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Tip session at the Book and Paper Group Session, AIC's 42nd Annual Meeting, May 27–31, 2014, San Francisco, California

The Book and Paper Group Annual

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Salvage of Paper Materials from the Flooding of São Luiz do Paraitinga

INTRODUCTION

São Luiz do Paraitinga, a city of São Paulo State, Brazil, is considered a cultural and historical heritage site. Located to the East of Sao Paulo in the region known as Vale do Paraíba it was founded in 1769 when that part of the state was being settled.

The city has a total area of 737 Km^2, an altitude of 760 meters and a population of just 11,000. Its main characteristic is the rich heritage of material and non-material regional culture of the countryside of São Paulo State, such as the street Carnival, the religious commemoration of Divino Espírito Santo, colonial buildings, etc.

Recognition of the city as a cultural landmark began in 1983 when part of the city historical center was designated a State Heritage Site and continued in 2002 when it was given, by the State Government, the title of "Estância Turística"(a landmark), which brings to the city additional funding to be used for its own improvements.

On January 1st, 2010 the city experienced a devastating flood which resulted in destruction of most of the city. Historical and public buildings, monuments and houses were seriously damaged. There was structural damage as well as loss of documents from the city's administrative center. Personal documents, such as those relating to retirement paperwork, medical certificates, maternity leave, legal process, and contracts, for example, were significantly damaged or completely destroyed by the flood water. These documents from the Municipal Government and Public Ministry are essential in order for citizens to receive their state benefits. With the damage and destruction of these documents most of the population lost their legal identity.

The Nucleus for Conservation of Public Files of São Paulo—APESP and the Nucleus of Restoration—Conservation Edson Motta, from National Service for Industrial Apprenticeship (NUCLEM-SENAI), worked in conjunction to salvage these documents. However, due to bureaucratic reasons, access to the Municipal Government and Public Ministry documents was only authorized 26 days after the flooding.

Three technicians from the State Public Archive and one from SENAI were sent to São Luiz do Paraitinga to salvage the documents. The first allotment sent to the Archive had been found stored on the second floor of a building located in front of the river. The materials found there were in an advanced state of deterioration because they had not been cared for since the flood. They were all adhered together with mold and mud and stored in drawers which were also muddy. The documents were taken from the drawers and re-housed in polypropylene corrugated boxes for transport to the city of São Paulo 181 Km away.

In Brazil there are few local bibliographic references to preservation emergency response and salvage work of this size and complexity. Generally there is little information in Portuguese about large salvage operations.

Because this was an extraordinary event for the country, we had many challenges and difficulties in preserving the documents. There were no salvage workers trained to preserve books and documents which were deteriorating because of being under water for more than twenty days and there were no specialized salvaging companies or freeze drying or lyophilisation facilities. We had financial constraints and no time to come up with a "big plan". With an enormous material challenge during a community crisis, we had to immediately devise and put into action a practical plan to treat as many items as possible within the capabilities of our limited resources. A completely manual protocol was developed and implemented to recover the documents.

The above mentioned collection was treated in three allotments: the first two included 800 files of different thickness, weight and dimension, 14 linear meters of documents from the 1970's up to today with a variety of paper types and formats, multiple handwritten ink and printing processes, photographs and reprographic copies. The third one had 176 files (3.52 linear meters) and the same variety of paper types and formats, types of media, and production processes.

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METHODOLOGY

The procedures described below were all compatible with technical methods and criteria of paper conservation and were developed in the APESP laboratory for the first two allotments:

- Drying procedures: the documents were arranged in a wide space with constant natural and artificial ventilation as well as dehumidifiers. The process took approximately ten days with variations of temperature of 24°C and 27°C and 60% to 75% UR.
- Document pages were interleaved with absorbent papers which were frequently replaced during the work shifts to facilitate the drying process and to mitigate the adhesion of sheets. The papers used in this process were Vergé®, paper towel, alkaline Chambril® 120g/m² and filter paper depending on the availability of the laboratory's stock:
- As there was no inventory of the material received by APESP, data was recorded on a detailed technical form which described the characteristics as well as the preservation state of each of the documents found in the files. This was a fundamental step for performing the job safely and efficiently as there were absolutely no references documenting the contents of the files. It also helped in documenting the quantity of documents sent for recovery. The technical form also described the content of the files, maintaining the original folders identification (names and numbers).
- Sheets which remained adhered despite interleaving during drying, were cleaned with brushes and attempts were made to mechanically separate the dry blocks into individual sheets.
- Aqueous immersion treatment with deionized water was used to separate sheets strongly adhered together. Many of them resisted all mentioned treatments and because of that, they were kept as they were.
- Aqueous immersion treatment with deionized water and the use of brushes was also used to remove the excess of mud on the dirtier sheets and on documents where the text was obscured by deposits.
- Topical or immersion treatments of 70% ethanol and 30% deionized water were used in order to treat mold on the documents.
- Supports were stabilized with Japanese paper Kamino 6g/m² and adhesive methylcellulose.
- Sheets with significant planar distortion, particularly where text was obscured, were humidified and dried under weight.
- The documents were then placed in alkaline paper file folders 120g/m² and stored in corrugated polypropylene boxes.

THE THIRD ALLOTMENT

Due to wrong information, the documents belonging to this allotment were kept wet in black plastic rubbish bags. They were sent to APESP after three months. As a result, the material was strongly infested by a variety of mold.

Using traditional methods to mitigate such a big infestation, even drying the material, would certainly not give effective results. It would also jeopardize the technicians' health as well as the health of future users. Another consideration was that the documents would have to be returned to the city administrative center where there are no environmental controls. The poor environment could exacerbate the mold growth and create the possibility of mold spreading to other areas of the collections.

It was decided therefore, to submit the documents to gamma-rays cobalt-60 from a multipurpose compact type radiator from the Radiation Technology Centre for Nuclear and Energy Research Institute - CTR-IPEN. A dose of disinfection (about 11kGy) was applied to reduce the bio burden. It is well known that doses used for sterilizing (25kGy) are considered way too high for materials based on cellulose because it degrades them.

RESULTS AND DISCUSSION

The constraints of scarce financial resources played an important role when deciding on assembling the team and conducting treatments. It was not possible to maintain a pattern referred to the use of materials so, it was necessary to use only what was available in stock.

The team included permanent and temporary staff. The permanent staff included four technicians in preservation and conservation of whom only one of them was available daily to supervise the job. The temporary members were employees or students apprentices of High or Superior School. It was possible to keep, on average, four people working constantly although sometimes there was only one—and this one was a temporary member of the staff. Therefore, the team did not have the required experience and had to provide several practical training courses due to frequent personnel changes.

The procedures were based solely on manual techniques (except for the use of ionizing radiation); this was also due to lack of technical resources in the country. Despite all the difficulties faced and despite the minimal experience in document salvage, it was possible to create conditions to efficiently train technical staff, adapt material resources, and devise and implement salvage protocols and techniques.

For the first and second allotment of eight hundred files which had been wet for more than twenty days, the drying process implemented by the APESP team showed to be effective in inhibiting mold growth. Only 30% of the documentation needed disinfection (topical or immersion).

Comparing the third allotment with the first and second which did not receive irradiation, it was possible to see that after irradiation:

- The mechanical cleaning process was much easier;
- Removing spores was easier when using brushes. It appeared as just a layer of dust.
- The adhered sheets separated quite easily in spite of their advanced state of degradation caused by the improper storage;
- The conservation treatment of the material was rapid especially when compared to traditional techniques.

Other advantages noticed in the ionizing radiation process are:

- There is no need for quarantine;
- No toxic or radioactive residuals produced;
- It can be applied to large quantities and varieties of materials simultaneously;
- It can be applied to the documents transportation housing;
- It is a fast procedure and;
- Costs are acceptable.

Despite the constraints of limited financial resources, limited professional staff, limited supplies, no access to salvage companies, facilities and equipment, no published reports of local responses, and little experience in large scale emergency response, the results of the operation were rather satisfactory and marked a milestone in the Brazilian history of treatment and conservation of materials damaged by disasters. The documents in the three allotments were rescued over a long period of time which took eight months. In the meantime, all procedures, implemented according to criteria described in the "Methodology" section and manual for the most part, resulted in 95% recuperation of the documents belonging to the Municipality and Ministry. However, without using Gamma radiation obviously there would not have been such a significant success.

CONCLUSIONS

It is significant that the procedures devised and implemented were made available within the Brazilian preservation community and that they established procedures to follow when there was no precedent available. As APESP and SENAI are reference centers and provide for the dissemination of information concerning the preservation of paper based material heritage, this project has already increased the available knowledge and in helping to generate new debates and discussion topics concerning Preservation in Brazil. The devised and implemented procedures allowed us to return these crucial documents to the city of São Luiz do Paraitinga in conditions that permit safe handling for research and other uses that require access to the contents of the documents. This makes possible the retrieval of official information critical to the Luizenses citizens' lives and restores to them the legal identities.

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Conservation for Digitization at the Wellcome Library

INTRODUCTION

The Wellcome Library is one of the world's major resources for the study of medical history with holdings of four million books, two hundred and fifty thousand works of art on paper, and thirteen hundred paintings. The Library has begun the process of digitizing its entire collection. This paper outlines the considerations needed for the co-operation between all interested parties to enable the completion of this major digitization project in a safe and timely manner. It lays out the expected level of care and protection of the physical objects during the digitization of all of the Wellcome Library's holdings.

Plans to digitize the Wellcome Library collection has involved a collaboration with our development partners, Digirati, for the purpose of designing and building a viewing platform for the digitized material, known as 'The Player'. At present the Wellcome Player is able to render digitized books, archives, multiple-volume works, images, audio and video. Key features include deep zoom, the ability to download high- and low-resolution images and PDFs, and some 'pro' features e.g., the ability to embed an object such as a video clip.

All Wellcome Library staff are involved in the digitization process and have a shared responsibility for the care and handling of the collection during digitization. At first the role of Conservation in Digital Preservation was not obvious, but our contribution has become clearer as the overall project has unfurled, and conservation for digitization has now become one of our primary foci along with exhibitions. The learning curve over the last six years has been steep, and will continue to be so, for all involved. Some strict conservation standards have been challenged in our attempt to establish best practice and treatment fit for purpose.

What we have all come to understand is that Digital Preservation is about preserving digital and born-digital images while creating wider access to the collections. Digital Preservation should not be understood as preservation of the analogue, although it does broaden access to the analogue from which the images are derived. It is now widely recognized that digitization is no guarantee of the survival of content; indeed, digital files are more vulnerable than analogue originals.

It should be kept in mind that the digital images are not just virtual but also material, since they reside in the physical world. Even the Cloud is on servers somewhere. At the Wellcome the bits are stored in a Safety Deposit Box (SDB) v4.4, which is the digital object repository for all of the Wellcome Library's digital content, both digitized and born-digital. We are scheduled to migrate to Preservica Enterprise Edition late in 2014. The SDB is hosted within the Wellcome Trust and all digital content is stored locally on Wellcome Trust servers. With this in mind, in collaboration with the Digital Curator, we have composed a preservation policy encompassing all of our physical collections as well as digital and born-digital images, in a document entitled *Wellcome Library Preservation Policy for Materials held in Collections,* by Dave Thompson and Gillian Boal (2014).

In the digital era everything has changed but, no, nothing has changed. From a conservation perspective digital capture is fundamentally no different from other previous reformatting technologies, such as photocopying and microfilming. Conservation concerns have always focused on the safe handling of collections during these procedures and on the need to establish ways of minimizing the damage inherent in *all* forms of use.

The context of use—in this case, digitization—does make a difference. Researchers in the reading room and photographers in the studio during digital capture have different intentions, different requirements and make use of human faculties. Eyes can look around corners and cope with undulations, but capture equipment requires the item to be flat. On the other hand, photographic technologies are able to record information outside that of normal 'naked eye' vision. By this is meant the ability to range beyond the visible spectrum—ultraviolet, infrared and X-ray. If you see shadow in

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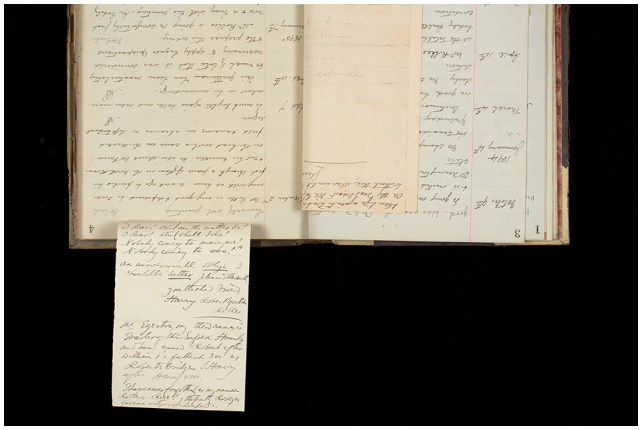

Fig. 1. Evidence of shadow.

an image, as in figure 1, then no crease has been made to the foldout during digital capture.

The digital photographer is intent on getting the best image. The current technology is much better than it was, but it is still limited. Digital capture should not be at the expense of the physical items being digitized. Conservators have a vested interest since it is they who will be doing the resulting repair work. The role of Conservation and Collection Care is to ensure that respect for the item is maintained across contexts of use: working closely with digitizers, creating condition surveys of collections that allow for good preparation, learning the physical needs of the equipment, writing guidelines and giving handling training can all help instill a respectful approach to digitization.

HISTORY OF DIGITIZATION PROJECTS

The Wellcome began with the digitization of the Arabic manuscripts in 2009. This was a collection with unique characteristics but we were able to learn about the overall needs of the digitization project.

A further pilot project was undertaken with several different components, for example, the Medical Officer of Health Reports which were prepared in the conservation studio for digitization off-site: thanks to this procedure we were able to understand the issues related to borrowing from other institutions, and the process of packing and dispatching the MOH Reports to Holland for digitization. The Genetics Books project involved materials digitized in-house by Wellcome photographers, and the Early European Books project was contracted to Proquest, and then subcontracted to the Numen Company for on-site digitizing at the Wellcome Library.

Currently, in Phase 2, there are several projects under way in-house simultaneously; among them, Medieval Manuscripts and 19th Century Books, which are being digitized by our own Photography Department and by the Internet Archive.

GENERAL REQUIREMENTS FOR THE DIGITIZATION PROCESS

With good planning, sufficient resources, a pragmatic approach to the condition of the object, and by withholding and putting out of scope where necessary, most of the collection can be safely digitized.

Conservation and Collection Care is one component in a complex workflow. The greatest risk to any physical object is in the handling, and the nature of the digitization process means that objects are often handled in new ways in new contexts, and with greater intensity. It is the risk of damage or loss from handling that all who are involved aim to mitigate. Communication among all parties in the digitization process is key.

Each digitization project will have specific values for each of the following variables: the scope of the collection to be digitized; its current physical condition; the demands of the equipment to be used; the experience of the trained personnel involved; and other resources available to the project.

Early participation of Conservation in a digitization project is necessary. A member of the Conservation team should attend preliminary meetings at the inception of the project. Their continued level of involvement rests on a number of factors, listed below.

GUIDING PRINCIPLES

- To prevent loss
- To ensure safe preparation of materials for imaging
- To provide handling training to all concerned in order to minimize damage from use, to be extended to digital preparators and imaging technicians
- To be prepared to mend after digitization

IDENTIFIED RISKS

Examples of risk factors from digitization at the Wellcome Library include:

- *Risk of loss*: particularly fragile items have been found in many collections selected for digitization and risk of loss has often been mitigated by ensuring that these items are imaged in-house where trained conservation support is immediately available. Fragile items may also be rehoused before image capture (e.g. using Mylar sleeves) to facilitate handling.
- *Risk of damage*: early printed books selected for digitization have at times had fragile bindings with restricted openings, where forcing them to the 110° required by a book cradle would have resulted in irreversible damage to the spine. As such, books that could not open comfortably to 110° were flagged for inclusion in a supplementary project workflow using an image capture device capable of photographing with lower opening angles.

Fig. 2. Gutter inaccessible.

- *Risk from repeated handling to capture a suitable image*: a variety of options are needed to address this issue, ranging from preparation by Digitization staff and Photographers, to technical repairs performed by trained Conservators. In the case of the Medical Officer of Health Reports, there was a need to disbind the reports to facilitate image capture. In some cases e.g. where the binding is too tight, a lower quality image may be a necessary compromise (e.g., allowing text to disappear into the gutter of bound material) (fig. 2).

SELECTION OF COLLECTIONS FOR DIGITIZATION

The selection of material for digitization is the first step in the preparation phase of a digitization project. The general physical condition of the collections to be digitized and the kind of image capture equipment being considered should be discussed early on in the selection of each project.

PROJECT LEAD TIME

Successful care of collections throughout a digitization project requires adequate lead time for planning, preparation and execution. This is necessary to achieve the appropriate balance between necessary collection care activity and project expediency during digitization. The time needed for a conservation assessment or survey turned out to average two to four weeks but extra time was allocated to accommodate unplanned contingencies. The initial scoping and assessments should inform the project lead time. The amount of time needed for pre-digital stabilization will vary depending on the outcome of these assessments.

CONSERVATION CONDITION ASSESSMENT

While the emphasis has been on facilitating the digitization process where possible, some books may nevertheless have to be deemed out of scope. This may be through lack

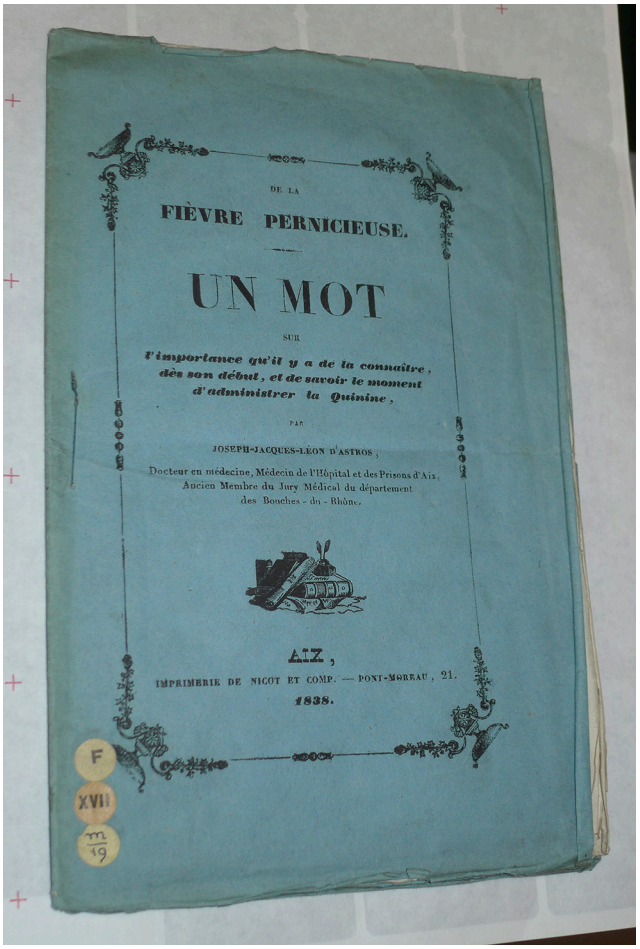

Fig. 3. Uncut pamphlet.

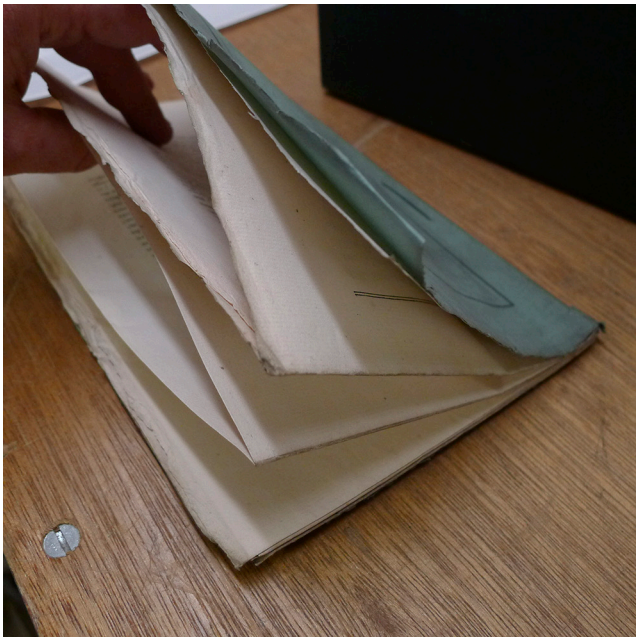

Fig. 4. Uncut pamphlet.

of resources but may also be for reasons relating to the historical value of the book as artifact, where treatment or other preparation for digitization would compromise the original attributes of the individual object and thus its research value. The uncut pamphlet in (figs. 3–4) is an example of an item that should not be cut to facilitate digitization. Such uncut items are invaluable for the study of publishing and printing history. This pamphlet can still be studied in the reading room as eyes can look around corners.

From a conservation perspective there are three methods of assessing the condition of bound and unbound materials: (1) a written condition assessment, (2) a random condition survey, and (3) for unbound collections typical in archives, a random visual survey. The approach taken will depend on the quantity of material surveyed. The time taken will vary according to the extent and nature of the collection in question. They can also determine the required resources.

1. A written condition assessment using an Excel spread sheet should be undertaken by a trained conservator at the initial scoping stage of the project. This is appropriate for a small project and produces a general scoping document — examining each item for its condition and opening angle and is limited to a project with fewer than a thousand items. This might typically take three to five days over a two to three week period.
2. A random condition survey, including a written report, should be performed by a trained conservator who determines the level of stabilization needed. Random surveys are appropriate for of a large collection, numbering a thousand items or more. It identifies specified conditions and the levels of stabilization required to ensure successful image capture. This can take three to five days over a two to three week period.
3. A random visual inspection is appropriate for archives which include both bound and unbound material housed together: paper; photographs; books; documents and letters. As the media are identified and scoped, and as the digitization program progresses, random visual inspection compiles information to highlight issues concerning the levels of pre-digitization stabilizing needed.

CONSERVATION AND COLLECTIONS CARE TEAM AND THE DIGITAL SERVICE OFFICER'S ROLE AND RESPONSIBILITIES

Conservation decisions and treatments are based on three axioms: minimal intervention (in the context of a research library); re-treatability; and the 'fit for purpose' principle. All treatments in preparation for digitization are undertaken with the aim of stabilizing objects for digital capture.

STABILIZATION LEVELS

Stabilization occurs before and during each project. The levels are based on the Library of Congress preservation guidelines (*see* bibliography) and have been established by the Conservation Department at the Wellcome Library. There are two levels of preparation for digitization with a view to stabilizing the object for image capture:

- *Level 1*: Basic preparation of both bound and unbound items for digitization is performed by trained digital preparation staff. For example, removing staples or pins where necessary, or opening folds or creases that interfere with image capture, dry cleaning materials, inserting brittle material into Mylar sleeves, or relaxing creased paper with a Teflon folder, if necessary with a tacking iron. These should be carried out close to the area of digital capture to allow ongoing discovery of preparation needed, as the items are digitized (figs. 5–9).
- *Level 2*: Technical conservation treatment of both bound and unbound items, usually performed by trained Conservators or trained Digitization Preparation staff. This treatment needs to be carried out in the conservation studio: for example, mending paper tears, disbinding bound collections, or humidification and flattening.

Responsibility for Stabilization Level 1—namely, pre-digitization preparation and preparation discovered during digital capture—will be extended to Digitization Preparation staff and Photographers, who have been trained by Conservation staff. Stabilization Level 2 will be undertaken by Conservators or trained Digitization Preparation staff in the conservation studio, except for items that are declared out of scope. Any digital preparation that involves moisture, e.g. disbinding or simple paste and Japanese tissue mends is done in the conservation studio and may be performed by trained staff and/or conservation staff.

Other ongoing and post-project conservation collection needs may be identified by Conservators, Digitization Preparation staff and Photographers during the project, for example, re-attaching loose or detached spine components or cover boards, or other more extensive repairs.

Materials requiring special attention are most likely to impact the project timeline. In some cases these are objects requiring Level 2 stabilization. They will be identified during the conservation condition assessment as to whether they will be included in the project or taken out of scope.

In most cases these objects *may* be prepared for digitization but they will need extra time and resource planning for both preparation and image capture. In all cases where a high level of intervention would be required for successful digitization a curatorial decision is required. The decision may also be to remove such items from the project's scope. Such special conditions in objects that may require immediate

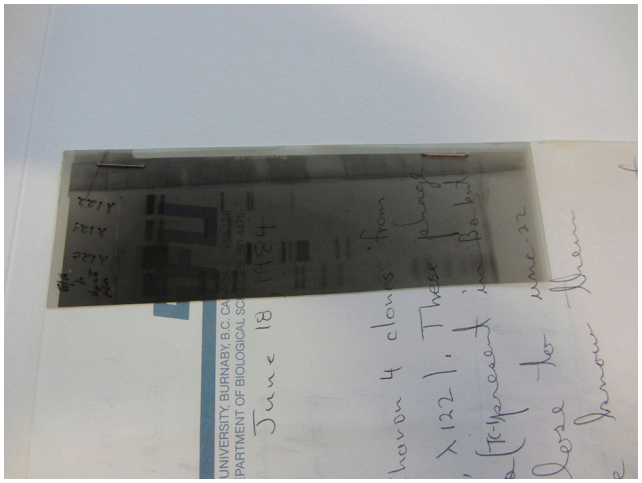

Fig. 5. Staple removal: X-ray attached to paper.

Fig. 6. Bundles of Ticehurst certificates.

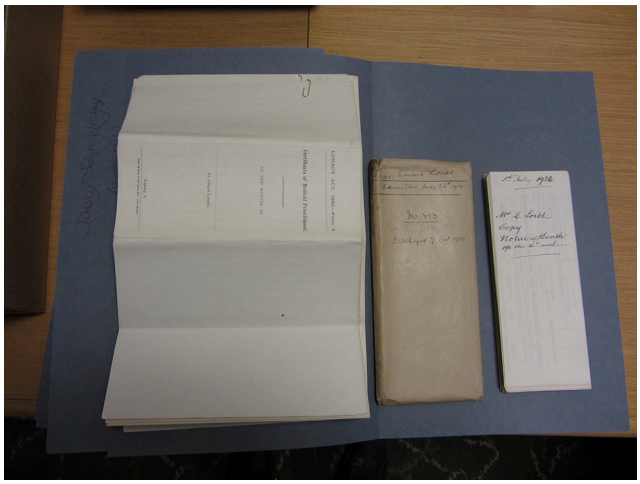

Fig. 7. Ticehurst certificates prepared for digitizing.

Fig. 8. Contents of each bundle placed in a folder for digitizing.

Fig. 9. Envelopes returned to archival box.

attention are mold and pests, vulnerable media and extreme fragility of substrates (figs. 10–11).

Surveys are needed to predict some of the preparation time and resources required for digitization projects. When whole books are uncut they will need to be cut by a digital preparer or conservation staff. This procedure is often carried out when a reader requests it in the reading room, but it is necessary to release these pages so that the book can be digitized. The conservation survey of five thousand books, in the Wellcome Library, dated 1850–1920 has suggested that there will be two hundred books that are uncut. It is estimated that this will take two to three hours per book, which will take upwards of ten weeks of work for the digital preparer over the two year project. It has been established that digital imagers are permitted to release up to five uncut pages with training in order that digitization can proceed without serious interruption (fig. 12).

In Phase 2, one of the projects, entitled "The Asylum and Beyond", will focus on mental hospital records in the 19th and 20th centuries. These are from the Ticehurst House Hospital collection founded in the 18th century and having

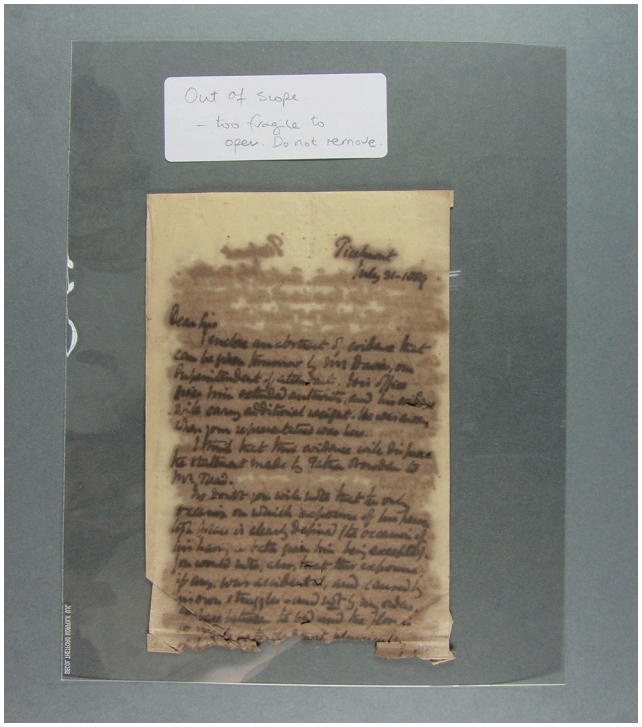

Fig. 10. Brittle material in polyester sleeve: out of scope.

Fig. 11. Brittle, torn pages: out of scope.

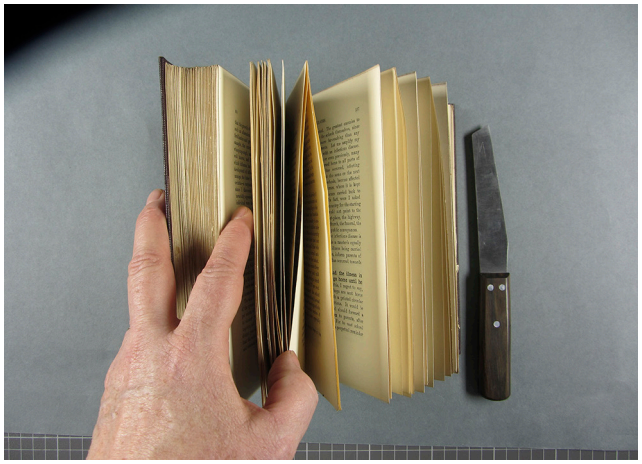

Fig. 12. Whole book with uncut pages.

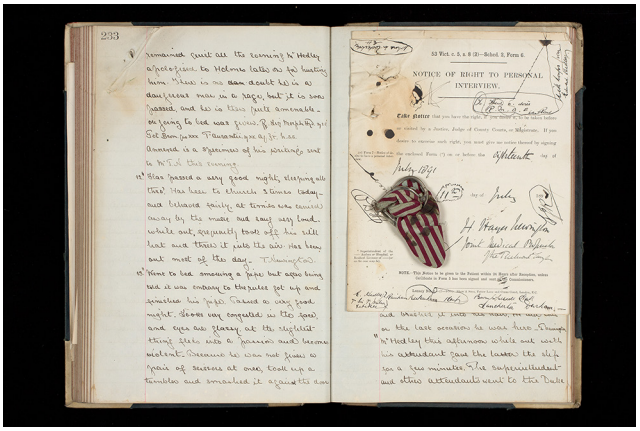

Fig. 13. Ticehurst records purse removed.

Fig. 14. Ticehurst purse.

detailed patient records going back to this time. Digitization of the Ticehurst papers is estimated to take fifteen months.

Projects such as Medieval Manuscripts and 19th Century Books will require specialized preparation, identified as a result of the surveys. Before they are selected and delivered for digitization, they will need preparation. Archives are proving to be the most challenging material, as they typically need more preparation than a book. Archivists already prepare materials for handling in the reading room. They remove rusty pins and staples and replace them with brass paperclips; thus it has been established that such items can be prepared for digitization by trained staff (figs. 13–14).

COMMUNICATION

The Digital Service Officer (DSO), the digital operators and the conservation staff all communicate to establish best practice. There should be an understanding as to how and where damage is likely to occur with the items that are being digitized. The staff should all maintain an open channel of communication throughout, with a member of the Conservation and Collection Care Team assigned to each project.

With good training and communication, conservation concerns can be raised and communicated back to the conservator, before and during digitization. The conservation team working with the DSO maintains a continuous dialogue with our digital contractors to clarify our expectations on book handling, and to learn from them about their equipment and workflow. Both our digital preparers and our photographic staff understand careful handling of items during the digitization process. We have also included training in the use of basic conservation tools and straightforward tasks that save everyone's time, such as unfolding the corners of pages overlooked by the digital preparator. This means that digitizing proceeds without undue interruption. Digital Preparation is mostly a matter of stabilization to facilitate the digitizing process.

The relationship between the physical object and the photographic equipment being used should be well understood by Conservators, Digitization Preparation staff and Photographers. Instructions to the digital capture staff concentrate on the use of equipment in such a way that no harm comes to the items being digitized—for example, how to hold the cradle off the open pages being photographed so that there is no pressure on the book during the period when the imager needs to leave their set-up for a protracted break, such as to lunch or a meeting.

DIGITAL EQUIPMENT

There exists a wide variety of photographic equipment and associated methods of image capture (figs. 15–18).

When image capture is being undertaken, whether on- or off-site, specific criteria for the equipment used, in relation to the materials to be digitized, should be met:

- Image capture equipment should suit the items to be digitized with regards to size. Scanning beds and book rests must be as large as, or larger than, the item being imaged so that it can be supported and digitized safely. This particularly applies to large items such as fold-outs, maps and charts.
- Vulnerable items such as those with restricted openings (less than 90 degrees), or having fragile components, should be digitized using appropriate equipment such as the Conservation Cradle.
- Photographers should make efforts to minimize light and heat exposure from photographic equipment with respect to the items being digitized, and to minimize the amount and duration of the pressure a book is placed under during digitization.

It is important that Conservators review image capture procedures with photographers before a digital project begins. Even familiar equipment may perform differently with different items. Such a review will both enhance the safety of collections and increase the chances of successful image

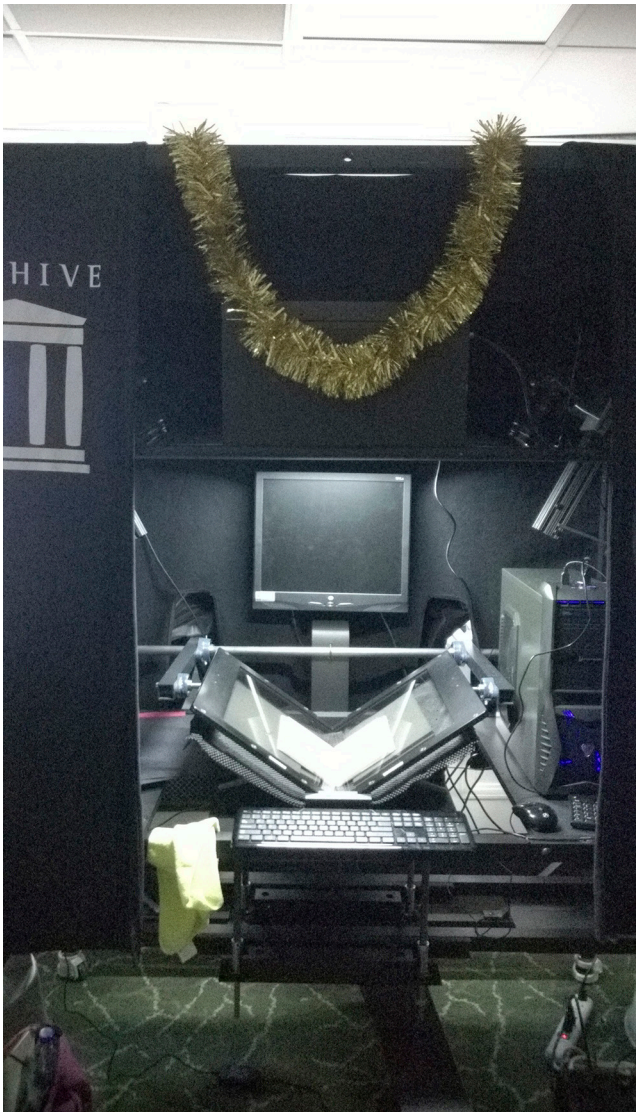

Fig. 15. Internet Archive book cradle: 110 degree opening.

Fig. 16. A regular copy stand with 90–110 degree opening.

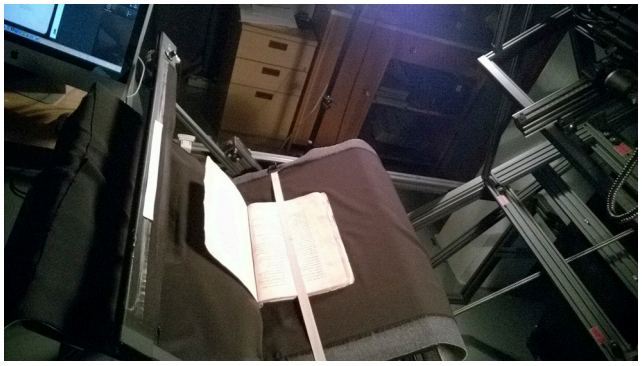

Fig. 17. Conservation Copy Stand 6545: less than 90 degree opening.

Fig. 18. Guardian Copy Stand System: 180 degree opening.

capture for high-risk items. Vulnerable bindings require specialized equipment such as the Conservation Copy Stand 6545 ('Conservation Cradle') (see fig. 17) or the copy stand setup (see fig. 16) albeit operating at a reduced rate of image capture. The Guardian copy stand is a more sensitive piece of equipment and is the recommended digitizing equipment for flat items or books that open 180 degrees. *(*see fig. 18). During digital capture the book is raised up to the glass by a foot pedal, but it can also be done mechanically, when a gentler movement is required. With other equipment by contrast the glass is brought down onto the object and flattens the item, rather than just touching it, as the Guardian does, with this equipment there is a faster rate of image capture.

ACKNOWLEDGEMENTS

I would like to acknowledge our Wellcome photographers for supplying images of their equipment and helping me understand the capabilities of various pieces of equipment. I would also like to acknowledge the Wellcome Conservation Team and the Digital Service Officer for their commitment to providing ongoing support for the digitization projects and for their contribution of certain images. We have grown in knowledge and understanding of all facets of digitization together.

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Conservation of Johannes Herolt's Sermones de tempore, c. 1450

Recently acquired by The Ohio State University Libraries (OSUL) Rare Books and Manuscripts Department, Herolt's Sermones is a mid-15th century bound manuscript on paper. Herolt (ca. 1386–1468) was a Dominican friar of Nuremberg, vicar of the Katharinekloster, and one of late-medieval Germany's most prolific sermon writers and preachers. This volume includes Herolt's collection of model sermons on topics and themes related to the liturgical year and cycle of saints' festivals. This sermon collection proved to be exceptionally popular, both during Herolt's lifetime and afterwards. It has been estimated that at least 500 manuscript copies of the collected sermons survive today (both complete and fragmentary), and as many as 186 separate editions of them were printed by the year 1500, with another 60 editions printed from the 16th–18th centuries.

OSU's copy had been re-covered sometime in the 20th century in quarter leather and paste paper over thick mill board. Also, at some time(s) in the past 50 years a number of pages had been reinforced with various clear plastic tapes to support areas where the acidic iron gall ink was corroding the paper. In many of these areas tape had been applied to both sides of the leaves. Originally, at least two scribes worked on this manuscript (one working on the temporal cycle, and the other on the Lenten sequence), and the condition of the various inks used ranges from near pristine to extensively corroded. The acidic and deteriorating ink was present on approximately 70 leaves in the last quarter of the text block.

In the summer of 2011 the Rare Books and Manuscripts Department requested that this book be conserved, including treatment of the text for tape removal and stabilization of the ink and paper, and rebinding in 15th century German period style with leather spine and exposed wooden boards. In September 2011 conservators in the OSUL Conservation Unit began treatment that included dis-binding, tape, adhesive residue, and stain removal; mending pages; re-sewing and binding in period style as requested by the curator, using wooden boards, alum-tawed leather for the spine, metal fore-edge clasps and creation of a custom box to house the book and earlier binding components—some of which were from the original 15th century binding structure. The most significant part of the treatment was the difficult and time-consuming removal of tape and adhesives, followed by reassembly of areas of text where much ink had been lost, leaving only the paper fragments between the lines of writing.

Another interesting aspect of this project, and this presentation, is the collaboration between the conservator and a land owner in southern Ohio for the "harvesting" of the beech wood used for the boards, which was cut from a storm-damaged 150 year-old American Beech tree by the property owner who donated the wood, the milling, drying, delivery and stacking to the Libraries specifically for this project, and for potential use on future binding projects.

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Presented at the Book and Paper Group Session, AIC's 42nd Annual Meeting, May 27–31, 2014, San Francisco, California.

KATHERINE KELLY AND ANNA FRIEDMAN

Conserving the Iraqi Jewish Archive for Digitization

INTRODUCTION

In May 2003, just days after coalition forces took control of Baghdad, a US Army team found thousands of Jewish communal and religious books and documents under four feet of water in the flooded basement of Saddam Hussein's intelligence headquarters.

Once most of the water was pumped out of the basement, the books and documents were brought out to a nearby courtyard. The team did their best to dry the materials, and then packed them into metal trunks (fig. 1). Unfortunately, in Baghdad's intense heat and humidity, the partially damp papers quickly became moldy.

Seeking guidance, the Coalition Provisional Authority placed an urgent request for assistance to the National Archives and Records Administration (NARA). NARA sent Director of Preservation Programs Doris Hamburg and Conservation Chief Mary Lynn Ritzenthaler to Baghdad to assess the damage and make recommendations for preserving the books and documents. In the meantime, the Coalition Provisional Authority secured a freezer truck to stabilize the materials. It was in this freezer truck that Doris and Mary Lynn first examined the collection.

The Baghdadi Jewish community has a 2500 year old history and was the most important center of Judaism outside of Jerusalem. Beginning in the 1940s, intensifying in the 1950s, and continuing through the 1970s, that community fled Iraq to escape persecution. This group of materials is not an actual archive in that it was not collected by the Iraqi Jewish community as an internal record of its activities. These books and documents were taken by Saddam Hussein's government. The name "Iraqi Jewish Archive" (IJA) was bestowed by Doris and Mary Lynn while they were assessing the disordered trunks of moldy material in Baghdad. The name provided a convenient way of referring to a collection that was otherwise difficult to define.

Presented at the Book and Paper Group Session, AIC's 42nd Annual Meeting, May 27–31, 2014, San Francisco, California.

Fig. 1. Recovery of books and documents in Baghdad, 2003. Photo courtesy of Harold Rhode.

The IJA contains published books, records of daily life, and correspondence from schools and organizations of the Baghdadi Jewish Community. There are approximately 2700 published books, tens of thousands of archival pages and 150 other items in the collection. An entry in the database could be a prayer book, an 800 page ring binder, a group of disassociated book covers or a single sheet of paper. It includes books from the 16th century through the 20th century, and documents largely from the 20th century.

PHASE 1: RECOVERY OF ARTIFACTS

With the agreement of Iraqi representatives, a Memorandum of Agreement between the Coalition Provisional Authority and the US Government was signed. External funding would be required as the National Archives was not in a position to use its operating budget which is mandated for work with US federal records. The archive was shipped frozen in the metal trunks to the United States for preservation and exhibition. This relocation was due to the limited treatment

options in Baghdad or elsewhere in the region at that time. In Texas, a commercial vendor vacuum freeze-dried the books and documents. Vacuum freeze-drying allowed the ice to sublimate off the collection materials as vapor. The paper and books were left dry, but in the same torn and distorted condition as when they were frozen. The mold was rendered inactive, but remained allergenic. The trunks were then shipped to the National Archives in College Park, MD to await further funding.

PHASE 2: ASSESSMENT AND PLANNING

In 2006, the National Endowment for the Humanities awarded a grant to the Center for Jewish History to assess the collection and plan for its care. In Phase II of the project, which was carried out at the National Archives, a Conservator and a Conservator Technician unpacked the trunks and separated the collection into discrete items (fig. 2). Each item was then wrapped in a Permalife paper package and assigned a number from 1 to 3846.

While they were unpacking the trunks and rehousing the material, they created a database. Each item was described by its physical format and condition as well as conservation needs. Digital photographs were taken for each entry, showing covers, title pages, and representative pages where applicable.

Catalogers used the photographs to view the still moldy material and then recorded their descriptions in the online database. Subject matter experts evaluated the entries and made recommendations for future actions, including digitization and exhibition priorities.

The combined recommendations from Phase II provided the conceptual framework for the National Archives to develop Phase III of the Iraqi Jewish Archive Preservation Project.

Fig. 2. Phase II: Conservator Susan Duhl sorting damaged material in 2006.

