

# The Book and Paper Group Annual

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SYLVIA R. ALBRO

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## Paper History During the Golden Age in Fabriano, Using Illustrations from the Zonghi Historical Archive in Fabriano and the Rare Book and Special Collections of the Library of Congress

### ABSTRACT

A nine-month research grant funded in 2002 by the Kluge Foundation at the Library of Congress helped support the research for this presentation. The grant period was the culmination of a number of years of exploring the subject during brief trips to Italy and to Fabriano in particular. Although most American book and paper conservators are familiar with the role of the Italian papermaking industry in the early dissemination of the craft throughout Europe, the specific contributions of Fabriano are perhaps less widely acknowledged. Literature published in Italian over the last twenty years fills out the role of Fabriano, which though not the first location for the transfer of papermaking technology from the Arab world, was the source of important technical innovations in the craft, including the use of the multiple-head stamping machine, the substitution of gelatin for starch in paper sizing, and the introduction of the watermark. In addition, the city's key position along firmly established trade routes contributed to making it the principal supplier of paper in Europe by the first half of the fourteenth century. The focus of the AIC presentation was on the period of 1300 to 1500 and explored the reasons why Fabriano both politically and geographically became the ideal location for the advancement of this new technology.

Paper made in this region during this era is still remarkable today for its pristine quality and permanence, such that acid-free modern papers mimic the elemental components in Fabriano paper made nearly one thousand years ago. A collection of paper samples housed in the Fabriano Museum of Paper and the Watermark and assembled in the nineteenth century by the accomplished historian, archivist, and prelate Aurelio Zonghi was described.

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This paper was delivered as the featured lunch presentation for the Book and Paper Group Session on June 8, 2003, AIC 31st Annual Meeting, June 5–10, 2003, Arlington, Virginia. Received for publication Fall 2003.

Zonghi collected watermarked blank sheets of handmade paper from dated documents in the local archives with known provenance from 1280 to 1600 and created a consecutive record of papers used in the Fabriano area during its "golden age" of papermaking. His watermark tracings were published in 1953 in a volume issued by the Hilversum Paper Publications Society of Holland. Zonghi corresponded extensively with the noted Swiss filigranologist Charles Briquet about his collection in the 1880s and the exchange of letters still kept in the Fabriano city archives was discussed. Briquet did fiber analysis for Zonghi on sixty samples of paper and concluded that all the early Fabriano papers were made from hemp (or *cana-pa* as it is known in Italian).

The presentation briefly went over the identifying paper characteristics of these early Fabriano sample papers including fiber content, color, sizing, alkaline earth content, laid and chain patterns, and watermarks which document the technical development of hand papermaking in Italy at this time. These features can help conservators recognize early Fabriano papers in artworks, manuscripts, and books which they come across in the course of their work. Examples of rare books, fine prints, manuscripts, and printed maps from the Special Collections of the Library of Congress made with Fabriano papers were shown.

An AIC publications grant from the Kress Foundation beginning in August of 2003 is supporting the eventual publication of the research conducted for this AIC paper. A digital album of watermark samples made from the Zonghi collection is also in progress. The planned completion date for the publication is January 2005.

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# Solvent-Set Book Repair Tissue

## ABSTRACT

This paper presents the development of and techniques for repairing leather using a custom-toned, solvent-set repair tissue made with Lascaux Acrylic Adhesive 498HV. The tissue repairs do not darken deteriorated leather and are more readily reversible than repairs made with other adhesives. Although designed for board reattachment and quick, simple repairs to leather bookbindings, the material and techniques may be applied successfully to complex treatments.

## INTRODUCTION

Solvent-set book repair tissue is an experimental material developed at the Harvard University Library. This repair tissue was designed for batch treatments of leather-bound, special collection materials and is a variation of other book repair techniques using Japanese paper (Etherington 1995). The technique uses Japanese paper that is toned with acrylic paints and then coated with Lascaux 498HV acrylic adhesive. The dried adhesive-coated tissue is reactivated for use with low-toxicity non-aqueous solvents such as ethanol and isopropanol. Open time for the remoistened adhesive is sufficient for careful manipulation and placement of the repair, but the rapid evaporation of the solvent sets the repair in under five minutes.

Traditional leather repair uses thin, new leather inserted under the old; lifting the old leather can be a difficult process, and the new leather often fails even more quickly than the original. Newer approaches using Japanese paper applied to the surface of the damaged leather were developed as an alternative to traditional techniques. Current paper-based leather repair techniques use a vari-

ety of adhesives including wheat or rice starch paste, polyvinyl acetate (PVA), and methyl cellulose, alone or in mixtures. Repairs using paste require long drying times, risk permanent darkening and hardening of the leather, and are difficult to reverse without placing the leather at further risk from moisture. Repairs adhered with PVA reduce the risk of darkening leather and dry quickly, but cannot be reversed without damaging the leather surface.

The advantages of solvent-set book repair tissue include: quick application and setting time; strength and stability of the repair materials; ease in matching the repair tissue to the binding leather; and reversibility of the adhesive. A solvent-based adhesive is also less likely to darken or more seriously damage aged leather, as is common with water-based adhesives. The solvent-set tissue can be applied successfully to board reattachments, spine and cap repairs, and joint damage.

## ADHESIVE

Lascaux 498HV adhesive has been primarily used in paintings and textile conservation. Unlike Lascaux 360HV, Lascaux 498HV is not tacky at room temperature. The manufacturer describes it as a “dispersion of a thermoplastic acrylic polymer on the basis of methyl methacrylate and butyl acrylate” which is “thickened with acrylic butylester,” and claims that it is “permanently soluble in acetone, toluene, Thinner X, etc.” (Diethelm 2003) We have found that the dried film may be softened and made tacky with either heat or solvent, including isopropanol and ethanol.

Accelerated aging and testing of Lascaux 498HV was conducted by Michael Duffy (Duffy 1989). The results revealed that the adhesive yellowed somewhat under thermal/light aging of 100+ hours. However, film protected from light during aging remained clear. Lascaux 498HV retained 2.6% swelling in isopropanol (down from 4.8%), and increased to 45.6% swelling in toluene (up from 43.8%). The ability to retain swelling during accelerated

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Fig. 1. Squeegeeing through silkscreen onto polyester film

aging suggests that the adhesive is potentially reversible over time.

#### PREPARATION OF THE REPAIR TISSUE

The tissue selected for this technique should be a strong, long-fibered, 100% *kozo* paper. It should be reasonably translucent so the color of the volume's leather will show through the finished repair. A paper that has proven successful is KTLG from the University of Iowa's Center for the Book Paper Facility, a smooth-finished *kozo* tissue about 0.05 mm in thickness. Commercially colored tissues are available but should be carefully reviewed for quality of fiber content, color fastness, and light stability.

First, the selected tissue is toned lightly with thinned acrylic paints resulting in a highly translucent material. It is only necessary to match the general color family of the leathers, not to exactly replicate the hue and saturation. This technique requires the color to be much paler than is used for other, more familiar techniques. Working with earth pigments, including raw and burnt umber and raw and burnt sienna, it is possible to prepare a variety of pre-toned tissues suitable for most common leathers. Brighter colors, such as blues and reds, are also easily accommodated. Liquid acrylics such as Golden Fluid Acrylics work well



Fig. 2. Dropping wet tissue onto wet adhesive

for such dilute colors since they disperse easily and remain dispersed rather than settling out.

Next, adhesive is applied to the toned tissue with a method similar to producing heat-set tissue:

1. Spread a thin, even layer of undiluted adhesive onto polyester film by squeegeeing through a silk-screen (fig. 1). A thin coat of adhesive is more flexible, conforms more closely to the leather surface, and is less likely to cause weak leather to delaminate than a thicker coating.
2. Lightly mist the surface of the adhesive with deionized water. The misting creates a more consistent layer of adhesive and prepares the surface for applying the tissue.
3. Lightly mist the tissue with deionized water to pre-expand the fibers and reduce the chance of wrinkling.
4. Carefully drop the tissue onto the adhesive, avoiding wrinkles and bubbles (fig. 2). Surface tension between the two wet surfaces encourages full contact; pressing is not necessary.
5. Allow the tissue and adhesive to dry completely; air dry or use a hair dryer.
6. The dried tissue should be left attached to the polyester for convenient storage, cutting and handling; it tends to curl if removed overall from the polyester.

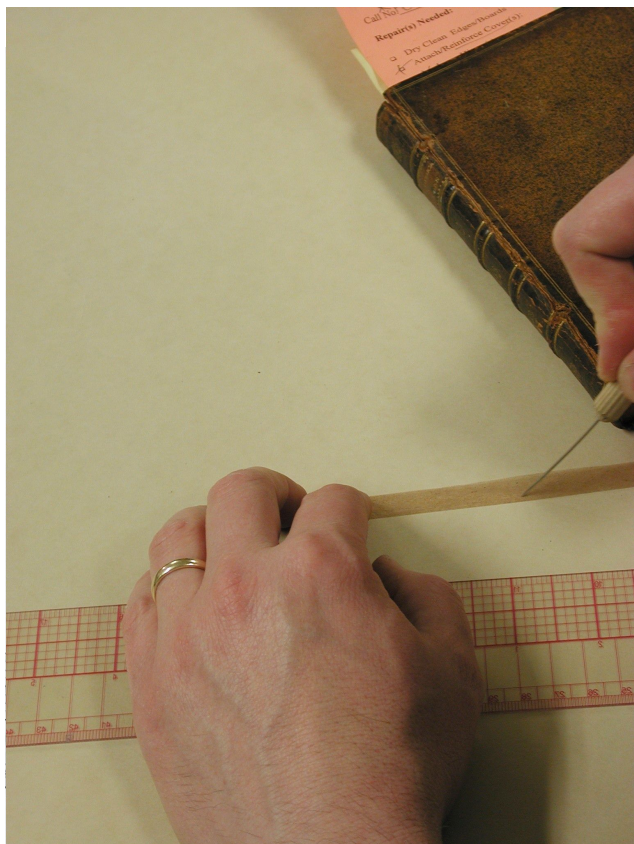


Fig. 3. Customizing a repair strip with a needle



Fig. 4. Trimming to accommodate a label

#### LEATHER PREPARATION

As with many repairs on leather, a consolidant such as Klucel G is often needed to prepare the surface to accept and hold a repair. We use Klucel G for consolidation of larger areas. However, we find that a solution of Lascaux 498HV dissolved in alcohol consolidates the repair area with only one coat, leaves the leather flexible, and provides a good surface to adhere to the solvent-set tissue. The Lascaux 498HV emulsion is mixed with just enough isopropanol to dissolve the adhesive into a clear, slightly viscous solution (approximately 1:5, Lascaux 498HV: isopropanol).

We have heard of one instance of alcohol-dissolved Lascaux 498HV not penetrating well on a deteriorated modern leather and remaining somewhat tacky on the surface. However, we have not had that experience during two years of using the mix for consolidation. Test carefully before using to be certain.

Although the solvent-set repair technique was developed as a surface repair, it may be used in the more traditional sense by inserting the repair tissue under lifted original leather. This method may be advisable when working with original leathers with a tendency to delaminate, such as sheepskin. Solvent-set repair tissues may also be used to face original leather during the lifting process.

#### REPAIR TECHNIQUE

The Lascaux 498HV solvent-set repair tissue was developed for reattaching boards or repairing damaged joints. The technique for applying this type of repair is described below.

Preparation of a text block prior to the repair is the same as any other binding repair technique. Endleaves should be soundly attached to allow the inner hinges to be repaired if needed. The inner hinges may be repaired either before or after the outer joints are repaired. The leather around the repair must be strong enough to support a repair and should be consolidated as needed.

Boards are reinforced or reattached with a strip of the solvent-set tissue that is wide enough to cover the joint and extend onto sound leather on either side. Cut the repair strip with a needle tool or a scalpel directly on the polyester. Customize the repair strip to fit around raised bands, spine labels, or other binding features. If there are tooled lines along the joint, a repair strip carried up to a line will be less obvious. Like any joint repair, the repair strip may be flared at the head and tail to accommodate leather losses or gaps from back cornering. Additionally, more complex shapes may be cut for other repairs, such as rebuilding a lost headcap (figs. 3–4).





Fig. 5. Pressing a repair through a sheet of polyester web

Place the shaped repair strip, adhesive side up, on a non-absorbent surface, such as polyester film or acrylic sheet. Reactivate the adhesive by brushing it out liberally with isopropanol. Allow it to sit for a moment to soften the adhesive.

Transfer the reactivated tissue to the damaged area with tweezers, placing it evenly across the joint. The reactivated adhesive has sufficient slip for approximately twenty to thirty seconds to allow rapid adjustments to the placement of the strip. Gently lift the board immediately after applying the tissue to reveal the natural crease line of the joint. The repair should extend at least 2 mm on either side of the crease. If the repair is too close to where the joint flexes, the repair may lift away from the surface of the leather when the board is opened.

The just-applied tissue also may be molded to fit over three-dimensional elements, such as raised bands. Press the strip through a single sheet of polyester web (fig. 5) or work it down with a crumpled ball of the polyester web (fig. 6). Tamping or brushing the repair with a stiff brush can help work the repair into pronounced grain patterns.

Additional shaping of the repair can be done at this point by gently lifting areas with a microspatula and trimming with surgical scissors. If needed, apply a Lascaux/alcohol consolidation mix or a warm (not hot) tacking iron to reset lifted areas.

If the board is at all distorted, place small weights on the cover to keep the board flat (particularly at the head and tail) while the adhesive sets. Setting time is no more than five minutes, at which point the rest of the repair may be completed, such as turn-ins or inner hinges. Once set, the

board should be flexed fully open to see if the repair is adhered properly to the leather.

The solvent-set repair tissue may be cut flush at the head and tail or left long and turned in. If turn-ins are desired, the pastedown should be lifted to anchor the tissue underneath, since turn-ins that are only abutted to the pastedown often come loose when the joint is flexed.

The repair tissue is generally translucent enough to allow the leather color to show through. In the case of special collection materials, it may be desirable to custom tone the repair to accommodate variations of the leather after the repair has initially set. Toning *in situ* may be done with brush-applied watercolors or with thinned acrylic paints applied with a cotton swab. In cases where the repair must overlap gold tooling slightly, we use small amounts of bronze paint to extend tooled lines on top of the repairs. We have been using Golden Acrylic brand Iridescent Bronze (Fine), often applied with a needle tool.

Once the desired color is attained, the surface gloss of the repair is easily adjusted. The solvent-set tissue may be polished directly using crumpled polyester web to attain a moderate sheen. If a higher gloss is required, common coatings such as microcrystalline wax or the Leather Conservation Centre's SC6000 may be applied and buffed as needed.

Completed repairs should be allowed to rest overnight before final quality control because the solvent does not fully evaporate for several hours. The boards should be opened and the repair reexamined. Lifting areas, such as those that might occur around raised bands, are easily



Fig. 6. Pressing a repair with a crumpled ball of polyester web



Fig. 7. Three books before treatment



Fig. 8. Three books after treatment

touched up with a warm tacking iron. If a small amount of additional adhesive is needed, the Lascaux/alcohol mix may be applied with a fine brush, allowed to dry briefly, and then set with a tacking iron (figs. 7–8).

#### OTHER APPLICATIONS

The basic solvent-set tissue technique is the same for other leather repairs. The tissue can be used to reinforce breaks in the spine, to cover exposed board corners, and to rebuild caps. If the repair will cover losses in the leather, any fill material used to build up thickness should be toned before the repair tissue is applied, since untuned fills will show through the translucent tissue.

The solvent-set tissue is also useful for more complex treatments and may be combined with other repair methods, such as board slotting (Clarkson 1992; Zimmern 2000), tacketing (Cains and Swift 1988), or fabric flange (Brock 2001) when rejoining detached boards of larger volumes. For a more in-depth discussion of board reattachment methods see the Discussion Group report from the *Book and Paper Group Annual* (Fredericks and Hellman 2001) and Donia Conn's comparison of board reattachment techniques (Conn 1996).

#### REVERSING LASCAUX 498HV SOLVENT-SET TISSUE REPAIRS

As with any surface repair on potentially weak leather, removing tissue repairs applied with Lascaux 498HV

should be approached with care. Lascaux 498HV may be softened with alcohols and other solvents, and by the application of heat. Coatings of wax and/or acrylic paints may act as a barrier to solvents. One effective approach is direct application of hot air, such as is sometimes used for tape removal (fig. 9). We have used the Zephyrtronics Airpencil ZT-2, which provides a well-controlled, fine stream of hot air.



Fig. 9. Removing a repair with a hot air pencil



Though we consider these repairs to be removable, leather types and conditions will affect the ease of removal and final results. All things considered, we feel this technique is at least as, if not more, easily removed than tissue repairs applied with paste or PVA.

