian Institution, Wash. D.C. 20560.

Reconnaissant que les collections anthropologiques ont été négligées, le National Institute for Conservation a publié les résultats de deux années de travail d'un comité de recherche, dans un rapport intitulé "Ethnographic and Archaeological Conservation in the United States". Un document d'appoint intitulé "A Suggested Curriculum for Training in Ethnographic and Archaeological Conservation" a aussi été publié en même temps. L'auteur de la communication résume ces rapports et énumère les réactions particulières qui ont surgi lors de la discussion de ces rapports durant le Symposium '86.

GLASS AND CERAMICS

The Deterioration of Glass Trade Beads in Ethnographic Collections
S. Lougheed
Canadian Conservation Institute, Ottawa, Canada

Restoration of Shipibo Ceramics
B. Gesell
Museum für Völkerkunde, Berlin, Federal Republic of Germany

DETERIORATING GLASS BEADS ON ETHNOGRAPHIC OBJECTS: SYMPTOMS AND CONSERVATION

S. LOUGHEED

In this paper the deterioration processes of glass are described with particular reference to beads on ethnographic objects. With beaded objects the most obvious symptoms of glass deterioration are cracked and broken beads. The more subtle symptoms include: crusty deposits on beads or threading material, a fine network of cracks, known as crizzling, present over the entire surface of beads and only detected under a microscope, a sticky or sweaty suface on the glass and internal cracking. Symptoms which appear on the substrate and are much less common include: "bleached images" of the beads on wool or silk substrates directly below the deteriorated beads, and substantial darkening of the skin or leather directly in contact with the beads. The emphasis of the paper is upon identifying the subtle early symptoms of glass deterioration so that preventative conservation techniques outlined in the text may be implemented, thus retarding the deterioration process.

1.0 Introduction

Terms used to describe unstable glass such as weeping and crizzling are not new to object conservators. The glass conservation literature almost always refers to stained windows, which have special problems of their own, or vessels which are made solely of glass. However, deteriorating glass beads on ethnographic objects present a special set of problems. The glass beads being examined in this paper are most commonly referred to as trade beads. As early as 1600, they were introduced to North American Indians by Europeans as gifts or in exchange for desired items such as furs.

Used primarily as decoration, they can not be viewed simply as beads but as glass in conjunction with a variety of other materials. For example, they may be threaded with sinew or a natural fiber thread and attached to a silk, wool, native tanned or commercially tanned substrate. When choosing the most suitable conservation treatment all the materials which make up the object must be considered. Only in very rare and unusual circumstances would a conservator consider removing deteriorated glass beads for treatment.

Often when an object is examined only glass beads of one particular colour will appear to be deteriorating, while the others remain unaffected (Figure 1). To date many different coloured beads have been observed deteriorating, with pale blue beads being the most prevalent. However, no correlation has been observed between specific colours of glass and their relative stabilities (1). It may be that, because pale blue was a very popular colour, there are simply more blue beads in a deteriorated condition.

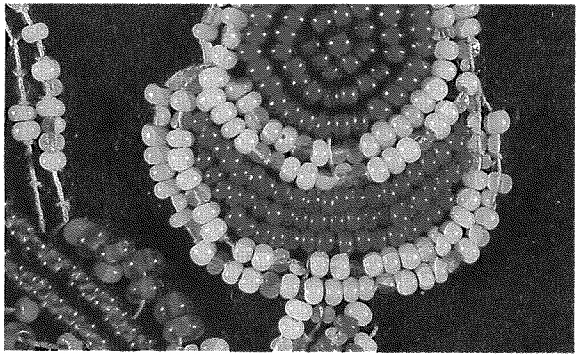

Figure 1. Detail of deteriorating glass beads. Note that only the white beads appear unstable. (From the collection of the Royal Canadian Mounted Police, Regina, Saskatchewan.)

Most of the beads examined in this paper suffer from what is commonly referred to as "glass disease". In the following sections the causes and symptoms of "glass disease" in association with beaded ethnographic objects will be examined and several techniques for preventative conservation suggested.

2.0 Composition and Deterioration

Glass is a viscous liquid that becomes rigid without crystallizing. Upon cooling, increasing viscosity prevents movement and orientation of the atoms from the liquid into the crystalline state resulting in a rigid but random network. Glass is composed primarily of a network former, usually an inorganic oxide which has the ability to harden into the glassy state. In antiquity the most common network former was silica. In addition, network modifiers or fluxes are added to lower the high melting temperature of the silica and alter its working properties. Common fluxes include the oxides of sodium, potassium and lead. A stabilizer, most commonly calcium oxide, is

also added to the glass to render it insoluble in water. Other metallic oxides may be added as colourants (2).

Not only is it important to include all the essential components, but also they must be added in the correct proportions to produce a stable glass. For example, it is known today that the silica content must be approximately 75%, the flux content no greater than 20% and the stabilizer between 6 and 10%. In the past the proportions were not rigidly controlled, often due to lack of knowledge. While attempting to achieve desired properties such as translucency or additional plasticity, the composition of the glass may have been significantly altered resulting in an unstable glass.

Where beads of glass are attached to a substrate, the symptoms of their deterioration may take two forms: deterioration associated with the glass itself, and effects upon the substrate to which the beads are attached. The following is a summary of the symptoms noted to date, and an in-depth examination of each symptom.

3.0 Symptoms of "Glass Disease"

1) Broken beads
2) Sweating beads
3) Crusty deposit on bead or threading material
4) Crizzling
5) "Bleached image" of the bead on a wool or silk substrate
6) Darkening of skin or leather directly in contact with the deteriorating glass beads

3.1 Broken Beads

Broken beads on an object are an indication that the glass under observation is severely deteriorated (Figure 2). While this symptom is easily detected in comparison to the remaining symptoms outlined below, there is unfortunately, very little that can be done to stabilize glass in this condition. The severe fracturing and breaking up of glass beads is usually preceded by one or more of the following less obvious symptoms. Only by learning to identify the subtle, initial symptoms of glass deterioration will the conservator have an opportunity to arrest the deterioration process.



Figure 2. Detail of a fractured glass bead.

3.2 Sweating Glass

"Sweating glass" results in a sticky alkaline solution on the glass surface (Figure 3). This is formed by the reaction of atmospheric moisture with sodium and potassium ions which have diffused to the glass surface.

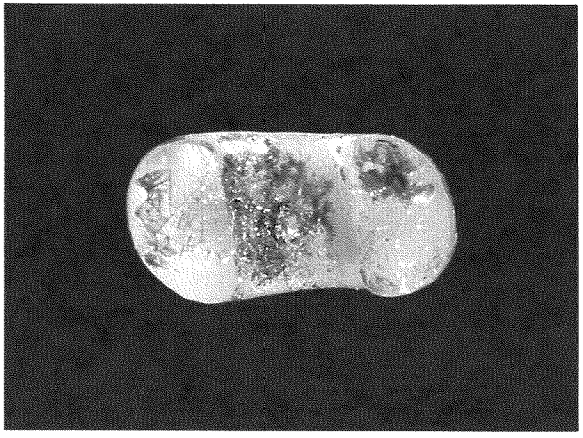

Figure 3. Detail of crizzled and sweating white bead. Note how excesive dust attracted to the sweating glass has accentuated the cracks.

On one example noted, sweating white glass beads were attached to a smoke tanned skin with a soft fuzzy texture. The tacky nature of the sweating beads was attracting the collagen fibers giving the impression that the beads were particularly grimy. Sweating glass beads attract dirt and dust and therefore may be exceptionally grimy when compared to adjacent stable glass beads.

3.3 Crusty Deposit

The alkali migration alluded to above may also result in a crusty deposit of alkaline salts on the surface of the beads, or the threading material. The effect is a loss of sheen.

A yellow bead exhibiting these symptoms was analysed using scanning electron microscopy and electron beam x-ray micro-analysis. High

potassium concentrations on the outer edge of the glass were detected, directly above the leached, alkali-deficient and crizzled layer (Figure 4). The particulate matter on the glass bead which was contributing to the loss of sheen was identified as potassium carbonate (Figure 5).

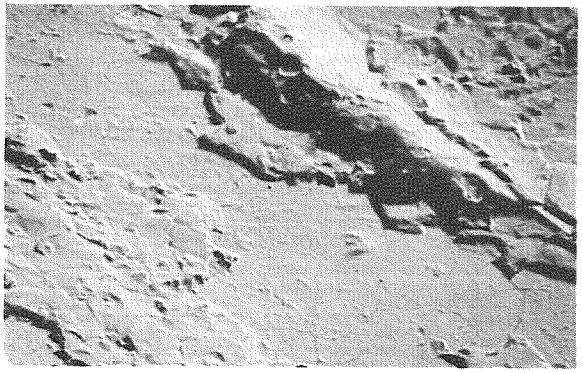

Figure 4. Scanning electron microscope photograph. Note the crizzling and flaking, and a very distinct leached layer.

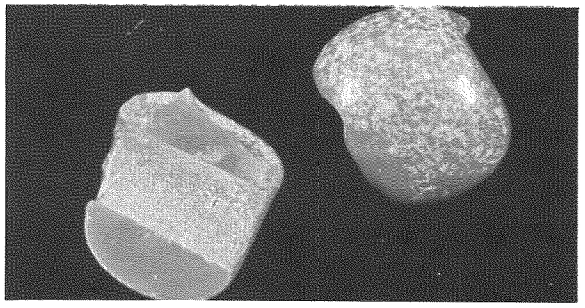

Figure 5. On this red bead alkali deposits are visible as a white, powdery substance.

3.4 Crizzling

Crizzling results in a very fine network of cracks or crazing on the surface of the glass. Transparency of the glass is reduced. Crizzling is not easily detected, especially on small, opaque beads, but careful examination under a microscope will reveal it.

3.5 Internal Cracking

It is important to examine not only the surface of the glass for crizzling, but also the interior as much as possible for internal cracking. This type of cracking is the result of improper annealing, incorrect proportions of raw materials or poor mixing of the molten glass. In addition, inclusions due to impurities in the glass may also provide sites for internal stresses which lead to the eventual cracking and breaking up of the bead. Internal cracks radiating out from the threading hole are sometimes visible in beads when examined under the microscope, and a colour change due to light scattering may also be noted. For example, very extensively cracked blue beads may appear green (Figure 6).



Figure 6. Severely cracked blue beads which appear green.

3.6 Damage to the Substrate

Alkaline products from deteriorating glass beads have been observed to cause bleaching of a wool or silk substrate directly in contact with the deteriorating glass (Figure 7). Blackening of native-tanned skin in contact with deteriorating beads has also been noted. Analysis of the darkened skin shows the presence of alkaline products (3).

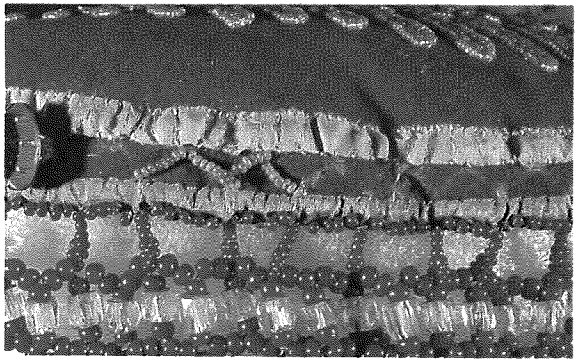

Figure 7. Wool fabric in contact with deteriorating beads reveals a bleached image (top row of beads on right side).

4.0 Treatment

It is important to realize that once glass beads have deteriorated to the extent that they are severely cracked and have fallen apart, nothing can be done to reverse the deterioration process. For this reason, the treatments proposed here concern only those beads which show the initial

stages of glass deterioration. By practicing preventative conservation techniques, the rate of deterioration will be reduced considerably and, hopefully, breaking up of the glass will never occur.

4.1 Testing

A pH measurement, using pH indicator paper, is useful to determine the alkalinity of the glass surface. A drop of distilled water can be applied directly to the bead or alternatively, scrapings of the alkaline crystalline deposits may be removed and their pH determined on a glass slide. In both cases the tests must be performed under a microscope due to the small quantities of sample.

4.2 Cleaning

The cleaning of deteriorated glass beads requires special precautions. Water should *not* be used: the threading material may act as a wick, maintaining a damp environment which can accelerate deterioration. Pits and cracks in the surface may also retain moisture. Ethanol is the preferred solvent for surface cleaning.

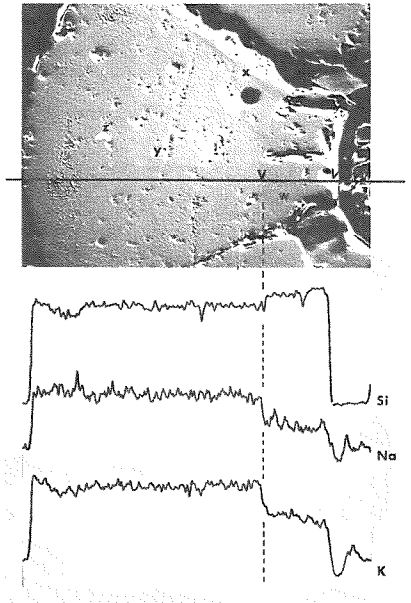

Figure 8. Scanning electron micrograph (secondary electron) of a polished cross-section of a severely cracked bead. The darker zone near the hole has undergone depletion of sodium and potassium. This is indicated by the x-ray line profiles for these elements which were obtained along the line indicated on the micrograph. The picture width is approximately 600 μm.) Narrow zones of similar composition can also be observed extending into the body of the bead.

On a deteriorating white bead examined under the scanning electron microscope, it was obvious that deterioration had began at the hole of the bead, as opposed to the outer surface which is much more common (4). This particular bead, threaded with a natural fiber thread, had become wet at some point in the past, possibly as a result of aqueous cleaning. The hygroscopic thread inside the hole had created a humid microenvironment for glass deterioration to proceed. Leaching was evident around the hole and cracks in the glass radiated from it (Figure 8).

It is important to remove hygroscopic alkaline crusts and solutions from the surface. In glass, alkaline extraction will progress until a pH of 9 is reached. At this pH the silica network will also be attacked resulting in spalling and fracturing (5). The silica network will only be attacked while a pH of 9 is maintained. Therefore, by removing these salts the pH is lowered and deterioration is retarded.

Occasionally, alkaline deposits can be transferred to stable adjacent beads. At humidities above 42%, otherwise stable beads may also begin to deteriorate as the silica network is attacked (Figure 9).

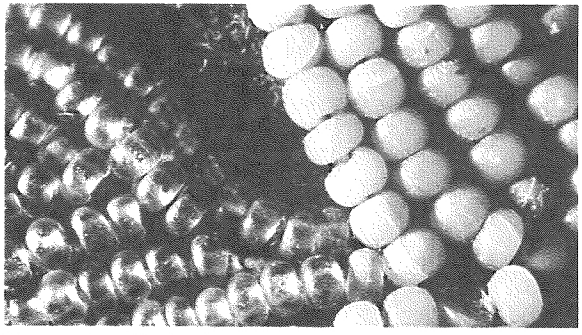

Figure 9. Alkali deposits are visible on the stable translucent blue beads where they are in contact with the unstable opaque beads.

4.3 Support

It is important to prevent glass beads from abrading one another during handling. The strength of glass is dependent on the condition of its outer skin. If scratching, crizzling or impurities are present on the glass surface major fissures could easily develop when beads are subjected to unnecessary movement. This can be minimized by tying objects securely with cotton twill tape to rigid supports.

4.4 Coatings and Consolidants

Coatings have been used in the past on weathered and crizzled glass with inconsistent results. The application of a moisture-impermeable surface coating to a deteriorating bead can create an alkaline micro-environment, thus accelerating the deterioration. In addition, it would be very difficult to completely coat a bead while it is threaded and attached to the substrate.

On occasion circumstances warrant the application of a surface coating, not as a moisture barrier but as a consolidant. Coating severely fractured beads performs the function of holding them together for a little longer. Consolidation of fractured beads has been done with polyvinyl butyral in ethanol and Acryloid B-72 in toluene. This is an extremely time-consuming process and its long-term effects are uncertain.

4.5 Control of Relative Humidity

It is well known that by controlling the relative humidity glass deterioration will be retarded. Above 42% RH alkaline carbonates which have migrated to the surface of unstable glass become hygroscopic, while below 30% RH crizzling may occur. Relative humidity between 30 and 40% is a compromise, while 35 to 40%, if possible, is better. At these levels leaching will be stopped and crizzling minimized. In most instances the latter range would be safe for the organic materials present on ethnographic objects, although each artifact would have to be assessed individually.

5.0 Conclusions

Glass deterioration is a result of improper manufacture and little can be done to reverse the process. However, by learning to identify the subtle and early symptoms of glass bead deterioration, preventive conservation steps may be implemented before complete break-up and loss of beads has occurred.

It is suggested that careful examination, with the aid of a microscope be carried out on beaded objects. Extra care in handling and controlled RH should be implemented immediately upon any signs of deterioration.

Acknowledgement

The author would like to acknowledge the assistance of Ian Wainwright and Jane Shaw of Analytical Research Services, CCI, for their valuable input.

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Biographical Notes

Sandra Lougheed studied museology at Algonquin College in Ottawa and on graduation became Conservation Technician at the RCMP Museum in Regina, Saskatchewan. She was an intern with the Canadian Conservation Institute's Mobile Laboratory Programme and is now Senior Assistant Conservator in the Ethnology Laboratory.

Les processus de dégradation du verre sont ici abordés en prenant comme exemple les perles sur les objets ethnographiques. Les signes les plus manifestes de dégradation sont les perles fêlées et cassées. Parmi les symptômes moins évidents, mentionnons: des dépôts croûteux sur la perle même ou sur le fil; un fin réseau de fissures recouvrant toute la surface de la perle et visible au microscope seulement, une surface collante ou humide, et une fissuration interne. Les signes visibles sur le substrat sont beaucoup plus rares: un reflet blanchâtre des perles au point de contact avec le substrat de laine ou du soie, et un assombrissement notable de la peau ou du cuir au point de contact avec les perles. La communication met donc l'accent sur la façon de repérer les signes avant-coureurs de la dégradation de sorte que les techniques de conservation proposées dans le texte puissent être mises en oeuvre et ralentir ainsi le processus de détérioration.

RESTORATION OF SHIPIBO CERAMICS

B. GESELL

Shipibo pottery presents a number of conservation problems. It is very thin walled and fired at a low temperature, while to provide waterproofing the interiors of vessels are coated with natural resin. In this paper techniques are described for re-flowing the resin in areas of loss using ethanol or shellac, re-assembling fragmented vessels with a baker's gelatin adhesive, infilling with Keramiplast modelling clay, and inpainting with watercolours.

1.0 Introduction

The Shipibos are a small sub-tribe of the Tschama indians living in the north-eastern part of Peru on the central Ucayali River, which flows into the Amazon at Iquitos. The foothills of the Cordillieras lie to the west, and to the east the border of Brazil is about 150 kilometers distant. Although living in great material poverty, the Shipibos are brilliant and skillful potters and their ceramic ware is unique in form and ornamental beauty.

2.0 Pottery Technique

The pottery is made by hand, and only by the women of the tribe. Vessels are moulded by hand and after a period of drying, the interior and exterior walls are scraped and smoothed with gourd spoons or very smooth stones. The final thickness of the clay is about 3.5 mm (Figure 1).

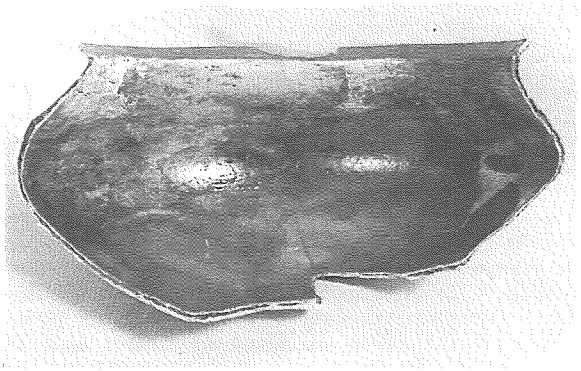

Figure 1. Interior of a vessel fragment showing thinness of walls and inner coat of resin.

Before firing the vessels are slipped with a wet white clay which is found only in one area of the foothills near the Ucayali River. Broad, ribbon-like ornaments are painted with earth pigments on this slip and the white parts between these are filled with fine black lines (Figure 2,3). The brushes for this work are made by the women from their own hair. Vessels are fired in a large old pot, lacking its base, which is placed over an open fire on the ground. Immediately after firing, and while still hot, the vessels are coated inside and out with a tree resin which renders them waterproof (see Figure 1).

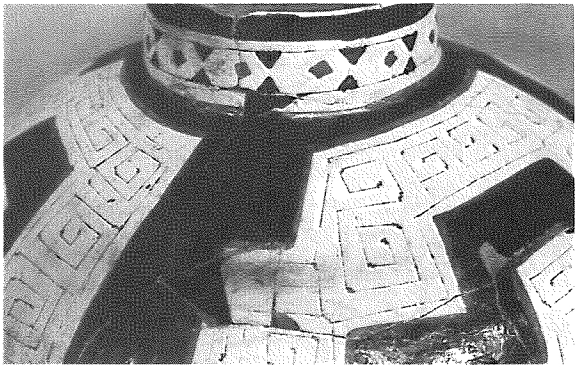

Figure 2. A restored vessel showing typical design details.

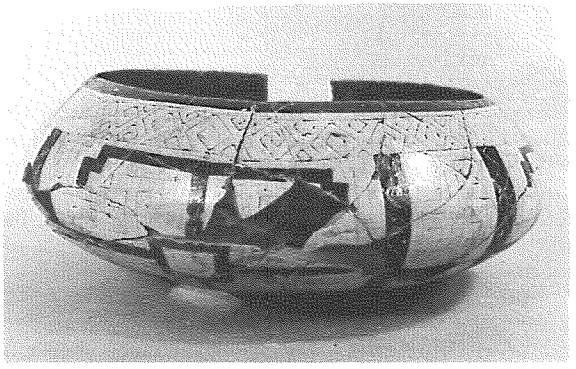

Figure 3. A near complete specimen of Shipibo pottery prior to infilling.

3.0 Conservation

Repair and restoration of Shipibo pottery is complicated by two factors: firstly, because of the comparatively low firing temperature (approximately 600°C) the sherds are very weak and friable and thus susceptible to damage; and,

secondly, the resin coating on older vessels tends to loosen, endangering the thin decorative details underneath. The thin black lines, the chief characteristic of the pottery, tend to be obliterated first, followed by the darker earth colours and the white slips. The treatment of these problems is detailed in the following sections.

3.1 Preserving the Resin Coating

If only the resin coating is damaged, while the decorative details below are still intact, it is possible to re-flow the existing resin over the losses with ethanol. This is done with a soft brush, moving the resin from areas of greater concentration and thinning it out over the surface. Occasionally, where insufficient resin exists for this technique, very dilute shellac may be used. Missing areas of the design must be completed before this process, of course (Figure 4).

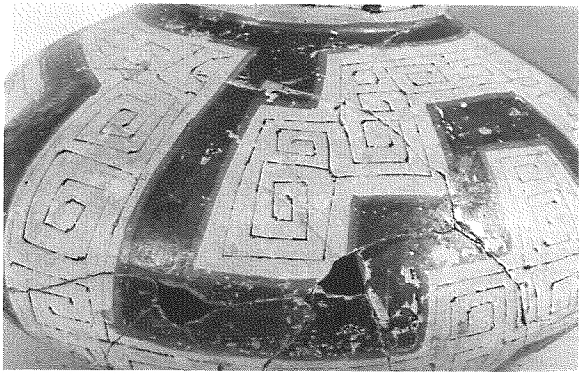

Figure 4. Damages to the resin coat and the colour are visible in several areas.

3.2 Repair of Broken Sections

The thin, friable walls of the vessels are difficult to glue because acetone in the common solvent-based adhesives will readily dissolve the resin coat, painted decorations and the slip. For this reason a water-soluble adhesive is prefered. After testing a number of materials, baker's gelatin was chosen as the best adhesive for the purpose. To the best of the author's knowledge, this is a unique application. It is impossible to say how well the joins will endure over time, but it is certain that future generations of restorers will experience no difficulty in taking down the repairs, should the need arise, as the gelatin remains readily water-soluble.

3.3 Infilling of Losses

The best material for infilling losses is Keramiplast, a modelling material manufactured for use by children. It becomes as hard as plaster on drying yet remains soluble in water. Also, if required, it can be fired at temperatures up to 900°C with only 1% shrinkage — much less than that of any natural clay. This is clearly advantageous as large or load-bearing pieces may be modelled *in situ*, allowed to air dry, and then removed for firing prior to final fitting. The material is supplied in red or white in a smoothly workable dough.

Keramiplast is used in the same way as clay for filling voids and modelling surfaces. Because of the small amount of shrinkage on drying, larger areas of loss should be completed in two stages; the first application is allowed to dry for a day and the edges are then wetted prior to applying new material. Once all losses are filled and the new areas are in harmony with the original, the surface is rubbed with a piece of wet leather to smooth down uneven joins. The Keramiplast has no deleterious effect on the pottery but it should be removed quickly with a damp sponge to avoid contact with the water-soluble gelatin adhesive. It should be added that Keramiplast does not stick to the original ceramic, although in the case of Shipibo pottery it fits so well to the cracked and friable edges that a certain amount of "locking" takes place. The degree of adhesion of the fill to the edges of the ceramic dictates the need for application of adhesive. If the pieces have been removed and fired an adhesive is, of course, essential although in some cases Keramiplast itself will work as an adhesive.

3.4 Painting of Fills

Watercolours are the preferred paints for Keramiplast infills. In order to prevent the pigments from soaking into the water-soluble surface, and perhaps loosening the glue joins, the fill must be isolated. Celluloid dissolved in acetone is best for this purpose, although great care must be taken that the solvent does not contact the original pottery surface. Once dried, design elements are painted on with watercolours using a fine Japan brush and matched with the principle colour of the vessel. The repairs are easily distinguished from the original by their matte surface.

4.0 Conclusion

The kind of pottery described here is not unique to the Shipibo indians and similar wares can be

found throughout tropical South America. For this reason the techniques described here have wide application. Little literature exists in the technology of this kind of pottery and even less is to be found on its restoration. The author would be grateful for any information from others who may have worked on this kind of material. Communication with other institutions on this subject has been indispensable and will continue to be in future projects.

Biographical Notes

Barbara Gesell had an apprenticeship as a cabinet-maker before she graduated in fine arts in Dresden (German Democratic Republic). She also holds degrees in sculpture and as a teacher in plastic arts. She worked for ten years in Berlin (West) as a teacher, where she specialized in ceramics. She is now conservator in the Native American Department of the Museum für Völkerkunde (Ethnographic Museum) in Berlin (West), where she specializes in the conservation of ceramics and wood.

La poterie des Shipibos présente plusieurs problèmes de conservation. Les parois en sont très minces et la cuisson se fait à basse température; de plus, l'intérieur est imperméabilisé par une couche de résine naturelle. L'auteur de cette communication décrit les techniques utilisées pour réintroduire la résine dans les lacunes à l'aide d'éthanol ou de gomme-laque, recoller les tessons avec un adhésif gélatineux, remplir les cavités avec de la pâte à modeler Keramiplast et retoucher à l'aquarelle.

INVESTIGATION AND ANALYSIS

African Red Pigments
J. Portell
Sculpture Conservation, New York, U.S.A

Fatty Bloom on Wood Sculpture from Mali
E. Pearlstein
Brooklyn Museum, New York, U.S.A.

Analysis of Paints Used by Canadian Native Cultures: A Project at the Canadian Conservation Institute
J. Miller
Canadian Conservation Institute, Ottawa, Ontario

Characterization of Alterations to Artifacts
M. Peever
Canadian Conservation Institute, Ottawa, Canada.

The Wakas Pole: History and Context
A. Laforêt
Canadian Museum of Civilization, Ottawa, Canada.

Field Research in the Conservation of Ethnological Collections: An Ecological Approach Applied to Polychrome Monumental Sculpture
A. Howatt-Krahn
Howatt-Krahn, Todd Conservators Ltd., Vancouver, Canada

AFRICAN RED PIGMENTS

JEAN D. PORTELL

Samples of powdery red pigments from various African objects, and several known comparison materials, were examined by polarized light microscopy. In some cases, scanning electron microscopy and microchemical testing were also used to facilitate identification of the unknowns. Several scientists were consulted during this investigation into the probable minerological and botanical origins of African red pigments, including a metalurgist who was asked about the possibility that rust powder might be the source of a certain type of iron oxide pigment. This paper discusses the kinds of red African pigments that have been observed so far, and presents simplified methods for pigment characterization of use to conservators in planning appropriate treatment of African objects.

1.0 Introduction

A study of the identification of African red pigments, especially those of friable, matte appearance, was begun in 1983. The initial purpose was to identify a particular type of microscopically-tiny tubular particle that was first noticed when traces of a possible red pigment layer on a large African carved wood figure attributed to the Mboye people (Menil Collection, No. Y301) was examined at 400X magnification. No reference to red pigment particles of this morphology could be found in published descriptions of artist's pigments (1), and an identification was needed in order to ascertain whether this material was the residue of a native red pigment or subsequent adventitious accretion. As the study developed, approximately 40 African red pigment samples were analysed, obtained mostly from painted wood carvings but also from other types of African artifacts and from supplies of red pigment materials collected in Africa. Iron oxides (in various forms), one verified example of red lead, and powdered-wood pigments in a range of red colours were found. It became evident that the nature and variety of red pigments used in African art is not generally appreciated, and that an understanding of these is necessary for planning appropriate care of objects coloured with them.



Figure 1. Male Figure, wood with traces of paint, attributed to the Mboye people, Menil Foundation Y301. (Photography courtesy of the Menil Foundation.)

2.0 Investigative Methods

The primary investigative technique used was polarized light microscopy, with a magnification range between 20 and 400X, and occasional use of oil-immersion microscopy with a magnification

of approximately 800X. The microscope used was an Olympus POS. Some samples were also examined by microchemical spot tests for the presence of lead, using potassium iodide reagent. It should be noted that no tests for the positive identification of iron oxides have been used other than characterization by light microscopy and crystal optics. A few samples were photographed by scanning electron microscope (SEM) in other laboratories.

The methodology throughout this study was to use light microscopy — the information it provided or questions it posed — to develop the direction and scope. It seemed possible that the elongated red particles from the Mboye Figure might be of botanical origin. However, when a prepared microscope slide of the sample was shown to Dr. Walter C. McCrone (2), he identified the minute birefringent red tubular particles as iron oxide on the basis of high refractive index and refractive index relative to that of the mountant, "Aroclor 5442" (refractive index 1.660) (3). The origin of this type of iron oxide was not understood by either of us at the time.

Once the chemical nature and the lack of information about this particular morphology of iron oxide became evident, the investigation proceeded by seeking mineralogical and metallurgical expertise, and by acquiring more samples of powdery red pigments from other African objects for comparison. The presence of tiny tubular iron oxide particles was noted on some other objects sampled, while only the more usual rounded-particle forms associated with red ochre pigment were found on others. Since frequent occurrence of wood-fiber red pigments (not distinguishable from the mineral red pigments by unaided eye) was observed on still other objects, botanical sources of African red pigments were added to the on-going study in order that all observed types of native red pigment would be considered together (4). The samples were not from any one specific area of Africa, but wherever possible only objects with documented provenance were studied. Scientists, art historians and anthropologists were consulted, in person or through a search of published information, and their contributions were considered along with observations made by visual examination of the 40 pigment samples.

3.0 Results and Discussion

The two major divisions of pigment types found were mineral (iron oxides, red lead) and vegetable (wood fibers). A variation of pigment colour, ranging from brown-red to orange-red by naked eye, was found in both the iron-oxide and the wood-fiber pigments. Since there were no characteristic differences in texture and gloss, in the applied red paints, it became evident that it was not possible to distinguish between the mineral and vegetable red pigments with the unaided eye. However, examination with the microscope quickly revealed the presence or absence of plant fibers in any given sample.

3.1 Mineral Pigments

Mineral reds examined through the polarized-light microscope were often seen to contain characteristically "rounded to elongated, equant grains (2μm in average diameter) of Fe_2O_3, hematite" (5) with high refractive indices and accompanied by quartz and other associated materials. But sometimes these equant iron oxide particles and agglomerates were present along with very tiny tube-shaped particles, with a diameter of 4um or less. Indeed, in some samples, such as the Menil Collection's Mboye Figure, and a Pende Mask (Cat. No. 90.0/6830) and Pende Figure (Cat. No. 90.0/6865) in the American Museum of Natural History (AMNH), these tiny birefringent red tubules were the predominant colourant.

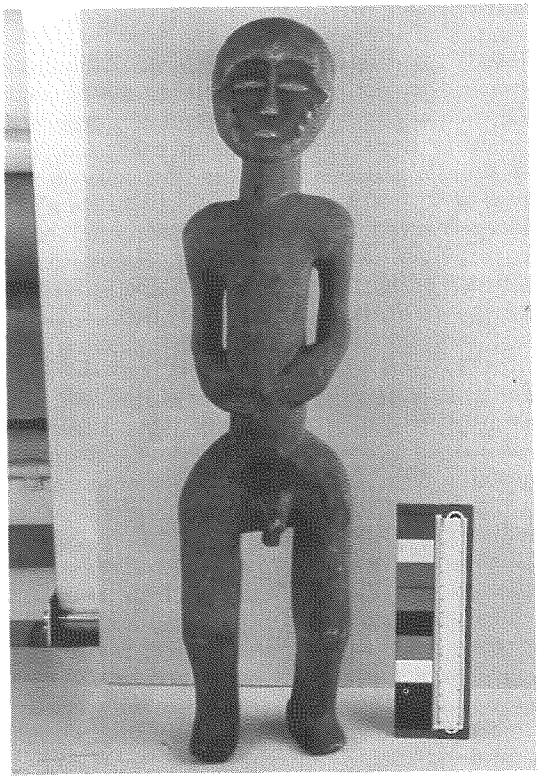

Figure 2. Male Figure, wood with paint, Pende, American Museum of Natural History 90.0/6865.

In Africa, both hard stone and soft clay (ochre) versions of natural red earth deposits were used for making red pigments. The AMNH Collection contains a sample of each of these kinds of paint stones (Cat. Nos. 17/141 A and B respectively, collected in 1869). Because red ochre is more easily worked into paint consistency than hard iron-rich rocks, it is likely that ochres were used whenever available.

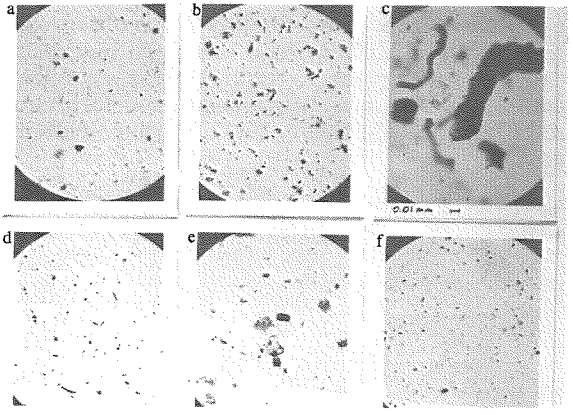

Figure 3a-f. Six photomicrographs, all at the same magnification, showing three African colourants and three comparison materials:

Figure 3a. Ochre from an agricultural drain near Salton Sea, California, showing bacterially-formed filaments. (Ochre sample provided by Dr. Harry W. Ford.)

Figure 3b. Red pigment traces from the Mboye Male Figure (Menil Foundation Y301) shown in Figure 1, with bacterially-formed filaments which appear bright red by transmitted light in both plane and cross-polarized light.

Figure 3c. Filiform rust, from the surface of a rusted metal container. Note much larger scale of these filaments. (Sample provided by Dr. Walter McCrone.)

Figure 3d. Red pigment from a Pende Mask (AMNH 90.0/6946) showing bacterially-formed filaments.

Figure 3e. Scraping from a clay paint stone from Africa (AMNH 17/141a) collected in 1869 and said to be "used to paint top knots of women's hair".

Figure 3f. Red ochre artists' pigment from Fezandie & Sperrle, Inc., a lightly-processed iron oxide material mined in the United States. (Microscope slide no. 23 of Paint Pigment Reference Set purchased in 1983 from Walter C. McCrone Associates, Inc.)

Ochre has been defined in an agricultural publication this way:

> Ochres are weathering products of iron ores and feldspar with and without lime content. Because of their high content (12-60%) of iron oxides, iron hydroxides or basic iron sulfates, they exhibit to yellowish-brown colors, for which reason they were formerly used as dye pigments. On heating and loss of water, ochres become rusty red due to formation of iron (III) oxide (Fe_2O_3)" (6).

The same reference goes on to describe the formation of ochre by chemical precipitation and by three types of biochemical processes associated with specific kinds of bacteria. All these processes can occur separately or concurrently. It seems obvious that red ochre pigments obtained from earth deposits will occasionally exhibit ochre formed by bacterial processes. The microscopic tubules of iron oxide, observed in some of the African pigment samples, are evidently the remains left by bacteria which formerly occupied the now-hollow tube interiors. Finding these bacterial casts in a sample of African red pigment indicates that the pigment was made (at least in part) from a type of natural earth ochre.

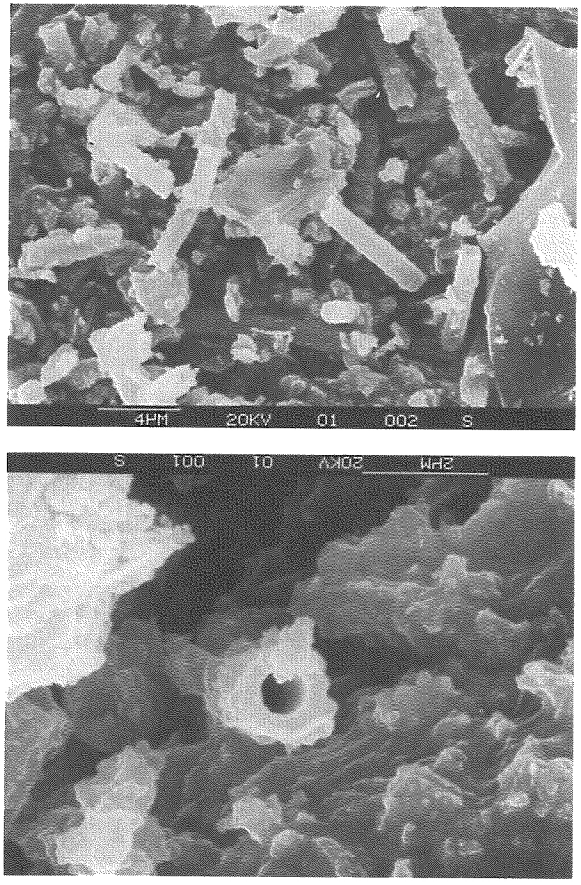

Figure 4a-b. Two scanning electron photomicrographs of the same sample: red pigment on a Pende Mask (AMNH 90.0/6830). The smooth openings and knobby exteriors (from Fe_3 deposits) of bacterially-formed filaments in this ochre pigment are very evident. (Micrographs by Andrew Simon.)

Agricultural scientists have studied various types of bacterial ochres because they cause clogging of drainage systems. Professor Harry W. Ford (7) was sent a sample from a painted Pende Mask (AMNH, Cat. No. 90.0/6946) and he confirmed that the tiny tubular particles present were similar to those formed by filamentous iron-precipitating bacteria called *Leptothrix*. According to Dr. Ford, aging of the African ochre paint probably increased crystallization of the iron oxide, which is more evident in African paint ochres than in agricultural-drain ochres. It is high levels of Fe that produce the knobby iron oxide tubular coatings that were formed around the now-departed bacteria. At very high magnification these well-aged hollow elongated particles show the brilliant red colour of haematite in transmitted light and also between crossed polars.

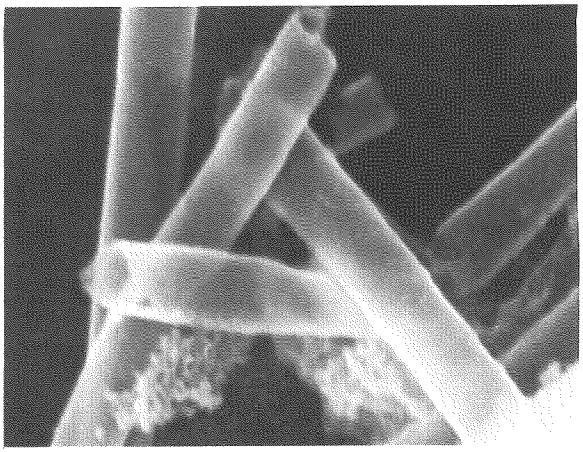

Figure 5. Laboratory-grown Leptothrix *filaments with a light coating of Fe_3, grown in water that contained 0.15 ppm Fe_2. (Scanning electron photomicrograph courtesy of Dr. Harry W. Ford.)*

Because earth deposits of iron oxides are rarely pure, the admixed particulate impurities associated with various geographical sources would be significant in some samples. But it is doubted that they could be relied upon to give meaningful "fingerprints" of specific geological sources since paint samples from valuable objects must necessarily be extremely small, and since there is a correspondingly great likelihood of inadvertently studying contaminant particles deposited during periods of handling or storage. Naturally-occurring iron oxide red, both bacterial and non-bacterial, can be distinguished from manufactured iron oxide (e.g. Mars red) by the finer and more homogeneous particles of the latter, which would contain no bacterial casts and probably fewer impurities.

A metallurgist was also consulted about the elongated tubular red-oxide particles in order to determine whether they might also be caused by corrosion processes and thus indicate use of powdered rust as a pigment. Dr. Norman A. Nielsen (8) described a tubular-particle type of iron and steel corrosion called "filiform corrosion" (9). However, he explained that these corrosion particles are from ten to 100 times larger than the bacterial iron-oxide tubules. No elongated red particles of such large size have been observed by the author in any African paint. Although this does not rule out the possibility that some form of iron oxide rust may have been used to produce red pigment, this theory has not been verified to date.

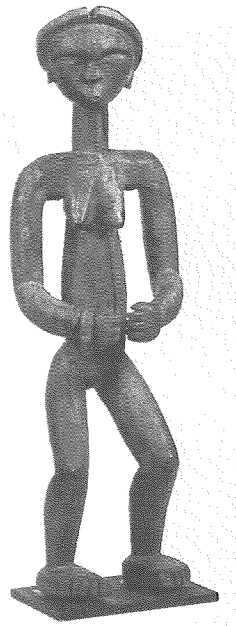

Figure 6. Female Figure, wood with paint and beads, Misogo, Gabon, Brooklyn Museum 74.211.6.

Surprisingly, because the author came across no mention of its use from African-art historians or anthropologists, two African carvings examined had red-orange paint consisting largely of red lead. One, (Brooklyn Museum No. 74.211.6) was a Misogo Standing Female Figure entirely painted red-orange. The figure was collected in a village in Gabon, and was said to be painted with *tukula* wood powder, yet microscopical examination revealed only mineral pigment. The pigment was identified by its optical characteristics in polarized light (10) and by a microchemical test for the presence of lead using potassium iodide reagent. The surface of the paint on this sculpture was

turning brown. Knowing that the pigment was red lead, one could surmise that a chemical reaction may have caused the colour change. The other example of an African red-lead paint occurred on part of a BaYaka Bird Head Mask (Menil Collection No. V959). The red paint over the right eye seemed to be a non-bacterial iron oxide, whereas the sample of orange paint from the lower right eyelid looked like red lead by polarized light microscopy; two different red pigments had been used on the same mask.

Other kinds of red minerals besides iron oxides (haematite, in the form of powdered stone or ochre) and lead oxide (minimum) might also have been used occasionally. These have not been detected by microscopical examination of African pigment samples, and so they have not been specifically tested for so far. They include mercuric sulphide (cinnabar/vermillion) and arsenic disulphide (realgar).

3.2 Botanical Pigments

It is well known that earth deposits are found in a wide range of reddish colours. Botanical red pigments can be almost as varied. Merely looking with the unaided eye at an African object that has been coloured bright orange to brownish red is not an adequate method for specifying whether the pigment is mineral or vegetable. An Igbo Mask (No. 78.118.6, Brooklyn Museum) had bright red paint which one might think was mineral. However, by using a microscope it was easy to see that the pigment was made from wood fibers.



Figure 7. Mask, wood with paint and beads, Igbo, Ihioma/Orlu Region, Nigeria, Brooklyn Museum 78.118.6. Gift of Mr. and Mrs. Paul Taylor. (Photograph courtesy of the Brooklyn Museum).



Figure 8. Mask, wood, vegetable fiber and paint, Ibo, Nigeria, Brooklyn Museum 73.179.12. (Photography courtesy of the Brooklyn Museum).

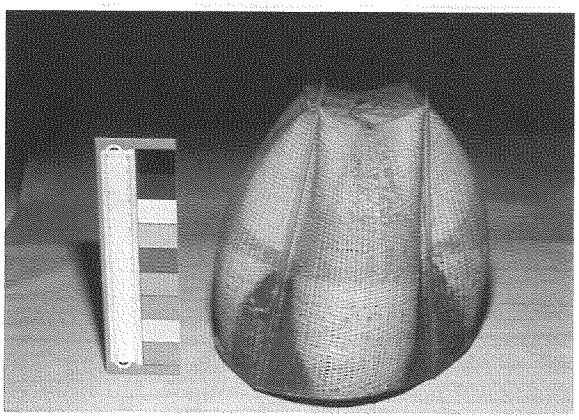

Figure 9. Hat, grass, wood, paint, Mongelima, Zaire, American Museum of Natural History 90.1/4006.

An Ibo Mask in the same collection (Brooklyn Museum No. 73.179.12) had bright orange paint which also proved to be made of powdered wood. A third example of wood-fiber pigment, this time with dark brownish-red colour was found on a Mongelima Basketry Hat (AMNH No. 90.1/4006) (11).

It is easy to determine if a pigment is botanical. What is less easy is to differentiate among the different woods used. Two kinds of trees, *Baphia nitida* and several species of *Pterocarpus*, are usually referred to, and the association of these with terms such as "camwood" and "barwood" as well as many African names is not at all precise. Two quotations, the first from a scientist

and the second from an anthropologist, testify to this ambiguity of names:

> Much confusion exists as to the botanical identification of various specimens of Redwoods known as Barwood and Camwood, and, as the native names are not distinctive, they give little assistance to collectors. It is proposed to confine the term Barwood to species of *Pterocarpus*, and Camwood to species of *Baphia* (12)

and:

> According to (missionary Karl) Laman's description of the production of colors in the old days (by the peoples of the Lower Congo), no specific raw material was regarded as necessary; any material would do, provided that the desired colour could be extracted from it. Alternative species of trees, other plants, stones and earth could be utilized in the production of any colour and not even the coral wood (*tukula* or *nkula*), to which Turner refers as loaded with symbolic meaning, constituted an exclusive raw material for the production of red pigment, regardless of the ritual use of this colour...
>
> Red is obtained by pulverizing certain stones or woods. The *ndimba* stone or the *ngunzi* stone may be used or else the wood of some tree, such as *mbamba*, *sungu*, or other trees whose wood yields a deep, red colour. The *tukula* (or coral tree) is, however, the most frequently used species of tree in connection with the production of red pigment, but if there is no *tukula* at hand, one may resort to any kind of red wood or yellow ochre (13).

Because such confusion of terms persists, it would seem prudent to limit ourselves to general descriptions, such as "red pigment obtained from wood" until ethnologists and botanists collaborate in establishing a reliable system of naming the African red wood-fiber pigments (14).

The investigator who chooses to use wood anatomy for characterization of small samples of pigment must be aware that not only were many different plants used, but also that the pigment fibers might have come from decayed heartwood, or roots, or bark, and not just from normal stem wood. For example, the American Museum of Natural History has in its collection a bag of !Kung "Coloring Powder" (No. 90.2/6080AB) for colouring skins, said to be inner bark material of the Acacia tree, and a !Kung Leather Breechcloth (No. 90.2/6118) said to be coloured with that type of pigment. The author has examined microscopic samples of each of these, and has compared them with samples of the same museum's specimen of molded Camwood (No. 90.0/6212, from the Congo), as well as with identified pieces of *Pterocarpus tinctorius* and *Baphia nitida* provided by the Royal Botanic Gardens at Kew. No reliable differences among these wood-fiber specimens could be observed through the microscope. In only one instance, a pigment scraped from inside a carved wood Kuba Box with Lid (private collection), the red woody fibers were seen in conjunction with microscopic starlike botanical forms called stellate hairs. The significance of that finding has not been explored yet.

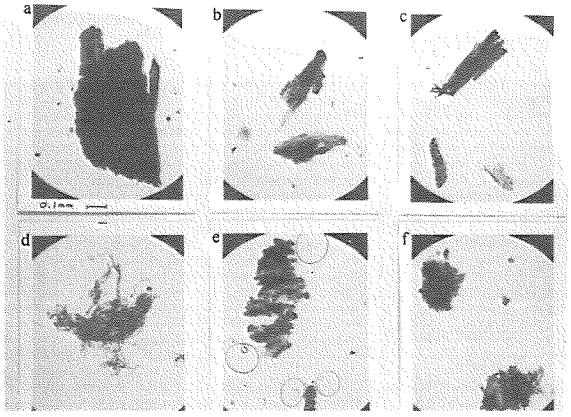

Figure 10a-f. Six photomicrographs, all at the same magnification, of red wood colourants from Africa. Two (a and b) are unprocessed wood, and the others have all undergone some amount of native processing. These images merely illustrate that powdered wood pigments as a group can be readily distinguished from the mineral pigments.

Figure 10a. Baphia nitida, *also labelled "best camwood", from the Sierra Leone (Royal Botanical Gardens, Niger Expedition c. 1859).*

Figure 10b. Pterocarpus tinctorius, *Welw., also labeled "heartwood of N'Kula tree", from the Portuguese Congo (Royal Botanical Gardens 43.1921).*

Figure 10c. !Kung Colouring Powder (AMNH 90.2/6080, see Figure 13).

Figure 10d. Scraping from a camwood molded cylinder, Nkundu, Zaire, with attached tag marked "Ngula" (AMNH 90.0/6212).

Figure 10e. Red pigment from Igbo Mask. Circles are air bubbles in slide. (Brooklyn Museum 78.118.6, see Figure 7).

Figure 10f. Orange pigment from Ibo Mask (Brooklyn Museum 73.179.12, see Figure 8).

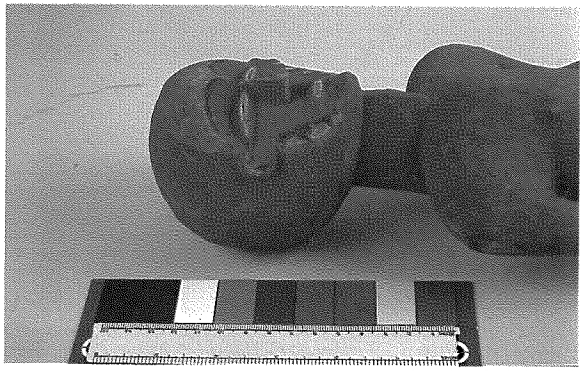

Figure 11a. Male figure, Pende (AMNH 90.0/6865, see also Figure 2). The orange paint consists of ochre containing bacterial filaments.



Figure 11b. Female Figure, Misogo, (Brooklyn Museum 74.211.6, see also Figure 6), detail of back. The orange paint consists of red lead.

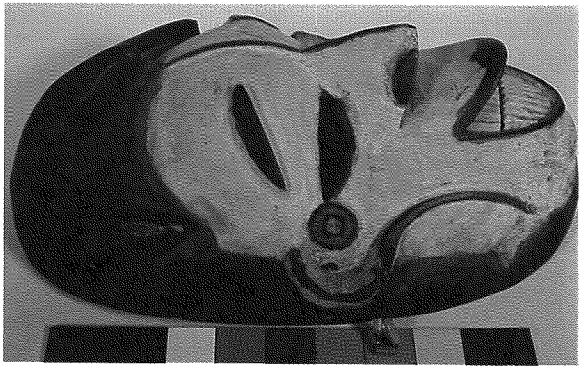

Figure 11c. Mask, Igbo (Brooklyn Musuem 78.118.6, see also Figure 7). The bright red of the hair area is underexposed in this photograph.



Figure 11d. Mask, Ibo (Brooklyn Museum 73.179.12, see also Figure 8). Bright orange pigment.

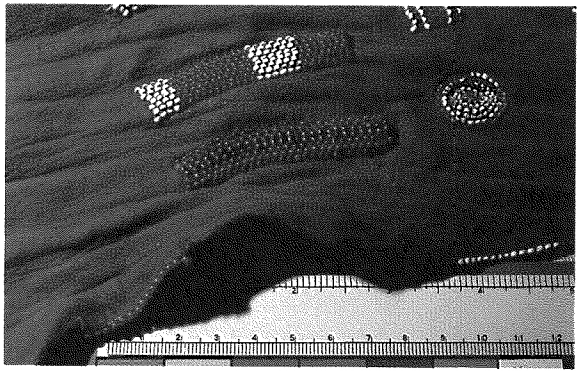

Figure 11e. Breechcloth, !Kung (AMNH 90.2/6118, see also Figures 12 and 13).

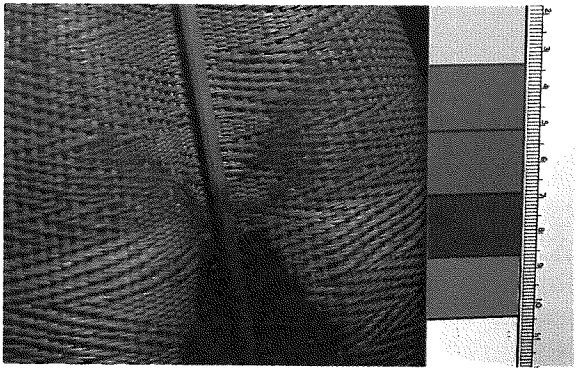

Figure 11f. Hat, Mongelima (AMNH 90.1/4006, see also Figure 9). Both the reddish-brown and black pigments are made from wood.

Figure 11a-f. Close-up views of applied red pigments on six objects, with the same Kodak colour scale included in each photograph for reference. Figures a and b show mineral pigments and figures c-f show botanical pigments.

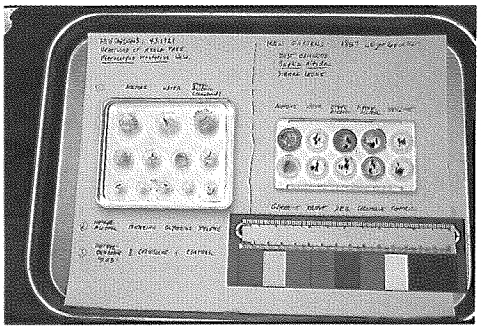

Figure 12. !Kung Colouring Powder (AMNH 90.2/6080) Collection notes report that the Colouring Powder was "said to be inner bark material of the Acacia tree" and "used for coloring skins". In the photograph, small amounts have been placed on a spot test plate and exposed one hour previously to the following solvents: (top row, left to right) acetone, water, denatured ethyl alcohol, methyl alcohol, petroleum benzine, (bottom row left to right) glycerine, xylene, diethylbenzene, cellosolve, with the bottom right sample left as a control.

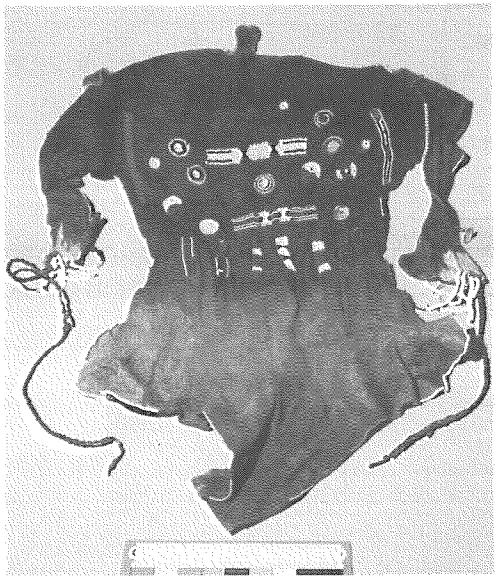

Figure 13. Breechcloth, skin, beads and red colourant, !Kung, Botswana, American Museum of Natural History.