PHASE 3: CONSERVATION, IMAGING, AND ACCESS

The third and final phase of the project was funded in 2011 by the Department of State with a $2.98 million grant to achieve the following goals:

- To complete cataloging of the collection and refine the database.
- To provide conservation treatment to:
  - complete stabilization to allow for safe handling during digitization
  - perform more extensive treatment for selected items to permit exhibition
  - rehouse for long term storage.
- To image all documents and selected books.
- To create an exhibit in English and Arabic to be shown at the National Archives in Washington, DC, and in Iraq.
- To create a web site to provide free, worldwide access to the database and digital images.
- To provide fellowships for Iraqi conservation professionals.
- To box, crate, and transport the collection.

In this paper, we focus on the role that conservation played in achieving those goals. Conservation's goals were to stabilize the collection for digitization, prepare for exhibition, rehouse all of the books and documents for shipment and permanent storage, and host the Iraqi Fellows.

Eleven full-time and three part-time staff were hired to accomplish the goals of Phase III. The team was headed by Project Manager, Sue Murphy, who coordinated cataloging, imaging, website development, and conservation. The conservation team was comprised of two conservators, Anna Friedman and Katherine Kelly, and two conservator technicians, Patrick Brown and Meris Westberg. Doris Hamburg and Mary Lynn Ritzenthaler provided consistent guidance throughout all phases of the project.

CONSERVATION WORK FLOW

PRELIMINARY ACTION

Given the moldy and damaged condition of most of the collection, the first stop for every object was in Conservation. From there, its progress depended on whether it would be digitized or simply rehoused. All archival documents entered the Imaging queue, but the Librarian assigned books either to the Imaging queue or to the Rehousing queue, based on bibliographic criteria.

For many entries in the collection, the Librarian could rely on the initial cataloging and images taken in Phase II to describe a book and assign it to a workflow. However, given the terrible condition of some entries, conservation staff sometimes had to work closely with the Librarian to uncover enough information to make even this basic determination.

SHAREPOINT

We used technology in some interesting ways to assist us in this collaboration. We tracked the progress of our material with a web-based computer program called SharePoint. The primary purpose of our SharePoint site was to track the location of all 3846 entries in the collection, but we also used it to generate documentation, record progress, and communicate with the Librarian and with Imaging staff. We also used SharePoint to pull information from the website database to print labels, box lists and work tickets. A work ticket was a one-page form we used to track an entry and record its treatment, rehousing, and digitization actions.

MOLD REMEDIATION

The collection is highly variable in its format and the level of damage it sustained. Some of the material looked like it never got wet and some items were fused, mold-covered, and unrecognizable as books (fig. 3).

The effects of mold on paper are well described in the conservation literature, so our description here will be cursory. At a microscopic level, paper consists of strands of paper fibers physically and chemically meshed together. When mold begins to grow in wet paper it sends out runners like roots which are called hyphae. They infiltrate the paper fibers and break down the connections between them. When the connections between the paper fibers are damaged, the entire sheet is softer and harder to repair. Well-established mold will eat away pages, leaving large holes and areas where the paper has been pulped together.

A conservation goal was to enable safe handling during digitization. In our case, this meant not only physically stabilizing the materials, but also minimizing the health risk posed to staff by the presence of the inactive, yet still allergenic mold. The principal health danger from mold is encountered when spores are inhaled. When books and papers are handled

Fig. 3. Severely distorted book (Iraqi Jewish Archive #203).

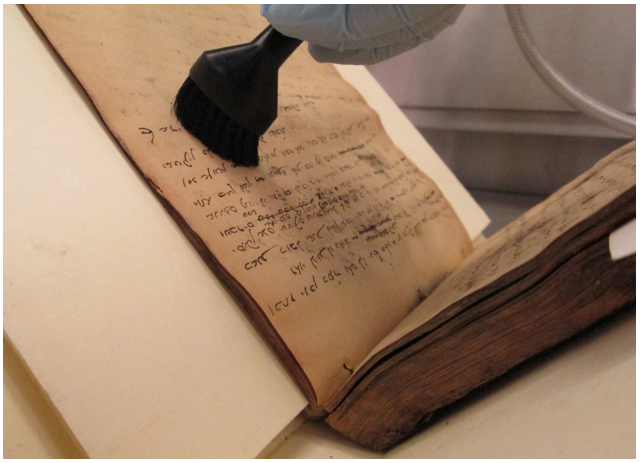

Fig. 4. Nilfisk vacuum with small attachments.

Fig. 5. Y-hose attachment for Nilfisk vacuum.

during treatment and imaging, inactive mold can easily become airborne, so removal was a priority.

The National Archives has well-established protocols for dealing with moldy materials, so our task was to adapt them to the special needs of the IJA project. Our project had dedicated use of one built-in fume hood and another stand-alone biological safety cabinet. The built-in fume hood vents to the outside of the building and can be used for mold particulates or solvent vapor. The biological safety cabinet, which recirculates air back into the room through a HEPA filter, can only be used for particulates like mold. In addition to these hoods, we also sometimes used a third fume hood generally reserved for NARA mold projects. Since all of our assessment, mold remediation, and measuring for boxes happened inside these hoods, we appreciated having lots of space.

Mold remediation was performed using a HEPA-filter vacuum and a variety of small attachments. The Nilfisk vacuum had an adjustable rate of suction, allowing us to gently clean even the most fragile papers. We used small attachments to get deep into tight binding structures and carefully clean tattered page edges (fig. 4). Larger attachments were useful for cleaning minimally affected material where the paper remained strong. When necessary, soot sponges were used after vacuuming.

Another great adaptation that NARA staff helped us to develop was the use of a Y-hose so that two people could work at the same time with one vacuum (fig. 5). When only one person was working, we would plug the other end of the Y-hose with a custom-shaped piece of Volara. The Y-hose attachment can also be set up in a single fume hood to permit quick switching between left- and right-handed use of the nozzle.

ERGONOMICS DURING MOLD REMEDIATION

Ergonomics was an area in which we were able to improve on the standard mold remediation protocol. Over the course of the project, nine different people worked on mold remediation. We worked hard to accommodate different people's heights, right- and left-handedness, and preferences for work styles. We used adjustable height lab chairs and padded floor mats. Staff were able to work both seated and standing according to their preferences. We also suspended the heavy hose of the vacuum so that the user would not be supporting its entire weight.

We modified the Nilfisk tools to allow them to be gripped more comfortably for long periods of time using Elastack tool tape. Elastack is a product marketed to people with arthritis or other medical conditions where gripping small tools like silverware is painful or impossible. It is a thick, soft, stretchable, clear plastic tape that can be wrapped around the handle of a tool to make it larger and give it a more secure grip. We sometimes put a layer of thin Ethafoam or Volara underneath the Elastack to bulk it out further. It can be removed and replaced as necessary.

REVENUE STAMPS

Once we started working on archival materials, one problem that immediately presented itself was revenue stamps. Iraqi revenue stamps were used to notarize official documents. Any given page with stamps could have anywhere from one to dozens of stamps on it, and there were well over ten thousand stamps in the collection. Like postage stamps, these were originally attached with a water-based adhesive. All of that adhesive was washed away in the water event. When we opened a stack of papers, the stamps would detach easily and their original location could be hard to find again (fig. 6).

We solved this by reattaching each stamp in its original place with a small dot of methylcellulose as soon as we came across it. We became incredibly good at finding the original location of these stamps, even on the most mangled and damaged sheets of paper.

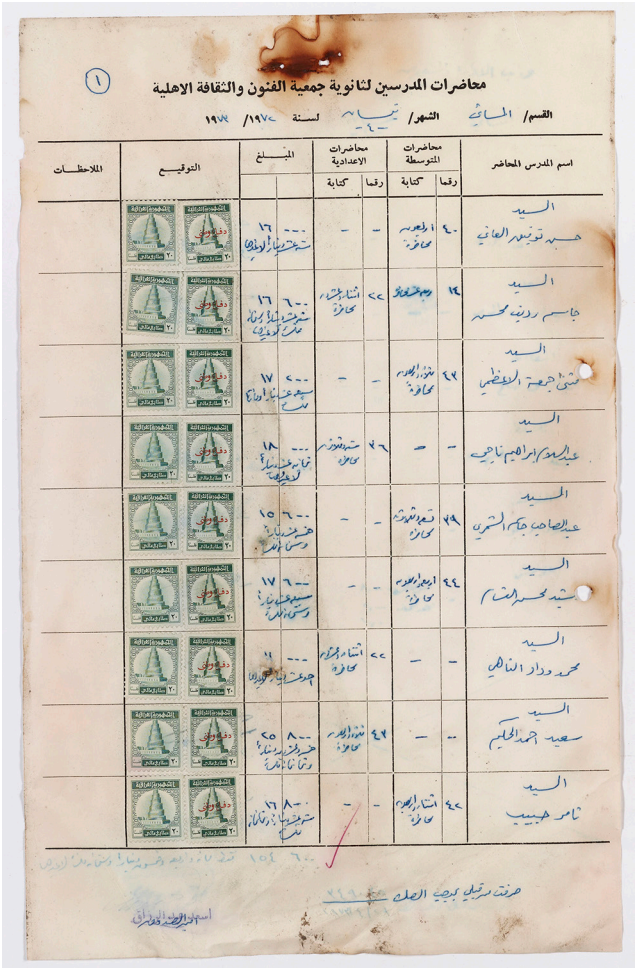

Fig. 6. Revenue stamps were reattached to archival documents with methylcellulose (*Ledgers from the High School Arts and Culture Association*, 1970–72, Iraqi Jewish Archive #3472).

One tool that allowed us to reattach stamps quickly and efficiently was a small syringe, filled with methylcellulose. This syringe allowed us to apply a very small and conservative dot of adhesive to the back of each stamp while keeping our work area clear.

While we worked in the hood, we also performed basic holdings maintenance tasks, like removing rusty staples or paperclips and replacing them with stainless steel paper clips over a barrier strip of paper. We also placed fragile documents in polyester sleeves and rehoused archival documents in acid free folders and document boxes. Books were usually measured for custom boxes after they were humidified and flattened because their dimensions could change drastically.

FLATTENING AND MENDING

Once mold remediation was done, the books and documents could be removed from the hood and further prepared for imaging. This collection had significant conservation challenges beyond the mold and surface dirt. Book bindings were warped, pages were brittle and torn, and much work needed to be done before each item was ready for imaging.

When items could be adequately flattened during imaging by using the hinged glass on the copy stand, we did not flatten them in Conservation. However, this left many distorted books and crumpled documents that did require our attention. When possible, we flattened materials dry under weight or with minimal moisture. This allowed us to work quickly and prevented the re-activation of mold.

One technique that we found to be a great help in flattening text blocks was humidification with Tek-Wipe. This non-woven polyester/cellulose fabric releases moisture more slowly than blotter, and by quickly moving a slightly dampened sheet through the pages of a book, the entire text block can be slightly humidified. This humidification was followed by reshaping of the text block and drying (figs. 7–8). Moving too slowly through the text block or working with a too damp cloth raised the risk of causing tide lines or of excessive wetting.

A technique which we used less frequently was complete immersion in water. The object seen in figs. 9–10 was successfully treated by completely immersing it and gently separating the pages underwater. As one can see, it went from being fused and unreadable to being entirely legible.

We used standard conservation materials for mending. These included long fiber tissues made from Kozo or Abaca fibers, and reversible water-based adhesives like wheat starch paste and methylcellulose. We also used reversible heat-set tissue, applied with a tacking iron.

We had a lot of success with the remoistenable tissue. We prepared it by lining 5 g Tengucho with wheat starch paste and methylcellulose. Small pieces of the prepared tissue could then be applied directly to tears and the adhesive reactivated with a small amount of moisture. We found that these prepared tissues allowed us to work accurately and quickly.

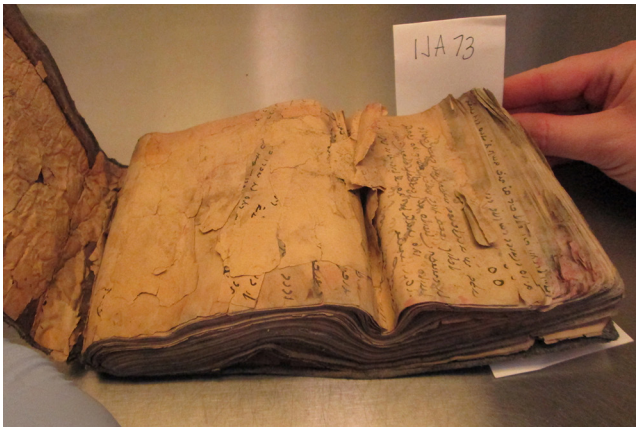

Fig. 7. *Handwritten Hebrew Book* (Iraqi Jewish Archive #73) with brittle and distorted text block, prior to treatment.

Fig. 8. Paper repair after overall humidification of the text block with Tek-Wipe (Iraqi Jewish Archive #73).

SCHOOL PHOTOGRAPHS

One of our most heart-wrenching conservation challenges was the school photographs found in student files. These administrative files, from the Jewish schools in Baghdad, generally contained a student's enrollment and graduation forms for elementary through high school. They included SAT scores, recommendation letters, transcripts, and almost always, several small silver gelatin photographs (fig. 11).

Like the revenue stamps, each school photo was originally attached to its record with a water-based adhesive. During the water event, this mounting adhesive almost always failed. Unlike the stamps, the photographs were severely affected by the water and subsequent vacuum freeze drying. In most cases, photographs were found with the gelatin side fused to the facing page.

If the attachment was strong, we left the photograph in place to avoid causing further damage, but when the

Fig. 9. Badly misshapen text block prior to treatment (*Al-Mausū'ah al-Filisṭīnīah*, Iraqi Jewish Archive #173).

Fig. 10. After treatment photograph of *Al-Mausū'ah al-Filisṭīnīah* (Iraqi Jewish Archive #173).

Fig. 11. Water damaged photographs removed from paper clip (*Student Folders with Photographs, Baghdadi Jewish Schools*, 1961–71, Iraqi Jewish Archive #3755).

Fig. 12. School photographs are presented to website users with background pages in place to show image offset and provide context (*Student Folders with Photographs, Baghdadi Jewish Schools*, 1961–70, Iraqi Jewish Archive #2853).

support layer released spontaneously from the facing page, we returned it to its original location. Sadly, the image layer often remained firmly adhered to the facing page or had already been washed away. In some cases, this produced a mirror image of the original photograph on the facing page.

The Imaging staff developed an approach to capturing these records that attempted to represent the photograph as completely as possible despite this problem. Each school file was imaged as a whole, with background pages in place. With this approach, they could show the original placement of the photograph and also any image offset on the facing page (fig. 12).

PREPARATION FOR IMAGING

Some other conservation challenges resulted from the variety of languages in the collection. Most obviously, it is more difficult to piece together fragments of text in unfamiliar languages, but there were also difficulties in simply rehousing and imaging the documents. The collection includes more

than ten languages, the most common being Arabic, English, and Hebrew. A mixture of Roman and non-Roman characters, with reading directions going right-to-left or left-to-right, was further complicated by blurry writing, ink that had bled though onto other pages, and unrelated stacks of papers that were gathered together. Conservation maintained the original order in all the materials we treated, and we were responsible for providing Imaging staff with guidance on orienting the text correctly. We devised a system to indicate to the Imaging staff what the correct (or most correct) orientation was so they knew how to page through a file folder for imaging. These "orientation flags" preserved everyone's sanity!

REHOUSING

A major goal in this preservation project was rehousing all the material in appropriate, archival housings. These housings contain each item and allow it to be handled, shelved, and labeled. Of particular importance for this moldy, fragmented collection, boxes help contain any residual debris and provide an environmental buffer against fluctuating temperature and relative humidity. The boxes will also protect the books and documents during transport and enhance long-term storage and access. In general, books over 1" in thickness were rehoused in custom-sized boxes and books under 1" in thickness were rehoused in folders in document boxes. Archival items were rehoused in folders and document boxes except in instances where the format of the archival item required a custom box.

TEAMWORK AND COLLABORATION

The Iraqi Jewish Archive Preservation Project was truly a team effort, and our work in conservation was closely tied to the work of the Librarian and the Imaging staff. One of the major constraints we had was the timeframe. This was a two year project, with no flexibility on the end date. Our success in responding to the many challenges and surprises we discovered in that time was due to the close collaboration among the team members. There was a formal process of establishing guidelines for treatment and imaging, and an informal process of communication throughout the project as new challenges were discovered. The Librarian frequently came to the conservation lab to help us piece together fragments of Hebrew text, and conservation staff were often called down to the imaging lab to consult on difficult items. Someone also noted that we did a lot of team-building through tea parties…

In October 2013, we were fortunate to be joined in our conservation efforts by two Iraqi Fellows, Ms. Nahid Fahil Mahdai and Ms. Zinah Adnan Majeed Al-Benezzi. They came to us from the Iraq National Library and Archives where Nahid is head of conservation and Zinah is a paper conservator. They tackled the full range of treatments as we made our final push towards completing the project and they gave us a sense of how our Iraqi counterparts work and the challenges they face in their day-to-day preservation efforts.

The IJA team has made available on the IJA website (www.ija.archives.gov) all of the documentation for the project. Included is the entire history of the project, our guidelines for conservation treatment, how we prepared materials for imaging, and the standards that Imaging followed when they handled and digitized the collection. These guidelines were based on NARA standards, but adapted to the special needs of the IJA. We hope that they can be a useful starting point for others faced with similar challenges.

EXHIBIT: *DISCOVERY AND RECOVERY: PRESERVING IRAQI JEWISH HERITAGE*

Selections from the Iraqi Jewish Archive were exhibited at the National Archives in Washington, DC, from November 2013 to January 2014. From there the exhibit traveled to the Museum of Jewish Heritage in New York City, where it was exhibited from February to May 2014. There were 24 original books and documents in the exhibit as well as many facsimiles, chosen to represent the range of material in the collection and illustrate the history of the community where they originated.

Most of the archive received simple stabilization treatments to allow handling and digitization. Collection items that were selected for exhibition received more extensive treatment. This was done to assure the safety and stability of materials during display, as well as to maximize the viewing experience of visitors to the exhibit.

One of the items that required the most treatment was an 1815 Zohar (fig. 13). The Zohar is a ḳabbalistic commentary on the Torah, and this particular volume is a commentary on the biblical book of Genesis. When it came to us, it was in very poor condition. Mold and surface grime obscured text, the pages were tattered, and there were large losses in the hand-drawn frontispiece. The original binding was missing, and the sewing was broken in several places.

Fig. 13. Before treatment photograph of *Zohar 'al ha-Torah Ḥeleḳ Rishon Sefer Be-Reshit*, 1815 (Iraqi Jewish Archive #2035).

The treatment for this book was not unusual—the processes of surface cleaning, washing, and mending are familiar to many conservators. We would like, however, to highlight some aspects of this treatment, as they reveal some interesting characteristics of the larger collection.

When one washes an older book, the water often turns yellowish—it's a way to know that impurities and the byproducts of aging are being effectively removed. The water from this book was coffee-colored, just really gross. Although time and resources did not permit us to wash every book and document in the collection, when we did wash, the results were dramatic. Stiff, brittle, darkly stained and tide-lined pages became flexible and bright.

While some of the staining that had occurred in the 2003 water event was easy to remove, other kinds of damage were more stubborn. Many pages, particularly more modern book papers, suffered a kind of overwashing in the flooded basement that left them with a porous, rough surface and distorted paper fibers. The main treatment challenge that this posed was the difficulty of realigning text again during mending.

In addition to staining from the dirty water, there were more stubborn stains from ink offset, bleeding and rust. This type of damage was ubiquitous in this collection, particularly among the handwritten archival documents (fig. 14). Our standard treatment protocol did not attempt to reduce these stains as there were simply too many to make stain reduction a feasible option.

The Zohar treated for exhibition had one annotation that had suffered from ink bleeding. When the book got wet in Baghdad, one of the annotations bled out onto the neighboring pages and turned slightly purple. Our treatment of the book could not restore the original color of the annotation, but we were able to prevent further bleeding by fixing the annotation with cyclododecane prior to washing.

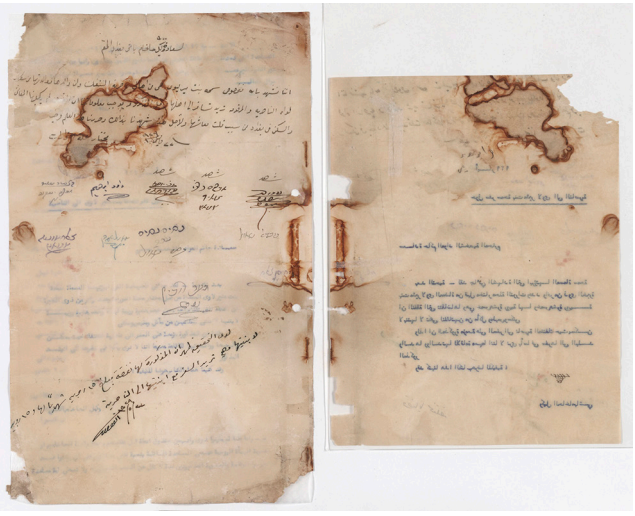

Fig. 14. An example of the staining from rust, ink offset, and ink bleeding found throughout the collection (Iraqi Jewish Archive #99).

Fig. 15. After treatment photograph of *Zohar 'al ha-Torah Ḥeleḳ Rishon Sefer Be-Reshit*, 1815 (Iraqi Jewish Archive #2035).

The remainder of this treatment shared its challenges with the collection as a whole. Some pages had to be pieced back together from fragments, and extensive mending was required to allow the volume to be safely handled. As an exhibit treatment, this tattered pile was rebuilt into a functional book, able to be used, handled, and read as was intended (fig. 15).

We see this as a metaphor for our work on the whole collection. We started with a huge mass of paper, unusable and unknown, and through conservation treatment, cataloging, and digitization, made it available for the entire world to see and to use.

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Scraps of Memories, Shards of Time: Preserving the African American Scrapbook Collection of Emory University Libraries, a *Save America's Treasures* grant project

PRESERVING THE AFRICAN AMERICAN SCRAPBOOK COLLECTION

Scrapbooks are frequently included in archives and libraries' special collections because they are valuable historical resources, whether they are a snapshot of a time period, such as school years or a journey, or the account of an entire lifetime of experiences. Scrapbooks present these stories in photographs, clippings, artwork, greeting cards and letters, invitations and objects. They are deeply personal, sometimes illuminating, and sometimes head-scratching.

Though invaluable research material, their use by scholars is often limited or completely restricted in order to prevent further damage to these complicated structures filled with everything imaginable. Scrapbooks have often been boxed, shelved, and then frankly ignored, probably to postpone complex and difficult, usually expensive, preservation decisions.

The National Park Service, through their *Save America's Treasures* grant program, awarded a three-year matching grant to the Emory University Libraries that funded our initial efforts into finally preserving a small selection of the many scrapbooks held in our Manuscript, Archives, and Rare Book Library (MARBL). Our African American collections are especially rich with scrapbooks created by or about celebrities and well-respected leaders, but we have an equal wealth that were assembled by average people, who had something they wanted to say or preserve. Collecting black print culture is large part of the mission of the MARBL. The scrapbooks held in our African American collections, with their unique assemblage of the ephemera of everyday life, are irreplaceable objects that capture the visual culture of the African American experience in the United States. If we do not preserve them, we risk losing a central part of our country's full history.

The *Save America's Treasures* (SAT) grant funding allowed us to purchase equipment, supplies, and most importantly, hire staff to perform the work—basic conservation and rehousing as well as digitally capturing the scrapbooks—in order to improve access to the collection. The Emory Libraries has committed to the importance of the digitization aspect of preserving collections, a growing program in research libraries as noted by The Association of Research Libraries (ARL), which "endorses digitization as an accepted preservation reformatting option for a range of materials" (ARL 2004, 1). As a member library, we fully support the ARL guiding principle to "promote and advocate barrier-free access to research and educational information resources" (www.arl.org/about).

Our grant project assembled a team from three different departments: MARBL (the special collections), Conservation, and Digitization & Digital Curation. Recognizing the grant's limited timeframe and resources, we knew we had to select the scrapbooks that were of the greatest research value, and that would be best served by both conservation treatment and creation of digital surrogates. Together the team did the research to balance historic and intellectual importance, frequency of use (whether actual or anticipated), and how well digital surrogates could capture the layers of information, with the amount and severity of each scrapbook's current condition problems. We each scored the items based on our departmental perspectives; when tallied, the numbers allowed us to select and group the scrapbooks into a project priority list. We narrowed our focus to the highest scoring/ranking scrapbooks.

The collection posed typical scrapbook problems, including multiple formats and layered materials all with various types of damage, including mirrored photographs, detaching items, cross-page spreads, brittle paper that when unfolded was larger than the album page, pressed flowers, and single-use items such as ticket stubs, napkins, and telegrams, none of which was meant to last through time. The items were attached with a variety of adhesives such as tapes, pastes and rubber cement, many failing. Questions arose such as whether we should undertake washing or solvent treatments to remove mold, water, and adhesive stains. How do we effectively preserve thick stacks of papers adhered on a single page; do we separate layers to reveal information, if so, then how do

Presented at the Book and Paper Group Session, AIC's 42nd Annual Meeting, May 27–31, 2014, San Francisco, California.

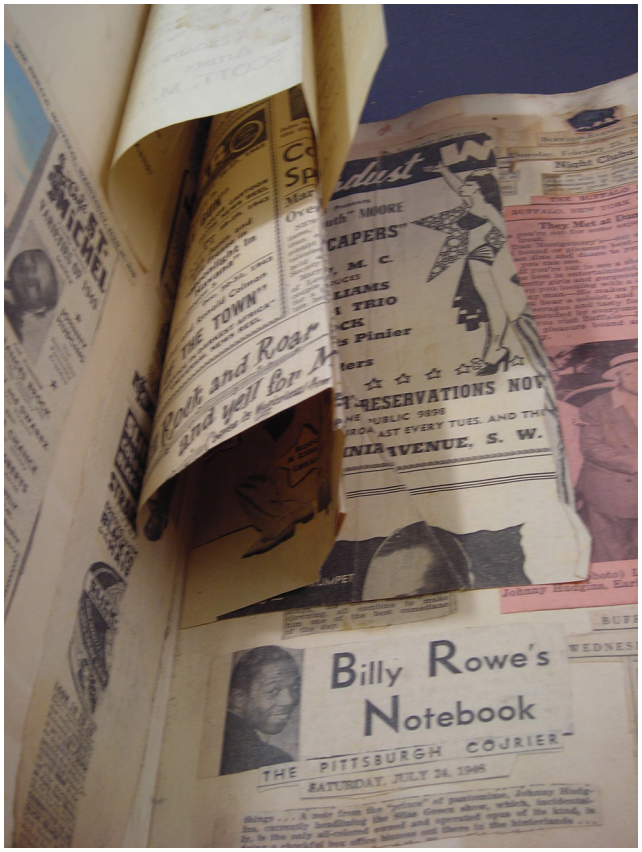

Fig. 1. Johnny Hudgins scrapbook—multiple layers of folded brittle newspaper.

we reassemble them within the scrapbook? We developed a Treatment Survey Form to tally the occurrences of different types of damage, as well as record the numbers of extra images that would have to be shot of each page in order to capture multiple sides of items, such as a letter in an envelope, a pamphlet, the backs of photographs, and each layer of overlapping newspaper articles that had hidden information (fig. 1).

CALCULATING COSTS AND TIME

Potential conservation work was ranked on treatment levels we established many years ago based on the ARL's Preservation Statistics. Treatment times are divided into three levels that each factor in complexity of the technique along with staff expertise and the amount of time involved in doing the treatment. Level One work includes simple techniques such as dry cleaning, mending, and hinging, most of which is accomplished in less than fifteen minutes per task. Level Two tasks require somewhere between fifteen minutes and two hours. The treatments also require more expertise to accomplish, such as removing mold, replacing spines, or re-associating loose materials into an album. Level Three work is the most complex; treatments include tape removal and encapsulating pages to reformat a scrapbook into a post-bound polyester encapsulation album. Level Three tasks take more than two hours to accomplish and require the most training and skills.

By knowing the average time it takes to accomplish the majority of the treatments and tasks each scrapbook required, we assigned dollar amounts to tasks and built a spreadsheet that calculated approximately how much each scrapbook would need, resource-wise. Having these time and dollar figures helped us further narrow to thirty-four scrapbooks that we thought we could accomplish within the three years of the grant, by a half-time conservation technician.

Digitization calculations were based on time trials and previous experience to determine how long it took to set up, shoot, process multiple iterations of a digital image, and file management factors such as the cost of storage. We allocated a portion, 60%, of a Digital Imaging Technician, and proposed to hire a graduate student assistant for ten hours per week. The grant also provided for small percentages of administrators from the three departments, including the manuscripts curator.

Thirty-four scrapbooks were ultimately selected, with dates ranging from 1883 to 1975. They include the scrapbooks of author Alice Walker, Spelman College graduate Virginia Hannon, W.S. Scarborough, who though born a slave, became

Fig. 2. Johnny Hudgins performs in black face; top right corner has mold stain.

an author, a professor of classics and eventually president at Wilberforce University, and vaudeville performers "Jolly" John Larkin, Johnny Hudgins, and Flourney Miller (fig. 2).

THE EVOLUTION OF THE PROJECT

Once the grant was awarded, we immediately posted a half-time Conservation Technician position, but had difficulty finding someone who met the requirements or was willing to work for the wage offered. In the end, this was a blessing, as it became clear early on in the grant that the conservation work was much more complicated and required more careful consideration and planning than had been originally planned. We were very fortunate to hire Kim Norman, who brought twenty years of experience and expertise to the project.

We also postponed hiring the intended graduate student assistant until our workflow was established, running smoothly, and the type of work and need for that position fully understood. In fact, we never hired a student because we thought that the digitizing was done more thoughtfully and consistently by professional staff. We shifted the student money to a staff line and increased the allocated percentage of time of the Digitizing Technician from 60% to 90%.

The project started with a group of six scrapbooks that were selected based on the current interest by and usage requests from researchers. The conservation treatment they needed was relatively uncomplicated and not time-consuming; also, the digitization imaging needs were fairly straightforward. This first group helped us develop initial workflow and transfers between the three departments. The policies established and conservation protocols devised during the work on the first group continued to inform our processes throughout the grant but as we worked through the later scrapbooks, it became increasingly clear that flexibility and changes were needed and to be expected.

The original treatment protocols had seemed reasonable, but we needed to balance treatment that was absolutely necessary against the overall conservation treatment of each scrapbook to stay within the limits of our grant schedule. Ever mindful of our defining intention to retain the original experience of interacting with the scrapbook, we had to make tough decisions. Did it mean not changing a scrapbook's format or structure? Should we remove all adhesives if the risk of damage was great or treatment too time-consuming? Should we remove items from acidic support pages or preserve as much of the original artifact as possible? For example we initially did not intend to photograph blank scrapbook pages. But when imagining the eventual end user experience of a virtual scrapbook, we decided it was necessary to digitally preserve the creator's original vision when organizing his or her scrapbook and that might include the blanks.

Throughout the grant project, we wrote a semi-regular blog which was hosted on the MARBL website (https://scholarblogs.emory.edu/marbl/tag/african-american-scrapbooks/). After we posted an entry about Reverend Ollie Turner's scrapbook, an Emory senior read it and contacted us to say that Turner was her great-grandfather. Soon, we found ourselves hosting a Turner family reunion, held in MARBL, bringing together relatives from across the country to see the scrapbook, and who helped identify people and places in the photographs.

Our blog was featured in the library's print newsletter and online news feeds. The Emory campus institutional news also picked up our information, and their news release brought us local and national attention. Our project was included in a New York Times feature, and in the Atlanta Journal Constitution's Living section entitled "New Respect for Scrapbooks," and in the Society for Georgia Archivists Newsletter. Kim also wrote an article for the Archival Products News publication.

CONSERVATION TREATMENT

Scrapbooks are complex amalgams of multiple types of deteriorating artifacts, assembled like a time capsule in book format. Scrapbooks in libraries and archives collections are like dirty little secrets tucked into vaults without any conservation treatment, awaiting curation and preservation decisions. Our project scrapbook themes ranged from chronological travel journals to stories of college experiences, military service, and family gatherings. Some were carefully arranged, while others seemed to be random assortments of ephemera (fig. 3).

During this grant project, we developed decision-making processes for treating different scrapbook formats. Historic importance, current condition, and frequency of use determined our conservation decisions. Whether turn-of-the-century constructions or 1970's *magnetic albums*, the

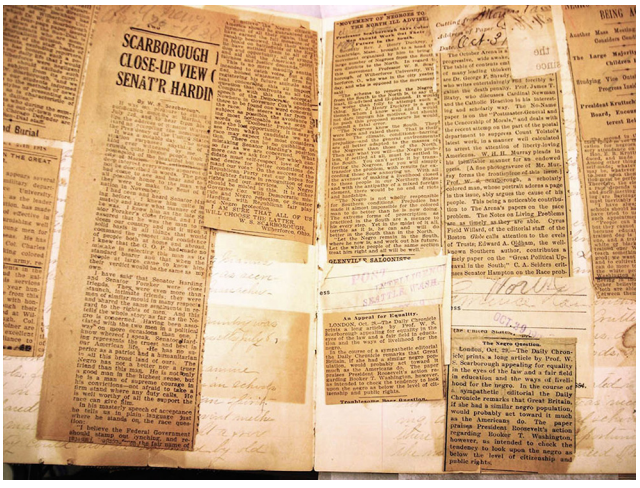

Fig. 3. Pages of deteriorating, acidic newspaper clippings in William S. Scarborough's scrapbook, originally a blank journal book structure.

collection of scrapbooks posed many conservation questions. Parameters of the grant such as time and budget constraints established boundaries around treatment phases, and these factors determined the proper course of action.

One of the most important things we learned was that each scrapbook would command its own treatment. A decision tree, originally developed to guide us, proved to be too complicated. No two items were alike, and though a decision tree can be a very useful tool, we abandoned it quickly.

The African American scrapbooks contained everything imaginable, from half-inch thick military patches to a dance card with the pencil still attached. Unlike traditionally flat book and paper items, the bulkiness of accumulated material within each scrapbook added challenges to the stressed original bindings. Sometimes we decided to separate pages in a scrapbook in order to prevent future damage, though often sections were already loose.

Our intention to retain as much of the original formats as possible did not arrest further deterioration, necessarily. Rather than going to extreme measures to separate acidic materials and remove all adhesives, we considered our approach as the first phase of treatment (fig. 4).

Papers, photographs, and objects were adhered to brittle pages with the entire spectrum of adhesives, all in different levels of failure. It was common to encounter multiple adhesives and layers of tape on one scrapbook page. Sometimes removing these materials was especially difficult or even impossible. For instance, notations written directly on the tape carrier layer were necessarily retained. Sometimes we chose not to remove an unreleased-tape or adhesive in order to avoid more damage.

Often, we were lucky enough to have an adhesive stain map to follow in order to reposition detached items. An example was the scrapbook made upon the retirement of Robert Churchwell, first black staff newspaper reporter in Nashville who reported specifically on education. The structure was made of heavy, hand-carved wooden covers and a rainbow of construction paper pages, bolted tightly at the spine. Over the years, all of the news articles and original collage pieces had released from every page. The stain map was crucial in reattaching everything, and though the treatment was straightforward and uncomplicated, it took 90 hours to complete, more time than any other scrapbook. Just as frequently, there was no apparent position for a loose item found between pages, and we had to study the context of the page to see whether or not the item belonged there. These were just a few of the conservation issues that we encountered.

Bound without regard to the thickness or weight of the contents, most of the book structures were strained beyond capacity, often wedge-shaped or completely broken. Disbinding proved to be necessary more often than not in order to protect the contents. As an added benefit, we were able to achieve better digital images from the flattened pages.

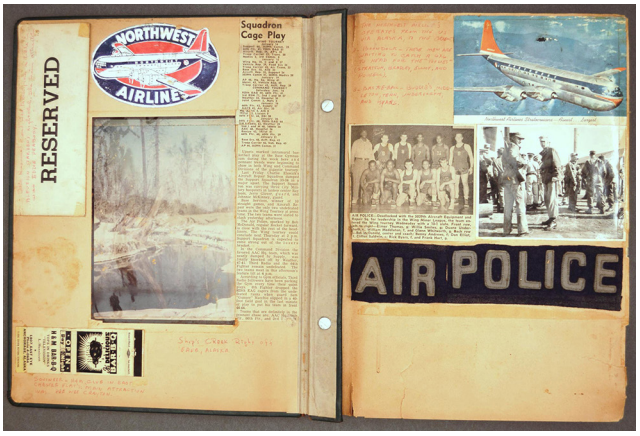

Fig. 4. Pages of artist Benny Andrew's scrapbook with handwritten annotations of photographs, felt patches, and ephemera.

Fig. 5. Support and interleaving pages of the Glaze and Rider Families scrapbook with handwritten annotations on adhered photographs.

Some of our scrapbooks began as blank journals, ledgers, or traditional photo albums; however, many started as repurposed textbooks, magazines, sketchbooks, and one was even stacks of file folders! A few were custom-made like artists' books. Some scrapbooks posed unique structural issues. This was the case with a shared album between two Georgia families, the Glaze and Rider families. In the 1960's, the Glaze family used the heavy support pages for their photos. The thin interleaving pages were used by the Rider family in the 1970's, for mostly saved newspaper articles. This structure was unique because of its original Bakelite plastic covers. Ultimately, the pages were removed from the fragile binding, encapsulated, and post-bound. We retained the original Bakelite covers and housed everything together in a custom-fitted box (fig. 5).

If we found no original binding structure intact or if the simple act of turning bound pages created more damage, we chose to reformat the scrapbook into an encapsulation book. Brittle support pages were weakened with the weight of heavy, attached items. Three-dimensional and problematic materials incorporated in the scrapbooks included photographs (ranging from albumen to contemporary color), artwork, metal and wooden objects, tassels, pamphlets, invitations, greeting

cards, and more. Occasionally, we found craft projects tucked into scrapbooks, making encapsulation tricky. Each of these materials had different preservation concerns.

If an item on a page required user-interaction, like unfolding large newspaper clippings, we had to decide the best conservation approach. One question we asked ourselves was whether or not to fully encapsulate, possibly leaving a page open at the top for access. A quarter-inch stack of telegrams received by vaudevillian Johnny Hudgins had caused severe distortion and damage. For this scrapbook, we decided the best solution was to separate and create new pages for the telegrams. Should we leave original and damaging fasteners such as staples? For example, author Alice Walker stapled her college photos to the support pages. We removed the staples and sewed through existing holes to secure the items.

Most of the volumes required stabilization repairs before being digitized. However, we did not anticipate the reality of providing immediate treatments identified during the digitization process. For example, a side-sewn pamphlet did not open enough to reveal all of the content for optimal digitization and needed its threads snipped (and later re-sewing.) While not frequent, we found ourselves providing on-the-spot treatments. If the conservation treatment dramatically changed the original structure, those specific scrapbooks were reimaged to capture the final bound product.

Developing clear lines of communication between our three library departments was most critical. Regularly updating a shared document allowed each team member to track where items were in the process. Ensuring that our team had proper *care and handling* instruction of such fragile materials proved beneficial for everyone involved. Re-associating loose items, separating glued stacks of paper, lifting photographs for hidden information, and reformatting some of the more fragile scrapbooks into post-bound albums were all group decisions.

Treating these scrapbooks allowed us to interact with them on an unexpected level, not just repairing but understanding the process that was used to create each one. For those items included in our grant project, every cover, page, foldout, attached object, and overlapping layer was stabilized, repaired, reattached, rebound, rehoused, and returned to its important place in MARBL at the Woodruff Library of Emory University. Ultimately, the goal is for researchers to access the digital images rather than handle the physical item. With this approach, we hope to prolong the life and experience of using each scrapbook.

THE DIGITIZATION PROCESS

As the objective of the grant was to retain the original experience of using each scrapbook, the goal of digitization was to meticulously photograph all facets of each scrapbook.

Before work began, we underwent an extensive planning process to calculate how much time needed to be dedicated to digitizing the collection. We estimated this by timing each phase, from camera adjustments to image capture and processing files. Due to the collaborative nature of this project, a custom workflow was designed to indicate the locations and handoffs of each scrapbook from MARBL to Conservation through digital preservation and image processing. A shared workflow spreadsheet was an invaluable tool in keeping track of each scrapbook at any stage in the process. Each department involved in the project regularly updated the spreadsheet and monthly team meetings were held in order to keep all parties apprised of the overall progress.

Upon receiving grant approval and funding, we had to procure equipment, software and materials in order to properly accommodate a project of this scope. We began several weeks of research and vendor negotiations. Our goal was to purchase imaging equipment that met our needs and standards, provided support and service from a reliable, preferably local, vendor, all at the best value possible.

We purchased a Phase One medium format camera with a Mamiya digital back, capable of capturing 80 megapixel images. The digital back contains a full-frame charged-coupled device (CCD) sensor, allowing for greater detail and a large capture frame. We also purchased two high quality lenses capable of providing exceptional detail. Specialized software (tethered to the camera) controls the camera operation, image adjustments, processing, and metadata creation. We chose the Atlanta-based vendor Capture Integration for their quality of service and competitive pricing, as well as their proximity to the Emory campus. Over the span of the project, our close working relationship with Capture Integration proved invaluable. Their knowledgeable technicians provided training; prompt service and trouble-shooting on equipment and software.

EQUIPMENT, SOFTWARE, AND MATERIALS

Workstation

- 2010 Mac Pro - 2.8gh Quad Core Intel Xeon Processor - 12GB Ram
- OS X 10.8.5 - 1TB of drive space
- 26" LCD Cinema Display

File Management

- Capture One Pro - image management software
- Photoshop CS6
- Golden Thread - image quality control software
- Mac Pro internal hard drive 1TB (*only used for storage while processing images*)
- 2TB External G-Technology Drive
- Networked Shared Drive (2TB expandable storage space) - onsite

- Extensis Portfolio Server (Digital Asset Management System) - onsite
- Offsite Storage - expandable and protected through University Information Technology Services. This system keeps multiple copies of all files and housing them both on campus and in downtown Atlanta.

Camera
- Phase One 645 DF Medium Format Camera Body
- Mamiya Leaf Aptus II-12 80MP Digital Back

Lenses
- Schneider Kreuznach LS 80mm
- Phase One Digital AF 45mm

Lighting
- 2 banks of TTI LED lighting, 2100 LED System

Reproduction Stand
- Tarsia TTI 3040 with 30" x 40" vacuum table base

Other Materials Needed
- UV coated Museum Glass - various sizes
- Framing grade Acrylite clear acrylic - various sizes
- Optium Acrylic - various sizes
- Anti-static brushes/cloths
- Anti-dust (canned air, cloths, duster)
- Rope weights - lead pellets covered with unbleached muslin
- Book cradle (used for supporting items with weak binding while shooting)
- Ethafoam and binders board for miscellaneous support of pages/binding
- DICE color chart
- Metal framing square - 16" x 24"

PROCEDURAL INFORMATION

1. ASSESSMENT

Conservation assessed each scrapbook's condition to determine if stabilization was required prior to image capture. Also, many times in the process of image capture, an item needed additional work requiring immediate attention, e.g., loosened items, creased or folded paper, removing staples, etc. These situations required a close working relationship between team members for simple pass-offs and accurately documenting changes in scrapbook location. After the assessment was made and the item deemed stable, the digitization process began.

2. ITEM IDENTIFICATION

A log entry was created that detailed each item's information, along with technical data that included recording the camera's settings, position of lights, and processing information, as well as notes about specific aspects of the scrapbook being digitized (fig. 6).

Job: William H Scott 12041
Collection: BV3
Date: 4/11/2014
Operator: BMM

Description: William Scott Scrapbook - Bound book with pasted in clippings
Camera: LEAF Aptus II
Scanner: N/A
Camera position: 0000
Vacuum Table: Off (media too thick to be suctioned to table)
Musuem Glass: Yes (Acrylic) NON UV-COATED
Lights: LED units
Lighting Position: raised 13" - approx 43" from floor to base of LED Fixture
Ruler: Included in shot
Grey Card: DICE Target Included in Shot
White Balancing Prior to Shooting: Yes
Processing: 400dpi TIFF Archival and Production masters
Post-Shooting Quality Control:BMM

Notes:
**** Scrapbook consists of clippings pasted on to existing bound book pages.***
*****Due to the compact size of this scrapbook, the digitization will be conducted in "spread"format in order to expedite the process.***
******The spreads can be later cropped as separate pages as a post production process.***

Fig. 6. Example of a log entry.

3. PREPARATION AND SHOOTING

A scrapbook's dimensions determined the best camera position. Lighting should be even overall and minimize shadows created by neighboring items, pages, or gutter, which could potentially obscure information. In order to ensure the page is as perpendicular to the camera lens as possible, clear acrylic was used to gently flatten and minimize creases and buckling. For archival purposes, each image included a ruler and a DICE color chart to ensure correct color and white balance. Every page was photographed (including the scrapbook's covers), as well as every layer or side of every item, ex., letters in envelopes, double-sided items, and backs of photographs.