#### CONCLUSION

Repairs of damaged leather bindings require careful judgment, practice, and skill. The new material and techniques described above are only one approach to solving the common problems of leather bindings. We consider the Lascaux 498HV solvent-set tissue to be a useful addition to the broad range of repair techniques already available to conservators. It is well suited to quick repairs and batch treatments and has been used successfully to rejoin detached boards, to reinforce split joints and breaks in the spine, and to rebuild endcaps. Though the technique should be considered experimental until suitable testing of leathers treated with acrylic adhesives may be performed, it offers many advantages that warrant further investigation.

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# Historical and Scientific Analysis on Sizing Materials Used in Iranian Manuscripts and Miniature Paintings

## ABSTRACT

The present study aims to investigate historical and scientific analysis of sizing material used in Iranian manuscripts and miniature paintings. A large number of sizing materials has been introduced according to historical treatises from the Taimurid (fifteenth century), Safawid (sixteenth century), and Qajar (nineteenth century) periods. In order to investigate the presence of sizing materials mentioned in historical literary references, sample analysis was conducted on the sizing materials of eleven historical Persian and Indian miniature paintings and illuminated manuscripts from sixteenth to eighteenth century.

Out of the twelve sizing materials that were recommended by masters based on the historical survey, the mucilage of cucumber seeds was the most common sizing material on the paper samples as identified by the FT-IR (Fourier-transform infrared spectroscopy) method.

The present historical and scientific survey suggests a wide range of natural sizing materials that can be used as tools for conservation and restoration of paper documents where the sizing of paper is required.

## INTRODUCTION

Sizing paper is the process of preparing the surface suitable for writing, illuminating, and painting. After the sheet is formed and dried, the cellulose fiber in paper can continue to absorb water unless it has been sized or impregnated with some substance such as starch, glue, or wax to prevent penetration (Bloom 2001). Different techniques have been applied for sizing paper depending on requirements, such as soaking or applying one or a number of layers of sizing material on the paper surface with the help of a soft brush.

Specimens from the third century indicate that paper-makers had a range of sizing techniques, from coating the surface with gypsum to treating with gum, glue, or starch, to prevent the ink from spreading (Bloom 2001). According to Dard Hunter one of the earliest methods of sizing paper consisted in covering the surface of the sheets with a thin coating of gypsum. The next improvement (Hunter 1957) was to render the body of the paper, as well as the surface, impermeable to ink by the use of lichen, starch, or rice flour. In Iran, according to Shiela Canby, once the paper was dried it was sized by soaking it in albumen or a starchy solution to fill in and even out the surface for painting (Canby 1993).

Some scientific investigation has also revealed valuable information on materials used in the sizing process. According to H. E. Wolf, based on chemical investigation, the Iranian papermakers at Samarkand have made an important contribution to paper technology by introducing sizing of paper to make it more suitable for writing with ink and a reed pen. According to him wheat starch and later gum tragacanth or the boiled bulbs of asphodel were used as the sizing substances.

There are a number of sizing materials, revealed by masters in Iranian treatises belonging to the Taimurid, Safawid, and Qajar periods, which have been overlooked by scientists and conservators. Studying these historical references not only gives a new chapter to identification of materials used in manuscripts and miniature paintings during the Safawid period, but also helps conservators and restorers to develop new methods and techniques for sizing processes based on traditional materials. Our analytical study on sizing material used in Persian manuscripts and miniature paintings was based on two phases: historical analysis and scientific analysis.

In the first phase we collected information and studied Persian historical treatises from the Taimurid and Safawid to Qajar period (fifteenth to nineteenth century). In the second phase sizing materials of original samples from the Iran Bastan Museum collection as well as from some pri-

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vate collections were identified based on the information from the historical analysis.

HISTORICAL ANALYSIS

During the Sassanian period (fifth to sixth centuries CE), before the Islamic era, Iranians used sizing materials on cloth to prepare the surface for writing and painting (Heravi 1993). After learning the process of papermaking from the Chinese, Iranians continued the sizing process tradition on paper to prepare a suitable surface for writing and painting. The chief contribution of Iranian paper makers working under Arab rule was the perfection of rag paper through improved techniques for beating the fibers and by preparing the surface for writing by sizing it with starch (Bloom 2001).

Referring to Persian historical treatises, use of a sizing layer has been recommended by Iranian masters many times. Soltan Ahmad Majnoon Ra fiqi Heravi advises in his book “Adab al-Mashq” to use soft, smooth, and even paper to write or to draw. Also in the book “Favayedal Khotoot” is the recommendation to apply sizing materials to make fragile papers strong enough and to reduce the fluffiness of paper fibers as well as to make them smooth for writing.

In the sizing process three basic elements are involved. Size (*ahar*), burnishing tools (*mohreh*), and a base surface (*takhteh*). Several sizing materials have been used according to the historical treatises, which is the particular concern of this paper. According to these sources the materials can

generally be categorized as proteinaceous materials, including: animal glue; starches from rice or wheat; vegetable gums; mucilage of plants and seeds; and fruits and sugar. A number of burnishing materials also have been used such as agate stone (*aqiq*), jade (*yashm*), ivory (*aa*j), glass (*zeja*j), crystal (*bollour*), and shell (*jis*). Sometimes hands alone also have been used to smooth the surface. A hard and smooth surface made of flint stone (*chaqmaq*) and a wooden board was also used as the base for burnishing and sizing the paper (Heravi 1993).

SIZING MATERIALS

Our historical analysis was based on nine treatises from the fifteenth to the eighteenth century. Some of these historical treatises are by known authors and some are anonymous. In table 1 the titles of the treatises along with the date and the name of the author have been listed. Twelve sizing materials in six general categories have been identified in the historical analysis and are listed in table 2. These sizing materials have been described in historical treatises basically from the Taimurid (fifteenth century), Safawid (sixteenth century), to Qajar (nineteenth century) periods as follows:

Starch (*neshasteh*)

A general term for starch (*neshasteh*) has been mentioned in five treatises; we believe that when the nature of starch has not been specified it refers to rice starch. In these

No.	Title of the Treatises	Author	Date
1	Dar Bayani Khaghaz, Morakah Va Hali Alvan	Anonymous	9th AH (c.15th CE)
2	Serat-al Sotour	Soltan Ali Mashhadi	920 AH/1542 CE
3	Golzari Safa	Ali Syrafi	950 AH/1572 CE
4	Favayed al-Khotoot	Mohamad Ibn Doust Mohamad Bokhari	995 AH/1617 CE
5	Adab al-Mashq	Baba Shahi Isfahani	10th AH (c. 17th CE)
6	Khat Va Morakab	Hossein Aqili Rostamdari	930–984 AH/1552–1606 CE
7	Resaleh Dar Bayani Tariqeh Sakhtani Morakabi Alvan Va Kaghazhayi Alvan	Anonymous	10th AH (c. 17th CE)
8	Dar Bayani Khat, Morakab Va Kaghaz Va Sakhtani Rangha	Anonymous	10th–11th A.H (c.17th–18th CE)
9	Haliat al-Ketab	Anonymous	10th–11th AH (c.17th–18th CE)

Table 1. Historical analysis of Persian treatises



sources (1, 2, 4, 8, and 9) the process of sizing by starch (*neshasteh*) has been discussed in detail. For example the eminent calligrapher Soltan Ali Mashhadi devoted several couplets of his treatise “Serat al-Sotour” on calligraphy to sizing and glazing paper by hand (Bloom 2001). The process of sizing has been described as follows:

Prepare the size (ahar) from starch  
Learn these words from an old man,  
First make a paste, then pour in water,  
Then boil this for a moment on a hot fire;  
Then add to thin starch some glue (*serish*);  
Strain [so that it is] neither too thin nor too thick,  
Spread it on paper and see  
That the paper should not move from its place;  
When you are applying size to your paper  
Moisten the paper slightly with water, carefully

It is worth mentioning that in sources nos. 2 and 4 it has been specifically advised to mix *serish* gum with the starch paste.

Wheat Starch

Wheat starch (*neshasteh-e gandom*) has been specified in two sources, “Golzari Safa” by Seyrafi and “Khat va Morakab” by Hossein Aqli Rostamdari, as follows:

For sizing paper make some wheat starch paste, filter it followed by cooking. Then take a wooden board and cover it with felt (*namad*) or a muslin cloth. Take two bowls; pour the starch in one and some water in the other.

Moisten a cotton ball with starch and rub it over the paper. Finally take another piece of clean cotton ball, moisten it with water and rub it over the starched paper. This way the paper can be sized.

Rice Starch

Rice has been specified in one source, “Haliat al-Ketab” by an anonymous author. In this source the process of making starch paste for sizing material out of rice has been explained as follows:

Take the best quality of white rice, rub it with salt, wash it until it becomes clean and the taste of salt disappears. Then add some water and keep it for one full day till it becomes soft and it dissolves by rubbing. Place it in a mortar (*havan*) and bray it with water till it becomes very soft. Boil it on a slow fire; stir it with a wooden stick until it becomes pasty. Let it get cold. Spread a piece of cloth in the sun and put the paper over it till it dries up. Finally burnish the paper till it becomes very smooth. Dyes can be added to the paste to get colored paper. By this method nobody can distinguish this paper from *Baghdadi* paper.

Plant Mucilage (*loab*)

Mucilage is a gummy or gelatinous substance produced in certain plants by the action of water or the cell wall. In four sources (1, 3, 6, and 7) a number of sizing materials out of plant mucilage are named. However, the descriptions are not as detailed as the descriptions on starch.

Historical treatises reference no.	Starch			Plant Mucilage					Fruit		Animal Glue	Vegetable Glue		Sugar
	Starch	Rice	Wheat	Rice	Fleawort Seed	Cucumber Seed	Marshmallow	Myrtle	Melon Juice	Grape Syrup	Fish	Gum arabic	Serish	Egyptian Rock Sugar
1	X			X	X	X	X		X	X	X	X		
2	X												X	
3			X	X	X	X			X	X	X	X		
4	X												X	
5	X													
6			X	X	X	X			X	X	X	X		
7							X	X			X	X		X
8	X												X	
9	X													

Table 2. Identification of sizing materials based on historical analysis

*Mucilage of Rice (loabi berenj).*

Rice mucilage is named in three historical treatises (1, 3, and 6) as follows: "Cook rice on fire until its mucilage is obtained. Make sure the rice and vessels used are free of oil. Then size the paper with it."

*Fleawort Seed (ispaghol, esfazeh, quitona)*

In all three sources (1, 3, and 6) the techniques explained are the same; however the duration of dipping the paper in mucilage is different.

In sources nos. 3 and 6 the term *quitona* has been used for fleawort seed and the process explained as follows: "Pour some fleawort seed until you get its mucilage. Leave the paper in the mucilage for one hour and then take it out."

In source no. 1 the advised duration for dipping the paper in fleawort seed is shorter. The description is as follows: "Size the paper sheet with mucilage of fleawort (*esfazeh, spaghol*) at one time. Then let it dry."

*Cucumber Seeds (tokhmi khiar)*

Another sizing material is cucumber seed, which is cited in the same three sources (1, 3, and 6). The description on preparing mucilage from cucumber seed is quite brief. "Keep cucumber seeds in water until its mucilage is obtained. Dip the paper into it for some time and then take it out."

*Mucilage of Marshmallow (loabi khatmi)*

Mucilage out of marsh mallow is mentioned in only two sources (1 and 7) as follows: "Keep marshmallow in some water for one night and one day. Heat it over fire until you get the mucilage. Dip the paper into it for some time and then take it out."

*Fruit Juice/Syrup*

It is very interesting to know that in the historical treatises two types of fruits, melon and grape, have been introduced for use as sizing materials.

*Grape Syrup (shireh-e- angoor)*

Grape syrup is mentioned as a sizing material in three sources (1, 3, and 6). Syrafi in *Golzari safa*, in part of his couplets on sizing materials, names grape syrup as the fourth material for sizing. In source no. 1 the technique is explained as follows: "Filter grape syrup. Apply it on paper for sizing. Grape should be seedless."

*Juice of Sweet Melon (Kharboozeh)*

Juice of the sweet melon known as *kharboozeh* is mentioned as a good sizing material in the same three sources (1, 3, and 6) as mentioned above. Seyrafi in "Golzari Safa," in part of his couplets on sizing material, lists melon juice as the second material for sizing. In source no. 6, Hossin Aqili Rostamdari in his book "Khat va Morakab" mentions

that: "... and furthermore they take juice of sweet melon (*kharboozeh*) and dip the paper in it for sizing."

*Animal Glue*

The next category that can be identified in the historical sources is animal glue.

*Fish glue (sirishumi mahi)*

Fish glue as one of the sizing materials used by the masters is mentioned in four sources (1, 3, 6, and 7) in a quite similar way as follows:

Soak a small amount of white fish glue (*sirishum*) in water. Change the water and refill fresh water for three days until it clears thoroughly. Heat the *sirishum* until it melts, then filter it with a piece of muslin cloth. Apply the fish glue on paper as a sizing material. Let it dry in the sun carefully.

*Vegetable Glue*

The next category that has been identified as sizing material in the historical treatises is vegetable glue.

*Gum arabic (Samqi arabi)*

Gum arabic is named in four sources (1, 3, 6, and 7). According to the above-mentioned historical reference gum arabic is a very good sizing material and it is suitable for writing. The description (6) reads: "... and furthermore melt gum arabic and size the paper with it."

*Serish*

Serish is a very well-known vegetable glue, which traditionally is used for binding books in Iran. As mentioned before, two sources (2 and 4) advise mixing serish with starch to thin the paste: "... then add some glue (*serish*), to thin starch."

*Mixed Sizes*

In one source, "Resaleh dar Bayani Tariqrh Sakhtani Morakabi Alvan va Kaghazhayi Alvan" (7), myrtle extract and sugar syrup are introduced as the materials to be added to a plant mucilage for sizing paper as follows:

If a paper has deep turquoise color and it is difficult to write on, the advice is to apply either sweet melon juice (*abi karboozeh*), or syrup of Egyptian rock sugar (*abi nabati mesri*) or myrtle extract (*abi mord*) with mucilage of fleawort seed (*ispaghol*) and mucilage of oil-free cooked rice (*loabi berenj*). All these materials make paper strong and if the paper is then burnished it becomes smooth like a mirror.

## SCIENTIFIC ANALYSIS

In order to investigate the presence of sizing materials mentioned in historical literary references, sample analyses

Origin	Owner	Object	Date	Check List No.											
					Sta	Fis	Gum	Fle	Mel	Ric	Gra	Cuc	Sug	Myr	Tra
IRAN	Iran Bastan Museum	M	16th c.	4555	sf										
"	Atiqi	I.M.	16th c.	11								f			f
"	"	I.M.	17th c.	12								f			
"	"	I.M.	17th c.	13								f			
"	"	I.M.	17th c.	14								f			
"	"	M	16th c.	15								f			
"	"	M	16th c.	16								f			
"	"	M	16th c.	18								f			
"	"	M	16th c.	19								f			
INDIA	Iran Bastan Museum	M	17th c.	4535	sf										
"	Atiqi	M	18th c.	17	sf										
<div><div><div>Key to sizings:</div><div>Sta = Starch</div><div>Fis = Fish glue</div><div>Gum = Gum arabic</div><div>Fle = Fleawort</div><div>Mel = Sweet melon</div><div>Ric = Rice mucilage</div><div>Gra = Grape syrup</div><div>Cuc = Cucumber seeds</div><div>Sug = Sugar syrup</div><div>Myr = Myrtle Juice</div><div>Tra = Tragacanth</div></div><div><div>Key to object:</div><div>I.M. = Illuminated manuscript</div><div>M = Miniature</div></div><div><div>Key to identification methods:</div><div>s = determination of starch by staining the paper with iodine-potassium iodide solution</div><div>f = identification of sizing materials in the sample is obtained by comparing the infrared spectrum with reference spectra or by reorganizing specific bands.</div></div></div>															

Table 3. Sizing materials on selected paintings collected from Iran Bastan Museum collection and traditional artists

were conducted on the sizing materials of eleven historical Persian and Indian miniature paintings and illuminated manuscripts belonging to the Iran Bastan Museum and private collections dating from the sixteenth (Safawid period) to eighteenth century (Qajar period). The analysis of sizing materials used in the original samples was carried out at the Research Centre for Conservation of Cultural Relics (RCCCR) in Iran. Sizing materials were identified by a staining method and FT-IR (Fourier-transform infrared spectroscopy) analysis.

Starch was detected on paper by formation of the characteristic blue color when a dilute aqueous solution of iodine-potassium iodide was added.