Solvent tests were made on three materials: the !Kung Coloring Powder, said to be Acacia bark fibers, and the two identified woods from the Kew Gardens Collection. All three produced immediate vivid colour bleeding in the following solvents: acetone, ethyl alcohol (denatured), methyl alcohol and cellosolve. A slowly-developed stain occurred in glycerine with all three. *Pterocarpus tinctorius* produced some colour staining in xylene and in

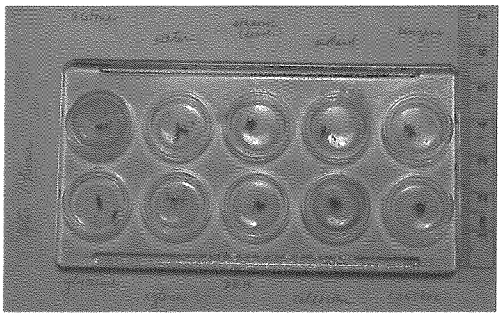

Figure 14a-b. Two African wood specimens from the Royal Botanical Gardens Collection have each been divided and exposed to the same solvents (in the same order, reading left to right and top to bottom) as those used in Figure 12. Photographed 3 days after application of solvents. Left: Pterocarpus tinctorius, *Welw., also labelled "heartwood of N'Kula tree" (Kew 43.1921). Right:* Baphia nitida, *also labelled "best camwood" (Kew, 1859 Niger Expedition).*

diethylbenzene, while *Baphia nitida* and the !Kung powder reacted (very slightly) only with the latter, probably because of its much longer drying time. All three woods appeared colour-resistant to distilled water and to petroleum benzine.

4.0 Conclusions

The variety of sources for African red pigments, both mineral and botanical, is greater than has generally been stated. More accurate identifications may assist scholars to relate painted objects in groups according to technique or geography, but it should always be remembered that the precise sources of red pigments may not be significant in terms of symbolism or artist's intent. However, to conservators planning treatment of unstable or damaged objects, identification of the pigments can be extremely important. Iron oxide pigments are known to be highly stable. If the pigment is red lead, care must be taken to avoid chemically induced discolouration from exposure to acids, sulphides or even excessive light. The wood-fiber pigments require even greater care. They owe their colour to resins and gums contained in the plant cells, and these extractives, as they are called, are readily dissolved by some solvents. Wood-fiber pigments may lose colour intensity by a wicking of extractives into cotton swabs during solvent cleaning, and may produce staining of adjacent areas of the object. All African objects painted red should have the pigment examined prior to using solvents to clean, to readhere fragments with adhesive, or to consolidate very powdery paint. Sometimes an entire object (15) is carved from a

log of wood which contains strongly-coloured extractives. Any plant-fiber pigment, and any carved object made of reddish-coloured wood, should be checked for solvent reactions before treatment.

Although it is not possible to differentiate the various pigment types by eye inspection alone, with a microscope one can readily distinguish between wood-fiber reds and mineral reds. Determining the exact source of wood-fiber pigments is not possible without botanical expertise. If the pigment is mineral, high-magnification polarized-light microscopy and microchemical reactions can be used to identify bacterially-formed and chemically-precipitated ochres as well as red lead. Scanning electron microscopy with elemental analysis capability, micro-probe analysis, and x-ray diffraction, if available, would probably also be helpful in identifying these pigments. Fortunately, the experienced light microscopist does not need to resort to such expensive methods in order to characterize African red pigments.

Acknowledgement

This report is the result of a collaborative investigation in which significant contributions have been made by many people. I am grateful to all, for I could not have attempted the work without their co-operation. Any errors of fact or interpretation in this paper are mine alone. I would like to acknowledge my debt to the curators and conservators of the following institutions for permitting and facilitating the examination of small pigment samples from objects in their collections, and for providing information: American Museum of Natural History (New York), Brooklyn Museum (New York), Menil Foundation (Houston), Metropolitan Museum of Art (New York), and New Jersey State Museum (Trenton). I am also indebted to the staff of the Royal Botanical Gardens, Kew (England), and to the following scientists for providing important information and comparison examples: Dr. Harry W. Ford, Dr. George E. Harlow, Dr. Walter C. McCrone, and Dr. Norman A. Nielsen. Since this investigation will continue, the author will be grateful to receive additional information.

Notes

1. For example: Gettens and Stout, **Painting Materials**, (1966); Harley, **Artist's Pigments**, (1982); McCrone, Delly and Palenik, **Particle Atlas**, Vol. II (1973) and Vol. IV (1979)
(See bibliography below for complete references for these and other books not fully described in the Notes).

2. Dr. McCrone, a consultant microscopist in Chicago, looked at the sample with me in May, 1983. He has discussed red pigments with me on several occasions since then, and I am indebted to him for much helpful information and advice.

3. "Aroclor 5442", available from McCrone Accessories & Components Company, Chicago, IL, contains the carcinogen polychlorinated biphenol (PCB), and should be used with appropriate precautions. R.P. Cargille Laboratories, Inc., Cedar Grove, NJ, makes a non-PCB substitute for Aroclor called "Meltmount 5870" (refractive index 1.662). Since Meltmount has only been available since 1983, its long-term stability is not yet proven.

4. No modern synthetic pigments and dyes (such as might be found in overpaint layers or on more recently-made African objects) were included in this study. Neither were native dyes, where the red stain produced on a substrate (e.g. textile) is more significant than the pigment particles themselves. Binding media, if used, were not investigated. However, it is interesting to note that the Dogon people added blood from sacrificial chickens to red ochre pigment when preparing paint for masks. (M. Griaule. **Masques Dogons**, Paris, 1938, 411.) I am grateful to Kate Ezra for this information.

5. **Particle Atlas**, Vol. II, 477 (see also pp 411, 476, 496, 497). I wish to express my appreciation here to Dr. George Harlow, a mineralogist at the American Museum of Natural History, for helpful discussions in 1984 about the various kinds of iron oxide which occur naturally in the ground, and their most common associated minerals.

6. Kunst, **Iron Clogging** (1982), 4. In this English edition of the German original, the word ochre is spelled "ocher"; I have changed it for consistency in this paper. Also, the questionable use of the word "dye" may be due to the translation. I am grateful to Prof. Harry Ford for providing a copy of this publication.

7. Professor Ford is an agricultural consultant in Lake Alfred, Florida, and communicated with me in 1985 and 1986. He provided literature and SEM photographs of bacterial ochres from agricultural sites as well as a sample. Mineralogists and geologists are familiar with iron-precipitating bacteria, which Dr. Harlow says can be present in the

formation of clayey iron-oxide earth deposits called "bog ore". These would presumably be the kinds of soft red or yellow clays that native people might use to make pigments.

8. Dr. Nielsen is a consultant on corrosion, in Wilmington, Delaware. We communicated in 1984 and 1985, and he provided SEM photographs of a sample of pigment from a Pende Mask (AMNH No. 90.0/6946) which were later sent to Prof. Ford for comparison with known bacterial ochre. According to Dr. Nielsen, petrologists have also studied bacterial clogging, and corrosion engineers have studied microbiologically influenced corrosion of various metals.

9. "Filiform corrosion" is said to occur especially on coated steel, but I have been unable to obtain any sample other than a slide preparation kindly sent to me by Dr. Walter McCrone. It seems not to be a common form of rust.

10. The chapter, "Red Lead and Minium", by Elizabeth West Fitzhugh in Vol. I. of **Artists' Pigments: A Handbook of Their History and Characteristics** (Robert L. Feller, ed., National Gallery of Art, Washington, D.C., 1986, pp 109-138) explains how light microscopy can be used to identify red lead, and discusses its occasional alteration to brown, black and even white lead.

11. Other occurrences of a brownish-red wood-fiber pigment, on some Mangbetu ceramic pots which appear at first to have only dark accretions that could be mistaken for soil, were brought to my attention recently by Judith Levinson and Sasha Stollman. A sample from one pot (AMNH No. 90.1/4643) was examined under the microscope and is definitely of botanical origin.

12. Dalziel, **Useful Plants of West Tropical Africa**, (1937), 256. I am grateful to Ellen Pearlstein and Leon Siroto for mentioning this important source of information about botanical pigments and how these are made and used.

13. Jacobson-Widding, **Red-Black-White**, (1979), 155-156. Susan Vogel kindly brought this publication to my attention.

14. Africans have been known to use wood and other plant parts to extract dyes for textiles, etc. A mixture of palm oil and (wood-fiber) pigment produces the deep red tint on some Kongo ivory sculptures (Kate Ezra, **African Ivories**, Metropolitan Museum of Art, New York, 1984, p 16). Mme. Huguette Van Guellue, of the Musee Royal de l'Afrique Central in Tervuren, Belgium, wrote to me in 1984 about the red sap of a fruit of the *urucu*, (*Bixa orellana*) which is used as a colourant in central Africa. Roger Dechamps, a wood anatomist also in Tervuren, mentions the use of *Morinda* (*Rubiaceae*) wood to make a red or yellow dye for colouring cloth and raffia, in "L'Identification Anatomique des Bois Utilises pour les Sculptures en Afriqure: La Sculpture 'Luluwa'" (**Africa-Tervuren**, XVII-1971-3). Perhaps textile conservators will undertake a comprehensive study of native African dye sources, unless this has already been done.

15. Such an object is an Urhobo (or Isoko) Figure from Nigeria in the Brooklyn Museum (Cat. No. 81.269.2), the wood of which has been identified as a species of *Pterocarpus*. This wood is known commercially as *padauk*.

Short Bibliography

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3. Fontana, Mars G., **Corrosion Engineering**, Third Edition, McGraw-Hill, New York (1986).

4. Gettens, Rutherford J. and Stout, George L., **Painting Materials: A Short Encyclopedia**, Dover, New York (1966).

5. Harley, R.D., **Artist's Pigments c. 1600-1835**, Second Edition, Butterworth Scientific, London (1982).

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7. Kuntze, Herbert, **Iron Clogging in Soils and Pipes: Analysis and Treatment**, DVWK Bulletin 10, Verlag Paul Parey, Hamburg/Berlin (1982). (Was distributed in the USA by Pitman Publishing, Inc., Marshfield, MA, but is no longer available from them.)

8. McCrone, Walter C., Delly, John Gustav and Palenik, Samuel James, **The Particle Atlas**, Second Edition, Volumes II and V, Ann Arbor Science, Ann Arbor, MI (1973 and 1979).

Biographical Notes

Jean D. Portell, a graduate of Vassar College, was introduced to conservation by Caroline K. Keck in 1962. She trained in objects conservation with Anton J. Konrad while working with him at the Brooklyn Museum and at the Museum of Modern Art, New York City. She has also worked part time in conservation at the Montreal Museum of Fine Arts, and at the former Museum of Primitive Art, New York City. Since 1978, she has conducted a full-time private practice in objects conservation in Brooklyn, NY, and sporadically investigated topics of special interest: resilient gap-fillers for wood, the use and misuse of silicones, and identification of ethnographic pigments.

Des échantillons de pigments rouges en poudre provenant de divers objets africains et plusieurs matériaux de comparaison connus ont été examinés au microscope à lumière polarisée. Dans certains cas, la microscopie électronique à balayage et la microchimie ont facilité l'identification des matériaux inconnus. Plusieurs spécialistes été consultés au cours de cette étude portant sur les origines minérales et végétales probables des pigments rouges utilisés en Afrique, y compris un métallurgiste à qui nous avons demandé si une poudre de rouille pouvait entrer dans la composition de certains types de pigments d'oxyde de fer. La communication traite des divers types de pigments rouges utilisés en Afrique que nous avons observés jusqu'à maintenant et on y expose des méthodes simplifiées de caractérisation des pigments, à l'intention des restaurateurs qui doivent définir des traitements appropriés pour des objets africains.

FATTY BLOOM ON WOOD SCULPTURE FROM MALI

ELLEN PEARLSTEIN

This paper presents the results of a study on the whitish blooms found typically on wooden ritual and functional objects produced by the Bamama (Bambara) and the Dogon, in the country of Mali in West Africa. It will be based on material recently published in the May, 1986 issue of Studies in Conservation. *The study included a survey of the ethnographic literature, which records the widespread practice of applying vegetable seed fats and oils to wooden objects. Nine fat and oil samples were obtained, including* shea *butter extracted by the author. These served as references for infrared spectroscopic and gas chromatographic examination of over 30 samples from sculpture surfaces. Results suggest that a white bloom on Mali wood sculptures may be the result of an ethnographic fat application. The mechanism of fatty bloom formation is described, using cocoa butter as a model.*

1.0 Introduction

Many pieces of African wood sculpture display a whitish surface bloom. Conservators and curators have observed this feature on wooden ritual and functional objects of the Bamana and the Dogon, two tribes living in Mali in West Africa. The appearance of these blooms under low magnification ranges from large, greasy opaque white masses, to translucent crystals, to an unresolved blue-white film. The intention of this paper is to describe a project for the analysis and understanding of these blooms on African objects.

2.0 Preliminary Investigations

A preliminary examination was conducted on samples of blooms from four African objects.This examination included melting point determination, solubility, X-ray powder diffraction (XRD), and infrared absorption spectroscopy. Bloom samples occurring as opaque white masses are the easiest to sample and examine, since they are the most abundant and free from impurities (Figure 1). Published infrared spectra of fatty acids or their esters closely corresponded with those produced from bloom samples, and the XRD results similarly corresponded with published d-values for the fatty acid esters palmitate and stearate (1). The presence of impurities made melting point determination a poor test for the presence of fatty substances. These preliminary results, together with the greasy character of some of the surface blooms, turned the investigation toward the possibility of ethnographic fat applications. Ethnographic literature revealed that there are five vegetable seed fats and oils native to Mali that have widespread use among the Bamana and the Dogon: shea butter or *karite*, sesame or benniseed oil, peanut or groundnut oil, baobab oil, and an oil which the Dogon call *sa* (from *Lannea acida*). Among the Bamana, shea butter has been used since at least the eighteenth century as a cooking and lamp oil, a vehicle for potent materials in ritual salves, and as a preservative for dried fish (2,3). Agricultural profiles of West Africa suggest the importance of shea butter as the leading domestic oil in Mali (4,5). Although shea butter does not have great commercial application in the United States, it is exported to Europe for use in margarines and moisturizing creams. Among the Dogon, the oil called *sa* functions as an inedible oil with ritual, cosmetic, lubricative and fumigation applications (6). The Dogon use shea butter and peanut and sesame oils as common cooking oils, though even their routine use is imbued with symbolism (7). Baobab oil appears to be less frequently used than these other oils (7).



Figure 1. Dogon door lock and portion of door (AMNH 90.2/6752, Anthropology Dept.) Photo: E. Pearlstein, AMNH Dept. Lib. Service.

The application of oil to household objects and works of art has been documented for many of the local species mentioned above. Shea butter was applied to Bamana *Gwan* figures (8) and *tyi wara* head-dresses (9), and to Dogon chiefs' bowls (10); baobab oil was applied to Bamana door locks (11); *Lannea acida* oil was applied to bark fibers in the preparation of Dogon *bede* masks (10); sesame oil was used as a preservative for wood intended for the carving of masks by the Dogon, and more specifically, mixed with millet to serve as a libation for masks used in the Dogon *Awa* society (10); and peanut oil was applied to certain Bamana sculptures to produce surface gloss when shea butter was not available (12). Inadvertent transfer of oil from hands to granary doors (13) and houseposts (14) has been noted, and probably extends to other objects as well.

This investigation provided the basis for the hypothesis that the blooms observed were the efflorescence of applied fats and oils.

3.0 Experimental

3.1 Reference Materials

Various fat and oil samples were obtained for use as references in the examination of samples from objects. Four samples of shea butter were obtained. These included two commercial samples, and a third sample prepared by the author from shea nuts from the Ivory Coast and Upper Volta (now Burkina Faso). In the three years between 1983 and 1986 while these nuts were stored, they developed a fatty bloom. The nuts were roasted in a conventional oven, ground into meal in a mortar and pestle, and boiled in water. The fat was skimmed off as is done in native preparation. The fat prepared in this way was grainy and contained red-brown impurities from the shea nuts. The Dogon consider the shea nuts to be female. A good yield of fat that rises to the surface symbolizes an infant being born, and the red impurities are the menstrual blood (7). The fourth sample was obtained from a ceramic container of shea butter from Niger, just east of Mali, which was accessioned by the American Museum of Natural History in 1869. A white bloom is readily apparent on the ceramic and on the basketry straps of the container.

Unrefined samples of five other African fats or oils, including Gambian peanut oil, Ugandan sesame oil, Nigerian palm oil (from the fruit of the *Elaeis guineensis*), Cameroonian palm kernel fat (from the seed of the *Elaeis guineensis*) and baobab oil, were obtained as reference materials.

The palm oil samples were obtained because of the importance of these materials on the south and west coasts of West Africa and in Central Africa, an area surrounding the shea nut tree growing belt (4,5). Awareness of *Lannea acida* oil came too late in the project for it to be included as reference material.

3.2 Identification Techniques

The precise identification of triglyceride materials requires sophisticated analytical techniques. This is due to the fact that fats are complex mixtures of triglycerides and that the only differences between vegetable fats are the proportions and arrangement on the triglyceride of the same fatty acid esters. One technique of choice for identification is gas chromatography, a fractionating technique that allows determination of the relative amounts of fatty acid esters (15). Gas chromatography was only available to this project on a limited basis, but was applied to the two commercial samples of shea butter and to a sample taken from a Dogon bowl (MMA 1977.394.31). The chromatogram of the bowl material had excellent correspondence with the shea butter chromatograms.

Gas chromatography has also been considered a very precise method for the identification of waxes (16). Vegetable waxes consist of alcohols, hydrocarbons, and fatty acid esters that are not in triglyceride form. As will be discussed below, the mechanism by which fats form a white bloom is found in waxes as well (17). Because of the chemical and physical similarity of fats and waxes, and the sophisticated technology necessary for precise identification, the application of waxes to African wood sculpture as a conservation or restoration measure can easily confuse the ethnographic evidence the piece may provide.

Infrared spectroscopy produces fairly uniform spectra from fat samples. The shea butter from different sources, obviously differing greatly in degree of refinement, texture, and colour also produced fairly uniform spectra. Infrared spectroscopy has been used in conservation studies to identify waxes and wax mixtures (18-20). The basis for this work has been the reproducibility of wax spectra and the availability of reference spectra. In this study, infrared spectroscopy was used to analyse chloroform extracts of about 30 samples of white bloom from Mali wood sculptures. It was also possible to determine whether a wax material or a triglyceride material was present. The sampling technique in all cases involved removing material from the sculpture

surface with a fresh scalpel blade and transferring it into a well slide, where it could be dissolved in chloroform without use of another container.

The differences between the chemical compositions of fats and waxes serve as the basis for distinguishing between their spectra. Spectra of pure paraffin and polyethylene waxes, a category that includes common conservation waxes such as microcrystalline and multiwaxes (21,22), are readily detectable because of their simplicity. These materials are branched and straight chain hydrocarbons. Plant waxes, such as carnauba found in commercial polishes, produce spectra more similar to triglycerides, since these waxes contain esters of long chain hydrocarbons. However, the fatty acid esters in the African reference oils contain between 10 and 20 carbon atoms, while plant wax components typically possess chain lengths of 29 to 34 carbons atoms (23,24). Thus, the proportion of methyl to ester bond absorption by infrared is greater in waxes than in triglycerides. This translates into discernible differences in the resulting spectra.

4.0 Results

Following are results from some of the more informative spectra with references to relevant literature on ethnographic practices. Returning to the Dogon bowl in the Metropolitan Museum of Art (MMA), it is interesting to note the work of Marcel Griaule, where he describes a wooden bowl of somewhat larger proportions, but also decorated with zig-zag motifs on the exterior. This bowl was used for serving a meal made of rice, fish and shea butter, and the exterior was smeared with shea butter (10). Samples of the white bloom in the MMA bowl were analyzed using gas chromatography and infrared spectroscopy; the chromatogram produced gave excellent correspondence with the chromatograms of shea butter reference samples. The infrared spectrum was very similar to the shea butter spectrum.

A very similar spectrum was produced from samples taken from a Bamana *N'domo* mask from the American Museum of Natural History (90.2/4641). The fat appeared as yellowish-white greasy crystals and was heaviest on the inside of the mask. The Bamana are known to oil themselves after bathing. It is possible that the fat on the inside originated from contact with the wearer.

Three other objects sampled had very similar spectra which corresponded well with those of hydrolysed fat. Both ester bonds and free fatty acid bonds showed their characteristic absorptions. The closest corresponding wax spectrum was that of stearin wax, but large areas of the sample spectra did not correspond with this spectrum. The objects were a Dogon lidded bowl (Figure 2), a Bamana *Kore* mask (Figure 3) (*Kore* and *N'domo*, mentioned earlier, are both initiation societies) and a Bamana sculpture, possibly a head-dress, of a female figure seated on an antelope. In the catalogue text of a recent exhibit of Bamana figure sculpture at the MMA is a reference to another category of Bamana sculptures of female figures: "The beads and other ornaments that are added to the figures, and the oil rubbed on them to make them shine, resemble the way in which young Bamana women prepare themselves for dances and other festive occasions, and are intended to make the figures as visually pleasing as possible" (25). The *Kore* mask and the female seated on an antelope are both from Bougouni in Mali, and the *Kore* mask is thought to be old. The spectrum of the naturally aged shea butter from the Niger Region, viewed earlier, was not nearly as hydrolyzed, but the sample was taken from the



Figure 2. Dogon lidded bowl (AMNH 90.2/4108, Anthropology Dept.) Photo: E. Pearlstein, AMNH Dept. Lib. Service.



Figure 3. Bamana Kore mask (AMNH 90.2/1330, Anthropology Dept.) Photo: E. Pearlstein, AMNH Dept. Lib. Service.

interior of a large volume of shea butter, while thin films are usually found on objects. Thin films may have greater chemical reactivity.

A number of doors and door locks were sampled. These are used by the Bamana and the Dogon on granaries, houses, kitchen entrances, and sometimes, chicken coops. The manufacture of these door locks is described as being completed with the blackening of the surface through contact with a heated knife blade. A herbal solution is then applied, perhaps a gum, which is said to fix the charred surface (11). However, during use "a patina of dark but shiny oil begins to accumulate and glisten at the edges and in the areas ... where the lock is most frequently handled." The Bamana will discard an over-oiled lock if the original carving is obscured (13). The position of oil staining and fatty bloom on these objects in museum collections, however, offers a record of use (Figure 4). An extremely interesting point to note is that illustrations of Bamana door locks *in situ* in Sola in Bougouni show them to be exhibiting fatty bloom. This is apparently a condition that is by no means restricted to museum objects.

Another large category of objects, where literature records intentional oiling and where blooms are very much in evidence, is Bamana *tyi wara* headdresses. These objects are left in front of a smoking fire for blackening, followed by smearing with shea butter to produce a shining patina (9). Shea butter is very important in the mythology of the dance of *tyi wara*, an agricultural rite. It is mixed with other ingredients and applied to seedlings at sowing time and is part of a salve applied to the spines of the men strongest in agriculture (26). The spectra of bloom samples from numerous examples indicated the presence of triglyceride materials.

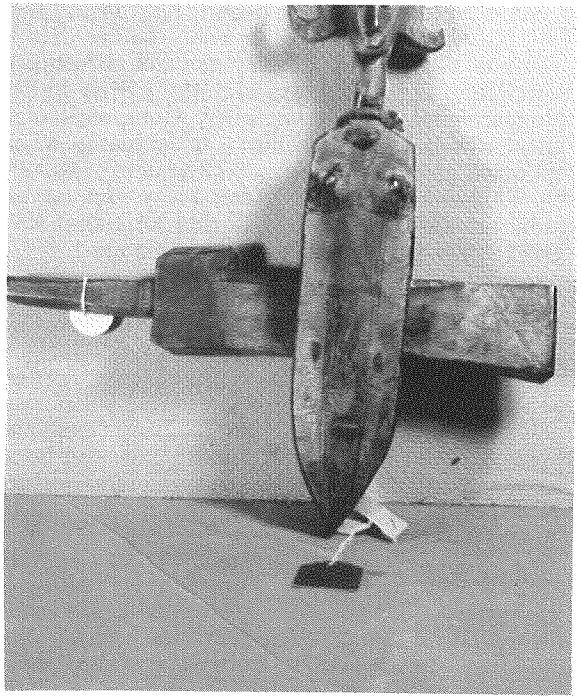

Figure 4. Bamana door lock (NMAA 69-31-2) Photo: E. Pearlstein

One object examined was a Senufo sculpture of a hornbill which exhibited a blue-white, flat bloom exclusively in areas of obvious repair. The Senufo live in the Ivory-Coast, Upper Volta border area just south of Mali. This bloom provided a good control, since the spectrum produced gave excellent correspondence with that of emulsified carnauba wax.

Finally, an exciting illustration of the research potential of an ethnographic fat application came with one object, which had been attributed to the Bamana, and then reattributed by a scholar to the Kissi in Liberia (27). The wood portions of this object were covered with an orange oil. Gas

chromatography performed on a sample of this oil showed it to be palm oil of a composition unique to Liberia, confirming the Kissi attribution.

5.0 Mechanism of Bloom Formation

The blooms exhibited on the range of wood sculptures examined seemed to be fatty in nature, which was consistent with their manufacture and use. The next question was, what causes the bloom formation? The answer was found largely in the literature on cocoa butter from the chocolate industry. The storage advice on the label from Baker's German Sweet Chocolate is as follows: "To store chocolate: Keep cool, below 75° if possible. Flavor and quality are not affected if color looks gray in warm climate. Cocoa butter has merely risen to the surface". Along with shea butter, cocoa butter exhibits a fatty bloom when subjected to slightly elevated temperatures (28, 29). This is because these fats, as well as waxes, undergo polymorphic transformations that can result in the appearance of surface bloom.

Polymorphism, the condition in which the same substance can assume different crystal forms, is shared by triglycerides, long chain acids, esters, alcohols, and paraffins (30-32). For triglycerides, three crystal packings, characterized by different molecular spacings and angles, are possible; these are known as alpha, beta prime and beta, in order of increasing crystal size and temperature stability (33).

Temperature conditions influence which polymorphic form is most stable, so that for instance, rapid cooling from the melt encourages numerous nuclei to form and consequently many fine, alpha crystals. Gradual cooling from the melt results in the opposite situation, producing beta crystals that are large enough to create visible graininess (34). Furthermore, fats and waxes, which are semi-solid at room temperature, will continue to respond to subtle temperature changes with phase transitions, reaching a new equilibrium at a new temperature.

Products containing cocoa butter, if stored for several weeks at a slightly elevated temperature (27°C) or for five months at room temperature (23°C), will undergo a change in which one polymorphic state separates out of the mixture, producing a white crystalline film described as a 'gray-white bloom' (28, 29). The material that crystallizes out is chemically identical to glossy cocoa butter, but represents the highest melting point polymorph, state VI of the beta phase. The non-uniformity in size of different triglyceride molecules within a fat increases the complexity of the system so that cocoa butter actually exhibits six polymorphic states, a few of which may be phase mixtures (28, 29).

Shea butter will form beta crystals after one month at 22°C or five hours at 30°C (35), though degree of hydrolysis and percent diglycerides present in the sample are two factors which can dramatically influence the polymorphic transitions (36). A varied temperature history and the inclusion of impurities in a sample would make predictions of polymorphic behavior almost impossible.

6.0 Conclusions

The polymorphic behavior of fat molecules may explain the formation and behavior of bloom on wood sculpture with fatty surface coatings. The recurrence on sculptures of a bloom which was reduced with organic solvents, a problem described by various conservators, may be explained by the fact that solvent crystallization produces stable beta crystals in triglycerides (31, p. 446). The surest way to eliminate the bloom entirely is to remove all of the material causing it, which is neither simple on a porous wood sculpture, nor necessarily desirable if the material is a fat of ethnographic origin. In fact, Bamana door locks still in use in Mali revealed that a white bloom is sometimes present. This is not surprising, since beta crystal formation in shea butter is encouraged by elevated temperatures which fall within the temperature range expected for southern Mali.

Finally, the use of conservation waxes in the treatment of the surfaces of African wood sculptures, particularly where an ethnographic patina exists, invites confusion when questions arise which analysis of the original sculpture surface can resolve. Certain waxes are chemically similar to fats, and both undergo physical changes that can result in surface bloom. This research has illustated that it is a difficult problem to differentiate between oily or waxy materials applied to conserve or modify the sculpture surface, and fatty films of ethnographic origin. In light of the native practice of applying fats or oils to wood sculpture, the addition to the surface of available oils, such as linseed oil, or Vaseline, or of wax materials (37, 38) for purposes of preservation or restoration may confuse future attempts to study or authenticate an object.

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Biographical Notes

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Cette communication présente les résultats d'une étude sur des efflorescences blanches typiques trouvées sur des objets rituels et fonctionnels, en bois, fabriqués par les tribus des Bamamas (Bambara) et des Dogons, au Mali en Afrique de l'Ouest. Elle est basée sur un matériel publié récemment dans le numéro de mai 1986 de ***Studies in Conservation****. Cette étude comprenait une bibliographie ethnographique traitant de la pratique très répandue d'appliquer de la graisse et des huiles végétales sur les objets en bois. Neuf échantillons de graisses et d'huiles ont été sélectionnés, y compris du beurre de* Shea *extrait par l'auteur. Ils ont servi de référence dans l'examen par spectrométrie infrarouge et chromatographie en phase gazeuse de plus de 30 échantillons prélevés à la surface des sculptures. Les résultats suggèrent que les efflorescences blanches des sculptures en bois du Mali pourraient résulter d'une application traditionnelle de corps gras. Le mécanisme de la formation d'efflores cences grasses est décrit en utilisant le beurre de cacao comme exemple.*

ANALYSIS OF PAINTS USED BY CANADIAN NATIVE CULTURES: A PROJECT AT THE CANADIAN CONSERVATION INSTITUTE

JUDI MILLER

This project was initiated by the Analytical Research Services Laboratory of the Canadian Conservation Institute in 1984 in order to document the pigments and binding media used by the various native groups from pre-contact times to the early part of the 20th century. Topics under investigation include the identification of "native" pigments primarily of vegetable or mineral origin, the introduction of trade pigments, the progression of trade pigments available and the use of synthetic organic pigments starting in the late 19th century. This information will enable C.C.I. to assist curators and conservators in establishing the provenance, date or degree of previous restoration, in confirming published historical information and in selecting appropriate display and treatment conditions. Such questions have frequently been asked but response has often been hindered by lack of reliable analytical reference data.

1.0 Introduction

This project was initiated in 1984 to establish a chronological database of the pigments and binding media used by various native groups across Canada from pre-contact to the early part of the 20th century. The information will assist curators, ethnologists, and conservators in establishing the provenance, date or degree of previous restoration of an artifact, in confirming historical information and in selecting appropriate treatment and display conditions. Such questions have been asked frequently but response has often been limited by the lack of reliable analytical data.

To illustrate the potential benefits from such a project three requests submitted to the Analytical Research Services (ARS) of the Canadian Conservation Institute will be discussed.

2.1 Northwest Coast Masks

In 1976, an examination of Northwest Coast masks was undertaken when four masks were offered to the Canadian Museum of Civilization* (1). Although they appeared old and in degraded condition, the curator became concerned because their style was very similar to masks being produced at 'Ksan in British Columbia. CCI was asked to examine the masks in an attempt to establish their age.

*formerly the National Museum of Man.

The masks in this group, which will be referred to as the study masks, were reported to have been found on a beach in British Columbia between 1910 and 1920 and were kept in the finder's family until the 1970's when they were turned over to a collector.

For comparative purposes, nine well documented reference masks collected between 1879 and 1911 were obtained from the Canadian Museum of Civilization. This group includes five Haida and four Tsimshian masks which were chosen primarily because they provided a wide range of colours.

Analysis of the paint on the reference masks showed very distinct pigment and media similarities. These same features were very different from those of the study masks which exhibited strong similarities amongst themselves. The reference masks had been painted using salmon eggs as a binding medium whereas the four study masks were painted with modern acrylic paints. Acrylic paints were not available until the early 1950's.

During this study, a similarity between one of the four study masks and a Beaver mask carved by 'Ksan artist Alfred Joseph was noted by Richard Inglis, then of the Archaeological Survey of Canada. He subsequently visited 'Ksan and showed photographs of the study masks to several carvers. Three masks were recognized as modern 'Ksan pieces in an "aged" condition. Alfred Joseph's beaver mask was also painted using acrylic paints.

Distinct trends in the use of various paints were noted. The red pigments on all of the reference masks were identified as vermilion while those on the study masks were identified as cadmium red and iron oxide. Cadmium red was not used until 1926. Titanium dioxide was also found on the study masks. Titanium dioxide was not manufactured until the 1920's. Lead-based paints common in the reference masks were absent in the study mask. This may reflect the pressure in recent years to reduce the use of lead based pigments. These results showed conclusively that

the four masks were of post 1950 manufacture. The masks had been legitimately purchased from artists, modified in order to make them appear old, then passed to the museum community as supposedly genuine old artifacts. This scientific data helped to reinforce the curator's original suspicions.

2.2 Charcoal Robe

A similar request for assistance was made by a museum which had been offered a supposed Blackfoot robe by a vendor who suggested that it had been painted in 1896. The museum was able to supply paint samples from a reference Blackfoot robe dated 1885. At the time of this request no previous analytical reports from this lab on the identification of Blackfoot pigments were available.

The pigment samples from the reference robe were identified as vermilion, chrome yellow, chrome green, ultramarine blue and red ochre. With the exception of red ochre, these are all traditional inorganic trade pigments. The pigments identified on the Blackfoot robe in question included ultramarine, raw or burnt umber, lithol red, benzidine yellow, and dianisidine orange. The latter three are twentieth century synthetic commercial pigments. For example, benzidine yellow appeared commercially in 1938. Therefore, assuming the yellow was original paint, the earliest date that the supposedly 1896 robe could have been painted was 1938.

2.3 Chilkat Blanket

Several years ago CCI was asked by Cheryl Samuel, who was preparing a manuscript on Chilkat weaving, to analyse the dyes on a number of Chilkat blankets (3).

Mrs. Samuel had attempted to duplicate the blue-green colour on the blankets using a recipe published by Lieutenant G. Emmons in 1907 (4). According to Emmons:

> "The greenish-blue, the most esteemed of all the colours, came from the oxidation of copper in urine and the boiling of the same. The yarn is introduced and boiled, removed, well washed in fresh water, and dried in the sun. The Tsimshian tell me that a blue clay-stone was used to produce this shade. The Tlingit use this same stone for the decoration of masks, houses, robes, etc., as a paint, but not as a dye."

Mrs. Samuel tried to reproduce the blue-green colour by steeping copper in "old urine" using a variety of methods, but was not able to obtain the desired colour. Prior to her visit to CCI, she found another mention of dyes in an unpublished note by Emmons in the British Columbia Provincial Museum which described another recipe including "oxide of copper soaked in urine".

In order to confirm the nature of the blue-green dye, various well-documented samples were analyzed for the presence of copper. Copper was found in only two of the green samples and none of the blues. The other dyes were all found to be organic. This is a prime example of the confusion that can be caused by some literature references. Mrs. Samuel has since obtained the desired colour by boiling blue trade blankets then over-dying with a yellow bath made from wolf moss which is a tree lichen.

The above three examples illustrate the need for and usefulness of accurate reference information.

3.0 Project Implementation and Methodology

The first phase of this project was conducted in collaboration with the Canadian Ethnology Service of the Canadian Museum of Civilization. Paint samples from well documented artifacts were obtained in consultation with curatorial staff. The emphasis during this initial stage was on Naskapi, Plains, and Northwest Coast artifacts. Samples from most groups across Canada have now been collected.

The earliest documented dates range from the late eighteenth century for Plains and Naskapi artifacts to the 1870's for Northwest Coast artifacts.

The goals of the project include:

1. To identify "native" pigments of mineral, vegetable, and animal origin.
2. To trace the sequence of trade pigments utilized in the various regions.
3. To document the use of synthetic organic pigments which became commercially available in the late nineteenth century.

Pigments identified which could be categorized as "native" include red and yellow ochres, green earth and extender pigments such as calcite, quartz, and kaolin. In the case of mineral pigments, it may be difficult to ascertain whether or not they are from native sources. No pigments of animal or vegetable origin have yet been

identified. Determination of the nature of these types of colourants is a problem as standards are not available for comparative purposes. Some of the more common literature references to pigments of this type are:

— roasted or burnt fungus for black.
— bark, berries, resin, oil and urine for red.
— buffalo gallstones for yellow.
— duck droppings for blue.

Most pigments identified thus far fall into the category of trade pigments. This is not unexpected since most of the samples in the reference collection are post 1870, a time when trade pigments would have been readily available. In addition, the common trade pigments such as vermilion, Prussian blue, ultramarine blue, and chrome yellow, are easily identified by routine analytical techniques.

Several pigments belonging to the third category, synthetic organic pigments, have been found on twentieth century artifacts.

All samples are analyzed using a number of techniques. Fourier transform infrared spectroscopy is used to identify not only organic chemical compounds such as oils, resins, gums, waxes, and organic pigments but is very useful in the analysis of inorganic paint materials including many pigments, fillers and extenders.

The chemical elements present are detected using x-ray energy spectrometry in a scanning electron microscope. Elements down to sodium (atomic number 11) can be identified in this way. Although this technique does not permit the definitive identification of a pigment, it is possible to make a judicious interpretation. For example, if a pigment is red and mercury is detected, it could be deduced that the pigment is vermilion.

X-ray diffraction is used to identify crystalline materials that occur as major components of the sample.

The samples taken from an object must be small enough that the removal is unobtrusive yet large enough that the component of interest is detectable and that it is representative of the composition of the object or part of the object in question. The samples need not be any bigger than a typed period.

An important factor to consider in establishing the pigment chronology is the accuracy of the dates associated with the paint samples. Three dates may be recorded in the database for each artifact. The date the artifact was acquired by the museum, the date that it was collected, and the date that has been attributed to the artifact by a curator. Acquisition dates are generally well documented but may bear little relation to the actual date of creation of the artifact. Collection dates can sometimes be more indicative. The attribution date is less definite than the other two but is a useful indicator of the estimated age of the object.

Some gaps in the chronology are expected. These are perhaps due in part to the nature of ethnological collecting. This is particularly evident with Northwest Coast collections, as the heyday of anthropological collecting on the Northwest Coast occurred between 1875 and the Depression. However, the database will be updated when new attributions are made or new samples are obtained.

To date samples have been obtained from a number of major Canadian museums and several American and European museums. European museums are providing samples from some of the very earliest collected and documented artifacts.

4.0 Results to Date

At this stage, even though the project is still in progress, trends are beginning to develop and there are some interesting results.

Few of the copper-based blue and green pigments that have been described repeatedly in the literature as being used on the Northwest Coast have been found. Authors speak of copper oxides, sulphides of copper, copper ores, urine-corroded copper and copper carbonates, but none of these have been positively identified. The blue green pigment of many of these samples is commonly known as green earth, which is a naturally occurring mineral of widespread geographical origin (5).

In several of these green earth paint samples a binding medium was not detected. It is believed that possibly no medium was used and that this may have been a conscious decision of the artist. The colour of the green may be altered by mixing it with a vehicle. Such a change was noted by Emmons in his discussion of a blue-green pigment found on the Queen Charlotte Islands: "This mineral gave a deep blue-green and was the most esteemed and expensive color, and was sparingly used. A small piece the size of a walnut was valued at $10 to $20 at Sitka as late as 1890. This color withstood the weather like the other colours,

but in contact with grease the blue changed to green or was lost" (6). At present it is not known if green earth is the pigment Emmons is referring to; clearly this warrants further study.

Often on the catalogue cards the description of the artifact will include reference to a paint called Rickitts dye or Reckitts blue. It is believed that the reference is to Reckitts Blue, a commercial laundry bluing. The pigment on many masks is ultramarine and laundry bluing contains ultramarine. Laundry bluing has been found to have been used both by Northwest coast groups and the Naskapi of Labrador.

The medium for many samples is identified as being a drying oil. It is suggested in the literature that fish oil was used on the Northwest Coast to make paint, but analytical results do not confirm this. In addition, a large number of these samples also contain extender pigments along with drying oils, which may indicate that the paints were commercially prepared. Nevertheless, it is known that many attempts were made to use fish oil in paints in the nineteenth century but it was found not to be a satisfactory binding medium as it dried too slowly and tended to become rancid. From 1750 linseed oil undoubtedly was the chief medium for most commercial paints as it was plentiful and inexpensive.

The patent and manufacture dates of pigments, and the dates some of these materials became available in North America, are well documented. For example, as early as 1710 "paint colours" were advertised for sale in Boston. In Quebec, linseed oil, nut oil and a wide variety of imported dry pigments were available from 1765 and ready-to-use paints were being imported by 1790 (7). Unfortunately it is not yet known when the pigments or paints became available to various native groups, or were first used by them.

5.0 Conclusion

The potential benefits of this project have been illustrated and several results discussed. When the analytical work is completed, the data will be compiled and correlated. The database will then be used to provide a response to questions conservators, curators and ethnologists may have about the provenance, previous restoration and treatment of artifacts.

Acknowledgements

The quality, scope and success of this project depend on the cooperation of a large number of and ethnologists, all of whom have given their continued support, encouragement, and enthusiasm from the beginning.

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Further Reading

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Biographical Notes

Judi Miller graduated from Carleton University in 1983 with a BSc Honours Degree in Chemistry. She has worked in the Analytical Research Services Division of the Canadian Conservation Institute since that time, specializing in the analysis of organic materials.

En 1984, le laboratoire des Services de la recherche analytique de l'ICC a mis sur pied un projet visant à étudier certains pigments et liants utilisés par les diverses cultures autochtones entre l'époque antérieure à l'arrivée des Européens et le début du XXe siècle. Nos recherches portent sur l'identification des pigments proprement autochtones d'origine minérale et végétale, l'introduction au pays de pigments européens de traite, la disponibilité croissante de ceux-ci et l'emploi de pigments organiques synthétiques vers la fin du XIXe siècle. Cette information nous permettra d'aider les

conservateurs et les restaurateurs à établir l'origine et la date de l'oeuvre, de déterminer l'importance des restaurations antérieures, de confirmer des renseignements historiques publiés, et de choisir les conditions propices au traitement et à l'exposition de ces matériaux. Ces questions nous ont été posées fréquemment; malheureusement, l'absence de données analytiques fiables nous a souvent empêchés d'y répondre.

CHARACTERIZATION OF ALTERATIONS TO ARTIFACTS

MARY PEEVER

Interpretation of an ethnographic artifact requires characterization of any alterations detected in the course of examination. Alterations to an artifact can be made at several stages in its history: during fabrication to correct inherent flaws in the original materials; during use to improve efficiency, repair breaks, embellish decorative elements, or for ritualistic purposes; prior to sale; and in a collection to retard deterioration or enhance appearance. When examining an alteration, one should consider why it was done, and by whom. Often field notes and accession cards do not give this information, but clues can be gleaned through study of the materials and techniques of the alterations.

1.0 Introduction

Examination of an ethnographic object requires characterization of all alterations. The nature and scope of these alterations can greatly affect interpretation of the object. Consideration should first be given to existing documentation. Clues can also be gleaned through study of the materials and techniques of the alterations, and through scientific analysis to assist in material identification.

This paper will examine seven case histories which demonstrate the importance of the study of alterations and the information which such studies both requires and generate.

The examination and treatment of these artifacts involved interaction between such various people as curators, conservators, scientists, native craftsmen, and artists. Such consultation is necessary to establish realistic expectations for conservation treatments.

2.0 Alterations

Alterations may be made at several stages in the history of an object:

2.1 Changes During Fabrication

With some objects, changes to materials are made even during the initial fabrication process. This is in response to the exigencies of construction where natural flaws or blemishes interfere with the craftsman's purpose.

A Northwest Coast canoe, for example, traditionally requires reinforcement and repair as part of its manufacture. The process first requires a cedar log to be hollowed out with adzes and the bottom and sides are then scorched to harden the wood. This is followed by steaming to spread the sides. Once softened, the sides are forced further apart by wedging split cedar sticks between the gunwales. This stress often produces cracks and ruptured knot holes.

The early Northwest Coast woodworker could repair a crack in a canoe by passing a cedar withe through a series of drilled holes. Using this sewing method, he would then pull the withe tightly to make a very secure join. The materials used in canoe repairs evolved as European materials became more readily available. Figure 1 illustrates repairs on a canoe constructed in 1908. The method of canoe manufacture remained traditional and the native approach to repairs also remained unchanged but the material used in the repair is copper. Copper staples were used in place of cedar withes while copper plates were used to cover knotholes.

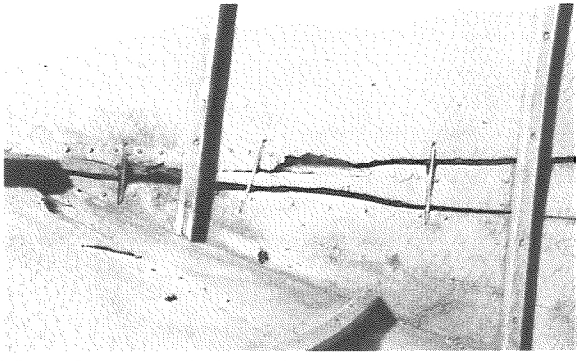

Figure 1. Copper staples and remains of copper plate on a Haida Canoe.

2.2 Changes During Use

The next stage in an object's history when alterations can be made is during use, the most common being the repair of damaged or broken areas.

The repairs on a Northwest Coast Mask shown in Figure 2 appear to have been made during the period when the piece was in use. Nevertheless documentation showed that, in fact, a conservator

had made the repairs quite recently. It is fortunate that this documentation existed as there was no indication from the appearance of the repairs that they were not original native repairs. The conservator was, in fact, replacing the old repairs. All faithful to original technique, he used the remains of existing materials, baleen and sinew, to recreate what had originally been a native repair. Broken baleen struts were soaked in hot water, lashed together with sinew, and allowed to tighten as they dried. In this case one has to hope that the conservator accurately interpreted the technique of the original repair.

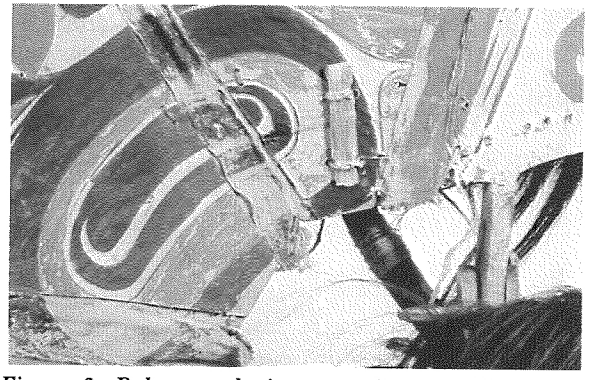

Figure 2. Baleen and sinew repair on a Northwest Coast Mask.

Some alterations made during use are performed to improve efficiency. On West Coast harpoons heads, for example, spruce-gum was applied to secure the blade and ensure smooth entry into the flesh. Several harpoons from the same collection were recently studied at the Canadian Conservation Institute (CCI). The coating on an early shell-blade appeared uneven and opaque, compared to the coating on other specimens of the same provenance. A sample was analysed using infrared spectroscopy which indicated a significant chemical difference between the sample and unmodified spruce gum. The coating was "most likely a commercially prepared product" (1) and thus unlikely to be original in such an early piece.

The coating on four metal blades was identified as "manila copal" (2) a resin obtained from the *Agathia alba*, a tree which grows in the Far East. These blades, mid-to-late 19th century in date, were not covered with spruce gum as supposed. Was this an earlier museum restoration; was manila copal, a trade product, easier to apply or more durable than spruce gum?

A Tlingit basket provided another example of a repair which was suspected to have been done while the object was in use (Figure 3). The repair was crude in appearance, and laced in no recognizeable pattern. However, care had been taken to ensure that the area was strengthened. Perhaps at some time a hasty repair was done in order to make the basket quickly serviceable. Documentation indicated that the repair was done before 1932. In this case the key to interpretation of the repair was scientific analysis. Fibres from the repair were subjected to microscopic analysis morphologically. The fibres were found *not* to be similar to those found in traditional native repairs, but were similar to commercially available fibres such as sisal or raffia (3). The curator and conservator both agreed that the repair should be removed. This decision was not made on the assumption that a native person would have more limited access to manufactured materials but rather on the fact that the repair interfered with the continuity of the pattern and detracted from its overall interpretation. For these reasons it was decided to replace it with a more modest form of reinforcement, but not to disguise the repair completely.

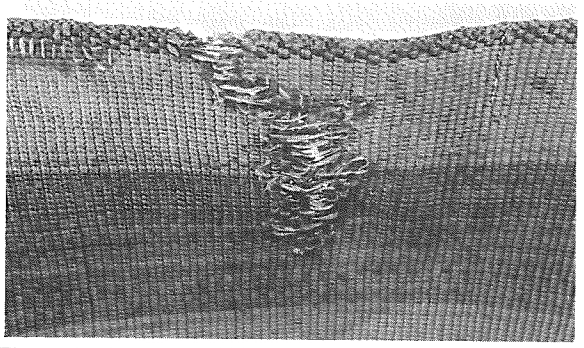

Figure 3. Repair on a Tlingit Basket.

Another instance of alterations made during use is the embellishment of decorative elements. Traditionally, totem and house poles were not traditionally repainted by their original owners, although by the mid-20th Century some native communities did occasionally re-paint a pole. Once the poles were acquired by collectors, however, they were repainted often. This was done for both maintenance and embellishment. Privately collected poles and even museum-owned poles, did not receive the same esteem as other museum objects. Instead, they were regarded as pieces of monumental architecture, displayed outdoors, repaired and maintained seasonally. The contradictory attitudes between non-natives and natives on how to care for totem poles is interesting in itself, as in the 20th Century many poles have been commissioned purposely for use by non-natives.

The Tanoo house pole shown in Figure 4 had been repainted numerous times. Photographic documentation established the existence of this pole in the 1880's. Since that time it had travelled to the Chicago World's Fair and various other locations in the United States. At one point it was in the possession of the Boy Scouts of America, who are notorious for the gratuitous repainting of totem poles. It was eventually acquired by the National Museums of Canada with hopes of removing the top paint layers to reveal the original paint. Microscopic examination of paint cross-sections and analysis of paint samples by infrared spectroscopy did not clearly identify the original paint layer (4). By a process of elimination, paints which were not in use around 1880 were identified. Photographs of the pole *in situ*, together with discussions with the curator and a West Coast carver, led to a clearer picture of where the remaining paint might be located.

With both scientific and curatorial information the conservator had a better idea of what was original. However, the original paint layer was finally revealed only after painstaking removal of the overlying layers. Comparing the eye area before and after treatment (Figures 4, 5) it is possible to see why this project required constant interaction between conservator and curator, especially since the results were so different from the appearance before treatment.

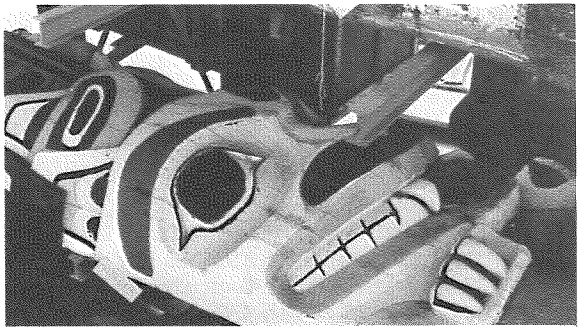

Figure 4. Detail of the Tanoo Totem Pole before treatment.

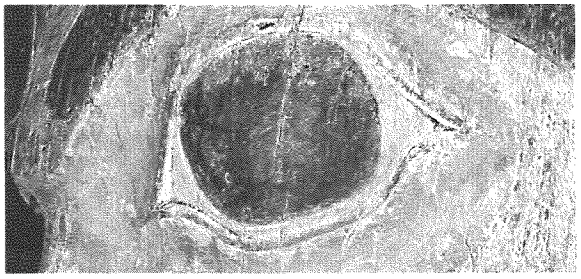

Figure 5. Detail of the Tanoo Totem Pole after treatment.

Another type of alteration can occur during ritual use of an object. Apart from the spiritual transformations which are believed to take place, rituals can involve physical change as well. When examining ethnographic objects, it is important to pay close attention to any residues. In Northwest Coast culture, for example, the scattering of eagle down and the sprinkling of ash are special ceremonial gestures.

When a Shaman's Head-dress came to CCI for treatment, it was understood of course that the fragments of eagle down would remain undisturbed if the other feathers were cleaned. Since the cleaning of feathers is a fairly standard conservation procedure, the conservator paid special attention to a grey-white deposit on the feathers which did not appear to be just dust (Figure 6). A sample was identified as mercuric chloride (5).

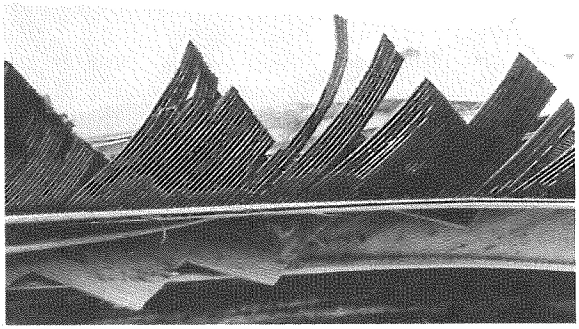

Figure 6. Detail of eagle down and residue on feathers of a head-dress.

This deposit was not a residue from a native ceremony but from the years when museums regularly fogged their collections with insecticides. In fact, what was suspected of being residue from a "native ritual" was actually from a "museum ritual". Nevertheless, the identification of this poison proved important to the people handling this artifact and alerted them to other possible hazards within the collection.

2.3 Changes Prior to Sale

Artifacts often undergo alterations prior to sale although this kind of alteration is rarely documented. This is because the alterations are usually carried out in order to enhance the piece visually, thus giving it more appeal for potential buyers. When a Micmac Cradle decorated with porcupine quill came to the CCI for treatment it was covered with smudges of colour. Examination revealed that specific design elements had been overpainted. Since Micmac quill was traditionally coloured only by dyeing, the question arose as to

the source of this painting. Before any scientific analysis was initiated documentation on the artifact was examined. This consisted of detailed drawings, a description, and even a glass-plate negative produced during a thorough examination in 1917 when a conscientious curator recorded the condition (Figure 7).

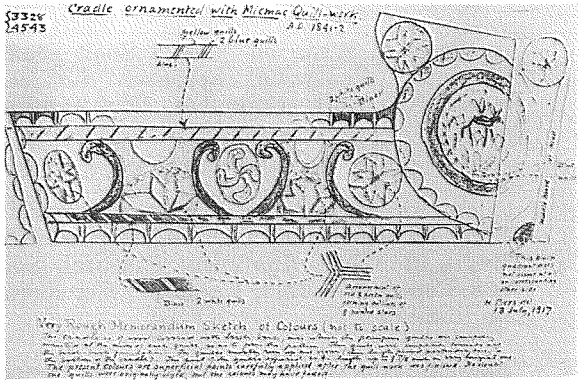

Figure 7. Description and condition report of a Micmac Cradle produced during an examination of the object in 1917.

The reason for such close scrutiny at that time was the offer for sale of the cradle to the museum by a dealer. It is possible that the overpainting might have had some connection with this transaction. The curator's notes state that "the present colours are superficial paints carefully applied after the quill work was finished. No doubt these quills were originally dyed, but the colours had faded" (6).

This information played an important role in deciding the conservation treatment. Further examination confirmed not only that the dyed quill had faded, but that the overpaint was an attempt to duplicate the original colours. Given the physical properties of porcupine quill it would have been nearly impossible to remove the paint and, once removed, the appearance would have been distinctly "washed-out" giving no indication of the vibrancy of the original colours. Thus the curator and conservator, concurring with a curatorial opinion of 60 years earlier, decided to leave the paint on.

2.4 Changes While in a Collection

As has been illustrated in previous examples, alterations are sometimes made inadvertently. The conservator's role in a museum is usually that of deliberate intervention in the natural cycle of deterioration. The purely conservative approach may be as simple as wrapping an object in acid-free tissue for storage, but it can also include repairs for stabilization. Cosmetic work for the enhancement of an object prior to exhibition as practised by some restorers goes beyond the modern approach. The farthest most contemporary conservators will venture into restoration is to indicate how the piece might have originally appeared.

The Northwest Coast Gravemarker, shown in Figure 8 had been fitted with "stick" legs and attached to a platform to make it stand up. This gave the piece a rather comical look, an unfortunate contradiction to the sombre function it originally served.



Figure 8. Northwest Coast Gravemarker before alterations.