4. IMAGE NAMING SCHEMA

Each image was named according to its location in the scrapbook. We devised a custom-naming convention to handle the unique structure of each book. Each name is four parts separated with underscores: P0000_I0000_P0000_BP (or) LI, each section referring to a position:

- P0000_refers to the Primary image of each page of the scrapbook.
- Each page may contain several items; I0000_refers to individual Items attached on the page. Each image is a shot of every layer/side of each item.
- If an item has more than one side or page, the second P0000_refers to each shot of every side or page.

- _BP refers to a Bound Page (or) _LI refers to a Loose Item - any item that is not attached to the primary page. An example is a loose letter page inside an envelope (fig. 7).

5. QUALITY CONTROL AND PROCESSING

After each page and item was digitally captured, the files underwent quality control (QC) and processing. The QC check involved comparing every digital image against each page and item in the scrapbook to ensure that everything was captured. Each image had to meet our quality standards for focus, color and white balance, as well as lighting consistency. After QC, the next phase was to convert the camera RAW (.MOS) files to 400dpi TIFFs. Each image was processed in two versions—the Archival version is the entire page, including the ruler and DICE color target. These were given the extension _ARCH; the Production version had the image cropped tightly around the primary page or item and were given the extension _PROD (fig. 8).

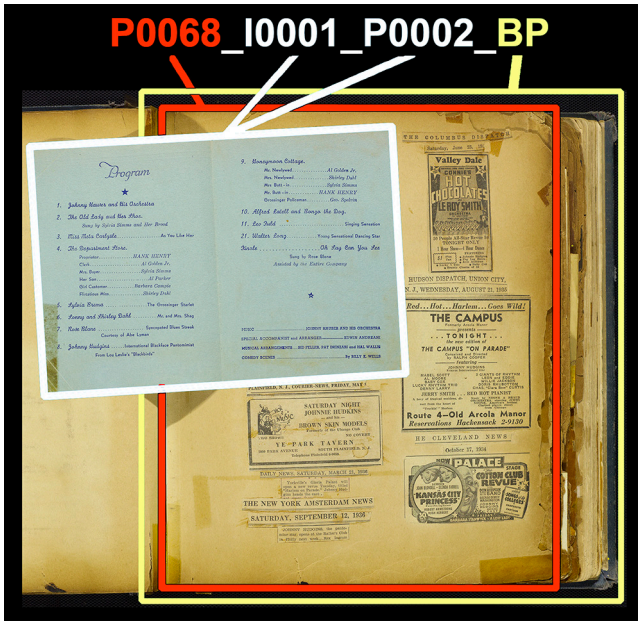

Fig. 7. Example of the naming structure in use.

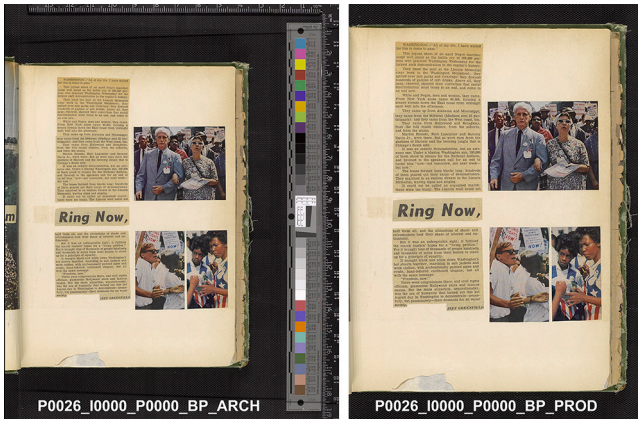

Fig. 8. Examples of Archival (left) and Production processed images.

Each image was packaged for archiving using a standardized file-naming schema that detailed the scrapbooks' structure. All digital files were uploaded to an archival network storage server, issued Archival Resource Keys (ARKs), and Digital Masters database metadata records. Once each book was completed, a second QC was performed, using the DICE color targets via Golden Thread software to examine each image for color accuracy, sharpness, and overall image quality.

6. FILE BACKUP AND MANAGEMENT

The image files were backed-up on an external hard drive, a networked drive, and on a monitored and secured off-site server. Saving and securing multiple copies of each image provides for a more reliable file backup system. The images were also uploaded into a Digital Asset Management System (DAMS) for onsite viewing and access.

DIGITIZATION CHALLENGES

Each scrapbook in the collection had unique challenges. Due to the personal nature of each item, no two books were alike, nor could be handled the same way. A challenge of digitizing of this collection was making sure that during capture, the integrity of the objects was not compromised. Considering that most of these scrapbooks were assembled by people who did not have archival methods in mind, along with the variety of age, wear, and format, all made the digitization process challenging.

Each scrapbook had to have its own method of support and preparation in order to ensure the highest quality images were captured. Affixed items often obscured information beneath them. We learned that the use of magnets cast a shadow and so we had to devise other ways to remedy this—combinations of foam, board, and rope weights worked well to lift layers, a sheet of glass or acrylic flattened creased items which helped to minimize shadows. From strategically supporting pages and bindings, to the utilization of glass and positioning of individual items, the various techniques we devised aided in making sure we digitally preserved each scrapbook accurately.

In addition to preserving these historic books, our goal was to create an accessible digital library that researchers will be able to use for years to come. In order to capture the original experience and intent of the creator, some scrapbooks required digitization both before and after conservation treatment. The conservation work that revealed hidden information and the reformatting of several of the scrapbooks into polyester encapsulation books required a second digital capture, making our process more time consuming. In the case of Johnny Hudgins' scrapbook, thick stacks of Western Union telegrams were glued together, obscuring valuable dates and times. Digitization was necessary both prior to

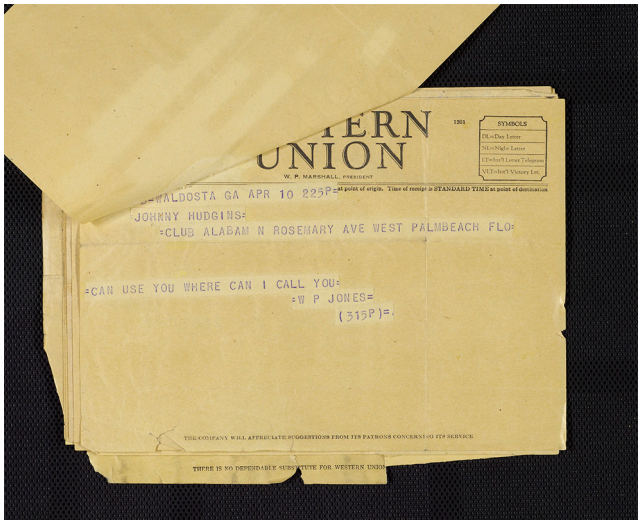

Fig. 9. Example of a partially obscured item.

separation of the layers and again after the telegrams were encapsulated (fig. 9).

Because amateur, personal historians handcrafted these books, we saw various stages of completion, for example, many blank pages with loose items tucked into a gutter. We decided not to capture large sections of blank pages, though we did include a blank page if it helped preserve the order of the creator. Loose or orphaned items included clippings, ticket stubs, hand-written scraps, photos, cards, and other personal documents. These items were captured and the images placed at the end of that scrapbook's image family. Though certainty of location was unclear, we wanted to document that the creator had included those items.

CONCLUSION

The conservation and digitization of the African American scrapbooks chosen for this grant project was a complicated, informative, and very successful process. Developing efficient handoffs and documenting workflow between the three departments was crucial to the success of the project. Cross training between our Digitization and Conservation teams on proper care and handling of fragile materials and learning proper metadata schema proved beneficial. We were successful, because we formed a cohesive and responsive team that was supportive in meeting the standards of each department.

The three and a half years spent working on this grant project gave us a wealth of experience and knowledge, most of which we are continuing to use in our daily workflow. This project allowed us to be creative in devising solutions to the challenges we encountered. From tasks as simple as developing a project workflow or naming convention, to those as complex as reconstructing an entire scrapbook, we learned that the early protocols we developed could be changed and adapted for the needs of each item treated. As the project continued, we became more familiar with the types of challenges these books presented. The methods we employed became "standard practice" over the course of the grant, and this made the processes much more efficient. Our original decisions influenced our final outcomes, providing us with a solid foundation for working on future scrapbooks in our collections.

The Digitization and Digital Curation department wanted to capture images that could be later used in a virtual repository. It was imperative that each image was captured and named in such a way that these scrapbooks could later be "recreated" in a virtual environment. Though our grant funding covered only the physical and digital preservation of the collection, the importance of making this collection available in an easily accessible front-end online environment remains as a top priority as it will be a valuable tool to researchers. Currently, Digitization and Digital Curation, MARBL and Emory University Libraries are in the early planning stages of creating an online repository for this collection. This ongoing project continues beyond the grant in the hopes of sharing this valuable collection with researchers, students and historians across the globe.

Having had the privilege of interacting closely with these personal collections of a rich African American heritage only reinforced this need. The wealth of personal and historical information relating to African American heritage contained in these scrapbooks is staggering. Perhaps the most interesting aspect of working on this project was seeing how people record their memories. Each hand-written note, every carefully placed photograph or artifact, cards, clippings, and drawings were all chosen for a reason by the creator of the scrapbook. Something seemingly unimportant to some, such as a ticket stub or receipt, was a cherished memory to others. These scrapbooks are a physical representation of their creator's emotions and memories.

With each passing year, time takes its toll. Inks fade, papers continue to age, and memories are lost. These scrapbooks won't be around forever, and is why preserving them was so vital. Through our efforts, they can live on digitally. Having the opportunity to "read" the memories these amazing creators over the course of this project was a unique and fulfilling experience. One, which we hope, can be shared with others for generations to come.

ACKNOWLEDGMENTS

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The Fadden More Psalter: De-Watering the Vellum Text

Fig. 1. The Faddan More Psalter after its retrieval from the bog.

INTRODUCTION

The Faddan More Psalter is a late 8th century codex discovered buried in a peat bog in North Co. Tipperary in the summer of 2006. It was reported as one of the most significant archeological discoveries in Ireland and among the "top ten" of the National Museum of Ireland's[1] treasures. Its unearthing was reported by the World's media and it is the first Insular[2] manuscript to be discovered in Ireland in over 200 years. Significantly in relation to this paper, it is also the first known early manuscript to be discovered in a wetland environment world wide as far as the author is aware. The following describes some of the more specific conservation aspects of this project, in particular the 'de-watering' techniques used to help facilitate access to its historical origins and provenance. The focus of this paper requires much to be omitted in the way of codicological information, and indeed many other aspects of the conservation and identification. The preservation of this unique 'bog book' has opened up many interesting areas of collaborative archaeological, historical and conservation research, and its world interest continues.

HISTORICAL DESCRIPTION

The Psalter is part of the Old Testament from Christianity. It contains Hebrew prayers and poems. Traditionally much of the content is attributed to King David. In Ireland the Psalter played an important role in monastic life as part of the divine office; a series of daily prayers and readings to be recited. The Psalter is also recorded as a teaching aide when instructing a young novice (often as young as seven) how to read and write before entering the monastery as a novice.

The explanation of how this particular copy found its way into a bog in Tipperary is un-clear. Archeologist Maeve Sikora from the National Museums staff carried out detailed excavation work at the find spot. The results of this work combined with fragments of associated material located in the same area give us some very interesting clues as to the last days above ground for the Psalter. We have the remains of a bag, manufactured from some form of collagen-based material. Also found were deposits of hair like material, which after analysis have been identified as an animal pelt, possibly calf and strongly suggests the manuscript was covered with this material during deposition. From the outset there was speculation that the Manuscript was concealed in this location. This in turn led to evocative stories of a fleeing monk burying his precious book while being pursued by marauding Vikings, such raids being recorded at the monastery in Birr, in neighbouring County Offaly. Fascinating speculation, and hopefully the continuing investigation may help us fill in some of the gaps, of which there are many.

Presented at the Book and Paper Group Session, AIC's 42nd Annual Meeting, May 27–31, 2014, San Francisco, California.

PHYSICAL DESCRIPTION

MANUSCRIPT

The manuscript is calfskin vellum, and allowing for trimming, it is likely that one skin would have provided two bifolia. Contemporary animal husbandry suggests that animals were smaller than they are today, so somewhere around fifteen calves would have been required to produce the Faddan More Psalter. There are approximately 31 to 32 lines to a page and the text block is approximately 305 X 226mm In its original form the text block contained 5 quires of varying folio counts and layout, with two quires containing 10 leaves and a twelve, a thirteen, and a fifteen for the remaining three quires, giving a total of 60 folios; no flyleaves although the last folio of the 5th quire is blank. The layout follows neither the Insular practice with hair side of one folio facing flesh side of another nor is it consistent in having the hair side on the outside of the quire as found in the Western tradition[3]. Likewise it ignores the continental or Gregory's rule of like facing like, it is more accurately described as ad-hoc, in the best Irish tradition!

THE COVER

The manuscript is contained in a semi-limp leather cover similar in execution to early Coptic structures[4] although in the case of Faddan More there is no clear evidence to suggest the gatherings were mechanically attached in any way. However we did find evidence of the use of quire tackets[5].

CONDITION ASSESSMENT, INCLUDING SCIENTIFIC ANALYSIS

Conservation measures were considered and evaluated as soon as the codex was excavated from its twelve hundred year archaeological environment and brought to the Conservation Department of the National Museum of Ireland. Much time was spent in assessing preservation needs with respected experts in the field[6].

To gain a better understanding of the components of the codex, specifically the vellum, and their condition, a selection of analytical procedures were embarked upon including the level of degradation and shrinkage the vellum had suffered over the years. In the first instance we employed non-destructive techniques such as MRI scanning and multi spectral imaging, which were for the most part unsuccessful, and High Definition filming including close ups[7]. CT scanning and X-ray were ruled out on the basis of reports of X-rays accelerating vellum degradation. Analysing how far the irreversible state of gelatinisation[8] had gone, as a second phase of analysis, we sent two small samples under licence to The Royal Danish Academy of Fine Arts School of Conservation. Here Rene Larsen, (Rector, Associate Professor, PhD) put the samples through the range of tests developed for the IDAP programme (Improved Damage Assessment of Parchment)[9] with an additional amino acid test to establish levels of oxidation of the vellum. The results of the Danish tests confirmed the much of the visual evidence in relation to gelatinization and severe damage to the collagen fibres. Levels of oxidation were quite low however, no doubt due in the most part to the generally anaerobic environment in the bog. Surprisingly, shrinkage temperatures remained very high and comparable to that of good quality new parchment, this possibly due to the partial tanning of the vellum from organic tannin in the bog material.

SEPARATION OF VELLUM LAYERS

The first major conservation challenge was that of separating the remaining vellum fragments from both each other and the mass of bog material surrounding the manuscript. Even a casual glance at the "as found" image of Faddan More will tell you that the typical approach to "pulling"[10] of the manuscript did not apply here. There was severe trauma and disturbance throughout the structure and indeed the find was said to resemble over-cooked lasagna more so than a medieval manuscript!

As we are aware, the nature of conservation can be said to be destructive in so much as disturbing material from its as found position results in the loss of information and this was particularly emphasized in the case of the Faddan More Psalter. With this in mind much time was given over to recording position and orientation of fragments before separating from the mass.

The use of backfolds is, as we know a basic aide to working out the collation of a bound volume, given that the survival of this feature equated to an average of 5mm, this combined with the complete book block being split across the book, spine to fore edge and the long period spent in this hostile and fluid environment, resulting in much movement between the leather covers. Again an emphasis on recording became central to the early stages of the hands on work. A Perspex® bridge was constructed, onto which a grid with x and y-axis was inscribed. Work would commence by sliding the entire manuscript, which sat on a Corex® base board under the bridge. After establishing which fragment was to be removed, the piece in question was mapped and recorded with a grid reference and also recorded photographically. During this stage, which continued for over 18 months, the manuscript was maintained in its saturated state and stored in a cold room at 4°C. The requirement to keep everything wet restricted the working time for any given session and while out of cold storage the moisture levels were maintained by spraying with an atomizer filled with de-ionized water. There was concern during this stage of the project that problems may arise with microbiological growth occurring once the organic material is removed from the protective and largely anaerobic environment of the

Fig. 2. A view of some surviving backfolds in-situ.

bog. Also, typically organic material survives better here than in soil, research suggesting that sphagnum moss, a component part of a peat bog plays a major role in this process. It has the ability to immobilise microorganisms and according to Terence Painter[11], produces an antibiotic substance called sphagnan that bind with proteins on the surface[12]. The concern was that by maintaining the saturated levels by spraying with de-ionized water the effectiveness of the bog water was diluted each time. Fortunately we saw no such growth during any stage of the work (fig. 2).

The first task prior to removal was to study the small area of extant backfolds. As these were in-situ they gave some clue to the original make-up of any given quire, also some codicological detail could be extracted such as the use of singletons or inserted folios. This proved to be a difficult and time consuming task but essential if we were to successfully establish a collation map of the manuscript. It should be remembered that even though we had a well-known and recorded text in the Psalms, we had several folio fragments where no writing had survived and only its position in the quire gave any clue to its identification. The physical position of the text block very much dictated the order of dismantling, and it was approached layer by layer, searching for natural divisions between the clumps of material, this usually occurring between quires. A thin slip of printers plate, cut to approximate the width of the piece in question was covered with a fold of silicone Mylar® and slowly eased between, the spraying with deionized water of the separation point assisted the transmission and reduced surface friction. This process continued until the delineation between the layers was no longer in evidence, and at this point the material, which was at a more advanced stage of deterioration, had become a single mass of gelatinised vellum, surviving letters and bog material, containing plant roots, seed pods and degraded plant material.

Fig. 3. Bifolia of quire two separated and ready for cleaning.

The intact folio fragments were lifted away and in a separate operation the associated mass material was removed. The task of separating out the intact fragments was achieved by facing with Bondina®, which adhered to the saturated vellum through surface tension. The individual fragment could then be lifted away and prepared for cleaning. (fig. 3).

CLEANING

The now separated and supported larger fragments were prepared for cleaning excessive dirt and debris that hindered the script, whilst it was saturated. The obvious advantage of the saturated state of the Psalter was the possibility of employing water as the main cleaning agent. The cleaning process proceeded more or less as follows:

1. The fragment on its Bondina® support was laid out on a sheet of glass, another sheet of Bondina® was laid on top and the fragment sprayed with deionized water. This allowed the piece to be manipulated to lie as flat as possible.
2. The top sheet of Bondina® was lifted away, and this in fact started the cleaning operation as it had the effect of lifting way some of the looser debris. A fine Japanese brush was dipped in deionized water and used to brush more material from the centre towards the edge of the fragment and from here onto the glass. This allowed examination of the material for matter other than bog and plant contamination.
3. For the next stage a piece of chemical sponge cut to a convenient size was first soaked in denatured alcohol and then in deionized water before being wrung out. It was rolled across the surface where it picked up smaller loose material missed by the brush. A second method of placing the sponge on the surface and allowing the water on the surface draw towards the sponge bringing with it even more debris. This proved a useful approach where the fabric of the vellum was very degraded and unable to withstand any

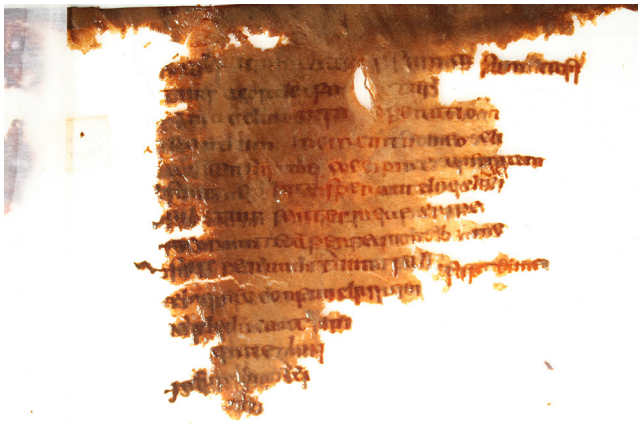

Fig. 4. Folio 13r after cleaning still saturated.

direct contact. When nearing the end of a wet stage cleaning, denatured alcohol would be introduced in solution in order to introduce the vellum to the solvent that would later be employed in the de-watering process

4. The final stage involved the use of a fine stainless steel tweezers and the picking off from the surface, what at this stage were mostly seedpods, of which there were thousands! They proved particularly difficult as when saturated they are quite transparent. All the above stages were carried out under a 3dioptre illuminated magnifier lamp.
5. In areas where the condition of the vellum was considered "robust" a further method that proved very successful was employed on occasion. Here a Dahlia® atomized sprayer was used to spray across the surface and by adjusting the angle, at which the unit was held, usually almost parallel to the fragment, much of the debris was pushed off, the intensity of the spray could be further modified by allowing the pressure in the sprayer to drop before use (fig. 4).

The clean fragment was faced with a new sheet of Bondina® and turned over to allow the operation to be repeated on the verso. It was imperative to maintain the saturated condition of the vellum throughout due to the further risk of instability if the drying process was not controlled effectively. After cleaning, a sheet of Mylar was placed over the fragment and the piece mapped using a permanent pen. Some datum points were measured and marked as was the centre fold line given that this feature was not always easy to locate once the bifolium fragment was dry. At this stage surviving edges consisting of narrow strips of vellum no more than a few millimeters in width were aligned to their correct position.

The quantity and variety of information produced, as each fragment was processed required particular attention. To this end a database was devised using File Maker Pro® as a platform. This proved an essential tool allowing as it does additional information to be inserted as it comes to light. Each record contains information such as the grid reference for location as mentioned above, folio number, psalm number (where applicable), general observations and the removal or addition of any newly discovered related fragments. A tag number was designated to each fragment as the folio number often changed as new evidence came to light effecting collation. This method allows any given piece to be tracked through the aforementioned changes.

DEWATERING TRIALS

Having established the condition of the Psalter vellum at a microscopic/cellular level it was decided that there was a need to understand the reactive condition of the material in comparison to the expected behavior of vellum that has not been subject to the long-term exposure of the extreme environment of Faddan More. It is commonly understood that the fibre structure of vellum retains much tension through its manufacture, which makes it sensitive to adjustments in relative humidity and temperature due to a low hydrothermal stability[13].

A small un-locatable fragment with no marking on the surface was selected for testing. This was flattened out and traced, then allowed to air-dry at normal room conditions. The result was difficult to access such was the change in physical condition. The fragment was very brittle and had shrunk to less than half its original dimensions, it was also very dark and almost unrecognizable as vellum. Although this is the same reaction we would expect from modern vellum in the case of the Faddan More each feature appeared exaggerated (fig. 5).

One of the difficulties of trying to discover how best to dry out the vellum was the lack of material on which to test any possible solutions. The unique nature of the problem also meant there was little to nothing in the way of previous published material on the subject. In order to address the first issue some discarded vellum flyleaves from a late 18th century binding were prepared by hydrating between saturated

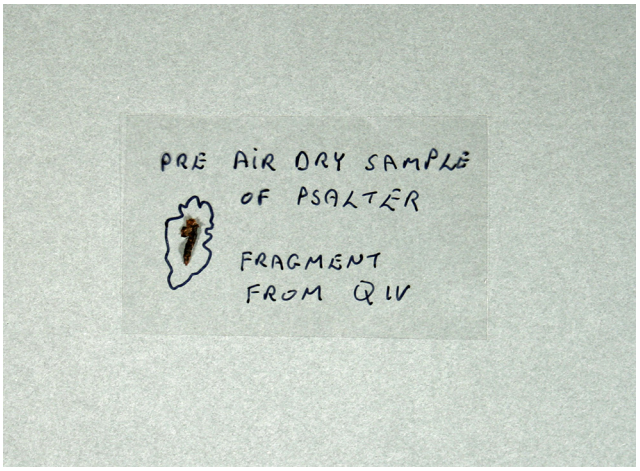

Fig. 5. Air dried fragment showing level of shrinkage.

blottings. The vellum sandwich was then placed into a large ziplock® bag under glass weights and left for a month at ambient temperatures. The end result was thoroughly saturated vellum with evidence of microbiological growth and dramatic change in appearance and handling characteristics. This did replicate some of the physical properties of the Faddan More vellum, and likely some of the conditions at an individual fibre level, but in most respects was still quite a different material. Nonetheless given the unique nature of Faddan More combined with the variation in manufacture methods between early Medieval vellum and that of the later centuries, we were always expecting a high degree of compromise. During trials the test vellum was maintained at the same conditions as Faddan More, 4°C and saturated.

As a basic principal, it was agreed that no chemical be added to the vellum that would remain after the completion of the drying process. This principal was established primarily because of concern over the possible long-term effects of chemicals such as polyethylene glycol and glycerol on the inks and pigments present in the manuscript, and as such ruled out some possible archaeological conservation techniques[14]. Central to these concerns was how these chemicals may obstruct future non distructive pigment analysis.

It was clear from the outset that one of the major issues was the physical restraining of the vellum as it moved from its saturated state to a dry one as the un-bound water was removed, regardless of the method chosen to achieve this. We know as a result of the manufacturing process of vellum that the cell structure is drawn into a low angle of weave and any uncontrolled removal of the un-bound water would result in a loss of this tension and unacceptable levels of shrinkage and irreversible gelatinisation of the vellum as the fibres stuck to each other. Normally this is avoided by physically restraining the vellum around its circumference as the drying process proceeds. This was not an option for Faddan More due to the degraded nature of the material. As an alternative, the methods listed below were chosen for trial in this aspect of the operation:

- The use of a suction table.
  - Sample places on double layer of Bondina® and surface of table masked off as required. Table set at 28" H_2O with ambient values of 20°C and 57% R.H. In order to reduce cupping as the sample dried layers of Bondina® masking were placed around the circumference of the sample. As drying of the samples neared completion the table setting was reduced to 13" H_2O
- The use of a vacuum machine.
  - Vellum samples placed between 100% cotton blotting papers and into an Archipress vacuum bag®. Vacuum pulled for 35 seconds and bag heat sealed for 5 seconds. The bag remained sealed for 24hours before opening to observe results.
- Vacuum freeze-drying.
  - Sample placed in unit for three days.
- Under glass weights at ambient values.
  - Vellum samples placed between 100% cotton blotting papers, under weight. After two to three hours the blotting was replaced with dry pieces. This process continued until the vellum reached ambient values.

The principle was to establish which of the four methods would best serve our needs in relation to controlling shrinkage, after which we would trial how best to remove the excess water from the saturated vellum. The best in each category would then be combined to deliver a working drying process. This somewhat simplifies what actually took place but in principle it was a successful approach. In deciding on how to proceed with the second phase of water removal, it quickly became apparent that some form of solvent exchange system, as practised in archaeological conservation, particularly in relation to saturated timbers might prove useful. This is based around the different surface tension properties of solvents including water, which has a high value. The higher the value the more likely it is to collapse cell walls as it is evacuated resulting in shrinkage of the velum. The selection of solvents was short listed for trialing based on properties such as their working characteristics, polarity, and health and safety issues, assuming that the conservator would be working in close proximity with quite high volumes of the chosen solvent over a lengthy period of time. An example of a rejected solvent was petroleum ether (H_3C O CH_3), because of its very fast evaporation rate, which allowed no working time with the solvent saturated fragment. The short list was as follows:

1. De-ionized Water (of course the vellum was already saturated with water, but trials drying straight from water were included)
2. I.M.S Industrial Methylated Spirit 95% (denatured ethanol)
3. Acetone (propan-2-one)
4. Acetone/H_2O 80:20

The criteria for comparison were partly associated with the IDAP results and its methodology of collection condition assessment, the following is the complete list of comparisons made:

1. Dimensional change: judged by measuring around the circumference of the sample.
2. Thickness: three measurements were taken at different points on the sample using a dial micrometer
3. Flexibility test: Using the four I.D.A.P discs of varying thickness to allocate a flexibility value to the test sample

4. Colour Value: A value was allocated to each test sample based on the Colour Atlas 96, Natural Colour System. A value was recorded for both hair and flesh side. A viewing box was constructed @1000lux to maintain consistency in recording before and after values.

The samples were prepared by cutting the vellum into triangular pieces that enabled, a high number of trial pieces out of a limited supply of material. It was also considered that this shape would represent the different tensions asserted by the different areas and direction of a skin (figs. 6–7).

Once the trials commenced we were quickly able to eliminate the suction table because of the difficulty it had in holding the sample in place once evaporation had begun, regardless of the solvent in use. We tried various settings and masking of the base, all proved unsatisfactory. Freeze-drying through water was also eliminated at an early stage due to the following observations: No distortion, an average of 3.5% shrinkage, opacity maintained, but critically the sample has "pulped up" with a spongy feel and noticeable increase in thickness and loss of natural pigmentation on the hair side, becoming almost white.

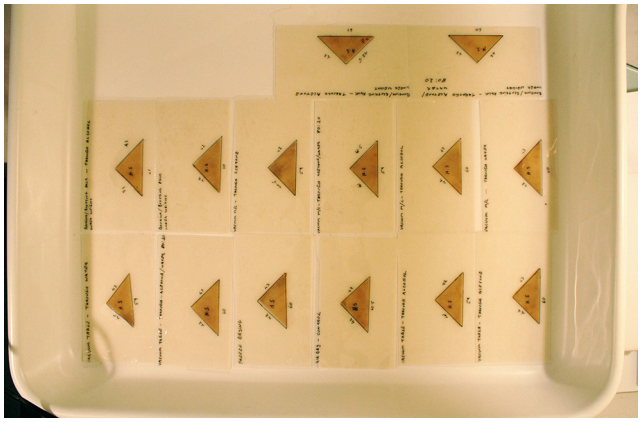

Fig. 6. Trial vellum pieces.

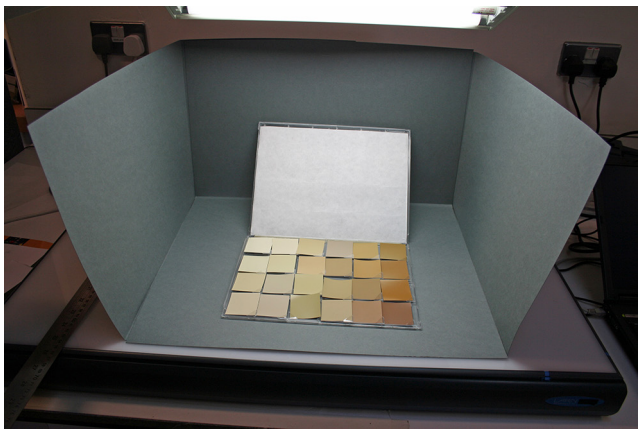

Fig. 7. Colour value station.

Due to the fast evaporation rates of all the other solvents it was not deemed worthwhile to test these through vacuum freeze-drying.

The basic format resulted in four trial pieces, each with a different solvent, tested through the three systems. By way of a control an additional four trial pieces with the four solvents were also allowed air dry. The results of the criteria listed above were then compared to the before and after values. Obviously the goal was to try move from the wet to the dry state with the minimum change in values, particularly in relation to the dimensions.

When we had promising results from different combinations, then we would compare the two against each other and repeat the test with new trial samples. An example of this was: solvent- H2O, mechanism- vacuum M/C, compared with solvent- H2O, mechanism- glass weights. Other results sometimes encouraged us to try a variation on our standard criteria. We had for example achieved good results through the Acetone/H2O method, however during the solvent exchange process a level of "activity" was noted in the solution in the form of bubbles in the solution and eventually a fine film forming on the surface. As an alternative we then tested denatured ethanol/H2O at a lower 98:2, given that denatured ethanol already contains a fractional percentage of water. Keeping in mind the limited supply of trial material we focused on only the most promising results.

SOLVENT EXCHANGE PROCESS

The trial vellum was placed in a bath of the solvent in question and covered. It remained here for an average of 12 hours after which it was changed for a fresh bath. The specific gravity of the solution was recorded before and after in an attempt to gauge any water content in the solution. Given the small size of the trial fragment and quantity of solution this did not prove to be a definitive method for the trials, but was useable when it came to the larger fragments of the Psalter vellum itself.

FINAL TEST RESULTS

The *vacuum machine* showed great promise from early on as it delivered the required criteria in a controllable fashion. The main advantage proved to be the ability of the blotting sandwich inside the vacuum bag to begin the drying process by the transfer of solvent from vellum to blotting while maintaining the integrity of the vellum[15].

For dewatering we settled on drying through *denatured ethanol* although the denatured ethanol /H2O 98:2 ran a very close second place and may even be preferable where the saturated vellum is less degraded.

From here a small piece of the Psalter vellum was chosen, with no writing and no clear evidence of its correct location. It was processed through denatured ethanol and vacuum

machine after first recording the same information as for the trial pieces. On successful completion of this fragment, we repeated the process, this time with a larger fragment of Faddan More that also displayed some writing. Again this satisfied the criteria laid down. The procedure was put before the Faddan More Steering Committee and approval was given to proceed with the complete remains of the vellum text block (fig. 8).

DEWATERING PROCEDURE

Remembering that processing began with the removal and cleaning stages already documented, from here the dewatering procedure was as follows:

1. The cleaned and saturated fragment was transferred into a bath of denatured ethanol while still supported between Bondina® sheets. The top of the bath was then covered. After 12 hours the solution was changed for a fresh bath. A graduated cylinder filled with denatured ethanol from each bath was taken and the specific gravity measured. The process was repeated after the time period had elapsed. The change in value indicated the take up of water (fig. 9).
2. The bath was drained and the Bondina® interleaved fragment laid out on a sheet of glass. The top sheet was removed and the any distortion of the vellum, particularly the long ribbon like edges were manipulated into position.
3. The top sheet of Bondina was replaced and the fragment placed between four sheets of 100% cotton blotting. This sandwich was then placed into an Archipress® vacuum bag and from here in the vacuum machine[16].
4. The bag and contents was placed parallel to the sealing bar with the open end of the bag resting on the bar. A large pressing board was placed on top with some additional loose weights. This prevents the fragments shifting before the expulsion of gas from the chamber. The weight does not affect that expulsion. A vacuum was pulled over a 40 second period and the sealing bar for 5 seconds. It was essential there was no delay between step 3 and 4 as the solvent began to evaporate (fig. 10).
5. After three to four hours, depending on the size of the fragment, the sealed bag was opened and the blottings changed. The pack was put back into the bag and the procedure repeated, this time for a 20 second vacuum. This stage only proved necessary for the larger fragments, due to the higher volume of denatured alcohol required to be displaced.
6. The vacuum bag was opened and the fragment removed. The Bondina was replaced for fresh sheets and everything placed between new dry cotton blottings, under a pressing board and lightweight. After three to four hours the blottings were replaced and weight reduced. The concept here was to acclimatise the vellum to ambient conditions[17].

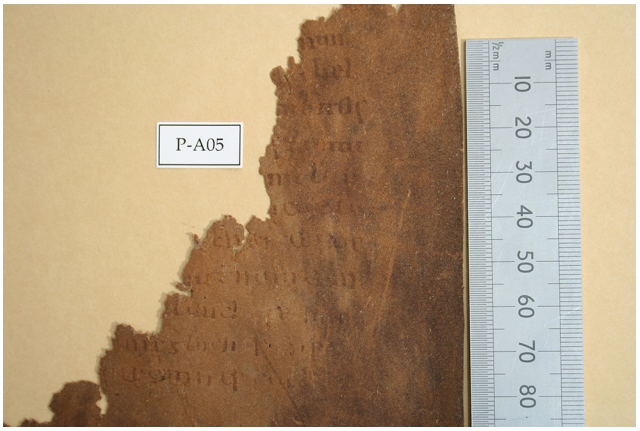

Fig. 8. First successfully de-watered fragment of the Psalter vellum.

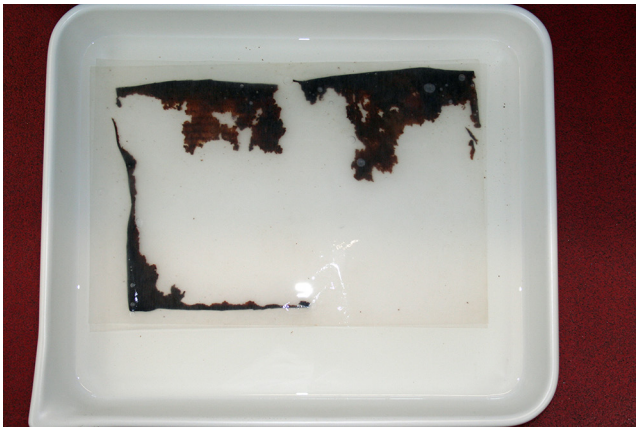

Fig. 9. Solvent exchange bath containing with f47v-56r to view.

Fig. 10. Audionvac 401H vacuum m/c.

Fig. 11. Smaller fragments of vellum under conservation treatment.

The end product is stable and reasonably robust but with no fold endurance. Although in appearance the stabilised fragments with their muddy brown colour and ragged edges might tempt you to believe that it is no longer vellum. I was reminded on one occasion that this is not the case[18].

At this point a mention should be made in relation to the areas of the vellum where the integrity of the skin did not survive apart from the surface onto which the iron gall ink was applied. This resulted in a very different and unique level of survival and required a different approach in how to stabilise the matrix of words and letters. There is no space in this paper to examine our approach but it became even more time consuming than dealing with the major surviving fragments and as such needed to be noted here (fig. 11).

CONCLUSION

The end result of the drying process has allowed us for the first time in over a millennium to examine the content of the remaining Psalter fragments. This achievement should not be underestimated given the dearth of manuscript material from this period in early Medieval Ireland. The Faddan More Psalter, as an early Irish manuscript retaining most of its original features, is beginning to play an important role in improving our knowledge in areas such as Palaeography and Insular Psalters. This paper documents just one aspect of an engaging project, which also included challenges in relation to display and housing, identifying and relocating dislocated text fragments and extensive recording throughout the project.

The Faddan More Psalter is now stable and on display but it is far from finished, with both actual conservation and follow-up research outstanding. I continue the latter as part of my PhD in tandem with delivering lectures on all aspects of this extraordinary book to anyone interested in hearing about it. Financial restrictions due to a severe economic downturn in Ireland's economy have slowed me down somewhat due to lack of available funding but my commitment to the Faddan More Psalter remain

Although I was the "bench conservator" for Faddan More, the only reason I was able to bring the project to its current level of completion was the support and advice that was available to me at a moments notice. The generosity of my fellow conservators in the National Museum was a resource I accessed often over the four years and there is little doubt both the Faddan More Psalter and I are the better for it.

NOTES

1. www.museum.ie/
2. "of or pertaining to an island or islands" Diringer, D. *The Book Before Printing* (New York 1982), 215.
3. Bischoff, B. *Latin Palaeography* (Cambridge 2008), 20–23.
4. The principle of a limp single piece of leather with internal linings with a flap on one fore edge extending onto the front of the cover. The majority contain single quire codices attached directly to the cover through the spine.
5. Used as a temporary method of keeping the bifolia of a quire together prior to binding. They often take the form of vegetable fibre or twist of vellum inserted through the backfold. These sometimes remain even after binding has taken place.
6. I engaged with many lengthy conversations at the early stages of the project with, Chris Clarkson, Tony Cains, Michael Gullick (Paleaography) and others, all who offered their valued observations and suggestions.
7. Filming involved the use of an articulated stage and a high-resolution camera on a track positioned over the subject.
8. Hansen, E. F., Lee, S. N. and Sobel, H. 1991. The Effects of Relative Humidity on Some Physical Properties of Modern Vellum: Implications for the Optimum Relative Humidity for the Display and Storage of Parchment. *The Book and Paper Group Annual* 10, http://cool.conservation-us.org/coolaic/sg/bpg/annual/v10/bp10-09.html
9. The aim of this project is to assess damage in historical parchments at the macro, micro and molecular levels
10. A book conservation term relating to the dis-binding of a book.
11. The late professor Terence J. Painter (Department of Biotechnology, NTNU, Trondheim, Norway)
12. Lindow man, tollund man and other peat-bog bodies: The preservative and antimicrobial action of Sphagnan, a reactive glycuronoglycan with tanning and sequestering properties. *Carbohydrate Polymers Vol.15 issue2 1991* (Journal) P. 123–142
13. The Hydrothermal Stability of Parchment Measured by the Micro Hot table Method Rene Larsen, Dore V Poulsen and Marie Vest *Microanalysis of Parchment*, 2002, Book. P. 55–58
14. Gillis, J. and Read, A. The Faddan More Psalter, A Progress Update, *ICON News issue 11 2010*, p.25–28
15. Chris Clarkson prompted the concept of using a vacuum machine during a visit to the Museum; he mentioned that he had been discussing the possibilities of drying parchment with Stuart Welch, formally of Conservation by Design, who had established the vacuum machine

as a conservation tool, particularly in the area of disaster recovery. It was Stuart in fact who organised the loan of a vacuum machine for our trials.

16. Audionvac 401H

17. Climatic conditions where the dry vellum fragments could be examined in a conditioned area where values are maintained to recommended levels e.g. 55% R.H and 20°C

18. Whilst documenting a fragment of processed vellum one cold December morning, a phone call had distracted my attention briefly. Upon my return I witnessed it curl up towards the hair side in reaction to the dry air, in exactly the way a new piece of vellum might, proof positive!

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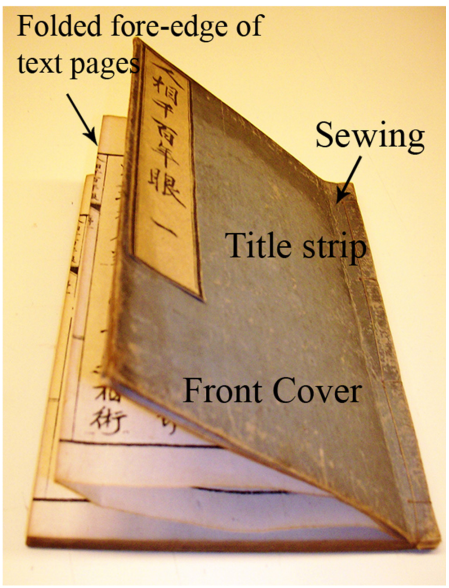
KAZUKO HIOKI

Investigation of Historical Japanese Paper: An Experiment to Recreate Recycled Paper from 18th–19th Century Japan

INTRODUCTION

Since 2003, I have been studying the physical traits of printed books from the 17th–19th century of the Edo period (Hioki 2008). The texts were almost exclusively produced by woodblock printing, on Japanese paper, and bound in side-stitched binding with paper covers (fig. 1). I was particularly interested in the book covers, including their decoration, structure, and materials. The cover decorations varied not only in their designs and colors, but also in their techniques, such as embossing (fig. 2) and burnishing (fig. 3).

The covers were usually constructed of one or more layers of poor quality paper. This inferior paper was made by the recycled papermaking process with waste paper such as discarded textbooks, written memos, and wrapping papers as the raw materials. An outermost sheet of the layered covers was made of thin, higher quality dyed paper (fig. 4). Recycled paper was selected for its softness, thickness, and its lower



LEFT TO RIGHT

Fig. 1. Example of a side-stitched binding. Text was printed on only one side of the text paper which was folded in half and sewn right-hand edge with paper covers.

Fig. 2. Embossed front cover of a mathematics text, *Kiku genpō chō ken bengi*, Dōkan Shimada; [Osaka : Kagaya Zenzō, 1828?]. LCCN: 2004552109, Library of Congress.

Fig. 3. Burnished back cover of a collection of cooking menus, *Shinsen hōchō kakehashi,* Hakuka Sugino, Osaka, 1803. LCCN: 99433295, Library of Congress.

Presented at the Book and Paper Group Session, AIC's 42nd Annual Meeting, May 27–31, 2014, San Francisco, California.

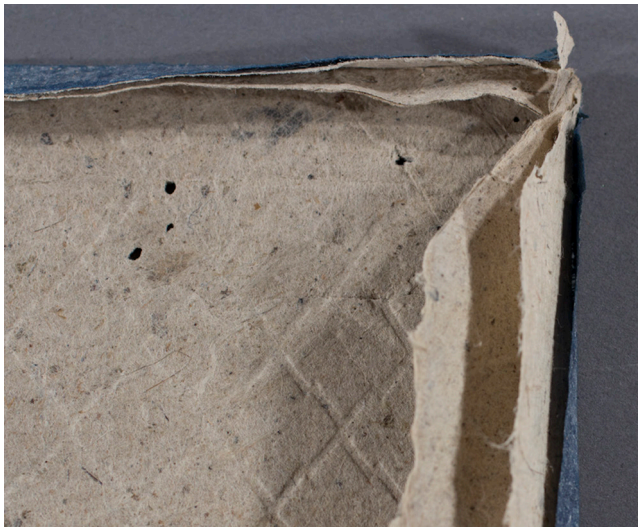


Fig. 4. Example of a book cover construction showing two laminated layers of recycled paper and a sheet of dyed paper.