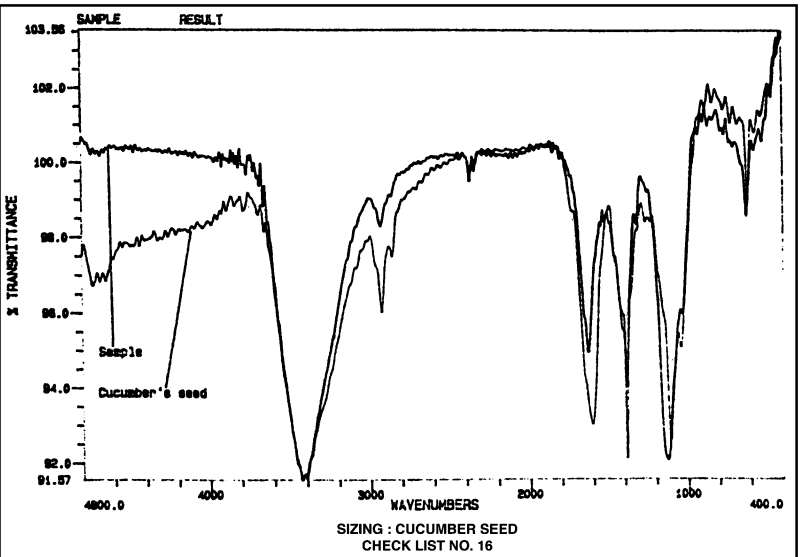
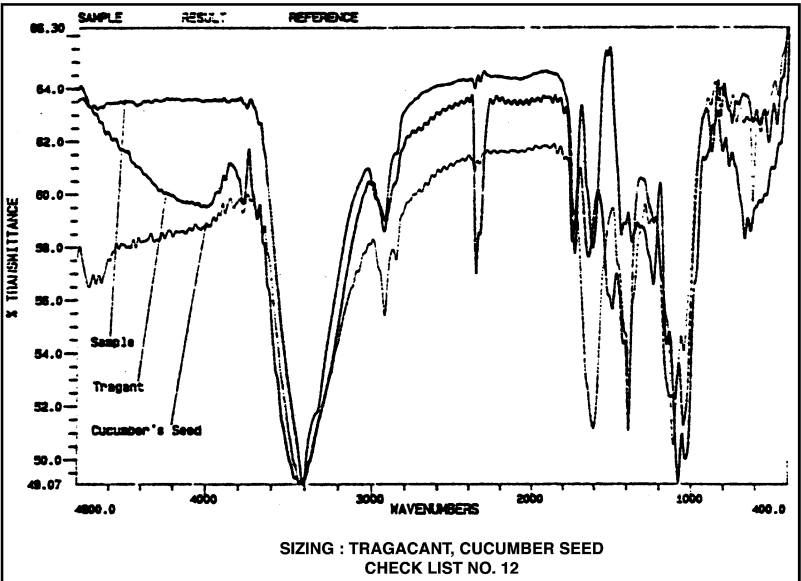
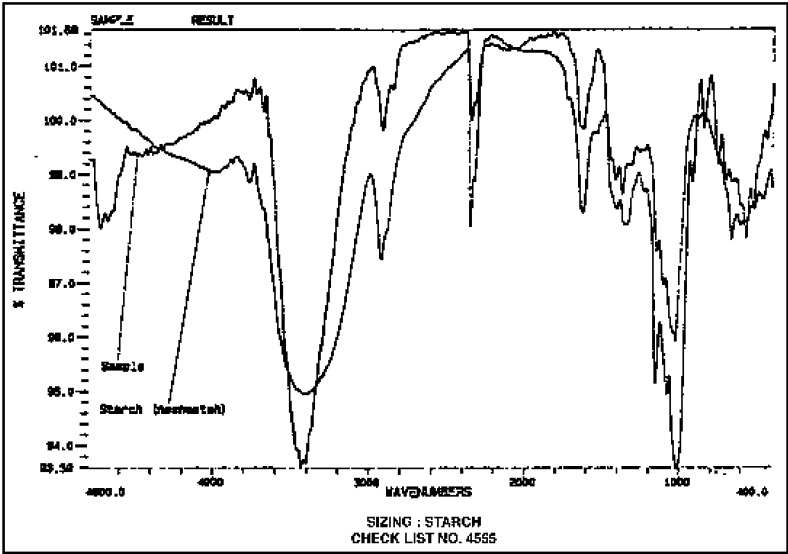
A large collection of sizing materials was prepared based on historical recipes for comparison with the spectra of the original samples. FT-IR spectroscopy was carried out with a Nicolet, Model 510 P, instrument provided with a microscopic attachment. Sample preparation was done by mixing potassium bromide (KBr) and the unprepared sample 100:1 (Broekman-Bokstijin et al. 1970). Identification of the materials in the samples was obtained by comparing the infrared spectrum with the reference spectra via recognition of specific bands. Table 3 provides a complete record of the sizing materials found and indicates the identification methods used in each case.

Out of the six categories of sizing materials recommended by masters in the historical survey, the mucilage of cucumber seeds was the most common sizing material on the paper samples identified by FT-IR. Out of nine Persian miniature paintings and illuminated manuscripts, one was starch, seven were cucumber seed mucilage, and one was a mixture of tragacanth and cucumber seed.

Figures 1–5 show some of the spectra of the sizing materials found in the sample. It can be noticed clearly that in the samples belonging to check list numbers 16, 13, and 18 (figs. 3–5) the spectra exactly match the fingerprints of cucumber seed spectra which were used as reference.

CONCLUSION

Unlike many nations that used limited sizing materials to improve the mechanical strength and to smooth paper surfaces, Iranians have used various materials for the sizing process. A large number of sizing materials have been introduced according to historical treatises belonging to Taimurid (fifteenth century), Safawid (sixteenth century), and Qajar (nineteenth century) periods, such as starch (rice and wheat), plant mucilage (fleawort, cucumber seeds, marshmallow), animal glue (fish glue), vegetable glue (*serish*, gum arabic), fruit juice, and syrup (melon and grape).



Above: Figs. 1a–b. Sizing: starch  
Right: Fig. 2. Sizing: tragacanth, cucumber seed  
Below: Fig. 3. Sizing: cucumber seed

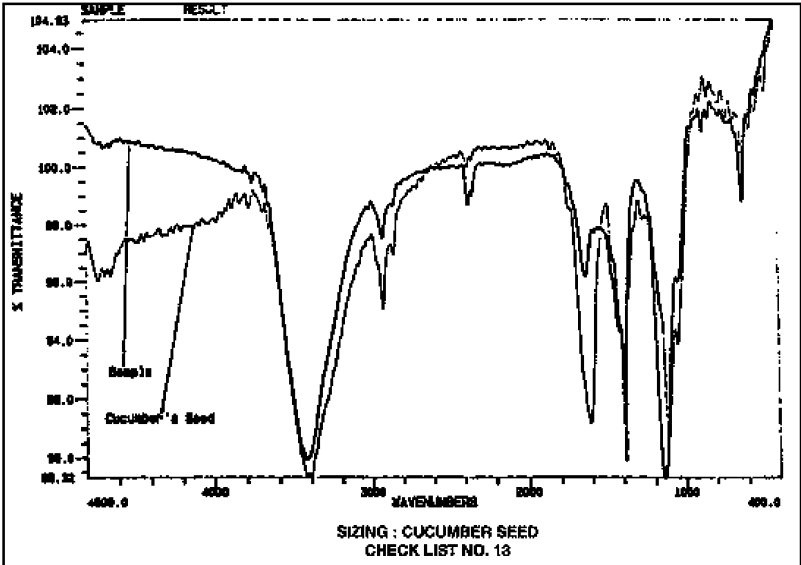
Scientific analysis was conducted to identify the nature of the sizing material used in Persian miniature paintings and manuscripts using a stain method and FT-IR analysis.

The findings of the present investigation revealed that cucumber seeds were used extensively in comparison to the other sizing materials under study. Of course further investigation is needed to conclude whether these materials have been used in pure or in mixture form.

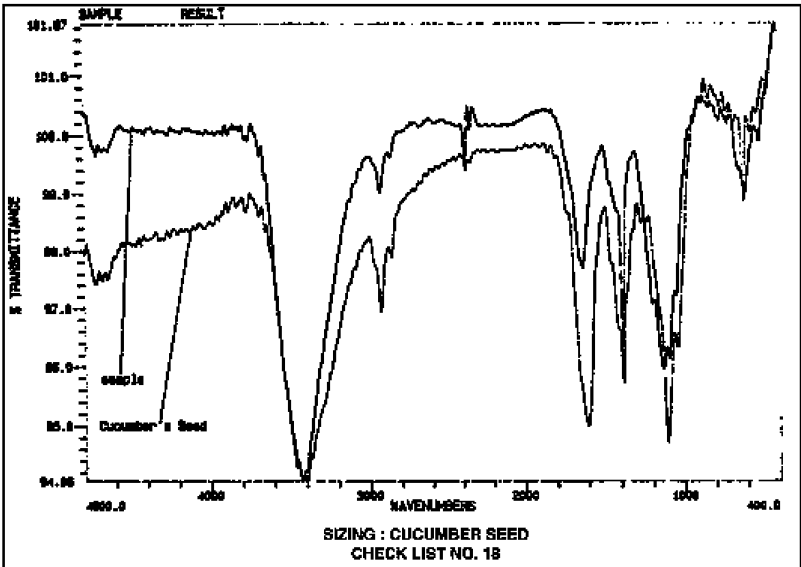
The present historical and scientific survey suggests the use of a wide range of natural sizing materials, which can be used as tools for conservation and restoration of paper documents when the sizing of paper is required. The present research is still under investigation. We need to collect more data to conclude which sizing materials were common during specific periods, and which sizing materials were used for specific papers and even for specific requirements.

ACKNOWLEDGEMENTS

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Figs. 4a–b. Sizing: cucumber seed



Figs. 5a–b. Sizing: cucumber seed

Agrawal whose guidance made this work a rewarding and pleasant endeavor.

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## What Treatment Means: Interviewing Curators, Collectors, Dealers, Art Historians, and Conservators

### ABSTRACT

Interviews were conducted face-to-face and by telephone with eleven people who work with art on paper in order to elicit their thoughts on the treatment of this type of material. The respondents were chosen from among experienced curators, collectors, dealers, art historians, and conservators working both in institutions and independently. Among the many topics discussed by respondents are changes in treatment theory and practice, balancing the needs of preservation with aesthetic considerations in treatment decision-making, how objects are selected for treatment, and what part education plays in how treatment is approached.

### INTRODUCTION

In the spring of 2003 interviews were conducted with eleven curators, collectors, dealers, art historians, and conservators to explore their thinking about the treatment of works of art on paper. The project was inspired by the "Treatment Revisited" theme of the 2003 annual meeting of the American Institute for Conservation, but rather than simply reporting my own or other paper conservators' experiences I decided to explore the topic with informed members of a wider world.

Those interviewed include one dealer in Old Master and nineteenth-century prints and one in Japanese prints; five curators—two with teaching museums, one with a private collection, one with a large public library, and one with a large art museum; one art historian specializing in Japanese prints; and three paper conservators—one in a museum, one in private practice, and one in teaching. Most fit into more than one category: four of them are also collectors, one curator also teaches art history, the art his-

torian was once a dealer, and one curator was a conservator. They each have between sixteen and forty-three years of experience in their fields.

### RESPONDENTS

Jim Bergquist, dealer in Old Master and nineteenth-century prints, Boston, Massachusetts.

Mimi Braun, Curator of the Leonard Lauder Collection and Professor of Art History, Hunter College, New York, New York.

Irene Brueckle, Associate Professor of Paper Conservation, Art Conservation Department, Buffalo State College, Buffalo, New York.

Jerry Cohn, Acting Director and Carl A. Weyerhaeuser Curator of Prints, Harvard University Art Museums, Cambridge, Massachusetts.

Antoinette Dwan, paper conservator in private practice, Sebastopol, California.

Izzy Goldman, dealer in Japanese prints, London, England.

Jan Howard, Curator of Prints, Drawings, and Photographs, Rhode Island School of Design Museum of Art (RISD), Providence, Rhode Island.

Roger Keyes, Director of the Center for the Study of Japanese Woodblock Prints, Cranston, Rhode Island.

Bobby Rainwater, Curator of the Spencer Collection and Miriam and Ira D. Wallach Chief Librarian of Arts, Prints, and Photographs, New York Public Library, New York, New York.

Sue Reed, Curator of Prints and Drawings, Museum of Fine Arts, Boston, Boston Massachusetts.

Harriet Stratis, Conservator of Prints and Drawings, Art Institute of Chicago, Chicago, Illinois

### PROJECT STRUCTURE

I conducted all but one of the interviews face-to-face or by telephone using a tape recorder and found both

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methods to be equally effective. Paper conservator Kim Nichols assisted this project by interviewing curator Sue Reed at the Museum of Fine Arts, Boston. Most interviews lasted thirty minutes, but if a respondent needed more time I did not press for a premature conclusion. Although given the choice, none of the respondents asked to be anonymous.

Since I am most familiar with the conservation of pre-contemporary Western art on paper and traditional Japanese woodblock prints and drawings, I interviewed people who also worked in those areas; and, to encourage frankness, I chose people whom I knew well as often as possible. I also looked for variety in background, geography, and the kind of environment in which they encountered conservation.

Rather than asking a set of standard questions, I encouraged respondents to discuss the issues which *they* found most relevant. I did ask each one to address a few of the same topics for the sake of overall coherence, namely changes in treatment theory and practice, balancing the needs of preservation with aesthetic considerations in treatment decision-making, and inpainting. I also encouraged them to address paper conservators directly if they had any message to convey.

After transcribing the interviews I organized the information according to the headings which follow.

#### TREATMENT OF AN EARLIER ERA

Some respondents looked back to treatment practices of between twenty and forty years ago. They noted the tendency for objects of all ages, both inside and outside museums, to look whiter and flatter after treatment than today. Sue Reed described paper supports as looking “clean” but lacking in character. Jerry Cohn recalled that “this was back in the very primitive days of bleaching” when the importance of neutralizing and rinsing after bleaching was not really understood. It was “treatment of an earlier era—[people] were doing what they knew.” The prints treated in-house by a well-known firm of London print dealers, in business until the 1980s, had an unmistakable look, described by one respondent as “bright and staring” and by another as “chalky white,” and having a “pulpy” feel.

Bobby Rainwater remembered that there was more interest in making things look good, as, for example, watercolors with considerable inpainting, and there was no record of what had been done. “It was more of a craft tradition.”

Jerry Cohn recalled the research of William J. Barrow: “Acidity was discovered and everybody freaked out. A pH measurement was taken and they would find that a drawing mounted on a beautiful sheet of nineteenth-century Whatman paper was on an acidic mount. Yes, the Whatman

paper had become acidic over time, but the paper was gorgeous and supple; nothing was turning brown or brittle, but still there was a dictate that all these things had to be taken off their mounts. Which was crazy, but it happened wholesale.” Since then she feels there has been an improvement in realizing that this wasn’t necessary. “A *folding* test wasn’t a correct test for the viability of old papers used for art.”

Thinking back to how a distinguished paper conservator of the 1960s, ’70s, and ’80s practiced, Roger Keyes recalled that his late wife, Keiko, “tried to make things look as fresh as possible; that’s what curators and dealers wanted.” Dismayed by the “stark and forbidding” quality of prints she saw coming from the aforementioned London dealers, she worked diligently to develop more sympathetic alternatives.

#### CURRENT PRACTICE

Here are remarks that some respondents made about current conservation practice:

1. Damage may be allowed to remain if it is not endangering. Jim Bergquist described wormholes as “authentic and inoffensive historical damage” and does not have them repaired unless required commercially for the purpose of handling. Harriet Stratis described “the patina of age,” and at the Fogg Art Museum they want objects to look as good as possible without compromising what can be learned from the object as a physical survivor.
2. Objects from earlier periods can have more blemishes than later ones. “Something made in the sixteenth century should look as though it was made in the sixteenth century.” This idea could mean more treatment for damaged objects of the modern era, since they should appear to have less wrong with them. But one person thought there would be less intervention in nineteenth- and twentieth-century pieces, and that it would be mainly structural.
3. Ideal treatments are more about stabilizing objects. Jan Howard described consolidation as her favorite treatment.
4. Research and education helps us to understand and respect the artist’s intent. Harriet Stratis cited the example of finding Whistler’s instructions to his printers to use stained and soiled papers for his prints. Conservators who didn’t have this information might be inclined to clean them.
5. Evidence of an object’s history is given more consideration when deciding about treatment. For example, Japanese prints were often pasted into bound albums and have binding holes along one edge when they are removed. These holes rarely endanger the prints but customarily have been filled and the fills inpainted to



disguise them completely. Now this evidence of use is starting to be preserved if it does not interfere too greatly with the print's legibility.