The new legs fitted to render the piece displayable (Figure 9) were based on the legs of a similar eagle of the same provenance. The important point to note in this process was the care taken to differentiate the replacement parts, and to make them easily removable. The legs fitted firmly, but not tightly into the original sockets and were marked with the initials of the institution and the date.



Figure 9. Northwest Coast Gravemarker after alterations.

3.0 Conclusion

These examples of alterations indicate activities more complex than those of straightforward repair of broken objects. Scientific analysis can be of immediate use to those examining artifacts from curatorial or historical perspectives. Analysis of wood joins, pigments, binding media, and the composition of metals and plant materials can substantiate documentary evidence. Use of analytical resources requires close collaboration between curator, scientist, conservator and native advisors. The paramount objective of such studies should be an understanding of the nature of an alteration within the context of the culture that produced it.

In the past, museum restorations have been retained in the belief that they were native repairs. Native repairs, on the other hand, have been concealed or even removed based on the aesthetic sensibilities of curator, conservator or museum director. Consequently, important information has been lost in efforts to make objects visually appealing or to fit within an art-historical context. In the event that it is necessary to make alterations to an ethnographic object, it is the conservator's responsibility to fully document the changes and the rationale behind them.

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2. Ibid.

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Biographical Notes

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L'interprétation d'un objet ethnographique nécessite la caractérisation de toute modification décelée pendant l'examen. En effet, les objets ont pu être modifiés à divers stades de leur histoire: pendant la fabrication, afin de corriger des imperfections inhérentes aux matériaux originaux; en cours d'usage, pour rendre l'objet plus efficace, le réparer, l'embellir ou pour qu'il serve à des fins rituelles; avant la vente; une fois intégré à une collection, afin de retarder sa détérioration ou d'améliorer son aspect. Lorsqu'on examine une modification, on doit se demander pourquoi elle a été faite, à quel moment et par qui. De tels renseignements se trouvent rarement dans les notes de recherche ou les fiches enregistrement, mais l'étude des techniques et des matériaux employés peut fournir des indices.

THE WAKAS POLE: ITS HISTORY AND CONTEXT

ANDREA LAFORET

The Wakas totem pole, first erected in the Kwakiutl village of Alert Bay around 1893, is scheduled to be restored and erected as part of the opening exhibit of the new Canadian Museum of Civilization. This paper places the pole in its historical context and traces the changes which affected the pole while it was in situ.

1.0 Introduction

During the summer of 1986 the Canadian Museum of Civilization (CMC) commissioned Ann Krahn, a private conservator in Vancouver, to conduct an inquiry into the types of paint which would have been available to a totem pole carver working in the Nimpkish village of Yilis at Alert Bay in the 1890's, and to take samples from a particular totem pole which dated from that period. This pole, commissioned by Chief Wakas before the mid-1890's, stood in front of his house in Alert Bay for over thirty years. It then stood in Stanley Park in Vancouver from the late 1920's until 1986.

In the ninety years or so that the pole had stood in the open air it had undergone many changes and had been subject to considerable wear and tear. Nearly forty years after it was erected, it was cut down, transported to Vancouver — a distance of several hundred miles — and erected on a new base. It was partly repainted, at least once, in Alert Bay, and completely repainted several times in Vancouver. In the 1960's it was sanded down and repainted and several of the most decayed parts were replaced. Each time it was repainted, the patterning of the paint grew further away from the painting executed by the original carver.

In 1986 the Canadian Museum of Civilization in cooperation with the Vancouver Board of Parks and Recreation and the Vancouver Museum inaugurated a programme to conserve and restore the pole and to prepare it for exhibit.

This project had been the subject of a lively discussion nearly four years before. Although the members of the Vancouver Board of Parks and Recreation, and many members of the museum community and the public, were very much aware that the pole was deteriorating, it was difficult to find a satisfactory and economical way to preserve it. The Canadian Museum of Civilization (at that time known as the National Museum of Man) was willing to pay for its restoration in return for the right to exhibit it. However, many people in the community were reluctant to have the pole leave the West Coast. Eventually an agreement was worked out whereby the custody of the pole would be transferred to the Vancouver Museum, while the National Museum of Man would commission a new-generation pole which would replicate in every way the original and would be erected in Stanley Park. The National Museum of Man would borrow the original pole for a term of 30 years, restore it and erect it in the Grand Hall of the new museum under construction at Parc Laurier in Hull, Quebec.

2.0 History of the Pole

Before restoration can be considered it is necessary to ask what the pole was like in its original setting. A review of the photographic evidence from Alert Bay for the period in which the pole stood there indicates that the answer to that question is complex.

For many years, while the pole was in Stanley Park, it stood in a group of poles from various parts of the Pacific coast. A very popular tourist attraction, it has been photographed for countless albums and calendars and for many people it has become a sort of generic totem pole. I have found photographs of it in a living room in a small village in the interior of British Columbia and in a kitchen in a suburb of Ottawa. To the family who owned the pole, however, its meaning was highly specific.

Chief Wakas' father belonged to the Owikeno people whose homeland was near River's Inlet; his mother belonged to the Nimpkish people. The earliest photograph in which the pole appears (see Figure 4) has an attributed date of 1888-9, but George Hunt, who lived among the Kwakiutl, recalled later in his life that it was in 1893 that Wakas announced at a potlatch held at Turnour Island that he would commission a pole to be modelled on the speaker's staff which has been in Wakas' family for generations (1). The pole was commissioned from a Mamtagle carver, Yuxwayu. As on the speaker's staff, the figures on the pole

were derived from the myth which was central, not only to Chief Wakas' family history, but also to the winter ceremonial held by all Kwakwala-speaking people and the Owikeno and other Northern Wakashan people.

2.1 Mythology

The myth concerns three brothers, the youngest of whom was called Wakas, who left their village to hunt for the being which had caused the disappearance of many of their people, including their sister. On the way they met an elderly woman who was rooted to the ground. Not sure of her power to harm them, they told her that they were going to hunt mountain goats.

The old woman warned them that they would come to several houses. The house with smoke like blood, which looked like the rainbow, was the house of *Baxbaxwalanuxsiwae*, Cannibal-at-the-North-End-of-the-World; the house with black smoke was the house of the supernatural Grizzly, who was also dangerous. The house with the white smoke was the house of the Mountain Goat. The old woman gave them four articles, a comb, a stone, a piece of cedar, and some hair-oil, and told them to use these if they needed to escape from danger.

The brothers realized that *Baxbaxwalanuxsiwae* was probably responsible for the disappearance of their friends, and when they saw the house with rainbow smoke, they went into it. There they found their sister, with a young boy, her son. The youngest brother, Wakas, had but his leg, and the child cried for some of the blood. At his sister's request, Wakas scraped some of the blood from the cut and gave it to the child, who sucked it and stopped crying. The brothers looked around the house and, to their horror, saw the bodies of their fellow villagers drying over the fire.

Pretending to play at shooting arrows out through the doorway, they left the house and began to run away. Their sister called to her husband, *Baxbaxwalanuxsiwae*, that the food which had come to visit him was escaping. As they ran, he began to catch up with them. When *Baxbaxwalanuxsiwae* was very close, Wakas threw down the comb, and a dense thicket grew up. This slowed *Baxbaxwalanuxsiwae* somewhat, but he began to catch up again. Wakas threw down the stone, and a mountain grew up. Each time *Baxbaxwalanuxsiwae* began to catch up, his way was blocked by an obstacle created by one of the articles provided by the old woman whom the brothers had met on the trail. The cedar stick became a log, which moved back and forth across *Baxbaxwalanuxsiwae's* path. The hair oil became a long, wide lake.

The brothers reached their home just ahead of *Baxbaxwalanuxsiwae* and called to their father, Nenwaqawa, to tie up the house with cedar rope. He did so and when they were inside, barred the door. *Baxbaxwalanuxsiwae* was heard on the roof, and the father called out to him to come back the next day with his wife and child.

Baxbaxwalanuxsiwae went away, and Nenwaqawa and his sons prepared for the next day. They dug a pit in the back of the house and built a fire in it, in which they put rocks to heat. They covered the pit and near it set a chief's seat, furnished with mats. They killed three dogs and took out their intestines, hiding the corpses so that *Baxbaxwalanuxsiwae* would not see them.

When *Baxbaxwalanuxsiwae* arrived with his wife and son, the three brothers were lying just inside the door, covered with the dogs' intestines. *Baxbaxwalanuxsiwae* thought they were dead, and moved to eat them, but he was stopped by Nenwaqawa, who said that it was the custom in that country to entertain guests with a story before the meal. He asked *Baxbaxwalanuxsiwae* and his family to sit on the chief's seat, and began to tell them a story. They fell asleep. When it was certain that they were all asleep, the father and the three brothers tipped *Baxbaxwalanuxsiwae* and his son into the hole with the fire and burned them to death. When they were dead, Nenwaqawa turned *Baxbaxwalanuxsiwae's* ashes into mosquitos.

Nenwaqawa's daughter, was very upset when she woke up and realized that her husband and son were dead. She explained that *Baxbaxwalanuxsiwae* had intended to pay the marriage price for her, and had intended to give Nenwaqawa, in addition to dressed skins, his Hamatsa dance and his name Cannibal-at-the-North-End-of-the-World. She also explained that Nenwaqawa's invitation to *Baxbaxwalanuxsiwae* to bring his wife and son had caused a terrible quarrel in his house, for *Baxbaxwalanuxsiwae's* household had consisted of other supernatural beings: Rich Woman, Raven-at-North-End-of-World, Crooked Beak of Haven, Hohok of the Sky, Grizzly Bear of the Door, and several others, all of whom had houses within *Baxbaxwalanuxsiwae's* house. They all had been incensed that Nenwaqawa had omitted them from his invitation. *Baxbaxwalanuxsiwae* had grown angry and

killed several of them, and he had intended to give their masks and songs to Nenwaqawa as well.

As she spoke with her parents and brothers *Baxbaxwalanuxsiwae's* wife gradually became part of their family once again. She led them back to the house of *Baxbaxwalanuxsiwae* and helped Nenwaqawa to restore life to the bodies of the other people of the village whom *Baxbaxwalanuxsiwae* had stolen. Nenwaqawa and the people took the masks and treasures that they found in *Baxbaxwalanuxsiwae's* house back to their own village, and that same night, held the first Hamatsa dance, and with it began the first winter ceremonial (2).

2.2 Imagery

The speaker's staff, and the pole which was developed from it, represent the speaker's staff used by Nenwaqawa as he told the story which lulled *Baxbaxwalanuxsiwae* to sleep. The figures of Raven, Bear, *Hohok*, Wise-One [*Nenwaqawa*], Wolf, Killerwhale and Thundermaker are at least partly inspired by the myth.

Raven, *Hohok* and Grizzly Bear lived in the house of *Baxbaxwalanuxsiwae*; *Nenwaqawa* or Wise-One was the young men's father. Wolf, Killerwhale and Thunderbird were among the supernatural beings who assisted ancestors of the Kwakiutl.

2.3 Documentary Evidence

The house of Chief Wakas was located at the south end of the Nimpkish village at Alert Bay. The principal Nimpkish village was located on the Nimpkish River on northern Vancouver Island, not far away. The growth of Alert Bay was the result of measures which the Nimpkish and other Kwakwala-speaking people took to adapt to changes which occurred in their economy during the nineteenth century. A cannery was established at Alert Bay in 1881. In the years that followed Alert Bay became a centre of commerce and population for Kwakiutl people from many villages.

An enduring image of Chief Wakas's house was captured in a photograph taken by Harlan Smith, an archaeologist then working for the American Museum of Natural History, in 1909 (Figure 1). The house has a facade of tongue-and-groove boards, painted white, with a dark border around the perimeter. The pole is at the centre. The bottom figure of the pole is a Raven with a large beak, estimated to have been nine feet long, stretching out toward the village walkway. The figure is completed by a painting of the body, tail, and feet of the Raven which stretches away from the pole across the facade of the house. A narrow rectangular doorway has been cut in the facade to the right of the pole. At the edge of the porch in front of the house is a triangular stone with a painted face. This pictograph is to be seen in the earliest photographs of the house, and remained with the house while it was standing. At the time Smith took this photograph the pole had stood in the village for sixteen years. In that time the house and the village had undergone significant changes.



Figure 1. Chief Wakas' house, Alert Bay. H.I. Smith, 1909. American Museum of Natural History 46014.

There are at least twenty-five photographs of Alert Bay which show Chief Wakas' house, many of them with dates which appear to have been rather casually attributed. Certain of the photographers, for example Harlan Smith and C.F. Newcombe, provide documentation which dates their own photographs and assists with dating others that are clearly of the same period. Some of the photographs reproduced here cannot be reliably placed in a particular year, but the

general sequence is clear and together the photographs show several distinct phases in the development of both the village and pole.

A photograph taken by Maynard at Alert Bay in 1870 (Figure 2) shows a row of houses facing the beach. They were gabled houses of broad hand-hewn cedar planks cladding a framework of massive cedar posts and beams. With a couple of exceptions the house facades were constructed in the old southern coast style: horizontal planks held in place between slender poles and secured with withes. The exceptional houses had facades of milled boards set perpendicular to the ground. These facades were painted with designs representing the family crests of the owners.



Figure 2. Alert Bay ca 1870. Maynard. PABC

Within fifteen years, the appearance of the village had changed considerably. Figure 3, apparently taken by Dossetter in 1881, is a panoramic view of the village, showing the edge of the industrial area at the south and the mission in the north. The village itself is a series



Figure 3. Alert Bay. Dossetter. AMNH 42271.

of houses, each of them with a gabled roof and a facade of vertical planks. There are flag poles, but a plain pole surmounted by a single carved figure at the north end of the village, and another similar one which may stand at the south end, are the only carvings similar to totem poles. The facades of the houses appear to be painted or whitewashed. Many of the houses have geometric motifs painted in darker colours around the mouldings of the facades. Two have large paintings occupying the facades themselves.

The site later occupied by Chief Wakas' house appears in this picture to be occupied by a large two-storey structure with a steeply pitched roof. This building may have belonged to the Nimpkish village but the steep pitch of the roof and the manner in which the roof boards are placed made it unlikely.

By the time Wakas' pole was first recorded on film, the house front paintings had faded, and the mission building at the north end of the village had acquired a steeple. However, the configuration of the village was much the same as it had been during Dossetter's visit. Figure 4 shows the Wakas house at the far right and at least ten other houses stretching down the water front.



Figure 4. N.B. Miller. Smithsonian Institution. 56, 438.

The pole appears to be new. A ladder stretches from the back of the house to the upper figures of the pole and rests against one of a series of boards which are attached to the back of the upper figures, apparently for additional support. The mouth of the lower figure, without the beak which was later added, appears to be the only entrance.

This photograph appears to have been taken in May. Strips of cedar bark are drying on the porch area outside the house. What may be a pelt stretched on a frame rests against the wall of the house. The facade rests on an embankment or porch which is reinforced at its outer edge with a hand-split plank.

At this time the Wakas house appears to have the most elaborate facade of any of the houses in Alert Bay. The other houses remain as they were before, with facades of vertical planks, but the house front paintings and the geometric decoration along the mouldings appear to have faded away. The facade planks are often in two sections, an upper and a lower. The doors are rectangular, framed with narrow boards. There are several flag poles and two carvings of birds, one on a plain pole, another simply resting on the roof peak of a house. There seems, however, to be only one other pole, which can be discerned near the north end of the street.

The photograph in Figure 5 appears to have been taken at the same time. The ladder and narrow planks are still in place. A man and woman stand in front of the pole, indicating the scale of the house and particularly of the doorway through the pole.

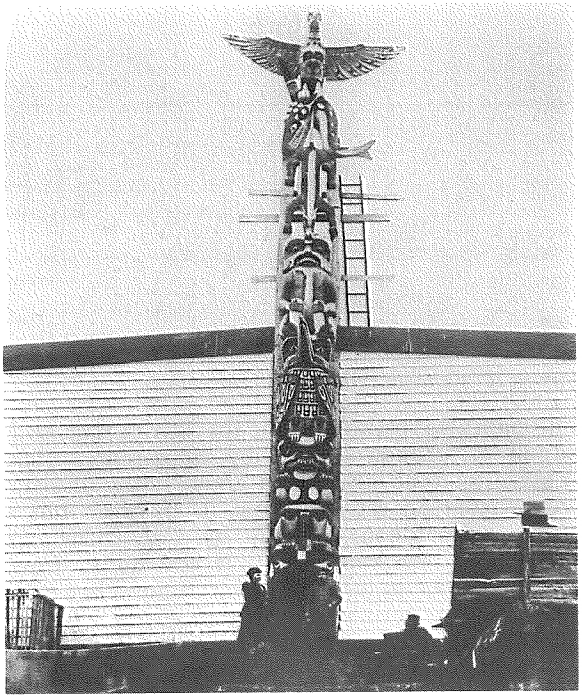

Figure 5. Suzzalo Library, U. of Washington.

The period represented by Figures 6 and 7 is apparently the late 1890's. The beak has been added to the lower figure, its scale illustrated dramatically by the person sitting in it. The beak was created by Dick Price (3). The upper portion is the prow of a canoe. The lower portion was carved to fit. There is now a small rectangular door cut into the facade to one side of the beak.

The house immediately to the north of Wakas' house now has a facade of milled lumber, taller than the facade of the Wakas house. The planks are neither vertical nor horizontal but arranged in three orientations. There is a narrow rectangular door and arranged above the door three narrow rectangular windows.

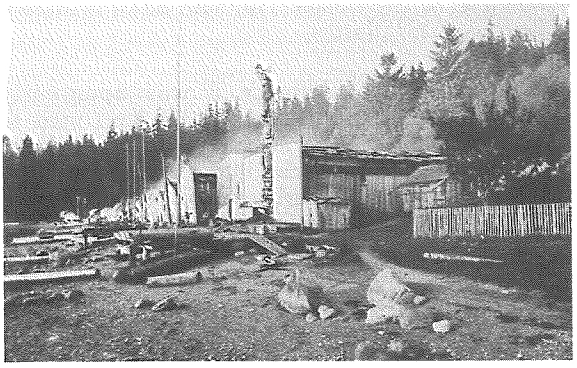

Figure 6. Alert Bay, general view. A.J. Brabazon, International Boundary Commission. Public Archives of Canada. PA 37738.

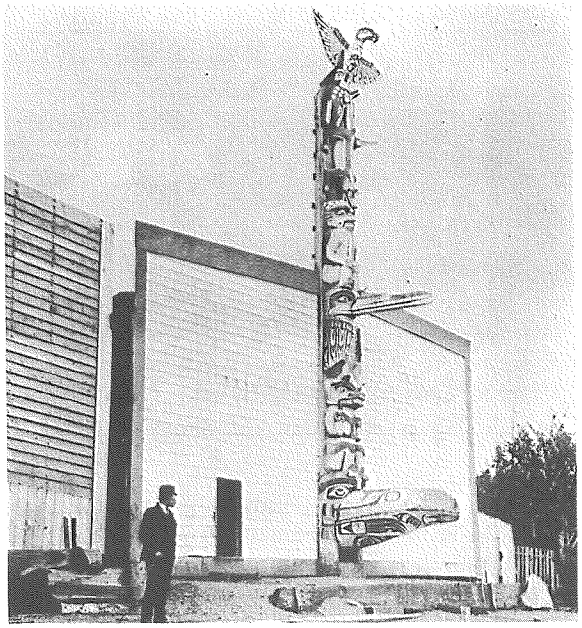

Figure 7. No documentation.

The house beyond has a carving of a bird on the peak of the facade and beside it a narrow pole topped with a carving of a broken copper. At the far end of the village is a pole with several carved figures, the top one a figure with outstretched wings.

In Figure 7 the detailed painting of the beak can be seen clearly. The planks reinforcing the upper figures of the pole have been cut off, their edges now conforming to the edges of the pole. The rectangular doorway in the facade can be seen clearly. The porch is evidently of earth, and a sloping pathway leads down to the main pathway through the village, which is also of earth. One roof support can be seen jutting through the north wall of the house. The wall itself is shown to be of vertical planks.

The photograph in Figure 8 was apparently taken by Harlan Smith during his first visit to Alert Bay in 1898. In general aspect the village remains much the same but changes are apparent. The round aperture in the side of the house, which can be seen in Figure 6, has been replaced with a rectangular window and a new shed has been built at the side. The facade of the house next door to Wakas' has been whitewashed or painted. The bird, broken copper and human figure carvings once associated with the house beyond are no longer there.



Figure 8. View of Alert Bay. H.I. Smith 1898. AMNH 42966.

New developments have appeared near the north end of the village. A bird with outstretched wings sits on a plain pole. Farther down is the frame of a new house or house facade and in front of this is a tall pole with a carving of a copper part way up.



Figure 9. Alert Bay. September 1900. PAC 16938.

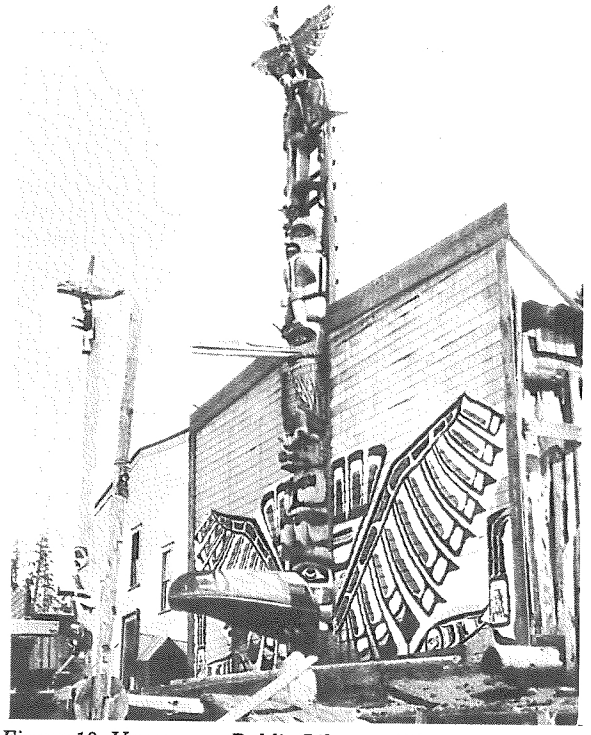

Figure 10. Vancouver Public Library. 4909.

The painting of the body of the Raven had been added to Wakas' house by September, 1900 (Figure 9). Bold assertions about dates like the one written on the print can be in error, but a photograph taken in 1901 by C.F. Newcome (BCPM E 143) confirms that the house front painting was in place at that time. This may have been a realization of the painting, Body of the Raven, which, according to the myth, was the painting on the front of the house of Raven-at-North-End-of-World in the house of *Baxbaxwalanuxsiwae.*

Apparently in conjunction with the addition of the house front painting, the painting on the beak appears to have been simplified. This is even more clearly evident in Figure 10 (VPL 4909) apparently taken within the first few years following the turn of the century. The major change apparent in this photograph is to the house next door to Wakas', which now has a full-scale pole in front.

Considerable change occurred in Alert Bay between 1900 and 1909. In Figure 11, a companion photograph to Figure 1, a flagpole is attached to the back of Chief Wakas' pole, projecting far above the top figure. The beak is either darkened, in shadow or has been repainted. Wooden steps with a railing at one side now lead from the porch area of the house to the village path. The rock still sits at the edge of the porch, the face on it made clearly visible with paint. Steps lead down from the pathway to the beach. The platform built over the beach now has a shingled roof. There are carved poles in front of both houses to the north and the second house down now has a facade of milled lumber and a sign with white lettering over the door.

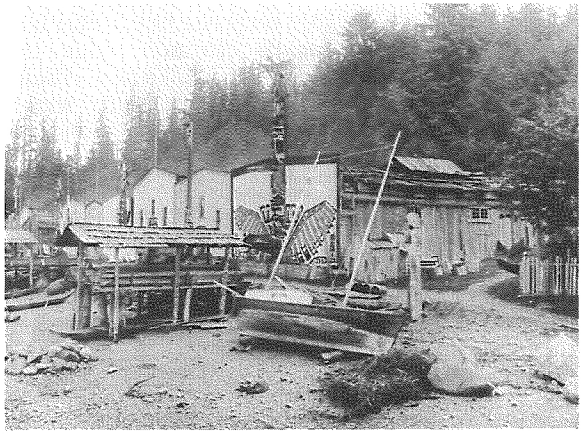

Figure 11. Alert Bay, B.C. H.I. Smith, 1909. American Museum of Natural History 46012.

Carved poles can be seen in profile at the north end of the village. To the south of the Wakas house, facing the north end, stands a carved wooden figure. There are canoes in the village still, but a two-masted fishing boat lies beached near the potlatch platform in front of Wakas' house.

Figure 12, taken in 1911, is one of the few photographs taken when the tide was relatively high. The steps leading down from the village path to the beach can be clearly seen. Several docks or platforms are roofed over.



Figure 12. Alert Bay village, B.C. 1911. British Columbia Provincial Museum Pn 504.

Washing hangs on the line beside the Wakas house. Something that looks like a wind sock seems to be attached to the flagpole above the frontal pole. The tall pole with the Thunderbird as the uppermost figure and the pair of Thunderbird carvings which are illustrated in Barbeau (4) are clearly visible.

In Figures 13 and 14 the time has shifted again. These photographs may have been taken as part of the ethnographic film work which Harlan Smith carried out on the coast during the 1920's.

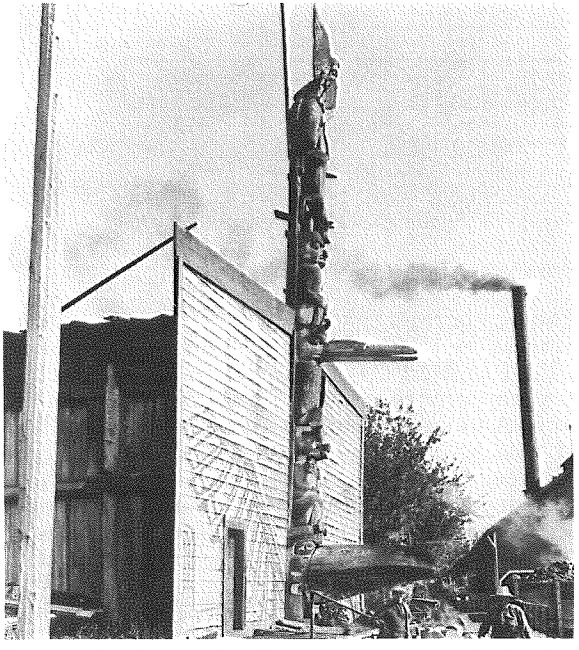

Figure 13. National Film Board, ca 1920. Public Archives of Canada c-47368.

The rectangular doorway is now framed with planks and the doorway itself recessed. The porch immediately in front of the rectangular doorway is sheathed with planks set at right angles to the line of the house. The painting on the beak of the pole has faded, and the head of the topmost bird figure is missing. Figure 14 shows an enduring feature: the rock with its painted face still sits against the porch.

There are changes to be seen in the village at large. Hydro wires run through the village above the pathway. The village pathway is no longer of earth, but paved with planks set horizontally by one house, vertically by the next. The house immediately to the north of Wakas' house has disappeared, and the pole associated with it has gone, too. In front of the site is a plain pole surmounted by a bird holding a copper in its claws. The next house is still there, with its pole, but it has a bay window in its facade, which contrasts with the hand-split vertical boards of the walls.

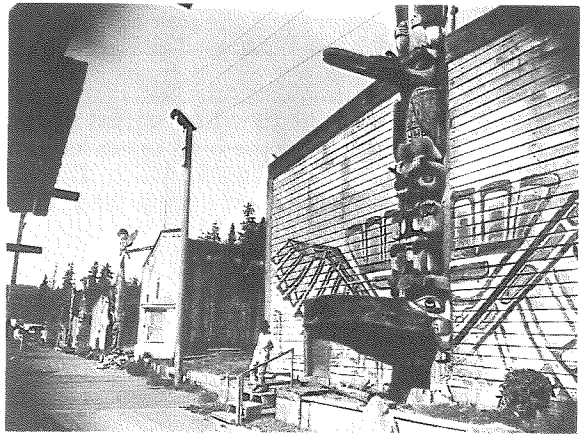

Figure 14. Public Archives of Canada C-47359.

3.0 Conclusions

The photograph taken by Dossetter at the beginning of the 1880's (Figure 3) shows the Nimpkish village at Alert Bay as similar in house structure and appearance to other Kwakiutl villages of the time. Although a few carvings exist in the village at this period there are no poles with multiple images. Two houses have major house front paintings and others have facades of vertical planks, with rectangular doorways in the centre, and mouldings around the edge decorated with geometric motifs.

A decade later the Wakas house shows two innovations: a facade of milled boards set horizontally, and a frontal pole carved with multiple images, with the mouth of the bottom figure serving as the doorway to the house. Before this the principal media for presenting ancestral crests in large format had been the house front paintings and the carved columns which held up the roof beams of houses. Although Chief Wakas' pole was not the first exterior pole with multiple images to be erected in a Kwakiutl village, it was one of the first to be erected in Alert Bay.

The changes can be seen as a manifestation of the influence generally exerted by northern style on the architecture of the southern coast, but the pole and house front painting are, in content and sculptural style, entirely within the framework of Kwakiutl artistic expression. Within a short time, Alert Bay had begun to change. By the mid-1890's facades of milled lumber were being added to other houses, and there were at least three poles with multiple images in the village.

The major changes were effected between 1900 and 1910. In the photographs taken in 1909 poles can be seen in profile at the north end of the village and a free-standing carved wooden figure stands at the north end, facing the length of the village pathway. By 1911 only one house still had the vertical plank facade common when the Wakas pole was new. By the 1920's the village had hydro wires and the public pathway was a sidewalk sheathed with planking set in a distinctive pattern.

Throughout the period between 1890 and 1920 houses were modified so that their outward appearance became more similar to that of European houses. Windows were introduced, doorways were framed, and even sheds came to have a different appearance. By the 1920's one house had a bay window in the facade.

Within the same period Chief Wakas' house and pole also changed. The large beak which was added to the pole within a few years of its erection both completed the pole and altered the bottom figure. It also altered the house, for although the beak could open and close, it was no longer possible to go in and out easily. A rectangular doorway was cut in the facade and over the years this was framed and recessed. The house front painting of the body of the Raven, added by 1900, covered this doorway, and completed the figure at the base in a different way. The complex painting on the top and sides of the beak, which may have been the elements of the Raven's body, was altered. By 1909 the painting on the beak had been simplified even more. The

face painted on the underside of the beak remained throughout this period. In all of the photographs the rock with the painted face can be seen set against the edge of the porch of the house, as much a part of the house as the pole and the house front painting.

There were flag poles in Alert Bay even in the early days. By 1909 the Wakas pole itself supported a flag pole and, slightly later, something that looks remarkably like a wind sock.

One of the last photographs taken of the house while it still stood in Alert Bay (see Figure 13) shows the topmost thunderbird figure without a head. Whether the original head was lost or just temporarily separated from the figure is not clear. By the time the pole was erected in Stanley Park, the thunderbird figure had a head once again.

The pole continued to change while it was in Stanley Park. In the course of routine maintenance as a feature of the park it was repainted several times, and the elements of the painting came to be only distantly related to the original. Major changes were made in the 1960's, when the pole was sanded and repainted and the thunderbird, the beak of the *hohok* and the beak of the Raven figure, which were considered to be decayed past the point of salvage, were replaced. The carver of the new pieces was Doug Cranmer.

Even at that time people who knew the pole well were reluctant to see any part of it thrown away. Three of the discarded parts, the thunderbird's head, the face that was the abdomen of the original thunderbird, and the beak of the *hohok* were rescued. The belly of the thunderbird is now in the University of British Columbia Museum of Anthropology. The thunderbird's head is in private hands and the beak of the *hohok* has not yet been located.

Both the belly and head of the old thunderbird served as sources of information about original paints. The thunderbird's head came into use in another, unexpected way. In the summer of 1986 the head of the thunderbird carved in 1966 disappeared from Stanley Park. The old head was ultimately used as a model for the head on the new-generation pole.

As we study the photographs with techniques for enhancing images and search through the early records of Alert Bay we will undoubtedly learn more about the pole. However, there is no simple answer to the deceptively simple question, "What was the pole like in its original setting?" In every decade since Wakas decided to transform his speaker's staff into a pole that would synthesise his house and his family history the pole has changed, and the changes have reflected the social reality of which the pole was a part.

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2. Boas, Franz, **Ethnology of the Kwakiutl**, Bureau of American Ethnology 35th Annual Report, II, 1913 - 1914 (1921) pp. 1222-1248.

3. Cranmer, Doug, personal communication to author.

4. Barbeau, *op cit* Plate 413.

Le mât totémique Wakas qui a été dressé pour la première fois dans le village kwakiutl d'Alert Bay vers 1893, doit être restauré et installé pour l'inauguration du nouveau Musée canadien des civilisations. Cette communication replace le mât dans son contexte historique et explique les changements qu'il a subis lorsqu'il était à l'emplacement où il fut érigé, à Alert Bay.

FIELD RESEARCH IN THE CONSERVATION OF ETHNOLOGICAL COLLECTIONS: AN ECOLOGICAL APPROACH APPLIED TO POLYCHROME MONUMENTAL SCULPTURE

A. HOWATT-KRAHN

This paper discusses methods for field research and analysis of ethnological collections. A case study of preparatory research for the reproduction of the polychrome Kwakiutl pole, commissioned by Chief Wakas, of Alert Bay, British Columbia, at the close of the 19th century is presented. The original pole, although considerably altered, was available for study, and the objective was to produce a reproduction which would accurately represent the technology and aesthetics which had been applied to the original decoration. Investigative techniques included the following: examination of photographic materials and curatorial consultation, paint sampling, paint analysis, research of literature on sources and types of paint materials available in the period 1880-1890 in British Columbia, interviews and collection reviews. The conclusion presents the results of this investigation and considers the broader implications for the evolution of native art and artifacts in response to the environmental influences of industry, technology and the museum. The author discusses methodology in the process of field research in conservation and suggests further applications for investigative conservation in support of native North American collections.

1.0 Introduction

Carved in red cedar from the Pacific Northwest Coast of Canada, the Wakas Pole, a monumental Kwakiutl sculpture, was the subject of an interdisciplinary investigation of 19th century painting materials and design. This paper selects for discussion the conservation field research component of the project, as distinct from, but complementary to, the laboratory analysis. This applied conservation study introduces an ecological approach to material culture research in conservation as a framework for integrating and interpreting the findings of field studies. Rather than detailing the specific results for individual paint samples, the author respectfully directs such inquiries to the research reports of curatorial (1), laboratory (2) and conservation field studies (3). The following case history emphasizes some of the resources available to the conservation researcher with selected examples face painted on the underside of the beak remained throughout this period. In all of the photographs the rock with the painted face can be seen set against the edge of actual findings to illustrate the potential for artifact studies in taking an ecological approach; namely, to study an artifact in relation to its environment, including not only geographical location, but also its historical and cultural contexts.

2.0 Historical Profile

Commissioned by Chief Wakas of Alert Bay, British Columbia, this 40 foot totem pole (Wakas I) had been carved from western red cedar (*Thuja plicata*) and is estimated to have been first painted in the 1880's (1). This pole had been installed outdoors for the better part of a century, including approximately 50 years of exhibition in Stanley Park, Vancouver. While displayed in Stanley Park the pole had been wire-brushed, belt-sanded, repainted and restored with the addition of various replacement parts. Prior to this, photographic records indicate that it had been repainted at least once in Alert Bay.

3.0 Objectives and Scope of Research

The objective of the author's conservation field research was to provide research support for the accurate replication of the painted decoration of the Wakas Pole. Doug Cranmer, master Kwakiutl carver and descendent of Chief Wakas, was commissioned to carve a replica of the original pole, which subsequently was termed the second generation Wakas Pole.

Preliminary curatorial research by Dr. Andrea Laforêt of the Canadian Ethnology Service revealed some of its earlier history and modifications in Alert Bay, as well as its transfer from Kwakiutl ownership to that of Vancouver's civic agencies (1). Laboratory analysis of paint samples was conducted by Judi Miller of the Canadian Conservation Institute (National Museums of Canada).

In order to determine the colours and gloss of the original paints, the author was charged with the following tasks, as quoted from NMC's research contract:

1. Researching the history of composition of paints available in the 1890's.
2. Researching the marketing, distribution and use of paints in the 1890's.
3. Carrying out a survey of paint distributors working in British Columbia or the San Francisco area in the 1880's and 1890's.
4. Researching companies, especially BAPCO and International, through Provincial Directories or Archives of British Columbia and Victoria during the years of 1880 and 1890.
5. Removal of samples of paints embedded in deep cracks in the original Wakas Totem Pole.
6. Showing comparisons between glossy or matte paints used in 1890's to modern paints used today, by detailing graduations between glossy and matte using colour charts.
7. Accumulate paint colour charts (three copies of each) from various suppliers in British Columbia, currently available, with particular attention paid to alkyd paints.

4.0 Applied Conservation Research — An Ecological Approach

Since the ethnographic record established a specific provenance and time period for the pole, it appeared that research of the original materials of the painted design would benefit from analysis of the production of the Wakas Pole in its ecological context, that is, in relation to the influences of climate, geography, population dynamics and commerce. Such factors have been demonstrated to affect the availability, selection and behaviour of materials. Also to be considered were the specific aesthetic conventions of the Kwakiutl. The personal style or training of the carver or the resources or preferences of one patron could also affect the choice of paint or method of application. Finally, paint modifications depended directly on the properties of the materials incorporated in the sculpture and their responses to their situation, either singly or in combination. For example, the properties of Western Red Cedar and those of directly applied pigments and binders are known to affect the preservation of paint; in this case those same factors could influence the retrieval and interpretation of material evidence as an indication of paint type and colour scheme. A final, but easily overlooked factor, is the scale of the object itself. When balancing resources, such as paint supplies and working time, scale is an important influence in determining materials costs and schedules for both the carving team and the supporting patron.

With so many variables, and the constraints of a rather compressed research schedule, it was important from the outset to maintain a flexible approach and realistic expectations. One could not necessarily expect to find many absolute answers, but rather a base of data from which to draw informed choices.

Conservators of anthropological collections often stress the importance of maintaining the physical integrity of an object as material evidence of history, culture and environment. To unravel the decoration of the Wakas Pole, it was necessary to test that process in reverse. The materials of the original pole had been rigorously modified and replacement parts were often not recorded. It was therefore necessary to reconstruct the options for the paint based on materials conservation research for the period of production. To this end, investigative techniques included the following: examination of historical images as evidence; paint sampling for analysis; literature and document surveys; interviews in the area of materials studies; and collection surveys.

Given its location on Cormorant Island, between Victoria and Alaska, in the rain forest of the Pacific Northwest Coast, Alert Bay and its monumental poles attracted many photographers and artists. Consequently there are several early paintings and photographs of the pole *in situ* in Alert Bay and in subsequent environments. These historical images also suggest its original painted design elements, carved surface features and state of preservation.

5.0 Examination of Early Photographs

Historic photographs recorded the pole facing south, and confronting visitors approaching the village by water. Unlike wood in interior or smoky environments, the Wakas Pole was exposed to direct sunlight as well as marine aerosols which are known to reduce paint gloss. In addition, its close proximity to water intensified light levels due to reflected sunlight. This would have increased the rate of discoloration and deterioration of both the wood surface and the paint. The storms, squalls, fog, rain and Nimpkish winds reported by Doug Cranmer (4) would also have contributed to the loosening of joins and the leaching from the wood of water-soluble extractives, including certain natural dyes and biocides. In such circumstances, one can expect a lightening

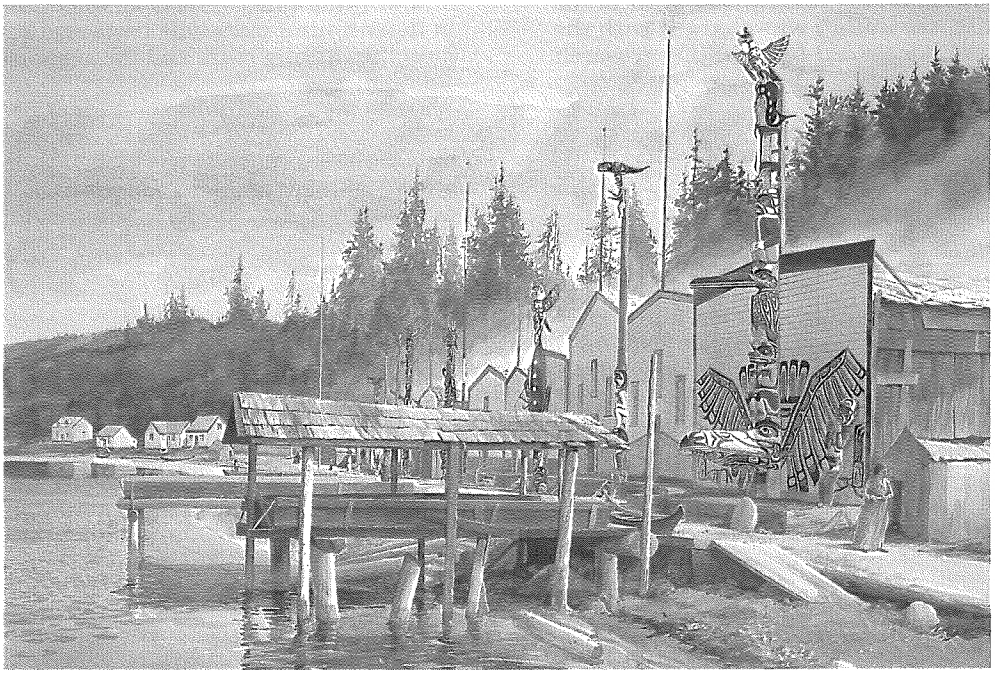

Figure 1. Alert Bay circa 1905. From a painting by Gordon J. Miller.

of the cedar from red-brown to silver, and often the development of yellowish to red-brown tints in adjacent paints. Because of this characteristic bleaching and leaching in cedar, colour variations in the pole, as recorded in black and white photographs, must be carefully examined. Often whitish areas, which resemble traces of white paint, are actually bare, unpainted wood.

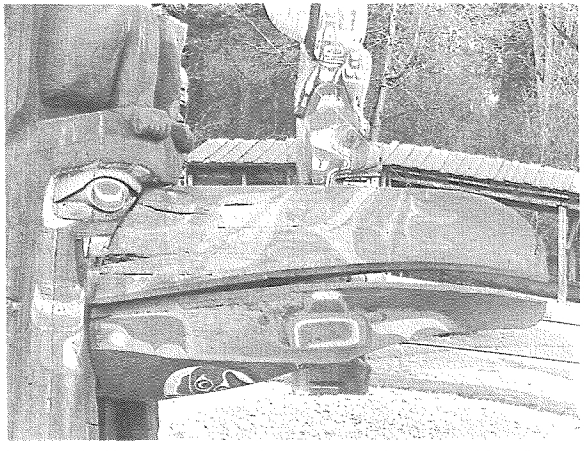

Figure 2. Parallel, carved ridges in lower half of beak, in eyebrow and in thigh of bear, above, indicate early surface decoration of the Wakas Pole obliterated by later "restoration". Photo: Vancouver Public Library, No. 8080 (detail).

Photographic enlargements of sections of the pole helped to resolve this question. Others confirmed the presence of subtle surface treatments such as d-adzing (shallow waves of surface carving) which had been removed as a result of previous belt-sanding in preparation for repainting by the park maintenance crews (Figure 2).

In addition to surface modifications, historic photographs documented changes to both design and structure, thereby assisting in the planning of paint sampling. This, in turn, had a bearing on not only paint selection for the second generation Pole, but directly related to planning future conservation treatment of the original.

Photographs were examined for changes in the angle of joined sections (such as the eagle's head) in relation to the vertical mass of the pole. The weight of these projections and the compression of the joining members, as well as the buffeting of wind and the invasion of biological agents caused mechanical failures and losses which were often recorded unintentionally in historical images. By anticipating such changes and identifying replacement parts, or repainted areas, one can ensure more relevant paint sampling and informed analysis of samples.

Awareness of environment, combined with photo-

graphic records, could alert the researcher to variations in the condition of both wood and paint throughout the pole. Indeed, dated photographs confirmed that it took months or years to complete parts of the Wakas Pole (1). Given these intervals, variations in surface erosion and paint types, even in one colour category such as green, could also be expected from one part of the pole to another. Such variations may be critical factors when planning conservation operations such as consolidation of original paint or removal of overpaint. Predictions regarding the behaviour of any given type of paint cannot be based on qualitative laboratory analysis alone, particularly when the medium may be only generally identified.

There are limitations, of course, to interpreting photographs and other image documents such as paintings. One example of the latter, a 1910 oil painting of the Wakas Pole by Emily Carr, (in the Vancouver Art Gallery), exhibits considerable artistic licence in the colouring of the pole, as do many hand-tinted postcards of this subject. Historic photographs, particularly in black and white, can also be misleading for interpretation of colours. This ambiguity is due in part to the varying sensitivities of photographic materials (5).

One of the most promising developments to arise from this photographic research was the application of image enhancement, using a computer to manipulate historic images in order to retrieve materials and design information. This is being explored with Dr. Robert Woodham, of the Department of Computer Science, University of British Columbia, using a negative of the Wakas Pole provided by the British Columbia Provincial Museum. The importance of preserving original negatives cannot be over emphasized. These usually retain far more detail than that which can be retrieved from their printed images. In some cases these negatives are all that remain to identify or describe indigenous objects.

6.0 Examination of Paint and Pigments

6.1 Paint Sampling

Paint samples were obtained from various components of the pole. The author sampled the main body in British Columbia and samples were also taken by others from two sections of the pole which had become separated and were eventually relocated in two different museums.

The objective was to locate and identify traces of the original paints used to colour the first designs and figures, and to reproduce those colours and gloss in the second generation Pole. As a reference, and to expand the number of paint samples for testing, a selection of twelve Kwakiutl artifacts dating from the same general period was provided by Dr. Laforêt for CCI to use in a comparative colour analysis. To do justice to this research, one is advised to consult the full analytical research report (2).

As field researcher, the author concentrated on taking samples from the pole. The condition of the samples and ease of access for sampling varied according to the contours of the sculpture. Collecting was done in two stages. The samples were numbered and recorded against black and white photographs. Notations were made against the numbers to relate information regarding grain or special features. The first set of samples was used as a test run to ensure that the technique was appropriate for CCI's analytical purposes. The second set completed this general sampling and was collected from areas indicated to be original by early photographic records.

Selection and extraction of paint samples were also assisted by magnification, using Zeiss (4x) surgical loupes. Fortunately, the large scale of the Wakas Pole relative to the sample size made it possible to take more generous samples than would have been possible in other circumstances. This was particularly helpful in deteriorated areas and where heavy layers of overpaint had accumulated.

Samples were taken from the Pole in the field with a Japanese micro-chisel, which has a crescent-shaped blade approximately 3 mm across and 1 mm deep. This curve in the blade made it possible to extract the paint sample through several layers of overpaint with minimum removal of wood. The inclusion of some wood in the sample established orientation of the base layer of paint. Although the paint layers were weak in many areas, field consolidation was considered inadvisable due to potential contamination of the sample.

6.2 Paint Analysis

Paint samples were analysed by CCI using the following techniques, either singly or in combination: Fourier Transform Infrared Spectroscopy (FTR), X-ray Energy Spectrometry (XES) and polarized light microscopy (PLM).

To expedite colour matching, and to develop a palette which could then be recommended as appropriate colours for "reproduction paints" for the second generation Pole, CCI visually matched each of the main colours of the twelve museum artifacts to the appropriate colour co-ordinates in the **Munsell Book of Colour**. (These coordinates give numerical values to hue, value and chroma). A visual comparison was then made in the laboratory between the colours in these ranges and corresponding colours detected as first layers among 200 samples taken from the Wakas Pole. The laboratory examination was conducted while conservation field research continued.

6.3 Commercial and Native Paints

Paint is defined here as a compound containing powdered colours (pigments) in a liquid (binder, medium, carrier or vehicle). In commercial paints, which were made according to Euro-American formulae, extenders were also added to provide consistency of application and durability. Adulterants too were added to extend paints.

Native paints will be defined here as mixtures which were mainly developed by indigenous North Americans and are composed either entirely or in part of either pigments or media which have their sources in North America. These materials may be naturally occurring organic or inorganic substances, which undergo little or extensive modification using native processing methods. For example, burnt clam shell and fish oils may be one combination for producing a white paint. Non-native substances may also be included in mixtures of which the other major components are considered traditional native material. For example, imported Chinese vermilion or Reckett's blue laundry powder mixed with processed (i.e. chewed or ground) salmon roe are reported to have been more commonly used as paint by native peoples than by settlers, and will be considered here as native paints. Again, future research in the areas of native mining and trade (6), as well as examination of pigments such as cinnabar for trace elements, may reveal North American sources for pigments which are now assumed to have been imported (7).

Whereas native paints were increasingly replaced by commercially manufactured paints, it is possible in the case of the Wakas Pole, that some of the original paints in sum or in part were of native manufacture. Indeed, it is the author's opinion that more research is advisable in the broader subject of native paints and their properties.

6.4 Interpretation of Samples

The conservation examination of Wakas I and research into local technology signalled variables which could influence the interpretation of paint samples in respect of: medium, pigments, sequence of colour and artist's technique.

6.4.1. Medium

Opportunities for protein contamination of samples by invading organisms were noted as a result of field observations of deposited animal and insect remains and the deteriorated state of the wood. Native or locally available fish oils may have been mixed with imported or domestic commercial vegetable oils in ready-mixed marine or house paints in order to either stretch a fresh paint or dilute an old thickened paint. Commercial paint of European or North American manufacture may have incorporated local or domestic fish oils, or corn oils at the time of manufacture. In fact the use of local fish oil by one Vancouver paint firm was confirmed as late as 1917 (8). Subsequent laboratory analysis did reveal some mixture of protein and ester in a single sample, but analysis for specific types of protein or oil was beyond the scope of this project.

6.4.2. Pigments

Native pigments could have been mixed with a commercial paint base or varnish, especially as paint components were sold as separate commodities along with the less popular "ready-mixed" paints of the period (9). The very scale of this pole makes the oft-quoted "chewed salmon-egg technique" less likely than the ground egg method or the use of fish oils which are also suggested in some references (10).

6.4.3. Sequence of Colour

Selective natural erosion of some paints could have removed earlier traces of colour, such as a weakly bound paint or water soluble lime-wash. Eroded or lightly bound paints may have permitted the deeper penetration of more readily absorbed paint mixtures. Also, aggressive maintenance techniques, such as sanding, had exposed fresh wood surfaces which were then painted over. Subsequent analysis confirmed that there were in fact several cases where it was not possible to establish colour sequence with any certainty based on laboratory analysis alone.

Finally, it was not clear whether all parts sampled were contemporary with each other. For

example, records could not be confirmed to establish the date of the eagle's head, and during the period when the Pole was in Stanley Park, restoration methods and replacement parts had not been documented.

6.4.4. Artists' Techniques

The variables introduced by artists' techniques must also be considered when using the stratification of paint layers to determine original colour areas. The painting methods of indigenous artists have varied individually and were adapted to suit certain circumstances. There may be differences in technique according to not only the period and location of artistic production, but also in accordance with the individual artist's development, and in some cases, according to the type of object and its use. For example, monumental Kwakiutl poles do not appear to have been commonly repainted until about 1940 (11), whereas it does not appear so unusual for masks to have been refurbished for Kwakiutl winter ceremonials.

One example of variation in technique can be seen in the work of Kwakiutl carver, Mungo Martin (1881 to 1962). He applied white paint within the incised outlines of features on the large house posts seen in Figure 3. In the process he painted beyond the carved boundaries of the lines with white paint. He later covered up the excess white paint to the edge of the incised line with the colour used to fill the adjacent feature (12). Thus, a paint sample taken in an area of overlap could give the mistaken impression that since white was the first colour applied to the wood, the figure had either been painted white overall originally or it had received a general base-coat of white to seal the wood.

Later, when a highly polished finish was preferred, Martin did in fact apply an overall undercoat of white. As a base coat, this prevented extractives from penetrating over-paint, provided a smoother surface to facilitate painting and achieved a higher gloss in the finishing coat (Figure 4). One of Willie Seaweed's earliest cannibal-bird (Hamatsa) masks (Rising Top, carved c. 1910, B.C.P.M. No. 1917) retains only faint traces of thin white paint over large areas. However, approximately ten years later, he was using commercial oil-based enamel which produced a tougher and glossier paint layer. Certain of his design elements in standard features, such as eyes, also changed according to the character portrayed in the carving (13).



Figure 3. Proper right half of pole shows excess white paint lapped over edges of incised lines; white is later covered with black. Artist, Mungo Martin. Photo: Tourism B.C. and compliments of Phil Nuytten.

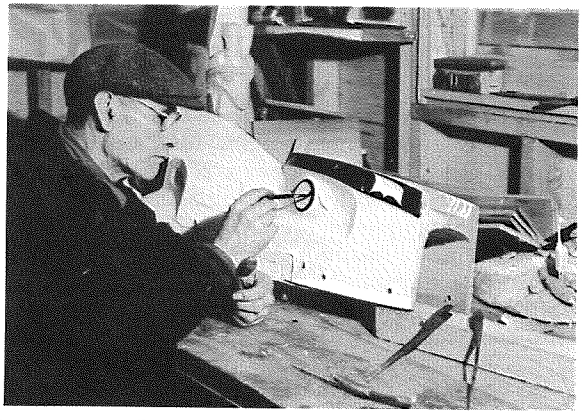

Figure 4. Artists adapt techniques according to individual carvings, category or scale of object, or as a consequence of evolving style. Here the same artist, Mungo Martin, paints over a general base coat of white. Photo: B.C.P.M. No. PN 13328.

As Bill Holm, a respected authority on Pacific Northwest Coast design, reminds us, an object does not exist in static isolation; one must consider the maker:

> All artists within such a (art) tradition share certain aesthetic biases. They all choose to do some things in similar ways, making their work recognizable as part of that tradition. At the same time, many choose, perhaps unconsciously, to do other things differently, thus making their work individually distinct (14).

He goes on to distinguish additional variations specific to different time periods and geographical sites of Kwakiutl artistic activity. These subtle differences, manifested in material culture, and in the absence of written documentation, give form to concepts which must be respected in research.

Generalizations regarding the types of paint and formal elements employed by Pacific Northwest Coast native artists can only be applied with caution when planning a replica of a specific polychrome object.

6.4.5. Colour Interpretation and Matching Through Visual Inspection

Reconstruction of design and colour, rather than being based on visual inspection of original samples alone, is best achieved by reference to other research sources such as written descriptions and commercial paint samples of the period.

This is particularly true if colour assessment is based on small samples from a pole in a marine setting where paint is likely to be discoloured and weathered to a flatter finish. Identification of pigments and media can be extremely important in attempts to reconstruct original colours and texture. This is particularly true where an identified pigment or medium is known to be unstable in certain conditions.

This combined approach to investigating paints is of particular relevance to highly coloured Kwakiutl art. Characteristic of the Kwakiutl palette are many varieties of deep green. Often green was made by mixing different pigments which theoretically have the potential for preferential fading of one pigment over the other.

For example, if the green were produced from a combination of blue and yellow colourants, a light-sensitive yellow might fade more quickly than a stable blue, causing a colour shift in favour of the less mutable pigment. (In fact, this was also observed in the field). In other mixtures, say a stable pigment in a light-sensitive medium, such as certain oils, the medium might darken, adding another colour element or altering the optical properties. For example, Reckett's laundry bluing mixed with certain animal or vegetable oils will darken whereas, when applied with water as a carrier it dries light, but is poorly bound. Also, western red cedar extractives are known to stain many paints (15). As potential sources of hydrogen sulphide, the lumber mill introduced in 1886 or decomposing seaweed on the shore, could cause darkening of white lead. If the saw mill also produced large quantities of particulate carbon, these deposits as a stratum in the Wakas Pole paint samples might function as a dating reference or marker layer.

6.4.6. Degree of Gloss

Estimation of original gloss by visual inspection of paint samples of exterior monumental sculpture in cedar was not by itself expected to be reliable; there are far too many variables. In addition to the dulling effects of erosion, aerosols and photodegradation, paint gloss is further reduced in linseed oil-based house or marine paints by damp or dusty conditions during application and prolonged drying times (16). Gloss also depends on the type and formulation of the paint, the presence or absence of either pigment or medium, the degree to which the paint is thinned and how it is applied. The texture, quantity, composition, grain-size and dispersion of pigment granules in the binding medium is also a factor (17). Finish can also be affected by the surface preparation of the cedar as well as its moisture and extractives content.