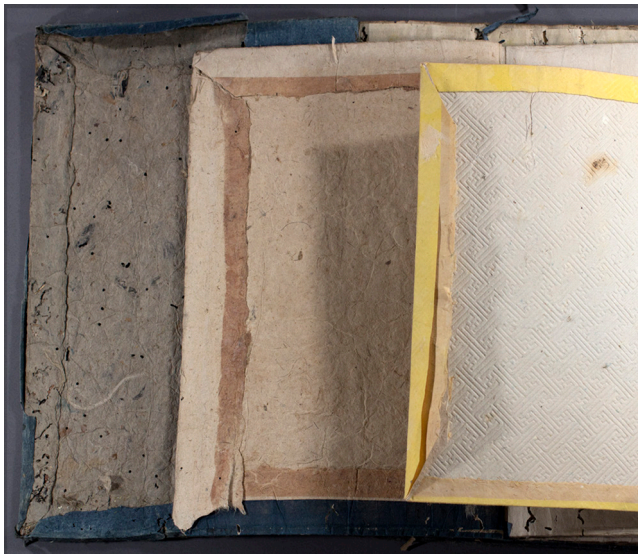


Fig. 5. Various kinds of Recycled paper used for book covers.

Fig. 6. Recycled paper book cover exhibiting contained impurities, such as pieces of fabric plants, paper, dust, and hairs.

cost for book covers. When certain cover decorations such as embossing were applied, the glued layers of thick and soft recycled paper cover became an effective support to carry impressive indentation (impression). Like the cover decorations, the recycled paper also varied in its color, thickness, and qualities. It could range from being thin and smooth to thick and dark gray in color (fig. 5), containing a high ratio of impurities such as dust, hair and pieces of fabric (fig. 6).

Investigating the technical aspects and historical background of the recycled papermaking could provide additional information about the book and help to identify the authenticity of book covers. The production methods and raw materials used were associated with a certain period of time and particular genres of texts. The manufacturing information can provide a clue on the makers and industry.

This is a report from the series of studies addressing the issues related to recycled paper. The state of recycled papermaking in the 18th–19th century Japan is briefly summarized, followed by an ongoing corroborative experiment to recreate recycled paper and book covers.

RECYCLED PAPERMAKING INDUSTRY IN THE 18TH–19TH CENTURY JAPAN

While papermaking started in Japan as early as the 7th century, it was the 18th century when production spread through the country that the quantity and types of paper produced drastically increased. In the 1736 publication *"Trading Goods in Osaka"* which recorded the important goods traded in the country's trading center, Osaka, paper was ranked 3rd after rice and lumber as having highest total cash value of commodities traded (Abe 1967) (table 1).

The production of cheaper and more affordable papers including recycled paper greatly increased, especially as they became the necessities for everyday life for the residents of the cities. For instance, the renowned scholar of the 19th century, Nobuhiro Sato, praised the commodity papers, including recycled paper, as the most useful of any paper (Sato 1928).

Japanese fine papermaking was carried out by farmers in poor farming areas during the agricultural off-season, using the raw materials of the *kozo* tree which grew in mountainous

Items	Quantity (unit)	Value (silver kan)
Rice	220,792 (koku)	8,638
Lumber	-	6,955
Paper	-	6,885
White cotton	11,178 (1000 tan)	5,172
Miscellaneous wood	38,698 (1,000 kan)	4,828
Cotton	1,604 (1,000 kin)	3,597
Copper	3,050 (1,000 kin)	3,512
Dried sardines	-	3,493

Table 1. List of the goods traded in Osaka in order of total cash value (Abe 1967,16).

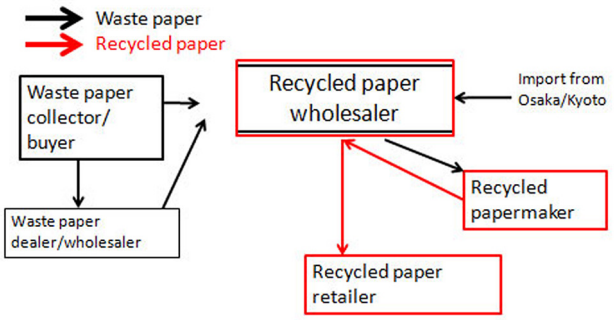


Fig. 7. Distribution of waste paper and recycled paper in the late 18th century in the Edo period.

areas. It also required sources of clean water and intensively skilled laborers (Kunisaki 1948)[1]. Conversely, recycled papermaking used raw materials such as discarded waste paper, secondhand texts, and trimmed new paper scraps, and its major production centers were the large cities, including Edo (today's Tokyo), Osaka, and Kyoto, mainly because these large cities were the biggest waste paper suppliers (Seki 1979).

Edo was the nation's largest waste paper supplier and paper consumer, and one of the biggest recycled papermaking regions (Seki 1943; Aida 2002). In Edo, all materials were recycled. A network of trash businesses such as waste collectors, brokers and wholesalers was developed. Trash was gathered on the street by sub-caste groups, and waste paper was also acquired by waste-paper buyers who went door-to-door.

The collected or purchased trash and waste paper was sorted into groups such as fabric, hair, and paper, and sold to waste paper dealers, brokers, and wholesalers, who then sold it to the recycled paper wholesaler (Yamano 2006). The recycled paper wholesalers then marketed the waste paper to the paper-making villages. When the supply from Edo area ran short, these merchants imported waste paper from the Osaka and Kyoto regions by ship. In addition to the distribution of raw materials, the wholesalers also controlled the dispersal of the final products. They purchased finished recycled paper from the papermakers and sold it to the retailers. A wholesale merchant might advance waste paper or cash to paper-making peasants, returning later to collect the processed goods in exchange for debts (Abe 1967, 32–33). By the early 19th century, the recycled paper business was controlled by the wholesaler monopoly, which found this arrangement very profitable (fig. 7).

RECYCLED PAPERMAKING PROCESS

Relatively little is known about the materials and the processes involved in recycled papermaking in the 18th–19th century. Recycled papermaking was perceived as too simple of a process that involved less-skilled peasants to be worthy of documenting (Seki 1973). In addition, the handmade recycled papermaking tradition seemed to vanish by the 1970s, and no Japanese papermakers continue this type of papermaking today. To find detailed or exact recycled papermaking processes, I studied the literature, interviewed Japanese papermakers for their comments, and came up with a plausible theoretical or hypothetical process which is summarized in Table 2 with a comparison to fine Japanese papermaking.

For recycled papermaking, first, waste paper was soaked in water for a couple of hours or cooked with ash and other alkaline agents. A viscous agent such as *tororo-aoi* plant was probably added to the pulp. The soaked or cooked waste paper was then hand-beaten. Then, a sheet of paper was formed on the screen of a mould by sheet-forming methods which probably required less skill than the traditional *nagashi-zuki* method, which consists of repeated motions of scooping up the solution, shaking the mould, and discarding the excess. The formed sheets were piled up. Next, a weight was placed on top of the pile to remove extra water. Then, each sheet was dried on a wooden board under the sun.

	Fine papermaking	**Recycled papermaking**
Raw materials	Inner bark of *kozo* (paper mulberry), other plants	**Waste paper**
Additives	Viscous formation aid (*tororo* plant)	**Was viscous formation aid used?**
Fiber preparation	Steamed, dried, re-hydrated, removed the core and outer bark, and cooked with alkaline agents Repeatedly washed and hand beaten	**Was it soaked in water?** **Was it cooked with alkaline agents?** **How long was it hand beaten?** **Ink-removal method by repeated washing and hand beating?**
Sheet formation	*nagashizuki*	**Was it a combination of *nagashizuki* and Western style ?**
Drying	Couching: laid on top of each finished sheet, no use of interleaf Gently removed water under heavy weight overnight Dry on a wooden board outside	**Was it dried on wooden boards?**

Table 2. Hypothetical process of recycled papermaking with fine Japanese papermaking for comparison.

Unfortunately, as shown in table 2, these hypothetical production steps invite many questions. To investigate the manufacturing processes in depth, I undertook some collaborative research to re-create recycled papers and book cover decorations with Anne Covell, an MFA candidate in Book Arts at the University of Iowa Center for the Book (UICB), in 2012.

RE-CREATING HISTORICAL RECYCLED PAPER

A series of experiments is divided in three trial phases:

- Trial 1: Thai *kozo* test
  - Experiments conducted by Anne at UICB in 2012–2013 to determine the recycled papermaking process using Thai kozo.
- Trial 2:19th century textbook test
  - Four days of experiment completed by Anne and Kazuko on July 24–27, 2013, at UICB facilities to recreate recycled paper using 19th century printed Japanese books
- Trial 3:University of Kentucky (UK) test
  - Follow-up experiments of the July 2013 carried out by Kazuko in February 2014 at UK's conservation lab using 19th century printed Japanese books

Trial 2 and 3 are briefly summarized below. A full report will be published after the completion of the experiments.

TRIAL 2

Materials/tools[2]

Waste paper (fig. 8)

- Five volumes of a multiple volume set of woodblock printed book, "**通俗漢楚軍談**" **(***tsuzoku kanso gundan*) were used. The first edition of this title was published in 1695 as a 15 volume set. The five copies used were the later edition; however, publication date was unknown. They were purchased at a book store in Kyoto in 2012.

Viscous agent

- *Tororo-aoi* plant: a frozen root (125 g) was mashed with wooden mallet and mixed with 4 L water (fig. 9)
- Polyacrylamide (PME)

Alkaline agent

- Wood ash (provided by Tim Barrett) 75 mg was added to 15 L water, boiled, left overnight, and strained to obtain clear solution.
- Soda Ash (sodium carbonate)

Papermaking moulds consisting of a deckle with a synthetic fiber screen and a wooden box (frame size : approximately 22 x 28 cm) (fig. 10)

Methods

1. The waste paper was prepared through various methods:

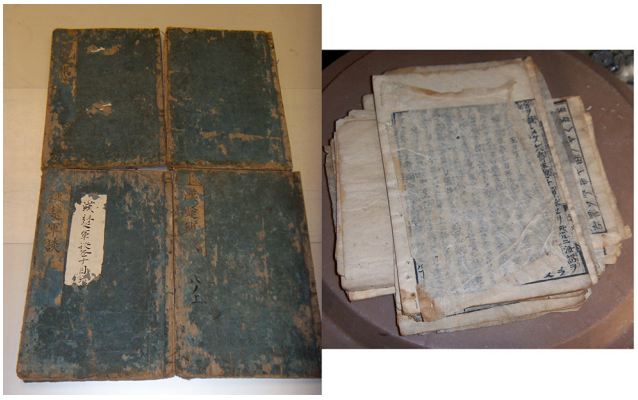


Fig. 8. Book covers (left) and text paper (right) of the volumes used for Trial 2.

Fig. 9. Thawed *tororo-aoi* roots mashed with a mallet.

Fig. 10. Papermaking mould consisting of upper screen frame and lower box.

  - soaked in water for 2 days, uncooked
  - cooked with soda ash for around 2 hours, and
  - cooked with wood ash liquid for over 2 hours
2. The prepared paper was beaten on a wooden board using two wooden mallets for various minutes (5–26 minutes), and then washed gently under running water. In order to see the effect of beating and washing to remove *sumi*-ink from the paper, the paper was repeatedly beaten and washed.
3. The beaten and washed paper was added to water. It was mixed well with *tororo-aoi,* PME, or neither by using a long wooden stick.
4. The mixed pulp was poured on to the deckle mould where it was suspended in water and mixed by hand. The amounts of pulp varied ranging from 450 ml to 1000 ml to achieve a desired thickness. A total of around 50 sheets were made.
5. A wet sheet of paper was laid on top of a post of previously couched sheets (fig. 11), and left from 2 hours up to 17 hours under the weight of a water filled trashcan. Over half of the sheets were interleaved with synthetic fabric between each sheet; the rest were laid without using interleaf.
6. The damp sheets were peeled off the pressed pack one at a time. They were air-dried flat on a drying rack, or brushed onto wooden boards and air dried in a conservation lab.

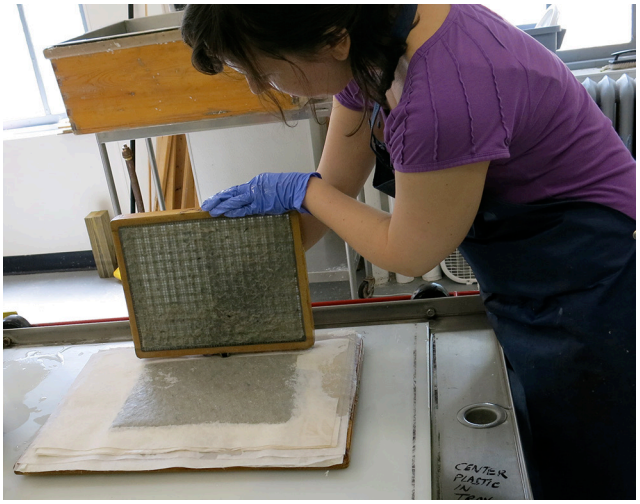


Fig. 11. A sheet formed on the mould's screen transferred onto a pile of previously made paper interleaved with synthetic fabric.

Fig. 12. Bookcover paper and text paper used for Trial 3.

TRIAL 3

Materials/tools

Waste paper (fig. 12)

- A variety of bookcover paper (208 g) and woodblock text paper printed with black soot ink (18 g) were used. The outermost colored sheets of the covers were removed and put aside due to their heavy sizing. Both were collected by Setsuo Kushige, a Japanese paper conservator, and given to the author. The source of the covers and texts were unknown.

Viscous agent

- Polyacrylamide : PME (6g) was dissolved in 4 L water

Japanese papermaking mould consisting of wooden frames (21 x 30 cm) with a woven bamboo *su* mat

Methods

1. Book covers and text paper were torn into small pieces by hand and soaked in water for 94 hours.
2. The soaked paper was beaten on a wooden board using two wooden mallets for 30–45 minutes and then, washed gently under running water for a couple of minutes.
3. The beaten and washed paper, water, and PME were mixed well by using a wooden stick for a few minutes.
4. Sheets were formed by using various formation methods including *nagashizuki*, *tame-zuki* (Western form), and combination of two. Single to multiple charges (2–3 times) were required to achieve a desired thickness. A total of 21 sheets were made.
5. The couched and piled wet sheets of paper were gently pressed with hands over the *su*, and left overnight for 17 hours under around 32 kg weights. Synthetic fabric was interleaved between each sheet for over half of the wet sheets.
6. The damp sheets were air-dried on wooden boards in a conservation lab.

FINDINGS FROM THE EXPERIMENTS

1. Paper preparation method

It is widely believed among historians that the waste paper was not cooked but simply soaked in water overnight (Aida 2002). However, soaking in water for several hours does not seem to be enough to break down the strong and durable Japanese paper. To confirm this process, in Trial 2, we treated the waste paper with two methods including soaking in

Fig. 13. Text paper soaked in water for two days. The paper was later torn into small pieces, beaten, and washed. Courtesy of Anne Covell.

Fig. 14. Text paper cooked with soda ash for over two hours. Courtesy of Anne Covell.

Fig. 15. Paper samples made in Trial 2, washed and beaten once. The paper on the right used uncooked waste paper; the left used waste paper cooked with wood ash.

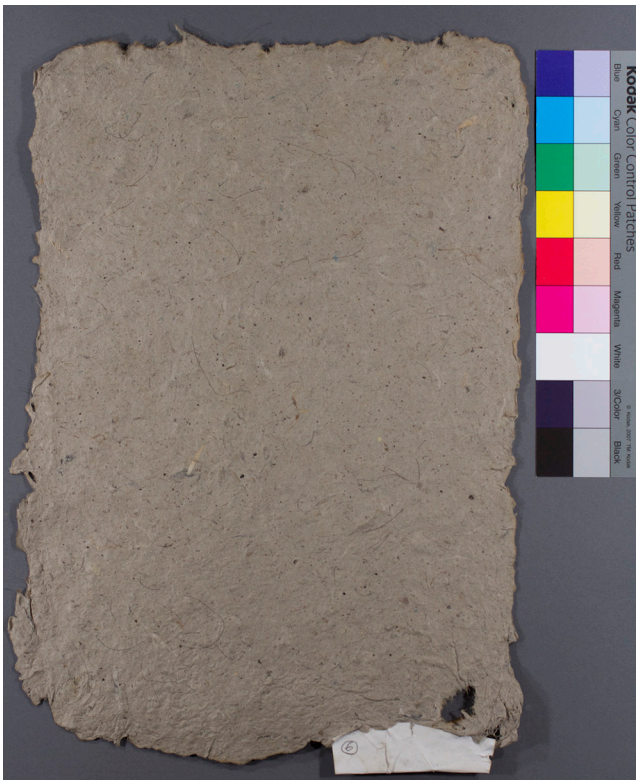


Fig. 16. Paper sample made in Trial 3, which used uncooked waste paper.

water for 48–94 hours (fig. 13) and cooking with soda ash or wood ash (fig. 14).

Both methods successfully produced paper. The uncooked waste paper, however, was not well broken down as the printed letters remained visible in the final product (fig. 15). The uncooked recycled paper was darker in color and displayed greater unevenness in fiber distribution than that in the paper made through cooking. Based on this result, in Trial 3, I employed only the uncooked method, which used much poorer and rougher quality of waste paper than Trial 2 did. The produced recycled paper displayed very similar color, texture, and appearance to a type of historical paper I tried to recreate (fig. 16). The experiments proved that the uncooked method was technically possible to make recycled paper. Some types of paper including book covers were probably made that way considering the papermaking economy

in which the cost of cooking materials such as wood would be prohibitively high for the recycled papermaking peasants.

2. Viscous agent

The use or absence of the viscosity agent, *tororo-aoi* plant is questionable. While recycled papermaking started as an agricultural off-season operation, the papermakers around the urban cities such as Edo could have had easier access to dealers and consumers and greater exposure to the cash economy, could have been more aware of the profitability of recycled papermaking than the farmers in the countryside, and could have expanded their operations to a year-round business (Aida 2002). If that shift happened, the papermakers would not have used *tororo-aoi* plant for their manufacturing because it would easily rot and became unusable in the hot season.

In our Trial 2, we had no alternative but to add a viscous agent. The pulp liquid without the agent just quickly drained from the screen of a mould. In the follow-up Trial 3, I increased the waste paper concentration to thicken the pulp, hoping the higher fiber ratio would help sheet formation. However, the fiber was not distributed evenly throughout the mould surface, resulting in the formation of entangled fiber clumps. Consequently, I had to add a viscous agent, though the amounts used were much more reduced than in the previous trial. The challenge was now whether and/or how we could eliminate the use of a viscous agent. We suspected that the processed fiber was still too long. However, in Trial 3, I used raw materials mainly from bookcovers composed of recycled paper. Should their fiber have already been broken-down and shortened to a maximum degree? Would an increase of beating time produce shorter fibers? Would more beating make harder, crisper, and stronger paper- which are not the traits I was looking for in this type of recycled paper? To answer these questions, the next steps would be experimenting with various beating times, as well as analyzing the length and the form of the fiber.

3. Sheet forming methods

Making a fine Japanese paper requires high sheet formation skills involving the elaborate *nagashizuki* method. On the contrary, it seems that forming a sheet of recycled paper with small size, uneven thickness, and rough surface should be easily mastered by an unskilled worker like me. In Trial 3, my attempts to form a sheet of recycled paper through *nagashizuki* method, however, met with repeated failure. I then undertook a so-called half *tamezuki* method, which was a combination of *nagashizuki* and Western sheet forming methods (Shishikura 2011). It was clear that the quality and preparation of the fiber influenced sheet formation. The use of crudely prepared, poor quality pulp limited my attempts to manipulate the methods (fig. 17).

The type of historical recycled paper varied in its quality and appearance, and the level of skills and forming methods of the papermakers varied, too. Further investigation of historical paper will be required on this issue.

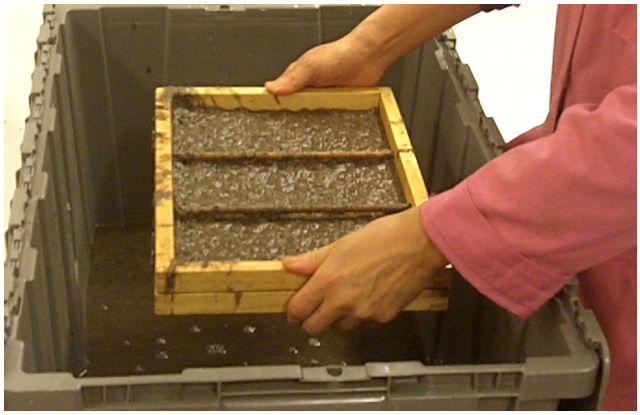


Fig. 17. Sheet forming during Trial 3, showing the gray and coarse textured pulp on the Japanese papermaking mould.

4. Drying methods

Very little documentation has been recorded about the methods of drying recycled paper. It is widely accepted among historians that recycled paper was dried on a wooden board in the way conventional paper was dried. However, wooden boards which could be around 180–200 cm in height and 35–50 cm in width did not seem to us to be easily affordable by the poor farmers who made cheap recycled paper. An alternative method is air-drying; however, this approach would cause too much planar distortion making it difficult to handle the paper for assembling and packing. In Trial 2, we experimented both air-drying on a rack and board-drying (fig. 18), and examined their effects on the physical traits of the paper. To our surprise, the air-dried paper cockled a little bit, but not as much as we anticipated (fig. 19). A reason of this minimum cockling would be the relative slow drying process of the packed wet sheets by removing extra water overnight. Further investigation is needed (Barrett 1989).

This result suggested that air-drying was technically a possible option. Therefore, the choice of drying methods probably depends on their economic and practical aspects. I found these conditions in 2013 when I visited Shigeo Shimada at his papermaking studio and house in Saitama prefecture in Japan. He makes a kind of recycled paper for Papier-mache dolls from a mixture of newspaper, *kozo* and cotton fibers. His paper was much larger and thicker than the paper I made, and he dried the paper on the ground (fig. 20). Mr. Shimada said in his experience any paper which was smaller than the current size would be quickly dried and easily blown off by a strong wind unless weights were placed on each sheet which would not be practical. The recycled paper produced in the 18th–19th century was much smaller than Mr. Shimada's, and as he pointed out, drying that type of paper on the ground was probably not efficient. In addition, this method demands a larger space than board-drying, in which the boards would vertically rest on the supports and use smaller space efficiently. Hanging the paper

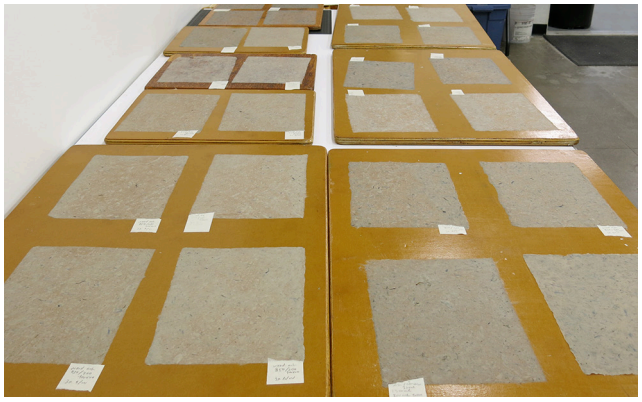


Fig. 18. Paper dried on wooden boards.

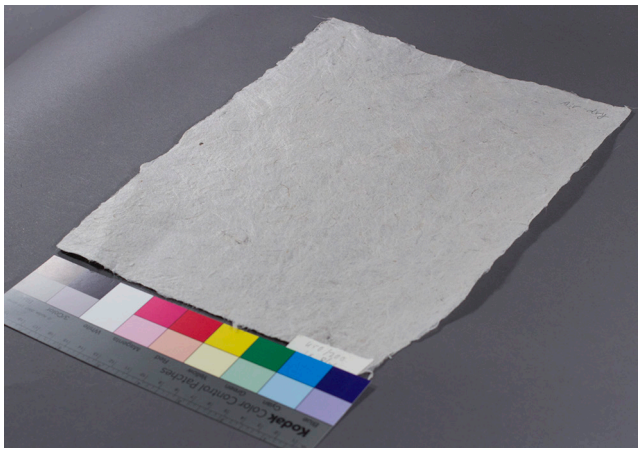


Fig. 19. Air-dried paper sample.

Fig. 20. Shimada's paper spread and dried on the ground in the front yard of the house and papermaking studio.

outdoors invites the problem of its being blown away, too. Indoor hanging like Western papermaking was probably out of reach for the papermakers due to the cost of construction.

Could the peasants afford the drying boards? Probably yes. To dry this type of low-quality paper, the boards didn't have to be high quality, and even the poor farmers could afford them. Actually, Mr. Shimada has seen the use of low-grade boards, which were made of pieces of lumber put together, for drying low quality paper. In addition, the papermaking peasant could get the boards via the "putting-in" system. This type of practice was documented in the renowned paper making villages in Mino, where wholesale merchants advanced the raw materials or cash to peasants and collected the final products of paper to pay off their loan.

5. Sumi-ink removal method

Several documents on recycled papermaking from the 18th–19th century recorded the methods of removing the writing and printing ink applied to the paper (Seki 1979)[3]. The methods are broadly divided into two groups, including one by fermentation and another by a set of steps of cooking and repeated beating and washing. According to these documents, two rounds of beating and washing could produce light gray paper and the third round would yield white paper. We experimented with the latter process, and tried various numbers of beatings and washings to determine their effect. We were at first skeptical about the effect of cooking, beating and washing. However, the results were impressive, as can be seen in the pictures[4] (figs. 21–22).

How did this ink-removal process work? *Sumi*-ink was made of a mixture of carbon particles from soot and hide glue (膠). The carbon particles applied to the paper surface penetrated the voids between the paper fibers and adhered to them as the hide glue dried. Beating and washing physically separated these particles from the fibers and removed the particles with water. By repeating washing and beating, even solidly adhered particles could be freed and washed away.

The effect of boiling with alkaline agent (such as ash) was briefly explained by Eizaburo Okada (Okada 2002). The alkaline-cooking would make cellulose fibers swell, leading to the peeling-off effect of the *sumi* particles which had adhered to the fiber surface. The alkaline agent also could help dissolving hemi-celluloce resulting in the removal of the particles which were trapped in the hemi-celluloce compounds. Finally, the agent would chemically break down the binder (hide glue).

The success of this experiment supported a possibility of the wider use of waste paper for papermakers than we previously understood. Especially, from the late 18th century onward, when a serious shortage of *kozo* plants and the subsequent increase of its price became the norm, even prominent papermaking villages used waste paper mixing with *kozo* fibers to produce higher quality paper. Indeed, in 1819, the self-controlled union at Echizen Gokasho village issued a warning of its intent to destroy stocks of the highly prized *hosho* paper if they found

Fig. 21. Pulp prepared by cooking with soda ash, washed and beaten once (upper left); and washed and beaten three times (lower right). Courtesy of Anne Covell.

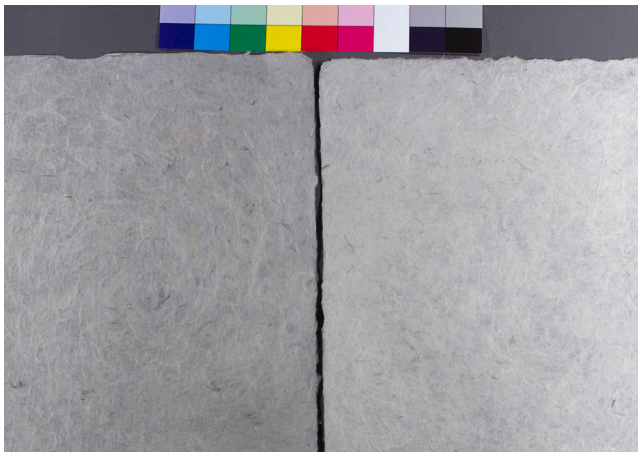


Fig. 22. Paper samples made from the pulp shown in figure 21, washed and beaten once (left); and three times (right).

its production had secretly included a mixture of waste paper imported from Osaka and Kyoto region (Kobata 1978).

SUMMARY

This project demonstrates the unique benefit of collaboration between a conservator and a papermaker. When the research is limited to a few sketchy historical documents and remaining artifacts, this type of collaborative experiment is one of the most effective research approaches. From the experiments, I learned much about the diversity and complexity of papermaking. Like high quality Japanese paper, recycled paper had great varieties of physical appearance and quality. These variations could have been the result of the quality of the raw material properties of waste paper and its processing methods, which were difficult to determine. The nature of the waste paper and organic processes of papermaking made the research challenging.

Investigating the technical aspects of recycled paper production can provide valuable information about the papermakers, the industry, and their society, and fill the gaps in the history of this lost craft. If we could confirm the technical possibility of a year-round operation of recycled papermaking by further testing the viscous agents[5], that would support the theory that urbanized farming areas could shift from conventional seasonal agricultural activity to full-time, manual production influenced by a cash economy. Recycled papermaking might then be seen as an important precursor to the coming industrial paper factory. The success of the ink removal experiment confirms the technical possibility of this practice and supports a theory that in the 19th century the use of waste paper spread greatly, even to the fine papermaking villages. It brings us a new perspective on the quality of hand-made Japanese paper. The use of waste paper mixed with plant fibers could be regularly practiced and therefore found in unexpectedly high quality papers. Fiber examinations of the paper artifacts from this time period can give clearer answers to these hypotheses.

ACKNOWLEDGEMENT

The author would like to thank Setsuo Kushige, Shigeo Shimada, and all other papermakers and specialists who helped me by giving advice and materials, especially, Tim Barrett, director at UICB and my co-researcher, Anne Covell for her creative and professional collaboration.

NOTES

1. During the Edo period, papermaking was monopolized by *han* (regional states) governments and became their most important tax revenue source. To protect competitiveness, *han* tightly restrained the manufacturing information and banned publishing it. *Kamisuki chōhōki* was published in 1796, which was the first ever published manual of papermaking during the *han*'s strict censorship.
2. The publications by Kizaki (Seki 1979) and Barrett (1983) were consulted to study the methods, tools, and materials employed for the experiments.
3. Of the pre-Meiji publications, *Kamisuki taigai* (1784) by Morisue Kizaki has the most detailed descriptions of the recycled papermaking processes, including ink-removal methods. Okura's *Kamisuki hitsuyo* (1836) has brief description of the ink-removal method through fermentation. *Kamisuki houdenjyu,* a manuscript, written around 1804-1833 by an undetermined author, has the description of ink-removal method through cooking with ash. These records were compiled and found in Seki's work (1979).
4. A video clip of the beating and washing process recorded in Trial 2 shows the effect of the process on ink removal. The video is accessible at: http://uknowledge.uky.edu/libraries_present/81/

5. *Noriutsugi* (Hydrangea paniculata) was another major viscous agent widely used during the Edo period. Unlike *tororo-aoi, noriutsugi* does not lose its viscous effect with high temperature. Therefore, for a year-round operation, *noriutusgi* should be further tested.

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An Investigation of Some Screen-Prints By Corita Kent

ABSTRACT

Harvard Art Museums hold a collection of 79 screen-prints by Corita Kent published between 1964 and 1969. It is intended that nearly all of these prints will be included in the travelling group exhibition *Corita Kent & the Language of Pop*, scheduled for Fall 2015. A number of the Corita prints in the collection include daylight fluorescent inks not commonly used by fine art printmakers of the period. Many of the earlier works are also printed on Pellon, a material unusual to printmaking.

The purpose of this research was to further the understanding of Corita's approach to printmaking and to investigate the light sensitivity of the daylight fluorescent inks in order to inform the exposure parameters for the collection. While it was found that there are some complicating factors in using the micro-fading tester to investigate daylight fluorescent inks, the results suggest that they are possibly more stable than previously thought.

The constituents of Pellon were analyzed to better understand its long-term stability and conservation treatment tests were carried out on three screen-prints on Pellon; the treatments are outlined and the results discussed.

INTRODUCTION

The prints in Harvard Art Museum's collection, which can be loosely divided in to two groups, span an important period in Corita Kent's life and artistic career. Corita printed those produced between 1964 and mid-way through 1967 in the art department of the Immaculate Heart College, the progressive Catholic community in Los Angeles where Corita trained and had spent the majority of her adult life. She often used the three-week summer vacation from teaching to edition her prints, either in the basement of the college or in a one-room workshop across the street. Colleagues, friends and students were usually persuaded to help.

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The images in these early prints were created using hand-cut paper stencils with the occasional additional use of stop-out applied to the screen by hand. The printing is characterized by occasional poor registration of the color separations and other inconsistencies between sheets. Off-set ink occurs on the verso of some prints and odd strips of color are present in the margins, possibly a result of ink that 'escaped' beyond the stencil. It is speculated that quickly producing large numbers of prints, in cramped conditions with volunteer assistants, could explain variations in the prints within an edition.

The prints in the first group are printed almost exclusively on Pellon, a stiffening and interfacing product used in clothing and quilting. Mary Anne Karia, the artist's assistant at this time, suggests it is possible that Corita used Pellon because she thought it could be cleaned (Karia 2013). Corita described her use of the material in an interview:

> *Corita*: Yes, these are on Pellon, which is a 3M product. It's actually cloth material, used for clothes lining, like men's coats, in tailoring.
> *Galm*: Now was this something that you discovered, or were other printers using it for production?
> *Corita*: I don't know that anybody else used it. They were using rice paper and similar papers, but this seemed so very practical and was much cheaper than the rice paper and much stronger.
> *Galm*: Did it give your serigraphs a different quality?
> *Corita*: The paint does look different on them. When you take a slicker surface or a harder surface, the paint has a more brittle quality—a brighter, sharper quality, whereas these, no matter how sharp the line is, the paint has a soft look. So there is that difference. (Oral History Program UCLA 1977)

The second group of prints, produced from 1967 to 1969, were printed by Harry Hambly in his commercial screen-print workshop in Santa Clara, California. Corita left the Immaculate Heart in 1968. She was given a dispensation from her vows and moved to Boston to pursue her artistic activities full-time. She sent instructions, working sketches

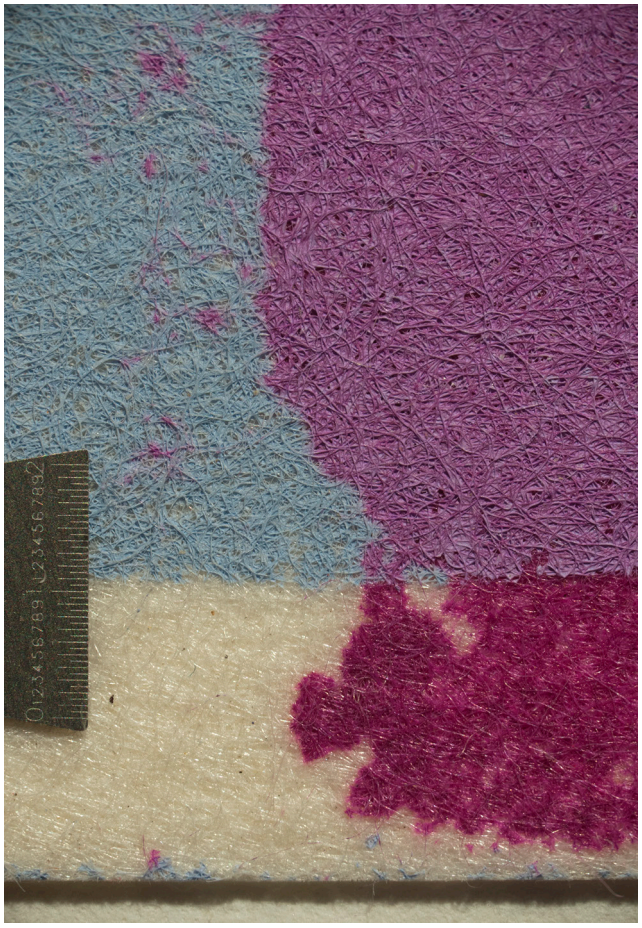

Fig. 1. *Where There's Life There's Mud* 1966 Harvard Art Museums 2008.153 Detail, field of view 20mm.

and color swatches to Hambly and discussed details over the phone. Examples of the correspondence between the two provide valuable insight into Corita's working methods (Corita Papers 1936-1992 MC583, Schlesinger Library, Harvard University). This arrangement had been in place for two years before Corita even met Hambly in person. It proved a successful and productive relationship and Hambly continued to produce Corita's prints for the rest of her life.

"I usually do my work about three inches square, sometimes—and say, "Enlarge this to such and such a size, and do this in this color, and this is this color." And he always either understands or knows enough to ask questions. So that actually now it's come down to my doing the design for them—he does the printing." (Oral History Program UCLA 1977)

This group of prints is all on off-white wove paper. Text is still a central feature of the images but photographic elements, printed on half-tone screens, are introduced. The registration of the color separations is accurate, there is an increased complexity and detail in the images and the printing is more technically advanced.

Corita was extremely prolific. Besides teaching and writing she published some 257 editions between 1964 and 1969, the period covered by the Museum's collection. She maintained a catalogue of her prints and while edition sizes are not always recorded, it suggests that she produced approximately 18,000 sheets during this period. Although the prints were published in signed and limited editions, they are not numbered and dated in the usual way. Corita used a two-part numbering system that reflected the year the print was published and its position in an alphabetical list of titles published that year. Individual prints in the edition were not marked with the edition size or the specific number of that sheet within the edition.

DAYLIGHT FLUORESCENT INKS

Thirty-seven of the 79 prints in the Harvard collection include the use of one or more daylight fluorescent inks; these inks feature throughout Corita's printmaking of the late 1960s, spanning both her work at the Immaculate Heart and her collaboration with Hambly. These colors appear on both the paper and Pellon supports. Two daylight fluorescent inks sometimes overlap on one print, but all the prints in the collection also include separations printed in standard, non-fluorescent colors.

Daylight fluorescent pigments derive their characteristic luminous appearance from the combination of two effects-directly reflected light and fluorescent emission, where a material absorbs electromagnetic radiation of a particular wavelength and emits radiation at another, longer wavelength. As a result, these inks appear, and can be measured, to reflect more than the 100% total available incidental light.

While the second half of the twentieth century saw significant advances made to both light-fastness of these pigments and in the reduction of the pigment particle size (a fine particle size enabled the use of these colorants in letterpress, gravure and lithographic printing; they had previously only been suitable for screen-print processes), these colorants are still generally accepted to be highly fugitive and susceptible to fading (Connors-Rowe et al. 2005).

There are a limited number of organic fluorescent dyes suitable for use in the manufacture of daylight fluorescent pigments. The combination of two or more dyes is a common occurrence that enables both a wider variety of hues than would otherwise be available and allows the manufacturer to take advantage of energy transfer between the different fluorophors. This occurs when the emission profile of the UV fluorescent dye overlaps the excitation profile of the second, resulting in a higher degree of fluorescence than could be achieved by the second dye alone. Complex and unpredictable fading patterns may occur if the fading of individual dyes

disrupts the energy transfer. Research has shown that current formulations of these pigments are heavily dependent on dyes that are ultra-violet fluorescent, included to facilitate energy transfer (Hinde et al. 2013). As a result, the common conservation strategy of limiting UV in display environments may potentially affect the appearance of these colors.

Daylight fluorescent colors present a variety of challenges to the conservator—not the least of which includes accurate documentation. Accurately color-matched images are a standard approach to monitoring change resulting from light exposure, but fluorescence cannot easily be recorded or replicated using traditional photographic imaging. It requires a light source with an output sufficiently broad to trigger fluorescence in all the dyes present, including those with an excitation profile in the ultra violet region. The brightness of the reflected light is orders of magnitude stronger than that of fluorescent emission (Hinde et al. 2007), and as a result it 'masks' the fluorescence when recorded photographically, resulting in an image with altered hue and lack of luminosity. Noting the lighting environment used when photographically documenting these objects may prove useful for conservators wishing to replicate the conditions for future comparison.

MICRO-FADING TESTS

The micro-fading tester has become a generally accepted tool for examining the fugitivity of works of art and other museum objects; the design and use have been extensively outlined (Whitmore et al. 1999). Tests were carried out on three prints, two on Pellon and one on paper. Each print included both daylight fluorescent and standard colors; each color on each print was tested, including areas where two inks overlapped. Tests were also run on the non-printed supports. Micro-fading was carried out three times in each location and photo-micrographs were taken before and after testing, which showed no discernable color change at the test spots. ΔE (1976) was calculated for each test and compared to those of Blue Wool Standards 1, 2 & 3; these standards were run before and after each test batch for calibration.

All non-fluorescent inks on the three prints were found to fade with a pattern similar to that of blue wool 3, i.e. $\Delta E \leq 1$ after five minutes, with one ink in two prints proving slightly more sensitive. No significant differences were noted where inks overlapped. The non-printed Pellon support brightened very slightly. All the fluorescent inks tested displayed significantly different fading curves to those of the non-fluorescents, with a sharp color change ($\Delta E \approx 2.5$) occurring in the first 30 seconds (fig. 2).

It was clearly important to try to investigate this initial change as it accounted for the majority of the fading that occurred over the test as a whole. Tests were run on the fluorescent inks where the lamp was alternately switched on and off for one minute periods. The result was unexpected as it

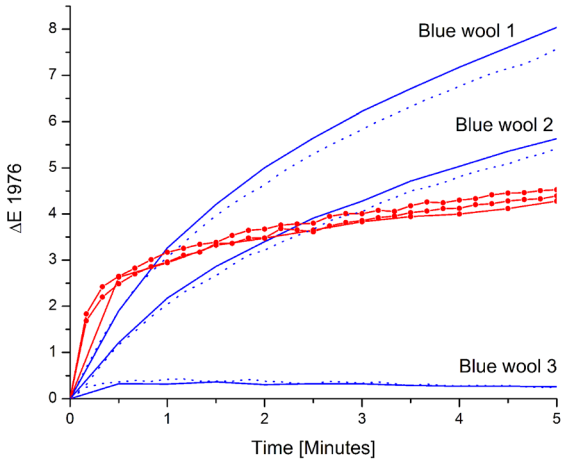

Fig. 2. Micro-fading data for daylight fluorescent ink in *Questions and Answers* 1966 Harvard Art Museums TL41188.

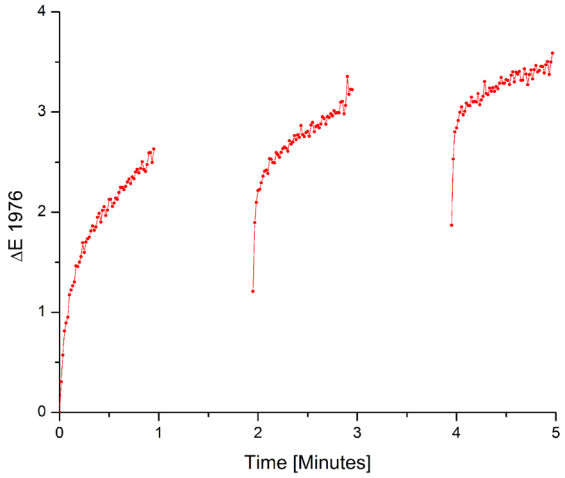

Fig. 3. On/off micro-fading data for daylight fluorescent ink in Questions and Answers 1966 Harvard Art Museums TL41188.

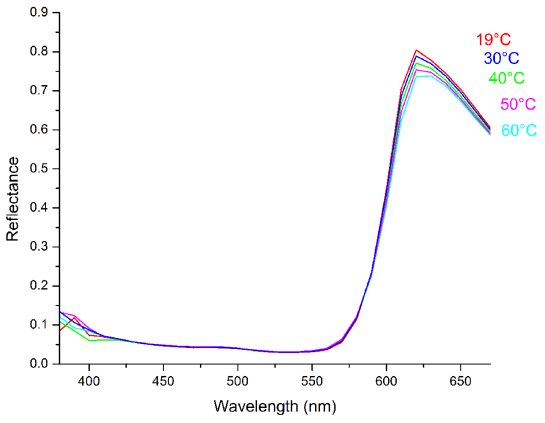

Fig. 4. The effect of temperature on the reflectance spectra of Kremer Flame Red sample.

shows that much of the initial color change reverted and, while fading does occur, the initial test result is likely to be an overestimation (fig. 3).

The surface temperature of the sample at the test location of the micro-fader has been investigated and the maximum found to be between 44ºC–52ºC (Whitmore et al. 1999). Further tests were undertaken by the author to explore the possible link between the increase in temperature of a sample, due to the micro-fader light source, and the reflectance. Samples were prepared using a variety of daylight fluorescent colorants in the current Kremer Pigment range in an acrylic binder and the paints were applied to pieces of aluminum to ensure even distribution of heat during the testing. The samples were heated using a module with an integrated thermometer; the temperature of the surface of the sample was also taken with a non-contact laser thermometer. The reflectance of each sample was recorded with a colorimeter.