6. Paper qualities are more appreciated. Sue Reed noted, "If there's anything I've learned, . . . it's the importance of the paper in the overall effect of the works of art." She gives paper conservators at the Museum of Fine Arts, Boston, the credit for having taught her so much. Mimi Braun pointed to one of a series of collages executed by Picasso on a blue wrapping paper, which gently undulates and has some creasing. In some examples this support had been adhered overall by later hands to flatten it. She was glad when her conservator advised against this. She really appreciates the natural planar qualities of the support, and that the different qualities of the various collage papers are much more apparent too.
7. Desirable effects of aging are recognized. Connoisseurs of Japanese prints appreciate the streaking and mottling of certain pale colors caused by blackening of the lead white with which they are mixed. In the past, lead white was sometimes chemically reduced, but it should be left alone. Whether or not the darkening is intentional, it enlivens the print surface, says Roger Keyes. Izzy Goldman "makes every effort to praise oxidation" to clients, and bluntly describes an altered print as always looking "flat and boring."
8. Irene Brueckle was unhappy to see repairs that did not look equally finished recto and verso. The look of the two sides should be balanced, she feels, especially since repairs can be easily detected now anyway.
9. There was a little grumbling about continued perceived pressure to make everything look as good as possible, even to the point of looking "like new," but there was no consensus as to where this pressure originates. Some intriguing opinions were expressed as to why this is so: that because so much pristine imagery is available today in publications we expect works on paper to look the same as reproductions; that an exhibition is the public face of an institution and exhibiting objects without blemishes reflects well on that institution; and that one trend is towards a seamless or merging experience with art, as, for example a museum installation that invites us to enter a recreation of Jackson Pollock's studio, and blemishes in works of art work against this process.
10. Treatments "of an earlier era," such as deacidification of watercolors, bleaching without rinsing, and fixing pastels, are still performed in the outside world.
11. A more balanced view of acidity exists today. Jan Howard described a photograph by the Malian artist, Malick Sidibe, who had mounted it on black paper, with brown cardboard on the back and brown paper tape around the edges. The format has to be respected

since the artist knew of Western archival standards but chose these materials and allows the object to be placed in a particular cultural context.

Harriet Stratis described how, with a nineteenth-century pastel on paper mounted to canvas on a wooden strainer, her focus would be the degree of tension on the paper. The format would be changed only if tears were beginning in the corners. In that case, the strainer would be removed (and saved), but the piece would stay mounted to the linen.

12. Improving environmental conditions is important. Bobby Rainwater noted that at the New York Public Library, as for many institutions, there was no rigorous climate control twenty years ago, but that books with even minimal individual protection fared far better than those with none.

#### INPAINTING

The decision to inpaint is based on how distracting the damage is for the viewer. Jan Howard's example was inpainting on photographs. A white chip in the photo emulsion in a dark area would be compensated, but in a light area, or one of visual complexity, there would probably be no need.

Inpainting should draw the eye away from any damage. Roger Keyes remembers that Keiko had been fascinated by the inpainting on the restored edges of an impression of Pollaiuolo's *Battle of the Naked Men*. The added lines were paler than the originals, so that one's eye drifted away from them and towards the printing. She adopted this method in her own work on large losses, but matched color as closely as possible in small areas.

Bobby Rainwater described his ideal as toning rather than reconstruction, whereas Izzy Goldman would want the work to be as finished as possible, short of being deceptive. Jim Bergquist would have a scuff or scratch in, for example, a Picasso aquatint inpainted as discreetly and uniformly as possible, but if a wormhole had to be repaired he would just have the repair paper toned.

#### DOCUMENTATION

Most respondents noted the value of treatment documentation; its lack in the past prevents a complete understanding of an object's history. Izzy Goldman, who does not require documentation and who has treatment done in Europe, wondered if recordkeeping in this country was in order to provide protection against litigation.

An example of the relevance of early documentation to the needs of today was provided by Mimi Braim. Juan Gris' *Still Life with Roses*, from Gertrude Stein and Alice B. Toklas' collection, had hung by a window in their kitchen. This environment caused the *papier collé* elements to curl

up off the painting's surface. Treatment consisted of removing these elements and then readhering them. When Leonard Lauder later acquired the piece he and the curator had the reassurance of knowing just what had been done, how, and why, because of thorough documentation.

Craigen Bowen, paper conservator at the Fogg Art Museum, was very grateful for the documentation of an early treatment performed on Ingres' *The Family of Lucien Bonaparte*, which Jerry Cohn had noticed becoming more and more brown over the decades. She believes that Craigen was willing to proceed with bathing the piece because the first treatment involved bleaching, meaning that if any film of graphite could be dislodged by wet treatment it had already happened, and that treatment was probably the source of the discoloration.

#### BAD EXPERIENCES

As Jim Bergquist put it, "we have had an endless succession of oopses in this world" and conservation has had its share. He recommends waiting, when possible, for better treatments to be devised for some condition problems. The bleaching agent chloramine T was cited by several people as one earlier problem.

Jan Howard does "not recommend bathing so much because of the changes you don't expect." She had had an experience where the "resulting shift in [paper] color and texture was greater than I had expected" and concluded, "is it so important that the spot is removed and then [the piece] is changed overall? Better to leave it alone." While Antoinette Dwan is sympathetic to this kind of thinking about treatment she also wants people to realize that one "can preserve a beautiful burnished plate area *and* remove a stain." It encourages her to want to do treatments better and better, since she feels that it is more often the skill, ability, and judgment with which a piece is treated, rather than the treatment technique itself, which needs improvement.

#### EDUCATION

The mutual education of conservators and custodians was mentioned by most respondents as having an important effect on how they viewed objects and their treatment by allowing them to develop greater understanding of, and accepting more about, works of art on paper. All the curators valued their long-term working relationships with paper conservators, although only two of the five curators had conservators on staff. One of those working with contract conservators noted that this situation made treatment decisions more complicated because of the difficulty of monitoring the progress of work and modifying treatment as it progressed.

Izzy Goldman noted that he can educate his clients about treatment issues when he is comfortable with a

print's condition himself. If a conservator has told him of the value of sometimes preserving binding holes, for example, then that becomes part of the information he can pass on to them.

The conservators and Jerry Cohn described their own training as being intensively involved with looking. They have found that what they learned holds true to today. Irene Brueckle was taught "to be respectful of artifacts, be fascinated with looking, and have the openness to allow what isn't known about an artifact to speak to you, rather than coming in with notions of how things should look." Antoinette Dwan described a process of "uninvested observation" when she is contemplating a piece for treatment, deciding "which knot needs to be undone" to achieve the result of "not making [the piece] look new, not even just restoring the artist's intention, but allowing it to continue its aging trajectory . . . letting it be what it will be."

Some respondents thought that perhaps not enough time was being given to the development of high levels of treatment skill in young conservators. Perhaps there is less time to devote to the subject with everything else that must be taught. One thought that the danger would be that new conservators would not feel able to ask for enough help once they were in the workplace.

#### TECHNOLOGY

Evolving technologies may affect treatment decisions, as when digital photography and computers allow the manipulation of visual information as a substitute for working on the object itself.

#### BALANCING

Respondents gave fascinating examples of how they balanced the requirements of safety, legibility, preserving artist's intent, aesthetics, and preserving history in treatment.

What follows are two different perspectives on remargining Japanese prints. Remargining is the application of false margins to trimmed prints, particularly landscape designs, in such a way that the new margins closely resemble the originals. Roger Keyes feels that remargining betrays the integrity of the object. "If the print is beautiful and has no margins, leave it, because the paper is never the same. . . It may take me a moment to notice the added margins, but once I do it creeps me out." He says the paper used for remargining never absolutely matches and the difference creates dissonance which, much more than the fact of preserving a historical accident (trimmed margins), is the reason for not remargining.

On the other hand, Izzy Goldman believes added margins allow the print to look more balanced and sympathetic. He feels that the work should be very well

done, with matching paper, or not at all. There is no attempt to be deceptive; the treatment is described in his catalogue. This disagreement between two experts centers on the perception of falsity or rightness created by the technique, and what that does to the viewer's perception of the restored print.

Harriet Stratis pointed out that one can perform an extensive treatment on an object and still respect the artist's intent, since artists want their work to be seen. Her example is a particular collection of very badly damaged Old Master Italian drawings at the Art Institute that required extensive inpainting of insect-ravaged areas and conversion of lead white oxidation. The enhanced legibility has allowed art historians to secure attributions for the previously compromised drawings.

Sometimes, removing the layer of silver which is creating a mirroring effect from the surface of a silver gelatin photograph can be the only way to render it legible, and therefore useable, even though this is removing an original component of the object.

One hand scroll from a set of the New York Public Library's *Taiheike monogatari* has a crude eighteenth- or nineteenth-century repair to a large loss measuring about six by eight inches. When the painting was being treated in Japan the repair was left in place, but its appearance was somewhat improved.

Jerry Cohn recalled how a museum complained that the Fogg's large-scale final preparatory drawing by Jacques-Louis David, *The Oath of the Tennis Court*, "one of the most important drawings from the French Revolution," did not have sufficient aesthetic merit to be included in the traveling exhibition it was considering borrowing from them. The drawing was composed of several sheets, worked on in many sessions, and was very discolored. She explained that treatment was not possible without affecting its documentary value.

Roger Keyes has found that treatment can occasionally thwart his work as an art historian, as, for example, when trying to determine if a rare print published and last seen in untreated condition in a 1927 auction catalogue is the same impression that has now surfaced, without blemishes, in a current exhibition catalogue. He gave a dramatic example of how helpful non-treatment can be. Two unsigned Japanese ink and brush drawings from different collections were brought together. One was a preparatory drawing for a published print and definitely by Hokusai; the other looked like Hokusai, but there was no print. Each had a prominent and identical wormhole. The matching wormholes showed that the drawings had once been preserved in an album together, providing forensic support for authenticity.

Some respondents described the circumstances under which one would remove an object from a mount so as to recover its original appearance or uncover information. A

Japanese print that has been mounted in an album may still have its lining, but this feature obscures the highly prized aesthetic qualities of the print verso; or there may be the temptation to remove a modern backing from a Japanese print in case it conceals treatment by an unscrupulous restorer. Jim Bergquist recalled when paper conservator Christa Gaehde removed a backing from a Manet ink and brush drawing on a sketchbook page to reveal a pencil sketch by the artist on the verso.

## USE

People sometimes treat similar objects in similar condition differently, depending on how they are to be used. Jim Bergquist provided the example of having to balance personal taste and commercial expediency, a "Jekyll and Hyde approach," regarding early mezzotints. While he rarely has treated those in his own collection, he is likely to have a significantly discolored mezzotint treated, since, with its restricted tonal range, he finds it otherwise almost impossible to sell.

Antoinette Dwan considered how one object might or might not receive treatment depending on who owned it. She compared a museum opting not to treat a disfigured piece but to show one in better condition by the same artist with a private collector who, after acquiring a disfigured piece, has it treated because of wanting to live with it on a daily basis and wanting it to look a particular way. She says, "How do we decide how something should look? It is much more subjective than we want to admit. . . We tend to want to look at an object out of context, but it *is* in a context: it belongs to someone."

How does use balance with the best interests of the object? An example of this dilemma is provided by the nine Spencer Albums at the Fogg, in which nearly four thousand prints were assembled in the early eighteenth century. When the albums entered the collection the director thought the prints would need to be removed, partly because he assumed the arrangement was not good for them, but also because he didn't think it was practical for them to remain *in situ*. They could neither be conveniently exhibited nor organized according to current art historical thinking. Jerry Cohn argued against wholesale removal, and the albums remain intact except when an occasional print is temporarily removed for exhibition. She added that it is easy both to remove and replace individual prints.

## WHAT GETS TREATED IN INSTITUTIONS

Following is a more detailed description of the curators' institutions and how objects are selected for treatment in each one.

1. The New York Public Library: a vast and varied assemblage of collections in a public institution with limited resources to devote to conservation treatment. In Bobby Rainwater's departments, treatment is mostly generated by in-house exhibitions and the large number of loan requests. While, ideally, they would have surveys performed and set their own treatment priorities, this ideal is not possible with their available resources. Fortunately, what gets treatment for loan generally agrees with their own priorities.
2. The Museum of Fine Arts, Boston: also comprised of large and varied collections but with a substantial conservation department. Exhibitions and loans also play a significant role in deciding what receives treatment.
3. The Leonard E. Lauder Collection: a private collection devoted to Cubist and Early Modern art, hung in the collector's home, with excellent environmental conditions. The contract curator and conservators all have long-term working relationships with the collection. The size of the collection allows for a systematic approach to examination and treatment.
4. Two museums which are part of teaching institutions, both also very active with exhibitions and loans. At the RISD Museum Jan Howard notes that having exhibition and loan deadlines is the quickest way to meet the needs of the objects. Otherwise objects receiving treatment are those most needed for teaching or which complement what is in the galleries. Jerry Cohn noted two additional reasons connected with teaching for more minor objects to be treated at the Fogg. Students sometimes have unusual research interests requiring the exhibition of prints in the collection that have not received attention in a very long time and so need treatment. Each year she provides interns in the paper lab at Harvard's Straus Center for Conservation with a group of relatively obscure black and white Old Master prints to treat as part of their training.

#### FASHION

A few respondents noted that the taste for a type of art, and therefore its economic importance, influences decisions about treatment. Jerry Cohn's example was that as photography became more valued more sophistication attended its care. Roger Keyes conversely pointed out that less commercially valued objects getting less attention can be a boon for the art historian looking for physical evidence of an object's history, since, as already noted, this history can sometimes be obscured or obliterated by treatment.

#### FINAL WORDS

Respondents were asked if there was anything they particularly wanted to tell paper conservators.

Mimi Stratis and Jan Howard both said they find it informative and enriching to look at objects with conservators. What they learn helps them to interpret the objects.

Antoinette Dwan wished there was more discussion of how we can do treatment better and better since the profession is still very young and we don't yet have a reliable body of knowledge. She sees conservation treatment as still being almost in an experimental stage.

Irene Brueckle believes that the three components of conservation—science, history, and treatment techniques—need to be advanced equally. Treatment must be discussed more and needs to be highly developed, not marginalized. Like Antoinette Dwan, she believes that one must become an absolute master of treatment, so that one does it very well if one does it at all. It requires ongoing refinement of skills.

Roger Keyes was grateful for the rescue work that conservators perform. He noted that, during treatment, conservators look longer and harder at works of art than practically anyone else, and that all the conservators he has known insist that they personally benefit from contact with the works they treat.

Jim Bergquist thought that conservators should be spending a lot of their time looking at works of art on paper trying to gauge their tactile and visual qualities. They should be looking at far more objects than just what comes into the lab.

Harriet Stratis felt that conservators should work hard at developing good relationships with the curators they work with so that they can have dialogue and can put others' views in perspective. Sometimes, she said, conservators are seen as being very subjective or dogmatic rather than considering each work of art in its own right.

Jerry Cohn wanted paper conservators to "stick up" for the object at all costs. They must work with museum personnel to remind them that, while rules and generalizations are necessary to keep control of large collections, everyone should be willing always to consider the unique qualities of the object and to use a little common sense with regard to decisions about treatment, loans, exhibition, etc.

#### CONCLUSION

In reporting some of the wealth of fascinating information, anecdotes, and ideas the respondents provided, I hope I have conveyed something of the complexity of the subject of conservation treatment. Regardless of theory, it appears that many of our decisions about whether and how to perform treatments are at least partly dependent on the circumstances in which the art object exists; two of the conservators explicitly asked for conservation decisions to be made on a case-by-case basis. Examples were given that showed that a conservative approach might call for treat-

ment intervention in one situation, but for no treatment in another.

There also appear to be two simultaneous trends determining the extent of treatment today, at least in this country. One is tolerance of, and even appreciation for, objects showing some of the effects of age and history, while the other is concerned with objects having a minimum of blemishes. Respondents also acknowledged that not all treatment has been good treatment, and that there is still much that conservators should learn, both individually and collectively, about improving the safety and efficacy of what we do.

#### ACKNOWLEDGEMENTS

I am most grateful to everyone I interviewed. Thanks also to paper conservator Kim Nichols for interviewing Sue Reed.

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## Big Paper, Big Problems: Preservation Issues of Large Format Works on Paper

### ABSTRACT

Only fifteen years ago conservators wrestled with the problems of oversize works on paper, such as the framing of Robert Rauschenberg's 72 by 36-inch print *Booster*. In many collections today this particular work is no longer considered "big." Artists are now creating works on paper that are billboard or wall size and often beyond the boundaries of any kind of framing. Such works certainly present challenges for installation in exhibits. They also create serious storage difficulties, especially when it is necessary to fit them into holding systems designed prior to the big size boom in art. The Kress Foundation has made possible a yearlong in-depth study of the preservation issues surrounding large format works on paper. This presentation and a subsequent publication provide a collection of storage and exhibition techniques currently in use for large format works on paper.