7.0 Literature Search

To supplement the physical evidence of field-collected samples from the sculpture, the author resorted to written sources of information. Of these, references were found in the technical and commercial data. Company brochures, catalogues which included paint chips or samples, and painter's manuals, for example, which were examined to determine the types, sources and appearance of available pigments, media and ready-mixed paints of the period 1880-1900 in British Columbia. Geographical location was only one factor in reconstructing the commerce in paint. Politics was also a major influence, so historical profiles of the area had to be considered (18). The results are discussed in some detail in the Conservation Research Report (19).

It is important to stress that for the history of painting materials in North America, the period 1880-1900 was one of transition for both native artists and also the individual paint mixer and "varnish-cooker" in the Euro-American crafts/ trades tradition. The age of "scientific" paint technology and mass production had been persistently perfecting the 19th century versions of canned, pre-mixed or ready-mixed commercial house, marine and industrial paints. (The first can of pre-mixed oil paint in the United States was recorded in New Jersey in 1860.) "Patent paints" were not readily accepted at first, due to their tendency to settle out, particularly during extended transportation from source (9).

Native pigments and media, and their production would still have been familiar in this period. In fact, Y'axwayu, the carver of the Wakas Pole was described as an old man in 1890 (20). Presumably he or one of his helpers would have been familiar with traditional materials.

During this period in its history, Alert Bay was a central stop for commercial transport and fishing vessels, and military and private craft plying the coast. Commercial paint was therefore readily available, particularly marine paint. In later years, Doug Cranmer recalled that a military vessel dropped off a surplus of grey paint which was promptly used instead of the conventional red paint for the inside of dug-out canoes. It was used simply because it did the job and "there was lots of it" (21) (Figure 5).

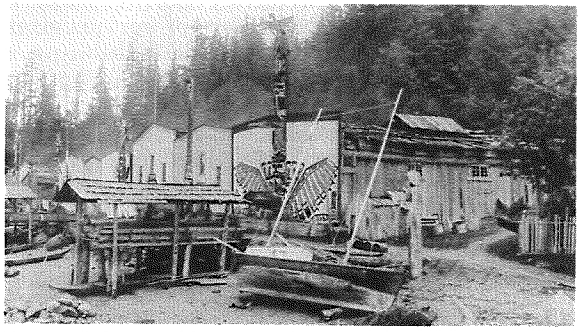

Figure 5. The sailing vessel in the foreground in this period in Alert Bay is consistent with other technological adaptations which saw Euro-American elements adapted to traditional activities, including the use of marine paints in some cases. Photo: American Museum of Natural 46012.

Prior to the acceptance of "patent paints", the manufacture of house and marine paint (as opposed to expensive artist's paints) remained in the hands of craftsmen who either mixed the ingredients themselves or prepared components for separate sale. While there were no paint or varnish makers listed in the British Columbia directories for Alert Bay from 1880-1900, painting materials would have been stock supplies for some of the other trades, including carpentry.

As for the anthropological sources, little has been recovered to date in the way of field research which details in a scientific manner the materials studies of native paints in the Pacific Northwest Coast. For example, few existing references can be cited relating pigments or media to geographical location or to trade. The details of paint preparation and application are often incomplete. The little existing in the literature has been repeated from secondary or tertiary sources, and is equally incomplete. For the entire Pacific Northwest Coast most references suggest the use of salmon eggs in paint for most, if not all, native groups. Fish oils are also mentioned in some references, although the terms "egg" and "oil" are often used interchangeably and perhaps inaccurately.

Information regarding both commercial and Euro-American paints produced by craftsmen of this region was often extracted from secondary sources, particularly from architectural references, and manuals written later in the century. In this case newspaper advertisements, catalogues, and technical and industrial reference texts, as well as standard library and archival references were consulted. Few industrial studies are available for this region and therefore, the co-operation of local manufacturers and paint producers was essential. The International Paint Company provided books on paint manufacturing and reference materials which had been consulted by some of its earlier managers. The General Paint Company of Vancouver even had a small museum complete with an early 20th Century formulary (or private recipe book). This would have been kept under lock and key by the Master Varnish Cook, who according to paint chemist, Bob Welsh, could have "held the company to ransom" as only he knew the secrets of varnish preparation on which their products were based.

There were two lessons to be learned here as far as research sources were concerned. Firstly, the literature on native paints is scant and, secondly, the turn of the century in North America marked a general transition from the European craft tradition to the industrial/scientific revolution. For this reason technical information regarding painting materials from 1880 to 1900 in this region was primarily suggested by company

inventories which recorded supplies. Mixing formulae and techniques, however, remained with the craftsmen.

Changes in industrial technology at this time were stimulated by mass production and a more controlled or scientific development of products and processes. Of particular importance for conservation research in North America was the increasing investigation, adaptation and processing of naturally occurring raw materials in Canada and the United States. These local materials had the potential of becoming economical substitutes for imported European ingredients in traditional product formulae. Paint is a prime example.

In consulting North American references, it is apparent that experiments were conducted before the turn of the century to incorporate local vegetable and mineral oils into formulae for house and marine paints which were previously based on European supplies of linseed oil. While these substitutes met with varying success, one in particular, Pacific Northwest Oil, a fish oil, was recognized for its excellent painting qualities (22). Its tenacity, ready penetration and resistance to hostile environments ensured its use for industrial purposes, including smoke stacks. There is no question that paints from not only Britain, but also the United States and Eastern Canada were still being imported to Victoria and Vancouver between 1880 and 1900. The degree to which their formulae varied remains to be seen, but the potential for variations, based on local media and pigments, should be considered when analysing paint samples from North American Indian objects.

The identification in a sample of certain paint ingredients (such as protein, oil, or lead) has been used to estimate the provenance or authenticity of indigenous art bearing painted designs. If one develops an ecological approach to materials studies, and acknowledges the existence of variables or special conditions specific to the provenance of an object, then there is less likelihood of inappropriately transposing the material standards of one region to situations in another.

Related to material studies, conservators should also bring critical assessment to bear on anthropological references. This is suggested in the constructive sense of evaluating the source of the information and the information itself vis-a-vis knowledge of materials science. While some of the early anthropologists were exact in their studies of material culture, others were not. The question of "copper blue" pigments is a case in point. Many students of indigenous art accepted the numerous and ambiguous references to "copper blues" which suggested that certain light blue pigments, prevalent in certain areas of the Pacific Northwest Coast, were commonly derived from copper compounds. This theory has yet to be supported by materials research despite the considerable analytical data collected from paint samples included in CCI's Research Project, Analysis of Paints Used by Canadian Native Cultures (2).

Commercial activities in this part of North America during 1880 and 1900 had a direct bearing on access to materials. In addition to the many visitors to Alert Bay, the literature confirms that many of its own people were involved in commercial fishing and travelled as far as Japan and the South Seas. They had access to many types of commercial paint including oil-based marine, domestic and industrial coatings, varnishes, and water-based temperas, case in paints and white-wash (3). The original paints used for the Wakas Pole could reasonably have included commercial, ready-mixed or home-made paints in the Euro-American tradition. The palette could also have included native paints, mixtures of industrial and local ingredients, or more than one paint type in its original design.

Indeed, on-site examination of the original Wakas Pole under magnification, revealed this to be the case. A primary layer of black paint had been used to colour features such as the bear's eyebrows. This is a distinctively grainy paint in which the pigment particles are of various sizes, relatively coarse in texture and exhibiting a shimmery, graphite-like appearance. The pigment from adjacent paints was finely divided and more readily concealed by the medium. Analysis verified this difference, but it remained for craftsmen in Northwest Coast design to explain why certain paints may have been preferred by the Wakas Pole artist.

8.0 Interviews

Interviews can be extremely important to the conservation researcher, as they provide new insights which are not available in the anthropological or conservation literature. They amplify conservation theory and practice by incorporating the experience of individuals in different fields, who are informed in the ecological or material aspects of the research subject. Wood pathologists and biologists, paint chemists, artists, curators and particularly craftsmen were very helpful in this study. For example, the question of the black

paint on the pole being "native paint" was put to Phil Nuytten, a carver and inventor who studied with Ellen Neel, herself a carver and granddaughter of Charlie James (1875-1938). Both carved in the Kwakiutl style. According to Nuytten, native paint (powdered charcoal or lignite in salmon egg or fish oil) was preferable to the more readily available commercial black marine paint (23). Commercially produced black marine paint of this period was heavily loaded with linseed oil to improve its water-proofing qualities. As with similar paint of the period, it separated out easily into pigment and oil, especially during prolonged transportation from either British or North American sources of manufacture which were often distant from Alert Bay. As a consequence, it was difficult to mix, and when applied directly to the cedar, it often left an oily and uneven line of black which was slow to dry, and therefore more likely to produce a "fuzzy line". By contrast, the native paint appears to have dried quickly, rendering the crisp, hard-edged form lines which are characteristic of Northwest Coast art. Preliminary analysis supported the field observation that the black paint taken from the areas in question was distinct from the commercial paints.

A conservator's knowledge of materials is an advantage when investigating the selection and behaviour of materials. The particular experience of the craftsman also results in a highly developed response to materials. The following example of "cross-pollination" is more related to the wood technology of the Wakas Pole than paint, but is worth reporting. Examination of the pole on site revealed that the tenons of one of the joined elements (the eagle's foot) appeared to have been deliberately charred; the carbonization appeared to be even and controlled, and confined to that part of the figure which would have been concealed in the sockets carved in the whale figure below.

According to Nuytten, tenons were soaked in fish oil (perch), ignited, and soon extinguished; apparently this was intended to accomplish two things. Firstly, it removed residual surface fibres, which otherwise would increase the surface area of the wood and therefore its dimensional response to dampness, and this would in turn loosen the join and hasten the loss of the object. Secondly, the carbon on the surface and the presence of oil also seems to have been a preventive seal against the invasion of fungus and insects. A sample of this wood tested positive for oil.

9.0 Collection Reviews

Collections are reviewed as a group to detect patterns in paint types, colours, gloss, design development and environmental effects in relation to other native groups, artists, time periods and categories of objects (for example exterior poles *versus* masks).

The liberal use of coloured design by the Kwakuitl has been observed to include black, red, white, green and occasionally yellow, grey and brown. Compared to some other Northwest Coast polychromy, more paint and colours appear in the body of Kwakiutl figures.

Regarding misleading modifications to the material of museum objects, a conservator is more likely to recognize applied "museum finishes" as opposed to inherent paint gloss. For example, in some museums wax was commonly applied to polychrome native sculpture. An eye trained in materials modification can often detect restoration additions and alterations such as in painting. This discrimination allows the researcher to focus on the original paints as the subject of research.

In applied conservation research, the collection review parallels what in ecology may be considered a species population study. In this case, the Pole was compared with other painted objects of similar origin rather than examining its painted decoration in strict isolation. Indeed, an ecological approach is now being applied to medical research, in the emerging field of medical geography. It examines aspects of health in relation to local influences of culture, history, geography and technical development.

Just as it had taken co-operation to produce the Wakas Pole originally, so co-operation was the key to the conservation planning and research. A similar, inter-disciplinary research approach for studying artifact technology has been suggested by Yale archaeologist, Harold Conklin, who says: "Much can be learned from those who still handle these materials, and from the collaborative use of ethnographic, archaeological, botanical, economic, chemical and technological field and laboratory techniques" (24).

10.0 Conclusion

In the case of the painted decoration of the Wakas Pole, the scope and schedule of the project were defined by the immediate objective of producing the second generation Pole. Despite

the limited time frame, many of the findings predicted for materials, and the modifications indicated by conservation field research, were supported by laboratory analysis. Exactly how this information will be adapted to the production of the second generation Pole is beyond the scope of this project.

The foregoing discussion is intended to introduce the application of ecological perspectives to materials conservation research. By necessity, this approach relies on interdisciplinary participation. Refining research methodologies ensures comprehensive and balanced results. Half the task is collecting the data; the other half is bringing the researchers together to compare, interpret, evaluate and distill these findings in light of their combined input. The Wakas Pole Project made it possible to explore such a methodology. The data suggest that anthropological collections in particular may benefit from the refinement of ecological models for applied conservation research in material culture.

Acknowledgements

The author is grateful to Mr. Tom Govier, Chief Conservator, and Dr. Andrea Laforêt, Curator, both of the Canadian Museum of Civilization, for the opportunity of working with them, and also to scientific colleagues John Taylor, David Grattan and Judi Miller of the Canadian Conservation Institute. It has been a pleasure to join carver, Doug Cranmer, in the process. Particular thanks are extended to those individuals who not only consented to be interviewed, but also brought their interest to this endeavour. These include Peter MacNair, Curator, and Dan Savard, Photo Archivist, both of the British Columbia Provincial Museum; Phil Nuytten, author and artist; Duncan Stacey, Historian; Dr. John Howard, Chemist, of British Columbia Research; Gordon Miller, Artist; Dr. Alan Mackworth, Dr. Bob Woodham and Dr. Bart van der Camp of the University of British Columbia; and Mr. Harley Cameron, President, and Bob Welsh, Chemist, both of General Paints, Vancouver.

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Biographical Notes

Ann Howatt-Krahn is a conservator specializing in anthropological collections. She has a B.A. in History in Art from the University of Victoria, Canada, with additional native studies at Carleton University, Ottawa. Further studies and research in biology were followed by conservation training at the British Columbia Provincial Museum and the Royal Ontario Museum. Conservation positions have included: Conservator, British Columbia Provincial Museum; Conservator, Archaeology/Ethnology Division, Canadian Conservation Institute, National Museums of Canada; and Chief Conservator, Glenbow Museum. A partner in the practice of Howatt-Krahn Todd Conservators Ltd. in Vancouver, she is also Assistant Co-ordinator and Editor of the **Newsletter of The Working Group on Ethnographic Materials** of the International Council of Museums, Conservation Committee.

Appendix 1

Interviewees

Richard Beauchamp
Chief Conservator, British Columbia Provincial Museum, Conservation Division, Victoria, B.C.

Harley Cameron
President, International Paints, Vancouver, B.C.

Doug Cranmer
Carver, Kwakiutl, engaged in carving and painting the second generation Wakas Pole, Alert Bay, B.C.

Dr. John Howard
Chemist, B.C. Research, Vancouver, B.C.

Peter L. MacNair
Chief Curator, Ethnology Division, British Columbia Provincial Museum, Victoria, B.C.

D. Alan Mackworth
Co-ordinator, University of British Columbia Division, Artificial Intelligence and Robotics Programme, Canadian Institute for Advanced Research, Vancouver, B.C.

Gordon Miller
Artist, recently engaged in paintings which reconstruct historical Alert Bay. Vancouver, B.C.

Ms. Charlotte Murray
Architect and occasional researcher, in the study of historical paints with the Iredale Partnership, Vancouver, B.C.

Phil Nuytten
President of Candive, Vancouver. Carver and a former student of Ellen Neel, Kwakiutl Carver.

Dave Rimmer
President, CIL, parent company of British American Paint Company, Toronto, Ontario.

Duncan Stacey
Curator and Researcher; Author of thesis on Commercial Fisheries in British Columbia (UBC. LE 3B7. 1978 A8 S73). Vancouver, B.C.

Bob Welsh
General Paint Company, Vancouver, B.C.

Dr. Robert Woodham
Director, The Laboratory for Computational Vision, Department of Computer Science, University of British Columbia, Vancouver, B.C.

Appendix 2

Collections Surveyed

British Columbia Provincial Museum, Victoria, British Columbia

University of British Columbia, Museum of Anthropology, Vancouver, B.C.

Vancouver City Museum, Vancouver, B.C.

Museum of the General Paint Company

Given the time constraints on the project, these surveys were intended to provide overviews only of the range of paints (colours and gloss) and combinations of paint types in objects of the period under study.

Appendix 3

Selected Documentation Sources

British Columbia Provincial Museum
Victoria, B.C.
— Photo Documentation, Ethnology Division
— Catalogue Collections, History Division
— Conservation Division

British Columbia Provincial Archives, Victoria, B.C.

University of British Columbia Special Collections, Fine Arts Library, Main Library

Vancouver City Archives

Vancouver Public Library - Photographic, Scientific, Commercial, and Northwest Historical Sections

Museum of the General Paint Company

Further research would benefit from access to centralized (federal) agencies; for example, pertinent port records for the City of Vancouver are held by the National Archives of Canada, Ottawa, Ontario.

La présente communication porte sur les méthodes d'analyse et de recherche sur le terrain appliquées aux collections de nature ethnologique. Elle présente l'étude de cas de la recherche préparatoire à la reproduction du mât totémique polychrome kwakiutl commandé par le chef Wakas d'Alert Bay (Colombie-Britannique) à la fin du XIXe siècle. Le mât d'origine, bien que très altéré, a été mis à la disposition des chercheurs dont l'objectif était de produire une réplique présentant avec exactitude les techniques et l'esthétique qui sous-tendaient la décoration d'origine. Diverses techniques de recherche ont été mises à profit: examen de documents photographiques et consultations de conservateurs; échantillonnage des peintures; analyse des peintures; revue de la documentation relative aux sources et aux types de matériaux disponibles entre 1880 et 1890 en Colombie-Britannique; interviews; et examens des collections. La communication se termine par la présentation des résultats de cette recherche. On y discute aussi des influences de l'industrie de la technique et du musée sur l'évolution de l'art et de l'artisanat autochtones et des conséquences qui en découlent. L'auteur discute de la méthodologie de recherche sur le terrain dans le domaine de la conservation et propose d'autres applications de ce type de recherche aux collections autochtones d'Amérique du Nord.

BARK AND FIBROUS MATERIALS

A Mounting System for Paintings on Bark
S. Walston
The Australian Museum, Sydney, Australia

Hawaiian Oiled and Mamaki Tapa
N. Firnhaber, D. Erhardt
National Museum of Natural History, Washington, D.C., U.S.A.

Conservation of a Maori Kite
G. Barton
Auckland Institute and Museum, New Zealand

Consolidation of Cellulosic Fibre Materials
C. Allington
Nationalmuseet, Lyngby, Denmark

When Textiles are Paintings
L. Smith
Museum of Fine Arts, Boston, U.S.A.

The Use of Polyvinyl Acetate Emulsion in the Preservation of Ethnographic Materials: A New Method for Supporting Fragile Woven Fibre Decoration
M.A. Robson
West Midlands Area Museum Service, Bromsgrove, England

A MOUNTING SYSTEM FOR PAINTINGS ON BARK

S. WALSTON

A technique which was developed over ten years ago for the mounting of bark paintings for storage and display purposes has been improved to provide a more accurate and effective support system. The painting is first wrapped in flexible poly(vinyl chloride) film followed by an outer wrapping of aluminum foil, then laid face down on cushions arranged to fit the contours of the bark. A fibreglass backing is laid up onto the wrapped bark using up to five layers of split chopped strand mat, depending on the size of the bark. Flanged nuts are set into the final layer of resin and glass fibre as part of the final attachment system. On curing, the bark is turned face up, the aluminum foil is removed and the outline of the bark traced onto the fibreglass backing, which is then cut to size. A cushioning layer of polyethylene foam is cut to the size of the bark and placed between the bark and backing. The bark is then attached to the backing with simple U shaped plastic clips screwed into place from behind the bark backing using nylon screws fitted through pre-drilled holes into the threaded return of the clip. The whole unit is attached to the back of a wooden box-frame with bolts inserted through the back to connect with the flanged nuts previously embedded in the fibreglass backing. A clear acrylic cover is then screwed into place.

1.0 Introduction

Paintings on bark, palm spathe and other semi-rigid materials are relatively common in ethnographic collections but are difficult to display or store. Bark and palm spathe tend to be fragile and to flex readily with improprer handling or changes in relative humidity, severely stressing the paint layer. Attempts to restrict such flexing by glueing, nailing or otherwise fixing the painting to a rigid backing or attachment device strain the bark or palm spathe unevenly, often resulting in its cracking.

The minimum requirements for the storage and display of the collection of Australian Aboriginal bark paintings for which this support and mounting system was developed, were:

- that the bark should be evenly and permanently supported whether housed in horizontal or vertical storage systems;
- that the position of the painting in its display mount or storage container should be maintained in the event that it was turned upside-down or face down;
- that the painting could be handled without direct contact with the bark or painted surface;
- that any devices used for the storage or display of the paintings should be non-destructive and fully removable.

The system which was developed involved the fabrication of a fibreglass backing moulded to the form of the bark, to which the painting was attached by clips. A layer of foam was placed between the bark and fibreglass support to cushion the bark and absorb differential movement of the bark and its fibreglass support, which could cause stress at the clip locations. The mounted bark was then fixed into a box-frame for added protection.

This technique was originally developed in 1972 (1) and has been used over the past fourteen years to mount approximately 450 bark paintings. Periodic inspections of the collection, however, revealed that a number of the clips had warped or had become dislodged along the load-bearing edges of the barks, and a significant number of paintings had slipped from their mounts. It was therefore decided to review the system to find out whether the problem was caused by basic design errors, unsuitable materials (including that of the clips), or poor quality workmanship.

A complete review was subsequently carried out which revealed that a number of factors contributed to the failure of the support system. The chief of these were that the original technique of forming the fibreglass and foam support did not take sufficient account of the way the contours and curvature of the bark affected accuracy, and that the load-bearing capacity of the clips had not been calculated. The system has now been completely revised and, although the original principle of clipping each painting to a backing cast on its own form, and mounting it in a box-frame, has been retained, most of the materials and fabrication techniques have been changed or modified. The revised system is detailed below.

2.0 Methods and Materials

2.1 Fibreglass support backing

The bark painting is first wrapped in two layers of 0.015 mm thick polyethylene film (commercial food wrap) ensuring that the film does not trap air and that it is not stretched too tightly over the bark. Over-stretching causes the film to bridge between ridges on the bark. The painting is supported face down on 'sandbags' (cloth bags filled with sand or expanded polystyrene beads) arranged to provide even support to all parts of the bark. Additional sandbags, wrapped in polyester film (freezer bags) to protect them from the casting resin, are then placed around the perimeter of the bark to support the overlapping glass fibre in the same plane as the bark. If the overlapping glass fibre is not supported, it will sag when the resin is applied and set at a sharp angle to the bark. Excess resin will also collect at this point and the combination will make accurate marking and cutting of the fibreglass almost impossible. One layer of 0.01mm thick aluminum foil (domestic or commercial oven foil) is finally placed over the painting and coated with a release agent. An 8% solution of microcrystalline wax (Mobil 70) in xylene was found to achieve good separation between the foil and fibreglass. Lengths of aluminum foil can be joined together using aluminum-coated polyester adhesive tape, if extra width is needed to cover the bark. The foil is used to isolate the casting resin from the protective polyethylene film, as polyethylene both inhibits the setting of the resin and swells when in contact with the resin's styrene monomer, causing distortion of the fibreglass layer.

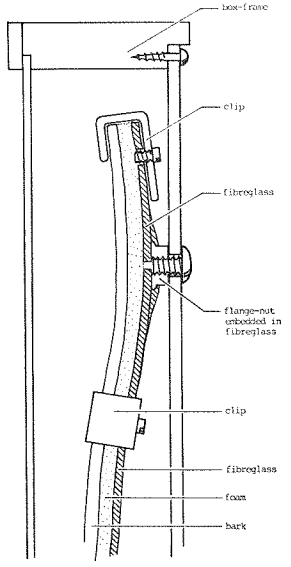

Figure 1. System for mounting paintings on bark

Attempts to find a material that could double as a protective wrapping for the bark as well as a separating agent for the resin failed. Metal foil could not be used by itself because of its poor tear strength, while the less reactive range of plastic films tested, including metal coated polyester films, proved equally unsuccessful. Either they were too inflexible to conform to the contours of the bark well enough to permit accurate moulding, inhibited the setting of the polyester, or caused distortion of the fibreglass layers.

Before the glass fibre and resin are applied to the wrapped bark, the positions of the nuts to be embedded into the fiberglass as part of the mounting system have to be marked (Figure 1). This is achieved by laying a flat, lightweight aluminum grid over the back of the bark, and identifying a minimum of three high points that make contact with the grid. These high points, which will be reproduced by the moulded fibreglass, will lie against the back of the box-frame and will be where the fibreglass support is attached to the timber backing. The attachment points are lightly marked through the open mesh of the grid onto the foil with a felt pen. The ink transfers readily from the foil surface into the fibreglass, providing an accurate reference for the location of the attachment nuts.

Between three and five layers of 225 g/m^2 split chopped strand mat and a waxed polyester laminating resin ("P63F", A.C. Hatrick Chemicals) are used to make the fibreglass support. The fibreglass is applied using standard laying-up techniques including the use of a ridged roller to ensure even distribution of the resin. A rule of thumb for the number of layers of glass fibre to be used is as follows: three layers for barks up to 500mm long, four layers for barks 500mm to 800mm long, and five layers for barks over 800mm long. Where particularly sharp or deep troughs occur in the bark and backing, the fibreglass should be weighted with bags filled with sand or lead shot, separated from the resin with aluminum foil. This prevents the fibreglass from drumming across the depressions. On completion of the final layer, 1/4" flanged brass nuts ("Whitflange Nuts") are centred over the marked locations and individually secured with additional layers of fibreglass. The resin is allowed to cure for a minimum of 48 hours, after which the bark is removed and the aluminum foil stripped off the

fibreglass support. The polyethylene film, however, needs to be left in place to protect the bark during subsequent stages of the process.

2.2 Foam cushioning layer

An oversize layer of 5 to 7.5mm thick brown, medium density polyethylene foam ("Softlon 3003", Pilon Plastics) is laid onto the fibreglass support and the bark replaced in its original position. The thickness of the foam used depends on the thickness of the bark; the three component layers of bark, foam and fibreglass should equal the internal dimension of the clip quite precisely. The outline of the bark is traced onto the foam with a white wax pencil and the foam then removed and cut to size with a sharp blade used against a flat cutting board. It is essential that the foam be sandwiched in its proper position between the bark and the backing when it is marked, as this ensures that the extra dimension of the ridges and troughs are taken into account. If the foam is simply draped over the bark when it is marked it will bridge across the depressions and end up being too small (Figure 2a).

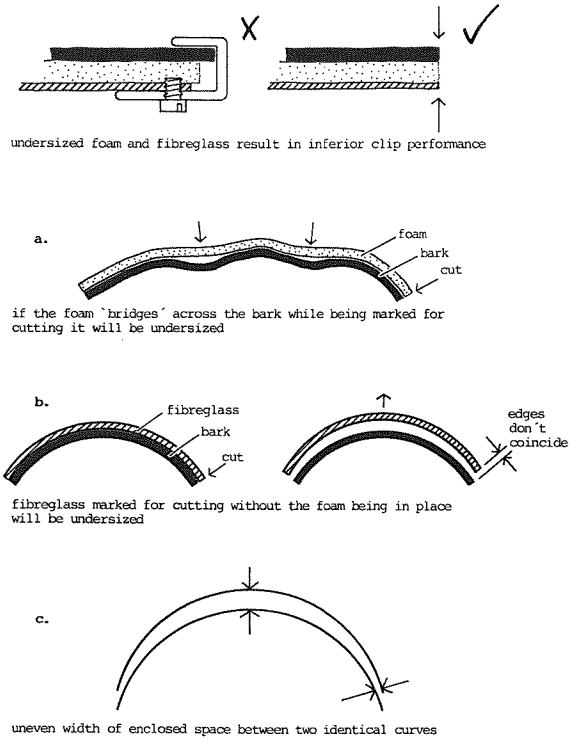

Figure 2. Problems associated with making mounting components for curved barks

2.3 Finishing the fibreglass support

The bark painting, still wrapped in polyethylene film, is replaced with the foam into the fibreglass support and the outline of the bark traced onto the fibreglass with a fine-tipped marking pen. The fibreglass is then cut to size using a jig-saw fitted with a tungsten carbide blade and its edges lightly sanded.

Replacing the foam layer before marking the fibreglass is an important step, particularly for curved barks. If the fibreglass layer is marked without the foam layer being in place, the fibreglass will almost inevitably end up smaller than the bark. This discrepancy arises because the bark is usually somewhat curved and when two identical curved surfaces are parted, as when the bark and cast support are moved apart for the insertion of the foam layer, the edges no longer match (Figure 2b). Before the bark painting is attached to its support, the precise locations of the bolt holes for fixing the fibreglass support to the wooden backing board of the box-frame have to be established. This can be done accurately by aligning the fibreglass to the backing board and drilling both at once through the centre of each of the embedded nuts. This system will achieve perfect positional and directional registration of the bolt holes with their respective nuts.

At this stage the edges of the fibreglass support can be coloured to match the edges of the bark with any suitable colouring agent, (e.g. "Orasol" dye, Ciba/Geigy) which, together with the dark-coloured foam cushioning layer, helps to reduce the visibility of the mounting materials. For display purposes, the fibreglass support and foam can be completely covered in fabric, which provides a more uniform appearance to the edges.

The technique outlined is satisfactory for most barks. However, when mounting barks with extreme curvature the technique must be further modified, for when two extremely curved shells are slightly parted (as in the case of bark and fibreglass), not only do the cut edges not coincide, but the enclosed gap is of varying width (Figure 2c). Obviously this affects the seating of the foam cushion, and forcing such a bark and fibreglass support into conformity with a spacing layer between them will stress the bark.

In the instances involving extremely curved barks, therefore, the fibreglass is not cast directly onto the bark. Instead, a spacing blanket is first draped over the bark to represent the thickness of the foam, and the fibreglass is cast onto that. The

blanket being used is simply-cast Glygel sheet (equal parts glycerine, gelatine and water), the same thickness as the foam. Glygel is used in preference to the foam because of its superior drape characteristics which allow it to conform to the ridges and hollows of the bark.

2.4 Attachment of the painting to the support

The bark painting, form and fibreglass are temporarily assembled so that the location of the clips can be marked. One of the clips is positioned at selected attachment points around the edges of the bark and marked through its threaded return section onto the fibreglass support. These points are drilled to accommodate the nylon machine screws that will secure the clips. The bark and its support layers are then assembled and the clips fixed into place.

The clips currently in use are 1.8mm thick injection moulded cellulose acetate, in two sizes to allow for the variable thicknesses of barks, one with an opening of 12mm and the other with an opening of 15mm. The number of clips to be used depends on the weight of the bark. Each side of the bark must have sufficient clips to support its total weight, and to allow for any manner in which it may be handled and stored in the future. The small clips can support up to 1kg of weight and the large clips can support up to 640g. Thus for an average size bark, 600mm x 110mm and weighing 2.5kg, a minimum of three of the small clips, or four of the large clips should be used along each side. Additionally, if the weight of the bark is not distributed evenly amongst the clips, it is likely that those bearing the load will sag. (The options for increasing the thickness of the load-bearing section of the clip and replacing the cellulose acetate with a more robust material are currently being investigated.) The clips should be as evenly spaced as possible and not placed over cracked or fraying areas of the bark. Accurate marking and cutting of the foam and fibreglass layers are also essential to ensure that the clips can be placed in their correct relationship to the bark and support layers to ensure optimum performance. The bark painting is fully secured to its fibreglass mount by this method and can be displayed simply by attaching a hanging device to the back of the fibreglass. The painting can be further protected, particularly while in storage, by mounting the whole unit in a box-frame.

2.5 Mounting in box-frame

The mounted bark is attached to the back of the box frame by means of short bolts inserted through the back of the box to connect with the nuts previously embedded in the fibreglass support. A clear acrylic cover is then screwed into place.

3.0 Summary

Apart from the general principle of using a semi-rigid fibreglass support moulded to the shape of the bark, a layer of foam cushioning, a non-destructive attachment system and a protective box-frame, virtually all of the methods and materials used were changed or modified as a result of the review.

The changes include:

- the choice of wrapping materials;
- the use of a rigid grid to identify attachment points for the fibreglass support to the box-frame;
- the technique of marking foam and fibreglass for cutting;
- the method of attaching the fibreglass to the back of the box-frame;
- the design of securing the clips;
- the order in which the bark, backing and frame are assembled.

The methods and materials described above are not, however, recommended for the display or storage of bark paintings that are subject to major fluctuations in relative humidity. The curvature of bark can alter quite dramatically with changes in moisture content, beyond the limits of the foam and fibreglass support. Stress will build up at clip locations and be transferred to the weakest points in the bark, causing it to crack.

The mounting system was also not designed for the transportation of bark paintings. Any prolonged movement or jolting could cause abrasion by the clips to the bark or painted surface. It is strongly recommended that barks should be unclipped and repacked for transportation purposes.

4.0 Safety

Full protective clothing including respirators/dust masks, goggles and gloves should be worn during all stages of the fibreglassing process. The fibreglass should be left to cure only where efficient fume extraction can be guaranteed, or in an area away from people.

Acknowledgements

A large number of people have been involved in the mounting of the Australian Museum's collection of Aboriginal bark paintings over the years and their help is very much appreciated. David Horton-James, Ellie McFadyen and Karen Coote in particular have contributed new ideas, constructive criticism and important input into the experimental sections of the project.

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Une méthode d'encadrement pour la mise en réserve et l'exposition des oeuvres sur écorce, mise au point il y a plus de dix ans, a été améliorée. Elle est maintenant plus précise et plus efficace. L'oeuvre est d'abord enveloppée dans une pellicule souple, en PVC, puis dans du papier d'aluminium, avant d'être posée, côté peint vers le bas, sur un support coussiné taillé suivant les contours de l'écorce. Une doublure en fibre de verre est ensuite posée sur le morceau d'écorce enveloppée. Cette doublure compte jusqu'à cinq épaisseurs de matelassure de fibre de verre, selon la taille de la pièce d'écorce. Des écrous à collet sont fixés dans la dernière couche de résine et de fibre de verre, comme système de fixation. L'oeuvre est ensuite retournée. On enlève le papier d'aluminium et on trace les contours du morceau d'écorce sur la doublure en fibre de verre, pour pouvoir le tailler. On prépare ensuite un morceau de mousse de polyéthylène aux dimensions du morceau d'écorce, qu'on place entre celle-ci et la doublure, comme protection. L'écorce est fixée à la doublure au moyen de simples attaches de plastiques en forme de U, retenues derrière la doublure par des vis en nylon passées dans des trous forés et vissés dans les bouts filetés des attaches. L'ensemble est ensuite fixé au fond d'une boître-cadre en bois au moyen de boulons vissés dans les écrous à collet qui avaient été encastrés dans la doublure de fibre de verre. Un couvercle en acrylique transparent est ensuite posé sur la boîte au moyen de vis.

HAWAIIAN OILED AND *MAMAKI* TAPA: CHARACTERIZATION AND CONSERVATION

NATALIE FIRNHABER AND DAVID ERHARDT

Characteristically severe forms of deterioration occur in Hawaiian oiled and Mamaki tapa (barkcloth), often resulting in complete loss of the specimen. These tapa are very different from each other in terms of manufacture, surface treatment, and fiber source. To better understand the nature of the oiled tapa and its deterioration, the oils were extracted with solvents and analyzed with gas chromatograph/mass spectroscopy. The results were compared to fresh oils, which had been cited in early literature sources. Artificial aging of new, freshly oiled tapa produced physical comparisons to the early tapa. Particular conservation problems were evident. The general use of starch paste as an adhesive for repair was not appropriate as the oil substance prevented adequate adhesion. A variety of adhesives were tested on the tapa, and it was found that adhesive combinations of acrylic emulsions and either carboxy methyl cellulose or Klucel H allowed for adequate adhesion and easy reversibility. Several tests are described to relax the fibers and reduce extreme brittleness. The tests were successful, but altered the characteristic nature of the oiled tapa. pH testing revealed greater acidity than found in unoiled hawaiian tapa. Washing raised the pH of the oiled pieces to an acceptable level, without apparent alteration of the physical characteristics of the tapa. In the second section of the paper, Mamaki tapa is discussed. This form is a very sheer, delicate tapa and is often found fragmented and crumbling and too brittle to handle. Excessive acidity is generally felt to be the cause of this brittleness. Testing revealed an average pH of 4.4. Analysis of the acid indicated that oxalic acid was present in a quantity 1000 times greater than in other Hawaiian tapa. Mamaki tapa samples were washed in water to reduce the acidity. This successfully raised the pH and increased flexibility somewhat without altering the physical character of the tapa. Various backings were tried on the Mamaki to provide overall support. Tengujo paper with rice starch paste gave satisfactory results. The fine Tengujo paper and starch paste also worked well for numerous small repairs of the tapa.

1.0 Introduction

Hawaiian oiled and *mamaki* tapa were chosen for research because they both show characteristically severe forms of deterioration, which often result in complete loss of the specimen. They are very different from each other in terms of manufacture, fiber source, and surface treatment, but are both two of the finest examples of tapa made. The literature sources are not specific nor consistent in regard to detailed manufacturing techniques of these two tapa. The research, therefore, attempted to clarify this through analysis of particular constituents of the tapa. Conservation techniques and materials were then tested on these tapa to help establish more appropriate methods of preservation.

2.0 Characteristics of Oiled Tapa

Hawaiian oiled tapa is made from the *Broussonetia papyrifera* or paper mulberry tree. The Hawaiian name for this tree is *wauke*. This tapa is very fine, beatermarked, orange to yellow in colour, and often scented. Kooijman (1) states that fronds of the fragrant *maile* scented fern were used, particularly the *laua'e* (*Polypodium phymatodes*). The liquid from the fern was mixed with oil of roasted coconut meat and this was worked into a yellow turmeric dye. The *malo*, loincloths worn by men, were often treated in this way. *Malo* worn by chiefs for bathing were soaked in oil from the *kamani* nut (*Calophyllum inophyllum*) in which seeds of the *ha'a* (*Antidesma platiphyllum*) had been infused (2). This was said to make the tapa more flexible, give it a better colour, and make it waterproof.

Over time the oiled tapa in the Bishop Museum collection had become stiff and often brittle. Edges easily broke and cracks occurred elsewhere in the cloth. The degradation of oils within the tapa is thought to be the cause of this brittleness. Since these specimens can be quite large, with five or more sheets stitched together along one border, (as in *kapa moe*, sleeping tapa), additional handling problems can result. Because of the frequently brittle and inflexible nature of oiled tapa, handling, exhibition, and even storage often damage these pieces. Moreover, starch paste combined with Japanese mulberry tissue, generally used to make mends, does not adhere well to these oiled tapa and is therefore not suitable for repairs.

2.1 Characteristics of *Mamaki* Tapa

Mamaki tapa is made from the *Pipturus albidus* or nettle plant, called *mamaki* in Hawaiian. This tapa is characteristically dark brown with black designs and is very fine and delicate, with beater

patterns impressing a lace-like texture into the cloth. (On fine Hawaiian tapa a pattern is impressed into the cloth during the final beating.) *Mamaki* was generally made on the Island of Hawaii. When made on the other Hawaiian islands it was often mixed with *wauke*, which made it a more durable material. It is also said that mucilage from the *ama'u* fern (*Saddleria*) was added to help hold the fibers together when it was beaten (1). According to Brigham (2) *malo* (loin cloth), *pa'u* (women's skirt), *kihei* (shoulder covering), and *kapa moe* (sleeping tapa) were made from *mamaki*.

Mamaki tapa can become so brittle with age that it crumbles with the slightest handling. The thin network of fibers along the beatermarks is where breakage occurs first. It generally has a lower pH than other tapa, and its very sheerness contributes to its fragile quality.

3.0 Tests Conducted on Oiled Tapa

3.1 Identification of Oils: Physical Comparison

As the oils are felt to be the major cause of the deterioration problems in these tapa, identification of the oil was a first consideration. From the literature it seems the Hawaiians obtained their vegetable oils from the coconut (*Cocos nucifera*), *kukui* nuts (*Aleurites moluccana*), and *kamani* nuts (*Calophyllum inophyllum*). Specimens of these oils were obtained locally for experimentation. Coconut oil is available commercially with no apparent additives and both roasted and filtered *kukui* nut oil and roasted, unfiltered oil were obtained as well. Both "false" and "true" *Kamani* oils were also tested. False *kamani* (*Terminalia catappa*) was introduced to Hawaii in the 1850's.

Although no literature sources were found mentioning the application of animal fat to tapa, the possibility was not ruled out. Because pigs were raised by the early Hawaiians, pork fat was therefore tested as well. Fish or shark oil could have been substituted as examples of traditional sources of animal fat, but they were not specifically tested.

Accelerated thermal aging tests were conducted on paper mulberry bast fiber that had been freshly harvested, fermented, beaten, and saturated with the six collected oils. These studies were conducted to allow comparison with similar specimens of ancient oiled tapa in the Bishop Museum collection (3). A laboratory oven set to standards for the aging of paper by the Technical Association of the Pulp and Paper Industry (TAPPI) was used. The standard is 100°C for 72 hours, which is considered equivalent to 28 years of normal aging at a temperature range of 20-25°C (68-77°F). Three relative humidity (RH) standards were added to the heat testing to simulate the probable high humidities to which the tapa normally would have been exposed: 60%, 80%, and 100%. It is not known how this changes the proportionate number of years of aging.

The six samples were tested under the following conditions: 0%, 60%, 80% and 100% relative humidities:

1. Two control samples of tapa.
   a. One with no oil, but heated, which would represent an *aged unoiled* tapa.
   b. one with oil added but no heat, representing an *unaged oiled* tapa.
2. *Kukui* nut oil (extracted from roasted nuts), filtered.
3. Coconut oil.
4. False *kamani* nut oil.
5. True *kamani* nut oil.
6. Pork fat.

Samples aged at 100% RH turned a uniform grey/brown and remained flexible. The samples aged with no added humidity tended to be stiff but not brittle. There was no noticeable difference between samples aged at 60% and 80% RH, and of these the coconut samples were least similar in texture and appearance to ancient oiled tapa. The *kukui* and animal fat samples showed the greatest similarities in colour and texture. It should be noted that the newly beaten tapa used for the tests did not duplicate the fine delicate quality of the original specimens. Though no turmeric or other colouring material was added to the oiled samples, the ones with *kukui* oil and animal fat turned a golden yellow very similar to many of the typical ancient oiled tapa in the Bishop Museum collection. None of the samples was brittle after this length of testing time. The coconut oil samples felt oily. Since *kukui* nut produces a drying oil, there is no oily or greasy residue, as was the case with coconut oil which tends to stay fluid. The other samples felt stiffer and also were not oily to the touch.

3.2 Identification of Oils: Comparative analysis

Small samples of oiled tapa and a sample of fresh *kamani* nut were ground and extracted with 10% potassium hydroxide in methanol. The mixtures were heated to boiling, cooled, and allowed to stand overnight. The solutions were acidified with hydrochloric acid and then extracted with ether. The ether extracts were evaporated, and the residues dissolved in small amounts of methylene chloride. An excess of the methylating reagent dimethyformamide dimethyl acetal was added to each sample. These solutions were analyzed in a gas chromatograph/mass spectrometer.

The results are shown in Figure 1. Figure 1a shows the reconstructed ion chromatogram for *kamani* nut oil, one of the materials reported to have been used on tapa. Palmitic and stearic acids, the 16 and 18 carbon monocarboxylic acids, are present. These are relatively unreactive, and these two acids should still be present in aged samples, and in the same ratios, if originally present. Also present are oleic and linoleic acids, the mono- and di-unsaturated 18 carbon carboxylic acids. These are unstable, and react to form

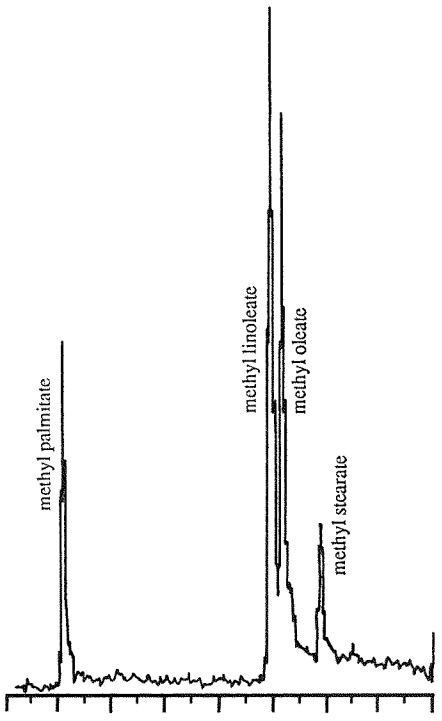

Figure 1a. Reconstructed ion chromatogram of the methyl esters of fatty acids for kamani nut oil.

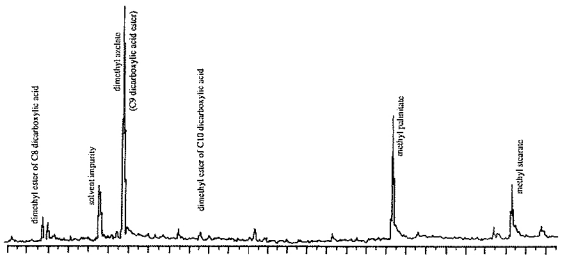

Figure 1b. Reconstructed ion of the methyl esters of fatty acids for tapa sample 3607.

crosslinks, which results in the drying, hardening, and possible embrittlement of the oil. The crosslink sites are fairly reactive and further reaction will eventually result in oxidation and fragmentation to produce shorter dicarboxylic acids, such as the 9 carbon azelaic acid.

Figure 1b is the chromatogram for tapa sample 3607. Palmitic and stearic acid are present, though in different ratios than in the *kamani* nut oil sample. There are no traces of the unsaturated acids. Their degradation products, the dicarboxylic acids, are present as are large amounts of azelaic acid, which indicates that the oil used to treat the tapa sample was highly unsaturated. No resinous compounds are present, indicating that there was no resin mixed with the oil. The results of these and other analyses are presented in Table 1, along with values from the literature for possible oil sources. For each analysis the values have been normalized relative to the value for stearic acid, so each value is the amount of that compound relative to stearic acid.

Several oils (*kukui*, *kumani*, and coconut) are reported to have been used in the manufacture of oiled tapa. Palm oil and animal fat were also considered as possibilities. Since no myristic acid (the 14 carbon monocarboxylic acid) was found in the tapa samples, coconut and palm oil were ruled out. The large amounts of azelaic acid together with small amounts of dicarboxylic acids mentioned above indicate that the oils used to treat the tapa were highly unsaturated, thus ruling out animal fats and leaving only *kukui* and *kamani* oils as possibilities. The reported range of the palmitic: stearic acid ratio for *kamani* nut oil is 1.04 to 1.73, and that for *kukui* nut oil is 1.04 to 2.23. The oil from tapa sample 3607 has a palmitic: stearic acid ratio of 1.78, which is in the middle of the range for *kukui* nut oil, but outside that for *kamani* nut oil by a small (and probably not significant) amount. Sample 3601 has a palmitic: stearic acid ratio of 2.44

TABLE 1

Proportion of Fatty Acids and Their Degradation Products (relative to stearic acid) in Tapa Samples and Possible Oil Sources

SAMPLE	SATURATED ACIDS			UNSATURATED ACIDS			
	Myristic	Palmitic	Stearic	Oleic	Linoleic	Linolenic	Dicarboxylic
Oiled Tapa 3601	—	2.44	1.00	—	—	—	1.99
Oiled Tapa 3607	—	1.78	1.00	—	—	—	6.98
*Kamani Nut	—	1.04-1.73	1.00	2.07-5.12	1.30-2.35	—	
**Kukui Nut	—	1.04-2.23	1.00	1.75-7.80	5.66-14.20	—	
**Coconut	4.80-18.0	2.30-9.0	1.00	1.60-7.60	0-1.60	—	
**Palm	4.10-10.8	3.0-6.80	1.00	4.50-14.20	0.40-0.80	—	

*Literature values. Measurements for this work fall in these ranges.

**Literature values.

which is far outside that for *kukui* nut oil. The oils from both tapa samples, 3601 and 3607, have relatively large total amounts of dicarboxylic acids. *Kamani* nut oil has much less of the unsaturated fatty acids than *kukui* nut oil, and probably could not account for all the degradation products seen in the samples. Both the palmitic: stearic acid ratios and the large amount of unsaturated fatty acid degradation products point to *kukui* nut as being the oil which was most likely to have been used to treat the tapa samples.

The degradation of tapa samples treated with oils is probably due in large part to the acid degradation products of the oil. In the fresh oil, the fatty acids are not present as free acids, but are bound in non-acidic ester linkages. Hydrolysis of these esters can produce the free acids. More important though, is the oxidation of the unsaturated acids to produce the dicarboxylic acids, which still have one acid group bound in the ester linkage, although the second group produced by oxidation is present as the free acid. The increased acidity results in the breakdown of the cellulose of the tapa. Another problem is the hardening and embrittlement of the oil itself. The tapa would be flexible and tough for quite a while after the initial oil treatment, but the oil would continue to harden and stiffen for many years, eventually becoming the brittle material seen in the samples.

3.3 pH Testing

The pH range of oiled tapa samples was determined through the use of acid-base indicator strips and a glass pH electrode. In five tested samples the range was 4.0 to 4.7. A sampling of six other pieces provided an average pH of 4.3.

An oiled tapa sample with a pH of 4.0 was washed for 1/2 hour in changes of luke warm tap water of pH 6.9. The piece was fairly flexible before washing but the folding strength was very limited. There was no visible leaching of coloured material in the water and the sample appeared to be saturated with water after a few minutes of soaking. After air drying it appeared to be more flexible than an identical unwashed sample, was softer to the touch, and the pH was raised to 6.0. The beatermark appeared to have been raised slightly by the wetting.

3.4 Testing of Adhesives

Over the last few years tests have been conducted to find a suitable alternative to starch paste as an adhesive for oiled tapa. Ideally, the adhesive should adhere strongly to the oiled surface, but remain flexible. It should be easily reversible, and leave little or no residue in the tapa. Several different methods were used to remove these repairs as part of the testing process.

A microspatula was used to mechanically lift the fiber edges while both water and organic solvents were used to soften the adhesive bond. Cotton swabs were moistened with the organic solvent and rolled over the mend, thus saturating the mend but not the tapa. If a mend could be removed easily without use of a solvent, a solvent was not attempted.

The results of these tests are given in Table 2. In general, combinations of water- and organic-soluble adhesive yielded the best results. They adhered well to oiled tapa and were easily removable. Toned mulberry tissue was also tested

TABLE 2

Reversibility Test Results of Selected Adhesives on Oiled Tapa

Adhesive	Release Agent			
	Mechanical	Water	Acetone	Toluene
Wheat starch paste	+			
Carboxymethyl cellulose	+			
Klucel H (Hydroxypropyl cellulose)	+			
Klucel H with rice starch paste 1:1	+			
CM bond M-4 (Polyvinyl acetate copolymer emulsion)	-	-	+	+
Cm bond M-4 with starch paste 1:1	-	+-	+	+
CM Bond with Klucel H 1:1	-	+-	+	+
CM Bond with CMC 1:1	-	+-	+	+
Rhoplex AC 33 (Acrylic emulsion)	-	-	+	+
Rhoplex AC 33 with starch paste 1:1	-	-	+	+
Rhoplex AC 33 with CMC 1:1	-	-	+	+
Rhoplex AC 33 with Klucel H 1:1	-	+-	+	+
Library of Congress Heat Melt (Rhoplec AC 73 and Plextol B500 emulsion)	-	-	+	+

to determine if the acrylic wash applied to toned tissue would inhibit adhesion. This did not appear to be the case.

3.5 Use of Consolidants

Several consolidants were tested in an attempt to increase the flexibility of the stiff and often brittle oiled tapa. Generally speaking, the best answer is proper storage rather than introducing a new substance to penetrate into the fibers and lubricate them temporarily. Nevertheless, as a controlled experiment, several consolidants were tested on the oiled tapa.

Polyethylene glycol (PEG) of 1500 molecular weight, was applied to a section of tapa. The test area was found to be much more flexible and translucent and stayed moist for several weeks, but some of the colour of the tapa transferred to the blotting paper it was resting on. After several months the treated area was still visible and flexible. Adhesives, however, did not adhere well to the area. Two years after the PEG was applied it was no longer visible but the tapa was still quite flexible.

Klucel H (hydroxypropyl cellulose) was also applied to a test area. It is characteristically clear, transparent, flexible, and soluble in water and polar organic solvents. Several coats were brushed on. This made the tapa seem a little stronger and "thicker" but did not render it more flexible.

4.0 Tests Conducted on *Mamaki* Tapa

4.1 pH Testing and Acid Analysis

Surface pH readings of *mamaki* tapa were taken with acid-base indicator strips. A glass pH electrode was used to take readings from cold water extraction. The pH range was found to be between 3.8 and 5.6, with readings most frequently around 4.4.

Mamaki tapa was analyzed for the type of acid present at the Industrial Analytical Laboratory in Honolulu. The acid was extracted using distilled water and ultrasonification and the analysis was performed using an ion chromatograph. A predominance of oxalic acid was found, about 1000 times more than found in fresh *mamaki*.

It has been suggested that at some time in its manufacture the *mamaki* tapa is buried in the marsh-like patches of *taro* (*Colocasia esculenta*). This mud is rich in iron compounds, which would react with the lignin compounds present in the mamaki bast fiber. When tested with potassium ferrocyanide for the presence of iron, the reaction was immediately positive. Burial in the *taro* patch mud may also explain the presence of oxalic acid in the *mamaki* tapa, as calcium oxalate is present in fairly large quantity in the *taro* plant.

4.2 Washing and Buffering

Other tests conducted on *mamaki* tapa included washing and buffering. Three samples of *mamaki* tapa were immersed in warm tap water. Sections of each sample were retained for comparison with treated samples. There was an immediate, but slight, run-off of brown-black colour. Each sample was washed for a period of one hour, and an increase in pH after washing was observed in the three samples, namely, 4.3 to 5.5, 3.2 to 5.3, and 3.6 to 4.7. The samples were somewhat more flexible after drying, and the black colour of the stripes in the design remained visually unchanged. After air drying the beater pattern ridges remained as they were before washing.

Because of the physical condition of much of the *mamaki* tapa in the Bishop Museum collection (size of sheets, layering of several sheets in a single specimen and fragile state of the cloth), washing may not be a feasible preservation treatment. Because of the difficulty involved in safely buffering large tapa in an aqueous bath, a non-aqueous deacidification solution was therefore tested.

Wei-To spray no. 11, which deposits magnesium ethyl carbonate in the fibers, was applied to a relatively small, manageable specimen before lining. The tapa was extremely fragile and torn, so wet treatment was entirely out of the question. The solution was sprayed repeatedly over the cloth to assure uniform coverage. Although efforts to measure the pH before and after were not completely successful due to solubility of the colour and the uneven surface of the lacey tapa, the results obtained did indicate that the pH had been raised considerably (5).

4.3 Repair

A variety of adhesives and repair materials were aged and tested for their suitability for repair and lining of *mamaki* tapa. Two possible repair combinations were selected for testing; one was *tengujo* tissue with rice starch paste, and the other was nylon gossamer with an acrylic emulsion heat-melt adhesive formulated by the Library of Congress.

A mixture of Rhoplex AC 73 and Plextol B500 emulsions (3:2) 10-15% in water was lightly coated on nylon gossamer. It was then applied to the reverse of a sample of *mamaki* tapa with a tacking iron. This backing seemed to hold well, added negligible thickness, did not alter the beater pattern, and did not appear to change the flexibility. It gave overall strength but also made the reverse side more opaque. The adhesive could be removed by softening with reapplication of heat and was also soluble in acetone, ethanol and toluene. The application of an acrylic, however, seemed a less desirable solution because of the opacity that resulted, the necessity of reversal with solvents or heat, and the generally less sympathetic appearance to the natural materials of the tapa.

TABLE 3

Artificial Heat Aging Tests Performed on Selected Materials Used in Tapa Repairs

Test Samples	Physical Characteristics Before	After
Supports		
Japanese papers Kizukishi natural Seikishu natural	White & pliable	Light brown, minimal tear resistance
Nylon gossamer	White & pliable	Light beige, remained pliable and strong
Polyester webs commercial samples	White & pliable	All remained strong and pliable but discolored
Silk crepeline, sized	White & pliable	Dark brown and white
Silk crepeline, washed, size removed	White & pliable	Beige, slightly less pliable
Nylon net	White & pliable	Light beige, pliable
Adhesives, Consolidants		
Rice paste	White gel	Light brown, hard
Rice paste liquid	White thick liquid	Off white, transparent film
Polyethylene glycol MW 1500	White, waxlike	Clear, greenish liquid
Coconut oil	Clear liquid	Clear liquid
Carboxymethyl cellulose	White gel	Grey hard mass

A long-fibered Japanese tissue, *tengujo*, which is thinner and more transparent than the nylon gossamer, was selected for further testing. This tissue could be successfully toned with washes of acrylic colour. The toned tissue was coated with rice starch paste and then used to repair breaks in the tapa samples and to line or reinforce them fully on the *verso*. The pasted-up tissue was tamped down with a soft Japanese brush bringing the tapa and tissue fibers into intimate contact, a situation which could not be achieved with the acrylic emulsion and tacking iron.