The results showed that there was a clear link between the reflectance of the daylight fluorescent pigments and the temperature of the sample. All four pigments tested showed a reduction in their primary reflectance peak as the temperature was increased. Significantly, it recovered on cooling. The sample of Magenta Red also showed a slight positive shift after the sample was cooled in a freezer. These tests suggest that the initial fast color change observed during micro-fading should be discounted. It is a temporary phenomenon caused by the increase in the temperature of the sample due to the light source (fig. 4).

All the inks tested on the three Corita screen-prints have a light-fastness at least equivalent those of between the blue wool standards 2 and 3. Under the current Harvard Museums lighting guidelines, this would allow between16 to 32 6-month rotations at 50lux before a 'Just Noticeable Fade' (JNF), defined as Grey Scale 4, the first noticeable step of fading used in most light-fastness tests (CIE Technical Report 157:2004).

It is important to note that the range that includes blue wool 2 and 3 is large and there is significant uncertainty when ascribing dose to JNF ranging approximately to the value of the adjacent blue wool (Michalski 2013). These categories have been described as high or medium-high sensitivity groups (Tse et al. 2011). Caution should be used when calculating display parameters for these prints. Micro-fading has only been conducted on three prints and conservation research into the long-term behavior of daylight fluorescents is limited.

PELLON

A variety of inconsistencies in the surface of the Pellon were noted during a survey of the prints in the Harvard collection. 'Clumps' of fibers on the surface of the sheet and series of 'ripples' were observed which resulted in subsequent uneven inking in the printed image. It also appears that when heavily inked, the support can 'saturate', with ink visible on the verso. The display history of these prints is not known, but a number of the Pellon sheets have discolored to a slight pale yellow color. Though not widespread, there are also instances of more distinct uneven brown orange discoloration.

The Pellon support of four prints, one from each year 1964–1969, was sampled and analyzed using pyrolysis gas chromatography mass spectrometry. All four samples appear to be the same, containing acrylics (EA: Ethyl Acrylate, MMA: Methyl Methacrylate, EMA: Ethyl Methacrylate) with some cellulosic material (allose). While the acrylics components are relatively stable, it is possible that poor quality cellulose, such as rayon, might be responsible for the pale discoloration noted. The more pronounced local discoloration is likely the result of substandard housings.

The Straus Center was very fortunate to be given and lent three prints on Pellon for research purposes. Various treatment tests were conducted to better understand the effectiveness of standard paper conservation treatments on prints with Pellon supports and to highlight potential risks. The prints had a variety of condition issues in common including planar distortion, deep embedded creases, general pale yellow discoloration, surface soil and tide lines. One also suffered mold damage.

A series of immersion washing treatments in warm deionized water was undertaken and proved successful in reducing the general discoloration and some of the tide lines. The results were supported with colorimetric measurements. Sodium borohydride was used to remove certain tide lines insoluble in water. Much of the significant planar distortion and creasing was related to liquid damage and poor storage and handling. Controlled drying was very successful in reducing this, a result not easy to achieve with screen-prints on paper. The distortion was progressively reduced over a number of washing and drying treatments with a succession of felts, soft thick blotters and then thinner, harder ones used during pressing. It is necessary to swap out the blotters very regularly and to dry the prints over a long period as the support retained a lot of moisture. Care should be taken to monitor dimensional change to the sheets. Minor expansion and contraction was found to occur, approximately 3mm across a 915mm sheet, although it had no adverse effect on the ink layer.

Attempts to reduce the mold staining and surface soil proved less successful. Particulate dirt is easily trapped in the interstices of the relatively open surface structure. A spray application of toned cellulose powder was used to mask the mold spots visible within the mount aperture [FN1]. It was necessary to make two applications, first pale then darker, to cover the staining and achieve the correct color match. Suction was used to prevent local cockling of the support.

Corita signed her prints with a variety of writing materials, some of which proved partially soluble in extended washing treatments and were temporarily fixed with cyclododecane.

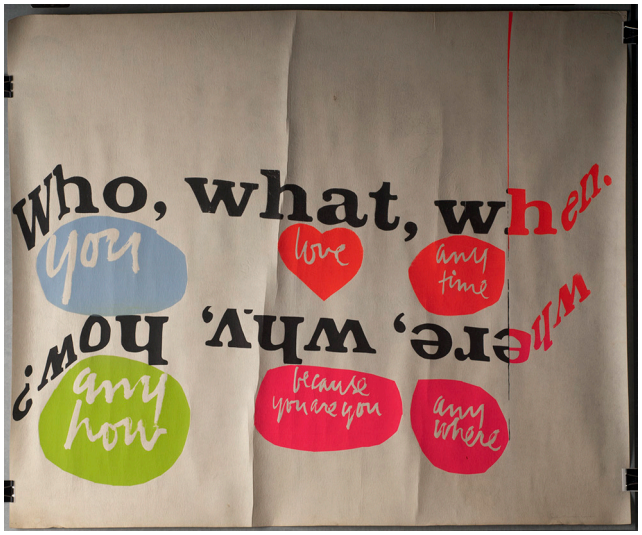

Fig. 5. *Questions and Answers* 1966 Harvard Art Museums TL41188 762mm x 914mm. Before treatment in raking illumination.

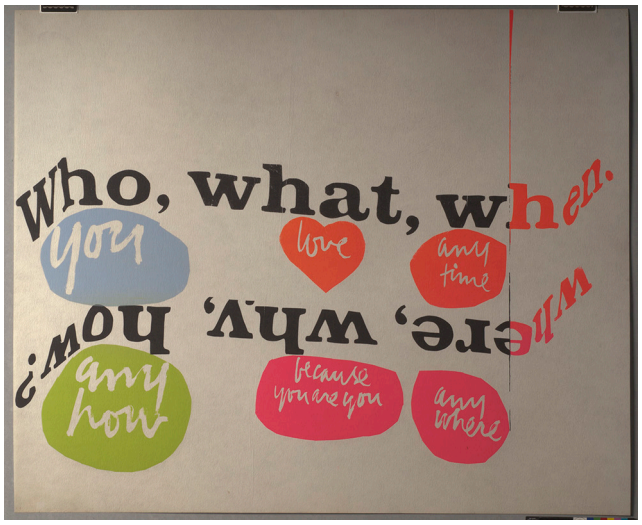

Fig. 6. *Questions and Answers* 1966 Harvard Art Museums TL41188 762mm x 914mm. After treatment in raking illumination.

SUMMARY

The micro-fading tester over-estimates the sensitivity of daylight fluorescent inks due to the increase in temperature at the test location caused by the light source. With further research it may be possible to quantify the error to achieve a more accurate indication of the sensitivity of a particular ink. These fluorescent inks still appear bright and vibrant and, while the display history of these prints is not known, the testing suggests that oil-based daylight fluorescent screen-print ink is not in the most sensitive category of colorants.

Treatment tests have shown that it is possible to improve the appearance of prints on Pellon. The most disfiguring damage, the general discoloration and planar distortion, can be successfully reduced with washing and controlled drying (figs. 5–6).

[FN1.] The cellulose mixture was prepared following a recipe described in the workshop notes *Mastering Inpainting*, Bernstein and Evans (2003 unpublished). 1g toned sieved Solka-Floc 300 powdered cellulose, 20ml water, 5ml 2% w/v methylcellulose A4C, 5ml isopropanol. The cellulose powder was toned by toasting in a pan on a hot plate, it was then mixed with the water and left to settle. The toned cellulose discolored the water and tests showed that this had the potential to create small tidelines when applied to Pellon with the airbrush. The water was removed and replaced periodically until no more discoloration was visible, the methylcellulose and isopropanol were then added to the mixture.

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The Conservation of Tiffany Studios Drawings: Cases of Complex Paper Reconstruction

ABSTRACT

This article explores the use of paper pulp infills and overlays to reconstruct and reinforce drawings severely damaged by mold. In creating custom-made papers to compensate large support losses and conceal irreversible mold staining, several ideas need to be contemplated regarding the transformations that take place in the paper structure due to biodeterioration. One consideration is the increased susceptibility of hydrolyzed paper to moisture, which results in a differentiated hygroscopicity of fibers within the same drawing. A technique is described that allows the conservator to prepare infills and overlays in a manner that provides sympathetic hygroscopic behavior with damaged areas of paper. The technique also guarantees minimal exposure to moisture during treatment for water-sensitive media. Three case studies from drawings made by the Tiffany Studios illustrate the use of this technique.

TIFFANY STUDIOS DRAWINGS AT THE METROPOLITAN MUSEUM OF ART

Louis Comfort Tiffany (1848–1933), one of America's most celebrated artists, worked in nearly all media available to designers in the late 19th and early 20th centuries: glass, ceramic, metalwork, textiles, jewelry, and painting. The American Wing of the Metropolitan Museum of Art holds a collection of over four hundred drawings from his workshops. The subject matters of these drawings are as diverse as were the catalogues of his legendary design company. They are preparatory sketches, cartoons, and presentation drawings for the myriad objects that the Tiffany companies created with the ideal of bringing beauty into everyday life, whether a lamp on a table or a grand theater.

Trained to be a painter, by the 1870s Tiffany had already begun experimenting with glass-making techniques, and in 1879 he founded his first design company. From then until the mid-1920s, Tiffany ran many interrelated design firms, including the Tiffany Glass & Decorating Company and Tiffany Studios, a prosperous interior design business that revolutionized the look of stained glass. The studios were known to be extremely innovative and dynamic, with hundreds of men and women working under the direct supervision of Mr. Tiffany. In the highly organized operations machinery of the workshops, drawings played a critical role, not only for communication with clients and promotional purposes, but also during the design phase (fig. 1). The study of the Metropolitan Museum of Art's collection opens a window into the various ways the drawings were used. Beautiful works of art in their own right, these drawings provide an extraordinary opportunity to understand the creative process of the Tiffany Studios.

Fig. 1. Tiffany Studios, Glass Shop. Craftsmen relied directly on drawings during the production phase. *From Character and Individuality in Decotrations and Furnishings*, New York: Tiffany Studios, 1913, n. p. Thomas J. Whatson Library.

Despite the enormous success that Tiffany experienced over his long career, his firm went out of business in 1924, and Tiffany Studios filed for bankruptcy in 1932. After Tiffany's death in 1933, his estate, including the contents of the studios, was sold in two consecutive auctions. A large number of drawings were bought by the museum in 1967 after they

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were discovered in an attic room of a marble dealer in Long Island. The dealer presumably acquired them from the Tiffany Studios when they closed in 1932 or from Laurelton Hall, Tiffany's country estate in Long Island. The historical storage conditions of the drawings are unclear, but when they entered the museum in the 1960s, they were not accessible for proper study or exhibition because they suffered from extensive mold growth due to water damage. The deterioration was so severe that these drawings were tremendously disfigured, structurally unsound, and posed a health hazard for handlers and researchers.

THE EFFECTS OF BIODEGRADATION

The biodegradation of paper is a very complex phenomenon. Fungal and bacterial interaction with media and paper compromises the integrity of the artistic object at two levels: the structural and the aesthetic. Once paper is subject to the enzymatic hydrolysis employed by mold to break down the cellulose molecules for digestion, its intrinsic physical qualities are transformed, and as a result, it not only becomes irreversibly weakened, but also more permeable to moisture. Other phenomena related to mold growth also alter hygroscopicity, such as the destruction or partial disintegration of the sizing and the uneven distribution of the paper filling materials.

The second consequence of biodegradation is the aesthetic alteration of the art object. Pigments and by-products induced by fungi disfigure art in dramatic ways. Pigments are bio-chemically produced by mold to serve several purposes. For instance, black pigmentation attributed to melanin, protects fungal cells from damaging UV radiation.

Extensive research continues to be done by microbiologists and paper conservators with the goal to better understand the destructive processes of mold growth, and find methods that can assist in safely removing fungal body from contaminated paper. Although much has been accomplished in this effort, in many instances conservators are forced to confront the realization that this pigmentation cannot be removed without compromising the integrity of a fragile support.

Decontamination and reduction of mold-produced stains are necessary aspects of the treatment of biodegraded drawings, but they are not the primary focus of this article. Briefly summarized, mold remediation usually involves a set of steps that can range from vacuum cleaning to the use of solvents, enzymes, bleaches, and chelating agents. Given the complexity of biodegradation, the strategy is always devised on a case by case basis. Furthermore, when addressing the cleaning of these drawings, extreme precaution must be taken due to the physical fragility of the damaged paper, but also its accentuated vulnerability to water. Bearing this vulnerability in mind, as well as the inherent susceptibility of watercolors to wet treatments, cleaning strategies are usually devised with a local approach.

Regardless of the level of success of any given treatment, in cases of severe biodegradation it is virtually impossible to bring back the paper to a state close to the original condition, and the damaged areas continue to be weak and disfigured. In these situations, conservators are left with the double challenge of providing structural stability while regaining, to the extent possible, an aesthetic unity. This article describes a reconstruction methodology that seeks to solve both of these challenges.

A TECHNIQUE TO RECONSTRUCT AND REINFORCE DAMAGED SUPPORT

The reconstruction and reinforcement of the damaged support can be accomplished by creating paper pulp infills and overlays with a methodology that takes the principles of traditional Western papermaking and adapts them to the scale of the conservation lab and the specific needs of the damaged artwork.

There are several distinct advantages to this method: it reinforces strata that have been structurally compromised by biological action; it helps to aesthetically improve areas of paper that have been irreversibly stained by fungal activity; the infill and overlay are created separately, preventing the drawing from excessive wetting; it allows to reintegrate large losses with minimal stress applied to the original support; it provides planar stability to objects with differentiated hygroscopic behavior; and it is reversible.

SELECTING THE FIBERS

Many types of papers and pre-processed dry paper pulps have been traditionally used in the field of paper conservation to compensate missing support. In selecting the raw materials to make paper in the lab, conservators have at their disposal an array of native fibers that have been processed in a variety of ways. The conservator's choice of the raw material and method of processing must align with the specific circumstances of each project.

Pre-processed dry paper pulps are refined, partially beaten pulps, where the long raw fibers have already been purified (bleached or unbleached) and separated from each other. These pulps are a convenient option for the purpose of creating custom-made papers in the conservation lab because they offer conservators control over the resulting product. Generally, it is easier to obtain technical specifications about pre-processed paper pulps than it is about machine-made and hand-made sheets of paper, which may contain unknown fillers and additives. Furthermore, these fibers have not been extensively beaten, which provides an opportunity to influence certain features of a fabricated paper, such as percentage of native fiber mixture and fiber length.

The pulps employed in the treatments illustrated in this article, are prepared by several papermakers who create

paper pulps specifically for the field of paper conservation. Alan Buchanan[1] makes pulps from 100 % rag cotton. Arte y Memoria[2] distributes 100 % cotton, 100 % flax, and mixtures of hemp and cotton that are ECF bleached[3] and contain a carboxy methylcellulose internal sizing and a magnesium buffer. Other mills that offer similar materials include: Carriage House Papers[4], Ruscombe Paper Mill[5] and Griffen Mill[6].

Properties such as hygroscopicity and opacity may be considered when selecting types of native fibers and combinations of these fibers. For instance, bast fibers are more hydrophilic than seed fibers due to their hemicellulose content. If both bast and cotton fibers are mixed together when creating an infill or an overlay, the conservator will produce a paper that is more hygroscopically similar to degraded, hydrophilized cotton. It has been observed that this is beneficial during drying and flattening treatments because it prevents the formation of tensions between the damaged paper and the infill or overlay.

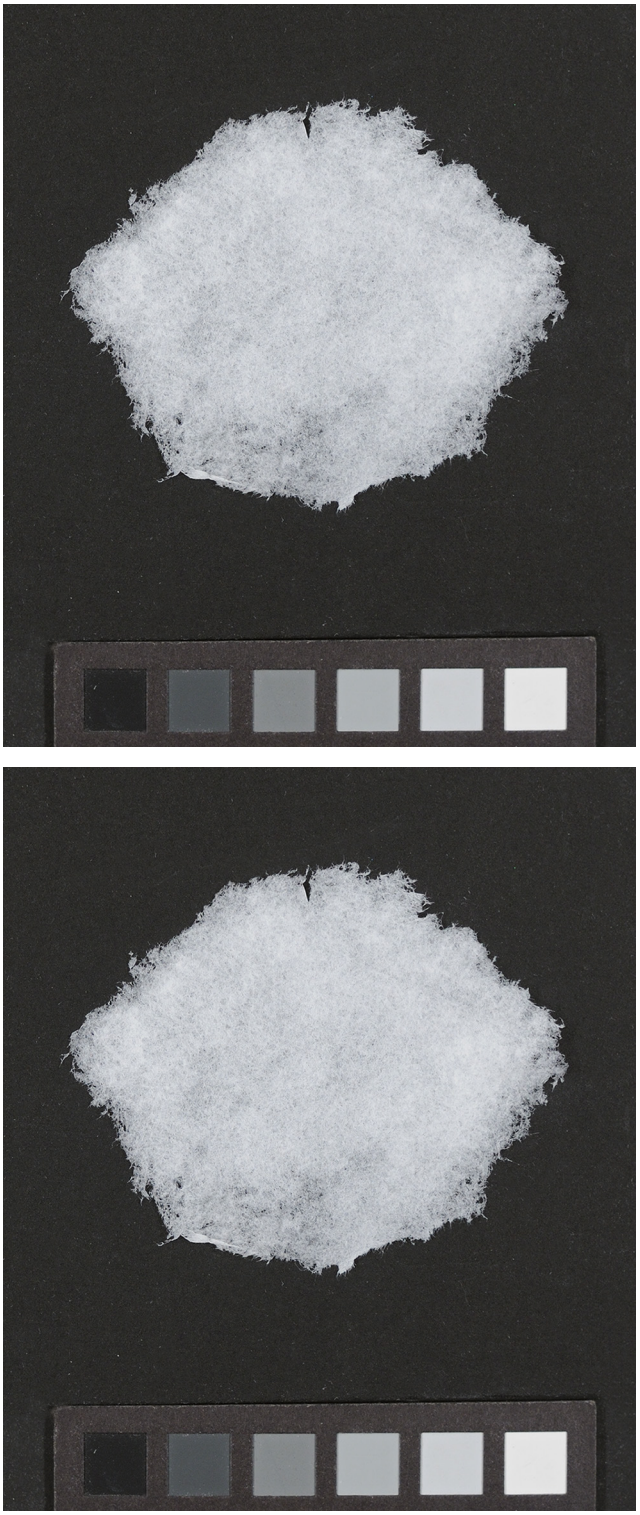
The opacity of fibers is significant as overlays can be used to hide stained areas of a drawing. For example, flax and hemp are more opaque than cotton and are better options for creating thin overlays with high covering qualities (figs. 2a–2b).

COLORING THE PAPER PULP

Another advantage of creating custom infills and overlays from pulp is that the conservator can make them close in color to the healthy paper of the artwork. This can be achieved in many ways. Coloring methods can include: using colored papers; using pre-dyed paper pulp; dying natural paper pulp; adding pigments to natural paper pulp; and adding colored media (such as acrylics or watercolors) to paper pulp or to the formed sheet of paper.

Many papermakers who distribute products for the field of paper conservation offer in their catalogues, colored dry paper pulps. Alan Buchanan follows the method developed by Ruth E. Norton to prepare pulps of the three primary colors at different Depths Of Shade (DOS) with fiber-reactive dyes (Buchanan 2008). Arte y Memoria offers a selection of pre-dyed pulpboard that includes a maroon mixture of cotton and hemp that is colored with direct dyes. There seems to be a consensus that fiber-reactive dyes are in general more lightfast than direct dyes.

Natural pre-processed paper pulp can also be colored with pigments, which in ideal conditions are the most lightfast colorants. Pigments need to be bonded to the paper fiber with the aid of a cationic agent. In her book *Color for the Hand Papermaker* (Koretsky 1983), Elaine Koretsky, offers detailed instructions for papermakers to optimize the use of stable pigments and dyes. One issue that conservators confront when working with these products is often the undesired bleeding of unfixed pigments and dyes. Another related complication is the relocation of unfixed pigments during casting,



Figs. 2a–2b. In these two comparative images, it is possible to observe how a 0.06 mm paper made of 100% flax fibers (below) is more opaque than a 0.06 mm paper made of 100% cotton fibers (above).

which can produce mottled papers. In addition, watercolor and acrylic colors can also be employed in the slurry or in the form of glazes.

Creating a specific color of pulp can be challenging. It requires trial and error and continued empirical analysis. However, the results that can be achieved, justify the effort.

BLENDING THE PAPER PULP

Pre-processed dry pulps need to soak in water to ensure the fiber swelling that is necessary for the formation of flexible paper. After the pulp has soaked long enough to fully absorb the water and swell, it is beaten in a food blender, where the bundles of different colored fibers are separated, mixed, partially cut and fibrillated. In ideal conditions, this process would take place in a beater or a hydro-pulper, but considering the small amounts of pulp that conservators need to prepare for each project, food blenders are good substitutes[7]. The blending time and speed will vary depending on the native fiber (for instance, bast fibers fibrillate more easily than cotton) and the desired characteristics of the paper—strength, thickness, opaqueness and uniformity. The formed paper will have different qualities depending on fiber length and the extent of fibrillation—shorter fibers, for example, will produce a weaker more uniform paper.

The consistency of the slurry, the amount of dry solid content in water, determines the thickness of the formed paper. Before preparing the slurry, the ratio of dry paper pulp to water is calculated in order to form paper of a specific thickness. Table 1 can be used as a reference (table 1).

CASTING INFILLS AND OVERLAYS

Once the slurry is ready, a Mylar template is made by marking both the losses and the areas to cover with an overlay (fig. 3). By principle, areas that contain media will not be covered and will be reinforced only from the back.

A screen is prepared with a sheet of Hollytex[8] attached with tape to a plastic frame. Used together, these materials approximate the moulds employed in traditional Western sheet forming, but are more useful within the context of a paper conservation lab. The template is placed on a light table

Fig. 3.

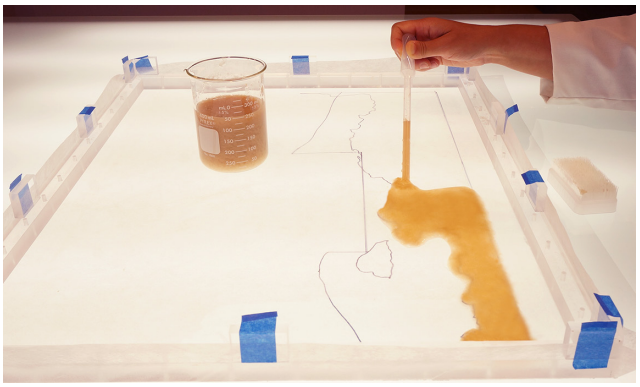


Fig. 4.

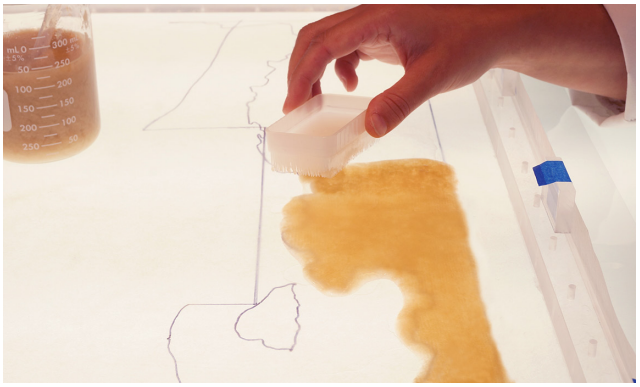


Fig. 5.

Dry paper pulp	Total volume paper pulp and water	Thickness of formed paper
3.0 gr	250 ml	0.25 mm
2.5 gr	250 ml	0.15 mm
1.5 gr	250 ml	0.08 mm

Table 1.

and the screen over it. Plastic pipettes[9] are used to pour the pulp over the screen following the contours of the template that are made visible with the transmitted light (fig. 4).

A gentle vertical tapping is performed with a brush (corn brush or sensory brush)[10] to avoid entanglement and flocculation and also to evenly distribute fibers in-plane (fig. 5). This approximates the leveling effect achieved by a papermaker after pulling a mould out of the vat and shaking it, which also evens the fiber orientation and gives the formed paper its directional strength properties.

DRYING THE CAST SHEET OF PAPER

In traditional hand papermaking, the pulp is dewatered by filtration, pressed and dried to form a web structure—the sheet of paper. In the lab, we can simulate this process using a series of steps. After the paper has been formed, the screen is lifted vertically creating a pulling effect and deposited over an absorbent material, such as a wet blotting paper. Blotters filter the water in a manner that is equivalent to what happens during the traditional couching. The paper is dried on the suction table between two sheets of Hollytex and two dry blotters. The applied pressure provides a restraint that guarantees the dimensional stability of the paper (fig. 6). This is just one method of many to dry cast paper. Other alternatives can be used for practical purposes and to alter the character of the formed sheet[11].

ATTACHING INFILLS AND OVERLAYS TO THE ARTWORK

Two papers are cast consecutively, an infill and an overlay. The infill must have the shape of the losses and must be as thin as the adjacent areas of the drawing; the overlay must be thinner and will cover the losses as well as the pigmented areas to be concealed.

The infill is first attached to the artwork using wheat starch paste (fig. 7). The artwork is then ready to be gradually humidified in a chamber in preparation for the second step, the attachment of the overlay.

Before bringing the drawing out of the humidity chamber, a diluted solution of cooked wheat starch paste (10% v/v) is mixed in the blender and placed in an air-brush bottle. The diluted paste will reinforce the hydrogen bonding that forms among the fibers, while still making the overlay reversible.

The artwork is then placed on the suction table, and after making sure that it is completely flat and free of creases, a protective blotter is placed over it, leaving exposed the area that will be covered by the overlay.

The paste is slowly applied with the air-brush over the damaged areas of the art, and the overlay, which has been pre-humidified and placed face down onto a piece of Mylar for easier handling. The overlay is then carefully positioned on the artwork, and after making sure that the contact between the two papers is even, the artwork is covered with a layer of Hollytex and a thick blotter until drying is complete (fig. 8). Finally, the drawing is flattened by humidifying it in a chamber and placing it under weight for several weeks. This last step is recommended to release any tension on the drawing that may have formed during drying on the suction table.

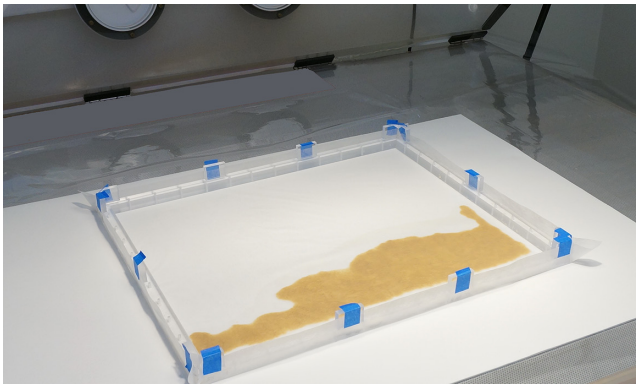


Fig. 6.

Fig. 7.

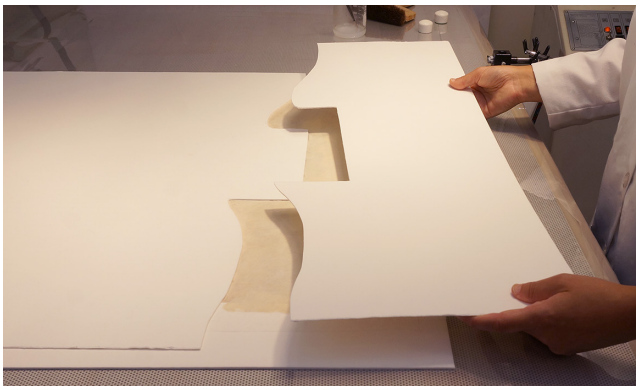


Fig. 8.

FIRST CASE STUDY: *DESIGN FOR A MOSAIC PANEL*

Design for a Mosaic Panel is a sketch painted with watercolor over an illustration board by Frederick Wilson, one of Tiffany's most distinguished designers (fig. 9). This exquisite drawing is one of the few examples in the collection of a design for a figurative mosaic.

Given the multilayered structure of these drawings, which are often attached to backing boards and mat windows, conversations with the curatorial department determine if prior to decontamination, the removal of the attached elements is advisable in light of their historic relevance. In some instances, like in *Design for a Mosaic Panel,* removing them is necessary to gain access to all the laminated layers and guarantee the correct preservation of the primary support.

In preparation for the backing removal, areas of the primary support that seemed structurally compromised were temporarily reinforced on the recto with small strips of remoistenable tissue prepared with 8% (w/v) Klucel G. The tissue strips were reactivated with ethanol, which prevented the formation of tidelines. Backing removal was accomplished with mechanical means, and decontamination on the verso was completed. After a thorough surface cleaning, reduction of discolorations and stains were performed locally on the suction table with a series of solvents, enzymes and chelating agents (fig. 10). The drawing was ready for the next series of steps to the reconstruction of the support, which was performed following the above-mentioned infill and overlay technique. The paper for the overlay was prepared by mixing cotton, flax and hemp in the following proportions: 2 gr yellow DOS ½% (Alan Buchanan), 1.4 gr maroon mixture of cotton and hemp (Arte y Mermoria), and 1.6 gr white flax (Arte y Memoria) in 500 ml deionized water. Blending time was 30 minutes at medium speed, which produced an opaque, soft and evenly distributed thin paper that featured the right qualities to reinforce the damaged areas of support.

Once the reinforcement of the damaged support on the recto was completed, the damaged areas that affected media were reinforced on the back with Tengucho paper and diluted wheat starch paste. Small areas of missing color on the lower right corner of the design were retouched by applying watercolor over the infill paper in a neutral tone matching the surrounding colors. Even though the drawing still exhibits scars from the severe damage it once sustained, this procedure was effective in returning the artwork to a state where it can be contemplated without the distraction of severe staining, and most importantly, it can be safely handled, photographed and exhibited (fig. 11).

Fig. 9. *Design for a Mosaic Panel*. Frederick Wilson, Tiffany Studios. 1902–1932. 53 x 71.8 cm. (Museum accession number 67.654.36). Before treatment.

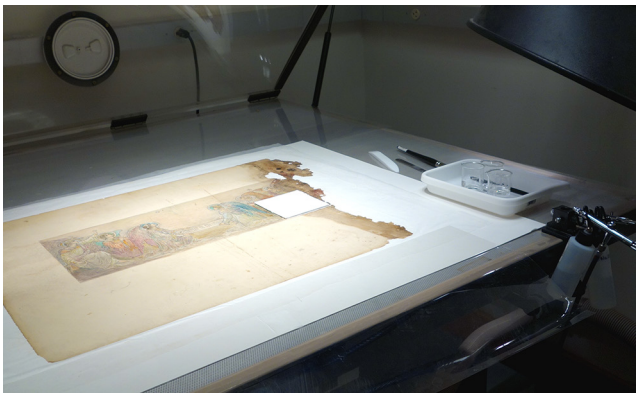


Fig. 10. *Design for a Mosaic Panel*. During treatment.

Fig. 11. *Design for a Mosaic Panel*. After treatment.

Fig. 12. *Design for wood and fabric screen for Church of the Ascension, New York City*. Tiffany Studios. 1902–1932. 37.9 x 54.9 cm. (Museum accession number 67.654.413). Before treatment.

Fig. 13. Steps were cut along the resected edge, and multiple layers of paper were used as reintegration material.

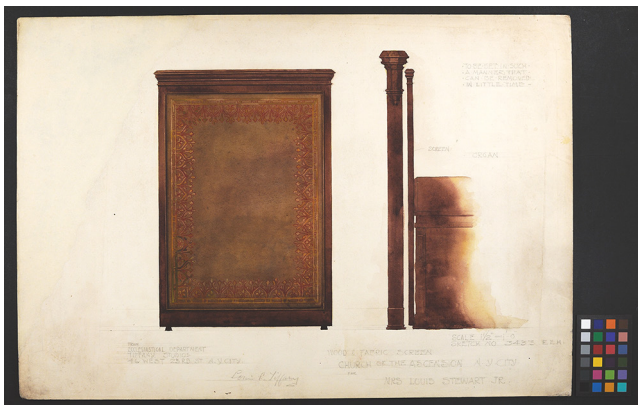


Fig. 14. *Design for wood and fabric screen for Church of the Ascension, New York City*. After treatment.

SECOND CASE STUDY: *DESIGN FOR WOOD AND FABRIC SCREEN*

When addressing the conservation of *Design for an Organ Screen* (fig. 12), a drawing commissioned for the Church of the Ascension, in New York City, it was decided that since the backing was historically relevant, only the severely mold contaminated areas with no inscriptions would be removed. The damaged areas of the primary support were decontaminated and cleaned.

Preserving the laminar structure meant that the areas of loss needed to be compensated. Three-dimensional reconstruction had to be accomplished in a way that created as little stress as possible to an inherently weak support.

The following method is successful in that it avoids adding tension to the original boards while remaining structurally solid and aesthetically sympathetic. Several steps were cut along the resected edge to increase adhesion area, and multiple layers of paper were used as reintegration material (fig. 13). The preferred material was a handmade rag paper from the Richard du Bas Mill in France[12]. Manufactured mostly for printing, these waterleaf papers are particularly soft and have optimal dimensional response when subject to moisture and the right amount of pressure. They were cut with precision to align with the individual steps and attached to the artwork as well as to each other with 5% (w/v) 4M methylcellulose, which was chosen in this case for its weak adhesion power and minimal shrinkage during drying. Once all layers were assembled, they dried under pressure for several weeks. When the attached infill was completely stable, the edges were trimmed to fit the exact dimension of the drawing and color was added to the sides with watercolor. Final layers of paper were cast to match the characteristics of the original papers. The paper for the overlay on the recto was prepared by mixing cotton, flax and hemp in the following proportions: 0.9 gr yellow DOS ½% (Alan Buchanan), 0.8 gr maroon mixture of cotton and hemp (Arte y Memoria), and 0.8 gr white flax (Arte y Memoria) in 250 ml deionized water. Blending time was 30 minutes at medium speed, which produced an opaque, soft and evenly distributed thin paper. The paper for the overlay on the verso was prepared with Alan Buchanan rag cotton fibers mixed in the following proportions: 1.5 gr DOS 4% yellow, 0.3 gr DOS 4% red and 1.2 gr DOS 4% blue (equivalent to Buchanan's DOS 4% 5Y 1R 4B swatch). Blending time was 5 minutes. A final glaze of burnt sienna acrylic was air-brushed to the formed paper. These two papers were attached to the recto and to the verso by air-brushing a 10% (v/v) solution of cooked wheat starch paste over the pre-humidified cast papers, attaching them over the areas that needed to be concealed, and letting the object dry under weight for several weeks.

In this case, a more integrated restoration was desired, and modulations of color that blend with the natural discolorations of the paper around the edges were added in the form

of thin glazes of acrylic pigments applied by air-brush after masking out the artwork (fig. 14). Ethical considerations are always addressed when adding such large portions of support to an art object, but in cases like this, when the area of the drawing that is being retouched is so extremely disfigured and it affects only the margin and not the design, it is easier to make the choice of covering the original.

THIRD CASE STUDY: *ANGEL APPEARING TO THREE MARYS AT THE TOMB*

The final study is the conservation treatment of *Angel with Three Marys* (fig. 15), a design for a leaded glass window. In this example, important inscriptions were present on the upper margin and needed to remain uncovered for future research[13].

The inscriptions regained legibility after decontamination and cleaning, and once the backing removal was completed, it became apparent that important fragments on the top area were detached from the main body and that the drawing had large losses that affected the design (fig. 16). Paper pulp was used to cast infills of the right thickness and shape, and they were attached to compensate for the missing support. It was decided that a paper pulp overlay would be used to cover the areas of the design that were irreversibly stained by black melanin, but that the overlay should not conceal the inscriptions. The paper for the overlay was prepared by mixing cotton, flax and hemp in the following proportions: 0.8 gr yellow DOS ½% (Alan Buchanan), 0.7 gr maroon mixture of cotton and hemp (Arte y Memoria), and 1 gr white flax (Arte y Memoria) in 250 ml deionized water. Blending time was 30 minutes at medium speed. The areas of the paper corresponding to lines of black ink marking the contour of the windows in the design were cut out so that when the paper was adhered to the drawing, the media would remain fully visible (fig. 17). Adhesion was accomplished on the suction table with the described technique and the overall damaged area was reinforced on the verso by providing a partial lining with a thin Tengucho.

Given the hybrid nature of this drawing, part historic record, part work of art, it was decided that the missing parts of the ink lines should not be reintegrated. The areas of overlay around the design were toned to match the surrounding paper and the mat window was cut to suggest the full shape of the top quatrefoil and the right arch (figs. 18a–18b).

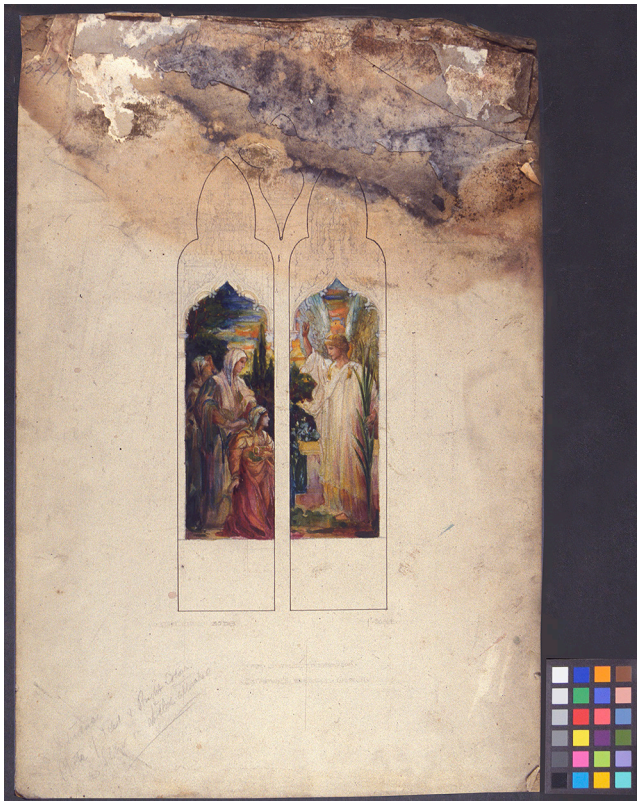
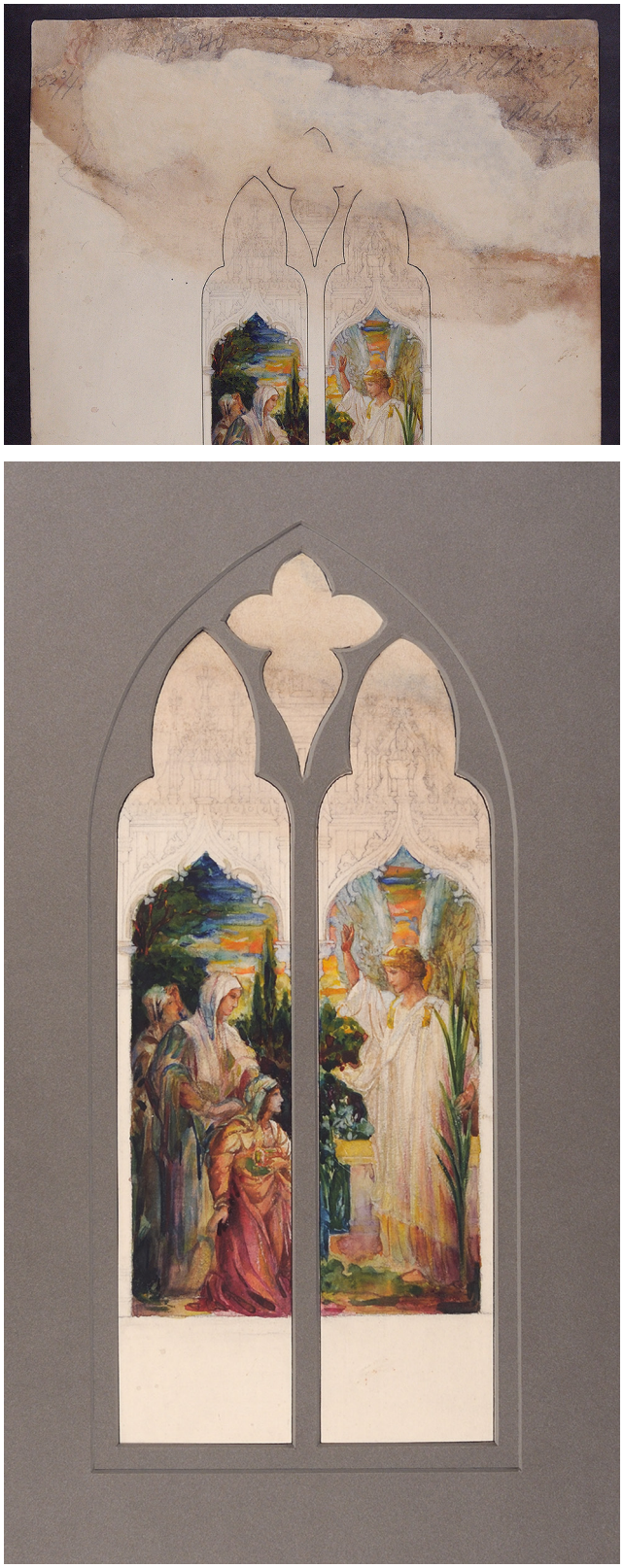


Fig. 15. *Angel Appearing to Three Marys at the Tomb*. Tiffany Studios. 1902–1932. 55.7 x 37.1 cm. (Museum accession number 67.654.206). Before treatment.

Fig. 16. Detail of the drawing during treatment, showing detached support and losses that affect the design.

Fig. 17. Image of the fabricated overlay. The paper was cast to avoid covering inscriptions and cut to precision where lines of ink should be exposed.



Figs. 18a–18b. *Angel Appearing to Three Marys at the Tomb*. After treatment.

CONCLUSIONS

Support reconstruction techniques with paper pulp can yield successful results in the stabilization and compensation of mold damaged works of art on paper. Considerations such as the characteristics of the native fibers, how their processing impacts the character of the formed paper, and the susceptibility to wet treatments of mold-degraded paper, can have a positive impact in creating a sympathetic interaction between the art work and the reintegration materials.

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NOTES

1. See Alan Buchanan in Sources of Materials.
2. See Arte y Memoria in Sources of Materials.
3. ECF stands for Elemental Chlorine Free.
4. See Carriage House Papers in Sources of Materials.
5. Ruscombe Paper Mill pulps are distributed by Talas. See Talas in Sources of Materials.
6. See Griffen Mill in Sources of Materials. They only take special orders for dry leafcasting pulp.
7. The model used by the author is a Vitamix Vita-pre3.
8. Different materials were tested that would allow the paper fibers to stay in suspension while remaining dimensionally stable. These included several non-woven polyester fabrics, rayon tissues and wet-strength paper tissues. Hollytex (thickness: 0.0029" +/- 0.0007) was found to have optimal qualities for this purpose.
9. See Fischer Scientific in Sources of Materials.
10. See Pacific Pediatric Supply in Sources of Materials. There are many online distributers of corn or sensory brushes.
11. Optional couching materials can include sponges, wool felts, and absorbent synthetic papers (Evolon AP, Tek-Wipe). Optional pressing and drying techniques can include traditional press between absorbent

materials, printer's press—drying stack built up with interspersed corrugated boards, with cold air and hot air—and stretch-drying.
12. See Moulin Richard de Bas in Sources of Materials.
13. The inscriptions revealed during conservation helped in the identification of the window made from this design as one from St. Mark's Episcopal Church in Salt Lake City, Utah.