Practical storage solutions, for both unlimited and shoe-string budgets, were presented. Housing methods include shelving, flat files, rolled systems, screen storage, and upright bins. Appropriate materials for protecting objects in storage were also considered. Limitations presented by the sizes of available materials and cost comparisons were discussed in addition to providing information about suppliers. Exhibition methods discussed in the presentation included modifications of traditional framing systems as well as more contemporary techniques, some of which do not include glazing. Current exhibition aesthetic, and sometimes the preference of the artist, often calls for works to be displayed directly against wall surfaces. This requires non-traditional methods of attachment, such as non-aqueous and/or pressure-sensitive adhesives, staples, pushpins, Velcro, magnets, rigid support panels, and cleat systems.

This study has depended on information gathered from museums, archives, individual conservators, and framers in the United States and abroad. The conservators and keepers of collections who generously contributed their time and experiences to this project are enthusiastically credited. Their willingness to share information so that others may benefit made this project possible. The outcome has been a rich compendium of methodology, which should be useful to conservators and others who are charged with the preservation of big paper.

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*See also the poster report by Stephanie Lussier and Michelle S. Facini, "Big Paper, Big Problems: Solid Support Options for the Mounting and Display of Large Format Works on Paper," on pages 111–117.*

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## Second Generation Wet Paper Pulping

### ABSTRACT

The author has followed the original paper pulp recipe devised by Keiko Keyes in her 1976 publications but has added secondary steps which use a pressure cooker to modify the pulp, rendering it more easily manageable. Several refining steps, dealing with dispersal, application, toning, and storage add more paper pulp information to the paper conservation repertoire.

### INTRODUCTION

Even though pulping is mentioned in the conservation literature as far back as the mid-1950s, it was Keiko Keyes's articles "A Manual Method of Paper Pulp Application in the Conservation of Works of Art on Paper" in the *Paper Conservator* and "A Practical Application of Paper Pulp in the Conservation of Works of Art on Paper" in the *AIC Preprints* from 1976, and her presentation at the AIC meeting in Dearborn, Michigan, in May 1976 that defined the use of pulp for filling losses in paper in a workable manner. I believe the entire field of paper conservation embraced the technique as a timesaving way to fill losses in paper supports from that time.

There have been several modifications of the initial pulping technique as presented by Keiko Keyes. The transfer of paper pulp using a large pipette instead of the spoon or flask refined the filling of the large losses. The use of the mushroom cleaning brush, the complexion brush, or the boar bristle oil painting brush to flatten, spread, and disperse the pulp by a number of colleagues is notable. I found the use of already aged paper enhanced the quality of my pulp, as did other conservators. The use of other supports rather than the wet-strength paper was helpful. I use several non-woven synthetic supports and imprinting

stamps and have even moved to Mylar, when the artwork was too large to transfer to non-woven synthetic supports. The news of each of these modifications spread through the network of friends and students. But there were two technical questions which were never satisfactorily answered—namely, how to make paper pulp on a large, repeatable scale from any paper and how to tone paper pulp on an equally large scale. I was soon made to address at least one of those points for a very large treatment, and I would like to present my findings and experiments in other areas as well, which I hope you may find useful.

### DESCRIPTION OF WALLPAPER PROJECT

I was approached four years ago regarding a wallpaper conservation treatment on a scenic wallpaper designed by Charles Burchfield and printed by the Birge Co. in the 1920s in Buffalo, New York. Although three scenic papers were designed by Burchfield, none was known to be off the wall and available. This sample of "Country Life" and "The Hunt," which was usually printed and sold as a unit, measured 80 inches high by 35 feet long and was in rather good condition, even though it had been roughly removed from the wall some years ago along with its two linings. There were many losses at the tops and bottoms of the twenty-three panels, long vertical breaks and tears with associated losses where the wallpaper had been wrapped around corners of the room, and large losses where paper had been torn out to accommodate light switches and moldings.

The technique was documented as woodblock by the Birge Co. in its catalogue on its scenic wallpapers, and the characteristic "squish" marks could be detected, which were similar to those found on the French scenic wallpapers. The colors were primarily pastel in nature with some red for the coats of the hunters. However, the plants and trees were pure Burchfield in design, and the colors were wonderful purples, greens, golds, and browns. We ascertained later as the in-painting was proceeding that the paint

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for the panels was custom mixed for the day of printing as no set of paints ever exactly matched any other set from other panels.

The medium was not water-soluble and looked similar to matte silkscreen ink; thus, I was able to use water in the treatment. This fact greatly facilitated the treatment of such a large work. Consequently, I considered the use of paper pulp filling for the extensive losses.

Given the amount of pulp I would need for the large losses on the Burchfield wallpaper (I ended up using a two-gallon jar of concentrated pulp stock), I decided to ask colleagues about their pulp recipes. Answers from several colleagues led me to believe that pulping was used sparingly for small losses and possibly not at all by some conservators. The main reason they gave was not being able to make a satisfactory pulp that would look good with a small amount of manipulation.

Certainly, I must say that there were other problems given, which I later categorized as "Pulping/Advanced," which included matching pulp to difficult papers. Thus, I arrived at the subject of my paper, which is making satisfactory pulp, repeatedly. Furthermore, I have designed the pulp to be applied with a small pipette, quickly. Other information includes my work on dispersal, application, bubbles, toning, and storage.

#### A NEW LOOK AT PAPER PULP

My research began by choosing a thin, even paper of good quality—Rives lightweight. I found that other papers could be used, but the thinner and more even a paper found in the Rives LW indicates to you that the fibers are uniform, and it was a good paper with which to experiment as it is found easily at art stores.

I carefully followed the Keiko Keyes recipe. It leaves a few questions: what size blender and what speed were used? Keiko Keyes's students responded that it was a regular blender (not a commercial size) and on medium speed, as they remembered. The pulp was thick as it appears in the *Paper Conservator* article. Keiko Keyes mentioned in her article that longer blending would rid the pulp of knots. Keiko always manipulated the pulp at the pulping site, according to her students, and it was applied using a spoon or poured from a glass flask. The pulp varied, depending upon the paper chosen for making the pulp. Good pulp was very highly regarded. With this technique, good pulping was possible, and our ability to fill losses in a wide range of papers was greatly enhanced. The following is a synopsis of the Keiko Keyes recipe:

#### KEIKO KEYES'S RECIPE

10 to 15 grams dry paper

Tear and soak for 20 to 30 minutes in deionized water [All

water used is deionized water.]

Change water

Cook paper pieces in 1 liter of water for 30 minutes

Change water

Blend for 2–3 minutes [or longer to rid pulp of knots]

Store in jars with fungicide or freeze

Tone by mixing pulp from various papers

Mix 1/2 fluid ounce of a 1.5% solution of methyl cellulose to 1 liter of fiber mixture before using.

The above recipe provided a pulp that was adequate for most paper conservation needs. However, I required a pulp which could be applied quickly, without manipulation, and I set out to see if that was possible.

My first variation on the Keiko Keyes recipe was to try more blending of the wet pulp. I tried more blending at higher speeds, the use of a food processor, and the use of a high-speed wand blender. I tried various pulp-to-water ratios. I tried longer processing times. Although the greater dilutions seemed to give a slightly better pulp, the pulp was still knotty and still required manipulation. I experimented with other papers in the same fashion as described above and did not achieve a working pulp mixture.

#### THE NEWER PULP

The following recipe is a longer version of pulp making, which I developed for my project, but now use for all my work as it is simply easier to use. It begins with the Keiko Keyes recipe and then it incorporates cooking the pulp in a pressure cooker. The pressure cooker that I use is the 4.2-quart Model #92040 by Mirro. It is their smallest pressure cooker. Cooking under pressure originated with early canning. In the early 1940s, models were made that could be used at home. The major advantage of cooking under pressure is the speed at which something can be cooked: asparagus takes 15 seconds, a pot roast takes 40 minutes, a whole chicken takes 30 minutes. The resulting food is supposed to be moist and flavorful. Cheaper and tougher cuts of meat are tenderized (which is what made me think of it originally). Pressure cookers cut down the cooking time for busier and busier housewives of the 1940s. A four-and-one-half quart pressure cooker at its 10 lb. psi pressure raises the temperature of boiling water to 240 degrees F. Be sure to read the manufacturer's booklet which comes with the pressure cooker you use. There are many stories of the vent tubes of the pressure cooker getting blocked and the over-pressure valve exploding, spraying hot food all over the kitchen ceiling. Don't overload the cooker. The recommended 10 to 15 grams of dry paper is acceptable in the 4.2-quart pressure cooker. Pressure-cooking has recently become stylish, and there are several European brands on the market. Most have safety devices which make them, at least, safer sounding. Their prices are more



than the Mirro brand, which is quite adequate for making pulp. I purchased mine at a good hardware store which sold canning supplies.

#### RECIPE FOR MAKING PAPER PULP USING A PRESSURE COOKER

10 to 15 grams dry paper  
 Tear and soak for 20 to 30 minutes in deionized water  
 Change water  
 Cook paper pieces in 1 liter of water for 30 minutes in regular cooking pot  
 Change water  
 Place pulp in pressure cooker; cook under 10 psi pressure for 20 minutes (following manufacture's directions)  
 Cool for 20 minutes; run cool water over top of pressure cooker  
 Divide pulp into two batches  
 Add 500 ml of water to each batch  
 Blend each for 5 minutes on medium in a standard blender  
 Store pulp by refrigeration (with fungicide), canning, freezing, or drying  
 Tone pulp using dilute acrylic emulsion applied on dry pulp  
 Before using the pulp stir in 40 ml of 2% solution of methyl cellulose (by volume) for 500 ml of stock pulp

If a particularly heavy paper or a grass paper is chosen as the pulp source, a second 20-minute pressure-cooking session may be necessary with a blending session in between. I find that I do this as a matter of course as I like the "lilt" of the pulp. (This is my own term, which denotes buoyancy. This pulp does not easily settle to the bottom of the jar. It floats in the water for a long time, thus the term "lilt.")

If a wood pulp paper is chosen as the pulp source, a brown stained water will accumulate after pressure-cooking with the pulp, and the pulp should be thoroughly rinsed to remove the brown stain. I do use wood pulp to pulp losses on wood pulp artwork. I apply a small amount of calcium hydroxide to the diluting water when working with this pulp.

Pulp cooked in a pressure cooker still has long fibers after being cooked under pressure, but the fibers are more pliable. The knots, when present, are easier to disperse.

#### DISPERSAL

Dispersal is a key part of the making of good pulp, and it has not been really appreciated. The most important dispersal step is adding the proper ratio of water to pulp: 5:1. If this is done, the pulp has a much better chance of being smooth and knot free. The time in a blender can be 2 to 5

minutes on medium in a standard blender. (I prefer the longer time.) The resulting pulp has less pulp per volume of water, and you may need to allow it to settle and pour off excess water. The excess water is necessary for the movement of the pulp in the blender.

#### APPLICATION AND WHAT TO DO ABOUT BUBBLES

My favorite application method is by pipette. I use a range of pipette sizes depending upon how much pulp I need for the size of loss. If bubbles are a problem, I charge several pipettes with pulp and leave them for a few minutes standing vertically in a container so that the pulp will settle toward the tip and the bubbles will rise toward the bulb. I jiggle the charged pipettes to encourage the bubbles to dislodge and move to the top. I apply the pulp in layers as usual over a light box, comparing the opaqueness of the original with the opaqueness of the pulp. As is known in the technique, I cover the pulped areas with non-woven polyester sheets and tamp out excess moisture with small blotters. I use a small fan to reduce excess moisture in the area, and I also use blotters around the losses to reduce moisture levels. When I am working rapidly, I use a magnetic stirrer hotplate to keep the pulp continuously agitated, and this technique tends to reduce the bubbles, I believe. It is a very good idea to gently add the methyl cellulose right before use and try not to incorporate any bubbles. Blending methyl cellulose is a bad idea if you are trying to avoid bubbles.

#### STORAGE

The Keiko Keyes recipe recommends refrigeration with a fungicide. She recommended thymol in methanol or freezing. I have found that simple refrigeration will slow the growth of mold, but a fungicide will be required if storage over two weeks is planned. I find canning to be better than refrigeration as the pulp improves upon further soaking, and the fungicide is not required. I use half-pint glass jars with standard canning lids and rings submerged in a boiling water bath for 10 minutes. There are several canning techniques that use the microwave and the oven. They take very little time given the great benefit of having available pulp ready to use at a moment's notice. Freezing requires thawing time, but otherwise appears to have no bad affect on the pulp. I have noticed that freeze-drying does occur with frost-free freezers over time, thus double-bagging is recommended. Drying the pulp (see below under "Toning") enables you to tone the pulp, and it lasts indefinitely stored in a glass jar or plastic bag. Label the pulp according to date, source, and processing. A sample placed in a plastic slide sleeve with a source sample can be attached to the pulp container or kept in a notebook.

When storing large quantities of pulp for a large project, I will drain off the excess water temporarily, simply to save on large jar space. Thus, the paper pulp becomes “pulp stock” and is a concentrated wet pulp for a few days. It is rewetted at the 5:1 dilution as needed during the pulping sequence or canned if not needed.

#### TONING

To my knowledge, toning wet pulp hasn’t proven successful as the toning (in the form of water color or dyes) bleeds out on the artwork when it is applied and doesn’t appear to stay attached to the pulp during the other treatment processes, such as patching and lining. I believe that Keiko Keyes’s recommendation that you mix different pulps is a good one, but it is also not always possible. Thus, I offer the following suggestion, which I have used successfully.

Applying color to manufactured dry pulp is a simple process based on the fact that acrylic emulsions dry and hold onto the paper when it is dry. If a dilute acrylic emulsion is applied in layers to dry pulp, it appears to stay attached when the pulp is rewetted. I simply apply a dipper of approximately 50 ml of dilute pulp (this should be 1 part completed pulp stock to 5 parts water) to a form—in my case I use new canning rings on a fiberglass window screen. This gives a thin 2-inch wafer or disk. I make ten to fifteen at a time. These dry to thin paper disks. I peel these disks of pulp from the screen when they are completely dry and store them in jars. As needed, I place them on blotters and apply a dilute acrylic emulsion wash on the dried pulp disks, usually using mixtures of raw umber, burnt umber, black, and yellow ochre for most paper matches. The paint *must* bleed through to the backs of the disks for all the fibers to be toned, and this should easily occur, as there is no sizing in the disks. Allow paint layers to dry before adding other layers of paint. I usually stop at three layers of acrylic wash. When matching your disk to your original artwork, choose a disk color which is slightly darker than the original, as some fibers will be left untoned. Those untoned fibers will tend to lighten the toned pulp. This toning technique is not recommended for strongly colored papers. First soaking for 1 to 2 hours and blending for 2 to 5 minutes on medium in a standard blender will reform the toned disks. Less time will not thoroughly mix pulp, which is less toned underneath than on the surface. Remember the 5:1 ration of water to pulp. *There is an extra step here:* I *always* drain the water from the toned pulp using a large sieve and add more water before using the pulp, as I find that a small amount of the dried paint may be dispersed in the water and may reveal itself as a tide line or stain on the artwork. Add methyl cellulose before working with the pulp, especially if you must add more color or inpaint on the pulp fills when they are dry.

#### CONCLUSION

Paper pulp prepared in a pressure cooker was designed to be used for treatments requiring a very smooth, free-flowing pulp which could be delivered through a pipette rather quickly. I found, however, that it satisfied more than that. In fact, it can be used as a sort of thin paper wash or film to reinforce weakened paper. It flows that well. Keiko Keyes mentioned that pulp could be used as a lining, but I do not believe she had a wash of fibers in mind. I simply had never found a pulp which could be dispersed well enough to do so. I also find that the canned pulp increases in this flow quality the longer it is immersed in the canning liquid. This technique does not answer all of the common complaints of my colleagues whom I initially contacted regarding pulping problems. Indeed, it simply provides a working technique for making a variation of paper pulp for special needs and offers some interesting alternatives to the usual materials with which we are used to working. I look forward to hearing your comments.

#### ACKNOWLEDGEMENTS

I would like to thank the numerous conservators who, both formally and informally, provided information about their pulping techniques. I would also like to thank my husband, conservator James Hamm, for his support in researching this topic, in treating this large wallpaper project, and in presenting this paper. I would like to pay tribute to Keiko Keyes, whose work in developing this technique I am only now appreciating.

#### MATERIALS

The methyl cellulose used in the above testing was: Methyl Cellulose for Museum Mounting, Grade A-4-CP, Product # 2368, sold through Light Impressions, P.O. Box 787, Brea, California 92822-0787; phone 1-800-282-6216; [www.lightimpressionsdirect.com](http://www.lightimpressionsdirect.com).

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- Mirro instructions manual & recipe book: Pressure cooker & canners*. [s.d.]. Booklet is available when purchasing a pressure cooker either through a local distributor or from Cooks Corner Factory Outlet, P. O. Box 220,

Manitowoc, Wisconsin 54221-0220; phone: 1-800-236-2433; [www.cookscorner.com](http://www.cookscorner.com).