Artificial heat aging tests were also performed on various backings and media that were considered for repair of *mamaki* tapa. These tests were conducted in a dry oven, at 100°C (Table 3).

5.0 Conclusion

From the analysis of the oiled tapa, it was concluded that the original oils were of an unsaturated nature, which excluded animal fat and certain vegetable oils mentioned in the literature. The comparative range of unsaturated fatty acids in the oiled tapa and the *kukui* nut oil strongly suggest that *kukui* was the oil used to soak these samples of early oiled tapa.

The presence of oxalic acid and iron in the *mamaki* tapa points to the probable causes of the severe deterioration and sheds light on its manufacturing process.

Washing of oiled and *mamaki* tapa seems the best technique to reduce the acidity found in both, and restore some measure of flexibility. Addition of a buffering agent, such as Wei-to, could act to neutralize the tapa against residual acidity.

The repair of oiled tapa seemed to work adequately using a mixture of adhesives rather than the traditional starch paste. These adhesives have a strong bond and are easily reversible. The *mamaki* tapa was successfully repaired with starch paste and mulberry paper. It was also lined with a high measure of success.

Restoring flexibility to the oiled tapa remains debatable as it seems to require the introduction of a lubricant into the fibers, which would restore a measure of flexibility, but also alter the tapa's integrity, and in time possibly present additional problems.

Further studies will be conducted to find a more effective method for neutralizing and relaxing the oiled tapa. To reduce continued oxidation of the oils more specialized storage techniques will be considered for the future.

Acknowledgements

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Biographical Notes

Natalie Firnhaber received a Bachelor of Arts degree in Anthropology from the University of Illinois, and went on to the Institute of Archaeology, University of London, to study archaeological conservation. Upon completion of studies, she worked as conservator with the Pacific Regional Conservation Center, Bishop Museum, Honolulu, Hawaii. In 1986 she joined the staff of the Anthropology Conservation Laboratory, Natural History Museum, Smithsonian Institution.

David Erhardt graduated from the University of Miami with a Bachelor of Science degree in Mathematics. He received a PhD in Organic Chemistry from the University of Maryland. He has worked as a research chemist at the Conservation Analytical Laboratory of the Smithsonian Institution for seven years. His interests include organic components of museum objects, conservation and display materials, chemistry of degradation, and the museum environment.

Le tapa huilé et le tapa mamaki, originaires d'Hawaï, présentent souvent une dégradation extrême qui entraîne fréquemment la destruction totale du spécimen. Ces deux types de tapa diffèrent beaucoup l'un de l'autre quant à la fabrication, au traitement de surface et à la source des fibres. Pour mieux comprendre la nature du tapa huilé et sa détérioration, les huiles ont été extraites au moyen de solvants et analysés par chromatographie en phase gazeuse-spectroscopie de masse. Elles ont été comparées aux huiles fraîches mentionnées dans des sources documentaires anciennes. Le vieillissement artificiel du tapa neuf récemment huilé a permis d'établir des comparaisons physiques avec les tapas anciens. La conservation posait quelques problèmes particuliers. En général, la colle d'amidon comme adhésif pour les réparations est contre-indiquée car les huiles nuisent à l'adhésion. Divers adhésifs ont été testés sur le tapa, et on a découvert qu'une combinaison d'émulsions acryliques et de carboxyméthylcellulose ou de Klucel H donnait de bons résultats et était facilement réversible. Plusieurs méthodes ont été mises à l'épreuve pour détendre les fibres et en réduire la très grande fragilité. Les résultats sont satisfaisants, mais ont modifié la nature propre au tapa huilé. Les mesures de pH ont révélé une acidité plus forte que pour le tapa hawaïen non huilé. Le lavage ramène le pH des pièces huilées à un niveau acceptable sans modifier sensiblement les caractéristiques physiques du tapa. La seconde partie de la communication traite du tapa mamaki. Ce genre de tapa très mince et cassant, est souvent découvert sous forme de fragments trop fragiles pour supporter la moindre manipulation. Une acidité extrême est en général considérée comme la cause de cette fragilité. Des tests ont révélé un pH de 4,4. A l'analyse, on a découvert une teneur en acide oxalique 1000 fois plus élevée que dans les autres tapas hawaïens. Des échantillons de tapa mamaki ont été lavés à l'eau pour les débarasser en partie de l'acidité. Cette mesure a permis d'élever le pH et de redonner une certaine souplesse au tapa sans modifier ses caractéristiques physiques. On a fait l'essai de diverses doublures pour renforcer l'ensemble du mamaki. Le papier tengujo collé avec de la colle d'amidon de riz a donné des résultats satisfaisants. Ce papier très fin et la colle d'amidon ont aussi été utilisés pour effectuer de nombreuses petites réparations au tapa et ont donné de bons résultats.

THE CONSERVATION OF THE MAORI BIRDMAN KITE IN THE AUCKLAND MUSEUM, NEW ZEALAND

GERRY BARTON

During 1984-86 a 19th century Maori Kite underwent conservation treatment in preparation for its display in the new Maori Gallery of the Auckland Museum. The kite is a rare example of a manuaute, *or birdman kite. The kite is constructed from materials traditionally utilized by Maori craftspeople and with materials newly available from European towns being established in colonial New Zealand. Research was undertaken prior to conservation treatment to establish the history of the kite since it was presented to the Auckland Museum. Evidence on the kite and archival sources revealed at least four occasions when the kite was repaired between 1890 and 1980. Research was also directed into uncovering more about such kites and their role in Maori society. The paper briefly outlines this research and describes the conservation work carried out on the kite. Also described is the fabrication of the visual replica of the mask of the kite as it appeared when the kite was in new condition.*

1.0 Introduction

The Maori fabricated a range of kites from small ones, which were easily made from few materials, to larger more complicated structures imbued with spiritual power. The accepted Maori term used for kites is *manu* (bird) followed by a definition; for example, *manu aute*, *manu taratahi*, or *manu kaka* (1).

Kites had a place in several facets of Maori society, ranging from children's games and more serious adult kite flying competitions, to playing roles in tribal politics. There are 19th century accounts of kite flying contests involving 20 to 30 men controlling kites soaring at the end of 700 metres of line. Other kites possessed special qualities and could only be flown by men of rank or by priests (2). In times of war kites were used to divine the advisability of carrying out an attack (3). Land claims were made or substantiated because of kites and there are a number of accounts of tribal groups laying claim to the locality where their runaway kite landed; reasoning that the kite had invested their *mana* in the land where it fell (4).

The social changes in New Zealand during the 19th century saw the end of the art of kite making as a popular craft. The Birdman Kite in the Auckland Museum is one of two remaining examples of this type of kite in existence (Figure 1). These kites are known as *manu aute* and were regarded as particularly fine kites because of the way their wings quivered when in flight. They were not high fliers and the length of the line was at best 150-200 metres. Constructed in the mid-1880's, the Auckland Museum kite is a superb example of Maori craftsmanship responding to the availability of non-traditional materials in order to create an artifact of pre-European antecedents.

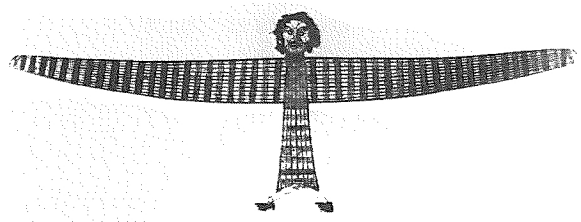

Figure 1. The Auckland Museum kite c. 1890. It was constructed in about 1885 by a kitemaker living at the East Coast region of New Zealand.

2.0 Description

The kite has a wingspan of 3.53 m and a body length (from top of head to claws) of 1.27 m. The maximum thickness of its structure rarely exceeds 10 mm, the diameter of the most substantial structural elements making up the wings and body frame. The kite consists of two components: the mask, and the body and wings.

The body and wing framework are formed from twigs and sticks which create a very strong but lightweight support for the fabric. Two species of wood were used: the framework is of *manuka (Leptospermum scoparium)* or *kanuka (Kunzea ericoides)*, both of the family *Myrtaceae*, and the side struts of the upper body and head are of a vine known as supplejack (*Riposonum scandens*). Sticks range in diameter from 2mm to 10mm. Binding the structure into a single unit are small diagonal lashings of two-ply flax cord positioned at most points where the sticks cross each other at right angles (Figure 2).

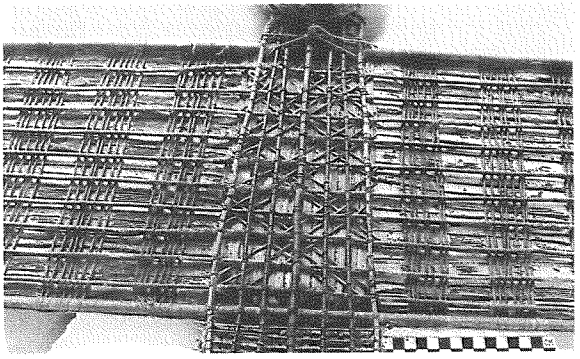

Figure 2. Detail of the wing and body construction of the kite. The parts of the framework which are wrapped in flax cordage for 5-6 cm of their length are the places where the tapered ends of structural members have been joined to make the wing framework.

The wings are made of 12 longitudinal struts braced at right angles by 45 groups of much thinner sticks. These groups, at the wide part of the wing surface close to the body, comprise 6 or 7 parallel twigs about 3mm apart. Towards the wingstips the number falls to 4 or 5 twigs per group. At the wingtips, further bracing is supplied with two groups of twigs forming a cross structure at 45° angles to the other structure. To obtain the 3.53 m wingspan the sticks have been tapered at their ends so that they can be lashed together side by side without thickening the strut.

The body framework consists of 7 vertical running struts passing from the curved bottom of the body to the neck area. To form the structure to which the mask is fixed, the *Myrtaceae* sticks are substituted in one area with split supplejack. This piece, because of its inherent flexibility, forms the upper half of the right hand strut. It is bent, first, into the neck, then out and around to form the outline of the head and the other neck indentation. It then straightens out to become the upper half of the left hand strut of the body (Figure 3). Bracing these vertical struts are groups of thinner sticks identical to those used on the wings. At the bottom of the body two short additional struts have been inserted into the framework to run vertically to the second group of cross struts. Both the wing and body have been partially painted with black and red pigments, the colours alternating with each group of thin struts.

The fabric of the kite consists of two layers. Against the wood framework, using two-ply flax cord, are tied strips of *raupo* or bullrush leaves (*Typha muelleri*) 2-3 cm wide. Covering these, and in effect making the back of the kite, is a plain weave cotton fabric sewn to the frame with linen thread. Along either side of the body from the wing to the feet is a plait of red, yellow and blue wools - now largely missing.

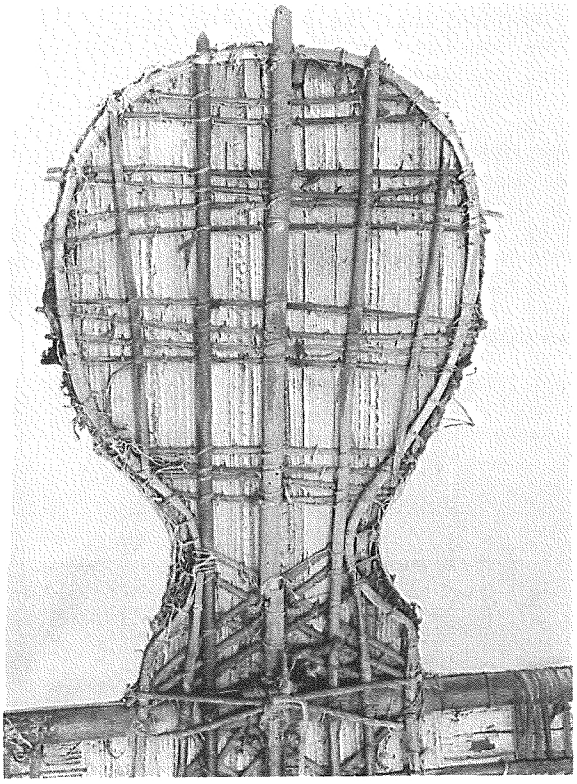

Figure 3. Detail of the mask mount. The curved edge strut of this area is split supplejack selected for its flexibility. All other bracing and structural wood is Myrtaceae. *The* raupo *leaf lining under the framework is clearly visible.*

The legs are constructed from a thick plait of New Zealand flax (*Phormium tenax*: fam. *Liliaceae*) which tapers at each end to form the ankles. This is covered with the cotton textile. The feet consist of bunched sticks of *Myrtaceae*, each of which is spread to terminate in 4 claws up to 30 mm long covered with red-coloured wool.

The face of the kite is an extremely rare example of Maori mask making (Figure 4). The basic structure of the mask is made from split supplejack tied with flax cord into a shape upon which the contours of the face could be created. Over this framework were placed pages from an 1884 copy of the New Zealand government gazette, *Ko te Kahiti o Niu Tireni*, anchored in place with sewing thread. The cheek bones, tip of the nose

and chin required higher contours than could be provided by the supplejack framework and were padded out with black-coloured cotton wool. Overlying the newsprint and cotton wool is a sheet of beaten bark fabric. No positive identification has been made, although it has been determined that the bark cloth is not beaten ribbonwood or lacebark (*Hoheria sp.*) which were used on occasion in New Zealand. Possibly it is a rare piece of *aute*, the Maori name for bark cloth beaten from the paper mulberry (*Broussonetia papyriera*). Fixed to the surface of the bark cloth are the mouth and eye details. These consist of an undetermined tubular core covered with a linen textile which, in turn, is largely covered with a black coloured flax cord tied into place with half-hitch knots. The eyes are built up from *paua* shell (*Haliotis iris*) discs but the mouth is sewn directly to the mask.



Figure 4. The mask of the kite as it exists today. Compare with Figure 1 to see the deterioration which has taken place over nearly a century of open display.

3.0 History and Condition of the Kite

The kite was made sometime between 1884 and 1886, when it was presented to the Museum by Sir George Grey. It was made by a kite maker in the East Coast region of the North Island of New Zealand. The kite was on open display from 1892 until about 1970 when a newly appointed ethnologist, concerned about its appearance, removed it from the gallery wall to save it from further deterioration by exposure to sunlight.

Over this period the kite underwent several restorations and repairs, most of which had disappeared by 1970. One, however, was of a more permanent nature. The right leg for some inexplicable reason was forced out of its original alignment in about 1929 into an inward curve so that the claws pointed roughly towards each other. To keep the leg in its new position a tensioned brass wire 1 mm in diameter was pushed into the flax core. The cotton which covered the leg was then crudely stitched back over the flax (Figure 5). By this time the cotton textile had begun to disintegrate about the legs and ankles.

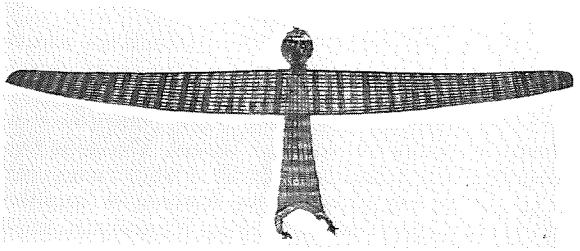

Figure 5. The kite in 1984 after about 80 years of open display conditions (compare with Figure 1.)

A comparison between the 1890's photograph (Figure 1) and the kite in 1984 (Figure 6) shows a number of the losses sustained over the years. With the exception of the missing battens at the feet, the losses are all from the mask. Missing is the linen or calico, upon which had been painted

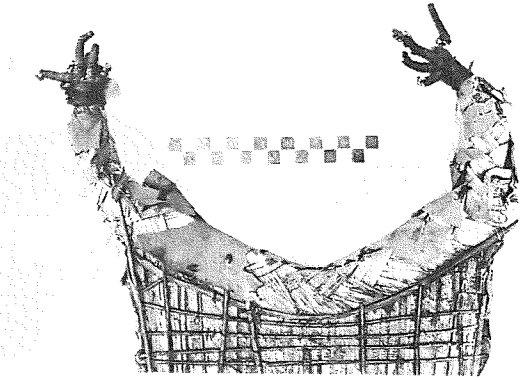

Figure 6. The condition of the feet and legs in 1984. The mis-alignment of the kite's right leg (compare with Figure 1) is intentional and date to the 1929 restoration work. It was kept in this position by the insertion of a curved brass rod into the flax leg structure which forced the right leg into the position seen here.

the *moko* or facial tattoo, and the 4 pointed teeth from the mouth. The hair, created by splitting the shafts of flight feathers from the *kahu* (Australasian harrier) has completely disappeared. The shark's tooth pendant from the right ear and some sort of collar or wrap about the neck of the figure have also vanished. In an attempt to preserve the degrading cotton textile and the bark cloth, the face and the feet areas were sprayed with polyurethane and the kite placed in storage until 1984 when its conservation commenced.

4.0 Conservation

4.1 The Body

The liberal application of polyurethane not only consolidated the textile, but also fixed its contours into the folds and creases created when the right leg was re-shaped in 1929. It also bonded the accumulated dust of 4 decades of open display conditions to the textile. It was hoped that enough polyurethane could be removed to have a cleaning effect. At the same time, removal might also introduce flexibility into the textile thus allowing re-alignment of the leg.

The polyurethane resin had not only coated the cotton fibres but had also formed permanent chemical links with the cellulose as shown in Figure 7. Part of the strength of cotton is provided by its water content which gives the fibres their flexible quality. Because any available moisture is used in the crosslinking process of the resin, the cotton fibres become desiccated as the resin cures. This results in a loss of flexibility in the fibres at precisely the time they are being subjected to powerful stresses by the curing resin. During the curing a shrinkage in resin volume of 1-2% occurs through crosslinking processes and solvent loss, thus subjecting the textile to surface and internal stresses before locking the weave into the resin.

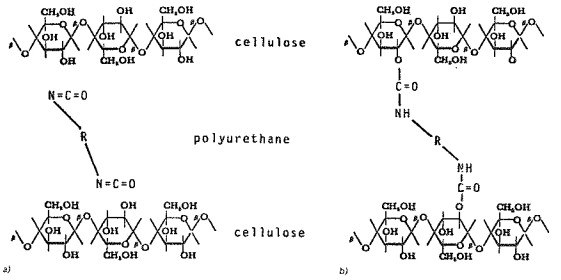

Figure 7. The reaction between cotton fibre and polyurethane resin. a) cellulose chains in contact with polyurethane resin; b) two cellulose chains bonded together into an impervious amide linkage.

By 1984 the resin had aged to the point that the textile was again breaking up. This disintegration was characterized by very brittle fibres which allowed sections of the treated cotton to break off from the kite with no physical encouragement other than gravity. Because of the above described processes the polyurethane-cotton was in a poorer condition than adjacent areas of untreated cotton and consequently removing the resin (in the unlikely even that it was even possible) was out of the question.

It was decided to manipulate the stiff textile as carefully as possible into its original shape and to support it with a textile backing. Stitching from the 1929 treatment was unpicked and the aged textile folded away from the legs and ankles. Carrying out this process inevitably resulted in further disintegration of the rigid textile. The plaited flax legs were re-aligned, severed flax fibres rejoined using poly(vinyl acetate) (PVA emulsion Promatco A1023) and new strengthening provided by inserting a slender wooden splint into each leg. The backing fabric was then slipped under the original cotton textile. The fabric selected was a polyester with a similar weave, texture and colour to the 19th century cotton. Stitching this to the polyurethane impregnated cotton proved impossible as the deteriorated fibres simply snapped with the pressure of the needle and sewing thread. Therefore, the polyester was coated with a heat sealing poly(vinyl acetate) (Mowilith DM44H) diluted 1:3 in ethanol and ironed to the cotton.

The frail cotton regularly split, first when being bonded to the polyester, and later when being wrapped about the legs of the kite. This required the tacking and re-tacking of small pieces and margins of the cotton to the polyester. The PVA emulsion used to adhere the two textiles imparted a glossy appearance to the surface of the polyester. This did not matter where bonding took place, but where there were holes in the cotton textile, and where whole pieces of it were missing, this glossy surface was exposed. This was minimized by dissolving the Mowilith film with acetone applied with a fine brush and, a few seconds later, blotting the area with absorbent paper.

Various broken twigs in the framework, as well as fractured pieces of *raupo* and snapped flax fibre lashings, also required some attention. All repairs were bonded with the Promatco A1023.

In order to avoid handling the kite unnecessarily, cleaning was restricted to areas that needed strengthening. Once the structure was stable it

could be cleaned completely. This was carried out using a soft sable brush while simultaneously vacuuming the area under treatment. The efficiency of this method was clearly shown when the grey coloured cotton covering the back of the kite became a buff colour as vacuuming progressed. On the front great care had to be taken with the *raupo* as the inner membrane of the leaves of this plant, which are exposed on the kite, was extremely thin and brittle. The fragile nature of the *raupo* also prevented the removal of the obtrusive catalogue number on the body by mechanical or solvent cleaning. It was therefore not removed but disguised by over-painting with watercolours.

The only aqueous cleaning carried out was that on the wool covering the claws which was dusty and discoloured. Brushing proved ineffective so the wool was washed in a weak detergent solution which resulted in some brightening of colour (5).

4.2 The Mask

The mask was attached to the kite by large stitches which were judged to date from the restoration work of 1929. These were cut and the mask removed from the kite. The newsprint, bark cloth and cotton wool were extremely fragile and the mask had also sustained structural damage from insect attack and poor handling.

Four supplejack cane struts at the top of the head were snapped and their covering torn, suggesting that the head had been crushed and later casually pulled back into shape. These fractures required butt joining. To provide the requisite strength to the joins several layers of Japanese tissue were wound round the breaks using diluted Promatco A1023 as the adhesive. The dilution varied with the amount of tack needed with each repair.

With structural strength regained, the interior and exterior of the mask were cleaned of dust and insect frass by brushing with a soft brush and using a vacuum cleaner. The *paua* shell eyes were cleaned with acetone applied with cotton wool swabs.

The face of the mask, like the legs, had been previously sprayed with polyurethane in an attempt to consolidate the disintegrating newsprint, bark cloth and cotton wool. The effect, if any, was now lost and the bark cloth was delaminating. A paste of 2% w/v carboxy methyl cellulose in water was applied to these areas with a stiff pointed brush.

A decision had not been made regarding the ragged areas of newsprint and bark cloth on the head. These two materials would once have completely covered the framework, but extensive losses had left only patches held in place by the most tenuous of links with adjacent pieces. When the mask was removed from the kite a number of pieces were found in the space under the head where they had fallen inwards over the years. Enough pieces remained to warrant an attempt at partially re-covering the head. This was done by spreading a piece of Stabiltex over a ball of tissue paper the same size as the head cavity. The mask was placed over this, the loose fragments of newsprint and bark cloth were laid on top, and then a second piece of Stabiltex was spread over the whole head — in effect sandwiching the fragments. By passing a curved sewing needle through the framework where no paper or bark cloth lay, the bottom piece of Stabiltex could be caught by the needle and drawn towards the upper piece by the sewing thread. The thread was then knotted. The effect was of a rather rough quilting with all the loose original material securely anchored between the almost transparent Stabiltex. A small amount of trimming and adjustment was necessary to make the Stabiltex as unobstrusive as possible.

5.0 Conclusion

This project emphasized the importance of curatorial research when assessing conservation requirements of artifacts. At the Auckland Museum the conservators are encouraged to carry out such research as part of their documentation. This policy resulted in an interesting situation because, as more information about the history of the kite came to light, less actual treatment was carried out. Originally the curatorial directive was to restore the kite to its 1890's appearance, but by the completion of the project 2 years later the kite had only been stabilized to its existing condition. To satisfy the curatorial demands, a replica of the most damaged part of the kite, the mask, is being created in order to show how the kite originally appeared. This approach is far more satisfactory than a complete restoration, although it was not particularly evident before the research was carried out.

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Biographical Notes

Gerry Barton graduated from the University of Auckland New Zealand with an MA (hons) in Anthropology. Following studies at ICCROM and an internship in ethnographic conservation at the Canadian Conservation Institute he has been employed as Conservator at Auckland Museum since 1981, specializing in the care of ethnographic materials. He is author of a number of articles relating to the conservation of New Zealand art and artifacts and in 1986 was made a Winston Churchill Memorial Fellow after completing a research programme on the washing of Maori cloaks.

De 1984 à 1986, un cerf-volant maori datant du XIXe siècle a été soumis à un traitement de conservation en vue de son exposition dans la nouvelle salle maorie de l'Auckland Museum. Il s'agit d'un rare manuaute, un cerf-volant d'homme-oiseau. Le cerf-volant est fait de matériaux traditionnels des artisans maoris et de matériaux introduits par les Européens à l'époques coloniale en Nouvelle-Zélande. Avant d'entreprendre la conservation, on a fait des recherches pour déterminer l'histoire du cerf-volant depuis son arrivée à l'Auckland Museum. Des indices sur le cerf-volant et des documents d'archives ont révélé que l'objet avait été réparé au moins quatre fois entre 1890 et 1980. La recherche visait aussi à mieux connaître les cerfs-volants de genre et leur rôle dans la société maorie. L'auteur de la communication décrit brièvement la recherche et ce le traitement de conservation effectué sur le cerf-volant. Elle décrit aussi la fabrication d'une reproduction visuelle, montrant l'aspect original du masque qui orne le cerf-volant.

CONSOLIDATION OF CELLULOSIC FIBRE MATERIALS

CAROLINE ALLINGTON

Many different consolidants have been used in the past on cellulosic fibre materials, with varying degrees of success. The most popular of these consolidants are examined briefly, and their performance commented upon. The consolidants in current use are then discussed and their performance evaluated. Hydroxypropyl cellulose is the most recent consolidant to be used in this field of conservation. Paper conservators have been using HPC — Klucel grade G — for some time, both as a consolidant and as an adhesive. A more flexible grade — Klucel grade E — has proved useful. Case histories are given of the treatment of fishing nets, grass skirts, and a straw bee-hive using this consolidant.

1.0 Introduction

Cellulosic fibre materials of bast, leaf, seed or root origin are degraded by almost every known physical, chemical and biological factor, resulting in embrittlement, discolouration, loss of strength, etc. (1). The aim of the conservator is to prolong the life of objects made of these (and other) materials. To do this, consolidation of the fibre material may be deemed necessary by the conservator responsible, depending upon the merits of the individual object and its proposed function. Some fibre objects, such as initiation masks, were only intended for use once before being discarded while other objects, such as fishing nets, may have been used extensively before becoming part of a collection. Obviously a museum object destined for storage in ideal conditions would not normally require the same treatment as an object that forms part of a study or loan collection, or open-air or travelling exhibit.

A consolidant is a medium which can impregnate the material and impart strength by binding it together (2). On the other hand, a lubricant or humectant, such as an oil or glycerol, is only intended to impart flexibility. Sometimes both functions are required for the preservation of an object. This involves the selection of either a consolidant and compatible lubricant or humectant, or a material which combines both functions, such as PEG (polyethylene glycol) 600 (3) or 1000.

2.0 Consolidants and Adhesives

An ideal consolidant for cellulosic fibre materials should:

- provide strength and in some cases flexibility to degraded and embrittled fibres
- remain reversible and chemically stable over long periods
- not change the colour, texture and appearance of the fibre material
- have low viscocity to ensure good penetration and minimal shrinkage due to solvent loss
- not swell the fibres.

There are probably other factors involved but the above is a personal list of requirements formulated from a wide range of problems encountered over the years (4).

It is only recently however that so much could be demanded of a consolidant, and that the functions of adhesion and consolidation have been separated. Formerly all that was required of a consolidant/adhesive was that it should hold the object together. To this end a considerable variety of substances have been used. Tables 1 and 2 show some of the types of adhesives used in the past which could penetrate the fibres to some extent and thus could be considered as consolidants. This list does not include the lubricants and humectants such as oils, lanolin and glycerol which prevent powdering but do not in any way strengthen the structure.

Museum collections, especially those in older museums, provide plenty of examples of consolidation with adhesives which are often difficult or even impossible to remove without damaging the object, even if one could identify the substance. Rixon (5) described simple identification tests for animal glues and gelatin, shellac, and cellulose acetate and nitrate. The colour-forming spot tests given by Howie (6) can identify some of the vinyl polymers by the reactions of their functional groups with an acidified iodine/potassium iodide solution. Howie compiled a very useful table showing the chronology of materials used for fossil consolidation from c.1800. Many of these materials have also been used on fibrous organic objects. Within the last six months the Textile

Conservation Workshop of the National Museum of Denmark has been presented with examples of archaeological cellulosic fibre textiles consolidated with shellac; string and knot samples coated with waterglass; and other fibre materials impregnated with glycerol. In these cases it has proved impossible to remove the consolidant without severely damaging the objects. This is hardly surprising when one considers, for example, the problems associated with removing shellac from a relatively strong bodied fabric such as ceramic (7).

2.1 Natural Adhesives and Consolidants

The natural adhesives are generally inflexible and susceptible to insect and mould attack. In addition, their chemical and physical properties change due to the presence of impurities, biodeterioration, relative humidity and exposure to light. Their properties can also be altered deliberately. Starch (Table 2) is one of the earliest known adhesives (8) and can be used as flour and water paste, or modified by heating to give dextrins (9). As a bookbinder's paste starch often contains a little gum to aid "tack" and to alter the drying rate (10).

Table 1

Natural Products

Plant origin	Gums Starches Resins Seaweed derivatives Proteins
Animal origin	Casein Gelatin Beeswax Shellac
Mineral origin	Paraffin wax Copal resin Bitumen

Starch was, and still is, one of the most widely used adhesives. It is valued for its ease of preparation, ready availability, cheapness, and compatability with cellulosic fibre materials such as papyrus, paper and textiles. Although relatively inflexible and prone to insect and mould attack, it has proved reversible after hundreds of years (8).

Gums and resins are another early type of widely available plant adhesive, which were collected from trees and bushes and required little or no preparation (11).

Table 2

Plant Origin

Gums	arabic	Resins	pine
	karaya		dammar
	tragacanth		elemi
	guar		mastic
Starches	rice		agar-agar
	wheat	Seaweed	alginates
	arrowroot		irish moss
	potato		
	sago	Protein	soy
	tapioca		
	waxy maize		
	dextrins etc.		

Animal glues and gelatins have been used in almost all areas of the world but require considerably more preparation than the previously mentioned adhesives. Although initially more flexible than the plant adhesives (especially gelatin) with time they become brittle and discoloured, often badly staining the object.

Shellac is another commonly employed adhesive/consolidant, but its drawbacks have already been described. Waxes, such as beeswax and paraffin wax, have also been used on fibre materials but, like bitumen, they do not penetrate well and tend to remain as a surface coating, which becomes somewhat sticky in hot climates and brittle in colder ones.

2.2 Synthetic Adhesives and Consolidants

A significant change in fibre consolidation occurred with the introduction of non-aqueous soluble adhesives such as cellulose acetate and nitrate around the turn of the century. The ease of application and quick drying of the synthetic adhesives ensured their use in most conservation applications. In the last 50 years or so the conservation profession has been experimenting with synthetic products such as those shown in Table 3.

Table 3

Synthetic Products

Acrylates
Cellulose derivatives
Polyvinyl resins
Soluble Nylon - N-methoxymethyl nylon
Waxes — Polyethylene glycols - PEG, Carbowax
Microcrystalline - Cosmolloid

The polyvinyl resins are available in many varieties and grades, and have been recently the most widely used group of adhesives/consolidants in conservation. The first published use of polyvinyl acetate in conservation was in 1934 by Plenderleith (12). Howie notes its use in 1932 for fossil consolidation (6).

Polyvinyl alcohol, acetate, and butyral have been used most in the conservation of flexible materials such as fibres. At present there are at least 19 different trade names for polyvinyl alcohol available in the United Kingdom. In addition, there are more than 60 brands of polyvinyl acetates, and about 20 polyvinyl butyrals (13). Many more trade names were available in the past, thus sweeping generalisations about the properties of these products are rather difficult to make. Manufacturers are prone to alter product content without notice. The variety of properties, particularly the range of flexibilities, viscosities, thermosoftening temperatures and solvents, together with the apparent stability of this group of products seemed to fulfil the requirements of conservation.

Unfortunately, the long-term stability of these products has not lived up to expectations. The polyvinyl alcohols, possibly the most useful of this group in the conservation of fibre materials due to their flexibility and solubility range, have especially poor ageing properties (14).

The acrylates have not been used as widely as the polyvinyl resins for fibre consolidation but seem to be more stable. Their main drawback as far as fibre consolidation is concerned has been their relative inflexibility and the solvents necessary for their application. Paraloid (Acryloid) B72, a methyl acrylate/ethyl methacrylate copolymer, is currently the most promising of this group for fibre consolidation because, due to a fairly recent change in its composition, it is now soluble in ethanol (15).

Soluble nylon was used enthusiastically during the 1960's and 1970's as a consolidant for many different types of materials. Hopefully its widespread use has now been curtailed, due to its insolubility with ageing (16). In the past, however, due to its flexibility, matt appearance and good adhesive properties soluble nylon was popular as a cellulose fibre consolidant. For example, Gowers has described its use as a consolidant for a fragile cedar bark Tlingit blanket (17). It was also used as a temporary consolidant, such as for protecting tassels when washing Maori flax

Table 4 — Synthetic Consolidants

Acrylates	
Methacrylates Ethyl methacrylates Butyl methacrylates Ethyl acrylates	Acryloid/Paraloid, Bedacryl, Plexisol, Plextol, Primal.
Polyvinyl Resins	
Polyvinyl acetates	Mowilith, Vinamul
Polyvinyl acetals	Alvar, Rhovinal, Mowital
Polyvinyl alcohols	Mowiol, Elvanol
Polyvinyl butyrals	Movital, Butvar
Polyvinyl formal	Rhovinal B
Cellulose derivatives	
Cellulose acetate	
Cellulose nitrate	
Methyl cellulose	Methocel
Sodium carboxymethyl cellulose	Cellofas, CMC
Methyl hydroxyethyl cellulose	Tylose
Ethyl hydroxyethyl cellulose	Modocol E
Hydroxy ethyl cellulose	Natrosol
Hydroxy propyl cellulose	Klucel

capes. It has also been used for consolidating tree fern root sculptures where it is very difficult to imagine its successful removal!

Cellulose ethers (Table 4) are a group of adhesive/consolidants which have proved very useful in the conservation of paper and other cellulose fibre materials. They seem to fulfil most of the requirements for cellulosic fibre consolidation. Many are quite flexible although this does, of course, depend on the viscosity grade chosen. For example, hydroxypropyl cellulose (HPC) Klucel grade "G" (used by paper conservators) has a medium viscosity whereas "H" has a high viscosity and is consequently quite stiff (18). The lower grades, such as "E", are not only more flexible but the solutions are less viscous, enabling better fibre penetration. If required, flexibility can be increased by adding one of the lower molecular weight polyethylene glycol waxes to the consolidating solution.

The fibre consolidants in current use are still dilute solutions of adhesives. The most popular seem to be polyvinyl acetate emulsions, and some of the cellulose ethers, principally sodium carboxymethylcellulose (Cellofas), ethyl hydroxy ethyl cellulose (Ethulose) and hydroxy propyl cellulose (Klucel). Modified wheat starch, acrylic co-polymer Paraloid B72 and polyvinyl butyral, acrylate

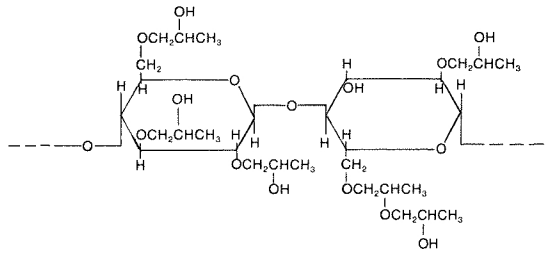

Figure 1. Idealized structure of hydroxypropylcellulose.

Table 5

Solvents for Klucel

A. Clear and Smooth	
Water	Dioxane
Methyl alcohol	Dimethyl sulfoxide
Ethyl alcohol	Dimethyl formamide
Isopropyl alcohol (95%)	Ethylene chlorohydrin
Propylene glycol	Tetrahydrofuran
Methyl Cellosolve	Cyclohexanone
Cellosolve	t-Butanol:water (9:1)
Chloroform	Acetone:water (9:1)
Formic acid (88%)	Glycerin:water (3:7)
Acetic acid (glacial)	Benzene:methanol (1:1)
Pyridine	Toluene:ethanol (3:2)
Morpholine	Methylene chloride:methanol (9:1)
B. Moderately Granular and/or Hazy	
Tertiary butanol	Methylene chloride
Cyclohexanol	Butyl acetate
Acetone	Butyl Cellosolve
Methyl ethyl ketone	Lactic acid
Methyl acetate	Naphtha:ethanol (1:1)
Isopropyl alcohol (99%)	Xylene:isopropyl alcohol (1:3)
C. Insoluble	
Aliphatic hydrocarbons	Methyl chloroform
Glycerin	Carbon tetrachloride
Benzene	Gasoline
Toluene	Kerosene
Xylene	Mineral oils
Dichlorobenzene	Soybean oil
Trichloroethylene	Linseed oil

(a) Solvents were tested using Klucel G at 2% solids concentration by weight. All ratios indicated in this table are on a by-weight basis.

Table 6. Viscosity of Klucel				
Solvent	Klucel Type and Concentration Viscosity, (a) cps			
	H at 1%	G at 2%	L at 5%	E at 10%
Water	1,900	270	80	275
Methanol	—	85	25	75
Methanol:water (3:7 by weight)	—	360	—	—
Ethanol	1,320	210	65	255
Ethanol:water (3:7)	—	500	—	—
Isopropyl alcohol (99%)	(b)	(b)	145	570
Isopropyl alcohol (95%)	—	—	130	420
Acetone	(b)	(b)	50	175
Methylene chloride	2,785(b)	—	1,240(b)	14,600(b)
Methylene chloride:methanol (9:1)	5,000	—	400	—
Chloroform	—	—	2,560(b)	17,000(b)
Propylene glycol	8,590	6,640	5,020	>10,000
Ethylene chlorohydrin	470	430	310	1,110

(a) Viscosities shown are presented only as typical values. Some variation in these viscosities will be obtained from lot to lot of each Klucel type.
(b) Liquid is borderline solvent for the particular Klucel type, and solutions are granular and may be hazy.

ester (Plexisol B597) are also used to a lesser extent. Hydroxypropylcellulose-Klucel (Figure 1) is the most recent addition to this group. In the last five years it has proved a useful fibre consolidant for paper (19) and other dry cellulosic fibres (20) and also in the freeze drying of water-logged material such as rope. It has good stability to both heat and light ageing (19,21) and is soluble in a wide range of solvents (Table 5). It is available in a variety of grades, "E" being the most suitable for fibre consolidation because of its low viscosity (Table 6). Its use will be further illustrated in the following section.

3.0 Case Histories

The following brief case histories illustrate typical uses of hydroxypropylcellulose for fibre consolidation:

3.1 Oceanic Modesty Apron

After 80 years nailed up on open display in a seaside museum this "modesty apron" was very fragile, brittle, and dusty (Figure 2). It was laid on a frame and washed by rocking gently in demineralised water. Excess water was blotted off and the frame lowered into a 3% solution of Klucel E in demineralized water. After 20 minutes the frame was taken out, and the apron allowed to dry while still on the frame. The object itself was not touched at all during treatment. It is now strong enough to be displayed again, hopefully under better conditions (Figure 3).

3.2 Stringbound Straw Beehive

This Beehive was from an open-air museum in West Jutland. Due to a flood it was wet, mouldly, misshapen and very dirty (Figure 4). After drying, loose debris was removed using a vacuum cleaner and the beehive washed in an ethanol/isopropanol mixture with a soft brush. When half-dry the beehive was impregnated with a 3% solution of Klucel E in isopropanol/demineralised water 9:1, and reshaped using elastic bandage. When dry, loose pieces were adhered with a 7% aqueous solution of Klucel E (Figure 5).

3.3 Net from "Greenland"

Fibre analysis showed this net, supposedly from Greenland, to be made of *Phorium tenax* — New Zealand flax (Figure 6). It is now undergoing examination by many of the Museums' departments to establish its provenance. The stiff and brittle net was put into a humidity chamber overnight and then carefully unfolded. It was sprayed with an aqueous solution containing 1.5% Klucel E and 0.5% polyethylene glycol 550.

The net is now strong and flexible enough to be handled (Figures 7 and 8). To date its provenance has still not been established.



Figure 2. Before conservation.



Figure 3. After conservation.

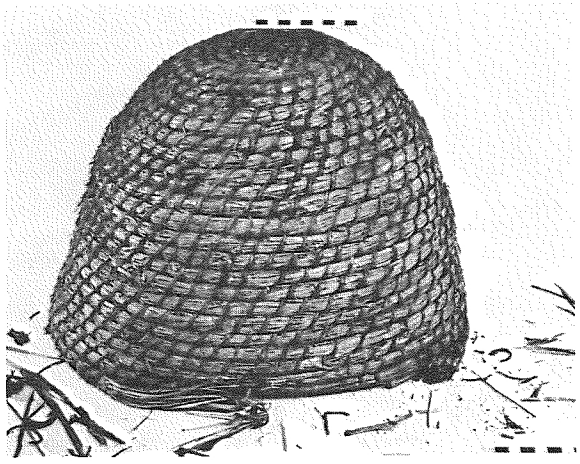

Figure 4. Before conservation.

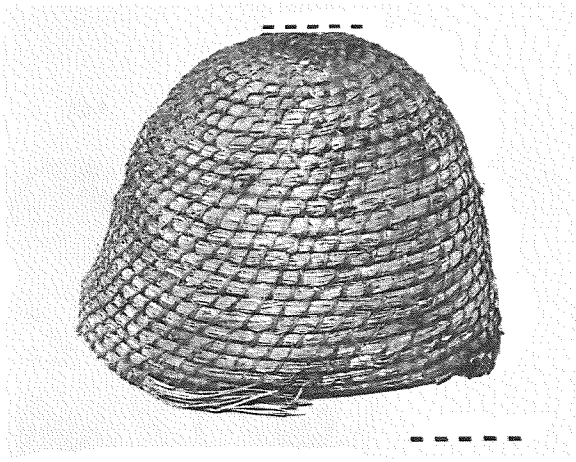

Figure 5. After conservation.



Figure 6. Before conservation.

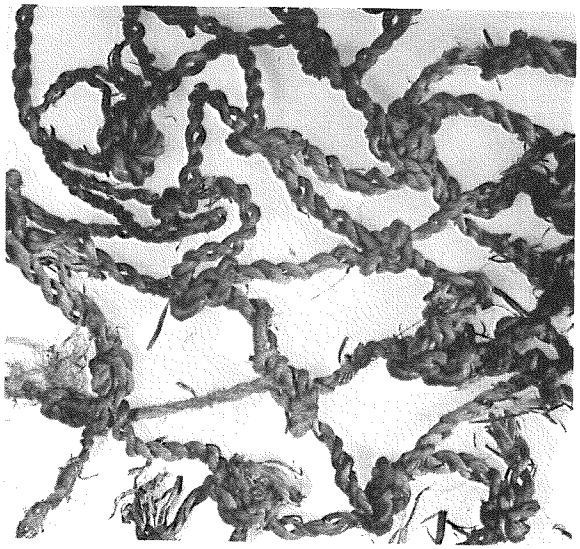

Figure 7. Detail, after conservation.

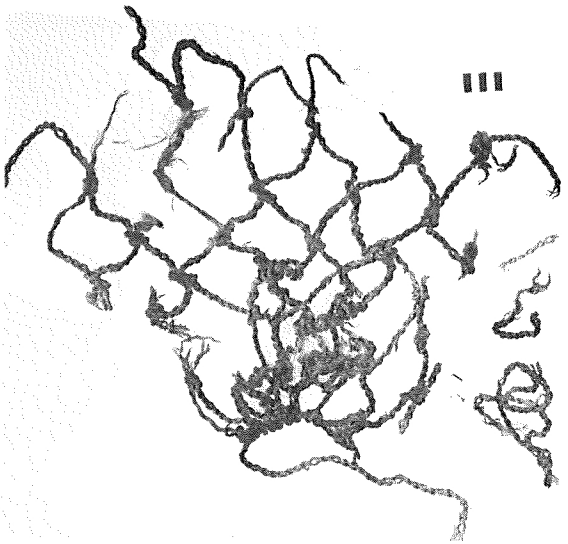

Figure 8. Overall view, after conservation.

4.0 Conclusion

This brief survey of the materials used for cellulose fibre consolidation clearly indicates that before the advent of modern conservation a wide range of unsuitable materials were used. Now that there is a better awareness of the physical and chemical characteristics of consolidating materials, the choice has became considerably circumscribed. Synthetic resins are to be favoured over natural ones because their properties are better understood. Of the synthetic resins currently available, hydroxypropylcellulose seems to have the most desirable characteristics as a consolidant/adhesive for fibrous cellulose materials.

Acknowledgements

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Biographical Notes

Caroline Allington trained in conservation at the Conservation Department of the British Museum (Organics Section) and the University of London Institute of Archaeology. In 1982 she joined the Ribe and Ringkobing counties conservation service in Denmark as Organics Conservator, and since 1985 has worked for the Textile Conservation Laboratory at the Danish National Museum, and at Rosenborg Castle. Her main conservation interests are fibre consolidation and the problems of composite objects.

Dans le passé, on a traité avec plus ou moins de succès les fibres cellulosiques au moyen de divers agents de consolidation. Les plus courants de ces agents sont décrits brièvement et leur rendement, commenté. Les agents de consolidation actuellement utilisés sont ensuite discutés et leur rendement, évalué.

L'hydroxypropylcellulose est utilisé depuis peu dans ce domaine de la conservation. Les restaurateurs d'oeuvres sur papier utilisent l'HPC — Klucel G — depuis quelque temps déjà, comme agent de consolidation et comme adhésif. Le Klucel E, plus souple, s'est avéré utile pour le traitement de pièces ethnographiques, folkloriques, historiques et même archéologiques. Pour illustrer l'emploi que l'on fait de ce consolidant, on présente des études de cas sur le traitement de filets de pêcheurs, de jupes de fibre et d'une ruche en paille.

WHEN TEXTILES ARE PAINTINGS

LESLIE MELVILLE SMITH

Pigment-painted patterns are encountered by the textile conservator, especially on ethnographic examples. In this paper interdisciplinary treatments of paper, painting and object conservation approaches are described. Case histories include: large South Pacific tapa cloths, torn and sharply folded at an unknown date which were scheduled for a loan exhibition, a series of Peruvian painted textiles analyzed before establishing a conservation programme, and the treatment of various Oriental textiles of silk with gilded designs.

1.0 Introduction

Most large museums with comprehensive collections have a conservation staff of specialists in the various disciplines. In the Boston Museum of Fine Arts (MFA), this is also our scheme, with further division in that conservators are members of the different curatorial departments and are located separately from other conservators.

The collection in the Textile and Costume Department is worldwide in scope and covers 5000 years, from Pharaonic Egypt to modern costume. Artifacts range in size from tiny archaeological fragments to yards-wide European tapestries. So varied a collection includes many objects constructed with a typical textile techniques. In the following paper the technology and conservation of a number of textiles from widely differing cultures, and possessing painted decorations rather than the more usual woven, embroidered or dyed designs, is discussed.

In these cases other staff conservators have provided invaluable help in deciding on the appropriate conservation techniques. The following examples illustrate the use of techniques and materials usually associated with other media, adapted for treatment of painted textiles. These examples also illustrate the importance of identifying the method of manufacture in order to establish a proper treatment procedure.

2.0 Conservation Treatment of Tapa Cloth

2.1 Background

The first example of cooperative treatments resulted from a request for two tapa cloths for exhibition in Europe. These were selected from a dozen cloths held in the collection since early in the century. None had ever been exhibited and as a result had not been mended or mounted. As tapa is closer in construction to paper than cloth, advice was sought from the Chief Paper Conservator in the Prints and Drawings Department (1).

2.2 Description of Cloth

The painted designs were in excellent condition; the ground alone had minor breaks and tears. Tears around the edges and cracks along fold lines were mended on the reverse with Japanese tissue, toned prior to attachment to match the tapa. For this purpose tissue was torn into strips across the grain and adhered to the tapa with wheat paste, so that grain lines of the tissue were at right angles to the tear in the tapa. As this work was done prior to the publication of Green's detailed study of tapa cloth (2), and there was uncertainty as to how much moisture the pigments could withstand, the efforts in flattening the old creases were restricted to the use of unheated humidity and weighted Plexiglas panels in the usual "cold pressing" technique.

These large tapa cloths were not completely flat when originally made, and consequently they were prepared for shipment and exhibition using partial pressure mounts. Solid panels the size of the tapa pieces and sealed with polyurethane were covered with polyester felt. The exposed felt border around the perimeter was covered with brown linen edging. The tapa sheets were laid on the panels, held partially by the friction of the polyester felt, and secured by Plexiglas strips overlapping the tapa edges by four inches on all four sides. As these were temporary mounts, the lack of complete framing was not considered essential.

3.0 Pre-columbian Peruvian Cottons

3.1 Characterization

A second group of painted textiles consisted of a small number of Peruvian textiles of Pre-Columbian date, similar to those that have been listed as "painted or dyed" in other collections. Decisions on appropriate treatment techniques were facilitated by analyses conducted by the MFA Research Laboratory (3), and by examination under the microscope to identify technique of construction.

Textiles in this group had painted designs applied to the surface after weaving. Some pigments were applied as thick pastes that had left noticeable crusts on top of the threads. Others appeared to have had pigments applied in thin slurries that penetrated the threads. None saturated the threads to the extent that colour was visible on the reverse side. The coloured areas thus belonged in the category of stains, rather than true dyes.

Cotton, the textile fibre of the coastal regions of Peru, is not an easy fibre to dye. While articles of wool can be direct-dyed (although usually pre-mordanted), cotton must be pre-treated with metallic salts in order that the fibres will absorb dyes. Native cotton was selectively grown in Peru in numerous shades of browns, tans, and white for colour variation. Other patterned textiles were produced with dyed wools that came from the highlands of Peru, where plants providing sources of organic dyes also were found (4).

The larger number of painted textiles that occur in the Late Intermediate Period could be symptomatic of interrupted trading patterns during the time of the conquering Incas' expansion into this region. Even though trade routes were cut off, the ritual of offering textiles to the dead in funeral processions of important personages would have continued (5).

3.2 Analysis

A literature search was conducted in an attempt to identify specific ceramic pigments used in this culture during this period but little has been published. While uniform clay body colours are found in South American ceramics, the colour of the surface decoration is distinct for those originating in different localities. The most conspicuous distinction is between ceramics from east and west of the Andes (6). Common colours for surface decoration are white, black, and red, with yellow occurring rarely. White decorative designs are produced with a white clay rather like kaolin. Black decoration is produced with fire soot of vegetable origin east of the Andes, but in western coastal Peru, it is made from powdered minerals and dark metallic ores. Red colours for decorating ceramics have been identified as iron oxides from red clay found extensively in soil in areas where wet and dry seasons alternate. Yellows and tans have been identified as deriving from iron not completely oxidized. In western South America, ceramic pigments were ground and mixed with water for application, but east of the Andes, slurries used for decoration were made with vegetable oils and juices (6).

The techniques used in examining these painted textiles involved preparing portions of each sample as microscope slides and examining them with a polarizing-light microscope at 500x. Part of each sample was analyzed by X-ray fluorescence (XRF) in an electron beam microprobe, which permitted the qualitative composition of particles or areas as small as about 1μm^2 to be determined. Many of the samples were coloured fibres; a number of areas of each of these were analyzed.

The textile pigments were identified predominantly as iron on all but one of the fragments originating in the Central Coast and the North

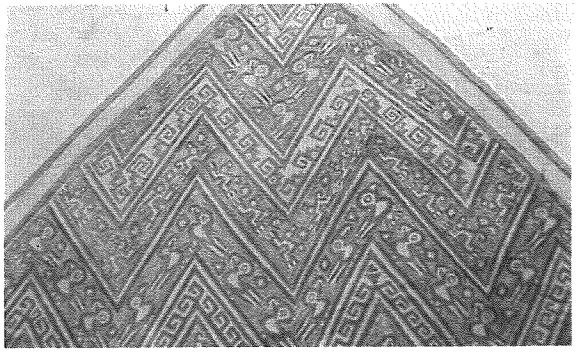

Figure 1. Detail of cotton shirt with iron pigments. Peru, later intermediate period. Probably Central Coast. BMFA No 78.68.

Central Coast of Peru from the Late Intermediate Period. Reds, tans, oranges, yellows and browns were identified as iron in varying degrees of oxidation. The pale tan in tan and white patterned fragments also gave weak iron signals (7). Black pigment on one sample was identified as carbon rather than a mineral ore. As phosphorous was also detected, the source could have been bone black (8) (Figure 1).

The one exception was found in a 15" x 9" fragment which had a deep brown pattern on a



Figure 2. Fragment of cotton cloth with lead pigments. Peru, late intermediate period. Probably North Central Coast. BMFA No 47.1091.

brown-red background, probably from a Central Coast site (Figure 2). Pigment samples from this fragment contained only lead. White lead oxide converts to red lead tetraoxide after some hours at about 480°C; at higher temperatures it reduces to white lead oxide again. Red lead will turn



Figure 3. Detail of figure 2 No 47.1091.

chocolate brown or black in acid, depending on the type of acid. Acetic acid (vinegar) causes a change to brown, and sulphur containing acids, which can be prepared from animal byproducts, can cause the change to black. Lead is found in the inland highlands contiguous to the fragment's area of origin, the North Central Coast region.

The designs executed with these pigments were created with great precision, suggesting the skill and control of an artisan in selecting and applying the pigments (Figure 3).

From these analyses, some consistent findings were observed:

a. Mineral pigments and not organic dyes were used to paint these textiles. (The orange and yellow colours would not have been so bright if the iron were from a mordant, rather than from pigments; dull and grayer colours would have resulted).

b. The mineral pigments identified in the analyses have been also found in local ceramics of this period.

c. These minerals are found in the area where the garments were made.

d. The complete garments of painted cotton in the Museum of Fine Arts collection do not show signs of having been worn, suggesting that they were used as offerings.

Most of these painted textiles were associated with funerary rituals in which speed of execution of the object may have been important. Choice of ceramic pigments in colouring these textiles may have resulted from a need for relatively rapid manufacture, and from a tendency to use materials at hand rather than producing specialized textile-painting materials.

3.4 Treatment

From the finding that mineral pigments were used in this group of painted textiles, it was concluded that none should be subjected to water or solvent cleaning. Mechanical cleaning with a water-vacuum was the only effective means for removing burial soil.

For safety reasons the conservator wore a face mask while reinforcing the mount of the fragment painted with lead-based pigment. It was also recommended that the textile remain framed even in the store room.

4.0 18th Century Chinese Painted Silk

4.1 Characterization of Deterioration

The treatment of a silk dress chosen for exhibition provides another example in which literature search, scientific analysis, and interdepartmental cooperation all contributed to the choice of treatment. The dress, constructed in France in

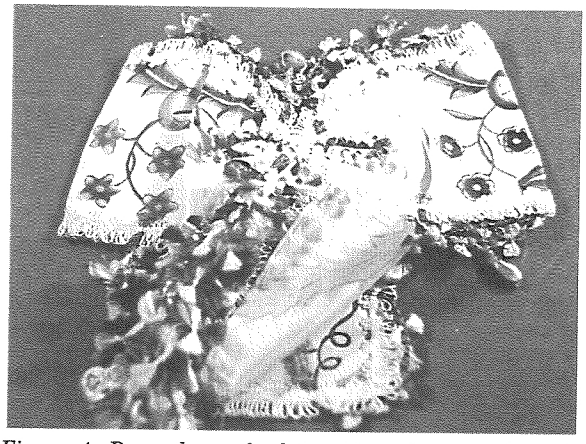

Figure 4. Dress bow of white silk, painted and dyed, China late 18th c. showing ink outline on reverse. BMFA No 43.1644. E.D. McCormick Collection.

the late 18th century, was made of Chinese export painted silk. The fabric was exquisitely designed for the taste of the French court, but used traditional Chinese materials and techniques in the floral tendrils painted on tightly woven white cloth. The underskirt had been cut previously to shorten it for reuse, but the most serious damage was the occurrence of many breaks in the silk at

the edges of the green painted areas. One of the sleeve bows, itself intact but identical in material to the damaged areas, was sent to the Research Laboratory for analysis (Figure 4).