SOURCES OF MATERIALS

Alan Buchanan Designs Ltd
www.alanbuchanandesigns.com
3 Arlington Cottages
Sutton Lane North, London
W4 4HB, United Kingdom
Tel: +44 (0)208 995 9780
e-mail: abuchanan880@gmail.com
Product description: dry pre-processed pulp

Arte y Memoria
www.arteymemoria.com
Industria, 26
08551 Tona
Barcelona, Spain
Tel: +34 938 125 378
e-mail: comercial@arteymemoria.com
Product description: dry pre-processed pulp

Carriage House Paper
www.carriagehousepaper.com
245 Kent Avenue
Brooklyn, New York
11249 USA
Tel: +1 718-599-PULP (7857) or +1 800-669-8781
e-mail: info@carriagehousepaper.com
Product description: colorants and additives

Fischer Scientific
www.fishersci.com
Tel: +1 800-766-7000
Product description: Fisherbrand™ Transfer Pipettes.
Length: 5.875 in. (15cm); Capacity: 7.7mL
Catalog No.: 13 711 7M

Griffen Mill
www.griffenmillhandmadepaper.com
Killinagher
Ballyhaunis (County Mayo), Ireland
e-mail: griffenmill@eircom.net
Product description: dry pre-processed pulp

Moulin Richard de Bas
www.richarddebas.fr
F-63600 Ambert, France
Tel: 33 (0) 473 820 311
e-mail: rdb@wanadoo.fr
Product description: paper (Blanc narcisse, vergé canton, 90-120 g/m^2)

Pacific Pediatric Supply
www.pacificpediatricsupply.com
Product description: corn or sensory brush

Talas
www.talasonline.com
330 Morgan Ave
Brooklyn, NY 11211
Tel: +1 212-219-0770
Product description: dry pre-processed pulp

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Indian Coloured Drawings: Modern Repair Techniques for an Album of 19th Century Paintings on Mica

ABSTRACT

Indian Coloured Drawings is a library-bound album in two volumes from the Art and Architecture Collection in the Miriam and Ira D. Wallach Division of Art, Prints and Photographs at The New York Public Library. Volume One contained 135 gouache paintings on mica that had been lined and mounted to acidic paper inside an album bound in the 1930s from different and unknown 19th century sources. The fragile nature of the dissimilar materials, previous reformatting decisions, and storage history of the albums contributed to physical damage of the materials and severely impacted access. This case study describes the research and treatment methods employed to stabilize, digitize, and rehouse the mica paintings. Consolidation of fragile, flaking, and cupped media was accomplished with mixtures of solvent-based Paraloid B-72, Aquazol 200, and Aquazol 500. Repairs were complicated by paper linings on each mica painting that captured paint on the verso of 28 paintings. Paraloid B-72 and BEVA 371 film were used to repair mica breaks and fill losses. Mylar support mounts inside customized window mats decrease physical contact during handling. Digital images of the recto and verso of each painting on an open access platform showcase the collection and aid discovery. Social media outreach efforts share images and videos of the mica paintings project to emphasize responsible collection stewardship and promote the NYPL mission to inspire lifelong learning and curiosity.

INTRODUCTION

The contents of *Indian Coloured Drawings* are thematically separated by format into two volumes of original and printed material related to 19th century Indian costumes, occupations, religious ceremonies, and historical scenes (fig. 1). Volume One contained 135 opaque watercolor paintings on small mica supports measuring an average 115x150mm.

Fig. 1. *Indian Coloured Drawings* (270 x 415 x 35mm). Before treatment from tail. n.a., n.d. NYPL MAF++ (*Indian coloured drawings*).

Volume Two had 44 engravings, lithographs, and watercolors on paper of Western and Indian origin that ranged in size from 165x200mm to 230x350mm. Though treated using standard paper conservation methods to remove the prints and watercolors from brittle album pages, Volume Two falls outside the scope of this paper.

The title had at one time been separated into two different collections within the New York Public Library (NYPL), the Spencer Collection of illustrated books and fine bindings and the Art and Architecture (A&A) Collection in The Miriam and Ira D. Wallach Division of Art, Prints, and Photographs of art historical reference and decorative history. Curiously, the unique mica paintings in Volume One were in the A&A Collection but the printed materials in Volume Two were atypically assigned to Spencer. The only identifying information within either volume was a typewritten title card adhered to the front flyleaf of each text block. The card inside Volume One read "Paintings on talc illustrating modes of transportation, industries, selling scenes, costume etc." referring to the common, though archaic, term for mica (Archer 1992). The albums were brought into the NYPL conservation lab because of the extremely fragile condition of the brittle album pages

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and mica paintings. Reference staff also cautiously wondered if the clear material was cellulose nitrate.

BACKGROUND

The original opaque watercolors on mica in the *Indian Coloured Drawings* are broadly classified as "Company paintings," a hybrid of traditional Mughal and European styles that developed during the early 17th through 19th centuries (Archer 1972, 1992). Traditional Indian patronage systems of art were disrupted before European venture capitalism and imperialism in the 17th century, giving rise to a brisk trade in souvenir art for the Western market that lasted until the 19th century (Guy and Britschgi 2011; Mishra 2011). The Company style derives its name from the East India Company (1600–1858), a British trade venture that grew to hold a monopoly with India and other areas of Asia (British Library). Company paintings on mica were produced until the end of the 19th century when they were superseded by photography (Archer 1992).

The major centers for Company paintings on mica were two cities along the Ganges River valley in the north, Benares (modern Varanasi) and Patna, and the southern city of Trichinopoly (modern Tiruchirappalli) (Birdwood 1880; Archer 1992). Major geologic deposits of mica, known as muscovite, are located nearby. Muscovite is a phyllosilicate mineral with a crystalline structure that easily cleaves into thin sheets (Mindat). Large groupings of the sheets are called "books". Mica is transparent, virtually colorless, and somewhat flexible. It is also chemically inert and stable in temperature and humidity fluctuations. Because of these properties, and the relative abundance in Asia, mica was historically used for lanterns and window panes. Another use was as a cheaper substitute for colored glass in religious processional structures during the Muslim month of Muharram (Birdwood; Archer 1972, 1992).

Paintings on mica were created by Indian artisans to appeal to the Western market. Rather than holding value as art objects, they were considered to be exotic novelties and trinkets. "The talc paintings are mere toys, picked up in Patna where they are made; they represent several of the trades and occupations in Hindostan… they serve for play things for children if nothing else" (Archer 1992). Easily transported, the mica paintings showcased to Westerners the exoticism and otherness of Indian culture where distinctions of rank and nobility in dress documented the Indian caste system (Frang 2003). Letters from contemporary travelers state that mica paintings were commonly sold at riverside markets in ready-made packets of 6 or 12 called *firqa* (Archer 1992, 193; Nevile 2007, 42). The mica paintings were often corner- or edge-mounted with paper tape onto custom paper cards with thin paper overlays (Archer 1992).

Institutional collection holdings for mica paintings are concentrated in Britain, with smaller collections in North America (table 1). Accurate item-level counts are complicated by groupings of the mica paintings in album, card, or boxed sets which may or may not have been compiled before or after entrance into the institution. The 135 mica paintings in NYPL's Indian Coloured Drawings represented a sizable and previously hidden collection of mica paintings.

TREATMENT PROCEDURE

OVERVIEW

Conversations between the author and Clayton Kirking, Chief of Art Information Resources at NYPL and primary curatorial contact for the project, established that the aim of treatment for the *Indian Coloured Drawings* was documentation, stabilization, and access. Sympathetic stabilization repairs of fragile materials attached to brittle album pages could be adapted or removed for future loan or exhibition preparations. Digitization would create digital access images to limit handling of the original mica paintings by future researchers.

During examination, the album-bound mica paintings were deemed too fragile to determine the full extent of damage without additional loss from handling. Treatment continued with Volume Two to allow time for research and testing of materials from Volume One. Consolidation strengthened the mica paintings to allow additional handling

Collecting Institution	Mica Paintings (approximate)	Reference
Wellcome Institute Library	1,500	Fleming 2006
Victoria & Albert Museum	700	Balser 1998; Wheeler 2000; Wheeler et al 2002
British Library	600	BL India Office http://searcharchives.bl.uk/
Peabody-Essex Museum	300	Frang 2003
Pitts-River Museum	100	Beiner 2007
Morgan Library	100	Morgan Library http://corsair.themorgan.org
Library of Congress	<15	Wilker 2008

Table 1.

and removal of each from their paper backings. Repair materials selected for the project matched the refractive index of mica, were easy to use, and were reversible to facilitate the work of future conservators. Inpainting fills was outside the scope of stabilization treatment. Upon completion of the stabilization treatment, the *Indian Coloured Drawings* materials were digitized. The treated micas were attached to Mylar handling mounts, hinged inside window mats, and then rehoused in a series of new customized archival boxes.

DESCRIPTION

Buckram-bound scrapbooks and library-bindings with oversewn text blocks on acidic paper follow conventional practices typical of the NYPL and contemporary peer institutions. The NYPL Bindery operated from 1913, soon after the Library opened, through the 1960s with a staff of up to seventy working to compile and bind materials to meet the research demands of the "People's Palace" (Martinez and Reeves 1992). The NYPL Bindery typically collected thematically grouped materials on a large scale from different sources and mounted them to albums for easy service to patrons in the NYPL reading rooms. This often resulted in little to no provenance information for the materials. Stylistic clues must be used to infer the origins, artists, authors, and dates of origin.

Volume One was disbound and separated into 29 leaves to enable item-level documentation and condition assessment of the mica paintings. Examination showed that NYPL Bindery staff arranged the mica paintings in Volume One of *Indian Coloured Drawings* according to size (fig. 2). The 64 mica paintings in the first half of the album, averaging 115x150mm, tended to be grouped four per page with pastoral, religious, aristocratic, and hunting scenes in landscape orientation. The 71 mica paintings in the second half were slightly smaller (70x110mm). Their portrait orientation allowed for tighter groupings of six on the album page. The imagery emphasizes occupations, trades, and costumes with repeated stylistic devices at the top corners like curtains and trees branches.

Small fragments of the painting support found loose in the gutter but too small to attribute to a particular painting were positively identified as muscovite mica using polarized light microscopy and comparison to reference samples (McCrone et al 1978; Mindat; Olympus). The mica mineral supports are transparent (refractive index n=1.563), with warm to grey tonal variations. The thicknesses of the mica supports vary from thin (0.0015") to thick (0.0050"). Scratched and abraded impressions of manuscript alphanumeric identifiers are visible in raking light at a top corner of all but seven mica paintings (fig. 3). These identifiers are consistent enough to be evidence of a unified mounting scheme prior to, though not retained by, the NYPL binding created in the 1930s.

The paintings were executed in gouache, opaque pigment-based watercolors with fillers of chalk or gypsum (Ash 1985; Hansen 1993). Layering techniques and color grounds

Fig. 2. Surface grime, paint loss, and mica damage. Page 27. During (top) and after (bottom) treatment.

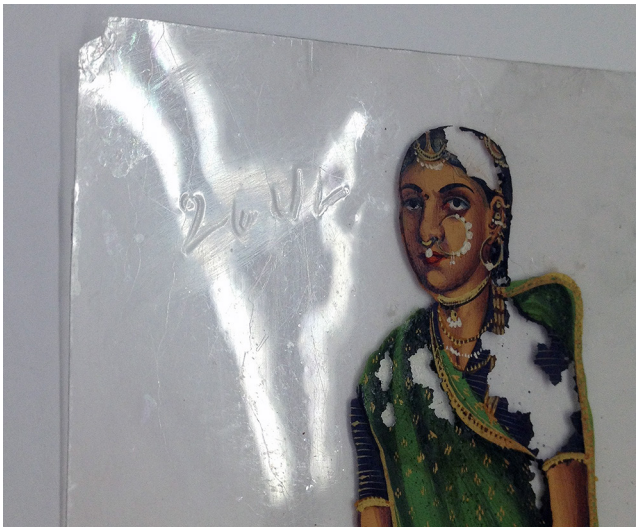

Fig. 3. Alphanumeric identifier "26UL" at top left corner in raking light. Painting 27.1. During treatment.

increase paint brilliance and light reflection. Paint on the verso of 28 mica paintings increases dimensionality of the imagery with shadows or underpainting areas of high detail. Pocked and textured paint surfaces are visible under magnification. Thick impasto details are visible in raking light. Lead white darkening or thin applications of white underpainting are visible from the verso on several paintings.

Paint samples still attached to a layer of mica were spot tested to determine the presence of starch and protein binders within the paint (Mayer 1990). Results from these tests were negative, suggesting gum arabic binders. Paint fragments were spot tested for solubility, swelling, and lateral movement. Fragments dissolved and bled in deionized water. No visible changes were observed in isopropanol or ethanol. Acetone caused very slight bleeding of components in brown and yellow paints but no other observable changes.

Samples of the lining paper on the verso were recovered from the exposed edges of several mica paintings. The paper fibers were identified as linen after observation under polarized light and comparison to reference samples (McCrone; Mayer 1994; Olympus). The lining adhesive was positively identified as starch using iodine potassium iodide tests.

CONDITION

Examination revealed three main categories of condition issues related to handling and fluctuations in the storage environment: paint loss, paint detachment, mica cleavage. Paint was often missing from areas of heaviest application. Thick areas of gouache paint responding to ambient conditions had flaked and cupped. Mica damage included cracks, cleavage, and breaks. The lining process introduced paste and paper that contributed to large delaminations of the naturally layered mica.

Overall lining on the verso of each mica painting with thin linen-fibered tissue and starch adhesive was the most damaging and ubiquitous condition issue. The lined mica paintings were edge-mounted with paste to the paper album pages in groups to fill the page. This method of attachment was common to albums created in the NYPL Bindery. The unusual use of lining paper was likely an interventive measure intended to hold together existing older breaks or those introduced by removal from previous albums or card mounts.

The linings and edge-mounting proved to be ruinous. Humidity and temperature fluctuations in ambient storage conditions caused the paint on the recto and the paste/paper layers on the verso to expand and contract while the mica mineral support remained inert. Crowding on the page enhanced planar distortion of the paper album pages. The grain direction of the paper encouraged cockling along the vertical axis, bowing the micas (fig. 4). The layered crystalline structure of the mica easily cleaved in thin layers, resulting in complex breaks, shearing, and paint loss (fig. 5). Few loose paint or mica fragments were present in the album gutters,

Fig. 4. Overall planar distortion, raking light. Page 18. During treatment.

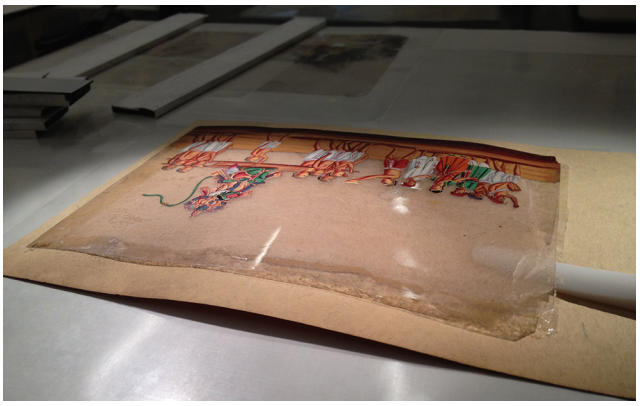

Fig. 5. Lined overall and edge-mounted to the album page, painting 16.1 was partially detached from the album page. During treatment.

suggesting the occurrence of earlier undocumented, but well-intentioned, "tidying."

Other condition issues were revealed as treatment progressed. Lining paper and paste captured paint on the verso of 28 of the 135 the mica paintings. Aesthetically disturbing sooty grime and brown animal glue from previous mounting campaigns were captured between delaminated mica layers. Paper remnants, daubs of waxy brown glue, and two handwritten labels on the verso were evidence of different mounting and identification methods employed in past formats (fig. 6).

A detailed Excel spreadsheet, noting descriptive characteristics and condition issues, was crucial for project management. Identification was complicated by a lack of cataloging information and seven instances of repeated imagery. Each painting was assigned a temporary identification number based on relative location on the album page (left to right in a clockwise rotation). The disbound pages were placed in temporary deep 8-ply window mats made of scrap boards to protect the fragile paint surfaces and maintain the original order during treatment.

Fig. 6. Loose paint fragment and evidence of previous mounting methods. Painting 7.1. During (top) and after (bottom) treatment.

MATERIAL SELECTION

In general mica paintings in institutional collections are valued as historic artifacts rather than art objects. This concept is supported by case studies of mica painting treatments and rehousing projects published by conservators from the Victoria and Albert Museum (V&A) (Wheeler 2000, Wheeler et al 2002), Pitt-Rivers Museum (Beiner 2007), Wellcome Institute Library (Fleming 2006), and Library of Congress (Wilker 2008). Several master's degree thesis projects have detailed the art historical and ethnographic perspective of mica paintings at the Peabody-Essex Museum (Frang 2003) and Ohio State University (Balser 1998). Conservation projects at the V&A most resemble the *Indian Coloured Drawings* because many of their mica paintings had been attached to card mounts by daubs of brown adhesive, causing fracturing of the mica and paint loss related to distortion. Wheeler's 2000 treatment case study used Paraloid B-72 5% w/v in acetone as a consolidant and 10% w/v solution as a repair adhesive for 1 mil polyester film (Melinex) infills (Wheeler 2000). Pigments mixed with B-72 were used to directly inpaint or retouch on Melinex spot-welded in place behind large paint losses to meet the aesthetic requirements of the V&A collections. Wilker conducted analytical testing of the media and support materials on a dozen mica paintings from a single album at the Library of Congress in 2008. She drafted a treatment procedure and tested various consolidants including Paraloid B-72 and Aquazol (Wilker personal communication). The Wheeler and Wilker case studies cautioned that weak consolidants were preferable in order to limit delamination of mica on a lower cleavage plane in fluctuating temperature and humidity conditions after return to the storage environment.

Paraloid B-72 (ethyl methacrylate (70%) and methyl acrylate (30%) copolymer) is a thermoplastic resin (n=1.479-1.489) commonly used in objects and paintings conservation as an adhesive and consolidant. Aquazol (poly(2-ethyl-2-oxazoline)) (n=1.52) has been cited for treating gouache binder desiccation and associated paint loss without altering gloss and color saturation (Ash, 15; Arslanoglu and Tallent 2003; Arslanoglu 2004). Aquazol polymers are available in four different molecular weights: 5, 50, 200 and 500 g/mol (hereafter Aq5, Aq50, Aq200, and Aq500). Aq50, Aq200, and Aq500 are the easiest to source and most commonly used for paper and paintings conservation (Arslanoglu and Tallent 2003; Arslanoglu 2004; Michalski 2008; Lechuga 2011; Bosetti 2012). Mixtures of different molecular weights can be blended to customize viscosity and bond strength. Diluent choice impacts drying rate, moisture uptake, and wetting (Arslanoglu and Tallent 2003).

The mica paintings from *Indian Coloured Drawings* presented many sprung and ridged breaks with complex alignment and small losses that made the use of a wet repair adhesive like B-72 in acetone difficult to control. Cast B-72 (Koob et al 2011) was considered but ruled out as a fill material because creating a thin even sheet without bubbles or dust was problematic. BEVA 371 film was identified as a flexible, transparent option (Horie 1987; Smith 1989; Jamison et al 2010). The 1.5 mil Mylar backing on the heat-activated, synthetic adhesive could also be custom cut to fill large mica losses.

CONSOLIDATION

Consolidation treatment aimed to reattach flaking, cupped, or friable paint to the deformed and fractured mica support while it was still held in place by the lining. The mica paintings required a consolidant with a refractive index similar to mica (n=1.563) and good adhesive strength. Aqueous consolidants like proteins and cellulose ethers were ruled out after media testing. The characteristics of Aquazol and Paraloid B-72 adhesives made them ideal candidates for consolidation.

The consolidation work space consisted of a fume extraction trunk, a metallic sheet surface, and a stereo binocular microscope with adjustable LED light sources for alternating between direct and raking light. The fume extraction trunk was directed at the work surface to pull residual solvents

away and reduce exposure since solvent mixtures can synergistically enhance toxicity (Davidson and Brown 2012). The metallic sheet was covered with white Permalife paper below silicone Mylar to provide a bright, magnetic surface with added contrast for better visibility. Weights were not used as a precaution against crushing cupped paint or delaminated mica. Small low-strength magnets with silicone Mylar barriers were ideal for holding the album pages in place during the consolidation work. The excellent reservoir tips on Kolinsky #000 sable brushes extended working times and gently introduced consolidant or solvent between lifted paint or mica layers. Silicone-tipped sculpting tools were useful for manipulating flaked and cupped paint. Custom cotton swabs made from bamboo skewers and rolled cotton batting wicked excess consolidant and delivered solvent for cleanup.

The consolidants were chosen in response to the observed paint condition of each mica painting under normal and raking light conditions with a stereo binocular microscope (table 2). Aq200 and Aq200/Aq500 mix were selected for inclusion as alternates to B-72 to reduce lateral movement of yellow and brown paints observed during testing. Local brush application of the Aq200/Aq500 mixture (2.5% w/v each in ethanol/water (2:1)) was successful at wetting out, relaxing, and readhering cupped flakes without disturbing paint details. Very tented and cupped flakes were initially prepared from the back with an ethanol/water mix (2:1) delivered by #000 brush. A solution of Aquazol 200 2.5% w/v in ethanol was the best for overall consolidation of friable or flaked paint without glossing or needing repeated applications. Paraloid B-72 4% w/v in acetone was used to readhere flakes still attached to delaminated layers of mica. Additional brush applications of solvent to the paint surface after consolidation flushed any residual Aquazol or B-72 on the surface into the paint layers, lessening the risk of gloss or cold flow. Several thin applications were more successful than one application of a thicker, more viscous solution. Areas of consolidation were documented on a color-coded treatment map created from scanned and printed copies of the treatment slides.

BACKING REMOVAL

Following consolidation, the album pages were trimmed on a self-healing cutting mat with a scalpel blade to separate the micas into individual units and ready them for removal from the paper supports and linings (fig. 7). Local application of a cotton pad dampened with isopropanol/water mix (1:1) from the verso wetted the paper and swelled the adhesive. The humidified paper was gently rolled away to reveal the mica verso. A visual examination of the entire verso surface under magnification in raking light was conducted to note newly revealed condition issues or the presence of paint in the project management spreadsheet.

A fresh cotton pad wrapped with a lint-free tissue was dampened with a higher isopropanol/water mix (3:1) to swell the adhesive on paint-free versos. Using gentle circular movements, the linen paper and starch adhesive were wiped away. The tissue was a precaution against scratching or abrading delaminated mica. If large breaks or losses were present the same process was controlled with cotton swabs followed by fresh swabs wrapped in tissue.

The verso was allowed to air dry undisturbed if paint was observed below the lining paper and adhesive layer. The dried starch adhesive was thick enough that a #15 scalpel blade could gently cut the linen fibers and create a hard edge at the paint boundary without disturbing the paint below. A chisel-tipped silicone tool was then used to push the paste/tissue lining away from the painted areas before continuing to swell and remove the lining. If sooty grime or fingerprints were present on the recto it was surface cleaned with a custom cotton swab dampened in isopropanol/water mix (3:1), carefully avoiding image areas.

Name	Concentration	Use
Aquazol 200 + Aquazol 500 (1:1)	5% w/v in ethanol and deionized water (2:1)	(paint-mica) Wet out cupped or lifted flakes; Consolidation
Aquazol 200	2.5% w/v in ethanol	(paint-mica) General consolidation
Paraloid B-72	4% w/v in acetone	(mica-mica) Reattach paint-mica fragments or large mica flakes
Paraloid B-72	8% w/v in acetone and ethanol (3:1)	(mica-mica) Split or break repair
Deionized water	n/a	Brush rinse
Ethanol/deionized water mix	n/a	Aquazol brush rinse; Quick dry; (infrequent) Wet out cupped flakes; Flush between mica layers
Acetone	n/a	B-72 brush rinse; Quick dry

Table 2.

Fig. 7. Local humidification from the back to remove paper linings and adhesive residues. Painting 23.2. During treatment.

Fig. 8. Flushing out delaminated mica layers to prepare for Paraloid B-72 and BEVA 371 film repairs. Painting 5.2. During treatment.

MICA REPAIR

A sheet of black paper inserted between the metallic sheet and the silicone release Mylar allowed the mica delaminations and breaks to stand out against the working surface. For health and safety a fume extraction truck was directed at the work surface. Mica delaminations were separated by thin Hollytex strips and flushed with ethanol or ethanol/water mix (3:1) applied with a brush to remove debris, animal glue (from previous restorations), or sooty grime (fig. 8). A solution of Paraloid B-72 8% w/v in acetone and ethanol mix (4:1) increased open time and reduced bubbles for aligning delaminated mica and complex breaks (Davidson and Brown, 104). Magnetic strips gently held the delaminations in contact between silicone release Mylar until they dried.

BEVA 371 film proved to be a fast, easy, and visually compatible repair material for filling losses and bridging simple breaks without overlapping mica (fig. 9). Sold in rolls, BEVA 371 film is a dried transparent layer of thermoplastic, elastomeric polymers sandwiched between protective outer layers of 4-mil silicone release paper and 1.5-mil Mylar (Berger 1975; Jamison et al 2010). The BEVA 371 film was custom-shaped with scissors to cover breaks and losses. The paper layer was peeled off and the repair was placed adhesive-side down on the verso and set in place with a heated tool at low heat (150°F). The heated tool was regulated with a rheostat

Fig. 9. Mica repairs and fills with Paraloid B-72 and BEVA 371 film. Painting 27.2. During (left) and after (right) treatment.

and regularly tested using a mercury thermometer to ensure consistent temperatures. Silicone release Mylar was used as a barrier. The 1.5-mil Mylar backing already present on the film was compatible with the thickness of the mica supports and was used for loss compensations. Excess film was trimmed with scissors or a scalpel. The BEVA was swelled from the recto with ethanol and gently rolled off with a cotton swab or

Fig. 10. Detail of BEVA 371 film fill at lower right corner recto. Painting 27.2. During treatment.

the silicone tipped sculpting tools (fig. 10). Adhesive remained only where the Mylar film layer overlapped with original mica.

DIGITIZATION

Discovery of the NYPL's image-based research collections often begins with the NYPL Digital Gallery[1], an open access platform which showcases collection materials from the Library's research and reference collections. Digital images of the recto and verso highlight the unique qualities of the mica paintings and provide primary access to these fragile materials for the majority of researchers. Reference interviews would identify patrons with extraordinary research need to view the actual objects.

In order to enable full digital access to the verso, the treated micas were imaged before they were attached to their final housing. Treated micas were transferred to the NYPL Digital Imaging Unit (DIU) in temporary paper folders. All digital photographs for the DIU were taken on top of a mat board surface customized with a recessed area to keep the digital color checker in plane with the mica. The author, using a large Teflon spatula, assisted the photographer with all handling of the micas during digital image capture of the recto and verso.

HOUSING

Because of the exceptionally fragile nature of both paint surfaces and mica supports, mica paintings require special attention during rehousing. Space limitations and NYPL preference for window mats excluded the rehousing methods used at the Wellcome, V&A, and Pitt-Rivers Museum. At the NYPL, computerized cutting machines for mats and archival boxes improve production efficiency. Standard materials, sizes, and thicknesses for storage mats maximize space in collection storage areas. A combination of 2- and 4-ply 8x10in window mats and 6x8in Mylar handling mounts were chosen for the mica paintings because they minimize direct contact with the mica or paint surfaces.

The mica-Mylar attachment needed to be strong enough for handling but easily reversible in anticipation of future exhibition or other unknown uses. Wet application of B-72 or similar acrylic adhesives was not considered because it was disruptive to previous repairs and difficult to control between non-porous layers. BEVA 371 film was chosen because it was readily available in an even thickness and could be heat-set for increased speed and control. Working on top of a heat-resistant silicone textile sheet, small (2x3mm) rectangles of BEVA 371 film without the Mylar backing were applied with heat at the corners of each painting verso. The paper backing was removed and the mica painting was aligned on a 6x8inch Mylar handling mount using a graph paper centering template. The size of the Mylar allowed for 50mm handling margins whether in portrait or landscape orientation. The BEVA 371 adhesive was activated with the heated tool and a silicone Mylar barrier to attach the mica painting to the handling mount. A glass square moved gently across the silicone Mylar barrier helped to maintain planarity (fig. 11).

Each 8x10in window mat was cross-grained with 2-ply tops and 4-ply bottoms to ensure planarity and minimize bowing. The micas were floated in the window with 1mm margins to protect painted and irregular, hand-cut edges. Kozo-fibered paper (Iowa KTLG) hinges dry-mounted to BEVA 371 film were used to attach the Mylar handling mounts to the mat board (fig. 12). The handling mount was centered in the window and attached by the hinges with a heated tool and silicone Mylar barrier. A 6x9 inch piece of silicone release paper interleaving was placed inside each finished mat. The mats were housed in a series of new archival boxes made from E-flute corrugated board.

OUTREACH

The *Indian Coloured Drawings* project was an ideal candidate for a multi-platform outreach campaign to highlight and aid discovery of the mica paintings by researchers. The New York Public Library has a robust social media presence with the ability to reach over a half a million followers via popular digital

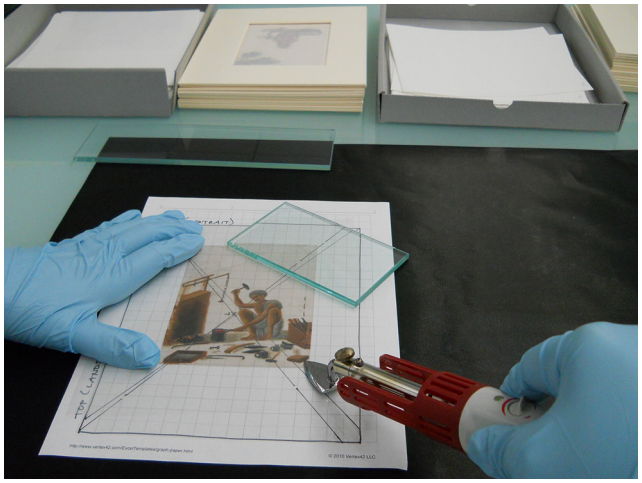

Fig. 11. Using a heated tool to activate Beva 371 film and attach treated mica painting to Mylar handling mount. Painting 4.2. During treatment.

Fig. 12. Mylar handling mount enables access to verso in storage mat. Painting 4.3. During treatment.

platforms like Facebook, Twitter, Vine, Pinterest, and Tumblr. Images and short videos of the digitization process were shared on Twitter by the Goldsmith Conservation Laboratory [2,3] and on Instagram by the author[4], principal photographer Peter Riesett[5], and New York Public Library[6] social media feeds. Outreach efforts reinforce interdepartmental collaboration, demonstrate responsible stewardship of NYPL resources, and promote cultural heritage awareness to the public.

FUTURE WORK

Since the scope of this project was limited to stabilization treatment and rehousing, additional research would be beneficial to provenance and material identification. Visual examination of online image galleries of mica paintings at the major collecting institutions to compare imagery and cataloging entries could yield provenance and dating information for the *Indian Coloured Drawings.* Published Company painting catalogs and glossaries (Archer, 1972; Archer 1992; Balser 1998) could be used to create or supplement detailed cataloging information. Analytical testing of the gouache paint to identify pigments and binders might help date and source mica paintings. Additional research would be useful not only to the NYPL collection of mica paintings but would enrich future case studies at other institutions.

CONCLUSIONS

Previous restoration campaigns like the 1930s library bound album format introduced ruinous condition issues to the *Indian Coloured Drawings.* Though incompatible with mica paintings, the lining materials and crowded album presentation were familiar reformatting techniques to NYPL Bindery staff in the 1930s. Without that intervention it is unlikely that the micas would have survived the rigors of NYPL handling and storage. Case studies from other institutions show that stabilization treatments of mica paintings are complicated and require problem-solving skills to identify the best course of action. The eclectic constituency of a large, publicly-oriented research institution like the New York Public Library and curatorial preference for enabling full access to the verso prompted a complex treatment, digitization, and rehousing plan.

Complicated projects require long-term planning and careful selection of materials to stabilize vulnerable physical materials and meet institutional access needs. The particularly poor condition of the *Indian Coloured Drawings* mica paintings necessitated research and experimentation to identify techniques utilized in allied conservation specialties. Consolidation of fragile media, removal of lining materials, and stabilization repairs will arrest further damage. Extensive documentation and the use of materials that reactivate with heat and solvent ensure that future conservation actions can be pursued with ease. Simple, standardized housings remove cumbersome and intimidating barriers to researcher access. Digital access copies protect vulnerable objects from over-handling. Social media platforms represent an informal but important venue to advocate for responsible collection stewardship and support the mission of the NYPL to inspire life-long learning and curiosity.

ACKNOWLEDGMENTS

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McCann (Conservation Librarian), NYU; Karina Corrigan (Curator of Asian Export Art), Peabody Essex Museum; Annie Wilker; Mike Wheeler; and Quinn Ferris.

NOTES

1. New York Public Library Digital Gallery. (Digital Gallery). http://digitalcollections.nypl.org/. (Accessed 06/30/14).
2. @nyplconserv (New York Public Library Conservation). Twitter post. March 11, 2014. 3:03pm. https://twitter.com/nyplconserv.
3. @nyplconserv (New York Public Library Conservation). Twitter post. March 26, 2014. 5:06pm. https://twitter.com/nyplconserv.
4. @sarahreidell (Sarah Reidell). Vine post. March 12, 2014. 12:43pm. https://vine.co.
5. @pete_riesett (Pete Riesett). Twitter post. March 12, 2014. 1:02pm. https://twitter.com/pete_riesett.
6. @nypl (New York Public Library). Instagram. April 12, 2014. http://instagram.com/nypl.

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SOURCES

Aquazol
Polymer Chemistry Innovations (PCI)
Talas
http://www.talasonline.com

BEVA 371 film
Conservators Products Company
http://www.conservators-products.com

Chef's Planet Nonstick Oven Liner
Bed Bath and Beyond
http://www.bedbathandbeyond.com

Colour Shaper Painting Set (Mini, Firm, Size #0)
Royal Sovereign Ltd (UK)
Dick Blick
http://www.dickblick.com

Coverite Trim Sealing Heated Tool
Talas
http://www.talasonline.com

Flexible Magnet Sheet with Vinyl Face
McMaster-Carr
http://www.mcmaster.com

Flexible Magnetic 1" Tape
Uline
http://www.uline.com

Iowa KTLG (kozo tissue light green)
University of Iowa Center for the Book
216 North Hall
Iowa City, IA 52242
(319) 335-0447
http://book.grad.uiowa.edu/store

Series 7 Kolinsky Sable Pointed Round, #000
Winsor & Newton
Dick Blick
http://www.dickblick.com

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Conservation in Action: Conservation of Mural Cartoons in the Public Eye

> 'The high light (sic) of the Maritime Art Association convention in Fredericton was undoubtedly the session entitled "Art in Action", at which an excited public comprising children and grown-ups of all ages had the opportunity of seeing brilliant craftsmen actually at work on their creations.
>
> Miller Brittain was one of the New Brunswick artists featured in "Art in Action"; he worked on his cartoons for the Saint John Tuberculosis Hospital mural in a school gymnasium:
>
> These panels [drawings] practically covered the wall, and—perched on a platform of boards supported by ladders—the figure of the artist could be seen above the heads of the crowd, at work on figures almost twice his own size! From time to time Brittain would stop and smilingly explain to the people below what he was doing, and then he would go back to work just as if he were alone in his own studio. –*Kathleen Shackleton, Maritime Art, Volume 2, No. 5. June-July 1942. p 153.*

Can conservators, performing conservation treatment in front of the public, recreate the popular enthusiasm and professional openness reflected in this quotation? Can we earn public and institutional support and funds by doing so? Can we achieve our treatment goals? The author hopes to contribute to the discussion of these questions.

The New Brunswick Museum (NBM) Saint John Tuberculosis Hospital mural cartoons (1941–42), by Saint John New Brunswick artist Miller Gore Brittain (1912–1968), comprise a series of eleven, 9' by 9' drawings. The cartoons are both the crowning achievement of Miller Brittain's prewar career and are among Canada's most important twentieth century art works. The size and fragility of the cartoons have inhibited public and scholarly access.

As a follow-up to Conservation of a series of mural cartoons: high hopes on a low budget, presented to the AIC in Milwaukee in May 2010, this paper continues the story of how a regional Canadian museum has struggled, found momentum and the means to complete an ambitious conservation treatment during a time of fiscal constraint:

- Funding for post-graduate internships provided enthusiastic and skilled conservators to assist treatment development and to complete the conservation treatment.
- The installation of the conservation treatment in an exhibition space helped to raise public awareness and maintain institutional commitment.
- Using a conservation treatment as an exhibition served to bring the discipline of conservation, and the cartoons themselves, to the attention of museum visitors and the media.
- The use of social media, and, scholarly and community partnerships, raised awareness of the conservation treatment and maximized the secondary benefits of the work being done.

This paper will briefly outline and contextualize the mural cartoon conservation project, and describe the methods and results of the NBM's efforts to achieve public education, mentorship and fundraising goals. Final conclusions will explore the successes and shortcomings of the project.

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Presented at the Book and Paper Group Session, AIC's 42nd Annual Meeting, May 27–31, 2014, San Francisco, California.

Made of Paper: Robert Motherwell's Collage Materials in the 1940s

The American artist, Robert Motherwell (1915–1991), had a passionate relationship with collage, producing nearly 900 works over the course of his career. He first experimented with the medium following an invitation by Peggy Guggenheim (1898–1979) to participate in her groundbreaking 1943 collage exhibition at her New York gallery, Art of This Century. Motherwell was instantly drawn to collage and continued to experiment with the process, creating a unique and very personal group of early works in the 1940s.

A technical study of Motherwell's early collage materials was conducted in conjunction with a 2013 exhibition, *Robert Motherwell: Early Collages*, organized by the Solomon R. Guggenheim Museum, New York. This study identifies a refined palette of different papers, paints, and adhesives that Motherwell used extensively during this initial period of discovery. Motherwell's choice of materials and the techniques he used are also discussed in relation to his experiences as a young artist and the growing shift toward Abstract Expressionism in America in the 1940s. In addition, Motherwell's thoughts on visual changes to his work and the potential for conservation intervention are also presented.

This paper is published in: Warda, J. 2013. "Made of paper: Robert Motherwell's collage materials in the 1940s" in *Robert Motherwell: Early Collages*, Davidson, S., Fontanella, M., Taylor, B., and Warda, J. New York: The Solomon R. Guggenheim Foundation. 55–67.

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Digital Rubbings: Monitoring Bookbindings with the Portable Mini-Dome (RICH)

The RICH project (Reflectance Imaging for Cultural Heritage, KU Leuven, 2012–2015) is creating a digital imaging tool for researching, studying, and exploring material characteristics of library materials produced in medieval and early modern times. In 2005 the module was created for reading cuneiform tablets in the department of Assyriology of the University of Leuven (KU Leuven). With the second generation of the imaging devise, the visualization of bookbinding stamps (gold- and blind tooled, on the back and on the boards of bindings) creates a sharp and exact image of the tooled surface, a 'digital rubbing' with the possibility to read, measure, compare and identify occasionally difficult accessible decorations on book covers.

The digital imaging device, IMROD (Imaging Module for Multi-spectral, Reflectance or 2D+) is digitizing with omni-imulti-directional lighting and export the result to 2D+. The technique is based on polynomial texture mapping, also known as Reflectance Transformation Imaging (RTI), a technique of imaging and interactively displaying objects under varying lighting conditions to reveal surface phenomena. With RICH the decorative and technical characteristics of manuscripts, paper and bookbindings are documented. The module is a hemi-spherical structure with a single downward looking video camera (28 million pixels). The object to be captured (maximum 180 to 120 mm) lies in the center and is illuminated from computer-controllable lighting directions, through the subsequent activation of multiple white LEDs. The different angles that illuminate the surface of the artifacts are revealing extreme details. Special attention is taken to produce raking light, the illumination at an oblique angle or almost parallel to the surface, to provides information on the surface topography of the book or page. For each illumination an image is taken by the overhead camera, in total 260 images for each object. After processing these 260 images, filters in de visualization system are incorporated in the software. Fine details can be highlighted by the use of specific digital filters, bringing out structures that would not be visible under single illumination (like shade, contrast, sharpening and sketch filters). By scaling the image, a measuring tool in the software defines the dimension of the stamp and print lines unto 10 micron.

To develop the possibilities for 'digital rubbings', in 2013 a group of medieval and early modern bindings (11th to 17th century) were examined in Flemish Heritage collections (the Museum Plantin-Moretus and Leuven University Libraries). The lecture will discuss observations captured by the visualization system, the development of the database with the online viewer, and the possibilities of 'RICH' as a research tool in the art technical—and in the conservation field.

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Presented at the Book and Paper Group Session, AIC's 42nd Annual Meeting, May 27–31, 2014, San Francisco, California.

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DISCUSSION GROUP CO-CHAIRS

Art on Paper Discussion Group 2014: Re-integrating Design/Deceiving the Eye: Compensation Issues For Works on Paper

ABSTRACT

This year's Art on Paper Discussion Group program examined issues surrounding compensation for damage and loss in works of art on paper. These issues encompass a broad range of approaches to compensation, from the nearly invisible and often intrusive interventions of Max Schweidler in the early 20th century, to minimally or non-invasive contemporary innovations. The appropriate nature and extent of compensation is the subject of ongoing debate and ethical reevaluation. The APDG session began with an introduction to compensation issues by the co-chairs, followed by brief presentations by five other paper conservators on approaches to, or techniques for, compensation. As organizers we hope that the presentations were engaging and helpful to our discipline in examining and contextualizing our decision-making process, and lead to greater introspection about aesthetic issues in paper conservation and a greater range of treatment options to meet the challenges we face.

SUMMARY OF PRESENTATIONS

NANCY ASH AND SCOTT HOMOLKA
AN INTRODUCTION TO COMPENSATION ISSUES

Aesthetic decisions in conservation inevitably are influenced by the philosophy of a period and culture. In the second half of the 20th century, the pursuit of increased transparency in the field and the development of written ethical standards encouraged a shift to greater restraint, which at times may be at odds with the practical demands that conservators face. Clearly many factors influence the extent and *intent* of compensation. These include audience and use, cultural traditions, and established aesthetic conventions, such as the pristine quality sought in contemporary works compared with the accepted "patina" of age in older ones. Moreover, our decision to carry out or abstain from visual compensation may affect not only the monetary value of a work but *how* the work is interpreted or valued—as art object or cultural artifact.

The material limitations of a work of art and the tenet of reversibility also have broad impact on our treatment decisions as reflected in the divergent conventions for compensation in paintings and works of art on paper—extensively-compensated easel paintings versus comparatively conservatively-compensated paintings on paper, for example. While these conventions certainly are influenced by the distinctive limitations of the different materials, the pursuit of "invisibility" can be appropriate and achievable in paper conservation. Questions remain, however, about the appropriate degree of invisibility and the implications of virtually undetectable repairs on scholarship or our understanding and appreciation of the work.

Other issues that may always persist include: selecting the most appropriate and effective approaches and inpainting materials—e.g., choosing between "wet" or "dry" media for compensation, the discrete removal of original material toward the goal of stabilizing or visually improving the object, and the dilemma of covering or camouflaging disfiguring stains or even flaws or "defects" that may be inherent to the work as a result of manufacture—such as a disfiguring printing crease (fig. 1). A late 17th-century Indian painting on paper in the collection of the Philadelphia Museum of Art illustrates another dilemma: how to approach missing or unknown design elements (fig. 2). In this example, broad, boldly-colored areas of the composition were continued onto a large, loosely attached insert, but more detailed design elements were not re-created. Such a decision may be influenced by numerous factors, including uncertainty about missing design, or established traditions for a particular culture in dealing with aesthetic compensation or repair. Furthermore,

This open discussion took place during AIC's 42nd Annual Meeting, San Francisco, California. The moderators organized the panelists, led the discussion, and recorded notes. Readers are reminded that the moderators do not necessarily endorse all the comments recorded and that although every effort was made to record proceedings accurately, further evaluation or research is advised before putting treatment observations into practice.

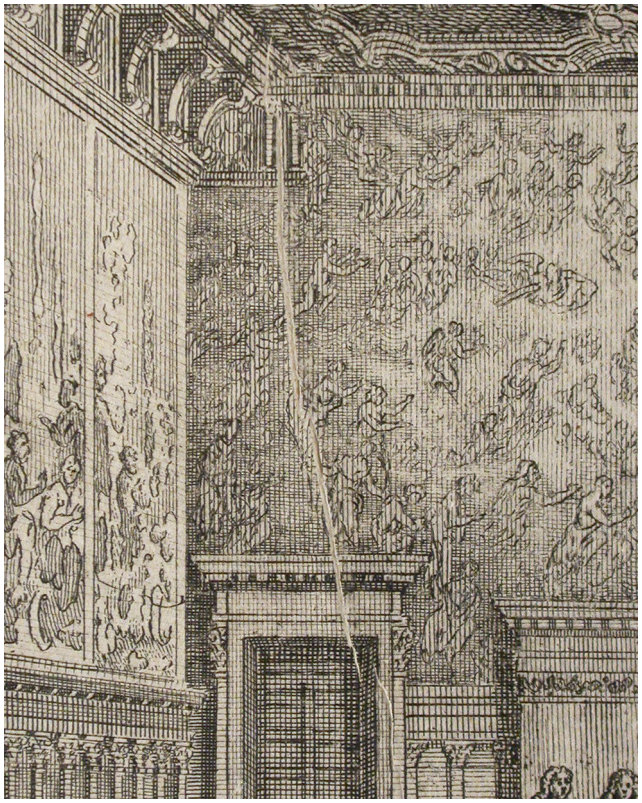

Fig. 1. Detail of an 18th-century etching by Giovanni Battista Brustolon, showing a prominent and visually distracting printing crease inherent from manufacture. Giambattista Brustolon, *The Doge in the Council Hall*, c. 1763, Etching, 44.2 x 55.7 cm, Philadelphia Museum of Art, 1985–52–1850.

a decision to remove old compensations that interfere with the original must be informed by the historic significance and quality of the repair, and any risk to the object during removal.