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## Magnesium Revisited

### ABSTRACT

A recent project undertaken at the Library of Congress (LC) and reported at the AIC conference in Washington in 2003 was interesting in more ways than originally intended. Inspired by the conference theme of “Treatment Revisited,” we embarked on a project focused on examination of objects executed in iron-gall ink and treated with various deacidification solutions over the years. It is surprisingly uncommon to examine objects treated in the past as part of our mechanism of evaluation and we wondered what we might glean from such an exercise. Magnesium bicarbonate as a deacidification agent has been used at the Library for decades and its use would seem to have been challenged by the results of recent research. Additionally, iron-gall ink has been the subject of intense study in the past few years. Although a multi-year research project designed to gather objective data on various treatments options used in treating iron-gall ink is currently underway at the Library, we wondered what might be revealed by a concurrent, more subjective project looking at objects which had undergone deacidification with magnesium bicarbonate. Acknowledging that the judgments resulting from visual examination of objects treated in the past would be subjective, it was generally felt that given the pervasive use of subjective knowledge in our profession, the exercise had some validity.

While various conclusions and opinions could be drawn from this exercise, some of the tangential issues that arose are equally worth noting. A brief history of the evolution of the Library’s standard treatment of objects executed in iron-gall ink will be articulated. This process was particularly interesting since the exercise led to a greater appreciation of the procedures that are currently employed and put them in a context that is not always

apparent if one is unfamiliar with how they were arrived at. In order to fairly assess our present methods it is necessary to understand their evolution out of decades of common experiences, exhaustive discussions, and scientific inquiry. The complexity and small size of our field makes definitive and/or objective data hard to come by and fuller understanding of any given issue can only be gained through familiarity with a broad cross-section of the literature and related practical experience. Secondly, the results of our examination of the objects previously treated with magnesium bicarbonate will be presented. Finally, some of the unexpected results that arose during the course of the study and what they reveal about how we evaluate our work will be discussed.

### HISTORY

The treatment of iron-gall ink has posed complicated challenges for conservators and conservation scientists. The variety of iron-containing ink formulas and the dramatic impact those formulations can have on properties, the ink’s self-destructive nature which compels us to “do something,” and the complexity of its chemistry, making scientific research that is applicable to treatment difficult to design, has left us with an impressive amount of conflicting information. The Library of Congress, with millions of pages penned in iron-gall ink and a strong mandate for public access, has been interested and participatory in the development of appropriate preservation strategies. Three distinct eras of treatment during the twentieth century can be defined at the Library.

The first era from 1900 into the 1940s was dominated by the practice of silking. Throughout this period, thousands of documents were silked every year although treatment details on individual objects do not exist. The practice of silking as described by the chief practitioner at the Library, William Berwick, began with immersion into a warm water bath to clean the manuscript of grime and pressing between newspapers to flatten. In a second, sep-

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arate step, both sides of the document were pasted out with cooked flour paste and the silk was placed on top and smoothed out. The object was then placed between two sheets of paraffin paper and pressed to flatten between smooth, white, unglazed pulp board.

It is difficult to match the variations in the silking materials and techniques with an object's condition today as there are no individual records. Paste recipes varied, as did the silk itself in quality and gauge. Silked objects today are in various states of preservation. Silked documents generally display a low surface pH, between 3.5 and 4. Some early recipes for the starch paste include alum and some silked items do test positive for alum. Most silked documents have darkened significantly and become brittle. Sometimes the silk itself is in an advanced state of deterioration with the document holding the silk together rather than the other way around! In other cases, although yellowed, stiff, and unnaturally flat, the document remains relatively intact. While the technique represented the best knowledge of the day and required considerable skill to execute, the alum and embrittling nature of the silk proved to be its undoing. Additionally, many of the inks reacted badly to the treatment—sinking, smearing, and bleeding—and the paste acted as a poultice, pulling elements of the ink into the paste and silk. The silk texture was impressed into the paper due to the excess pressure exerted. The silk interferes with the legibility of the writing, a quality that becomes more noticeable with time as the paste and paper yellow. These factors, along with better understanding of the nature of paper aging and new ideas about how to treat them, led to the decline of silking.

The second era of treatment of iron-gall ink documents is dominated by the practice of lamination. Lamination involved sandwiching an artifact between cellulose acetate film and semi-transparent paper and running it through a hot press to melt the layers together. In 1948, the annual report from the Manuscript Division states that over thirty-five thousand documents were laminated. The era of mass treatment had arrived at the Library. It is easy to see the managerial appeal of this type of operation. Lamination was seen as far superior to silking and a method that received considerable attention from the leading figures in the manuscript restoration field at the time. Its superiority was demonstrated by its speed, reduced specialization of labor, and cost.

The early laminations did not include a deacidification step, and the objects frequently turned brown after the process. This browning was thought to be a result of accelerated aging due to the tremendous heat involved with the process. The browning phenomena led William Barrow to incorporate a deacidification step. Although he was not the “discoverer” of the role acid plays in paper deterioration, he was unparalleled in disseminating this information through the promotion of his laminating tech-

nique. The first method he recommended was the “Barrow Two-Step” that involved successive twenty-minute baths in concentrated calcium hydroxide, followed by concentrated calcium bicarbonate. This treatment was replaced by the “Barrow One-Step,” immersion into saturated magnesium bicarbonate. The quantity of buffering salts introduced into the papers by these methods is unknown but certainly adverse reactions of iron-gall ink to what is now seen as extremely high pH is something we have all encountered in our work. The high pH of the baths and the resultant high pH of the papers are almost certainly to blame for the familiar changes to iron-gall inks such as reddening, fading, and/or sinking. Despite the managerial appeal of the laminating practice, it became increasingly acknowledged that the difficulties associated with this approach outweighed the benefits. Unfavorable reactions of the media to the concentrated deacidification solutions were noted and began to be taken more seriously. The concept of “individual treatment” began to gain stature as conservation took its early steps towards professionalization in the 1950s and '60s.

The third era in treatment of iron-gall ink began with the establishment of the Conservation Office in 1967 and the appointment of Peter Waters as the first “Restoration Officer” in 1971. One of his early accomplishments was convincing the Library to halt the practice of lamination. Additionally, deacidification and the treatment of iron-gall ink were issues that received considerable early attention. Many conservators working in the Library at the time reported problems with deacidification in general and aqueous treatment of iron-gall ink, such as sinking and physical breakage of ink-corroded areas. Use of the concentrated deacidification solutions frequently caused a change in color and/or intensity of the inks and left a gritty deposit on the surface of the paper. Mr. Waters formed a deacidification committee of staff conservators and scientists. One of the first actions he took as head of the committee was to direct Norvel Jones to conduct a survey of conservators at the Library on practices they used. He hoped to record the various methods employed, define areas of needed research, and establish standard practices within the laboratory. The survey revealed that many conservators were diluting the deacidification solutions by at least half to alleviate the gritting problem. It was also noted that some did not use magnesium or calcium salts at all in their treatment of iron-gall ink due to experiences with unwanted effects. As a result of the work of the deacidification committee and Margaret Hey's research as a visiting scientist at LC studying deacidification and iron-gall ink treatments, Mr. Waters developed and distributed standard guidelines to the staff. These guidelines acknowledge and support individual experience and judgment but direct that if a book or other item is washed, it should be followed by deacidification. Magnesium bicarbonate is mentioned as

the agent of choice and conservators were directed to dilute it as necessary to avoid unwanted effects. Two important principles are implicit in these guidelines that remain relevant today. The first is that whenever possible, deacidification should follow washing—a concept which, while it has fallen from favor in practice, remains firmly supported by science. The second important principle spelled out in these guidelines is that the visual integrity of the object is paramount. This principle, coupled with the abandonment of lamination, articulated a shift in thinking away from one whose primary focus was preserving information to the current focus which places far greater emphasis on preserving what we normally think of as aesthetic or original qualities of the material.

After the issuing of the laboratory standards, treatment of iron-gall ink objects underwent many ingenious modifications in the late seventies and throughout the eighties. While washing and deacidification proceeded along the directives of Margaret Hey's recommendations, many objects could not be treated in this manner. Work with various non-aqueous methods of deacidification continued to be an active area of research but is beyond the scope of this paper. What is perhaps most prevalent and effective has been the development of the technique of treating water-sensitive inks through the "dilution" of the aqueous washing and deacidification solutions with ethanol, which forms the basis of how we treat iron-gall ink today. While acknowledging that the efficacy of the cleansing and deacidification operations could be proportionally decreased with the increase of ethanol percentage, conservators still felt that the improvement resulting from the intervention validated these techniques. On the other hand, a generally accepted opinion that the addition of alcohol to a washing bath would actually increase the efficacy of bathing was supported by Margaret Hey's research. Additionally, work was published which supported the superiority of aqueous deacidification over non-aqueous methods. Empirically, conservators arrived at methods of washing and deacidification that would accommodate the medium's unique sensitivities while attaining maximum cleansing and deposition of alkaline material into the paper. Typically, conservators would test an object with 25%, 50%, 65%, and 100% water and deacidification solutions while arriving at a treatment recommendation. These alcohol modifications were in use from at least the 1980s and firmly established by the early nineties. In 1995, Heather Wanser studied these various modifications and demonstrated that the effectiveness of cleansing and the deposition of salts by even a 65% ethanol bath were significant. The study results revealed that up to 0.5% alkaline salts are deposited into the paper by this treatment. While this amount of alkaline salt deposition was short of the 2% alkaline reserve recommended by earlier publications as

the level required to ensure "permanence," the trade-off in media stability was seen as well worth it.

If what grew out of this evolution of techniques for treating deteriorated iron-gall ink documents from the establishment of the Office in 1967 until very recently could be summarized as a standard approach at the Library, perhaps it may be articulated as follows:

1. As part of the standard examination process, the need for treatment is assessed. The level of ink deterioration is considered, as is the paper's state of preservation. At the Library, we are faced with a multitude of objects which have been treated with materials now known to contribute to their deterioration, and thus the impetus to retreat may be greater in this case. Objects that have not been previously treated and appear in a good state of preservation are unlikely to undergo any treatment other than housing improvement. Additionally, a great deal of information pertaining to a document's reactivity to aqueous treatment may be obtained by assessing its reaction to either the silking or the deacidification process which was part of most of the lamination treatments. For example, if the inks on a silked document appear to be relatively intact, it is likely that they will hold up well to aqueous treatment. Conservators at the Library of Congress have developed a testing protocol that we feel is reasonably predictive of an object's behavior during treatment.
2. Ideally, if the object will permit it, iron-gall ink documents are treated with a twenty-minute recalcified deionized water bath followed by a twenty-minute magnesium bicarbonate bath. The magnesium bicarbonate is diluted from a saturated solution to a 25% solution by volume. There are many variations, including length and number of baths and whether or not the object is dried between baths.
3. If testing or experience has indicated that the inks may change with this treatment, the washing and deacidification baths may be diluted up to 65% ethanol/35% water or deacidification component.
4. After aqueous treatment, resizing with gelatin or methyl cellulose is commonly performed and is seen as beneficial and protective on a number of levels.
5. If testing or experience indicates that the inks should not undergo aqueous treatment, a non-aqueous deacidification treatment is considered. Bookkeeper is most commonly used today.
6. If the object cannot be chemically stabilized, support is obtained through housing solutions. When an object is Mylar-encapsulated, a buffered sheet is inserted into the package.

The subject of treating iron-gall ink has garnered considerable renewed attention in recent years. Since the mid-to-late nineties no less than four international conferences have been held on the subject. New information about the

degradation of iron-gall ink has been published indicating the role of the iron 2+ compound (FE II) in prompting the oxidation process.

This work inspired the development of two decidedly new approaches to treatment. Washing objects in water near the boiling point removes most of the FE II and has been reported to have been used successfully. More promising, perhaps, is a treatment proposed by Han Neevel at ICN (Netherlands Institute for Cultural Heritage) which would sequester any free FE II permanently through the use of phytates. Conservators at the Library were both excited by this second approach and alarmed by some of the results that were reported in the study. Neevel's experimental results included papers deacidified with saturated solutions of magnesium bicarbonate that yellowed significantly upon aging, though effectively protected from acid hydrolysis and oxidation. Yellowing of paper associated with magnesium compounds has been previously reported but is countered by other research, and these conflicting results can often be attributed to the study's protocols. Studies using concentrated solutions tend to produce negative results and conflicting information is produced by differing aging methods. Neevel used saturated solutions in his experiments and employed a cycling temperature and relative humidity aging protocol. Additionally, the ink recipe employed by Neevel exaggerated the proportion of FE II in historic recipes in order to study the effects of the phytate on highly corrosive ink. While acknowledging the limitations of our current practices using magnesium compounds to treat iron-gall ink, in that they do nothing to prevent FE II from continuing to form, we were nevertheless reluctant to abandon our practices and the thirty years of accumulated experience for something that is unproven in practice. As a result, the Library of Congress is currently engaged in a multi-year study aimed at gathering data that would allow us to assess ICN's work within the context of our current and past practices.

Among the changes in experimental protocol adopted are three important ones. Because Library conservators have not used saturated solutions for thirty years, the more diluted solutions are being substituted. In addition, recently adopted ASTM (American Society for Testing and Materials) standards for artificial aging are being used instead of the cycling method. Finally, real ink samples will be tested along with the exaggerated ink formula for comparison. Early results of the Library's study tend to support the results obtained by Neevel, but as is typical of studies involving iron-gall ink, raise more questions than they answer. While a full report is still a year or two off, we were inspired by this year's AIC annual meeting theme of "Treatment Revisited" to perform a parallel study that would look at actual objects treated in the past.

## RESULTS OF THE PROJECT

While well versed in the dangers associated with aqueous treatment of iron-gall ink, many conservators past and present had been able to perform safely the "standard" Library of Congress treatments previously described. I personally have treated scores of iron-gall ink documents through washing and deacidification with magnesium bicarbonate and felt that with proper pre-testing and consideration the problems with ink changes could be avoided. On several occasions there was the opportunity to "test" the treatment on part of the document, compare it with the untreated part, and allow for more confidence in proceeding. The significant body of positive experiences in treating iron-gall ink was difficult to reconcile with the accumulating evidence of possible harm that might result. After all, if paper yellowing or dramatic ink changes were readily apparent, development of the Library's standard treatment would have developed in a different direction. Perhaps these changes occur only upon aging. To begin our reexamination of treatments performed in the past, all of the treatment, photographic, and some administrative records accumulated since the establishment of the Office were combed, and iron-gall ink objects that were treated with magnesium compounds were noted. The records that had treatment details and photographic information associated with the treatment that reasonably could be used to make some type of assessment were brought to the lab. All of the conservators were invited to visually examine the objects and discuss their perceptions. Unfortunately, documentation such as colorimetry or spectrophotometry that would provide a mechanism for an objective assessment does not exist. Nevertheless it was decided to proceed with the available information, reasoning that while fallible and notoriously variant, a conservator's visual perception and aesthetic sense are a valuable part of the preservation discipline and will remain so.

What was found through this exercise was surprising on a number of levels. The first surprise was that relatively few objects penned in iron-gall ink received aqueous treatment in the thirty years since the establishment of the Office. Perhaps the reason for this is that an iron-gall ink document has to pass a gauntlet of tests before it is considered for aqueous treatment and some conservators have felt that treatment with magnesium bicarbonate is too risky to be considered. The second surprising result was that those objects that did pass the various tests and were treated through the standard approach described previously have held up well, mechanically as well as visually. Examination of the available documentation that includes written information, color slides, and color transparencies supported our visual perceptions. Of the several hundred pages examined, we could find no obvious paper color shift associated with the magnesium treatments. Any alteration

to inks that had been noted in the reports were subtle and it was difficult to determine if the inks had actually changed in color or our perception was influenced by the color balance shift in the paper tone. While acknowledging the limitations of this exercise, the results obtained supported the notion that the careful testing and open exchange of information amongst ourselves had been effective in avoiding many of the negative effects associated with aqueous and magnesium bicarbonate treatment of iron-gall ink documents.

#### UNEXPECTED RESULTS

While definitive and objective answers to the questions that prompted this study were not found, some of the tangential details revealed warrant discussion. If conservators are to have meaningful discussions about previous treatments, the following factors need to be taken into consideration.

Conservators remember every excruciating detail of a treatment they judged went wrong but do not remember the ones that went well. While “self-flagellation” is a well-known, and possibly beneficial, character trait of conservators, the weight given to negative experiences was disproportionate to the far more common positive experiences. Does this built-in “prejudice” serve us well? Could it, in part, explain the reluctance of conservators today to incorporate deacidification into their practice despite their admission that it is beneficial to the paper? After all, if done correctly, we do not see any change. What we do remember are objects that have behaved badly or reports of others who have had negative experiences. While “negative experiences” is obviously an enormously important factor to consider when designing a treatment protocol, is it the only one? Certainly this prejudice impedes the formation of a balanced program as well as colors the sometimes decidedly emotional aspect of our discussions.