X-ray fluorescence analysis indicated that the fabric had all of the prime characteristics of Chinese painted textiles of this period. The design was first outlined in black, then filled in with lead white as a base paint. Over this, a copper-based pigment was used for green, thick dye paste for blues and reds, and silver ovepainting for outlines and some interior details. Only brown iron-based pigment was missing from a published list of diagnostic traits for Chinese painted textiles of this period (9).

The cause of damage to fabric in areas bordering the green pigment required research. Copper-based pigments have long been known for their potential destructive effects on ground supports. Various authors have discussed problems of change in colour and damage to paper supports caused by copper ions released by deteriorating pigment (10). In this case, however, the mechanism did not appear similar, as the damage was at the margin of the pigment.

Examination under the microscope showed that the deterioration lay in a thin margin of tan substance beside the green paint. This margin was also present in areas where the silk had not yet been attacked. It differed from the brown halo previously reported as being found around malachite paint. Studies of a 16th century wooden panel painting reported a brown stain caused by humidity acting to cause deterioration of the ground of animal glue and alum (11). The ground had been applied in several layers and then covered with yellow ochre and shell white. Hydrolysis of the alum [K Al $(SO_4)_2$]$12H_2O$ produces sulfuric acid that reacts with the calcium of shell white to produce gypsum, and hydrolyzes the animal glue.It was the combination of alum, glue, and clay which caused the problem. Malachite staining is claimed to result from a related process: the attack of acids can produce soluble copper products that can seep out and stain the surrounding area. It has been suggested that sulphuric pollutants in combination with ultraviolet light attack the cellulose and copper salts, the reaction being one in which copper ions are transferred to the paper with resulting oxidation of the cellulose, and increasing browning of both paper and pigment (12).

For the painted silk, these mechanisms only partially apply. Here the ground is lead white, and the paint is malachite and animal glue. The mechanism described for the formation of fabric pseudomorphs on buried bronze objects provides a valuable clue to explain the deterioration of this painted silk. From the published table of microvolt and pH potentials required for the formation of various copper compounds (13) one may speculate that by a reverse reaction, malachite could produce assorted copper oxides (cuprite, tenorite), water, carbonic acid, and copper carbonate. In the pigment-hide glue mixture the coarse particles of malachite are exposed to the air on many facets, and permit the glue to be exposed to atmospheric humidity. Amino acids liberated by the effects of humidity on the glue would attack the malachite. While the carbonate in malachite could partially neutralize some acids, with time this would be an insufficient buffer and the pigment would decompose. Materials seeping beyond the outline of the pigment would contain acids and copper ions. Deterioration of the silk fabric beyond the pigment boundaries would be accentuated by the effect of light, as the light-filtering properties of the lead base would not be present.

It was concluded that the combination of copper ions and animal glue were the chief causes of deterioration. It was determined that the blue colour was a dye; no inorganic elements were found in its emission spectrum. Had the blue been azurite it is likely that less deterioration would have occurred, as the extra carbonate group found in azurite results in a more stable mineral.

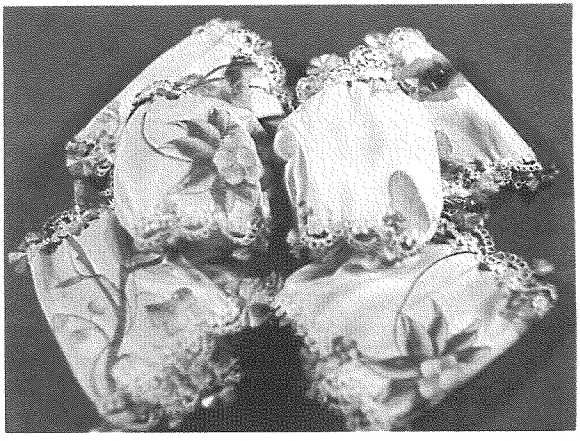

Figure 5. Dress bow of yellow silk, painted and dyed. China late 18th c. BMFA No 43.1633 E.D. McCormick Collection.

Another painted Chinese silk yellow dress of similar date showed no noticeable deterioration. In this case the dye and mordant combination

presumably blocked ionic pickup by the amino sites of the silk fibres which were bound already by this complex metallic group (13) (Figure 5).

4.2 Conservation Treatment

Having considered the likely causes of deterioration of the silk, the prevention of further degradation required limiting exposure to light as well as minimizing elevated humidity and temperature. Rimming the green areas with an anti-oxidant was considered but deferred to a future date when more research has been done. However, as the dress was scheduled for exhibition the existing losses had to be compensated.

As this fabric was of Chinese origin and of thin, crisp paper-like construction it was treated in much the same manner as a Chinese painting. With the permission of the curator the slits were closed with adhesive-applied mends rather than the more usual sewn lining.

After experiments were conducted using wheat paste to adhere Japanese tissue, pongee, and crepeline fabric, the crepeline was chosen as the preferred material, being the least visible and adding the least stiffness to the original fabric. However, Japanese tissue was chosen for mending breaks on the bodice, as the dress was to be exhibited on a mannequin and these areas of greater stress required the additional strength derived from the larger surface area of adhesion that is possible between paper (*versus* crepeline) and silk fabric.

Because the deterioration of silk is hastened by heat and high humidity (this type of degradation being only exceeded by that caused by UV light) the dress was not subjected to these hazards while being prepared for exhibition. Cold pressing of creases over time was the only method permitted.

5.0 Painted Silk — Japanese Robes

5.1 Characterization of Deterioration

Pigment-decorated silks originally intended for Oriental domestic use are numerous among the more than 200 Japanese robes in the Boston Museum of Fine Arts collection. More than half of these were used in the *No* theatre. Several robes chosen for exhibition were decorated in certain areas with gold or silver foil. In Japan this type of decoration is said to have been originally developed as a local substitute for costly imported Chinese silks with woven patterns of gilt paper strips used as supplemental wefts (14). Even after the Japanese learned to weave their own Chinese-style (Karaori) silks, the adhered gilt decoration of robes continued and was perfected.

Robes in the Boston Museum of Fine Arts collection exhibit two types of gilt foil: *nuihaku* in which the foil is combined with embroidery, and *surihaku* with gilt and painted designs without embroidery. According to the literature, both are produced by the same technique for metallic details: stencils are cut to form designs, and paste is applied to the fabric through the stencil. The stencil is removed and gold or silver foil is laid over the pasted area. When the paste has dried the unadhered foil is removed. The presence of starch paste on 17th and 19th century *surihaku* robes was confirmed by the iodine/potassium iodide stain test (15).

A number of these robes had been worn as inner robes in the *No* theatre. Examination of the robes revealed evidence of their use: perspiration stains at the neck, seat, and under the *obi* sash, and stains from hair lacquer and makeup oil saturating the collar area. Another source of staining found in these robes was caused by transfer of the traditional red lining dye. This dye is from a species of safflower that is notoriously fugitive (16) and had transferred through to the outer silk.

5.2 Conservation Treatment

Most exhibited *nuihaku* robes were in good



Figure 6. Detail of satin nuihaku patterned No *Robe showing remains of gold foil in branch and flower centers. Japan, late 18th c. Silk satin with gilt and polychrome silk embroidery. BMFA No 15.1162, Bigelow Collection.*

condition with stable gilded areas. A few medallions showed lifting flakes. These were re-attached with methyl cellulose, which is also commonly used for laying loose floats of floss silk embroidery. The widely used adhered gold in gilt-paper-strip wefts, gilded-paper-wrapped embroidery threads, and applied foil decorated areas were cleaned mechanically using powdered gum erasers.

A late 18th century robe presented special problems. Because of its soiled and worn condition it had not been considered exhibitable. A guest curator from Tokyo, however, selected this robe for exhibition because of the exquisite decoration of foliage and flower sprays (Figure 6).

Much of the gold foil had been lost from tree branch and flower spray motifs. Rather than submersing the robe in dry-cleaning solvent, it was cleaned by stroking mineral spirits onto the satin ground with a soft brush while avoiding the gilt. The torn shoulders were mended with couching stitches in fine silk thread. This combination of treatments permitted the robe to be exhibited.

Problems of re-adhering flaking paint and foil in these robes have much in common with problems recently encountered in the course of conserving the Boston Museum of Fine Arts' fan collection. On the advice of the consultant paper conservator, parchment size was prepared and used successfully in re-attaching flaking paint on some of the fans. Success with these treatments rekindled interest in the problems of conserving the *surihaku* decorated kimonos, by re-adhering flaking foil and paint with water-based adhesives that would not react to non-polar solvent cleaning.

Pre-testing was done on strips of plain tabby weave and satin weave silks with various water-based adhesives. The limits of solubility in organic solvents were explored with a suction table. The strips were spotted with adhesives brushed over patches of pastel crayon lines. The test adhesives included 2% hide glue, 2% methyl cellulose, gum arabic, parchment sizing, and wheat paste. (During application, the hide glue and gum arabic caused staining of the underlying blotter by dye transfer from the silk).

After three days of air-drying the strips were subjected to methods of cleaning that might be used in the textile laboratory. One strip was saturated with de-ionized water and then with 5% Igecal CA360 on the suction table. Hide glue bled

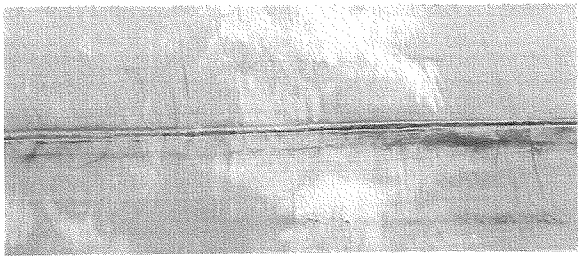

Figure 7. Detail of lining of No *robe showing dye change from orange to yellow in stains. Robe, Japan 1818-1829. BMFA No 28.5, Bigelow Collection.*

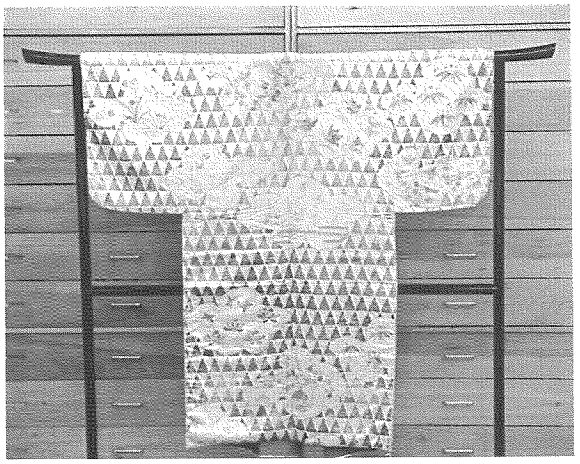

Figure 8. Surihaku patterned No *Robe of silk satin with silver foil and painted details before treatment, Japan, 1655-1657. BMFA No 28.6, Bigelow Collection.*

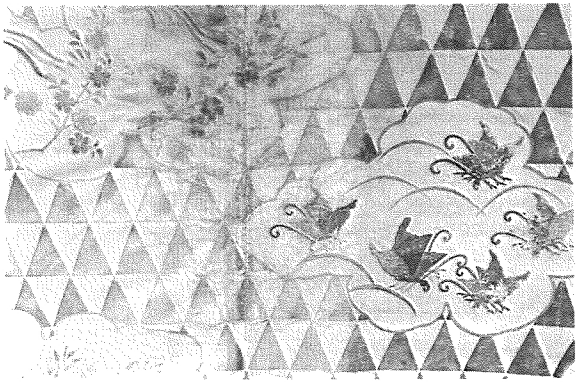

Figure 9. Detail of Figure 8 showing test cleaning. Partial stain removal at right of center back seam, with no paint loss.

on both the satin and tabby cloth; gum arabic bled on the tabby only; and wheat paste bled on the satin only. There was no noticeable change in the adhesives subjected to suction treatment with either mineral spirits, or amyl acetate.

Although none of the water-based adhesives was affected by mineral spirits, the parchment size was selected for re-adhering foil and paint on the basis of it being the least visible on the silk. This combination of treatments was found to be only partially successful because red lining dye that had transferred to one outer robe proved to be insoluble in mineral spirits (Figure 7). Cleaning with this solvent with the use of a suction table removed some body and hair oils but not all. This process did reduce staining without further loss of design pigments or foils (Figures 8 & 9).

6.0 Conclusions

A sampling of conservation problems involving painted textiles has been presented. These problems were more akin to those associated with Western painting on paper and Asiatic painting on cloth than to painting on stretched primed canvases in the western tradition. These examples underscore the need to acquire information about original methods and materials used in producing an object in its own culture before treatment is attempted.

Acknowledgements

Conservation staff at the Boston Museum of Fine Arts were very generous with time, advice, and shared materials. Roy Perkinson, Conservator of Prints, Drawings and Photographs and his Associate Conservator Elizabeth Lunning shared their expertise and ideas with the Textile Department staff. Joan Londan, Mellon Fellow prepared the toned Japanese tissue and instructed in methods of application for the Tapa cloth. Yasushiro Iguchi, Conservator of Asiatic Paintings, was a fund of knowledge on materials and techniques used in Japanese art. Margaret Leveque, Assistant Conservator of Objects, and Jerri Reynolds Newman, Private Paper Conservator, provided wide-ranging expertise and consultation. Pamela England, Research Scientist, provided laboratory analysis of samples and expertise in the interpretation of findings. Richard Newman, research scientist, expanded and reconfirmed the Peruvian pigment analyses.

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Le restaurateur de textiles rencontre souvent des motifs peints au moyen de pigments, surtout sur les objets à caractère ethnographique. Il est question dans cette communication des approches interdisciplinaires en conservation du papier, des peintures et des objets. Les cas suivants y sont notamment abordés: de grands tapas du Pacifique sud, déchirés et pliés de façon très prononcée, qu'il fallait prêter pour une exposition; une série de textiles peints, d'origine péruvienne, analysés avant l'établissement d'un programme de conservation; et le traitement de diverses soieries orientales ornées de motifs dorés.

THE USE OF AQUEOUS POLYMER EMULSIONS IN THE CONSERVATION OF ETHNOGRAPHIC MATERIALS: A NEW METHOD FOR SUPPORTING FRAGILE WOVEN FIBRE DECORATION

MAUREEN A. ROBSON

A safe method of bonding fragile fibres onto a support fabric of suitable weight is described. Two essential criteria were considered in selecting a suitable adhesive: it must be light in weight and sufficiently mobile to impregnate the support fabric. Five poly(vinyl acetate) emulsions were tested for colour, clarity and reversibility, both in the short- and long-term and of these, three were found to be satisfactory. These adhesives were used to bond a support fabric to fragile woven fibre decoration by impregnating the support fabric with the adhesive and sealing it to the woven fibres with a heated spatula. Since the three samples of adhesives varied in strength, they could be successfully used in supporting different strengths of fibre within the same object, ranging from the severely weakened to the more substantial.

1.0 Introduction

There are a number of museums in the West Midlands region of England which possess ethnographic collections of varying size. This paper will be concerned with the category of cellulosic and other fibrous materials which abound in these collections. The technique to be discussed may be applied to different materials of varying strengths such as bark cloth from New Guinea, sennit fibre from Fiji, and woven fibre decoration from South America. These materials often become embrittled with age. The application of a lightweight adhered support is therefore preferable to the general practice of protecting the fibrew tih bandages during storage. The removal of bandages often leads to further disintegration and subsequent loss of the fragile woven fibres.

Obviously, objects cannot be successfully displayed unless fibres are safely supported. It is a well accepted practice in conservation to match the strength of the adhesive to that of the material it is bonding. For this reason, it was considered necessary to evaluate only low bond strength adhesives. The adhesive was applied to the support rather than directly to the fibres themselves because in many cases the fibre structure was so weakened that any attempt to apply the adhesive by brushing would have resulted in complete disintegration. Some fibres had already disintegrated during storage as could be seen by the minute piles of fibre dust. It

Table 1

SOME PROPERTIES OF THE AQUEOUS POLYMER EMULSIONS TESTED

Trade name	Chemical group	Particle size (micron)	pH	Solid content (%)	Solvent (long-term)
Evostik Resin W	Polyvinylacetate emulsion	1.0	4-4.5	55	Organic solvent, e.g. Methyl ethyl ketone (M.E.K.), Hydrocarbon, e.g. Toluene.
Texacryl 13-002	Acrylic/Methacrylate	0.25 approx.	9.0-9.5	55±1	Alcohols, e.g. Industrial methylated spirit, Propan-2-Ol; Organic solvent, Acetone, Methyl ethyl ketone (M.E.K.).
Revacryl 1A	Pure Acrylic Copolymer emulsion	0.5	8.8	51	Alcohols, e.g. Industrial methylated spirit, Propan-2-Ol; Organic solvents, e.g. Acetone, methyl ethyl ketone (M.E.K.).
Mowilith DM 131	Unplasticised Vinylacetate/ Ethylene Copolymer emulsion	0.5-5.0	4-5	50 approx.	Esters, e.g. Butyl Acetate, Aromatic Hydrocarbons, Halogenated Hydrocarbon.

was considered that the method least damaging to the fibres would be to impregnate the support fabric with the adhesive. Nylon gossamer tissue was considered a suitable support fabric being both lightweight, highly absorbent and in general use in the conservation of ethnographic materials in the United Kingdom. In order to impregnate the support fabric evenly and thoroughly, an aqueous solvent was considered the best vehicle for the adhesive. Its slow rate of evaporation compared with that of organic solvents allows a uniform distribution of adhesive. Hence, aqueous polymer emulsion adhesives were evaluated and four of these were considered in detail (Table 1). These adhesives fell into the following chemical groups:

— polyvinyl acetate emulsions
— acrylic copolymer emulsions
— vinyl acetate/ethylene copolymer emulsions

2.0 Methods and Materials

The following adhesives were tested:

— Evostik Resin W
— Texacryl 13-002
— Revacryl 1A
— Mowilith DM 131

The adhesives were tested for colour range and clarity on thermal ageing. Two samples of each adhesive were applied to standard watch glasses and allowed to set at room temperature according to the manufacturer's instructions. One sample of each was then placed in an oven at 60°C for four weeks. After testing, the samples were compared with those which remained at room temperature.

The adhesives were also tested for reversibility in both the short- and long-term. Two samples of each adhesive were once again prepared according to the manufacturer's instructions. These samples were maintained at room temperature and out of direct sunlight, one for a period of six months the other for a period of two years. At the end of this time a range of solvents as specified by the manufacturers was applied to each adhesive.

The adhesives which produced the best results in these tests were further tested with the conventional support fabric, nylon gossamer tissue, in order to assess their suitability in the conservation of fragile woven fibre decoration.

A sample of the support fabric was impregnated with each emulsion in the following manner (Figure 1). A glass sheet of suitable dimensions was degreased and the emulsion was applied by

TABLE 2

TABLE SHOWING THE RESULTS OF THE ACCELERATED AGEING TESTS AND THEIR COMPARISON WITH SAMPLE TESTS AT ROOM TEMPERATURE

Each sample of aqueous polymer emulsion was inspected by naked eye with transmitted light

	After four weeks at 60°C		After four weeks at room temperature	
	Colour range	Clarity	Colour range	Clarity
1. Polyvinylacetate Emulsions				
Evostik Resin W	**	Opaque	**	Opaque
2. Acrylic Copolymer Emulsions				
Texacryl 13-002	***	Clear	***	Clear
Revacryl 1A	***	Clear	***	Clear
3. Vinyl acetate/Ethylene Copolymer Emulsion				
Mowilith DM 131	***	Clear	***	Clear

Key:

*** Excellent, emulsion remained clear, colourless.
** Good, slight discolouration (yellow) of emulsion.
* Poor, Substantial discolouration (yellow/orange) of emulsion.

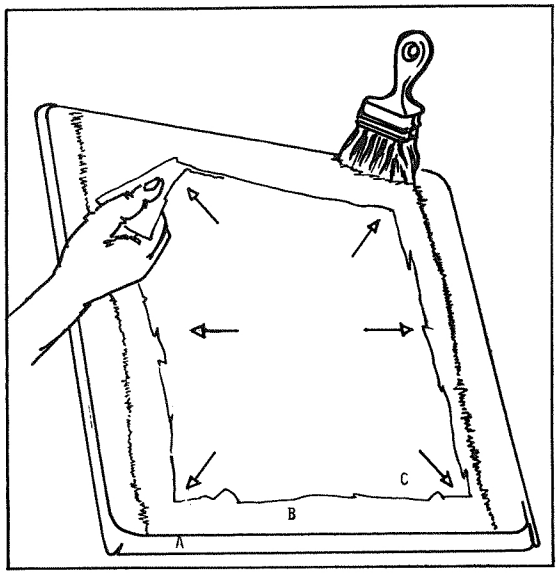

Figure 1. Method of applying the emulsion to the support fabric. Not to scale. (A) Sheet glass (B) Aqueous polymer emulsion (C) Nylon gossamer tissue.

brush to the clear glass surface. The nylon gossamer tissue was held taut and then dropped onto the glass. The corners were slowly pulled outward to remove trapped air, thus ensuring uniform contact with the glass surface and even impregnation on the underside. After 24 hours the now dry fabric was removed. No adhesion remained between the glass and the tissue.

Each impregnated support fabric was tested for adhesion with the fragile woven fibre decoration. The impregnated support fabric, with adhesive side uppermost, was placed underneath the artifact. A sheet of silicone paper was placed on top of the fibre decoration which was subsequently heat-sealed to the underlying support fabric by application of a heated spatula to a maximum temperature of 60°C.

3.0 Results and Discussion

The results of the thermal ageing test are shown in Table 2. There was a slight discolouration (yellowing) and a high loss of clarity of the polyvinyl acetate emulsion (Evostik Resin W). There was no change in the colour or clarity of either the acrylic copolymer emulsions (Texacryl 13-002 and Revacryl 1A) or the vinyl acetate/ethylene copolymer emulsion (Mowilith DM 131).

The adhesives proved reversible with the exception of the polyvinyl acetate emulsion (Evostik Resin W) which remained insoluble in the hydrocarbon solvents after both six months and two years. The acrylic copolymer emulsions Texacryl 13-002 and Revacryl 1A were successfully reversed both in the short- and long-term by application of solvents such as industrial methylated spirit, propan-2-01 and acetone. The vinyl acetate/ethylene copolymer emulsion was successfully reversed by application of butyl acetate. In general the solubility rate was greater in the short-term samples.

In the case of the polyvinyl acetate emulsion (Evostik Resin W) its discolouration and irreversibility in the short- and long-term tends to render it unsuitable for use in the delicate work of ethnographic conservation under discussion. Also, its high percentage of emulsifiers and plasticizers makes it less likely to permeate the support fabric evenly and thoroughly which is essential for this technique.

The acrylic copolymer emulsions, Texacryl 13-002 and Revacryl 1A, and the vinyl acetate/ethylene copolymer emulsion, Mowilith DM 131, retained their colour and clarity and could be successfully reversed in both the short- and long-term. These three adhesives were therefore considered suitable for evaluating the conservation techniques described above. All three adhesives successfully impregnated the support fabric and formed a thin, cohesive film. Each film different in weight and degree of flexibility. The weight of film was commensurate with the strength of adhesion as follows:

- acrylic copolymer emulsion (Texacryl 13-002) - very light
- vinyl acetate/ethylene copolymer emulsion (Mowilith DM 131) - light
- acrylic copolymer emulsion (Revacryl 1A) - substantial

Thus it can be seen that Texacryl 13-002 is more suited to supporting severely weakened fibres, whereas Revacryl 1A can be used for more solid fibres. There may be considerable variations in fibre strengths within an individual object and hence it may be necessary to select different adhesives for different areas.

4.0 Conclusions

Both the acrylic copolymer emulsions and the vinyl acetate/ethylene copolymer emulsion tested can be recommended for bonding fragile fibres

onto a support fabric of suitable weight. The support is impregnated with the adhesive, which is then allowed to dry. The adhesive is then reactivated by the application of heat.

The method described has been successfully evaluated over a two year period and has proven successful for the supporting of fragile woven fibres. An interesting example is a South American ceremonial paddle made from mahogany with a detached but non-removable sleeve of woven decorative fibres (Figure 2). In this instance, talc (French chalk) was used as a release agent between the impregnated support fabric and the wooden substrate. It was considered essential that the support fabric not be bonded to the wood as movement of the wood due to fluctuating moisture content, might cause damage.

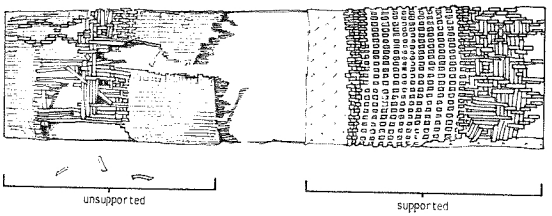

Figure 2. Deteriorated woven fibre decoration. One half has been mounted on to a secondary support fabric. The support fabric is impregnated with the emulsion which is allowed to dry. The adhesive may then be reactivated by the application of heat.

Acknowledgements

The author would like to thank the following people for their discussion, encouragement and support: David Bailey, Phillada Ballard, Leo Biek, Frances Buchanan, Eileen Collins, Wendy Firmin, Anne Hudson and Janet Mannall.

This contribution to Symposium '86 was supported in part by financial assistance from the West Midlands Area Museum Service, United Kingdom, to whom the author wishes to express her gratitude.

Materials and Supplies

Evostik Resin W: Evode Ltd., Common Road, Stafford ST16, U.K.

Mowilith DM 131 & Revacryl 1A: Harlow Chemical Co. Ltd., Temple Fields, Harlow, Essex CM20 2AH, U.K.

Texacryl 13-002: Scott Bader Co. Ltd., Wollaston, Wellingborough, Northamptonshire NN9 7Rl, U.K.

Nylon Gossamer Tissue: Picreator Enterprises Ltd., 44 Park View Gardens, Hendon, London NW4 2PN, U.K.

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Appendix

Vinamul 6525 (vinyl acetate/vinyl caprate copolymer) although commercially available when originally tested, is no longer manufactured and therefore the results for this product have not been included in this paper. The manufacturers were approached for possible alternatives and three further adhesives were suggested as suitable for testing this technique-vinacryl 4378 (vinyl acetate/acrylic copolymer), Vinamul 3401 (vinyl acetate/vinylchloride/ethylene terpolymer) and Mowilith DM 1320 (vinyl acetate ethylene copolymer). Accelerated ageing tests have been carried out on these products, all of which remained clear and colourless and are therefore suitable for further investigation. when the remaining tests (natural ageing and reversibility) have been completed a full assessment of the suitability of these adhesives for the technique described will be published.

Biographical Notes

Maureen A. Robson was originally trained in Ceramic Design (Diploma, Birmingham College of Art and Design 1969). She was made Associate in Design Management of The Chartered Society of Artists and Designers, London in 1984. She has

trained and worked in Conservation in London. (Diploma in Archaeological Conservation in 1975, Institute of Archaeology, University of London; The British Museum, London from 1969 to 1974; The Victoria and Albert Museum, London from 1974 to 1976; and the Ancient Monuments Laboratory, English Heritage, London from 1976 to 1979.) She joined the City Museum and Art Gallery, Birmingham, in 1979 as Senior Conservation Officer (Archaeological and Ethnographic Materials), specialising since 1984 in Ceramics, Glass and Stone. She has been a private consultant (Archaeological and Ethnographic Materials) to the West Midlands Area Museum Service since 1980.

Une méthode sûre pour fixer les fibres fragiles sur un support de tissu d'épaisseur appropriée est décrite. Deux critères essentiels ont été retenus pour le choix des adhésifs: la légèreté et une fluidité suffisante pour permettre l'imprégnation du tissu de soutien. La couleur, la clarté et la réversibilité à court et à long termes de cinq émulsions d'acétate de polyvinyle ont été testées. Trois émulsions ont donné des résulats satisfaisants. Ces adhésifs ont servi à fixer un tissu de soutien au fragile décor en fibres tissées, en imprégnant d'adhésif le tissu de soutien et en fixant celui-ci aux fibres tissées à l'aide d'une spatule chauffante. Les trois types d'adhésifs testés présentaient divers degrés de résistance; ils pouvaient donc être utilisés pour consolider sur un même objet des fibres de résistance variée, des plus affaiblies aux mieux préservées.

WOOD

Research on the Conservation of African Camwood: A Project Realized in a Small Conservation Laboratory
B. Pouliot
Prince of Wales Northern Heritage Centre, Yellowknife, Canada

La patine et restauration en art zairois
G. de Plaen
Lubumbashi, Zaire

RESEARCH ON THE CONSERVATION OF AFRICAN CAMWOOD: A PROJECT REALIZED IN A SMALL CONSERVATION LABORATORY

B. POULIOT

The purpose of this research was to find adequate conservation treatments for camwood objects, made almost exclusively by the Kuba tribes of Central Zaire. Necessary for the research was a two-person laboratory (one conservator, one intern) very well equipped in materials and products but lacking elaborate scientific equipment. A full literature search, followed by microscopic examination and exchange with other conservators, was sufficient to determine in detail the materials and procedures used in the fabrication of the camwood objects. Simple tests for the solubility of camwood in commonly used solvents are described. Consolidation of broken and often brittle edges was then tested with different adhesives soluble in toluene. Lack of sample pieces limited testing to broken edges of actual objects. Comparative evaluation of colour changes was done visually and a suitable method was elaborated, consisting of two coats of 5% and one coat of 10% Acryloid B-72 in toluene. Following consolidation, adhesion of broken fragments was achieved successfully with 40% P.V.A. (AYAF) in toluene. Due to unavailability of strength testing machines, the adhesive was determined as appropriate if the joint could resist a strong pull with the hands without breaking or moving. An infilling material was then chosen following a series of tests for solubility in appropriate solvents, similarity of components, texture and reactions, and finally reversibility. Availability of technical data influenced choice to a commercial product, Sculptamold, from the American Art Clay Co.

1.0 Introduction

In every ethnographic collection there exists a variety of objects of a very specific nature often produced by only one cultural group through one definite period of time. These objects are usually not numerous but found scattered in collections at the four corners of the world. Often very little conservation research has been done on these as priority for research, naturally enough, has been given to more common objects.

Under discussion in this paper is one research project conducted on camwood, a material of this category. In addition to presenting the results of this research, the paper will demonstrate how it was done and how a small conservation laboratory, of the kind found in smaller museums, is adequate for the elaboration of such research.

2.0 The Material

Despite its name, which is not to be confused with the camwood tree of West Africa (*Baphia nitida*) from which a dye is obtained (1), camwood objects are in fact modelled from a paste.

An extensive literature search was conducted to determine the nature and the fabrication of the objects. Camwood objects were made almost exclusively by the Kuba Tribes of Central Zaire. The objects were modelled in many different forms, from purely ornamental slabs and crescents (Figures 1, 2, 3,) to animals, human heads and everyday objects (2-9). They were related to the funerary practices of the Kuba people and used to adorn and support the bodies of their dead (4, 6, 10). They were later kept by families and friends as mementos of the deceased (3, 7, 8, 11-13).



Figure 1. Oblong camwood slab — Museum of Cultural History, U.C.L.A.



Figure 2. Rectangular camwood slab — Museum of Cultural History, U.C.L.A.



Figure 3. Rectangular camwood slab — Museum of Cultural History, U.C.L.A. This object was broken in two fragments near the centre and has been treated during the project.

The paste from which camwood objects are modelled is a mixture of several ingredients. Wood fibers are obtained from the Tukula tree (*Pterocarpus tinctorius*) whose heavy wood ranges in colour from deep red to maroon. The tukula wood is chopped into small pieces, moistened with water and rubbed against a flat, rough stone (3, 14, 15). A red paste is obtained which could be used as such or mixed with palm oil to become a decorative ointment for the body and hair, for coating of wooden objects and for dyeing clothing.

In the fabrication of the camwood figures, the process is continued further. The camwood paste is dried and then mixed with fine sand, water and palm oil (16) to the desired consistency (4). Occasionally, vegetable fibers are also added.

The resulting mixture is moulded into the desired shape and often carved. Once finished the pieces are dried under the sun and then exposed to the heat of a fire. The process is not that of a real firing, but rather similar to baking (4, 17).

Today, as was the case in the past, the sound practice of making camwood is not always followed and some specimens are of poorer craftsmanship than others (3, 4).

3.0 The conservation problems presented by the camwood blocks

The camwood objects from the Museum of Cultural History's collections used during the experiment were mostly rectangular in shape and decorated with geometrical motifs. Many were broken into two or more fragments with heavy losses of red powder at the fractures or at corners. Also, some objects had been restored in the past with very unstable materials which had since hardened, cracked and caused severe deterioration.

4.0 Experimental research

4.1 The laboratory

The laboratory itself is of the type found in most small and medium-sized museums and is occupied by one full-time conservator, one intern and the occasional volunteer. It is well equipped with materials and products, but like most smaller conservation laboratories, its degree of sophistication for analytical purposes stops with the microscope.

In this case, a literature search and a microscopic examination of the objects were sufficient to determine their basic nature and fabrication.

Under the microscope, the sand grains and the wood fibers were clearly visible. No other sophisticated equipment for analysis, such as electron microscopy, could be used as it was not available in the laboratory. There was no precedent in the conservation literature for the treatment of camwood objects, neither was it possible, because of their composite nature, to draw parallels from similar materials.

4.2 Solvent

Following the preparation of condition reports and photography, a series of experimental trials was conducted to find a solvent which would not detrimentally react with camwood.

The tests were performed with several solvents commonly encountered in a conservation laboratory. The availability of a fume hood increased the range of solvents that could safely be tested.

A small swab was soaked in the solvent and then rolled on two small areas of the camwood piece, one darkly patinated and the other red in colour. As there were no test pieces available, the experiments had to be conducted directly on the objects. In order to minimize possible damage, all experiments were conducted either on broken edges or on the backs of broken fragments. The tests were always conducted on small areas so that comparative results could be readily visible with an untreated portion of the same nature.

Two characteristics were noted: hardness and change of colour. Tests for hardness were conducted with pointed wooden sticks and any change in colour was noted. The results of these tests are shown in Table 1.

Surface of camwood	Darkly Patinated		Red in Colour	
Solvent Used	Nature of softening	Nature of stain	Nature of softening	Nature of stain
Acetone	Severe	Light	Severe	Dark
Deionized water	None	None	Severe	None
Ethanol	None	Dark	Light	Dark
Stoddard solvent	None	None	None	None
Toluene	None	None	Very Light	None
Xylene	None	None	Severe	None
Ethanol toluene 60/40	None	None	Light	Dark ring with light centre

Table 1. Results of tests for the reaction of camwood to different solvents.

As expected, the areas of non-patinated camwood (red in colour) are more sensitive to most solvents than the patinated areas. Nevertheless, only two solvents, Stoddard and toluene, proved to be non-reactive enough to be possibly used with camwood.

Of the two, toluene was considered to have better potential as a solvent for a variety of consolidants or adhesives and it was chosen for all future experiments.

4.3 Consolidant

A second series of experimental trials was conducted to find an adequate consolidant which would reinforce the crumbly edges of the fractured pieces. Indeed, on the pieces restored in the past without application of consolidant, a reproduction of the fracture was seen to recur only a few millimeters away from the old fracture line.

Three different synthetic resins soluble in toluene and known for their long-term stability and reversibility were chosen for the tests:

(a) 2.5% P.V.A. (AYAA)
(b) 5.0% Acryloid B-72
(c) 5.0% Acryloid B-67

A fine brush was used and each of the three consolidants was applied on a small area, about two centimeters square, of the same broken edge. Test areas were separated by 2 cms in order to allow for an easy comparison of the results. Each consolidant was applied until the penetration of the resin in the camwood began to slow down. Tests for hardness were conducted with wooden stick applicators. Any colour change was easily visible.

More than one application of the consolidants was necessary in order to reinforce the edges in a sufficient manner. The results of the tests after two applications are given in Table 2.

At this point, none of the consolidants was considered satisfactory. For both the P.V.A. and the B-67, the colour change of the camwood was too severe and both tended to darken the surface of the piece along the broken edge.The B-72 had caused a light change of colour in the camwood but had not produced a sufficient hardening to use an adhesive directly over the treated areas.

It was decided to use an increased concentration of the consolidant up to 10% in toluene over the area already treated twice with the 5% solution of

Consolidant	2.5% P.V.A.		5% B-72		5% B-67	
	Darkening	Hardening	Darkening	Hardening	Darkening	Hardening
First Application	Slight	Slight	None	Slight	Slight	Good
Second Application	Severe	Good	Slight	Good	Severe	Very Good

Table 2. Results of hardness and colour change tests after application of two coatings of the three consolidants onto camwood.

B-72. The camwood darkened, but was still paler than both areas treated with only two coats of either P.V.A. or B-67. This can be seen in Figure 4. The hardening of the camwood was good, and was considered sufficient for the future application of the adhesive.

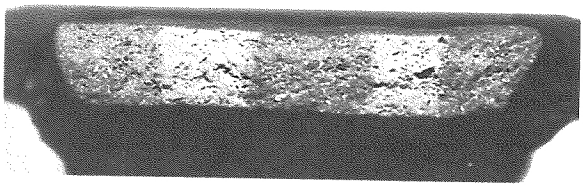

Figure 4. Broken edge of camwood slab after application of the consolidants. Two coatings have been brushed with the P.V.A. and B-67, while the area with the B-72 was treated with two coats of 5% and one coat of 10% solution in Toluene.

A problem was encountered at this stage; some darkening of the surface along the consolidated broken edge was noticeable where the camwood was pale red in colour. More tests proved that this darkening could be avoided by not brushing too much consolidant on the outer edges of the fracture line during the application of the third coating. Because of the porous nature of camwood, the solvent also tended to evaporate through the surface and carried with it some resin which caused the darkening.

An adequate consolidant had been found, consisting of two coats of 5% B-72 followed by one coat of 10% B-72, all in toluene, each separated by a 24-hour drying period. Even though there was some darkening of the original colour of the camwood, it was limited to fractured edges that would not be visible once the treatments had been completed.

4.4 Adhesive

Once again, the choice of adhesives was limited to those synthetic resins soluble in toluene. Because of their high stability and easy reversibility, increased concentrations of the resins previously tested as consolidants were used.

The three adhesives chosen were:

(a) 40% P.V.A. (AYAF)
(b) 50% Acryloid B-72
(c) 60% Acryloid B-67

In all tests, the adhesives were brushed on the already consolidated, broken edges of chosen pieces. Despite the reduced porosity due to the three coats of consolidants, both the 50% B-72 and the 60% B-67 were not viscous enough and no adhesion could be achieved. Because of the higher viscosity of the 40% P.V.A. solution, it was possible to brush it on the broken edges without much penetration and to adhere the fragments together. After application of the adhesive, the pieces were left to dry horizontally with weights at each end. Smaller weights were also placed on the pieces themselves in order to ensure an accurate alignment of the fragments.

It was impossible to measure exactly how strong the joint was in the absence of precise instruments. Moreover, the work was being done on actual objects. However, it was found that the joint was able to resist a strong pull with the hands. The strength achieved was therefore considered satisfactory and the experiment could move on to the next stage.

4.5 Gap-filling material

Before testing for a gap-filling material, an adequate sealing compound for the camwood edges had to be found. This barrier would prevent any migration of substances into the camwood and also make the removal of the infilling material possible and easy. Although it could not be determined to what extent the porosity was reduced, it was thought that the three coats of B-72 used as a consolidant were probably adequate as a sealing compount for the pieces.

Several requirements were then established to choose the best gap-filling material for camwood. Following these and a discussion with several conservators, the choice for the tests was limited to three commercially available materials:

(a) DAP, a vinyl paste, manufactured by Dap, Inc., of Dayton, Ohio, subsidiary of Plough Inc.

(b) Celluclay, an instant papier mache manufactured by the Celluclay Co. of Marshall, Texas.

(c) Sculptamold, a cellulose moulding compound manufactured by the American Art Clay Co., of Indianapolis, Indiana.

The manufacturers of these products were contacted in order to obtain more details on the materials. Then each product was prepared in a small dish and left to dry prior to performing different tests on it. For both DAP and Celluclay, no information was forthcoming from the manufacturers. Very little is known about the long-term reversibility of DAP and its texture is too fine to easily make it look like camwood. Celluclay had the disadvantage of being too soft and impossible to sand or carve easily and it also seemed to contain a large amount of impurities. For these reasons, efforts soon concentrated on Sculptamold.

Sculptamold is available in a dry form and is prepared by simply mixing with water. Its manufacturer promptly sent us general information and data sheets (18). The material consists basically of a mixture of cellulosic fibers, industrial plaster and starch in non-specified percentages. It does not represent any fire or health hazards and polymerization of its components is reported not to occur.

After setting, Sculptamold remains rather soft and readily soluble in water. Its texture, because of the cellulosic content, is almost identical to that of camwood. It also does not shrink upon drying and is reported to be compatible with almost any material. Both camwood and Sculptamold contain aggregates of organic and inorganic compounds and likely have similar coefficients of expansion.

During the test the drying time of Sculptamold did not change, meaning that the edges of the camwood had been sealed to a good extent. No stain developed on the objects and Sculptamold could easily be removed with small amount of water.

Once painted with watercolours, Sculptamold very closely matched the surrounding areas. It undoubtedly could be considered as an adequate gap-filling material for damaged camwood and it was later used in the restoration of different pieces (Figures 5-8).

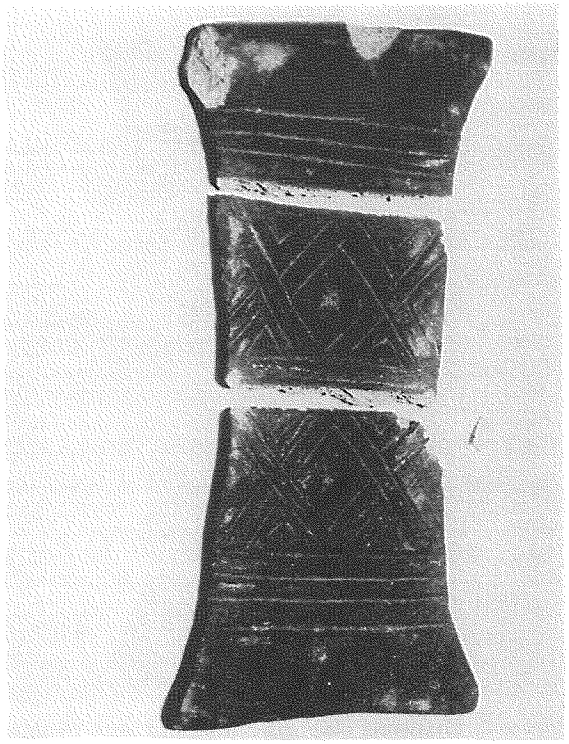

Figure 5. Camwood slab before treatment.



Figure 6. Camwood slab after consolidation of broken edges with B-72 and adhesion with 40% P.V.A. in toluene. Note the loss of material at the joints.



Figure 7. Camwood slab after in-filling with Sculptamold modelling compound. Note that the edges were sealed prior to applying the gap-filling material.



Figure 8. Camwood slab after treatment.

5.0 Conclusion

At this stage, the project was considered as completed and natural aging within the museum was left as the best agent to determine the long-term stability of the materials used. All the objects treated were returned to storage with consideration that they now were stable enough and aesthetically pleasing to be used in future research or exhibition. It is now two and a half years since the project was completed and a recent survey of the 17 camwood blocks treated showed that they all withstood storage in an uncontrolled environment without any modification to their condition. Camwood is only one of dozens of materials encountered in ethnographic collections on which little or no research has ever been conducted. Now, new knowledge has been gained on the fabrication and conservation of this material, which should be useful to all those having to deal with camwood. It is also hoped that this paper will encourage other conservators who work in smaller laboratories without the analytical facilities of larger institutions to undertake similar research. Only a broadening of conservation knowledge and a consequent improvement to the preservation of our cultural heritage can result from such efforts.

Acknowledgements

For the funding of this project, the author wishes to acknowledge the National Museum Act of Washington, D.C., as well as the Museum of Cultural History, at U.C.L.A. where this research took place. Also, thanks are expressed to many conservators of the Los Angeles area who shared their ideas and knowledge of varied materials used during this research.

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Biographical Notes

Bruno Pouliot graduated from the Master of Art Conservation programme at Queen's University, Kingston, Ontario. He then undertook several internships, specializing in both ethnographic and archaeological conservation at the Canadian Conservation Institute, The Glenbow Museum in Calgary, the Museum of Cultural History at U.C.L.A. and the Institut de Recherches Archeologiques et Paleo-metallurgiques in Compiegne, France.

He then participated in the teaching of an ICCROM workshop on the conservation of wooden objects in Bamako, Mali. Presently, Bruno is conservator for the archaeological and ethnographic collections of the Northern Heritage Centre, Yellowknife, N.W.T., Canada.

Notre recherche visait à déterminer des traitements adéquats pour la conservation des objets en camwood, fabriqués presque uniquement par les Kuba du centre du Zaïre. Elle a été menée dans un laboratoire de deux personnes (un restaurateur et un stagiaire), très bien fourni de matériaux et de produits, mais dénué d'appareils scientifiques perfectionnés. L'étude de la documentation, les examens microscopiques et des conversations avec d'autres restaurateurs ont permis de déterminer avec précision les matériaux et les méthodes de fabrication des objets en camwood. Des tests simples pour vérifier la solubilité du camwood dans des solvants d'usage courant sont décrits. Nous avons ensuite testé divers adhésifs solubles dans le toluène pour consolider les rebords brisés et souvent cassants. Faute d'échantillons, nous avons dû faire les essais sur les rebords brisés d'objets de collections. L'évaluation comparative du changement de couleur a été effectuée visuellement et une méthode de consolidation appropriée a été élaborée, soit trois couches d'Acryloid B-72, les deux premières diluées à 5% et la troisième à 10% dans du toluène. Après consolidation, les fragments brisés ont été fixés à l'objet au moyen d'une solution d'acétate de polyvinyle (AYAF) à 40% dans du toluène. A défaut d'appareil pour tester la résistance, l'adhésif était jugé adéquat si le joint pouvait supporter une forte traction manuelle sans se rompre ou se déplacer.

Un matériau de masticage a ensuite été choisi après une série de tests visant à déterminer la solubilité du matériau dans les solvants appropriés et sa réversibilité, ainsi que la similarité de sa composition, de sa texture et de ses réactions par rapport au camwood. L'existence d'informations techniques nous a fait porter notre choix sur un produit du commerce, le Sculptamold, de l'American Art Clay Co.

ÉTUDE DE LA PATINE

G. DE PLAEN

La patine en art zairois est l'oeuvre du sculpteur et non du seul travail du temps ou de l'usage. Elle est liée aux caractères culturels propres à chaque style. Le travail complexe du sculpteur peut comporter jusqu'à 10 opérations successives; ces opérations ont des fonctions complémentaires les unes visant à la conservation du bois, les autres à lui donner un caractère «culturel». La connaissance de ces techniques est indispensable pour distinguer le vrai du faux mais aussi pour permettre la restauration des pièces tout en restant conforme à cet aspect important du style. A titre d'exemple, diverses techniques propres à des groupes ethniques connus sont examinés : Les Luba — les Tabwa — les Kuba. Des référence sont faites aux différents usages prévus pour la sculpture — utilisation domestique, instruments de musique — objets religieux. Une juste appréciation de la valeur de la patine conduit à une juste définition de l'art authentique et à des règles de conservation adéquates.

1.0 Introduction

Nous nous proposons d'étudier dans cet exposé la patine afin de démontrer qu'en art africain, elle est bien plus qu'un signe d'âge ou d'usage — qu'elle n'est pas la seule oeuvre du temps mais bien celle du sculpteur, au même titre que la recherche de la forme.

Chaque groupe a ses traditions dans ce domaine et l'inventaire nous en semble être indispensable. L'intérêt de cette recherche est multiple : nous pensons qu'elle permet de récolter des données sur les techniques anciennes de conservation des bois, sur l'amélioration de leurs propriétés, mais aussi de mieux comprendre les notions de style et d'authenticité.

Nous étudions d'abord la relation entre la patine et l'usage, pour aborder ensuite la patine et le sculpteur. Nous pourrons alors évoquer quelques suggestions sur l'importance de la patine du point de vue des experts mais aussi des cultures qui les utilisent. Nous conclurons enfin par un appel à la nécessité de recherches dans ce domaine.

2.0 Patine et Usage

Les traces d'usage sont souvent recherchées par les experts, elles appuient les jugements sur l'authenticité et confirment une utilisation traditionnelle: l'âge du bois, l'usure de certaines parties, les empreintes dues au contact des mains, les marques laissées par les cordes, le Kaolin ou le sang en passant par la noix de Kola ont souvent été appelés patine.

Deux remarques s'imposent ici : il y a souvent abus de la notion d'usage, ensuite l'usage et la patine ne doivent pas se confondre.

L'abus de la notion d'usage se retrouve notamment dans le fait que plusieurs masques ne doivent pas être portés et il est inutile d'y rechercher des traces d'usure liées à la danse. C'est le cas de masques singes Hemba ou des masques Yaka Mbaawa — ils étaient simplement déposés dans une partie des habitations ou des camps de circoncision. Les masques blancs Luba ne pouvaient servir qu'une seule fois avant d'être jetés en brousse.

Dans les cas précités une bonne documentation ethnographique peut corriger les erreurs. Ce qui nous semble plus important, c'est qu'usage et patine ne peuvent se confondre.

La patine en art africain ne peut se réduire aux blessures de la vie, au travail du temps qui fonce et use les bois, les polit et leur donne un velouté incomparable. La patine en art — et nous pensons principalement à l'Afrique Centrale — est le travail du sculpteur lui-même ou d'un spécialiste en la matière. Elle fait partie intégrante du style, et diffère de l'âge ou de l'emploi.

Pour l'aborder, suivons quelques exemples précis.

3.0 Patine et Sculpteur

Dans la région Kuba, une pièce non patinée s'appelle *éphalaka* (ébauche). Elle n'a aucun caractère sacré et ne peut être utilisée.

Le sculpteur lui-même doit la patiner de plantes tinctoriales comme le *Tool Kabet*, la *Bixa oranella*, plante bien connue de la famille bixacée, dont les graines sont utilisées aussi bien pour teinter les ongles que pour conférer une teinte sombre aux statues et masques. La patine luisante et noire était obtenue à partir du latex d'euphorbe ou la sève du *Bosqueia*, le rouge venant de décoctions de *Ptérocarpus*, le jaune du *Baphia* dont la pièce était badigeonnée avant d'être exposée au soleil.

Les Hemba préféraient pour certaines statues un mélange de lait de manioc et de terre. Plusieurs sociétés ont pour habitude, avant de considérer une pièce comme terminée, de la fumer au dessus du feu en rajoutant parfois des boutures de manioc aux braises afin d'obtenir une teinte acajou. Les ivoires devaient être foncés chez les Lega ou les Pende grâce à des décoctions de tronc de bananier dans laquelle on les faisaient mariner. Le rocouyer servait aussi à cet usage. Ces plantes furent remplacées rapidement par le tanin du thé.

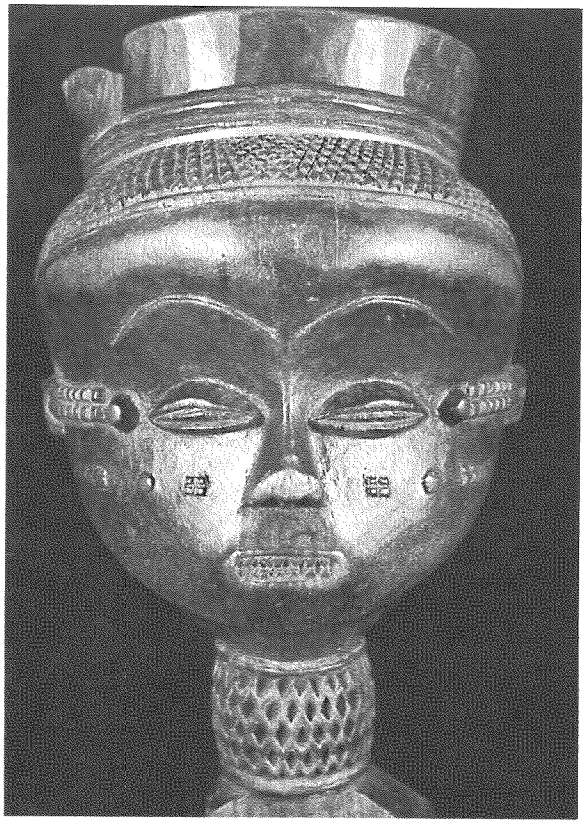

Figure 1. Coupe Leele, Zaire. La patine confère à cet objet de la couleur, mais aussi resserre la texture des fibres. Collection I.M.N.Z. Lubumbashi.

Plus complexes sont les techniques Luba. Lorsque le travail de la sculpture du tabouret est complètement achevé avec tous les détails, l'artiste Luba va à la recherche de l'arbre *Kifumbe* (*Milettia persiloba* ou *Bauhinia*). Une fois qu'il le trouve, il prend les écorces et les racines de cet arbre et les ramène à sa hutte de travail. Là, il coupe écorces et racines en morceaux et les écrase. Une partie de ce qu'il a écrasé est utilisée pour enduire le tabouret et le reste est mis, mélangé avec de l'eau, dans une grande jarre en poterie appelée *Mudiba* (grande jarre en céramique utilisée aussi pour conserver de l'eau ou de la bière de Sorgho, ou comme grenier) ou dans une autre sorte de jarre appelée *Muteko* (grande jarre en céramique étroite à la base, allant en s'évasant largement vers le haut, de plus ou moins 70 cm. de haut). Il met le récipient sur le feu, le tabouret est placé dedans, et il laisse bouillir assez longtemps cette préparation jusqu'à ce que la couleur du *Kifumbe* pénètre fortement le bois du tabouret. Le tabouret ainsi traité devient aussi plus résistant et risque moins de se fendiller. Il le retire par la suite du feu et le laisse reposer un ou deux jours sans le toucher. Il complète souvent le travail au moyen de la sève d'un autre arbre teinctoriel nommé *Baphia*, en suivant le même traitement que celui avec les écorces et les racines du *Kifumbe*, décrit ci-dessus.

Le *Baphia* donne une couleur jaune, qui se fixera sur la première couleur laissée par le *Kifumbe*. Puis le sculpteur laisse de nouveau reposer le tabouret. S'il désire une patine plus sombre et plus grumeleuse, il prend la boue toute noire *bwiiza*, trouvée dans une rivière, qu'il met à bouillir dans la grande poterie *muteko* en y introduisant en même temps le tabouret. Ce dernier sortira de cette préparation avec une couleur toute noire, d'un noir satiné.

On ne verra aucune trace de nervure du bois original, l'ensemble sera uni, lisse, et d'une patine foncée et uniforme.

Le sculpteur n'est pas encore arrivé au bout de ses peines. Il prend ensuite des patates douces bien pilées à l'avance, qu'il repasse plusieurs fois sur la couleur laissée par la boue *bwiiza*. Après, le tabouret est mis au repos. Le lendemain, il commence à frotter très fort le tabouret avec le tourteau de palme bien sec, en le trempant de temps en temps dans le liquide épais restant sous forme de bouillie, un résidu d'huile de palme à couleur jaunâtre.

Il continue à frotter très fort. Cette opération terminée, il prend un morceau de tissu usagé, (dans l'ancien temps, on utilisait la peau d'un petit animal ressemblant au chat ayant une fourrure épaisse, douce et blanche comme du coton appelée *mpongo*). Il continue à frotter avec ce tissu ou cette peau, et enfin, avec l'amadou de palmier, obtenu en grattant le dos d'une branche de palmier, il frotte soigneusement la pièce jusqu'à ce que le tabouret ait une couleur noire et brillante.

Les Tabwa peuvent nous fournir un autre exemple de l'utilisation de la patine : leurs pièces, masques,

tabourets, statues, etc. sont patinées, soit en partie, soit en totalité, tantôt en un ton, tantôt en deux tons contrastés pour accentuer certains traits, comme la chevelure ou des scarifications (technique qui se retrouve dans certains masques Tshokwe). La couleur jaune caractéristique des pièces Tabwa n'est pas liée au bois choisi par l'artisan, mais au traitement que ce dernier va appliquer aux objets. L'opération commence par le polissage de l'objet par une pierre douce d'abord, puis par des feuilles abrasives. Inutile donc de rechercher les traces d'herminettes. L'artiste va ensuite conférer la vie à sa pièce en lui donnant les teintes Tabwa. Pour ce faire, il recourt aux racines de l'arbre *Kikolwa* (*Terminalia mollis*).