Finally, in recent years paper conservators increasingly are exploiting approaches that may reduce or remove the physical hand of the conservator. Such methods may utilize digital techniques to recreate design elements or employ temporary overlays or fills. Even subtly adjusting display lighting—or more dramatically—engineering sophisticated computer-controlled light projection systems as in the case of the recent and highly innovative "virtual restoration" of Harvard University's Rothko murals[1], may be the best solution to meet the aesthetic needs of an object with only limited conservator intervention.

NOTE

1. A light touch for Rothko murals: Virtual restoration to be unveiled with opening of Harvard Art Museums". *Harvard Gazette*, May 20, 2014. http://news.harvard.edu/gazette/story/2014/05/a-light-touch-for-rothko-murals/, accessed May29, 2014.

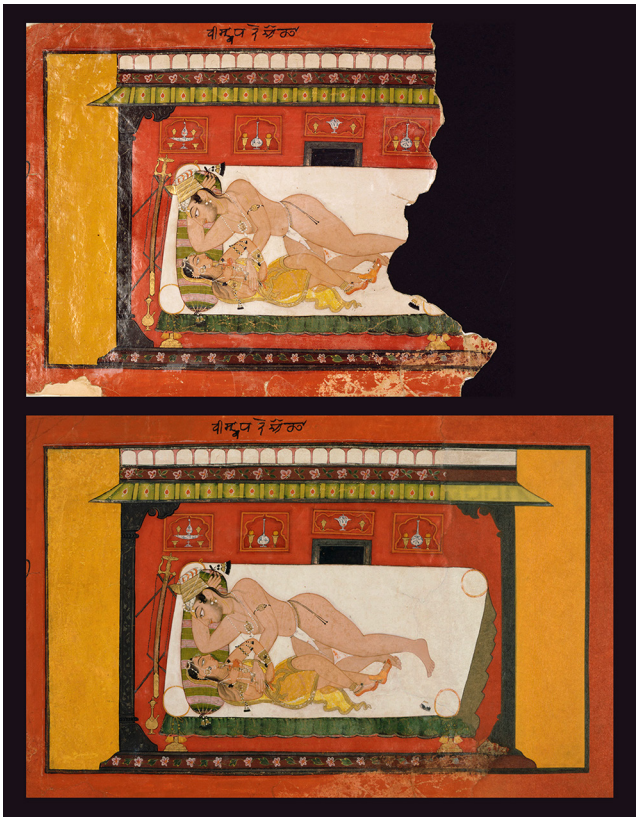

Fig. 2. An Indian painting on paper before treatment, with an expansive loss and other damages (top). The same painting after compensation (bottom), which included a large insert with broad areas of the boldly-colored design integrated. Unknown artist, *The Awakening of Trust* (Vishrabhanavodha Nayika), 1694–95, Opaque watercolor and gold and silver metallic paints on paper, 20.6 x 26 cm, Philadelphia Museum of Art, 2004–149–25.

DEBRA EVANS

IN SUPPORT OF INVISIBLE INPAINTING (WITH SUGGESTED MATERIALS FOR YOUR INPAINTING TROVE)

Since 1994 Jim Bernstein (master inpainter extraordinaire) and I have taught week-long Mastering Inpainting workshops to over 400 conservators. Our course was chosen by the AIC as the very first of its mid-career training workshops. I mention that because it goes to show the enthusiasm our colleagues have for this subject. In fact, inpainting might be the activity that the public is most likely to envision when you mention art conservation. Over the years, I have found our participants, almost without exception, to be striving for ways to achieve "invisible" inpainting. As a conservator of works on paper who works in a fine arts museum, this has routinely been *my* focus and our curators' preference. In order to do seamless inpainting on paper, it helps to have an extensive inventory of inpainting materials.

When we conduct our inpainting workshops, we are always interested in learning the participants' customary inpainting media. It's not uncommon to hear from paper conservators who use just one system: watercolors, Caran d'Ache pencils, or pastels, for example. I believe that it is difficult to achieve good inpainting without a wide array of materials. That inventory is what saved the day in many an inpainting challenge. My dear buddy Jim long ago converted me to his philosophy of "More is More." Art comes in incredible varieties and one medium definitely does not suit all. While watercolors and Carbothello pastel pencils might do the trick for paper conservators 90% of the time, it's the other 10% where you'll need expanded inventory to achieve success. I recommend the following:

- *More watercolors, made from many different pigments*. A good starter set is the 48 half pan set made by Schmincke. Swatch cards, painted to the edge of the card, work wonders for honing in on the closest color match.
- *A watercolor set compiled of a wide variety of blacks*. Essential for inpainting prints. Conventionally, watercolor sets will have only ivory black or lamp black. A wide range of black pigment half pans is now available for purchase individually from Kremer Pigments.
- *Specialty watercolor set for frames*. Also available from Kremer Pigments.
- *Specialty watercolor set for photographs*. Individually-compiled sets work better than the old retouch sets made by Schmincke and other brands.
- *Pastels and an array of applicators*. Cards with different pastel mixtures can be kept housed in Ziploc bags. Useful applicators are sable brushes (cut-off to work like stipplers), small swabs, dental paper points, and points of thin blotter.
- *Powdered pigments*. These are particular useful for modifying colors from watercolor half pan sets or when an unusual color needs matching. Do obtain some titanium orange and see how often it is the "magic bullet."
- *A variety of media and modifiers*. Methylcelluloses, Aquazols, jun funori, gum Arabic, glass beads and platelets, and kaolin are just some of the materials that can be helpful.
- *Colored pencils of all sorts, both ordinary and pastel*. While Carbothellos get the most use in our lab, assorted brands have differing pigment strength, hardness and reflectance and will be useful for different projects. Separate sets comprised of all the earth tones of a particular brand are especially handy.

BECCA POLLAK

TREAD LIGHTLY: CREATING FILM OVERLAYS TO INTEGRATE DIMENSIONAL MEDIA LOSS

The frequent reality of inpainting on works on paper is that it is often not reversible or that its removal may further compromise the object. If the support is fragile or moisture sensitive, even the *application* of compensation materials may cause distortion and destabilize surrounding media. Losses in dimensional media such as impasto, crayon, or even intaglio ink can be very challenging to integrate because inpainting material must be built up in layers or a fill material manipulated in situ to match the topography of loss edges.

Two treatments recently performed at the Philadelphia Museum of Art illustrate the potential of overlay techniques to compensate media loss where other methods could not be used. A drawing by the artist Eddie Arning comprised broad areas of delaminating, brittle wax crayon with scattered existing flaked losses. As insecure media was consolidated, it became evident that even slight expansion of the paper fibers caused by minimal moisture or the pressure of a fine brush stressed the glossy paper coating and surrounding media. Therefore, compensation needed to be applied with no moisture or manipulation after placement on the fragile drawing.

The losses were ultimately filled with shaped inserts of dried Golden® acrylic paint (fig. 3). The acrylic was brushed out on Mylar to form a film of varying thickness. Small pieces were scored and peeled away from the Mylar before shaping with a micro-scalpel or by tearing the edges. The acrylic film was then carefully placed over areas of loss with tweezers or a damp brush and adhered to the support with no additional moisture. This straightforward method was useful for recreating both thickly applied media and thin, streaky passages with small inherent gaps. It minimized interaction with the fragile object and the fills could be easily removed with the tip of a brush slightly dampened with ethanol. Using a material different from the original had the added bonus of allowing the fills to be easily distinguished with close examination or analysis.

In creating mock-ups for the crayon drawing, a technique that had been introduced by Elissa O'Loughlin at the Walters Art Museum was also explored: creating a remoistenable film material by spraying a mixture of micro-cellulose powder and methylcellulose onto Mylar. The dried films can be shaped and used as overlays to diminish the appearance of foxing on paper. While trying out this method it was observed that the cellulose slurry reticulated when sprayed on silicone coated Mylar and might have potential for filling surface damage in aquatints or collotypes. For this application the slurry was tinted with dry pigments and Golden® acrylic paint before spraying to make several black toned sheets.

The films were effective for filling gouges within the printed design on a damaged aquatint (fig. 4). Having several

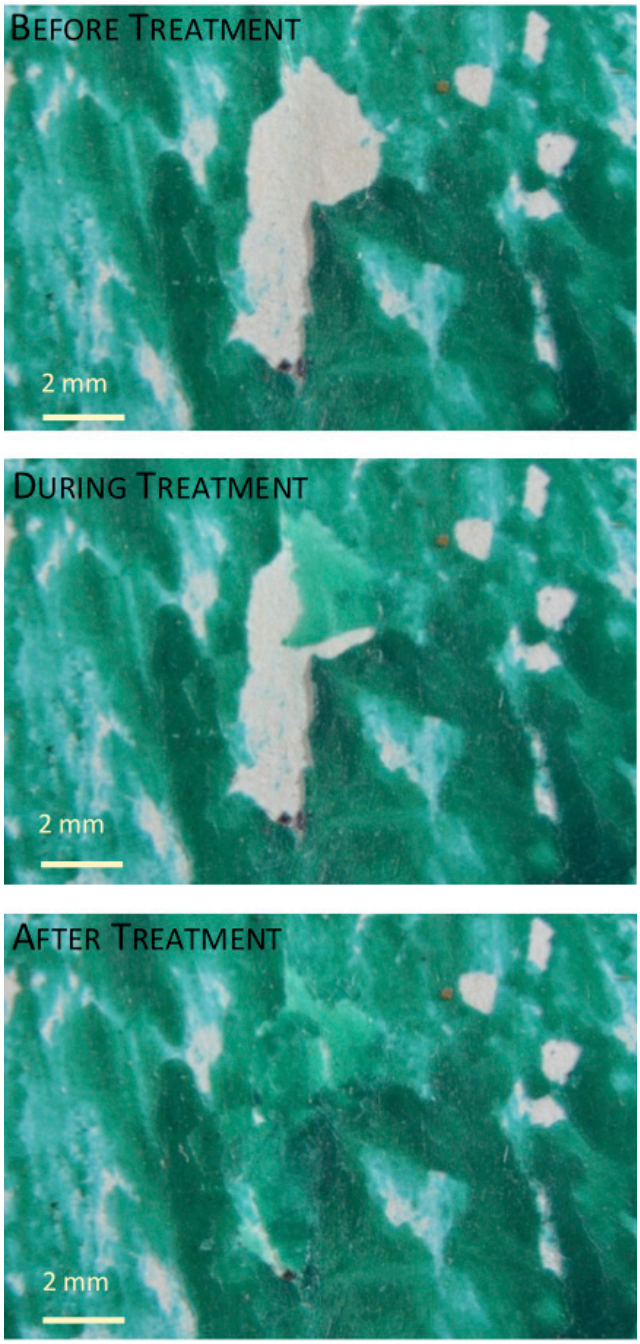

Fig. 3. Before, during, and after treatment details of a fill in the upper right corner of the crayon drawing. In the center image one layer of film has been placed in the loss area before two more pieces were laid over the first, as shown in the bottom image. Eddie Arning, *Six Colored Circles*, c. 1965. Wax crayon and oil pastel over graphite on wove paper, 45.7 x 61 cm, The Jill and Sheldon Bonovitz Collection, Philadelphia Museum of Art (promised gift). Field of view is approximately 9 x 13 mm.

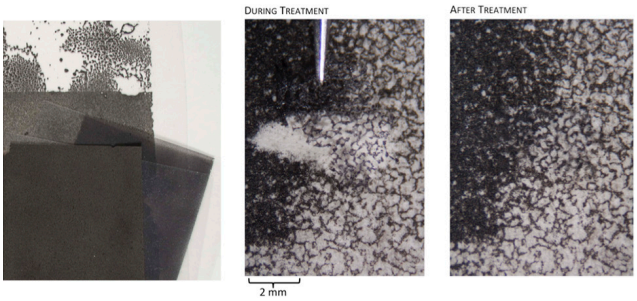

Fig. 4. Sheets of black toned cellulose powder made by spraying on silicone coated Mylar (left); A piece of the reticulated film is placed over the damaged area of the aquatint (center); Detail of the filled area after treatment (right). Field of view is approximately 9 x 13 mm. Carlos Santivanez, *Untitled*, 1990. Etching and aquatint on wove paper, 71 x 46 cm, private collection.

sheets with varied reticulation patterns and tones makes it easy to match the line dimension, grain size and range of ink density surrounding a loss area. Abraded paper fibers were consolidated with dilute methylcellulose and the film was immediately placed over the loss. As with the drawing, the overlay can be adhered and easily removed without the colorant staining the support.

Although the more usual approach of consolidating, applying a barrier layer, and layering inpainting media may not be that much more time consuming for small areas of loss—it may be impractical for larger areas. While the reticulated films do require an initial time investment, they offer an alternative that may be ideal for moisture sensitive objects or broad areas of damage.

AMY HUGHES

COMPENSATION FOR LOSS IN A MODERN SCREENPRINT: REVERSIBLE SCREENED FILLS

The following case study was presented to encourage discussion regarding the difficulties of compensating for loss in screenprints. Samella Sanders Lewis' [American, b. 1924] screenprint *Arena* (1942) is made up of 12 layers of inks that were actively cracking and flaking prior to treatment. After consolidation, the curator agreed that the work would benefit from reversible, textured fills, but suggested that fills were only needed for the six largest losses. A textured acrylic fill material was created by screening Lascaux 498HV through a handmade miniature silkscreen onto Japanese paper (fig. 5).

The most challenging aspect of this treatment lay in procuring a plain weave fabric with the appropriate interstitial size and thread thickness to create a screen pattern similar to the original silkscreen matrix. Thread thickness plays a crucial role in determining the distinction of the screen pattern and the height of its impasto. The selected fabric was stretched over a small (4" x 5") window mat with tape to create the

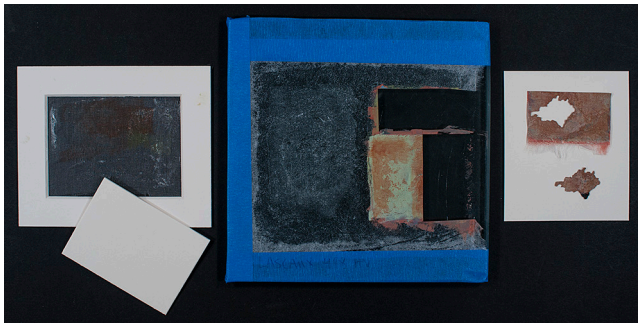

Fig. 5. Steps to create a screened fill. From left to right: mini-screen and squeegee; screened and partially toned fill material stretched on a glass plate; completed fill.

Fig. 6. Before and after treatment details of the screenprint.

screen. Lascaux 498HV was pulled through the screen onto thin Japanese paper using a disposable squeegee made from scrap mat board. The Japanese paper support had been taped down to a glass plate and primed with a thin brush-applied layer of Lascaux to reduce the paper's absorbency and porosity. After screening the texture, the fill material was toned to match the original print using acrylic paint (fig. 6).

To cut the fills with precision, and to avoid the need for tracing directly on top of the fragile work of art, 1:1 photographic reproductions of the major losses were created in Adobe Photoshop.[1] After cutting the fill material directly through the photograph with a sharp scalpel, the reverse of the shaped fill was pared to create a surface flush with the original. A secondary layer of gossamer thin Japanese paper was adhered to the verso of the fill by reactivating the Lascaux with acetone vapor. Relatively weak adhesion between the primary and secondary Japanese paper supports allows for ease of mechanical removal when or if the fills are no longer desired. Finally, the fills were pasted out with wheat starch paste, positioned within the losses, and dried under light weight. The fills are clearly visible under examination with ultraviolet radiation.

Thanks to the artist's expressive use of line, color, and texture, this particular screenprint had an inherently forgiving surface for camouflaging fills. Compensation for losses within a flat field of solid color would certainly be more challenging, but with further refinement, this technique holds promise. Experimentation will continue, beginning with additional trials designed to exploit the versatility of ArtCare's B72 Retouching Gels.

NOTE

1. Garrett, R.J., "Creating 1:1 Images with Adobe Photoshop," *Iowa Division International Association for Identification*, 2008, http://www.iowaiai.org/creating_1_1_images_with_adobe_photoshop.html, accessed June 20, 2014.

VICTORIA BINDER

AUTOMATIC CONTACT SHEETS FOR PRINTING DIGITAL FILLS

Digital fills are a great technique to have on hand for compensation of losses in works of art on paper. With digital fills you can achieve a very accurate representation of the loss area that is still distinguishable from the original object. With some basic Photoshop skills almost anyone can do a decent digital fill in a relatively short amount of time. However, the problem that most people encounter is achieving a print of the fill that is accurate in color. No matter how well your printer and

Fig. 7. Comparing a photograph with loss against a contact sheet generated with a digital fill, showing variations in color midtones.

monitor are color calibrated, inevitably the color of your print is slightly off and you end up wasting ink, paper, and time. To overcome this problem I have used the Actions feature in Photoshop to create a series of automatic contact sheets that generate variations of a fill from which the closest match can be selected. Photoshop Actions records the steps that you make in Photoshop and saves them so you can reapply them to future projects. Once saved, a Photoshop Actions file can be shared with others. The Actions set that I am sharing can generate six different contact sheets including variations in color midtones, color highlights, color shadows, exposure, saturation, and color filters. These contact sheets are very basic. If you do not get an exact match, at the very least the contact sheets you generate will guide you to a closer match (fig. 7). The following is a URL for a website with links to the Actions file, a video tutorial, and a PDF tutorial: https://sites.google.com/site/digitalfills/

Fig. 8. The puzzle shapes were cut from mat board and the mat board pieces were adhered to the digitally printed fill (left). The fill is inserted into the negative puzzle shape for a tight fit without the need for adhesive (right).

CHRISTINA TAYLOR

EXPERIMENTAL LOSS COMPENSATION TECHNIQUES AND REINTEGRATION OF DESIGN WITH REMOVABLE PUZZLE FILLS

When compensating for large areas of loss, the extent to which the design is reintegrated should be carefully considered. During my specialization project carried out at SUNY Buffalo State, I investigated experimental loss compensation techniques for an impression of the engraving *Knight, Death and the Devil* by Albrecht Dürer. The impression suffered a large area of loss in the lower left corner. Dürer's engravings are composed of areas of such intricate and dense line work that conventional filling and inpainting techniques were not sufficient for the degree of loss suffered. Unlike drawings and paintings, prints are created in multiples and details of lost areas can be obtained by referencing other existing impressions. High-resolution images of other impressions of *Knight, Death and the Devil* were captured in preparation for this project.

Digital printing and experimental intaglio printing techniques were carried out to determine if intaglio printed fills could produce a more visually pleasing fill, potentially as a result of the topography of the printing ink on the surface of the paper after printing. Intaglio printing methods required both the formation of the printing matrix and subsequent printing to create the fill. The formation of intaglio printing matrices was carried out in multiple ways, including laser engraving, CNC milling, photopolymer plate exposure, traditional zinc etching, toner transfer etching, among other techniques.

Both inkjet and laser-jet digital printing proved to be the most effective and efficient filling techniques. Although intaglio printed fills have the advantage of using traditional media and provide a similarity to the original printing technique, these intaglio methods were not as successful in their final appearance, required additional equipment and skills, and were very time consuming to produce.

After fills were created, a removable puzzle fill technique developed by Judith Walsh was implemented to allow for complete reversibility and interchangeability of the fill. Puzzle pieces that accommodated the size of the loss were cut from archival mat board, and the print was properly aligned and hinged to the mat board that contained this negative puzzle shape (fig. 8). To prepare the fills, the mat board puzzle pieces were brushed on the top surface with wheat starch paste and quickly placed into the negative puzzle shape in the mat board. The digitally printed fill was aligned with the print and pressed onto the wheat starch paste with fingertips. The fill was quickly removed and weighted separately to dry. This allowed for perfect alignment of the fill.

The puzzle fill technique is a good solution for an artwork with large areas of loss. Inpainting can be carried out to the desired extent and can be removed at any time because it is not adhered directly to the artwork. A fill paper toned to the color of the surrounding sheet can also be inserted to allow the area of loss to appear more prominently. This provides the conservator flexibility to remain invisible during treatment with the option of highlighting larger areas of loss when appropriate.

ACKNOWLEDGEMENTS

The co-chairs would like to thank Emily Rainwater, BPG Program Chair, for her efforts in arranging the session, all of the speakers and participants for an engaging, if all-to-brief, foray into this important and expansive topic, and past (and returning) APDG co-chair Stephanie Lussier for her input in developing this year's topic. We look forward to many spirited discussion sessions to come!

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JUSTIN JOHNSON AND DANIELLE CREECH
DISCUSSION GROUP CO-CHAIRS AND SUMMARIZERS

Library Collections Conservation Discussion Group 2014: Options for Sustainable Practice in Conservation

This Library Collections Conservation Discussion Group (LCCDG) explored methods of lightening the ecological and economical footprint of conservation work. The discussion incorporated voices from both profit and non-profit facilities and included both theoretical concepts and practical advice for project implementation.

Four speakers presented on topics such as the management of conservation materials to reduce waste and improve reuse of scrap, the implementation of green waste and/or recycling programs, the identification of recyclable and/or reusable materials commonly used in conservation, the adaptation of wide scale green initiatives to the conservation lab and the exploration of myths and realities of recycling. Because it is easy to consider ecological conservation too large or too expensive a problem to be tackled by the everyday conservator, this LCCDG session explored not only the ecological benefits of sustainable practice in collections conservation, but also the financial benefits to the conservator.

BRIAN BAIRD
RECYCLING MIGHT BE GOOD, BUT CONSERVATION IS ALWAYS GREAT!

Though it is less likely to be so among conservators, terms like recycling, environmentalism, conservation, sustainability, waste and landfills can be hot button topics. The arguments surrounding these topics bring to mind the "tastes great, less filling" Miller Light advertising campaign from the 1980's, in which two groups agreed that the beer was great, but argued over whether it was because of the taste or because it was less filling. Most people generally agree that green initiatives are important to preserve the environment; they just do not agree on how or why. Politics and emotions get involved, and data is often manipulated to serve the needs of those presenting the argument. Media bias can lead to misrepresentation of the success or failure of particular green projects and more often does more harm than good.

For example, in the mid-1980's there was a campaign against the use of polystyrene containers, which were in heavy use across the country. Laws were passed to regulate the use of this material, which all but completely removed it from the marketplace. Polystyrene was originally vilified for the use of chlorofluorocarbon (CFC) in its production, but polystyrene manufacturers were actually no longer using these CFCs when the campaign to outlaw the material began. Similarly, polystyrene is 100% recyclable and is 90% air, so the actual volume of waste generated from the use of polystyrene is very small. In general, it makes up less than 1% of the landfill today. Now this is due to the restrictions put in place on its use, of course, but that only demonstrates how the data can be manipulated to prove a point. Nevertheless, this illustrates how the cure can sometimes be worse than the disease. Measured in sheer waste generation, materials that were adopted to replace polystyrene are in fact worse overall for the environment.

It used to be a common experience at the grocery shopping line to be asked if one wanted paper or plastic for his groceries. Many people found themselves not knowing what the right answer was because few people understood how each of the materials was really made. This plays out similarly all over the country. People are aware that there is supposed to be a right and wrong choice, but are not fully informed enough to know which is right. In some instances, each choice can be both right and wrong.

San Francisco became the first city to outlaw plastic grocery bags. Since then, many cities have implemented a tax which requires the shopper to pay a small fee for any kind of a bag handed out by a store, regardless of whether it is paper or plastic. A tiny pellet of plastic the size of a BB is used to make

This open discussion took place during AIC's 42nd Annual Meeting, San Francisco, California. The moderators organized the panelists, led the discussion, and recorded notes. Readers are reminded that the moderators do not necessarily endorse all the comments recorded and that although every effort was made to record proceedings accurately, further evaluation or research is advised before putting treatment observations into practice.

a plastic bag. This is a relatively small amount of plastic for the size the bag eventually becomes. Moreover, plastic bags are easier to recycle and generate far less byproduct as a result of recycling than paper does.

Paper recycling has come a long way, and today people are able to recycle more paper than ever before. The quality and function of recycled paper has also improved greatly. Even with these great strides in the paper recycling industry, 40% of all the material that goes into the paper recycling plant ends up in the landfill. Far more than the overall waste generated if people were to shift gears and focus on using and recycling plastic bags.

In 1990, President George H. W. Bush passed into law the Permanent Paper Law, which required all government documents and printed material to utilize acid-free paper. In 1993, President Bill Clinton passed an executive order requiring all government publications to use recycled paper. The preservation community worried about what introducing recycled material would do to the permanence achieved in the 1990 law. There is only so much permanence or recyclability that can be achieved before one effects the other.

At Bridgeport National Bindery, they recycle about 99% of all of their waste. They separate their waste into various types of products to maximize their recycling value. They use a lot of paper as they are primarily a printing and binding company rather than just binding. They go so far as separate their paper waste by quality so that they can get a higher return on long-fiber and clean materials versus the short-fibered and used. By recycling in this way, they are able to pay for all their waste and dumpster fees and still make a profit on recycling at the end of the month. Even materials such as discarded book covers, which cannot be fully recycled due to their complex components, are used to manufacture fuel pellets that are then used to generate electricity. The dirty little secret is that they still generate 30–40 tons of waste every month. This translates into 40–50lbs of waste per staff member per workday. Yes, money is made on recycling, but much more would be made if the waste were never generated in the first place.

On the whole, recycling as a nation has never been easier. There are more laws in place and more educational programs being used than there ever has been. Recycling is becoming part of our normal life, and is slowly becoming second nature. Despite these achievements, the country has reached a plateau of what can be recycled. It has allowed itself to become less circumspect of the recycling programs themselves. Like everything else related to these green initiative subjects, the data available is very hard to trust. The real numbers suggest that only about 50% of what is sent in for recycling is actually recycled.

In terms of ease and economy, recycling aluminum cans is at the top of the efficiency list. Aluminum is 100% recyclable. It can be recycled over and over again with only minimal decay. Unfortunately, those recycling programs that offer a payout for returned cans can get mired in politics, which skew the data and provide inaccurate effectiveness and efficiency rates. When money is involved, the value is no longer in the recycling, but in the revenue generated by unreturned cans. This profit is carefully guarded and is used to discourage people from seeking a payout for their recycling efforts.

Glass, on the other hand, has a very high recycling rate, but there are relatively few places that can actually recycle glass. The vast majority of "recycled glass" is crushed and used as filler in roads. Though it is reused, the point to take home is that the idea people have that the glass is being literally recycled into a new glass bottle is misleading. The materials to make glass are just too cheap to make the use of recycled glass profitable, except in areas where there is a glass plant that can recycle close by.

The "recycling" of ink jet cartridges is a similar, though more extreme, example. At roughly $1,000 per liter, this ink comes in at probably the most expensive material that gets recycled. Many people go to great lengths to ensure that ink cartridges are returned to companies who claim to recycle them. The truth is that almost all these cartridges are sent off to places in Asia where the leftover ink is extracted for resale. The cartridges themselves are then simply tossed into a local landfill.

Using less is the key and should be where focus is placed. Given the inefficiencies and expense of recycling, more education and effort should be put into using less material overall. Having one of the most robust recycling infrastructures in the world means very little if excessive wrapping materials and packaging are exacerbating waste problems. Reducing consumption overall can have a huge positive impact on protecting the environment.

The most efficient conservation departments are often those with lower supply budgets. Human nature seems to be frugal only when money is tight. Too often, people revert back to more wasteful practices when a fiscal crisis is over. Everyone should look closely at their practices and evaluate their efficiencies. Take a closer look at what happens further down the recycling production line. Recycling and sustainability do not end at the curb.

Brian Baird, Vice President of Library Services, Bridgeport National Bindery

DANIELLE CREECH
EVERYTHING BUT THE KITCHEN SINK: A CASE STUDY IN BINDERY RECYCLING

The Midwest facility of HF Group houses a conservation lab and print-on-demand service in addition to their library and edition binding services. These book-based services generate a large quantity of paper-based waste. As a result, HF Group-Midwest has been involved in recycling for as long as such

programs have been available. Thirty years ago, the bindery sent over one-ton of paper waste to the landfill per day. At the time, long before the advent of electronic journals, library binding was a much bigger enterprise. Rebinding a library book in those days also inevitably meant trimming the three outer edges.

Paper-based recycling always made sense for the bindery. It could sell the paper waste to a paperboard supplier, who would process the scrap through their mill to produce new binder's board that they in turn sold back to the bindery. Unfortunately, requirements were strict on what could be recycled. Only corrugated boxes, clean paper, clean paperboard and magazine ads were accepted. The bindery produced much that could not be recycled due to adhesives, sewing threads and lining cloth. Paper was, and still is, the largest waste stream the bindery generates, but they also recycled lead, steel, aluminum and tin.

The bindery revisited its recycling program in the 1990s, and found that they had gotten lazy. At the time, the bindery had over 300 employees. Those employees were split between two, sometimes even three shifts. It required a lot of training to organize that many people and to convince them to take the time to recycle. By the 1990s, paper-processing plants had relaxed their material requirements substantially and the bindery was able to send more paper waste to them than before. In fact, by 1992 the bindery had cut the amount of waste going to the landfill by 186 tons per year. There were also more non-paper items that could be recycled, such as fluorescent bulbs, oil, limited plastics, glass, some solvents and electronic waste.

The bindery found that it could offer recycling services to its employees with little extra labor and often a savings in money. For example, the local waste management district offered free battery recycling if the majority of the batteries were from domestic households. By encouraging employees to bring in their household batteries for recycling, the company was able to recycle its own batteries for free. Once a year, the company also opens up its electronic recycling for employee participation. The bindery works with Goodwill to recycle employees' electronic waste—even large items like broken washing machines and dryers.

The bindery has reached out to the local community in its recycling efforts as well. Broken pallets are donated to local farmers, who use them as fuel in their wood stoves. The local farming community also makes use of the tons of paper dust the bindery generates during adhesive binding production. This paper dust is too short fibered to be used by paper mills in the production of recycled paper. Approximately 5,000 pounds of paper dust per month are donated to local Amish farmers to be used as biodegradable livestock bedding. In addition, the perforated stubbing paper from library binding is donated to local schools and daycares to help supplement their art supplies. Rubber bands are donated to a teacher in Northern Indiana who is working with his students, primarily underprivileged youth, to break the world's record for largest continuous rubber band ball. So far, the ball has 71,000 rubber bands, the majority of which were donated by HF Group.

In 2007, the plant manager and maintenance team undertook a massive survey of every material that came into the plant to determine how much was scrapped. They also surveyed how much of that scrap went into the landfill. The survey uncovered that the bindery had gotten a little lazy in its recycling again. As a result, employees redoubled their efforts to reduce and reuse wherever possible. For example, the bindery reuses shipping boxes and packing materials until they are structurally unsound. The bindery cuts every tiny scrap out of a sheet of binder's board that it can. The KASEMake plotting machine in the conservation lab allows them to turn archival board into lacework before recycling the thin scrap leftover.

The second and more pressing issue that the survey uncovered was that the bindery needed to find a way to deal with the discarded book covers replaced during the rebinding process. These covers were covered in cloth, leather, or laminated paper that standard recycling programs were not set up to process. In addition, the bindery's new print-on-demand and facsimile cover services had added large quantities of laminated paper to the list of materials that standard recycling programs were not interested in.

The bindery contacted their local solid waste management district for help and was directed to Quincy Recycle, a business-to-business recycling company with international customers. Quincy Recycle's global customer base provided them the incentive and wherewithal to recycle more stubborn materials like discarded book covers. They were not only interested in paper waste, but much of the plastic waste the bindery could not previously recycle as well. All of the plastic banding and shrink-wrap that secured palletized shipments and the protective plastic films from pamphlet binders could be recycled.

There is a cost to all this recycling in manpower and storage space. All of the recyclables have to be sorted before delivery to Quincy Recycle. For example, the pallet banding and other plastics must be sorted by color and cut into small pieces for efficient storage. Even though the bindery employs approximately 1/3 of the staff it did 30 years ago, training even a reduced staff for such a variety of pre-sorting is difficult, especially during the summer when seasonal staff is hired.

Despite the extra labor expense, HF Group believes their recycling efforts are worth it. Every 3 weeks, the bindery ships out approximately 32 large containers of various recyclables, along with an average of 9,600 lbs. of simple paper waste. In 1988, when the bindery first started keeping track, it was sending nearly 60% of its waste stream to the landfill. Today, it sends less than 5%. In landfill fees, that saves the bindery $13,000 per year, while allowing the company to help its employees, local community, and environment.

The bindery's recycling procedures are in a state of continual evolution. Like with any mundane task, it is easy to

become complacent. Repetitive reevaluation and training is important to maintain compliance with sustainability goals. Recycling technology itself is always improving, allowing the bindery to recycle a larger variety of materials every year. When all else fails, the bindery gets creative and spreads the wealth, donating to local community art groups and schools as a rewarding way of dealing with excess materials.

Danielle Creech, Associate Conservator and Operations Manager, ECS Conservation—Midwest

MARIEKA KAYE
SUSTAINABILITY INITIATIVES OF THE UNIVERSITY OF MICHIGAN LIBRARY GREEN TEAM

Opportunities for sustainability are everywhere, and tend to make operations simpler and easier. The University of Michigan Library Green Team is comprised of interested staff from across the library system. About 25 staff members currently volunteer for the library's multi-departmental Green Team. The Green Team meets about every two months to review and improve sustainability efforts.

One of the reasons the library is so involved in sustainability measures is that the University as a whole is so dedicated to environmental issues. There are campus-wide activities and an entire curriculum related to this subject. U of M's sustainability initiatives are represented by what is referred to as *Planet Blue*, which covers a large range of sustainability education, research, and operations work taking place within and across U of M schools, colleges, departments, and units. Efforts especially focus on energy efficiency, reduction of greenhouse gases and carbon intensity of campus transportation, recycling and composting, land and water management, and education programs for the campus and Ann Arbor community as a whole.

The university strives to have a green campus. This is illustrated many ways, such as growing organic food at a campus farm. It supports large events such as RecycleMania, where different dorms and buildings compete to see who can recycle the most in a given time. There is also active recruitment of Planet Blue Ambassadors who provide the energy and momentum behind a lively dialogue on how we can reduce our carbon footprint and keep our actions sustainable.

Planet Blue maintains careful statistics on how much the university is achieving and is really the large backer of the library's smaller efforts. An entire Sustainability Institute and Office of Campus Sustainability make sure initiatives reach their potential.

There are a few library-specific initiatives that have made a noticeable difference. First, a staff intranet site was modeled after craigslist.org in order to advise staff of serviceable surplus furniture and office equipment that is available for offices and departments. Library staff are strongly encouraged to utilize this internal reuse website instead of buying new office supplies or furniture. Staff members can even make proactive wish lists of items that they are looking out for. Almost all items are placed. New staff and offices in transition are encouraged to use existing furniture and supplies when possible. For example, when the Serials & Microforms department moved to a new building, they were able to find and reuse all the furniture they needed internally, instead of buying new.

Taking reuse further, much of the furniture in the library is reupholstered and repaired instead of replaced when needed. The U of M Upholstery Shop can provide many fabrics and services to make old furniture look new. They are able to use bolt-end fabrics, which are free for the library, so the library only has to pay for labor. Ultimately a significant amount of money and resources are saved through this special service on campus.

Library staff and students from Central Student Government worked together last year to install seven water bottle refill stations in the University Libraries. To date, an estimated 650,000 disposable bottles have been prevented from being used and discarded. This inspired a campus-wide initiative, which has resulted in over one hundred bottle refill stations campus-wide. Any additional water fountains were retrofitted with gooseneck water fillers making refilling any bottles easy.

The Library also now sells reusable water bottles in the two cafes located in the largest libraries. The bottles are sold for $1, which is less than the cost of bottled water. These sales began on January 9, 2014 and to date over 1,500 bottles have been sold.

The Green Team also performed a survey of library buildings to track where recycling and trash receptacles should be located. The team was able to place recycling receptacles next to every trash can and maintain a database of every location where a disposal set-up should be for easy monitoring and future upkeep. Many of the graphics designed by the team are meant to grab students' attention. The signs also have to be pretty straightforward and clear, because there is always confusion as to what can and cannot be thrown in the recycling bins.

As the conservation department creates a high volume of scraps and refuse, we are always recycling as much as possible. We have also formed partnerships with other departments that may be able to make use of some of our scraps. The architecture department has used our mat board scraps for various model-making projects.

Signage templates have been established to reduce waste associated with preprinted signs that are removed and discarded with personnel changes or room reassignments. The library switched to paper inserts for signage that can easily be updated and placed in plastic sleeves instead of using plastic signs that need to be completely changed. These signs are especially useful for reading rooms, which can often have changing hours depending on the time of year.

Kill-A-Watt at the University of Michigan is a student organization that arranges an energy saving competition each fall. Their mission is to involve students in energy, environmental, and sustainability issues, and start discussions on these topics while reducing energy usage on campus. In 2012, students reduced energy consumption in University Housing by over 107,000 kilowatt-hours, saving an estimated $9,000 in utility costs.

While this competition is university-wide, the library has become a repository of tools that help students and members of the university community monitor their energy consumption, such as the Kill-A-Watt meter that can be checked out of the Media Library. Each year during the competition, Kill-A-Watt organizers and partners aim to help students reduce their energy usage by 10% during a 4-week period compared to the same period during the previous year.

Something the conservation department has focused on is the switch to CFL bulbs. Despite their typically more yellow cast, CFL bulbs result in lower UV levels as well as lower utility bills. The average incandescent light bulb is 60 W, and a CFL equivalent is 14 W. This means that if everyone on campus, which amounts to about 43,500 people, had one incandescent and switched it to a CFL, the campus would save approximately 2,001 kW of energy.

Last but not least, the library hosts a number of lectures and events related to sustainability and environmental issues each year, showing further that although it is one small part of the university, the library plays a large part in promoting and supporting sustainability and a healthier, more conscious community.

Marieka Kaye, Conservation Librarian and Book Conservator, University of Michigan Libraries

JULIE NEWTON

THE MIXED PAPER PROJECT: RECYCLING, WASTE REDUCTION, AND CREATIVE SCRAP REUSE AT EMORY UNIVERSITY'S PRESERVATION OFFICE

Conservators are generally very frugal. Take for example Japanese tissue. It is purchased in big sheets, which are torn into narrow strips. Those strips are torn into even finer strips and tiny pieces. Finally, conservators tease out individual fibers for repair. So what does a conservation lab generate in the way of waste? Generally not much from conservation treatment itself; however, there remain a number of sources of waste in a conservation lab.

In the construction of protective enclosures quite a lot of scrap from binder's board to book cloth to a variety of lignin-free boards and fine papers is generated. The encapsulation process produces a large quantity of polyester film off cuts as well. Pamphlet binders produce plastic waste by way of the protective film used in their production as well as the plastic wrapper that bundles the binders into groups. Music scores require covers for their individual parts, which are made out of a 10 pt. board that also produces scrap. The lab at Emory University uses Vivak for book supports and that generates off cuts of the Vivak itself, as well as more of the protective plastic film covering. The lab also generates quite a bit of white paper by way of memos and correspondence, binding tickets and discarded damaged books. Since conservation staff is fastidious about cleanliness when treating rare books, inevitably there are also quite a few paper towels used despite efforts to use reusable rags. Finally, the lab generates adhesive waste.

At Emory University, the unit that handles the physical and logistical part of recycling is Emory Recycles. It originated from the efforts of a group of staff and students in the Woodruff Library where the lab is located. Since its creation, Emory Recycles has grown to serve two campuses—Emory University, Oxford College, the sprawling Emory health care system, and the CDC—all through the efforts of library staff and students. Over the years, the conservation lab has worked with Emory Recycles to determine the suitability of certain materials for recycling.

In order to minimize the waste, the lab tries to extend the life of materials even before recycling them. White paper waste and polyester film off cuts are first used for gluing out. With fine papers like Reeves and so on, the small pieces are kept to line the trays of platform boxes and for tiny endpapers. They can also be cut down into pieces just a few millimeters wide for spine inlays and liners. Polyester film can be cut into thin strips to strap books for exhibition. Small Vivak pieces can be used to make tiny book mounts. Scrap board can be turned into wedges and backing boards for the exhibition of documents. Cardstock scraps can be cut down into tabs for Special Collections to use for barcodes and call numbers.

Woodruff Library's conservation lab uses its small scraps in a cross training program as well. The cross-training program was developed to train all student workers and staff to be able to respond to any rush order, regardless of enclosure or binding type, and to keep student workers stimulated. These training sessions used the scraps smaller than feasible for real protective enclosures. At the end of the cross training, each participant had a miniature portfolio of techniques and different structures they could keep for their reference. As an added bonus, the use of discarded book jackets for collage allowed participants to tailor their portfolios to their own aesthetics.

Emory University's Office of Sustainability Initiatives promotes outreach to the local community and donation before recycling. One of their partnerships is with a program called re:loom, which gives jobs and training to homeless and under skilled Atlanta citizens. re:loom has used donated materials from Emory University to produce items like reusable coffee cup sleeves made from old Emory staff uniforms. The conservation lab is investigating the possibility of donating long cloth

off cuts and that protective plastic film to be woven into new products. The conservation lab is also looking into donating materials to a group that makes bedding for shelter animals. Conservation staff members take materials, as well as skills out into the community to work with at-risk youth and underserved populations. Scrap materials have been reused in artist books and other craft projects during these workshops.

Many of the staff in the conservation lab are artists, and tend to horde scrap materials for personal projects. Almost anything can be recycled into beautiful art. Paper-based scraps can be pulped to cast new, handmade sheets of paper art. Miniscule scraps can be crafted into tiny book earrings.

What cannot be repurposed or reused is recycled. Discarded books can be put into white paper waste after the spines are chopped off. The blue plastic liner waste can be put into the standard plastic 1–6 waste stream. The library also has an aggressive composting project. The conservation lab's wheat starch paste and paper towels are placed into this compost, which is given to a commercial recycler before being returned to Emory for use in the educational gardens and landscaping.

These recycling practices also present challenges. The conservation lab at Woodruff Library is a production lab, so it has to be periodically evaluated whether or not it is worth it to take the time to accumulate scrap, check the grain, and check the size in order to use for protective enclosures. That is a labor-intensive process that may, in the long term, not be as feasible as cutting from a new board. Also, though the conservation lab is closed to the public and has a high level of control over recycling streams inside the lab, once the recycling leaves the lab, it is no longer so contained and the public does not always recycle correctly. The library as a whole is still in a learning phase and working towards better education about and better labeling of the varied recycling streams. At the end of the day, the conservation lab's recycling efforts have substantially reduced its landfill waste. Lab staff keep in touch with Emory Recycles, and as recycling processes improve, the lab is able to recycle more and more of its waste material. Emory University has a mandate to radically reduce landfill waste by 2015, and the conservation department is doing its small part.

Julie Newton, Collections Conservation, Emory University

QUESTIONS, COMMENTS AND DISCUSSION

Commenter: I thought it was really neat that you also do art projects with your scraps because at my institution we have all this scrap that is the wrong size which we don't really know what to do with. So what we do is actually donate a whole stack to our local book artist club. Which has been really great. As well, local schools love to take that material to supplement their supplies inventory.

JN: We've also been donating to some of the artists groups in our area, and just recently went through stacks of matt-board which had been cut up for exhibition. We went to our local arts high school, who will make use of that material.

JJ: I'd like to thank the representatives from the commercial bindery community for being willing to share what's behind the scenes. For those of use working in a university setting, commercial binding is a big part of what goes on and it is good to hear that all the work we are involved in is being done in a responsible way. It is important that when we think of our work, whether at the bench or away somewhere in a factory, that we follow our impact all the way through the process so that we are not only sure of our own impact but those of our partners as well.

Commenter: In my shop, and having had students over the years. For those of you who do not do this, but using colored pencils to mark the grain direction, and of course the different colors identify the different thicknesses. This can be an effective way to organize off-cuts and make them easily identifiable amongst the stack. I've also been using a file cabinet to sort the scraps and make them easily accessible. The point here is that with any waste material, if you can't find it then its not worth the time.