The notion of “acceptable change” in manuscript conservation is true in theory only. Much is made of the differing standards between fine art and manuscript conservation. It was found that among LC conservators past and present that the only acceptable change in the visual appearance of iron-gall ink is “no change.” This concept has driven development of the standard treatment protocol principle, overriding the desire to address deteriorating components by invasive treatments, and has been in direct conflict with information coming from the scientific community about the long-term benefits of treatments that deposit alkaline salts into the paper.

We need to find some practical way to incorporate objective standards in our measurements and more fully understand and acknowledge that our visual perceptions are subjective. Conservators are critical and have a highly developed visual sense. This quality is obviously one of

the things that sets us apart from much of the rest of the world and is a vital component in our work. Unfortunately, what any given individual conservator “sees” and makes judgments about can be quite at odds with his or her colleagues. Without objective standards, we are forced to accommodate these differences in our practice.

It became obvious during the course of this project that these qualities may be seen as a source of both strength and weakness. The following two examples encountered during this study highlight this point.

When looking for objects for this project, several people mentioned one of the Library’s “Top Treasures,” James Madison’s “Notes on the Continental Congress” as an example of a deacidification treatment of iron-gall ink gone awry. There are two volumes; the first had been washed and deacidified. Lab legend had it that the inks had changed so dramatically in response to the magnesium bicarbonate deacidification that the treatment was halted halfway. In fact, it was generally felt that one could tell just where treatment had stopped by looking through the papers. We started by looking at the volume that had been treated. We immediately began ascribing qualities that we normally associate with washing and deacidification such as blurred, reddened, and sinking inks. Then we turned to the volume that had not been treated. To our surprise, the inks looked very similar. There were inks that were blurred and some that were just as reddened in the untreated volume as there were in the treated one. In short, the range of ink appearance in the treated volume looked very similar to the ink appearance in the volumes that had not been treated. There were no details about the treatments other than that the papers were “washed and buffered.” Very curious about exactly what had been done during the treatment, we had the volumes tested by scanning electron microscope (SEM) analysis. The manuscripts had indeed been washed, displaying the typical spectra of water-washed objects. To our complete surprise, however, no magnesium or other alkaline salt could be detected by this method. Although the results are not definitive—more research would have to be performed to clear the mystery of exactly how the first volume of the treasure was treated—it is most interesting to note the mythology that had surrounded this object and the weight given to this “myth” when conservators were considering treatment options for other objects.

The second example illustrating the difficulty conservators encounter when assessing their work may be found with Heather Wanser’s research. In this study, one expendable iron-gall ink document was cut up and each piece subjected to various alcohol-modified washing and magnesium bicarbonate deacidification treatments. Twelve senior conservators were then asked to visually evaluate the results. The judgments of the highly-trained, visually-



acute conservators could be charitably described as varied. The ink in one sample was judged as having undergone no visible change by some and displaying the most drastic visual change by others. Interestingly, the iron-gall ink in the control sample was also judged as having been treated by some. This experience is not uncommon. We aim at objectivity but our visual perceptions are imbued with subjectivity.

To conclude, this study veered in a different direction than the one in which we originally set out. It was evident from this exercise that support for both the magnesium and the anti-magnesium arguments could be found by selective examination of the published literature and practical experience on the subject. Another benefit of the research was a renewed appreciation of the dramatic evolution in treatment over the past one-hundred years. Most interesting was being able to trace the emergence of “original” appearance as an ultimate goal in document conservation. Scientific evaluations of chemical stability and how to achieve them have been fully integrated into a conservator’s planning and decision-making but these considerations do not override aesthetic judgments. Many successful modifications of the standard washing and deacidification treatments at LC have been developed to try to get the best of both worlds. Effective treatments have been carried out, and to the extent that we can judge, have held up well. New research informed by a conservator’s real life experiences impact research design with the promise of more targeted results. The dynamics of how we assess our work deserves wider acknowledgement to ensure that better preservation standards evolve. Finally, a conservator must balance the information available at any given time with the mission of the institution and make the best decision; it will inevitably involve a compromise.

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## A Brief Personal History of a Conservator of Art on Paper in the United Kingdom: 1959–2003

### ABSTRACT

The author's background in the conservation of art on paper is, in today's terms unorthodox. She describes her training over a period of ten years as an apprentice in London and afterwards working in her private practice in London and latterly in Suffolk.

The changes to the practice of the work through this period are noted by the emphasis of important landmarks, particularly the new training schools in the 1970s and the founding of the Institute of Paper Conservation, with subsequent international conferences and the cross fertilization that has sprung from these. A Churchill Fellowship to North America in 1977 and meeting fellow conservators is recorded. Also recorded are the growth and changes of important areas of conservation, the marketing of materials and equipment for the conservator and preservation of artifacts.

### HIGHBURY, LONDON, 1959

In England in the late 1950s there were extremely limited possibilities for training to be a conservator of fine art on paper. There were no training courses, and even little chance of training in a museum. The conservators in the British Museum had been trained by various combinations of bookbinders and photographic retouchers. That museum did have a scientific department, but most processes were highly experimental. Other major museums had similar personnel, smaller ones had none.

There were various private restorers and conservators working in London at that time; particularly well known were the Dreschers, father and son. The former had been trained in Berlin under Carl Schweidler, and they were

practitioners of the German school of restoration, performing miracles in invisible mending. They did not take in pupils. Many restorers of prints and drawings either were framers or worked for them.

Other areas of paper conservation—archives and books—were a little more established. The Public Record Office and regional record offices were carrying out treatment on archives while there had always been a tradition of bookbinding, the British Library leading the way.

At nineteen I was fortunate to be employed by Mordo Barnard of Messrs. Craddock & Barnard of Museum Street, London (fig. 1). Mordo ran a high-quality print shop selling only original prints, including Dürer engravings and woodcuts and Rembrandt etchings, with his brother Osbert (fig. 2). These two lived in a large house in Highbury, North London. This is where the lab had been set up. I was Mordo's first pupil—and an apprentice, to be paid £7.00 per week.

Mordo had been a chemist but had given this up to run the print shop with his brother. He worked on the chemistry of paper conservation, morning, noon, and night, coming up with some good, not-so-good, and dubious solutions to problems. One has to remember that everything everywhere (maybe apart from the Dreschers' establishment) was experimental. We only worked on prints that were owned by Craddock & Barnard, never for the general public.

As I did not own a camera in those days, this scene in Mordo's old lab was taken by a

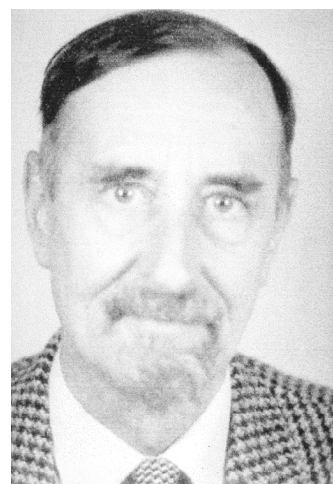


Fig. 1. Mordo Barnard

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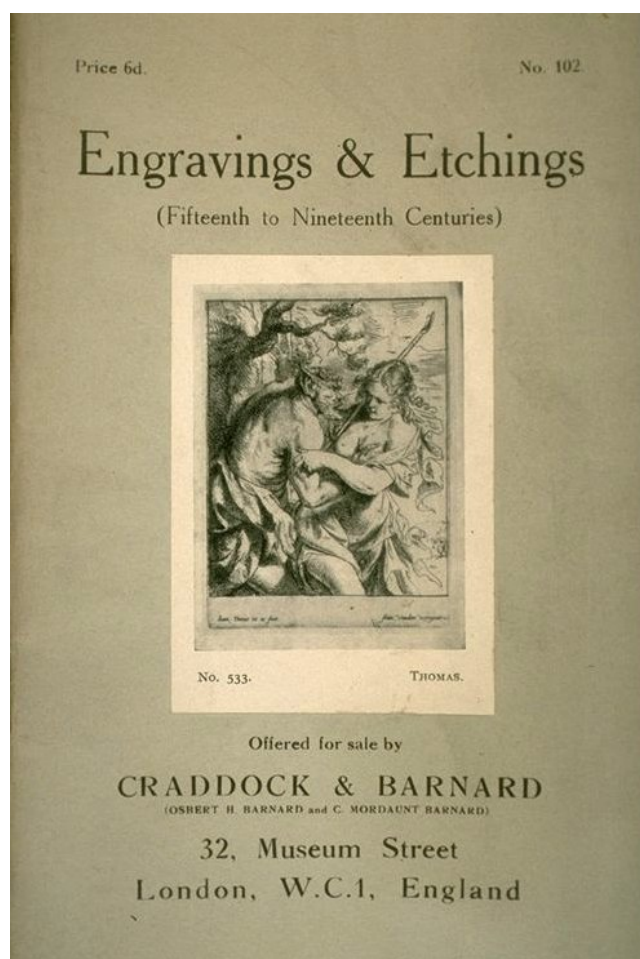


Fig. 2. A Craddock & Barnard print catalogue

colleague, Roy Farrow, at the end of its days, in the 1970s (fig. 3).

I will not dwell on the bad “inventions,” except for mentioning his use of hypochlorous acid which he took great lengths to make and is now known to be a really damaging agent for bleaching paper (Hey 1977). Mordo also used sunlight bleaching to clean the prints, not always so useful an agent in England. He rigged up suction points, made from old vacuum cleaners, and following the German tradition used matching antique papers for paper repairs. I was sent on quests to suppliers for better, sharper knives, erasers, inks, and general working equipment. For me the atmosphere was exciting, especially as I found the work suited me. Old Master prints became very familiar and also by observation I filled in great chunks of art history. I learnt to admire the techniques and art of the old masters greatly and am still in love with “fine impressions.”

#### PRIVATE PRACTICE

At the end of 1969 I left Craddock & Barnard in order to set up my own studio in the King’s Road in London. A

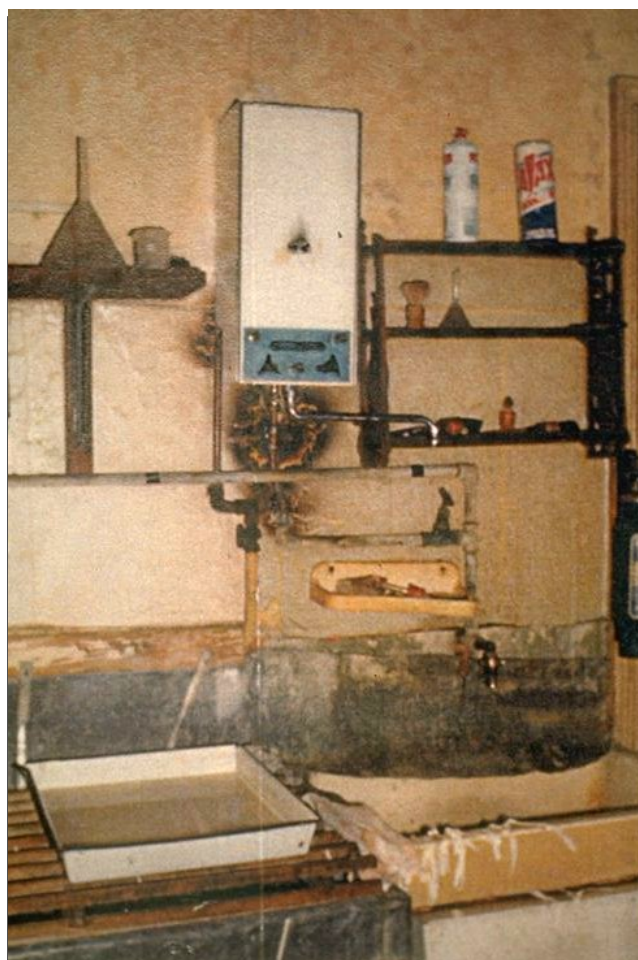


Fig. 3. Mordo’s “lab” in the 1970s. Photo by Roy Farrow.

small space was lent to me by Alfred Hecht, a framer, for one year, at no cost—however I managed to fit in a sink and a table with a light box. The large gilt frames for Francis Bacon’s paintings were being gilded in a room beneath me. Immediately I had a great deal of work as I had, by then, many connections, after living for eleven years in London. The learning curve was a steep one as I also had to cope for the first time with running my own business. By 1972 I had my own house in Battersea, and more—but not enough—space: two converted double bedrooms, about 300 square feet. I determined then that a fully practicing conservator needed a minimum of 1,000 square feet of space separate from any domestic environment, with large, flat, versatile surfaces, sinks, ample storage space, and areas for extraction and humidification cabinets, suction tables, a photograph stand, and microscopes, with dedicated positions for everything, including at least three work stations. Such a space could accommodate students; my two converted rooms could not.

By this time I was handling watercolors and was able to do this with the help and advice from Michael Warnes who was at the British Museum. Later on I was to work with





Fig. 4. Keiko Keyes in 1977

him in the Royal Library, Windsor Castle, for a couple of years, part time on the Holbein drawings. Keiko Keyes (fig. 4) had been in my life during the 1960s as she had been working for another print dealer, Ray Lewis in California. She and her husband Roger came to London regularly and spent some time in the city. We exchanged our individual knowledge and ideas, and I started to work on Japanese prints.

#### TRAINING COURSES

Florence in 1966 had seen a major flood when the river Arno burst its banks causing widespread damage to museum artifacts, libraries, and archives. Good things come out of bad and this catastrophic event pushed forward the need to cope with the damage done to so very many paper artifacts. The volunteers went back to England, one being John Corderoy who founded a course in paper conservation at Camberwell School of Art and Crafts (now Camberwell College of Arts). This course covered books, archives, and art on paper. At last paper conservation was on the map, as people from all over the world had been helping in Florence, and internationally the need for research, development, and teaching was considered a priority. The course at Gateshead Technical College (now the University of Northumbria) followed a few years later. Students began to emerge from these courses and find employment in the museums and private sector.

#### FOUNDING OF THE INSTITUTE OF PAPER CONSERVATION

As, through the courses, the numbers of paper conservators were increasing, there was a developing need for some kind of group or body, and so a few practicing paper conservators from both the institutional and private sectors formed, in 1976, the Institute of Paper Conservation. This was a landmark in the field and shortly *Paper Conservation News* was published along with *The Paper Conservator*. We, for it did include me, decided that it should be an international group; this was necessary as it was essential to build up a network for exchange of information in a fast-developing area of conservation with so many artifacts relating to paper needing help and attention.

In 1977 I was fortunate enough to be awarded a Churchill Fellowship and chose to go to North America to further my knowledge and meet fellow conservators. At this stage, to the chagrin of my clients, I broke up my practice and went for three months visiting labs and training institutions on the East and West Coasts of the U.S. and in Canada. The tour was immensely stimulating: I met very many kindred souls on the same similar quest and some have remained good friends ever since. It was a time of so many new developments both in treatments and equipment. Marilyn Weidner and her new suction table was an inspiration (fig. 5). On the West Coast Victoria Blyth-Hill (fig. 6) and Keiko Keyes and Bob Futernick (fig. 7) showed me their studios (or *labs*), and the latter his innovative pneumatic press. Caroline Keck (fig. 8) was busy training new conservators at Cooperstown, and Marjorie Cohen was still a practicing conservator at the Fogg and demonstrated her mount-cutting facilities and technique to me (fig. 9). Antoinette King was at MOMA, and I was able to



Fig. 5. Marilyn Weidner and her suction table, 1977



Fig. 6. Victoria Blyth-Hill at the Los Angeles County Museum, 1977

have long discussions with her over the variety of problems we both faced when conserving art on paper objects.

The first conference the IPC organized with the Society of Archivists was Cambridge 1980. This conference was of enormous importance, not only to me, but to my colleagues back home in the U.K. I had while on my Churchill Fellowship asked my new American and Canadian friends whether a paper conservation conference would be popular; everyone answered YES. On my return I put this possibility to the IPC committee, thinking it a good way to return all the kindness, exchange of knowledge, and hospitality I had received in North America, and to encourage further exchanges. Everyone agreed to this with enthusiasm, and so the IPC, with the Society of Archivists, organized Cambridge 1980, a conference on "The Conservation of Library and Archive Materials and the Graphic Arts," our first successful and well-attended conference. Speakers mainly came from Europe and North America. Since 1980 the IPC has had three more major conferences, in Oxford, Manchester, and London, as well as many other smaller, one- and two-day events. All have attracted foreign participants.