Le sculpteur rape la partie extérieure des racines et, le jour même, met cette préparation à bouillir dans une même proportion d'eau. Le mélange presque tiède sert à badigeonner la pièce.

La patine noire est obtenue au moyen de la boue noire *matipa* qui sèche sur l'objet et est enlevée après imprégnation. Les objets patinés sont ensuite rendus luisants grâce à des onctions d'huiles de sésame ou d'huile de ricin, huiles dont se servaient aussi les femmes jadis. L'objet soigneusement huilé était enfin vigoureusement frotté. L'arbre *Terminalia mollis* est bien connu dans la société Tabwa car il ne sert pas qu'à conférer la vie aux statues mais est aussi utilisé comme plante médicinale destinée à soulager les maux de ventre.

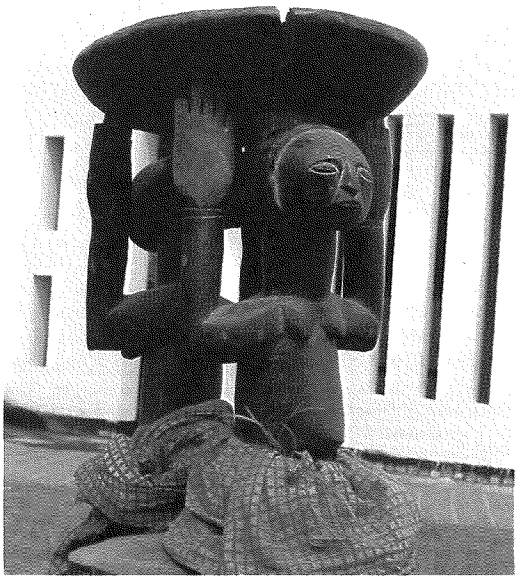

Figure 2. Quatre operations ont été nécessaires de conférer la patine à ce tabouret.

Ces exemples montrent que la patine est un élément indispensable pour que la pièce puisse remplir la fonction à laquelle elle est destinée. A côté de l'aspect fonctionnel, un important apport culturel détermine son choix et chaque société a ses propres habitudes dans ce domaine.

4.0 Importance de la patine

L'importance de la patine doit donc se juger selon deux points de vue : celui de l'expert en art, et celui de la culture qui la valorise.

Pour l'expert en art, nous pensons que les opérations que nous avons décrites sont inhérentes à l'authenticité de la pièce. Une pièce non patinée ne peut être authentique, et il en est de même d'une pièce dont la patine ne correspondrait pas aux traditions du groupe. Nous n'évoquerons pas les patines fausses et celles destinées à cacher des falsifications internes. En général, ces fausses patines recherchent l'escroquerie chronologique; elles changent l'apparence de l'objet d'art. Pour les musées, nous proposons donc de définir la pièce authentique comme une pièce sculptée et patinée, ou peinte par un artiste reconnu par la société, sans que n'y soient apportées des modifications autres que celles dues à l'usage auquel ces pièces étaient destinées.

Les sociétés ont attribué une grande valeur aux patines. Il est précieux d'approfondir le rôle donné à cet aspect du travail du sculpteur. Nous ne nions pas les aspects fonctionnels liés à la conservation des bois, à l'amélioration de certaines propriétés, comme la sonorité des tambours, le resserement des textures, le colmatage des fentes, la résistance à l'humidité et aux insectes. Il nous semble cependant que la patine est liée à un niveau plus profond et qu'elle rejoint l'opposition nature — culture; elle culturalise l'objet, le retire du monde naturel de la forêt pour l'intégrer à la vie socio-culturelle. Un objet patiné est un masque et non plus une pièce de bois.

Cet important processus de culturalisation de la matière est le suivant. Premièrement, pour qu'une pièce ait accès à un rôle religieux, il faut que le bois déjà soit doté de propriétés. Le *Chlorophora excelsa* (*nsanga*), chez les Luba du Kasaï, signifie force et puissance (le chant *Kasala* utilise son nom et en fait les louanges), mais cet arbre transmet aussi les messages, et il est alors la force de la parole quand il est tambour. Il est aussi ancêtre et arbre sacré, arbre généalogique d'où est issu le groupe. Le bois choisi par le sculpteur est donc déjà culturel et moyen de médiation entre les vivants et les morts.

La forme ensuite va compléter cet aspect, mais ce n'est pas tout, car il importe que le bois, si sacré soit-il, s'efface, et que la pièce offre aux regards une nouvelle transformation culturelle de sa matière que patine et couleur confèrent. C'est une personnalisation qui s'opère, une initiation à un statut nouveau. Le niveau technique est donc dépassé. Certes, l'artiste connaît les avantages matériels des opérations menant à la patine, surtout du point de vue de l'amélioration des bois qu'il destine à une oeuvre durable. Ses travaux sont liés à une référence souvent religieuse et toujours culturelle. Nous avons parlé d'opposition nature-culture, on pourrait aussi évoquer celle du cru et du cuit, de la forêt et du village. Seule la patine permet à la pièce d'accéder à ce nouvel état culturel, la forme seule ne le permet pas.

Les couleurs obtenues correspondent généralement aux teintes valorisées dans les sociétés qui les recherchent: rouge, noir-brun, alors les couleurs des ancêtres sont aussi celles de la beauté idéale des vivants.

Les deux couleurs conférées aux pièces Luba ont un sens profond. Le noir se réfère à *kalala ilunga*, noir comme la nuit, et le rouge, à *kongolo*, celui qui transformait en rouge tout ce qu'il approchait.

Nous avons dit que, chez les Tshokwe, rouge et jaune sont réservés aux visages humains, le noir indiquant le monde animal. Les arbres choisis par les sculpteurs ont souvent une valeur mythologique. Ce sont les arbres sacrés, les arbres cosmiques auxquels le sculpteur s'adresse avant d'entamer une oeuvre visant à transformer le bois, qui continuera à vivre dans l'objet. Le choix des arbres tinctoriaux connaît la même référence au sacré: le *kifumbe* est une plante médicinale qui guérit les maux de gorge mais, de plus, il intervient pour conjurer les paroles malveillantes. Il est alors administré en solution dans la bouche de celui qui les a proférées, le reste lui étant versé sur les pieds. Le *kifumbe* efface. Le *Bixa oranella* sert de fébrifuge et de calmant contre les effets des crises de possession. Nous sommes ici en présence d'une relation dialectique complexe: les particularités du bois lui donnent un rôle religieux, et le rôle religieux justifie le choix de telle espèce.

5.0 Conclusion

La patine est due à l'action du sculpteur plus qu'à celle du temps, elle est fonction de la nature de la pièce et du groupe où elle est travaillée. Le sculpteur doit conférer cet élément «culturel» par différentes techniques: la pièce peut être fumée ou ignée. Au moyen de produits variés, on peut la frotter ou l'imprégner. Sa surface connaît des transformations dues à l'enduit, au fard, ou à la peinture. Ces techniques peuvent être cumulatives et il est fréquent que trois techniques différentes soient utilisées successivement sur la même pièce. Ces opérations sont généralement longues et complexes mais leur présence est indispensable pour que la pièce remplisse son rôle. Il n'est pas rare que, si contradictoire que cela paraisse, la patine culturelle soit effacée par celle du temps.

Chaque pièce doit être conservée et restaurée avec sa patine, et chaque technique va poser des problèmes différents de conservation: détérioration par la lumière, par l'humidité, l'acidité, par transformation naturelle des éléments. Nous suggérons donc des études précises sur ces pratiques de sculpteurs afin que ces aspects essentiels des oeuvres d'art puissent être conservés.

Notes biographiques

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The patina in Zairian art is the work of the sculptor, and not merely the result of time or use. It is tied to the distinctive cultural characteristics of each style. The complex work of the sculptor may include up to ten successive operations with complementary functions — some are designed to preserve the wood, while others give the artifact its "cultural" character. Knowledge of these techniques is essential in order to be able to distinguish genuine artifacts from fakes; however, it is also important for determining restoration procedures which respect this important aspect of style. For example, various techniques characteristic of specific ethnic groups are examined: Luba, Tabwa and Kuba. References are made to the various intended uses for the sculpture, for example: domestic use, musical instruments and religious objects. A true appreciation of the value of the patina leads to an accurate definition of authentic art and appropriate conservation procedures.

MAORI BUILDINGS

Restoration of Maori Buildings in New Zealand
A. Geelen
New Zealand Historic Places Trust, New Zealand

The Conservation of the Maori Meeting House in Field Museum
C. Sease
Field Museum of Natural History, Chicago, U.S.A.

RESTORATION OF MAORI BUILDINGS IN NEW ZEALAND

ANNE GEELEN DE KABATH

This paper describes the typical Maori meeting house and discusses the assistance provided by the New Zealand Historic Places Trust to restoration. Two specific projects are described: the restoration of a small family meeting house, and the cleaning of the interior of a house to reveal original painted designs. In all cases, the training of local people under the supervision of conservation advisors is emphasised.

1.0 Introduction

This paper gives an outline of the programme developed by the New Zealand Historic Places Trust to assist Maori people in the care and preservation of the buildings and monuments which belong to them. The Trust was established by Parliament in 1954. It is independent of government, having its own Board of Trustees, and is partially government funded. Staff of the Trust are government employees. The Trust has a number of Advisory Committees, one of which is the Maori Advisory Committee which has responsibility for the Maori programme.

2.0 Maori Buildings

A group of Maori buildings comprising the meeting house, dining hall, ablution block, flagpoles and monuments is sited on communal ground owned by a tribe, subtribe or family group. The place in front of the house, the *marae*, is the place of oratory and is of paramount importance. The houses support the function of the *marae*. The meeting house is believed to be the point of contact between Ranginui (the Sky Father) and Papatuanuku (the Earth Mother). The carvings on a house represent ancestors. The house is conceived of as a person: it has a backbone — the *tahuhu* and from here the ribs (*heke*) run out to the walls to join with the ground. Inside the house the carvings may represent a variety of ancestors from different tribes.

A Maori meeting house, for example, embodies the ancestors of the *marae*. It links people with their own genealogy, their *whakapapa*, and with the traditions that belong to them. It is this and *not* the age of the building which gives it its *mana*, its historic and spiritual value.

Architecturally, the meeting house has a unique form of construction. The backbone of the house, the *tahuhu*, is a basic structural element. Every part of the building — *pou*, *heke*, *amo* —has a traditional meaning and a traditional purpose. The carvings and other artworks are an integral part of the building. The presence or absence of individual carved pieces, paintings and *tukutuku*, are significant in the history of a particular *marae* and of a particular area.



Figure 1. Cover design of leaflet "Maori Building and Sites". A drawing by Maori Artist Cliff Whiting depicting the place of the marae and the meeting house in continuing the relationship between Ranginui the Sky Father and Papatuanuku, the Earth Mother.

3.0 The Role of the New Zealand Historical Places Trust

There is no individual ownership of Maori buildings. Maintenance and restoration are in the hands of Trustees for the *marae*. The Maori Advisory Committee of the Trust examines matters concerning Maori buildings. These include all buildings and monuments on a *marae* or in an *urupa*, or cemetery. The Historic Places Trust gives assistance for restoration work, provides architectural advice, makes grants for the purchase of materials and provides training in the conservation of artwork. The Trust also carries out *marae* surveys. Information on the historic buildings and monuments, their regional characteristics and the needs for restoration are recorded.

The local Maori tribal authority and the Trust together plan a restoration programme. Conservation workshops to train local people in conservation techniques are part of this. Because there are many hundreds of Maori buildings throughout New Zealand, the Maori Advisory Committee needs to have some way of assessing the priorities for assistance. Of prime importance are buildings which have not been significantly altered in the past and where planned restoration will retain the original appearance and style. On the other hand, some buildings have a special relationship with a notable person or event. The meeting house at Waitangi is an example. Again, some buildings may be representative of a particular style of construction or they may show regional variations in design, or a building may have significance because of the carver. Innovations in construction, in the type of material used, in the colours selected for decoration, are all factors to be taken into consideration. Applicants for assistance need to describe the buildings, indicate any special features and historical associations, state what previous restoration work has been done, and give details of the planned restoration and costs.

4.0 Specific Projects

4.1 Nohomaiterangi

Nohomaiterangi is a small family meeting house and its *marae* is named Mataweka. It is said to date from 1866 and has never been modified or restored in the intervening years, thus making it a good project for the Trust. The first stage of the project was to obtain a description of the building in its present state. The style of weatherboards suggested that the house was built during the early period of European influence. It appeared to be original with no additions or modifications. The floor was an integral part of the building and not an infill built over a dirt floor. The roof was not separately framed, the iron being attached directly to the purlins exposed on the inside. The *hekes* were the only framing supporting the roof. Externally the house was quite plain. There were no carvings on the porch of the house although there had been an ancestral figure at the apex. Of particular interest in the porch were the *kowhaiwhai* patterns on the *poupou* which had etched into the timber and were quite clear even though the paint had long since flaked off.

The *kowhaiwhai* design work on the *tahuhu*, *heke* and *poupou* inside appeared to be original and were in very good condition. The *kakaho* (reed lining) had survived well but was in need of some repair and selective replacement. There were no windows in the rear wall of the house and the sliding front door had the low head height of pre-European houses.

Structurally the house was sound and could easily be restored without any major reconstruction.

The next stage was the formulation of a restoration plan. Among the proposed treatments were: recommendations for repiling; minimal replacement of floorboards; new back wall framing which no longer existed; replacing some damaged interior panelling; refitting the sliding door and window; replacing panelling in the porch and some of the *heke* (purlins); replacing weatherboards with new ones sawn to the same profile; lifting the roof to the frame properly and applying insulation paper; and adding of new flashings and spouting as necessary. It was further recommended to repaint the whole house, including the roof, in existing colours. The total cost of materials was estimated at $6,000 (October 1984).

The National Museum Conservator was asked for a conservation report on cleaning and sealing the original artwork and repainting as necessary. As the carving on the porch was absent, the local people have been trying to locate Maori elders in the community who may have visited the building in earlier days and who may recall what carving existed. Archival research had not brought anything to light. The Trust also sought people in the community to advise on restoration of the *kakaho* lining of walls and ceiling. The reed has to be cut at a certain season, left for a period then placed over the *heke* in the traditional pattern.

The above project stages represent the Trust's policy to date — to provide information on how

the restoration work can be done in an appropriate manner, and to provide some funds to pay for the materials. The Trust does not arrange the work nor does it supervise. Constraints on staffing and funding do not allow for this.

Once the fabric of the building has been restored, attention is focussed on the artwork. In the case of this house, it was mostly painted designs on wood. These had suffered damage over the years by people touching them, breathing on them and leaning against them and they had generally collected dirt. It is usually recommended that a thorough cleaning be done using a 1% dilution of Lissapol. A sealer is then applied. 15% Paraloid B72 in xylene is recommended for this. Paint colours are carefully matched wherever there is any retouching to be done.

At the time of writing, none of this work had been started. It had been the Trust's intention to run a Conservation Workshop at this *marae*, teaching the people working there and others from *marae* in the district, how to do the cleaning, sealing and repainting. Such a workshop could take from 5-10 days depending on the vcomplexity of the work and the ability of the local people to understand and follow the process. The conservator in charge of the workshop may feel that ongoing supervision of the work is necessary and this would normally be agreed to and funded by the Trust.

4.2 Hinetamatea

Hinetamatea is a meeting house located on the beach front at Anaura Bay on the East Coast of New Zealand. The building itself did not appear to have any special significance until, in 1983, a group of young people were hired on a government funded labour scheme to repaint the interior. During stripping of the earlier layers of paint they came across patterns which no living person had ever seen. Each panel around the inside walls had a figure painted on it in the style of the carvings that were more common in meeting houses of the 1880's. Not only was this likely to have been one of the earlier houses with painted figures (it dates from the 1880's or even earlier), but also the figures showed a remarkable range of colour and pattern. When the significance of the house had become apparent, and the complexity of the work accessed, the Trust's Maori building advisor requested a halt to further work until the Trust could devise a programme. In the first instance, a conservator was employed to view the building and to draw up a work plan. The Trust was able to contract a fine arts conservator in private practice who had had some previous experience in working on a *marae* project. Permission was given for the removal of one of the panels so that it could be restored. The conservator was asked to devise a method of working which could be taught to the local people so that they could be involved in restoring their own *taonga* (treasured heritage). The conservator spent a week on the *marae* and when he was assured that the work could be carried out successfully, he left intending to revisit from time to time to sort out any problems. The local people had access to a video recorder to document the conservator's processes. This proved a useful memory guide as the work progressed.

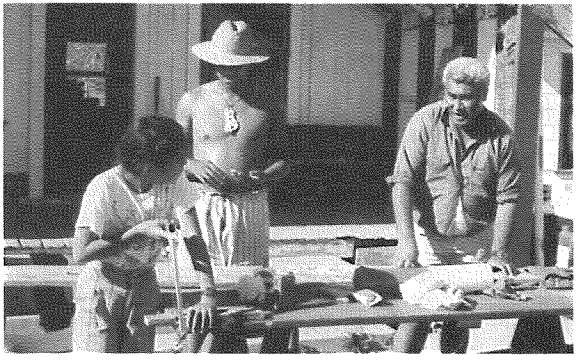

Figure 2. People at Anaura Bay restoring panels from the meeting house Hinetamatea.



Figure 3. Removal of three layers of plain paint reveals a geometric design in the top half of the panel covering part of the original figure which is revealed in the lower half.

The panels were removed from the walls and laid on trestle tables to be worked on horizontally. A Leister hot air gun was used in conjunction with a 1 inch 800 scraper made by the Warner MFG Co which proved the easiest to control. The hot air gun was adapted to a temperature of 175°C with an air speed rating of 6. Four layers of paint had to be removed. From the top, these were: light

yellow; yellow ochre; basic *kowhaiwhai* pattern in red, black and white; and grey with a creamy/ grey background on which pencil lines were drawn around the figures and bordering all the details. The figures were painted in red, black, tones of green, yellow and flesh colour. Once the top layers of paint had been removed, the remnants of the original painted design were cleaned with a scalpel and a methanol wash. The Paraloid B72 sealer was used in places where the original paint had disappeared, but where the paint stain remained and could be colour-matched, retouching with vinyl paints was carried out.

Work on the panels is expected to be completed early in 1987. At this stage, the fabric of the building will be restored as specified in the architectural report. The rededication ceremony is likely to take place in December of 1987.

5.0 Conclusion

Both of the projects described can be considered successful but to achieve a better result there were elements of each that could have been done differently. In each case, Maori involvement had led to a heightened awareness of the cultural treasure which is theirs to care for and to pass on to succeeding generations. New skills were learned which are already, in one case, being put to use on other local projects. This is what the Trust hoped would happen. Funding such work can only ever be applied to a limited number of projects. Many of the meeting houses have artworks of lesser significance and of less complexity. Restoring these historic places is left to the local people, with minimum assistance from the Trust. It is therefore an important step forward, to have some local people already trained in cleaning, sealing and in some cases retouching of interior and exterior decorated wood surfaces.

In both cases, it would have been better to have made a full record of all stages of the work and to have assessed each stage before the next was started. Historical documentary research has not been carried out. There should have been a greater level of consultation with the Trust so that problems were ironed out as they arose. However, the extra costs involved would have meant that the Trust could only have assisted one of the projects and the other would have gone ahead without access to professional advice.

The hope for the future is that the Trust's Maori Buildings Programme will become an important part of its overall policy and projects, resulting in a professionally staffed unit having its own conservator and conservation architect. The Trust could then 1) select projects for more through investigation and conservation 2) conduct conservation workshops in each area to cover training in basic maintenance/cleaning procedures 3) be able to advise on conservation of individual artworks 4) draw up conservation plans on request 5) publish information on conservation techniques and procedures.

Whilst in Canada, the author planned to examine the CCI Mobile Conservation Laboratory Programme to see if this could usefully be adapted for use by the New Zealand Historic Places Trust in the Maori Buildings programme.

Biographical Notes

Anne Geelen earned her MA with 2nd class honours in Anthropology at Auckland University in 1975. She joined the New Zealand Historic Places Trust as an Advisory Officer in 1979 and has worked on the Maori programme since 1981.

Cette communication décrit une maison commune maorie typique et examine l'aide que fournit le New Zealand Historic Places Trust au titre de la restauration. Deux projets y sont abordés: la restauration d'une petite maison commune servant de lieu de réunion familial, et le nettoyage d'un intérieur de maison pour mettre au jour les peintures originales. L'auteur insiste sur le fait que les ouvriers sont des habitants de la région travaillant sous la supervision de conseillers en conservation.

THE PROPOSED CONSERVATION OF THE MAORI HOUSE IN THE FIELD MUSEUM

CATHERINE SEASE

In 1905, The Field Museum acquired an entire Maori meeting house. In preparation for a total renovation of the Pacific Hall, plans are being made to conserve and relocate the house in the new exhibition space. This paper discusses this planning process. The proposed conservation treatment of the various elements of the house is outlined, including decisions on the kind and degree of conservation. The discussion of the proposed reassembly of the house addresses the facts that the house can no longer be weight-bearing and that many elements are currently wrongly positioned. The determination of proper positioning will include the use of archival and photographic documentation as well as careful inspection of individual elements for clues of the original construction. The type of outside consultants necessary for such a project will also be discussed. An important part of the paper concerns the interaction of the curatorial and conservation staff with the Maori people, with the amount and type of involvement of the Maori family that originally made the house. The making of missing elements by the Maori is discussed. The necessary ceremonies and rituals will be observed to preserve the integrity of the house at all stages of the procedure. In such a way, it is hoped that the conservation of the house will become in itself an ethnographic exhibit.

1.0 Introduction

In 1905, the Field Museum of Natural History acquired an entire Maori meeting house in Germany and had it shipped to Chicago. The Museum moved to its present site in 1921, and the Maori house was erected by 1924 where it now stands.

For many years the house was part of the Museum's Pacific Halls (Figure 1). Mats, feather cloaks and other Maori artifacts were displayed inside the house. Since 1977, the house has been behind a temporary partition. This partition was removed, however, in 1986 and the house was once again exhibited for the **Te Maori** exhibition held at the Field Museum from March through June, 1986. In fact, the house served an important function in both the opening and closing ceremonies of this exhibition, as well as being a popular attraction to visitors during the exhibition.

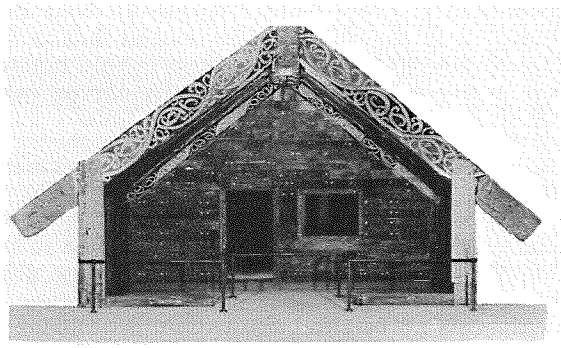

Figure 1. Ruatepupuke II as originally displayed in the Field Museum, circa 1924. Photo: Field Museum of Natural History.

Unfortunately, the house is again not displayed, but hopefully for the last time. In fact, all the Pacific Halls are now closed in preparation for a major reinstallation. Over the course of the next few years, the Maori house will be conserved and relocated in the new Pacific exhibition space. It is the intention of this paper to discuss the method of approach and planning currently being considered to tackle the enormous task of conserving the house.

2.0 Historical Research

Much research has taken place already to establish the identity of the house. Over the years, considerable confusion has surrounded its identity, but it is now believed that the house is *Ruatepupuke II* and that it came from Tokomaru Bay on the East Coast of the North Island. Due to raids from hostile northern tribes, *Ruatepupuke I*, the original house, was dismantled about 1828 and buried in or near the mouth of Mangahauini Creek which runs through the middle of the town. After the land wars, a new house was needed and subsequently built. *Ruatepupuke II*, built for Mokena Romeo Babbington, was opened with great ceremony in 1861 (1). For reasons unknown, in the 1890's, the house was sold to Hindmarsh, a dealer in Maori curios, thus creating a major tribal rift (2). The house was dismantled and reputedly taken to England before it eventually came, in 1902, to Hamburg,

Germany where it was re-erected. It was here that the house was acquired by the Field Museum through the dealer J.F.G. Umlauff in 1905.

Ruatepupuke II has great interest and importance as an ethnographic specimen. Said to be carved by Wiremu Managapouri (3), it is the oldest surviving carved house from the Waiapu County area and is the second oldest from the East Coast-Poverty Bay region. Within all New Zealand, it is the third oldest extant house (4). *Ruatepupuke II* is also distinctive in that none of the other early houses has a fully carved front porch.

As an historical and ethnographic document, *Ruatepupuke II* is second only to *Te-Hau-ki-Turanga*, a house built in 1843 currently in the National Museum in Wellington (5). Due to the fact that it was removed from the country, prior to any attempt at restoration, *Ruatepupuke II* represents an original decorative assemblage of carvings and rafter paintings. All of the carvings on the porch and in the interior belonged to the original structure; very few elements are missing and there has been no retouching of the rafter paintings. As a result, it is thought by some to be more authentic than existing houses of earlier date which have received varying amounts of restoration. *Ruatepupuke II's* importance lies in the fact that it presents an authentic decorative scheme, including both carvings and paintings, that is the earliest known example of the decorative and architectural type of the Waiapu School of carvers (6). By providing such reliable ethnographic data, *Ruatepupuke II* is clearly a significant ethnographic specimen worthy of the effort necessary to conserve and restore it to its original form.

3.0 Conservation

The first step in the conservation process will be to dismantle the house which should be a fairly straightforward process. In the course of the dismantling, it is hoped that significant clues may be found that will provide information about the house. For example, as a result of careful examination, the curator has found several names written below the decorated portions of the *poupou*, or interior side carving panels inside the house (Figure 2). These names are difficult to read as the writing is faint and the surfaces are badly worn. Attempts will be made to enhance this writing and it is hoped that the Maoris in Tokomaru Bay will be able to help decipher it. With luck, more such writing may be found on the house as it is taken apart and this may yield additional information about the house. It is also hoped that by aligning nail holes and other construction evidence, more will be learned about the way in which the house was originally assembled.

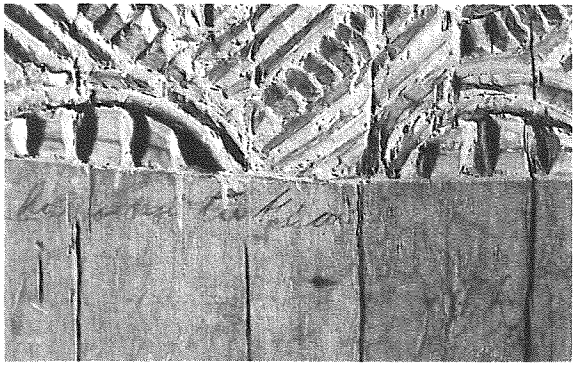

Figure 2. Detail of an interior poupou *(side) panel with writing on it.*

Perhaps the most important decision is to determine the amount and degree of conservation to be undertaken. *Ruatepupuke II* functioned as a meeting house for some 30 years before it was purchased. Fortunately it was photographed *in situ* before being dismantled (Figure 3). It can clearly be seen in a state of disrepair. With this in mind, it would be inappropriate to attempt restoration of the house to its original, unused condition. This would deny and destroy much of the historical and ethnographic importance of the house. Instead, it is proposed to restore it to the appearance it had towards the end of its functional life at Tokomaru Bay in the late 1880's. No attempt will be made, therefore, to hide the effects of sun, rain and wind on the porch elements. Scratches and worn areas will remain as a testament to the many people who used and treasured the house.

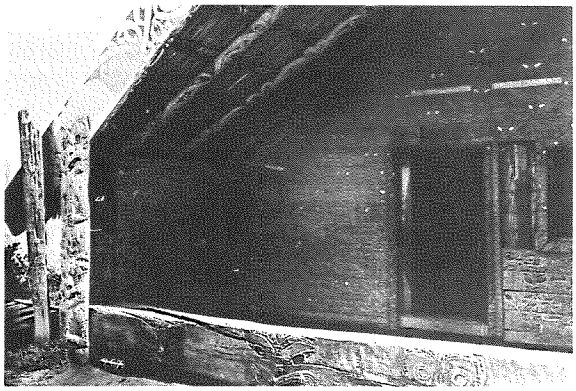

Figure 3. Ruatepupuke II in situ *in Tokomaru Bay prior to being sold in the 1890's. Printed with the permission of the National Museum, Wellington.*

3.1 Structural Repairs

The actual conservation work required is minimal. In general, *Ruatepupuke II* is in very good condition. There are a few structural elements, however, that will need repair. The *tahuhu*, or ridge pole (Figure 4), is badly split and will require some form of support, as will a broken *heke*, or rafter (Figure 5). The bottoms of many of the posts were originally embedded in the ground. Continuous exposure to moisture caused the wood to rot and now the post bases are soft and friable and may require consolidation (Figure 6).

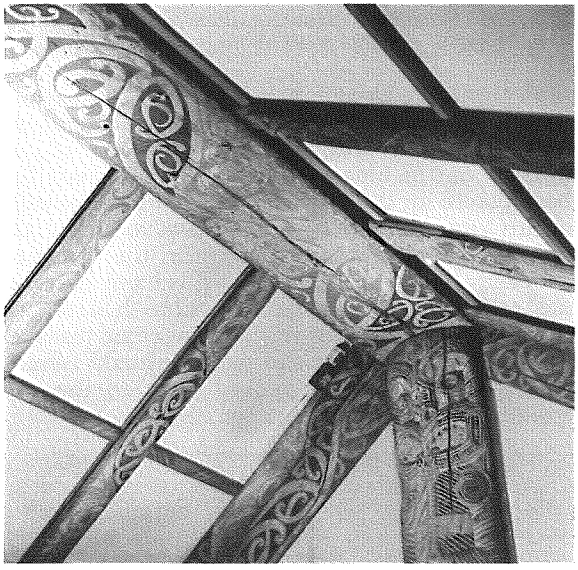

Figure 4. Detail of the tahuhu *(ridge pole) showing large split and bolts currently holding it in place. Photo: Field Museum.*

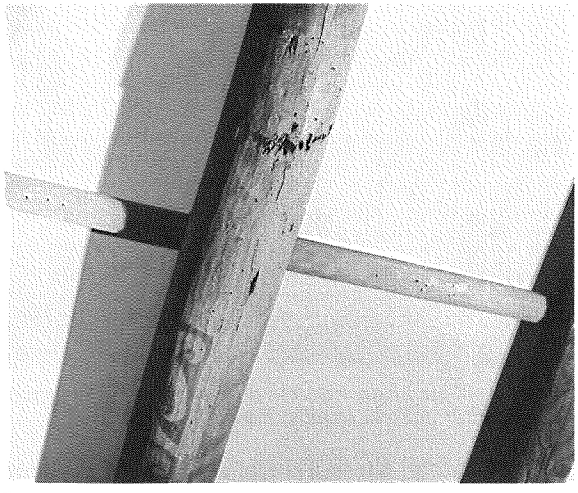

Figure 5. Detail of a broken heke *(rafter). Photo: Field Museum.*



Figure 6. Detail of the center post on back wall showing its rotten base. Photo: Field Museum.

3.2 Cosmetic Treatment

In addition to structural repair, some cosmetic treatment will be necessary. For example, the entire house will require cleaning. All elements, especially those up high, have collected a thick layer of dust and cobwebs and lower down, there are generous wads of chewing gum. Many of the *paua* shell eyes have been pried out and have disappeared. It was a regular maintenance procedure to cut and insert new shell eyes when the

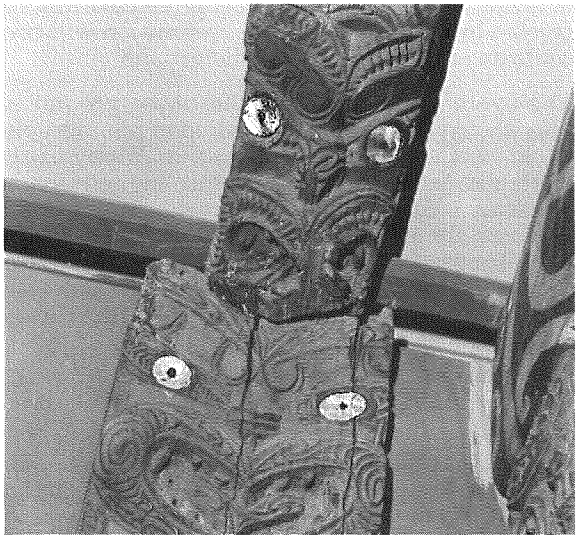

Figure 7. Detail of joint between poupou *and* heke *on porch showing crude restorations and excess black adhesive around the shell eyes. Photo: Field Museum.*

need arose and there was a lack of regard for where the black adhesive went (Figure 7). The rafters on the interior of the house are covered with dirt and soot, presumably from the hearth fires originally lit inside the house. This dirt obscures the detail of the painted designs and should be removed (see Figures 4 and 5). Cleaning the rafters, however, will be limited to making these designs more visible; it will not restore them to their original brilliant appearance.

Examination and analysis of the paint will be performed when cleaning the carvings, especially those on the facade. The front wall of the house is painted a dark matte red. Showing through this is a bright orange paint which is especially visible around the window. The *amo*, or uprights on the facade, on the other hand, have been painted a greyish white. Where this paint has flaked off, the dark red, matte paint can be seen underneath. Does the orange paint represent the original colour of the house and are the subsequent coats of paint evidence of attempts at refurbishing the house? When the answers to these questions are known it should be possible to piece together more details of the history of the house. More important, it may be possible to shed some light on ethnographic problems concerning paintings of Maori carvings.

3.3 Reassembly

This will be by far the most difficult task. *Ruatepupuke II* has clearly suffered from its various moves and, as a result, the original conception of the carver has been distorted. This is largely due to the house being erected and re-erected by non-Maoris. Thus, restoration will concentrate on correcting these distortions.

The overall proportions of the house are not as they should be. From examination of photographs of old meeting houses it is clear that *Ruatepupuke II* should be lower to the ground, by perhaps as much as a foot, and the side walls should lean inwards slightly (Figure 8) (7). The apex of the bargeboards and the top of the *koruru*, or carving at the apex, have been cut off; thus drastically affecting the unity and proportions of the facade (see Figure 1).

According to an *in situ* photograph (Figure 3), the side walls of the porch were completely carved in the same manner as the front wall. The small panels that fit horizontally in between the *poupou* had been thought to be spacer panels fitting under the *poupou* on the interior of the house. Now in storage, these panels must be reinstalled in their proper position on the porch to restore its rich texture and design.

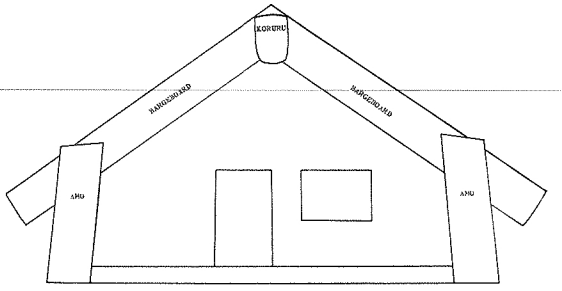

Figure 8. Schematic drawing illustrating the proper proportions of a Maori meeting house.

Many interior elements are wrongly positioned. The *poupou* panels, for example, are placed too far apart and throw the proportions of the interior out of balance (Figure 9). One pair has been placed on the end wall where it masquerades as an *epa*, or end carving. However, it is the wrong size and shape to perform this function properly. As a result, the end walls have lost their aesthetic cohesiveness. It is possible that this use might be original and it will take some research to determine whether the panels should remain where they are or be moved back to the side walls.



Figure 9. View of an interior wall showing the current placement of poupou *panels. Photo: Field Museum.*

Unfortunately, there is little archival and photographic evidence to help determine the original appearance and proportions of the house and

placement of elements. To the author's knowledge, no descriptions exist of the house when it stood in Tokomaru Bay and only three photographs exist of the house *in situ* (see figure 3). The house was fully documented photographically in Hamburg around the turn of the century, though it was erected by non-Maoris and the proper proportions are already out of balance (Figure 10). These German photographs, however, are useful in that they provide reliable documentation of the condition of all the elements of the house at the turn of the century. This can be used as a comparison with their present condition.



Figure 10. Ruatepupuke II *as displayed in Hamburg, Germany circa 1902.*

It will be necessary to rely on photographs and drawings of other Maori houses of the same period as a guide to reassembling *Ruatepupuke II.* With luck, clues may be found within the house itself about the original construction. Since the house has been erected and dismantled several times since it was first built, it may take considerable detective work to find and interpret these clues. For example, careful analysis of nail holes may help establish a chronology of construction.

3.4 Replacement of Missing Elements

Once the correct proportions of the house have been determined, a decision must be made regarding the replacement of missing areas. Many pieces are missing while others exist in storage. Exactly what parts are missing cannot be determined until the remaining pieces have been reunited with the rest of the house and proper positioning of all elements established.

It is known that much of the front exterior wall is the result of prior restoration. A mold was made of one original panel and then several casts were made in plaster of paris which was then painted. These panels appear in the German photographs and were made there around the turn of the century. The *tukutuku*, or woven panels, on the interior walls are not original to the house and were also made in Germany. Although the designs are authentic, the current panels are poorly made and have suffered considerable damage (Figure 11).

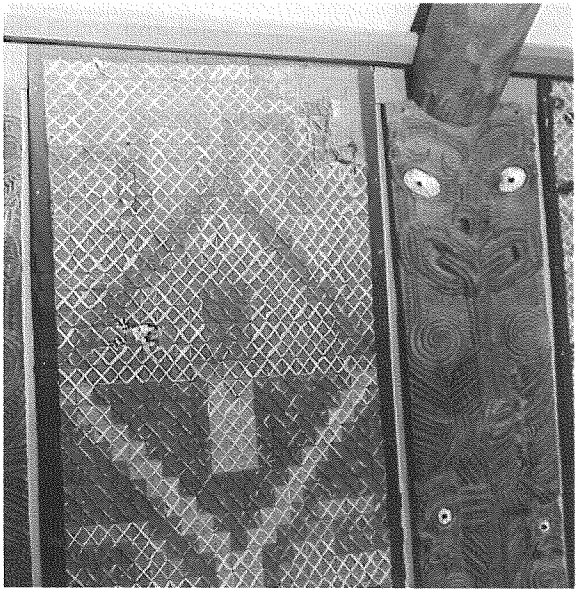

Figure 11. Detail of tukutuku *(woven) panel showing damage. Note also the gaps between the* tukutuku *and the adjacent* poupou. *Photo: Field Museum.*

What should be done about these missing elements? Should new ones be commissioned or should the missing areas be filled with blank elements so there is no question of originality? These questions have not been addressed yet, partly because it seems wiser to wait until the extent of the problem can be fully assessed as well as the aesthetic effect it will have on the appearance of the house.In the end, a combination of several techniques will probably be used. Since the *tukutuku* panels with their designs form such an integral part in the overall decorative scheme of the interior, new panels will probably be commissioned to be made by people in Tokomaru Bay.

For the missing panels on the front wall, a different solution will most likely be chosen. In order to maintain the overall unity of the facade, a very important part of the house aesthetically, new panels may have to be cast in much the same way the existing restorations were made. New carvings would be inappropriate. Fresh carvings in *totora* wood are very raw and bright

in colour and would contrast harshly with the old, weathered and worn wood surrounding them, giving the house a patchy, disrupted appearance.

In other areas, such as the interior, it may be appropriate to have new elements carved in order to enable visitors to touch them. On tours of *Ruatepupuke II* given during the **Te Maori** exhibition, there was a tremendous urge on the part of visitors to feel the wood and touch the carvings. Indeed, when the Maoris came for the ceremonies surrounding **Te Maori**, they, too, immediately reached out to touch and caress the house. By having new carvings made, it might be possible to accommodate this desire to touch and have a section of the house where touching is allowed.

The method for reassembling the house has not yet been determined. The house consists of one large room 55 by 22 feet (16.75 x 6.7m) with a height of 15 feet (4.6m) to the peak of the roof. The door opens onto a small porch 22 by 10 feet (6.7 x 3.0m). In essence, the house is a veneer of carved elements. The outside walls, with the exception of the facade, and the roof no longer exist. As the house now exists, it cannot stand without support. The structural elements are now dry, brittle and have rotted bases and can no longer be load-bearing. This presents a problem for reassembly. Either the house can be treated as a veneer as it is now and be attached to the inside of an empty room, or a large framework can be built from which the various elements can be suspended. To a certain extent, the method chosen will depend on design considerations. For example, if the house is to appear completely recessed into a wall as it is now, the framework method might be the best way to support it. If, however, it is decided to make the house fully or partially free-standing so that it has side walls outside and a roof, a proper house would have to be built to which the carved elements would be fastened.

The attachment of the elements will be a problem no matter which method is used. At the moment, nails, screws and bolts have been driven straight through the carvings with little regard for the design elements on them. In some instances, the holes made were crudely filled in with putty and paint (Figure 7). In others, the nail or screw was driven in so deeply its head does not show, but the hole does, and is disruptive.

To what extent an architect would be helpful in deciding the method of assembly is hard to say. Certainly an architect would be able to offer valuable suggestions concerning stresses and loading but, not being conversant with Maori building techniques, would have little to contribute in determining proportions and the proper positioning of elements. Even a Maori architect would be of limited value in this, for all modern meeting houses are now made using European building techniques, with European proportions. Perhaps rather than an architect, a Maori scholar, well acquainted with the old meeting houses and their styles in New Zealand, would be a more useful consultant for this project.

4.0 Maori Participation

The major consultants throughout this entire project will be the Maoris themselves. Many prominent Maori scholars have already studied the house and provided information on its artistic, historical and ethnological importance. Contact with the family who owned the house originally was made when family members came for the opening of **Te Maori** in March 1986. This contact has been further strengthened by a recent Field Museum trip to New Zealand. Led by the Curator of Oceanic Ethnology, the group visited Tokomaru Bay and met the family. It is hoped that they will come to Chicago to help advise on the project and celebrate the reopening of the conserved house.

Although the family is content with the fact that *Ruatepupuke II* now resides in the Field Museum, it will be necessary to consult them at various stages throughout the restoration to ensure that it is done properly. The family overwhelmingly supports the conservation project and is willing and eager to help in whatever way they can. The challenge will be to direct and channel this enthusiasm in a way that will be constructive and bring about the goal of reopening the house. It is to the family, then, that the conservation team will turn for the manufacture of new *tukutuku* panels. It will also be necessary to call on their guidance to help find suitable carvers for new wooden elements should the need arise. It is also possible that various family members might be able to help in the research. By carefully searching records in local, regional or national Record Offices or in local historical societies, information might be discovered that will shed new light on the history, construction and appearance of *Ruatepupuke II.*

5.0 Conclusion

In keeping with the new direction of Public Programs it is hoped that some, if not all, of these Maori projects would take place in the Field Museum, not in New Zealand, and thus become exhibits in themselves. By providing suitable

work space within the public portion of the museum, visitors could watch the carvers or *tukutuku* weavers at work and participate vicariously in the conservation of *Ruatepupuke II.*

Indeed, it is hoped that the reassembly of the house itself will be done in such a manner that visitors can watch its progress from beginning to end. Much interest was generated in *Ruatepupuke II* thanks to **Te Maori**. Vicarious participation in the conservation and reassembly of the house would serve to sustain and nurture this interest and lead quite naturally to public participation in the opening ceremonies and, when the house is again open to the public, in the interpretive programs structured around it.

The potential of *Ruatepupuke II* as an interpretive exhibit is great, not just for dealing with Maori culture, but for a wide variety of Pacific cultures as well. The details of how *Ruatepupuke II* can be used most effectively are just now being explored, and it is hoped the interpretive use of the house will occasion the visit of Maoris from time to time to help keep its spirit and warmth alive. In March 1986, a special ceremony took place to prepare *Ruatepupuke II* for the conservation process. Appropriate ceremonies will take place when the conservation is complete and *Ruatepupuke II* is again open to the public. Once the house is open and the *marae*, or sacred courtyard, is again functional, the Museum will be fortunate to have a special area available that can be used for a wide range of events pertaining to the Pacific.

This, then, is the plan for the conservation of *Ruatepupuke II.* Once the project is underway, it may well be necessary to reassess the original plan and make changes to accommodate unforeseen problems. In the future, the author hopes to report on how the project actually was accomplished, detailing problems encountered and their solution. No matter how the conservation and reassembly of the house is finally achieved, it is hoped that it will be done in such a way that the whole conservation process will become in itself an ethnographic exhibit.

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Biographical Notes

Catherine Sease graduated from Bryn Mawr College with a Bachelor of Arts degree in Anthropology. She also has a Bachelor of Science degree in Conservation from the Institute of Archaeology, University of London. She has worked as conservator on archaeological excavations in Britain, Greece, Libya, Iran and Iraq. She has worked on ethnographic material as Head Conservator for the Rockefeller Wing at the Metropolitan Museum of Art and in private practice. She is presently Associate Conservator in the Department of Anthropology at the Field Museum of Natural History, Chicago.

En 1905, le Field Museum a fait l'acquisition d'une maison communale maorie. En vue de la rénovation complète du Pacific Hall, on planifie actuellement la conservation et la réinstallation de cette maison dans la nouvelle salle d'exposition. La communication traite de ce processus de planification. On y décrit aussi les traitements proposés pour la conservation des divers éléments de la maison, y compris les décisions concernant l'ampleur des réparations. Divers problèmes se posent. La maison ne peut plus supporter de charge et de nombreux éléments sont actuellement installés aux mauvais endroits. La documentation archivistique et photographique et un examen soigneux des éléments, qui pourrait fournir des indices quant à la construction d'origine, permettront de déterminer le juste emplacement des éléments. La discussion traite aussi des spécialistes qu'il faudra consulter à l'extérieur. La communication accorde en outre beaucoup d'importance l'interaction des conservateurs et des restaurateurs avec les Maoris, ainsi qu'à la participation de la famille maorie qui a bâti la maison. On prévoit que les éléments manquants seront fabriqués par les Maoris. Les cérémonies et les rituels qui accompagnent ces travaux chez les Maoris seront respectés afin de préserver l'intégrité de la maison à toutes les étapes du projet. On espère ainsi que la conservation de la maison constituera en elle-même une exposition à caractère ethnographique.

MUSEUM REPORTS

Ethnographic Conservation at the National Museum of Copenhagen, Denmark
W. Odder
Nationalmuseet, Lyngby, Denmark

Conservation Practices in the National Museum of the Philippines
S. Naranjo
National Museum of the Philippines, Manila, Philippines

Report on the National Museum of Gabon
A. Rosenburg
Ann Arbor, Michigan, U.S.A.

ETHNOGRAPHIC CONSERVATION AT THE NATIONAL MUSEUM OF COPENHAGEN

WINNIE ODDER

In this paper a brief historical survey of the National Museum in Copenhagen is given. As exhibition concepts have changed, and the number of objects increased considerably, the Museum is now faced with an enormous problem of lack of space and an exhibition area which does not meet current requirements in respect to climatic demands, modern communication and access to both objects and information. In order to meet present demands and plan for the future, the National Museum is now in the first stages of a total renovation, which also includes construction of a modern storage building outside the city-center in close connection with the conservation departments. This total rearrangement of the exhibition area and open-storage facilities, is described. The author concludes with short descriptions of several interesting and unique conservation treatments carried out at the Museum.

1.0 Introduction

In this paper the field of ethnographic conservation in Denmark is examined with particular reference to the National Museum of Copenhagen. In order to appreciate the variety of objects and materials of fabrication involved in the conservation treatments, it is necessary to first examine briefly the historical background of the collection.

2.0 History of the Collection

Ole Worm, a physician and professor at Copenhagen University, was the first to display a private collection to the Danish public. His inspiration came from the great scholarly collections amassed in Europe during the 16th and 17th centuries. He inspired the Danish King Frederik III to establish a "Cabinet of Curiosities", or *Kunstkammer*. After the death of Ole Worm in 1654 his Museum Wormianum was incorporated into the Royal *Kunstkammer*. In the second half of the 17th century, after further acquisitions, the *Kunstkammer* was rehoused on the second floor of a new building which also contained the Arsenal and Royal Library (Figure 1). The collection was arranged in several rooms, one of which was called the Indian Cabinet. At this period "indian" referred generally to remote lands — America, India and the West and East Indies.

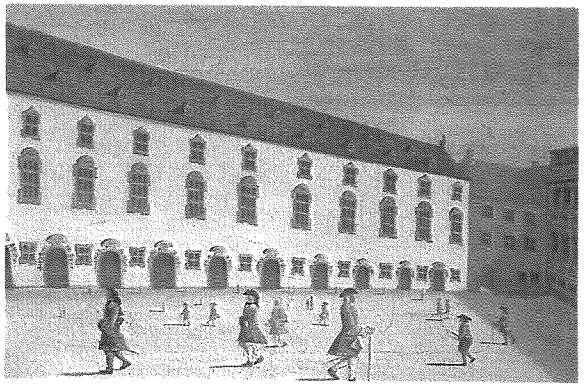

Figure 1. The Royal Kunstkammer *and Library building around the middle of the 18th century. From a painting by Johannes Rach and Heinrich Eegberg. Photo: Lennart Larsen.*

The *Kunstkammer* was eventually dissolved at the beginning of the 19th century and in 1841 the collection of the Indian Cabinet became the nucleus of the Royal Ethnographic Museum. This was later united with various other collections and housed in the Prinsens Palais and so became the present National Museum of Copenhagen.

Ethnographic objects in the museum were initially displayed along with Danish prehistoric material. In the 1930's, after further expansions in the Prinsens Palais complex, they were exhibited by regional division and culture. To a certain extent this scheme is still in effect, although exhibition concepts have changed over the past 20 years and many exhibition rooms have been turned into storage areas. The poor conditions obtaining in these areas contributed greatly to the deterioration of artifacts.

3.0 Future Plans

As a result of the poor display and storage conditions, and a growing understanding of the demands of modern museology, the National Museum is entering a new phase of its existence. This implies drastic changes in building design, exhibition concepts and communication. The National Museum in its present state and the proposed new structures are shown in Figure 2. The Department of Ethnography occupies the

three floors surrounding the courtyard to the left. This area will be arranged to meet several demands such as open storage, and more didactic and thematic exhibits. A new storage facility, closely connected to the various conservation departments, will be erected outside the city centre.

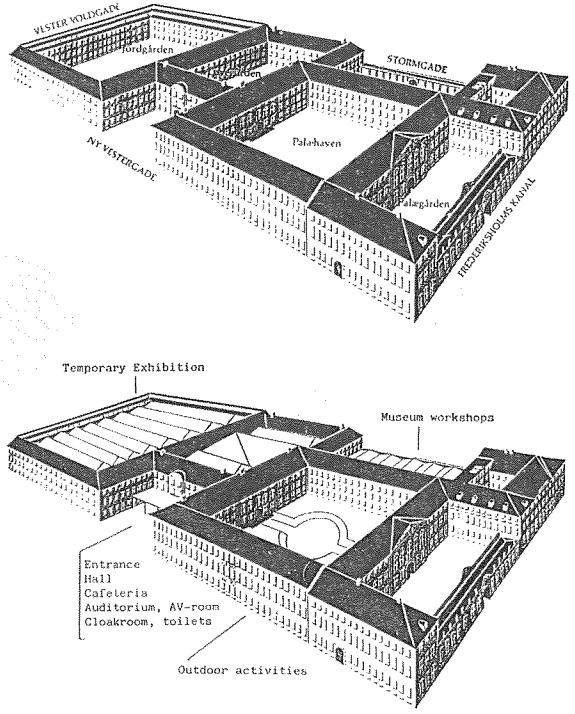

Figure 2. Plan of the National Museum in its present state (top) and the proposed new structures (above). Photo: John Lee.

4.0 Conservation Activities

4.1 Environment

Generally speaking, control of the environment in the museum has been practised upon a very low scale with a limited budget. For example, the humidity in some of the display cases containing delicate objects, such as Japanese lacquer work, has been raised to acceptable levels by the use of glass jars filled with distilled water and a little charcoal. The mahogany display cases built in the 1930's are relatively air-tight and the water needs replacing once every few weeks.

Similarly, some storage facilities in the Museum have been organized to meet modern museological demands in several ways. The rooms are oriented towards the east and have two layers of curtains, black and white, to bring lighting to acceptable levels. Small or very delicate objects are kept in acid-free cardboard boxes on wooden shelves and arranged in such a way that handling during examination is minimized (Figure 3).

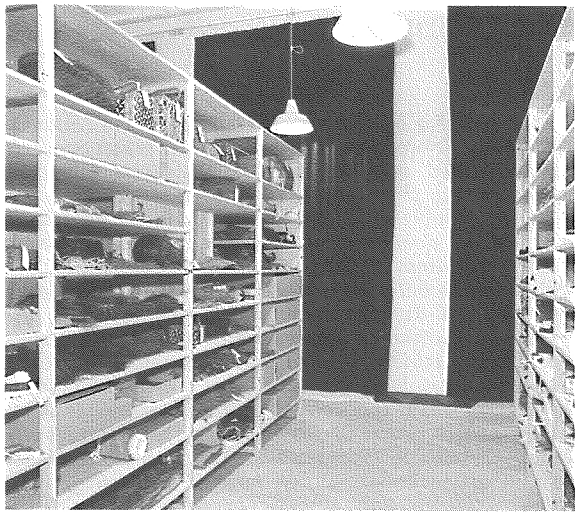

Figure 3. View of a newly arranged storage area produced with a low budget. Photo: John Lee.

4.2 Insecticide Residues

The Museum's collection of Eskimo clothing has been analysed at the Conservation Laboratory and high concentrations of DDT, Lindane and methoxy chloride have been identified. In order to remove these deposits safely a special fume extraction cupboard has been constructed (Figure 4). The objects are placed in the cupboard and insecticide deposits removed by a stream of pressurized air. Particulate matter is trapped in a system of filters. Personal safety equipment is also worn during this process. Cleaned objects are wrapped with acid-free tissue paper, packed in acid-free cardboard boxes and then placed in a clean store room.



Figure 4. Working with the fume cupboard to remove deposits of insecticides. Photo: OKNEJ.

5.0 Treatment of the *Kunstkammer* Collection

A research project was undertaken by the Museum to establish the provenance of some 1000 objects from the original *Kunstkammer* collection. The results of this survey were published in 1980. Meanwhile conservation treatment of these old and delicate objects was undertaken over a period of years, culminating in a special exhibition in 1979. Following are brief notes on some of the many different materials and exotic objects treated during this time.

5.1 Brazilian Red Ara Head-dresses and Hawaiian Red Ibis Cape

Both artifacts comprised a net base, of either pineapple or cotton fibre, to which were attached the feather shafts. Fluoro-mat detergent, 0.5% in Shellsol, was used for the Brazilian head-dresses. Due to matting of down feathers it was not possible to use this technique for the Hawaiian Ibis Cape. Tinovetin J.V., 0.05% in distilled water, was used instead. Both these techniques are described in detail elsewhere (1).

5.2 Clove Artifacts

The household utensils (Figure 5) from the Cabinet of Curiosities were made from cloves in Indonesia. Even though then were nearly 300 years old, when the dust was removed in the laboratory the scent of cloves still remained very strong. The cloves are joined to each other by fine metal wires some of which are gilded.

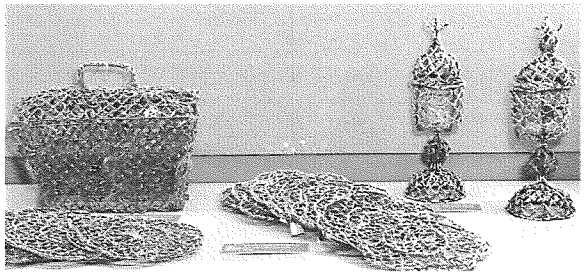

Figure 5. Household utensils made in India from Indonesian cloves. Dated 1695. Photo: John Lee.