DC: That also can help to keep dust off your piles, which as we know tend to sit around for long periods.

BB: I've worked with some your students, and they all have kept that method of organizing scraps.

Commenter: As I listen to this, I can't help but think we are in the business of library, and every book that is on our shelves is there to be reused many times. So it's kind of stacking the deck, but the libraries do a bigger part for the environment than the mission of any recycling program.

BB: I bet that doesn't get counted in your stats though. You should count each circulation as a reuse.

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Book and Paper Group Tips Session 2014: Contemporary Treatment—Tips and Techniques

MARJAN ANVARI
APPLYING NEW TECHNIQUES ON A TRADITIONAL ADHESIVE FOR BOOK CONSERVATION

Marjan Anvari, Book and Paper Conservator, Portland, Oregon, rastaakenterprises@gmail.com

Green Paste is a polysaccharide which dissolves readily in water thus making it ideal for paper and book binding conservation projects; it remains flexible, strong, stable, non-shrinking, and shows good aging characteristics and reversibility. These unique characteristics have been recognized by traditional paper conservators and bookbinders for many decades.

In fact, a version of this traditional adhesive has been used for hundreds of years in the making of Middle Eastern manuscripts. In the 20th century it was a primary adhesive used for making hand crafts and woodcrafts and is a trusted time honored material. The main advantage of this adhesive in addition to all its other good qualities, is the ease of use that does not require additional processing—it can be used right out of the jar cold. Just by simply adding some distilled water to the powder you can prepare the desired concentration of glue.

We have done in depth chemical analysis of the glue and its constituent components and can provide supporting documentation and compositional analysis if required. In addition extensive field tests have been performed and we feel confident you will find this adhesive an important new element for your conservation practice.

Please try our complimentary sample and let us know if you find it a useful addition to your workshop: rastaakenterprises.com, rastaakenterprises@gmail.com.

BETH DOYLE
ALT TRAINING

The staff in the Conservation Services Department at Duke University Libraries provides care and handling training for new library staff and student assistants. Our goals for this training are to communicate what we do, demonstrate how to handle books safely, and teach attendees how to identify materials that should come to Conservation.

In the past we have hosted individual training sessions as well as Care and Handling Week where we offer 8–10 sessions at a variety of times and locations on campus. To catch people we miss at these sessions we distribute our handouts and presentations via our intranet, but people seem hesitant to use our system to download the handouts. We also regularly get requests for a more flexible learning method than in-person sessions.

In order to reach more people, to make the training more fun, and to make the training schedule more flexible, we are experimenting with using social media tools to make quick training videos. We have used Instagram for short 15-second videos <http://instagram.com/p/juFiE6gw3q/>. Instagram is most popular amongst students and is a good place to reach them. YouTube allows you to post longer videos. We use it to create 2–3 minute training videos that incorporate more information and could stand alone as training modules. <http://youtu.be/LB0HhdSy808>.

Creating the videos takes little time and we have no video-production expertise. We've been able to repurpose many images that we already have, and we have also learned to embrace the concept of "good enough." You don't need professional equipment to make a short video tutorial. You need a smart phone for short Instagram videos, and if you are making longer videos you might need iMovie or another movie editor. "Just Do It" and "Keep It Short" are my mantras.

This informal tips session took place on May 30, 2014, during the 42nd AIC Annual Meeting in San Francisco, California. The moderator, Book and Paper Group Program Chair Emily Rainwater, selected and organized the tip contributors after placing an open call for volunteers from among the BPG and AIC membership. Readers are reminded that the Book and Paper Group does not necessarily endorse the methods or materials shared by tip contributors. Further evaluation or research is advised before putting treatment observations into practice.

We have covered topics including identifying damaged books, basic care and handling, how to remove a book from the shelf, how to shelve large books, and how to pack a book truck. Links to our videos can be found online. <http://tinyurl.com/doyleAIC2014>

Beth Doyle, Head of Conservation Services Dept. and the Leona B. Carpenter Senior Conservator, Duke University Libraries, b.doyle@duke.edu

GWENANNE EDWARDS
TEK-WIPE IN CONSERVATION

Tek-Wipe, a nonwoven, hydroentangled fabric composed of 55% cellulose and 45% polyester, is an inexpensive and sustainable alternative to cotton blotter. The fabric is currently available in heavy and light weights (122–126 g/m^2 and 64–69 g/m^2, respectively). Tek-Wipe is highly absorbent and strong when wet, unlike blotter, which has no wet strength. Tek-Wipe is also reusable: It can simply be rinsed with deionized water or rinsed, with no detergent, in a washing machine. This releases the discoloration and soluble degradation products that may be transferred from an object to the fabric. Tek-Wipe is also more dimensionally stable than blotter and does not distort when wet. The amount of moisture is easily controllable to match the needs of a given object. Tek-Wipe can be misted with water or wrung or brushed to remove excess moisture. Tek-Wipe is also significantly less expensive than blotter.

The most common use of Tek-Wipe is for capillary washing, so that instead of changing and discarding discolored blotter throughout the washing process, conservators can simply rinse and reuse the fabric. This is especially useful for objects with a large amount of discoloration, as there is less waste, and objects with sensitive media, as only slightly dampened Tek-Wipe will still pull a significant amount of discoloration from the support. For especially fragile and sensitive objects, stacking sheets of Tek-Wipe increases the capillary action and decreases the frequency of rinsing, thereby reducing handling of the object. It is also possible to capillary wash large objects, such as wall maps, by using a few long, overlapped strips of Tek-Wipe.

Tek-Wipe is also used instead of thin blotter as a support for washing objects on the suction table. Because it swells less, Tek-Wipe allows for greater suction than blotter. Tek-Wipe can also be used instead of Paraprint OL 60, a nonwoven fabric of viscose fibers in an acrylic binder, for slant washing. Paraprint wets unevenly upon reuse, while Tek-Wipe, which has no binder, does not.

Due to its absorbent properties, Tek-Wipe can also be used to dry and flatten paper objects. Bill Minter (2002) introduced the idea of using Tek-Wipe to dry wet books, using a modified interleaving system. In a similar vein, Tek-Wipe can be used as interleaving for water-damaged books in emergency-response scenarios.

Because it has a smooth surface and is chemically stable, Tek-Wipe can also be used for surface cleaning glass plate negatives, whereas cotton often leaves small fibers behind. Tek-wipe can also be used for dry cleaning some paper objects, humidification like Gore-tex, and calcium bicarbonate and phytate treatments.

REFERENCES

Minter, B. 2002. Water damaged books: washing intact and air drying—a novel (?) approach. *Book and Paper Group Annual* 21: 105–109.

SUPPLIERS

Heavyweight Tek-Wipe
36 in. wide, by the yard or 100-yard roll
Polistini Conservation Material LLC
www.polistini.com
conservation@polistini.com

Lightweight and Heavyweight Tek-Wipe
36 in. wide, by the 100-yard roll
William Minter Bookbinding & Conservation, Inc.
wminter@pennswoods.net

Texwipe Techincloth® (lightweight)
Packs of 4–12 in. square cloths
www.texwipe.com

Gwenanne Edwards, Andrew W. Mellon Fellow in Paper Conservation, Conservation Center for Art and Historic Artifacts, Philadelphia, PA, gedwards@ccaha.org

BETSY PALMER ELDRIDGE
BEADING: A JAPANESE TECHNIQUE USED TO RELAX LAMINATED PAPERS

The Japanese paper conservation tradition is full of wonderful techniques that are useful in western book and paper conservation as well. One of my favorites that seems to be little known in the West is "back beading" laminated papers to make them more flexible. In Japanese it is called Urazuri. It is described in the Glossary of the 2004 International Course on Conservation of Japanese Paper as "Rubbing Beads: A string of glass beads or soapberry seeds (mukuroji) used to soften and smooth a scroll by rolling the beads over the back of the final backing (soura) after it has been stretch dried, before the reverse drying. Also known as juzu."

The proper string of beads is about 105 glass beads, roughly ¼ of an inch in diameter, loosely strung together into a strand approximately 38 inches long, tied together to form a necklace of 19 inches. The necklace is first coiled

on a flat surface and placed flat under the palm of the hand. Then the coil is rubbed across the surface, either in a circular motion or back and forth, with considerable pressure. The beading does not delaminate the sheets but softens the adhesive so that the sheets lose their stiffness and lie flat, losing any warping or cockling. Any burnishing can be avoided by using a protection sheet.

This simple but remarkably effective technique can be used to soften any lamination. In paper conservation where lining items is a common practice it is particularly useful. In bookbinding it provides a convenient solution to the stiffness in the flyleaves of "made endpapers" that often has been found to be objectionable. It also lessens the stiffness in other sheets lined during restoration such as the title page and frontispiece. With a little imagination, the principle can be adapted and applied elsewhere… And if glass beads are not available, Mardi Gras beads seem to work very well in a pinch! Enjoy!

Betsy Palmer Eldridge, Book and Paper Conservator in Private Practice, Toronto, Ontario, bpeldridge@aol.com

ANNE MARIGZA
USING RARE EARTH MAGNETS IN A SOLVENT CHAMBER

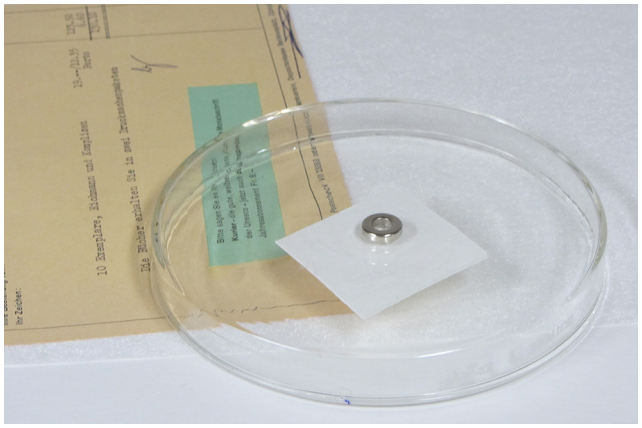

Fig. 1. Rare earth magnet with large petri dish.

Fig. 2. Rare earth magnet with Pyrex dish.

A pair of rare earth magnets can be used to secure a solvent-saturated blotter to the ceiling of a glass solvent chamber. One goes on the inside and the other goes on the outside. You can use a glass dish in the size and shape most appropriate to your project.

Additional notes:

- The magnets work just as well with disposable Mylar trays.
- Inspect your magnets before use. Discard magnets that are powdery or have flaking coating.

Anne Marigza, Conservator, US Holocaust Memorial Museum, Washington DC, amarigza@ushmm.org

TERRY MARSH
CLING AND RELEASE: SILICONE MYLAR + JAPANESE PAPER + WHEAT STARCH PASTE = A ONE-STEP HINGE FOR FLOAT FRAMING

Here are directions for delicate, translucent hinges to be used for attaching translucent or opaque paper items to back mats for float framing. The gossamer Japanese paper (Tengujo-thin) chosen for the hinges clings to the silicone coated polyester (Mylar) when the wheat starch paste is applied. The silicone coated polyester supports the wet hinge with the fibers in position. This method attaches the hinge to the art and back mat all at one time. This method can also be used for any weight or size hinge. The item being attached remains face up, positioned on the back mat.

1. Prepare silicone coated polyester strips. A suggested size is 1 1/4 by 6 inches for 2 by 1/2 inch hinges.

For interior hinges: shape the silicone coated polyester strip using scissors, curving the cut to create a tail so the strip can be pulled out using tweezers after drying. Cut along long side about 1/2 inch from the edge for about 3 1/2 inches, then curve up to cut off this section. The balance of the strip can be trimmed but leave enough of the full size section to hold while manipulating.

2. Shape the hinges, possibly wet torn on the long sides, and scissor cut on the short vertical sides. Fold the hinge to make a sharp crease.
3. Position the item to be hinged on the back mat and place a blotter and weight.
4. Place a hinge on a scrap of mat board, place a strip of silicone coated polyester on top covering 1/2 (horizontal orientation). Fold over the hinge so the crease is snug to the edge of the strip. Use the shaped strips for the center hinges so they can be easily removed.

5. Coat the exposed half of the hinge with wheat starch paste. The hinge will cling to the silicone coated polyester strip. Turn over the hinge onto a second strip and coat the other side. Blot very lightly.
6. Lift the hinge/silicone coated polyester and position between the item and the back mat. Immediately press three times with blotter. Then place blotter and weight.

Continue with all the hinges. Let dry overnight, or 20 hours.

7. Position weight on the item about 4 inches below hinge. Remove blotter and weight from hinge. Gently remove the silicone coated polyester strip by pulling with tweezers and your hand. Wiggle to help detach if necessary.

Note that the silicone coated polyester is also very handy as a carrier when mending tears using Tengujo-thin as the fibers will stay in position because they are clinging to the carrier.

SUPPLIER
Talas
330 Morgan Ave, Brooklyn NY 11211
212 219-0770
www.talasonline.com

- Silicone Coated Polyester (Mylar), coating on two sides, .0015 inch gauge Item #TFM004004
- Tengujo (Thin) Item #TPB092001

Terry Marsh, Terry Marsh Art Conservation, Damariscotta, ME, tmarac@tidewater.net

BILL MINTER
REVERSE-ROLLING OF ARCHITECTURAL DRAWINGS

Rolled architectural drawings are always difficult to handle. When some of these drawings were sent to our department for digitization, they had to be flattened in some manner (fig. 1). Since the paper was in good condition and not brittle, humidification did not seem necessary. An efficient method of treatment was prepared based on an early account bookbinder's technique: To create the rounded spines for ledger books, account binders would use a mailing tube with a length of paper attached; then a piece of thin board was covered with glued paper, and the assembly was then rolled up inside the paper extension. This same technique is ideal for reverse-rolling of paper in good condition.

A small diameter mailing tube of about 1–1/2" to 2" is used, along with a length of paper that is secured to the tube with double-sided tape. Since this treatment is very short-term, 36" wide Kraft paper about 6-feet long was used. When ready, the tube is positioned near the edge of a workbench with the

Fig. 1. Architectural drawings to be flattened for digitization.

Fig. 2. Leading edge of drawing aligned to the nip of a mailing tube; note the support paper extends to the floor.

Kraft paper extending to the floor. The leading edge of the rolled drawing is inserted into the nip of the mailing tube and support paper (fig. 2). While the mailing tube is being rolled, the drawing is unrolled (fig. 3). When completed, the roll can be secured with tape or Quick-ties. The reverse-rolled

Fig. 3. Unrolling the drawing while rolling up the support paper around the tube.

drawing should remain in this manner overnight. Most of the drawings were ready for digitization after that time; in some cases, a second day may be needed and/or a smaller diameter tube can be used. Reverse-rolling in this manner seems ideal for most drawings. Care and other treatment options should be considered if the paper is delicate and/or brittle.

BILL MINTER
ALTERNATIVE TECHNIQUE FOR SPRAYING WATERCOLORS AND PAINTS

When a specially colored or toned paper is needed, we sometimes brush on a color or dip the paper. An alternative is an air-brush, if one is available. Another option is the PREVAL Sprayer Products system. This system uses a small compressed gas cylinder that is attached to a bottle with your paint or color. A 6 oz. glass jar is supplied, or 3 oz. plastic jars are available, and these jars can be sealed for use at a later time

Fig. 4. Preval Sprayer Product systems.

(fig. 4). Any color can be mixed and used in the sprayer just like a regular can of spray paint. For a special project, I used dilute watercolor, sprayed in a horizontal and then a vertical pattern for uniform coverage. Further comment: For a very large, special project, an automotive, gravity-fed, paint sprayer was used. With either sprayer, the end results were very satisfying and met the requirements of the project.

Suppliers: Preval Sprayer Products are available from auto body refinishing suppliers, some hardware stores, Home-Depot and Lowes home improvement stores.

BILL MINTER
VELCRO-CLOSURES FOR PHASE BOXES

Velcro is commonly used to secure phase-boxes and portfolios. Unfortunately, standard Velcro is very aggressive and this can be too strong for some boxes. In some cases, the extra strength has a tendency to delaminate the board. Our commercial binder for Penn State had used the standard Velcro for some boxes. We sought an alternative and upon contacting the manufacturer we learned of a so-called, "Clear-Transparent" Velcro. This product is much more suitable for use in our library collection. In addition to the lower strength, this alternative has a reduced bulk, which is an added advantage (fig. 5).

Suppliers: While there must be other suppliers, we were directed to Home Depot for our first supply of the Clear-Transparent Velcro.

Fig. 5. Standard Velcro at top with "Clear-Transparent" (reduced-strength) Velcro.

Fig. 6. Tracing an infill on a suitable paper for a perforated line.

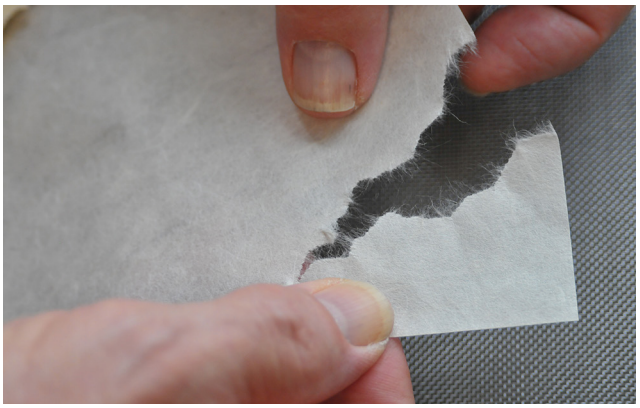

Fig. 7. Dry-tearing of perforated paper.

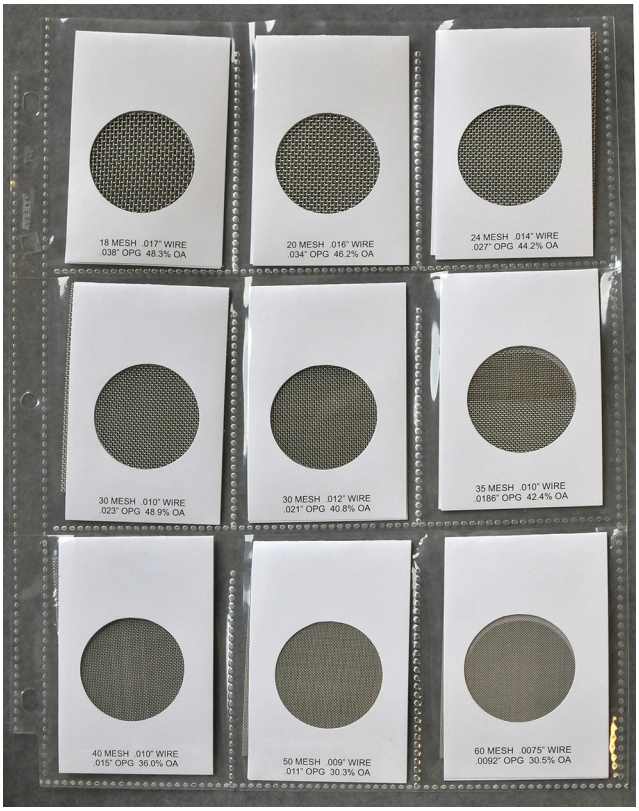

Fig. 8. Samples of various sizes of woven wire mesh.

BILL MINTER

DRY-TEARING OF PAPER FOR INFILLS

This is a simple idea that may have eluded us for many years: the use of a piece of woven stainless-steel mesh seems to offer an ideal surface when tracing the outline for an infill to a document. To use, the mesh screen is positioned on a work surface with a sheet of mending paper, either Western or Japanese, on top (fig. 6). The document needing the infill is then positioned. By using an awl or suitable stylus, one can trace the shape of the infill. Since the awl tends to mark the paper because of the mesh, it perforates the paper so that it is easily torn along that line. Depending on the type of paper and the size of the mesh, the resulting perforation will vary to create a neat, dry-tear that is ideal for most infills (fig. 7).

The woven mesh screen is typically identified by the size of the wire and number of wires per inch, such as .010" wire and 40 x 40. That size might be considered a medium screen,

while a coarse screen might be 20 x 20 and a fine screen is 90 x 90. For testing purposes, McMaster-Carr Industrial Supply offers a set of sample mesh screens in a range from 18 x 18 to 70 x 70 (fig. 8); other finer mesh screens are also available. After determining the best for your purposes, the screen can be ordered in any size from one square foot to almost any size.

Supplier: Sample pieces, catalog # 9231T16 from McMaster-Carr at www.mcmaster.com; larger woven sheets are also available.

Bill Minter, Book Conservator, Penn State University, University Park, PA, wdm14@psu.edu

LAURA NEUFELD
REVIEW OF FLATTENING TECHNIQUES FOR THIN OR TRANSPARENT PAPERS

Thin or transparent papers can be difficult to flatten because they often have distinctive surface characteristics, can be fragile due to embrittlement, or be prone to extreme cockling and uneven expansion when exposed to moisture. Humidification and flattening can alter the surface texture and sheen of thin or transparent papers. These features should be considered when selecting a flattening method. This tip is a brief review and endorsement of several useful techniques that have been previously published.

Mylar flattening (fig. 1) was described by Catherine Nicholson (1988) and is useful for imparting a slight sheen to the paper as one side dries against the surface of a Mylar or Teflon sheet. The object must be fully wet to achieve the best results, which may not be possible for all works.

The hard-soft sandwich (fig. 2) was developed by Hildegard Homburger and Barbara Korbel (1999) for architectural drawings but can be used for any thin paper. The technique only requires light humidification, which minimizes dimensional changes in the sheet. Severe creases are removed without significantly altering the surface texture. For severely distorted papers multiple layers of fleece are used. White capillary matting or Gore-tex can be substituted for polypropylene fleece. The success of this method requires significant weight on the stack.

Friction flattening (fig. 3) was developed by Keiko Mizushima Keyes (1984). In this variation the humidified object is sandwiched between damp sheets of a dimensionally stable medium-weight Japanese tissue. Smooth the layers with a brush (*nadebake*) to ensure good contact. Damper Japanese tissue will result in stronger flattening since the sheets restrict the object as it dries. Because friction flattening imparts some texture from the Japanese tissue to the object it is not recommended for highly calendared papers.

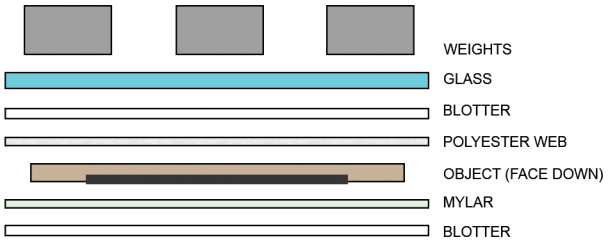

Fig. 1. Diagram of Mylar flattening.

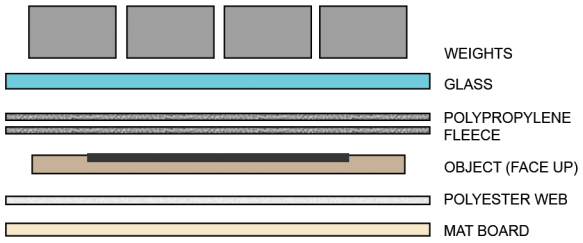

Fig. 2. Diagram of the hard-soft sandwich.

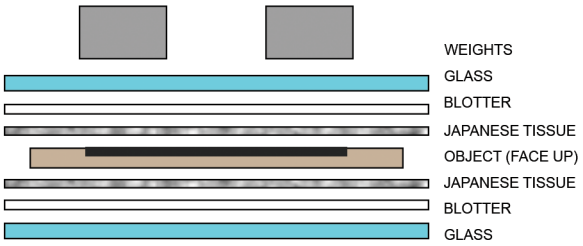

Fig. 3. Diagram of friction flattening.

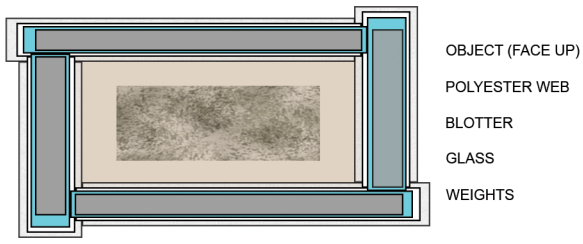

Fig. 4. Diagram of edge/stretch flattening.

Edge or stretch flattening (fig. 4) is useful for works with fragile media that can't withstand weight on the surface. The object must be very damp in order to pull the sheet into plane as it dries. Because edge restraint creates tension in the sheet, it should not be used on brittle papers. This technique can also result in greater dimensional change.

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ADAM NOVAK
AQUAZOL AS A HEAT SET ADHESIVE ON PAPER

Based on research and publications by Katherine Lechuga, Aquazol can be used successfully as a heat set adhesive for mending applications that are usually complicated. In my applications, I have applied a solution of 5–6% Aquazol 500 in ethanol to two cross-grain sheets of 2 gram Tengucho (Hiromi). Application in ethanol allows for quick, lint-free drying; crossing grains of two sheets of thin paper allow for even expansion and adequate transparency.

I initially used this technique on vegetable parchment, a thick, slick, and transparent paper that had numerous tears around the edges and into the design layer of architectural drawings. I was able to align the tears and apply the prepared heat set tissue with the pressure and heat of a finger. Once the mend was in place, silicone release paper was placed above and below the vegetable parchment and the mend was further set with a tacking iron. The mends were slightly shiny on the applied side, but appeared completely transparent from the opposite (recto) side.

Katherine Beaty carried out another treatment with similar application techniques and a slight modification at the end. A book with iron gall ink borders was repaired by applying the heat set tissue, this time made with Berlin tissue, on both sides of the corroded-ink border. After tacking the tissue in place with heat, the gloss of the Aquazol film was reduced by going over it with a small stencil brush barely dampened with ethanol. The small amount of ethanol was enough to give a matte appearance to the adhesive and making the mend more invisible.

ADAM NOVAK
PH STRIPS VERSUS PH METERS

For conservation facilities that have water purification systems, this is a note about the accuracy of the traditional pH strips versus an electronic pH meter. My observation came out of general frustration of the pH strips changing quite slowly or not at all when placed in deionized water conditioned with calcium carbonate. Theoretically, this type of water should be basic; when measured with pH strips at various times during the day or throughout the week the results would be significantly different or inconclusive. Measuring with the electronic pH meter gave results that were higher in pH than the strips, resulting in general confusion about which measuring device was more accurate. (At the Weissman Preservation Center we use pH strips with various trade names manufactured by Merck, and a Horiba twin-pH meter.)

I then decided to also measure the conductivity of the water. Conductivity is the concentration of ionic activity within a solution, important in this instance because we use primarily deionized and calcium-conditioned water. I found that our water has very little ionization, which is to be expected from a purified water system, but even the calcium-conditioned deionized water measured in the low range of 10–40 μS/cm. As a comparison, I prepared two buffer solutions with known pH ranges and measured with pH strips and the electronic pH meter (table 1).

Note that in the table the measurements between the pH strip and the electronic pH meter are the same. The conductivity of the two buffer solutions is also considerably higher than the calcium-conditioned deionized water. This would indicate that a higher conductivity allows for a more accurate measurement with the pH strips.

Merck notes in a technical leaflet that the pH strips are less accurate and slower to read a weakly buffered solution,

Solution	pH strip	pH meter	Conductivity (µS/cm)
Deionized water	~	~	0
Calcified water	7.5-8	10.2	32
Phospate-Citrate Buffer in water	5	5	6000
Trizma Buffer in water	7.5-8	7.7	4100

Table 1

but they do not define weakly buffered. Measurements that seem more accurate at one point and less at another could be accounted for by the concentration of ionized material (calcium carbonate, calcium hydroxide, ammonium hydroxide) that has been added to the water. It is likely safe to assume that using highly purified water in conservation necessitates the use of more accurate measurement devices, such as the electronic pH meter.

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BECCA POLLAK
SPRAYED CELLULOSE POWDER TO MINIMIZE LOCAL DISCOLORATION ON PAPER

The use of cellulose powder to cover stains or other disfiguring damage that may not otherwise be reduced has been common practice in paper conservation. Recently, methods have been developed by Elissa O'Loughlin with Stephanie Jewell at the Walters Art Museum for spray application of micro-cellulose powder directly onto a paper support, or onto Mylar for use as a remoistenable film[1] (fig. 1). These techniques have been used effectively to lessen the appearance of stains and foxing on paper and can also serve as a barrier layer for inpainting on moisture sensitive objects. Direct spray application—through Mylar stencils on paper, for in-situ treatments on wallpaper, or for camouflaging damage to canvas is an additional alternative to traditional inpainting or other overlay techniques.

To make the film, the cellulose powder is dispersed in methylcellulose to form a slurry. An external-mix paint sprayer is used (fig. 2) which can spray a more viscous solution with larger particles than standard (internal-mix) airbrushes. The sprayer is made for broad coverage and can be run on an airbrush compressor (fig. 3), canned propellant, or CO_2 tank (with fittings and regulator).

After complete drying, the finished film can be stored on the Mylar support and pieces separated as necessary using a micro-spatula. The cellulose films do require some front-loading efforts but can be a valuable addition to an inpainting tool kit. Please refer to the BPG wiki for a detailed procedure sheet and equipment resources.

RECIPES FOR THE CELLULOSE POWDER SLURRY

Recipe 1 (Elissa)

- 20mL water
- 0.5 tsp. Methocel® A15C (selected because of its low molecular weight)
- 5mL isopropanol (wetting agent)
- 1g cellulose powder[2]

Fig. 1. Sheets made using Solka-Floc® purified powdered cellulose and Methocel® A4M. Gradations of brown can be made by cooking the dry white powder and mixed to achieve various tones of paper, board, and canvas.

Fig. 2. Spraying the cellulose powder slurry onto Mylar using Testors® Multi-Purpose sprayer #8814 (This model was recently replaced with Testors® Basic Broad Stroke Airbrush System #A2207).

Fig. 3. "Mini" air compressor (Testors® #50204A) with paint sprayer and hose attachment.

Recipe 2

- 20mL 1–2% Methocel® A4M (a lower concentration of the higher molecular weight methylcellulose yielded good results)
- 5–10mL isopropanol
- 1g cellulose powder

NOTES

1. O'Loughlin, E. and S. Jewell. 2013. Two new techniques for loss compensation in art on paper: Integration of surface losses using textile fibers and the use of sprayed cellulose powder to minimize foxing and other discoloration [Abstract]. *The Book and Paper Group Annual* 32:52
2. Spraying was most successful with Solka-Floc® 300 micro-cellulose powder (fiber length ~22 μ), available from International Fiber Corp. North Tonawanda, NY 14120. Tel: (888) 698-1936. http://www.ifcfiber.com

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CHER SCHNEIDER

QUICK AND EASY PLEXI PASTE

INTRODUCTION

The Rare Book and Manuscript Library (RBML) at the University of Illinois Urbana-Champaign campus (UIUC) participated in a traveling exhibition of 35 books traveling to Germany and the custom-made acrylic cradles were breaking at the joints. The RBML director approached Conservation to repair the broken cradles. Many of the commercially available Plexiglas® adhesives are proprietary with unknown chemical composition or contain a toxic ingredient, such as methylene chloride. Methylene chloride or dichloromethane is a volatile, colorless liquid with a chloroform-like odor that is labeled as a carcinogen by OSHA. Due to safety concerns and unknown off-gassing properties I developed this process to make a conservation-grade Plexiglas® paste that can be recreated in most equipped conservation laboratories.

PROCESS

Equipment Needed: goggles, nitrile gloves, fume hood, straight edge, Plexiglas® cutter, cutting board, polyethylene bag, glass beaker, glass stirring rod, Parafilm, cotton swabs, weights, microspatula, tweezers, pliers, eyedropper, acetone, and toluene.

Step 1: Collect Plexiglas® Shavings

- Choose a color of Plexiglas® that suits the item to be glued. *Clear Plexi works for all colors.*
- Cut Plexiglas® to make shavings. fig. 1
- Save shavings in a container (glass beaker or polyethylene self-sealing bag).

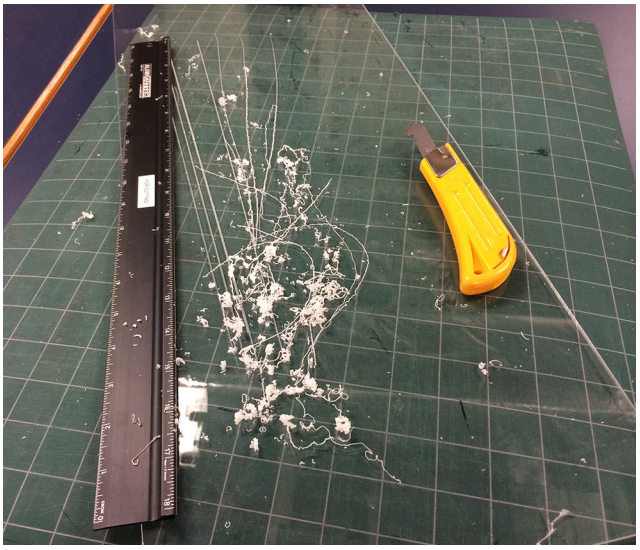

Fig. 1. Cut Plexi with Plexi cutter to make shavings to dissolve into paste.

Fig. 2. Acetone will partially dissolve Plexiglas and will be semi-transparent and milky-white in color.

Step 2: Dissolve Plexiglas® to Make Paste

- Crush Plexi shavings into smaller bits by stirring with glass rod in beaker.
- Mix in drops of acetone until Plexi shavings are mostly dissolved.
  - *The semi-dissolved Plexi will be slightly transparent and milky white in color* (fig. 2).
- Mix in drops of toluene until Plexi is fully dissolved and transparent (fig. 3).
  - Consistency is best in *gel form* or like *molten glass*.
  - Continue to add drops of acetone or toluene to keep in gel form. Cover with Parafilm "M" to extend gel stage.

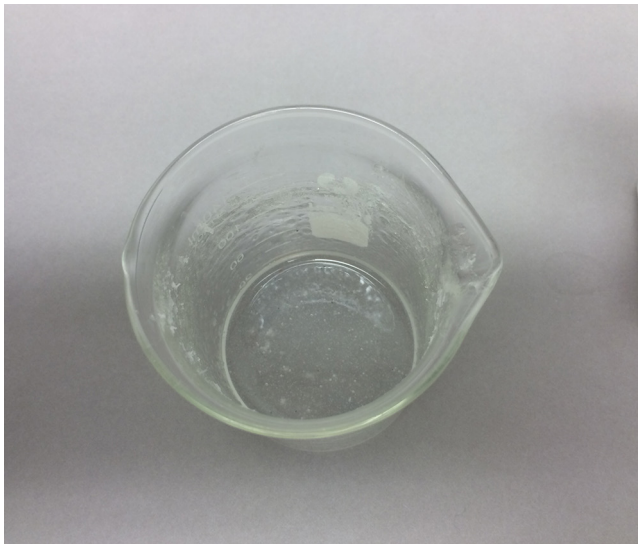

Fig. 3. Adding toluene to the paste will fully dissolve the mixture and it will become transparent and clear. Do not over mix!

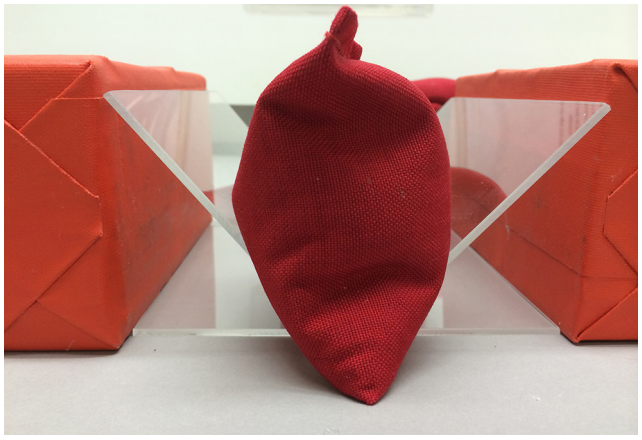

Fig. 4. After gluing out Plexi make sure to dry underweight in the fume hood.

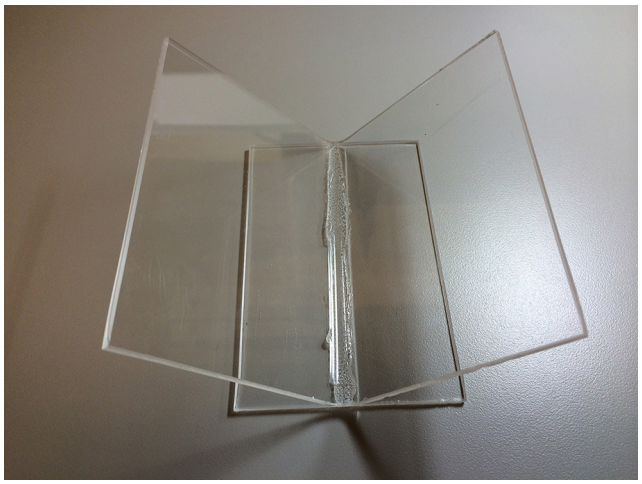

Fig. 5. One of the custom RBML Plexiglas cradles glued with quick and easy Plexi paste. The cradles survived travel to Germany and home using this paste.

Step 3: Attach Plexiglas® Using Plexi Paste

- Add a strip or beads of Plexi paste with the glass stirring rod or eyedropper. *A little goes a long way*.
  - Use mat board or Plexi scraps to scrape away excess paste.
  - Clean up excess Plexi paste on edges with a cotton swab and toluene.

Step 4: Curing Process of Plexiglas® Paste

- Hold item in place with weights in fume hood until completely cured (fig. 4).
  - *All organic solvents dissipate in approximately* 15–*20 hours, overnight.*

Step 5: Clean Up

- After paste dries in beaker, the Plexiglas® paste removes easily.
  - *The dried Plexi Just pops out of beaker and off glass rod. (May need pliers)*

If the Plexi adhesive is left in the glass beaker then the Plexi paste can be reactivated with acetone and toluene. To reactivate, break up the dried paste into smaller pieces and begin at step 2 of the Plexi paste process.

CONCLUSION

There are pros and cons to the quick and easy Plexi paste, but overall the paste is found to be a superior solution to commercially available Plexiglas® adhesives for conservation purposes. The Plexi paste is cheap to produce as the scraps of Plexi can be used or your local Plexi retailer can supply the shavings, *although may not be pure in color*. The paste is also easy to make in an equipped conservation laboratory. This Plexi paste is quick drying and once dry—although not tested—only Plexiglas® remains forming the bond with limited to no off-gassing. This Plexi paste is also very strong and the Plexiglas® will often break before the bond. The few negatives about the paste are bubbles and cracking. While creating the paste, bubbles will form if the paste is over mixed but can be alleviated with letting paste stand for a while covered with Parafilm "M". *(Parafilm "M" can extend the gel-stage for up to three days.)* The Plexiglas® can develop cracks during the curing stage and *existing cracks will extend*. To conclude this Plexi paste is often used by UIUC Library conservators and has allowed more creativity with cradles with the use of different shapes and angles while holding books and special collection materials from libraries and archives safely and securely (fig. 5).

FURTHER INVESTIGATIONS

- What causes the cracking observed along joints to grow during curing?
- Methods to reduce and eliminate bubbles in Plexi paste.
- Can heat be used to reactivate or extend gel phase safely?

- Can organic solvents be eliminated by using heat such as Kistka pen?
- How many times can you reactivate paste?
- What is the best applications of paste?

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STEPHANIE WATKINS
STUDIO-LAB WEIGHT SOURCES

THINGS TO CONSIDER WHEN SEEKING WEIGHTS

Be creative, resourceful, and open-minded. The sources are limited to your imagination. Think "outside-the-box" at what might work for your needs. Seek variety: No one perfect weight, size, or shape exists for all applications across specialties. Compare prices as a wide range of cost in pricing per pound/kg exists. Making your own is the best value for the money. To be as green as possible, look locally, ask around for free items, re-use, and repurpose. Use local transport to reduce gasoline, oil, and carbon emissions. If you have to ship, consider USPS flat-rate priority boxes. The smallest size is under US$6 per box on-line for up to 70 lbs/31.75 kg (as of May 2014).

READY-TO-USE WEIGHT SOURCES

Distributors such as Conservation-by-Design, Gaylord, Hollinger Metal Edge, Talas, and University Products, sell ready-made weights from pillows to tailor's style weights. Hand-crafted weights include varieties from Elissa O'Loughlin's Wren Haven Tools and Inherent Vice Squad. Conservation specific weights are the most expensive options.

A variety of weights are used in many non-conservation endeavors and include magnets, sewing supplies (such as drapery or curtain, string or tape, pattern and tailor's weights), scuba and exercise weights (sold by the pound/kg), fishing weights, car-tire balancing weights, glass scraps, paperweights, flat irons, shoe anvils, door-stoppers, copy presses, rail-ties, counter-weight window sashes (pre-WWII USA houses, hexagonal ones roll less), torchiere lamp bases, laptop computer battery packs, calibration, postal, and balance weights, books, and construction supplies such as bricks and threshold molding.

New items can be bought from specialty and box stores, including hardware, fabric, upholstery, art and craft stores, sport, boating, scuba, and fishing stores, glass and auto shops, box stores, science and electronic equipment suppliers. Used items can be obtained for free or found at reduced prices in a plethora of resale markets including garage/yard/jumble sales, flea-markets, second-hand and antique shops, construction recyclers and industrial surplus centers, Habitat for Humanity resale stores, Craig's list local, Freecycle, Ebay, Etsy and Etsy vintage (look for local vendors then contact them via a "convo" email).

MATERIALS TO MAKE INTO WEIGHTS

Metals and stones can be adapted into weights suitable for conservation use. Metals include heavy metal scraps including scrap metal, steel bar, bb shot (graphite coated lead to minimize corrosion is one type), used scalpel shards, nails, washers, mending plates, ball bearings, and coins. Metal materials are available from hardware stores, recycling (Habitat for Humanity) and industrial surplus centers, machinist's shops, shooting ranges, gun and sporting stores. Coins are available from coin collectors and your own stashes. Lab refuse of used scalpels and metal hardware can be used.

Stone materials include granite, marble, river rocks, pebbles, washed sand-box sand, lithographic limestone, and epoxy-coated aquarium gravel or aquarium-grade natural pea-gravel. Stones are available from hardware stores, landscape suppliers, quarries and stone centers, garden centers, pet-stores, box stores and recycling building suppliers. If your community allows it, stones are also available from local streams. Kitchen-floor samples including manufactured counter-top materials and bathroom scraps, "sink holes", and design room sample squares are often free if you ask.

Glass and resin beads easily replace rice and bean use and available from science and craft suppliers.

MODIFYING MATERIALS TO MAKE WEIGHTS

Some materials need minor modification to make suitable conservation weights. Polish rough stone edges. Seal unpolished stone edges with sealants: Topical sealers (polyurethanes, acrylics); penetrating sealers to anchor material to surface (siliconates, fluoro-polymers, and siloxanes) and impregnating sealers (silanes or modified silanes). Use steel instead of lead to reduce toxicity (although not as heavy). Isolate lead, metal scraps, BB shot, and crumbly stones in:

- Tips of rubber-gloves. Makes nice small weights.
- Heavy plastic sheeting or bags. Note lead shot eventually rubs holes through even the heaviest of plastic, so expect to periodically service your pillow weights to replace the plastic.
- Sealed, rigid plastic containers (try not to drop them!).
- Embed in inexpensive poly (vinyl acetate) emulsion, e.g. "white glue".

Add smooth boards or thick felts to the bottom. Add handles for easier, safer pick-up and transfer on and off items. Cover weights that are meant to go directly against art and manuscripts with soft fabrics that won't harm. Examples are velvet, velveteen, chenile knit, ultrasuede, or charmuese. Cover pillow-style weights with leather or heavy fabrics such

as buckrum (book and box cloth), mattress ticking, upholstery, and Denier Cordura. Choose natural fibers for better pictures. Choose medium range colors to hide handling marks.

MAKING YOUR OWN CLOTH-COVERED WEIGHTS

Many free pattern instructions and tutorials are available in sewing blogs on-line. First determine your need: "Form follows function". Determine the size needed, the interior weight material, then the exterior material. Hand-sewing is possible if you don't have a machine. If you can sew a button, you can sew a weight. Heavy-weight upholstery, mono-filament, and leather sewing threads available. Reinforce the fabrics with heat-activated adhesive liners that create stiffer, longer lasting cover for better wear, provides further rigidity, and blocks weaving holes. Offset double sewing lines by differing the stitch length. Large nose funnels are helpful for filling bags.

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- Name each digital file with the appropriate reference number (e.g., "Smith01")
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- The list of captions for each figure should appear at the end of the paper (Fig. 1. Caption as you would like it to appear under the figure.) There should be a capital letter to start the caption and then end with a period regardless of whether it is a complete sentence. If there is no caption, say [no caption], no need to list the file name.
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