5.3 Ivory

Manual cleaning of ivory objects proved very time-consuming and placed the objects under considerable mechanical stress. For this reason specially designed ultrasonic equipment was constructed for the treatment. The equipment had a wide range of control so that specific cleaning conditions could be established for particular artifacts. A Chinese ivory model house with internal clockwork (Figure 6) shows one of the typical characteristics of the *Kunstkammer* objects; large and obtrusive accession numbers. Although this method of applying accession numbers is not ethical by today's standards, the numbers have not been removed because they constitute a part of the cultural history of the objects which bear them.



Figure 6. Chinese model house of ivory with clockwork. 18th Century. Photo: Lennart Larsen.

5.4 Paintings

Ethnographic paintings pose problems for painting conservators as their training is normally restricted to materials used by Western cultures. A large painting from Puri in India had to be treated to prevent complete destruction. Fortunately, an unbroken tradition over the last 100 years of producing paintings exists in Puri, so a conservator and an anthropologist were dispatched there to study the materials and processes involved.

5.5 Polychromy

The polychrome piece in Figure 7 illustrates the problem of when to conserve or restore objects. This mask from Bali had totally disrupted polychromy and what was left in place has now been secured. No attempt has been made, however, to complete the treatment as the piece belongs in the study collection and not on exhibition.

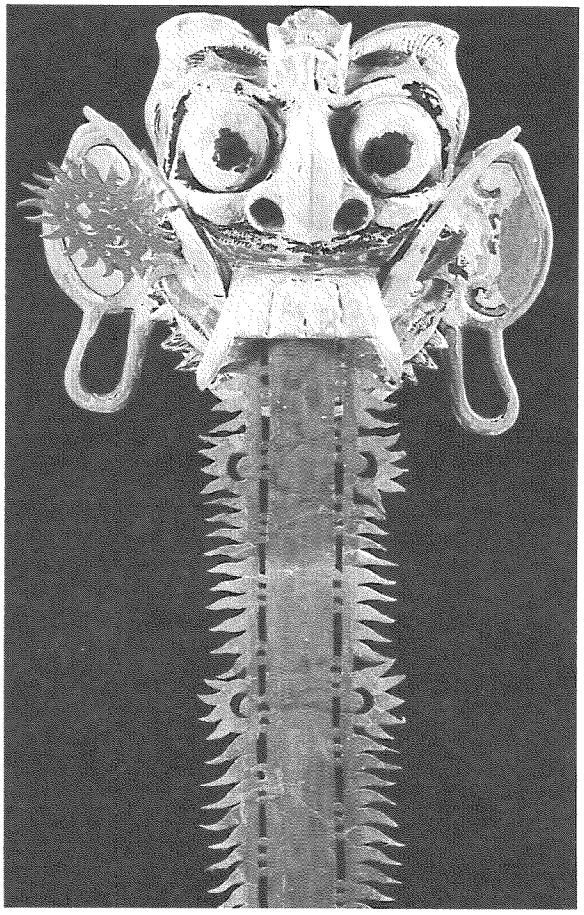

Figure 7. Mask from Bali with flaking polychromy consolidated. Photo: John Lee.

6.0 Future Treatments

The collection of the Museum comprises more than half a million objects, many of which will present problems in the future. Examples of problems which must soon be faced are listed below:

— Seven life-sized paintings of Brazilian natives and 12 smaller ones of tropical plants, all ascribed to the Dutch painter Albert Eckhout, were given to King Frederik III in 1654. Although the technique is Western, ethnographic considerations still play an important role. This project was started a few years ago as the paintings were to be exhibited in Denmark and Brazil.
— Hundreds of shadow puppets from Java await an acceptable consolidant for flaking paint.
— Nearly 200 Tibetan *thangas* are in a very poor state of repair.
— Items from Oceania have poorly bound pigment for which an appropriate consolidant is sought.
— Eskimo clothing, particularly gut-skin coats, will require specialized treatment.

7.0 Conclusion

This has been a necessarily brief overview of the many conservation activities at the National Museum of Denmark. As many cultures no longer possess the material witness of their own history, the care and preservation of these collections is of extreme importance.

Future reorganization of the collection will doubtless entail new techniques of handling and mounting objects, although the results may not be as drastic as those illustrated in Figure 8, where an exhibition of modern and primitive art at a modern art museum north of Copenhagen has attracted wide attention. This exhibition has enabled museum visitors to experience ethnographic objects in a quite novel way and it may well represent a trend for the future.

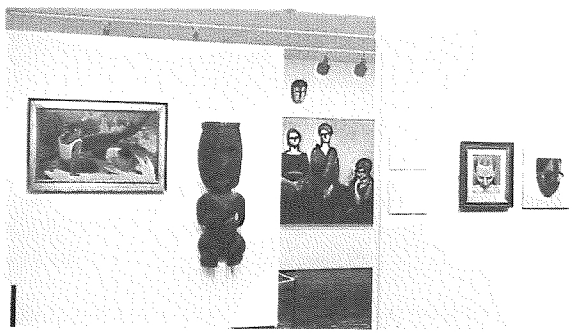

Figure 8. View of the exhibition of Modern and Primitive Art at the Louisiana Museum of Modern Art, summer 1986. Photo: John Lee.

Reference

1. Petersen, K.S. and Sommer-Larsen, A., "Cleaning of Early Feather Garments from South America and Hawaii", **Preprints of ICOM Conservation Committee 7th Triennial Meeting**, Copenhagen, 1984, 84.3.15.

Cette communication propose d'abord un survol historique du Musée national de Copenhague. L'adoption de nouveaux concepts d'exposition et l'augmentation du nombre d'objets ont fini par créer un énorme problème au musée: une pénurie d'espace et des aires d'exposition où la qualité du milieu ambiant, les communications et l'accès aux objets et à l'information laissent à désirer. Soucieux de corriger la situation, le Musée national vient de commencer une rénovation totale qui comprendra la construction d'un bâtiment moderne pour les réserves, à l'extérieur du centre-ville, en relation étroite avec les départements de conservation. On prévoit une réorganisation complète des aires d'exposition, y compris des installations de réserve ouvertes. L'auteur termine son exposé en décrivant quelques traitements particulièrement intéressants effectués au musée.

CONSERVATION PRACTICES IN THE NATIONAL MUSEUM OF THE PHILIPPINES

SUSAN SR. NARANJO

The Chemical Research Laboratory of the Anthropology Division of the National Museum was established in 1977, in pursuit of the objectives embodied in Presidential Decree No. 374 dated January 10, 1974, otherwise known as "The Cultural Properties Preservation and Protection Act". The history, collections maintained, factors of deterioration of museum collections, laboratory facilities, conservation activities and various researches are described. The laboratory is developing as an important center for the conservation of cultural property in the Philippines. The problems of pest control, museum climatology and storage are noted. Examples are given of the conservation of textiles, wood, basketworks, mats, barkcloths and metals.

1.0 Introduction

The Philippines provides protection for its cultural properties through Republic Act No. 4864 of June 18, 1966. This is known as "The Cultural Properties Preservation and Protection Act" as amended by Presidential Decree No. 374 dated January 10, 1974. The Act provided the National Museum with the mandate of protecting Filipino heritage. It reads in part:

> It is hereby declared to be the policy of the state to preserve and protect the important cultural properties and National Cultural treasures of the nation and to safeguard their intrinsic value.

In keeping with this legislation, the National Museum created a pioneering conservation laboratory under its Anthropology Division in 1977. Since then the Museum has been given the responsibility for the conservation and scientific study of the country's cultural properties. Two other institutions are also involved in conservation: the National Historical Institute which is responsible for historical collections including relics and memorabilia of national heroes and other illustrious Filipinos; and the National Library which is responsible for the preservation of archival materials.

2.0 The National Museum Collection

The National Museum in Manila is the largest and oldest state museum in the Philippines, and has steadily developed and expanded in both operations and collections.

The Museum collection of over 490,000 items is classified under archaeological, ethnographic, underwater, natural history and art. The more notable collections include: the famous Tabon man remains, constituting the earliest evidence of modern man (*Homo Sapiens*) in the Philippines, 22,000 to 24,000 years old; 16th century wooden Balanghai boats; the Late Neolithic Manunggul earthenware jar; fossilized remains of stegodon and rhinocerous found in Paleolithic sites; Batan cloth from the 13th-14th century (the earliest known cloth found in the Philippines); and Chinese stoneware jars and ceramic pieces of the 14th-15th century.

As the museum collection grew to its present size and value, the need for taking care of the artifacts was increasingly felt. This was especially so in the case of ethnographic materials of which the museum has a varied collection in terms of material type. The collection is mostly indigenous and is noted for its unique beauty. The ethnographic collections are broadly grouped as follows: costumes, ornaments, basketry, fabrics, mats, pottery, metal objects, utensils, fishing articles, ritual objects, weapons of war and chase, musical instruments and grave markers. These artifacts are further grouped into organic and inorganic materials. The organic materials are bamboo, wood, ivory, bone, textile, fiber, leather, palm leaves, twigs, tree bark and feathers. Inorganic materials include stone, glass, pottery, ceramics and metal. The metals in the collection include gold and silver and their alloys, copper and its alloys, and iron. Most of these are in the form of jewelry, utensils, weapons and ornaments.

About 85% of the ethnographic artifacts are organic and the problem of preserving these in a hot, humid and dusty climate is very serious.

3.0 The Chemical Research and Conservation Laboratory

The establishment of the museum laboratory is considered a breakthrough in the field of conservation and material analysis of artifacts in the

Philippines. Engr. Orlando V. Abinion, a practicing chemical engineer, and the present chief of the laboratory, was initially recruited to deal with the problems of the museum collection, and to organize the laboratory. Preliminary work started in 1977 in a small room of the building housing the Anthropology Division. The laboratory owes its existence to the vision of Dr. Jesus T. Peralta, the curator of Anthropology. In its second year of operation fresh graduates were hired including the author. As the volume of work increased, the laboratory was transferred in 1979, to its present site, which has a total area of 535 square meters.

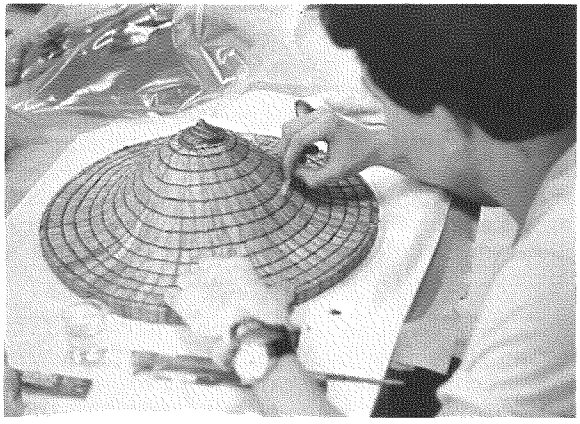

Figure 1. Cleaning of a palm salakot using cotton swabs dipped in solvent.

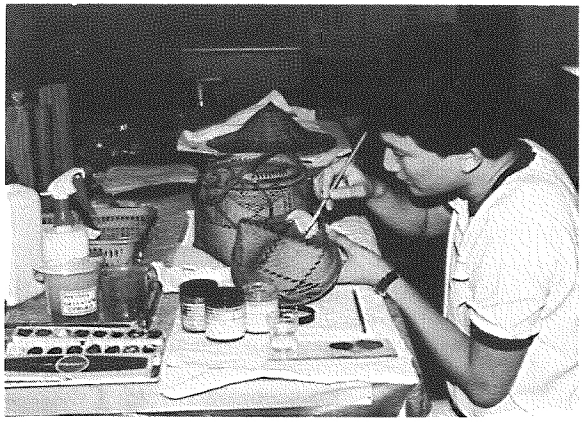

Figure 2. Toning down the Japanese tissue paper with pigments to match the colour of the elements.

The staff of the laboratory now comprises the laboratory chief, the assistant chief, six objects conservators, three analysts, and four assistants who help in restoration work, sample preparation, and maintenance of equipment. There are also a full time clerk and a dispenser.

The equipment available for scientific examination and conservation is far from complete. The following list gives an impression of the capabilities of the laboratory: a scanning electron microscope, an atomic absorption spectrophotometer, a furnace for baking clay test specimens and for refiring pottery, an electric oven for drying various objects, a vacuum cleaner, eight thermohygrographs, a light meter, distilling apparatus, de-ionizer, two fumehoods, equipment for electrolytic reduction of metallic antiquities, cameras, a refrigerator, two hot plates, two pH meters, an ion conductivity meter, mercury, quartz and infrared lamps, infrared telethermometer for measuring surface temperatures of art objects, dental equipment for restoration of antiquities, two centrifuge machines, hot and cold hand dryer for spot drying of surfaces, and sets of analytical balances. Attached to the laboratory is a small technical library.

4.0 Conservation Activities

To date over 1,150 objects have been treated and restored and over 2,400 specimens have been tested and analyzed in the laboratory. The actual conservation procedures practiced in the museum laboratory were largely established by Ruth E. Norton, former conservator of the Bishop Museum in Honolulu, and presently lecturer on objects conservation at the Canberra College of Advanced Education. She was conservator-trainer to the National Museum on two occasions during the period 1979 - 1982, under a grant from the Ford Foundation.

4.1 Factors of Deterioration

The Philippines is in a tropical zone, located on the western rim of the Pacific Ocean, north of the Equator and about one thousand kilometers from the Asian mainland. It is humid for most of the year, has an abundant rainfall, gentle winds and a mild temperature which ranges from 21°C to 32°C with a 27°C average. There are three pronounced seasons: the wet or rainy season covers the period from June to October; the cool, dry season is from November to February; and from March to May is the hot, dry season. The average humidity is extremely high, ranging from 75% - 100%.

These natural climatic conditions, in combination with man-made factors, account for much of the damage to ethnographic materials in the museum. Problems of acidity, dust, and biological deterioration, especially mold growth and damage by insects, are common. The pests so far identified in the museum are termites, cockroaches, moths, silverfish, ants, wasps, and beetles.

For financial reasons it is not possible to have air-conditioning units running for a full 24-hour period. In order to control the high humidity, the practice was to run the units during working and visiting hours only, which was quite damaging to the collection. As a compromise, electric fans are now occasionally used to allow some degree of ventilation, pending the installation of adequate air-conditioning and dehumidifying units.

4.2 Fumigation

In an effort to combat museum insects, the laboratory conducts periodic fumigation of the entire building, on a room to room rotation basis, using local fumigants like F-5 Molyslip and Sectisol. Fumigation does not eradicate insect pests, however, especially the cockroaches, which reproduce rapidly and recur periodically.

4.3 Lighting

Fluorescent lights inside the showcases are encased with ultraviolet filtering sleeves (The Morden T Co.). All the other lights in the galleries, exhibition halls and in the rest of the museum are fitted with opaque diffusers.

4.4 Storage Rooms

Because of budget restrictions the Museum employs cupboards, open rack type and closed cabinet storage, and also utilizes the exhibition halls for temporary storage. Since no air-conditioning units are installed in the storage rooms, there is a major problem with dust. Where necessary the objects are individually packed in acid-free paper and plastic.



Figure 3. The temporary ethnographic storage area.

5.0 Conservation Treatment

Before any treatment is undertaken, objects are photographed to record the nature and extent of existing damage. The process of treatment is recorded in detail and the conserved piece is photographed again after the treatment.

5.1 Textiles

The actual conservation work undertaken on the textile collection involves cleaning and reinforcement. Removal of dirt, grime and stains is done by both mechanical and chemical means. Mechanical cleaning involves either brushing, or suction with a hand-held vacuum cleaner through screens and with a piece of cloth stretched over the nozzle. A series of solvents is used to test for stain removal: water, water with Orvus (nonionic detergent locally supplied), methyl alcohol, ethyl alcohol, acetone, hexane, dimethyl formamide, toluene, benzene, dichloromethane, dimethylethyl ketone and ammonium hydroxide. Aqueous washing is employed if the condition of the fabric allows it. Drying is carried out by means of a current of air from an electric fan.

In order to flatten creases and folds and to realign the fibers, humidification is undertaken. The process is simply carried out by spraying distilled water on the affected portion, then covering it with tracing paper and weighing down with glass plates. The procedure is repeated until the creases and folds are completely flattened and the threads realigned.

A weakened fabric is reinforced by backing it with a stronger one, usually cotton. Reinforcement is done by stitching using Milward needles and mercerized cotton threads, ensuring that the fibers are kept in place.

5.1.1 Textile Storage

Flat textiles are rolled onto tubes covered with buffered acid-free tissue paper (Lindermeyer Paper Corp.). This is also used for the interleaving of textiles, the whole artifact then being wrapped with plastic sheet and securely fastened with a piece of cotton cloth to which an identification label is tied.

5.2 Wood, Basketry, Mats, Bark Cloth

In the conservation of wooden artifacts, basketry and mats, fungicides and insecticides such as Shelltox (Vapona in petroleum distillate, Shell Chem. Co.) and Chlordane (Velsicol Co.) are used

to combat biological attack. Spraying is done in an improvised chamber. Paradichlorobenzene and thymol crystals are also widely used in an enclosed wooden chamber installed with a 50-watt incandescent bulb. Wood preservatives like Chemflex 1001, Preservex, and Ferrochem are also applied.



Figure 4. Preparing for an improvized humidification process for a small rice basket.

If consolidation of wood, basketry or mat is necessary, a 15% solution of poly(vinyl acetate) in toluene is brushed on the object. When a wooden object is severely deteriorated, consolidation is carried out using a mixture of fine sawdust mixed either with poly (vinyl acetate) in toluene, or with methyl cellulose in water. The sawdust is usually mixed with dry pigments (Conservation Materials Ltd.) to match the colour of the elements and fumed silica (Cabosil, Conservation Materials Ltd.) is added to remove gloss.

The procedures for cleaning basketry, bark cloths and mats are basically the same as those used for textiles. Mechanical cleaning is done with soft brushes, blower brushes or by vacuum cleaner.

For removing creases and folds, mats and bark cloths are laid flat using the same humidification process mentioned earlier for textiles. Covering the material with a piece of moist blotting paper and allowing it to dry naturally is an alternate procedure.

Acid-free Japanese tissue paper is used for mending tears in baskets and mats, and for replacing the missing weft or weave that had been destroyed by insects. The paper is cut to the desired size and adhered with methylcellulose paste, or sometimes with ethyl methacrylate (Rhom and Haas Acryloid B-72). The Japanese tissue is toned down with Sakura matte water-colour, or sometimes with other pigments, to match the elements. Splits and small cracks in wood are adhered with emulsions of either Rhoplex, Gelva, Mowilith or poly (vinyl acetate).

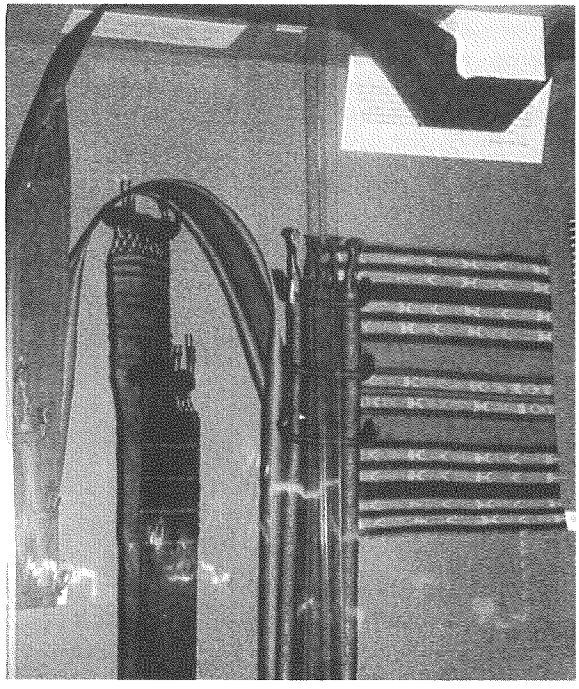

Figure 5. G-strings and other fabrics exhibited in a drapelike manner.

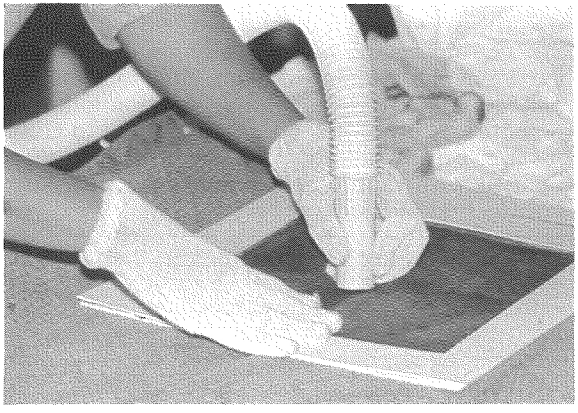

Figure 6. Mechanical cleaning of a piece of mat using a vacuum cleaner and a nylon screen.

5.3 Metal Implements

Ferrous metal spears and blades of hunting weapons in the ethnographic collection are usually only lightly corroded with sound metal cores. There are two choices of conservation procedure, but first mechanical cleaning of the artifact is done.

The first method is electrolytic reduction, where a 5% sodium hydroxide solution is used as the electrolyte, extra care being taken to protect wooden handles from the solution. Stainless steel plates and basins are used as anodes. Artifacts are occasionally removed and brushed under running water until free from salts. They are then dried with acetone and further air-dried. A 5% tannic acid solution is applied and allowed to dry. Finally, the artifacts are coated with microcrystalline wax. Sometimes dry pigments are used to tone down the final colour.

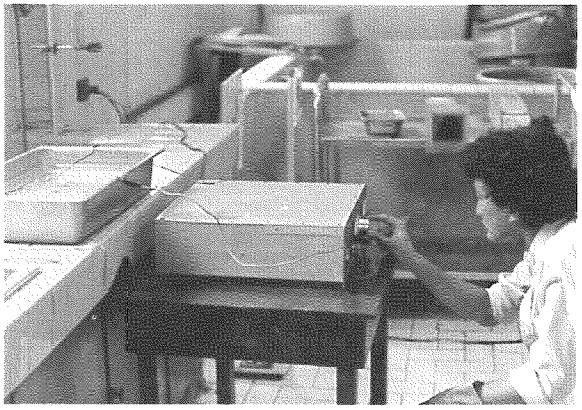

Figure 7. Electrolytic cleaning of small ferrous artifacts using a laboratory-fashioned rectifier.

In the second method, the objects are immersed in 3% Versenex (Versenex 80 or 60, Dow Chemicals), the pH of which is adjusted to 3 with acetic acid. The objects are occasionally brushed during their immersion.When free from salts, objects are washed in 2% sodium hydroxide solution followed by distilled water and sodium gluconate to rinse out the excess alkali. The objects are then passified with tannic acid and coated with wax as in the first method.

6.0 Other research activities

To operate effectively the museum laboratory staff also conduct research projects on various problems of archaeological and ethnographic importance relating to sources of raw materials, ancient technology, provenancing, dating and deterioration.

The establishment of a complete ethnographic conservation center to serve the conservation needs in the Philippines is envisioned. This could eventually serve the relative needs of its ASEAN neighbors.

7.0 Conclusion

The Chemical Research Laboratory of the Anthropology Division of the National Museum is slowly emerging as an important center for conservation in the Philippines. Its growth is essential to the preservation of the rich cultural heritage of the country, and to cater to the growing needs of various regional and private museums.

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Biographical Notes

The author is a chemical and ceramic engineer. She taught chemistry, mathematics, and physical science at the Philippine Christian University from 1978 to 1980 while earning her Master of Science units at Adamson University. She received an appointment with the Chemical Research Laboratory in 1978 in connection with problems of archaeometry and conservation in the Philippines. She is now the Assistant Laboratory Chief. She is the recipient of several awards and fellowships, and has served as lecturer on many occasions.

Le laboratoire de recherche chimique du département d'anthropologie du Musée national a été créé en 1977, pour faire suite à l'objectif qui avait été inscrit dans le décret présidentiel n° 374 en date du 10 janvier 1974. Ce décret est en fait une loi sur la conservation et la protection des biens culturels. Il est question de l'histoire du musée, de ses collections, des facteurs de détérioration particuliers au musée, du laboratoire, des activités qui s'y déroulent et des recherches qui y sont effectuées. Le laboratoire est en train de devenir un important centre de conservation des biens culturels aux Philippines. Les problèmes causés par les insectes, le milieu ambiant et la mise en réserve des collections sont abordés. On y donne des exemples de travaux de conservation sur des textiles, du bois, de la vannerie, des nattes, des tissus d'écorce et des métaux.

REPORT ON A VISIT TO THE NATIONAL MUSEUMS OF GABON, CENTRAL AFRICA

AMY ROSENBERG

Early in 1986, the author received a request from the Ministry of Culture and Popular Education of Gabon to study and evaluate the problems of preservation and conservation of the collections of the National Museum of Arts and Traditions in Libreville and the Albert Schweitzer Museum in Lambarene. A schedule had been arranged by the Administrator of the National Museum who proved to be well-informed on museum practices and who provided an appropriate setting for the visit. In this paper a history of the National Museum of Gabon is given. Current conditions, problems and solutions are described, and other possibilities suggested. Some thoughts on environmental requirements for collections, problems faced by museum professionals in Europe and North America, and use of museum collections in Africa are addressed.

1.0 Introduction

The following report is a case history. It is presented as an example of problems that are faced in African museums, how solutions to conservation problems may be devised for a specific situation, and how assistance to African museums may be approached.

On 19 February 1986, I received a request from the Ministry of Culture and Popular Education of Gabon to study and evaluate the problems of preservation and conservation of the collections of the National Museum of Arts and Traditions in the capital, Libreville and the Albert Schweitzer Museum in Lambarene. I also conducted a workshop on conservation for museum staff.

My study revealed the following interrelated problems facing the National Museums of Gabon: poor environmental conditions in the museum buildings in Libreville and Lambarene; devastation of the collections in Libreville by biological agents; lack of policies for collection care and management; and demoralization of staff members.

During my visit, it became clear that solutions to the problems must use locally available and easily accessible resources. Solutions must also be appropriate to the economic situation and to the culture and traditions of Gabon. Where possible, action taken should involve staff members in order to relieve their demoralization.

2.0 National Museum, Libreville

The collections of the National Museum of Arts and Traditions of Gabon are currently housed in a concrete and glass building on the coast in Libreville. There are about two thousand objects in the collection, mostly organic materials of plant and animal origin but also objects of stone, metal and ceramics. According to the staff, the museum has been in this building for ten years. Before that, the museum was located in the palace of the French Governor, a building dating from the colonial period which had been located near the present Presidential Palace, and which was demolished when the museum was moved.

Located on the equator, the climate and vegetation of Gabon are classified as tropical rainforest. The first museum building in Libreville was located on a hill top. Movement of air provided by the colonial architecture with its raised floors, large windows and natural ventilation gave some protection to the objects. The current building, though constantly air conditioned, does not provide a good environment for the collection. The main problems are the dangerously high humidity, inadequate air circulation, and inadequate space. Measurements taken in several locations in the museum indicated a temperature between 21 and 24°C. and about 80% relative humidity, while on the outside the temperature was 31°C and 68% relative humidity. The site of the museum partially accounts for the high relative humidity. It is located directly on the coast, storerooms are below ground level, and the surrounding land slopes towards the building allowing moisture and rain water from the surrounding area into the building. Although air conditioning may provide some reduction in relative humidity, in this case the effect is offset by the excessive humidity already present.

The current building houses storage and processing areas for the objects, staff offices, and exhibition galleries which are open to the public.

There is inadequate storage space for objects and museum furniture. The staff has little space to lay out safely objects which are being studied, treated, or selected for exhibition. Neither is there space for quarantine of incoming objects. Packing crates are necessarily stored in offices, galleries and passageways. The space is much smaller than the original building and the staff is demoralized by the cramped quarters, and poor environmental conditions, along with other factors. Demoralization has led to inactivity and the reduced use of the collections.

This inactivity sets the stage for undisturbed attack of the collections by biological agents. The staff reported only one or two cases of insect damage during the ten years when the museum was housed in the palace of the French Governor. The most pressing problems in the collections are insect infestation and mould growth. In the course of examining the collections, at least five different live insects were seen including silverfish, cockroaches, termites, moths, and wood borers. The stagnant conditions in the storerooms of the museum were conducive to mold growth on the objects. In addition metal objects were corroding due to the high relative humidity. Insects were active in objects in the exhibition areas, as well as in closed storerooms. The exhibition areas of the museum do provide a slightly better environment simply because there is more light, more activity, and more air circulation. However, some objects were suffering from poor mounting. In addition, many objects were not in cases, leaving them vulnerable to re-infestation.

3.0 Dr. Albert Schweitzer Museum, Lambarene

The personal effects, books, and papers of Dr. Albert Schweitzer are kept and displayed in the historic buildings at the Schweitzer Hospital at Lambarene, located on the banks of the Oguwe River, 150 kilometers from Libreville. There are three buildings which are entirely or partially open to the public through guided tours. Many of the objects in the Schweitzer Museum are in their original positions, recreating the living and working environment of Dr. Schweitzer. The areas visited are Schweitzer's bedroom, his study, his wife's study, and a sales room. In another building is a small gallery of craft objects made by patients of the hospital. In a third building, the Grande Pharmacie, are the former examination and treatment rooms used by Schweitzer and his staff. Doctor Schweitzer died in 1965, and new hospital facilities have replaced the ones which are now a museum.

The historic buildings, made of wood and screening in the colonial style, are weakened with age and deterioration by micro-organisms and termites. A project for the restoration of the buildings is underway. The interiors, especially Schweitzer's quarters, are surprisingly well-preserved, despite an indoor temperature of 27°C and 80% relative humidity. Although archival material and photographs have aged and discoloured, there is little termite or mould damage to objects inside the buildings. This can probably be attributed to attention from staff and the flow of visitors, which keeps the building ventilated. All buildings have benefited from the periodic application of diesel oil to unpainted wood floors, structural members, and furniture, although in some cases the oil has been inadvertently brushed on the lower part of the walls. The original linens are still used for the exhibit and are laundered periodically, which has helped preservation, though repeated cleaning will eventually deteriorate them. About 4000 visitors view the historic quarters each year, averaging more than 10 per day. Most visitors see only Dr. Schweitzer's residence since other buildings are located a distance away, and as a result, the ventilation in the other buildings is inadequate. For example, the contents of the Grande Pharmacie are faring less well. Mould growth and rust can be seen on the objects.

A major problem, indirectly related to preservation but of equal importance, is security. The current system of guided group tours is not effective in preventing theft, especially from Dr. Schweitzer's residence.

4.0 Care and Preservation of African Collections

As more information about the conservation of ethnographic material is published, African museums will increasingly come to overseas conservation professionals for help. As they become familiar with our museums, we will be asked to lend our objects to museums in Africa. In the process, more conservators may find they need to provide assistance. As advisors, I believe we need to take an informed approach when providing advice to our African colleagues. Three areas of concern arose in advising the National Museums of Gabon on conservation plans for their museums: the structure and function of the museums, the preservation and conservation needs of materials in their climate, and the relationships between African museums and outside experts.

4.1 Structure and Function of Museums

Although each museum in Africa has its own history, function and status, it seems that African museums, even national ones, are essentially small museums. They have small staffs, small collections, and limited budgets. Yet, as branches of government they operate as part of a large bureaucracy, where access to resources is limited by government allocations and bureaucratic procedures. In Gabon, the government acknowledges the importance of a National Museum but no policies for the care of collections, exhibitions, public education, publications or research have been defined or implemented. Activity in the Museum has stagnated due to lack of direction. Few school groups come into the Museum, opening times are short, exhibitions do not change, and there is no programme of research or acquisition. Some publications are available. In museums in general, if the collections are not regularly used, there may be no perceived need for care of collections. However, museum programmes advance together; any one aspect of museum practice may propel the others. A visit and report from an expert may serve to change attitudes towards the museum. A commitment to caring for collections can, in turn, spark an educational or exhibition programme.

4.2 Conservation Problems

The environmental conditions in museums and degree of development of programmes differ among African countries. Yet, once conservation of collections is set as a goal, methods and procedures must be tailored to the climate, culture and traditions of the country involved, and to the available resources. To conserve objects from African cultures in our museums we often prescribe the reduction of relative humidity to 65% or below in order to prevent the growth of mould. However, in a tropical climate, the relative humidity is often above this and the objects were created in, and intended to reside in, a high relative humidity. For example, a shirt from Zaire made of antelope skin is brittle and inflexible at the low relative humidity in a museum in a temperate climate, but flexible at a higher relative humidity which may be considered too damaging in that climate. A different approach to controlling the environment in Africa must be taken. We are beginning to realize, even in our own museums, that a solution which attempts to change radically the environment or strictly control it can cause major damage when misapplied or inadequately maintained. For example, in a hot climate where resources are limited, air-conditioning may be run only when the staff are at work. The temperature and relative humidity during non-working hours can be extreme and damaging. New buildings in tropical climates, where the climate is relatively stable, can and do provide appropriate museum display and storage conditions using open-air ventilation. In this case a traditional, low technology approach is possibly the most efficient.

Not only do African museums have different environmental conditions from those in Europe and North America, they also seem to have different kinds of objects. Most of the objects in the National Museums of Gabon seemed to have been collected recently, more recently than African objects in North American and European museums. They appear to be made of green woods and not extensively used. As such, they have not had the same history of use as the older objects, nor are they constructed in the same way or of the same materials. For this reason, they appear to be less resistant to biological attack. Once started, biological attack proceeds at an alarming rate if left uncontrolled. Thus, methods of collecting and processing objects are a major part of conservation in the tropics where biological agents regularly enter the collections with the objects.

4.3 Solutions

The recommendations made to the Minister of Culture of Gabon were appropriate to the specific situations in that country. The solutions needed to be low cost, employ locally available resources and, where possible, relieve staff demoralization. For dealing with the biological attack of the collections in the short term, a process of "microfumigation" in the museum building was recommended. Rather than attempting a wholesale fumigation of the building or the entire collection, for which trained specialists as well as special equipment are needed, each object can be treated in an insecticidal and mould-inhibiting environment. This micro-environment will kill insects in objects and also keep out new infestation. This can be done simply in a two-part operation. Firstly, each object is packaged in a polyethylene bag with a sachet of crystals or balls of paradichlorobenzene (PDB). Secondly, store rooms are thoroughly cleaned, all cracks and crevices by which insects can enter the building are blocked, and a commercial insect spray is applied. While objects on display are being treated, sound ones without insect infestation may be exhibited.

While there are considerable disadvantages to the use of PDB, such as toxicity, reactivity with some materials, and overall effectiveness, the advantages outweigh them. Firstly, the materials are easily obtainable at a reasonable price in Libreville and can be used by the staff of the museum with a minimum of training. This treatment can be carried out on a daily basis and requires a minimum of advanced planning or extensive organizing. In addition, the process of packaging the objects requires the cleaning and rearrangement of storage areas, and monitoring of the collections, thus involving museum staff. In tests on the site, PDB was effective in killing insects which infest the museum. It has the added advantage of inhibiting mould growth while other insecticides do not. I would have very much liked to have recommended the freezing of objects for killing insects as a less toxic short-term alternative. It is conceivable that deep freezers exist in Libreville, since nearly all food stuffs are imported from abroad, yet organizing such an undertaking was impossible in the time available. In addition, the complete elimination of insects from the storerooms was not guaranteed and packaging objects does provide some protection from re-infestation.

To solve the environmental problem, the Ministry of Culture has acquired new space in a better location which will house administrative functions, storage and processing of objects for the National Museum. In addition, natural ventilation will be employed in storage areas. Care was taken to explain the importance of not bringing the insects into the new space and also protecting the objects from a rapid decrease in relative humidity. As previously mentioned, objects packaged in polyethylene bags will be better protected from radical changes in relative humidity.

Solutions to the problems of the Dr. Albert Schweitzer collections at Lambarene could be proposed using readily available resources. The beneficial effects of current practices should be analyzed, maintained and extended to other parts of the compound. The good ventilation and application of diesel oil to wood should probably be maintained on a periodic basis. Ventilation in the Grande Pharmacie should be improved by increasing visitor traffic or installing ceiling fans. Simple periodic house cleaning can solve some other problems including dust accumulation and mold growth. Books, photographs and other items need specialized treatment.

To solve the security problem at Lambarene, the size of groups, route and duration of tours must be analyzed and changed. Several possibilities exist for the protection of objects from theft. One may be the securing of objects in exhibition areas. A system of barriers could also be devised to allow visual but not physical access to the rooms.

4.4 Relationship with Outside Experts

As awareness grows, African museums are making requests for assistance from experts. They may expect European or North American specialists to possess ready-made solutions to their problems. They may have been told by outsiders or by their own government that such solutions exist, or that recommendations from outside experts are the only means by which they can prove or solve their problems. While we are available to help, we must remember that Africans have a history of solutions being given to them from outside. In many cases, European education and European solutions have been regarded as the ideal without thought for appropriateness. As client states, African nations are the target of European companies who try to sell technology which may or may not be appropriate. For example, a fumigation programme, carried out by specialists using toxic chemicals may not be feasible for an African museum. Its success is dependent on every stage being synchronized and carried out smoothly, which is often impossible to maintain at a long distance from company headquarters. On the other hand, a solution arrived at by consultation and recommended by an "expert" which employs locally available technology and staff may, in the long run, solve the problem and build organizational effectiveness in the process.

5.0 Conclusion

Keepers of collections of African art will benefit from a body of conservation and other museological knowledge and practice created by Africans for their own collections. Africans may need the tools and knowledge we have to assist them, but a programme arrived at by practical use of resources and exchange of ideas will have better and more long-lasting results. The experience and expertise gained by Africans in museum practices will increase as information is shared nationally and internationally. As preservation and conservation programmes are established in African museums we will be able to exchange objects secure in the knowledge that our collections are safe.

Acknowledgements

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Biographical Notes

Amy Rosenberg holds a B.A. degree in Ancient Near Eastern Languages and Civilizations from the University of Chicago and a Diploma in the Conservation of Archaeological material from the Institute of Archaeology at the University of London. She has been the Conservator at the Kelsey Museum of the University of Michigan, Ann Arbor, since 1974, where she not only undertakes conservation of the collections but also organizes and contributes to educational programmes and exhibitions in the Museum.

Au début de 1986, le ministère de la Culture et de l'Éducation populaire du Gabon a demandé à l'auteur d'étudier et d'évaluer les problèmes de préservation et de conservation des collections au Musée national des arts et des traditions, à Libreville, et au Musée Albert Schweitzer, à Lambaréné. L'horaire avait été dressé par l'administrateur du Musée national, qui s'est avéré très au fait des pratiques muséales et a préparé un cadre approprié à la visite. La communication comprend un historique du Musée national. Les conditions actuelles, les problèmes et leurs solutions y sont décrits et d'autres possibilités sont esquissées. L'auteur traite aussi certaines questions relatives aux conditions ambiantes appropriées aux collections, aux problèmes que connaissent professionnels des musées et les collections en Afrique par rapport à ceux rencontrés en Europe et en Amérique du Nord, et aux utilisations des collections muséales en Afrique.

APPENDIX 1

Poster Sessions

Applications of a Laser Scanner in Conservation: Recording and Replication
J.M. Taylor, I.N.M. Wainwright, F.R. Livingstone, M. Rioux, P. Boulanger

Examination of Totem Poles for the Canadian Museum of Civilization
D.W. Grattan

A Handling Device for Large Wooden Objects
R. Barclay

POSTER SESSION 1: APPLICATIONS OF A LASER SCANNER IN CONSERVATION: RECORDING AND REPLICATION

J.M. Taylor, I.N.M. Wainwright, F.R. Livingstone, M. Rioux, P. Boulanger

A poster session was jointly presented by the Canadian Conservation Institute, the National Research Council of Canada, and Hymarc Engineering Ltd. to introduce the conservation field to a 3-D laser scanner system, the HYSCAN-60. The operation and design of this laser scanner were described.

In recent years there have been a number of new developments in the field of machine vision using laser scanners to remotely capture three-dimensional surface data from objects. In the museum field a number of potential applications of such systems can be identified: basic measurement of three-dimensional artifacts and specimens for documentation and research purposes; assessment of the accuracy of replicas; comparison of the shape of an object at different periods of time (for example, before and after conservation treatment) before and after a loan for exhibition, or to investigate weathering, deterioration, or dimensional change over time; and, finally, generation of digital data and contour plots which can be used either with manual or numerically controlled (NC) milling machines to fabricate replicas (at any scale) for display mannequins, or supports for objects of complex shape.

In order to test the HYSCAN-60 system in the context of the museum, a variety of objects and specimens from several disciplines were scanned. The objects were chosen to represent ranges of curatorial and conservation problems and different materials, surface textures and colours. Discussions were held with curators, conservators and scientists at the Canadian Museum of Civilization, the National Museum of Natural Sciences, and the Canadian Conservation Institute regarding the applicability of this technology to their work and the choice of suitable test objects and specimens.

The objects tested which were illustrated in the poster were:

- a carved North Pacific Coast pole which once stood at Kitwanga,
- a severely corroded cruciform artifact found at Ferryland near St. John's, Newfoundland,
- a preserved toad (*Bufo americanus*),
- a bone and abalone soul catcher,
- and a replica of a North Pacific Coast (Tsimshian) stone mask to evaluate recording accuracy and the usefulness of the method for comparing with similar masks and exchanging replicas (Figure 1a).



Figure 1a. Tsimshian Stone Mask (Canadian Museum of Civilization No. VII-C-329). See also front cover. Note: for the experimental laser scanner tests a replica of the mask was used rather than the original.

In addition, a pair of pantaloons from the archaeological site of a Basque whaling station on Saddle Island, Red Bay, Labrador was studied to determine if the laser scanner could be used in the fabrication of supports for delicate archaeological textiles and if the system could capture textile contours and detail. Ceramics, a variety of ethnographic objects, a mammoth tibia and molar, and a wooden mask were also part of the study.

The project successfully demonstrated that it is possible to capture several million bytes of data representing the surface of an object such as a mask in a matter of a few minutes. The spatial

resolution can be varied depending upon the density of points sampled by the scanning system; +/- 0.25 mm is a typical value. Once in computer memory, the data can be edited and selected for display and manipulated using graphics software.

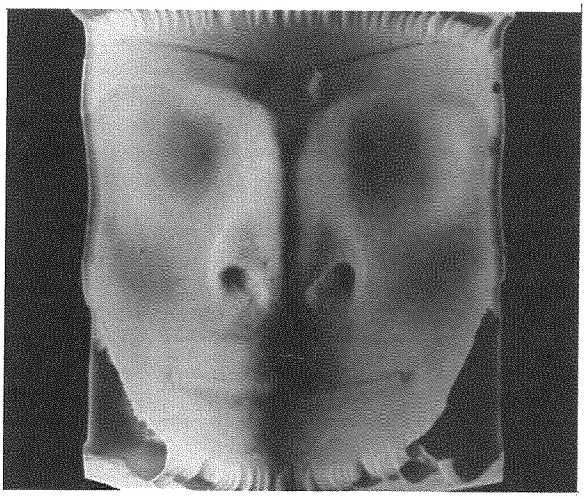

Figure 1b. A foam replica of the front section of the Tsimshian Stone Mask made at the National Research Council by using the measurement data from the scanner to drive a multi-axis milling machine.

One of the immediate aims of this feasibility study was to demonstrate that a detailed model could be made of a complex surface such as a mask using numerically controlled machining. Figure 1b illustrates a foam replica made of a Tsimshian stone mask by the Manufacturing Technology Centre of the National Research Council of Canada using data obtained by the laser scanner to drive a multi-axis milling machine. Replication of scanned objects in a variety of materials is possible depending upon specific requirements. The saving in time over conventional methods of replication, and the fact that the method is completely harmless to the object, offer tremendous benefits to the museum field.

Although the tests conducted must be regarded as preliminary, the project to date has demonstrated that a laser scanner has wide potential application in conservation, museum registration and replication. Its speed could greatly facilitate the basic recording of large quantities of three-dimensional objects. If some sacrifice of spatial resolution can be tolerated to increase speed, it is also possible to record living specimens using the method. This laser source gave acceptable results for a wide range of materials of varying colour, texture and reflectivity.

POSTER SESSION 2: EXAMINATION OF TOTEM POLES FOR THE CANADIAN MUSEUM OF CIVILIZATION

D.W. GRATTAN and W. BOKMAN

1.0 Introduction

The Canadian Museum of Civilization possesses Northwest Coast totem poles from a number of sources in North America and Europe. Some were received in a very deteriorated condition having been displayed outdoors for many years. The Museum intends to install the poles in a recreation of a Northwest Coast village in the new museum currently under construction. Before the poles could be displayed two questions had to be answered. Were the poles sufficiently safe to be erected, and what structural conservation repairs were needed?

The condition of totem poles cannot be accurately assessed by superficial examination, however sophisticated, because of the tendency of Western Redcedar to internal pockets of rot which tend to form in discrete "compartments" where water has collected. In addition, heart rot is very common in this species.

The Canadian Conservation Institute had developed a method of analysis of totem poles using X-radiography at 300 kv. This gave images which were then digitally evaluated so that the actual density of the wood could be measured. It was the role of this project to adopt this technique and develop it further. In modifying the technique we had a number of goals in mind. These were:

(1) To adapt the procedure for interior use and for horizontal rather than vertical poles.

(2) To collimate the X-ray source to a fan-shaped beam to reduce the effects of Compton scattering.

(3) To improve the method of data presentation so that a number of sections of a whole totem pole could be visualized at once.

(4) To speed up the procedure as much as possible.

2.0 Description Of The Technique

The 300 kv source was mounted on a mobile gantry which could straddle a totem pole. The poles, mounted upon low trolleys, were passed through the gantry and radiographed at 0.5 to 1 metre intervals. For greater economy the X-ray film was cut into narrow strips. These were prepared by cutting up Kodak Industrex lead-pack film into strips in the dark room, and resealing the edges with black tape. The film was mounted on a lead sheet placed on the floor directly under the pole. Care was taken to align the film within the narrow region of the collimated beam. Processing was carried out by an automated processing unit at the Non-destructive Testing Unit of the Department of National Defence. Exposures were calibrated with aluminum stepped wedges.

After processing, the film strips were "read" with a Macbeth digital densitometer. This measured the silver image density with great accuracy. The densitometer was interfaced with a computer so that data was immediately stored upon acquisition.

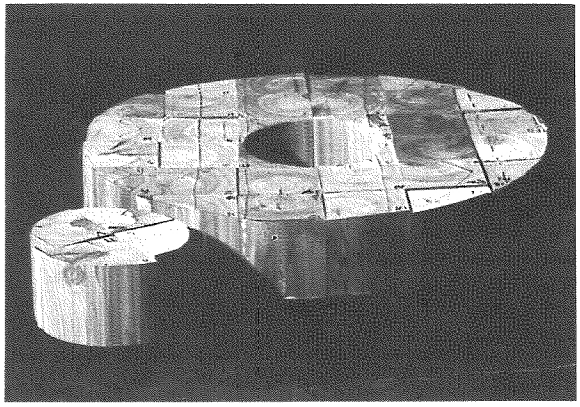

Figure 1. Test blocks simulating a typical cross section of a large pole, with and without heart-rot.

Each measurement of silver image density was converted into a path length of wood. The computer then constructed a cross sectional shape according to one of several models: elliptical, semi-elliptical and semi-elliptical with a semi-elliptical section cut out of the rear. The latter modelled the commonly encountered "c-section" pole. Each measurement of path length was then drawn by the computer's plotter upon

the model in the location and orientation of measurement. The result of this is shown in Figure 1 where a test radiograph of cedar blocks is arranged to represent a pole section. With the intact section, the radiographically measured profile accurately follows the elliptical outline drawn by the computer. When the centre of the section is removed to mimic a pole with heart rot, the radiographic data no longer matches the outline. The central cavity is accurately represented in size and in position in two dimensions. Another radiograph would have to be taken at right angles to fix the cavity in three dimensions.

3.0 Support Posts

Many c-section poles have been supported by placing a wooden post in the back. It is usually inconvenient and sometimes a risk to the pole to remove these for radiography. Thus a technique was devised to remove them by computer. An example of this is shown in Figures 3 and 4. Figure 3 shows the image without subtraction of the support post. Figure 4 shows the true condition of the pole without the confusing data from the support post. Thus the true state of deterioration is revealed.

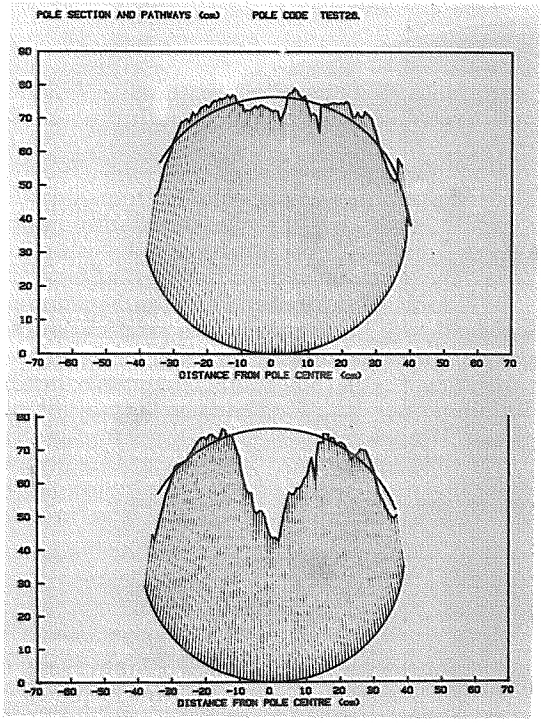

Figure 2. Computer reconstructions of pole cross sections.

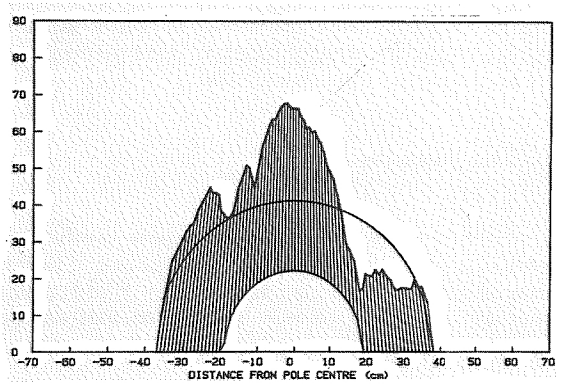

Figure 3. Computer-constructed image without subtraction of support post.

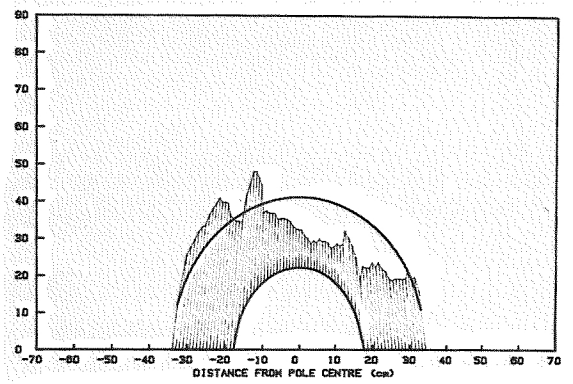

Figure 4. True condition of the pole without confusing data from the support post.

4.0 Toast Racks

In order to show graphically the condition of a whole pole, computer plotted images of radiographic density measurements were cut out, mounted on cardboard and arranged upon wooden

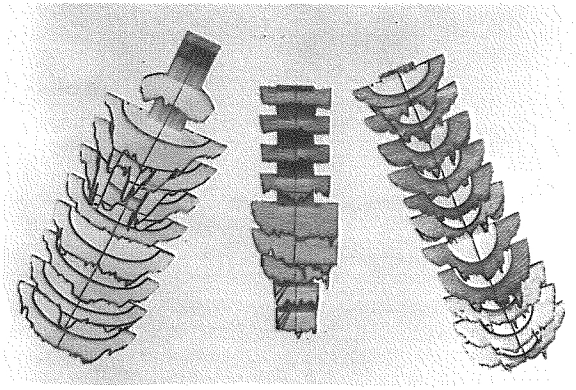

Figure 5. Toast rack models.

supports, nicknamed toast racks, as shown in Figure 5. They were mounted to scale so that defects could be exactly located thus providing a working tool for the conservator.

5.0 The Pilodyn

In addition to the above radiographic method for assessing the condition of the poles, Pilodyn measurements were also taken. The Pilodyn is a recently invented device which measures the surface strength of wood. It consists of a blunt pin which is driven into the wood by a spring-loaded hammer. Depth of penetration, which is read on a scale at the side of the instrument, is related to the condition of the wood, and any strength loss from rot is detected with ease. Since the pin has a flat end, it has to break wood fibres in order to penetrate, unlike a sharp pin which pushes in between fibres. Depth of penetration therefore gives a readily calibrated measure of wood strength. In most instances surfaces on the poles surveyed were found to be surprisingly strong despite appearances to the contrary.

POSTER SESSION 3: A HANDLING DEVICE FOR LARGE WOODEN OBJECTS

R. BARCLAY

Handling of totem poles and other large wooden objects during examination, documentation and treatment presents considerable problems. The potential of damage to delicate surfaces is multiplied by the number of separate operations necessary from the commencement of treatment to the time of eventual erection on display. The weight of such large components also causes degraded wooden surfaces in contact with supports to become damaged.

In addition to damage caused to surfaces during handling, long wooden objects also require evenly spaced support to prevent stress and eventual distortion. However, when more than two rigid supports are placed under a long artifact there is a tendency for uneven distribution of weight, causing sagging either in the centre or at the ends (Figure 1).

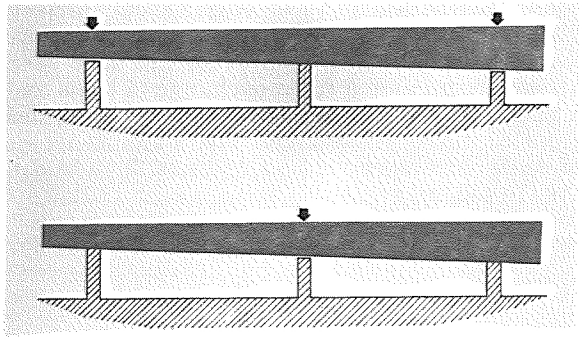

Figure 1. Uneven support of long objects causes sagging.

The devices illustrated here support heavy artifacts with slings and are coupled in dynamically linked pairs. Thus, long objects like totem poles are evenly supported over their entire length and may be rolled for access to all sides (Figure 2).

These handling devices can be easily built from readily available materials. The nylon loop slings may be ordered in varying lengths to suit the application. The ones used here were 4.5m long and had a load capacity of 5670 Kgms. A full description of this system is in preparation for publication.

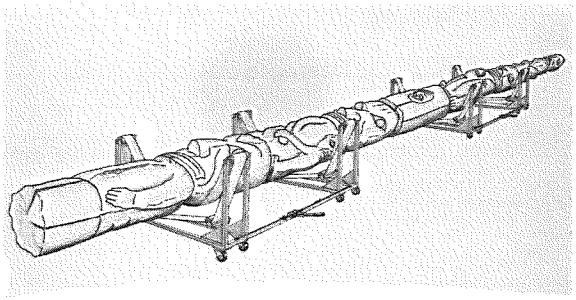

Figure 2. Devices used in pairs to give even support to a long totem pole.

APPENDIX 2

Workshop Sessions

At an early stage in the planning of Symposium '86 it was thought that a series of workshop sessions might be of interest to the conference participants. Thus, several demonstrations and lectures were offered one evening by C.C.I. staff and delegates on the following topics:

1. Collagen Shrinkage Temperature: its Importance and Measurement, G. Young (CCI)
2. Feather Cleaning and Repair Techniques, M. Peever, S. Lougheed (CCI)
3. Fill Materials for Ceramics, B. Gessel (Museum für Völkerkunde)
4. Fill Materials for Wooden Objects, C. Mathias, D. Martinet (CCI)
5. Pest Control by Freezing, R. Norton (Canadian Museum of Civilization)
6. Replication of Damaged Basketry, R. Barclay (CCI)
7. Tapa Cloth Repair Techniques, C. Turchan (Chicago Historical Society)
8. Tear Repairs for Skin Artifacts, J. Mason (CCI), C. Collins (Manitoba Museum of Man and Nature)
9. Treatment of Ethnographic Textiles, J. Vuori (CCI)
10. Treatment of Powdery Pigments, D. Lee (British Museum)
11. Treatment of Quillwork, A. Howatt-Krahn (Howatt-Krahn Conservators)

Sessions were held concurrently, with each presentation occupying about 15 minutes. In this way it was hoped that delegates could attend most sessions in the course of the evening or could concentrate on those of particular interest. This programme proved so successful that more than the one evening allotted should have been allowed to provide a fuller exchange of ideas and a maximum of "hands-on" experience. Delegates reported that these sessions were a unique aspect of conference organization and one from which they benefitted greatly.

APPENDIX 3

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