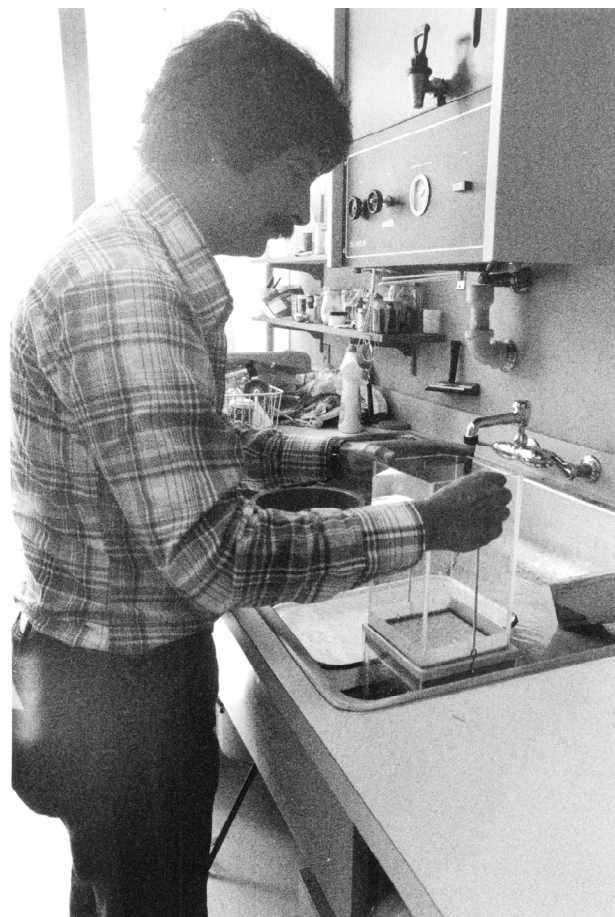


Fig. 7. Bob Futernick at the Legion of Honor in 1977

With the expansion and development of the number of trained conservators came the demand for materials and equipment, including conservation boards and papers, suction tables, steamers, humidification chambers, and many other items now familiar to the practicing conservator. Companies were formed—John Money, Falkiner Fine Papers, Atlantis, Archival Aids, Conservation Resources, Conservation by Design, and Preservation Equipment, to name but a few. Some have folded, but the new companies and ones that have survived are of invaluable use to the conservator. Trade fairs are now always part of our conferences.

#### NETHER HALL BARN

In the same year as the first conference, 1980, deciding that indeed I badly needed that 1,000 square feet of studio space, I moved house and studio. Property and space are expensive in London but cheaper outside so I moved to the middle of East Anglia, Suffolk, about forty-five minutes to the east of Cambridge. The property I found was modest but had all the right ingredients—an acre of old farmyard with a barn already converted to live in, within fairly easy





Fig. 8. Caroline Keck at Cooperstown in 1977

reach by train or road from London. After a little time, I built a “state of the art” studio out of two existing buildings and incorporating a new additional space (figs. 10–11). Within this space I was able to fit in the entire desiderata list plus good lighting, both natural and artificial. This building has been a pleasure to work in ever since. As my work comes mostly from London I have kept a small flat in the centre of the West End. These two combine well for my practice—peace (except for the birds) and tranquility for the work, while London is where most of my clients in all sectors work or have their collections. One day a week is my London consultancy day, and thereby clients are kept at bay and do not interrupt work progress. The contrast of town and country is attractive and stimulating for such sedentary work. Weekend walks are a necessity while London art exhibitions are similarly important.

The space allows for three work stations, so at last I had space for students. The office is separate and is in the house. Since building this studio, I realize one just cannot have

enough space, so have built a multipurpose garage/store with a loft for boards, papers, and the inevitable overflow of items such as frames and packing materials, items relating to the studio. To have this space in the centre of London would have been exorbitantly expensive. Suffolk is beautiful and I feel privileged to be able to work on wonderful works of art in such lovely surroundings. Finances apart, it was being in Japan in the early 1970s that inspired me to organize my work and life in this manner. Visiting all the beautifully arranged studios of Japan’s painting conservators gave me a different view on the need for beautiful surroundings when working.

The Tate Gallery, the Victoria and Albert Museum, and Museums and Galleries on Merseyside now have new up-to-date laboratories, as do many others. The British Museum does need more space, but I am sure this will be forthcoming in due course. They all employ young people trained on the courses. It is all a very different scene from my early experience in 1959.

The new studio space gave me the opportunity to employ students and Kate Newton (fig. 12) joined me, followed by others, including Deborah Willis who patiently put up with the studio extension project. All students were taken from the two courses, and numbers were increased from time to time with foreign interns from the USA, Switzerland, Russia, and Holland. The studio was quite full at times, and I found this difficult to manage and control—I really needed a “non-hands on” manager to deal with the bureaucratic work involved; however, financially this would have put too much stress on the studio. I have now “trimmed my sails” as far as interns are concerned, realizing that everything runs more smoothly with two or three of us involved, plus a secretary.

With all the published international research and development huge changes have taken place in the practice of



Fig. 9. Marjorie Cohen at the Fogg, 1977



Fig. 10. Studio at Nether Hall Barn, 1990s, Dr. Judith Gowland in the foreground

conserving art on paper since 1959—mostly for the better. Each treatment is finely tailored to the work concerned: light bleaching of paper with banks of lights is a big step forward; new steamers, suction tables, humidification chambers have all helped to streamline the processes. Most and best of all there is a network of practitioners to interact with. The work is no longer shrouded in mystery as it was when I first became involved.

The intense climate of interest—esthetic, historical, and financial—in art generally has made for much more demand from the institutions and the public for conservation of fine prints and drawings. Conservators now as a matter of practice do condition reports for clients prior to purchase or lending for exhibitions. The conservator now has a status not previously experienced.

The privilege, and responsibility, of working at such close quarters on many wonderful works of art by masters as varied as Holbein to Kandinsky is an on-going pleasure and inspiration, as well as at times a challenge. The chance to travel to work on collections in Turkey, India, Australia,



Fig. 11. Jane McAusland in her studio, 1980s

and the USA as well as Europe has been interesting and rewarding. At present my involvement with the project in the library in St. Catherine's Monastery at the foot of Mount Sinai in Egypt, where the relative humidity is in the region of 19%, has been a technical challenge.

Not only fine works of art have illuminated the work, but to meet and work with so many interesting and talented people—curators and custodians, historians, scientists, other conservators, and students with all the exchanges of information—have given depth to further, and really endless, understanding of the subject. One just goes on learning.

#### ACCREDITATION

All areas of conservation in the U.K. had been discussing the need for accreditation for some time and so, in 1999, finally a system for accrediting conservators came about within the IPC. Of course there are flaws



Fig. 12. Kate Newton in 1982



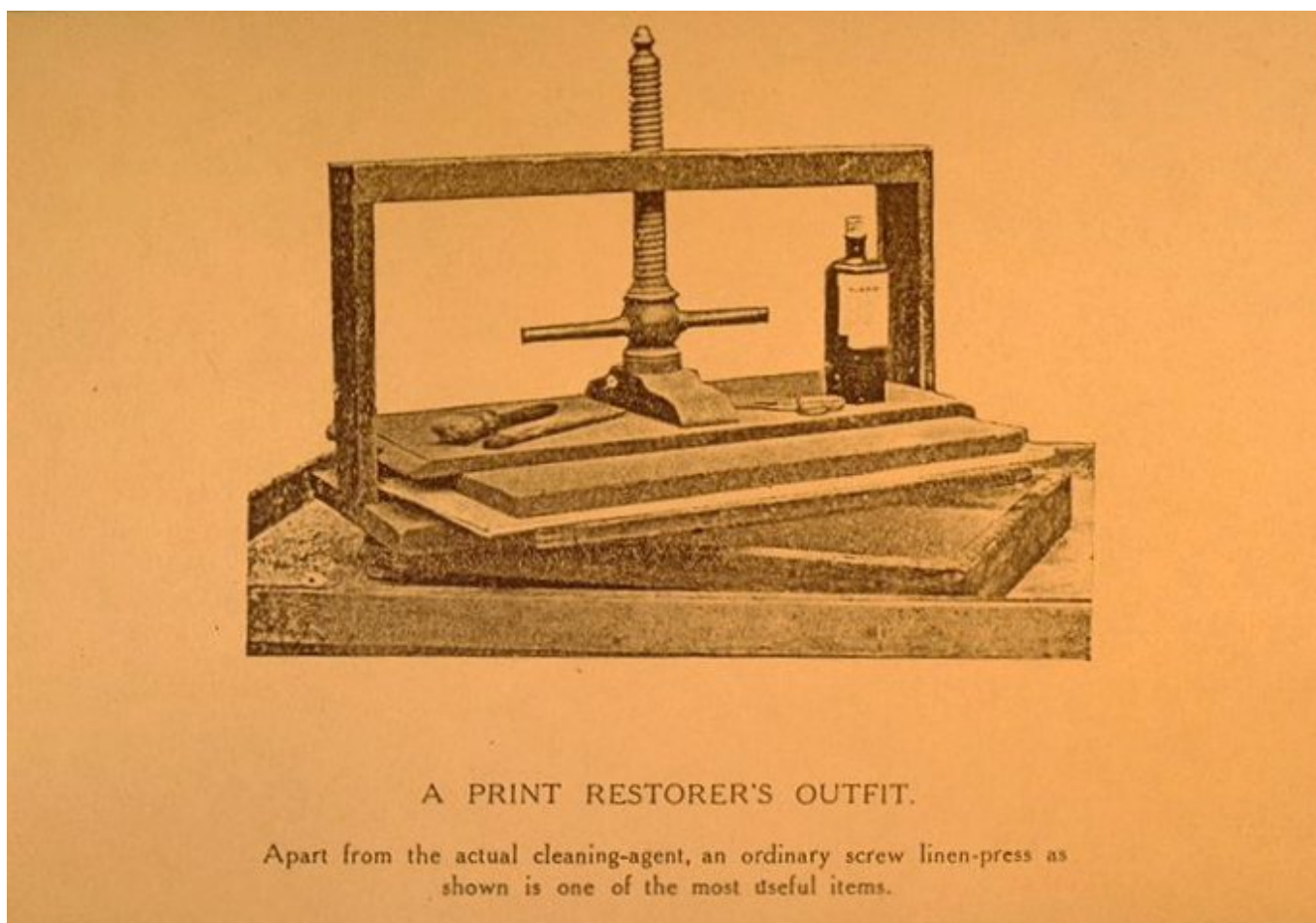


Fig. 13. A Print Restorer's Outfit. Maurice James Gunn, *Print Restoration and Picture Cleaning*, London, 1911.

in anything new, but the Fast Track system initially put into operation has got it going and accredited fully practicing conservators with more than seven years experience, including training.

There is now a move to combine all the conservation bodies in the U.K. into one large organization; this will engulf the IPC. Personally I feel that "small is beautiful."

Well, we paper conservators have moved on and many who were pioneers have gone before us. I would like to dedicate this paper to this latter group, which included my master, Mordo Barnard. We must be grateful for their inspiration and enthusiasms. I have learnt not to be critical of early techniques, now dispensed with. We have all learnt from them. In fact I have been there myself after over thirty years in private practice, having discarded soluble nylon and the hypochlorites, and am fully aware now of the harsh climates works of art on paper have to suffer in different parts of the globe, particularly high and low humidity levels. Not everywhere enjoys the equable climate of our *green and pleasant land*. It was a surprise to find how hard it was, given the low RH level, to press paper on the East Coast of America when I first attempted it. I also experience the joy of American conservators over here

with the ease that pressing can be carried out. New inventions and new developments, along with different philosophies, have, I think, elevated what we might now call an emergent profession (fig. 13).

I would like to thank the Book and Paper Group of the AIC and Elmer Eusman for inviting me to give this paper at the conference in Arlington, Virginia, in June 2003. It was a pleasure, as always, to be in the USA amongst my fellow conservators and enthusiasts.

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BILL MINTER

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## Think Back—*Do You Remember When . . .?*

### ABSTRACT

Today, as conservators, we have the great advantage in the culmination of many years of experience when we make a treatment decision. That, however, has not always been the case. Remember when there were no training programs; when there were few conservation materials; when there was only one conservation supplier; when there was no AIC, and definitely, no Book and Paper Group? This paper attempted to examine and discuss some of the materials and treatments that we use in order to fulfill our obligation in the preservation of books and paper.

Remember when chloramine-T was considered the best way to remove stains from paper? There was a time when modern commercial papermakers did not even know about acid-free paper. There was a time when the only adhesives were animal glue and wheat paste. Remember when it was suggested that we should apply potassium lactate to leather bindings, and to follow that with a leather dressing of lanolin and neatsfoot oil? In fact, some instructions from the late 1970s recommended to apply the dressing “liberally with a paint brush and allow [it] to sit for 48 hours before removing the excess.” I still cringe at the thought of that statement. Today, we have gone to the opposite extreme, where little or nothing is applied to leather.

The book and paper restorers who have come before us had very little preservation experience. In the years prior to 1966, many of them worked in isolation and they used the materials and techniques that were readily available. We cannot, and should not, condemn them for any of their actions.

The Florence flood of 1966 was the catastrophic stimulus for gathering many of those restorers in one place to

work together. They quickly realized that they needed help to determine the best way to deal with the recovery operation. Today, we might consider “The Flood” as the birth of modern book and paper conservation. Our field, however, is still in its adolescence, as there still are many things to understand. We must realize that future conservators might condemn some of the treatments we perform today. Fortunately, we have the experience of our predecessors and a forum, such as AIC and now the Internet, where we can exchange information. We have access to research chemists and scientists who can assist us with our decision making, and help us to find the best materials. We also have an opportunity to look back at some of those early treatments to see what has survived the test of time and the actual handling by patrons.

We should take the time to reexamine some of the treatments that are now twenty to forty years old. We are the only ones who have the expertise to assess the long-term effects of our treatments and it is our responsibility to evaluate the treatments that have been done in our lifetime. We cannot assume that we have all the answers. We must be ever vigilant as our treatments and the materials we use naturally age and as we observe how these items endure handling by patrons in our libraries, archives, and museums. This paper looked at a few of those early treatments and the treatments we use today.

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## History of Japanese Painting Conservation in the United States

### ABSTRACT

This paper covers the brief history of pioneers in the field of Japanese painting restoration/conservation in the United States. It describes the circumstances under which they worked and the changing ethics and philosophy they applied in doing Japanese painting conservation. When Japan opened to the West in the 1860s, countless Japanese screen and scroll paintings made their way to the United States. Major museums on the East Coast started collecting Japanese and Chinese scroll and screen paintings. Japanese painting restoration studios were among the earliest museum conservation/restoration studios to be located in-house. Traditional *hyogushi*, or scroll mounters/restorers, Tamura and Kinoshita were invited to work at the Museum of Fine Arts, Boston, in the early twentieth century. Since then several scroll/screen *hyogushi* have been invited to work at the Boston Museum, at the Smithsonian's Freer Gallery, and at New York's Metropolitan Museum. From the time the first conservators came to the U.S., the techniques and philosophy of Japanese painting conservation have evolved both in Japan and the United States. East and West have had important influences on each other in the development of current conservation ethics and practice.

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# Cellulose Acetate Lamination at the National Archives

## Part 1: The Louisiana Purchase Documents, a Case Study

ABSTRACT

Conservators at the National Archives and Record Administration (NARA) have years of experience working with cellulose acetate lamination, associated with both the application and removal of cellulose acetate lamination. Lamination, like its predecessor silking, was used as a means of holding together and safeguarding fragile or fragmented paper. Once considered a state-of-the-art preservation technique, lamination was one of many ways used to protect precious and inherently valuable historic documents of the United States. This paper will present a review of the positive and negative aspects of lamination almost fifty years after the National Bureau of Standards (NBS) studies that standardized lamination materials and processes.

Thirty documents relating to the purchase of Louisiana, 1803–04, laminated at NARA during the late 1930s or early 1940s, were recently delaminated to prepare for their two-hundred-year anniversary. This paper describes their treatment.

INTRODUCTION

Two centuries ago this spring—without a call to arms, with little advance notice, and with only the briefest negotiations—the United States doubled in size (fig. 1).

In an astounding transaction that amounted to four cents an acre, President Thomas Jefferson saw his dreams of westward expansion coming true for the nation he had helped create. The United States of America would grow beyond the Mississippi River and include rich forests, vast plains, and craggy

mountains. The historic transaction is known as the Louisiana Purchase, but it was not something Jefferson had sought to make at the time. He would have been content just to buy the port of New Orleans so the United States—not Spain, not France, certainly not Great Britain—could control the gateway to the Mississippi River, the main street of commerce in what was then the American West.

But France’s ruler at the time, Napoleon Bonaparte, was losing interest in establishing a North American empire and needed funds to fight the British, so he directed his emissaries to offer not just New Orleans but all of the Louisiana Territory to the Americans. Jefferson’s envoys in Paris, without awaiting any direction from their President (which would have taken two months), accepted the deal and on April 30, 1803, signed the Louisiana Purchase Treaty.

The story of the Louisiana Purchase, however, is more than just a quick deal among the top French and American



Fig. 1. Map of Territory of Louisiana, 1803–1819, the National Archives and Records Administration

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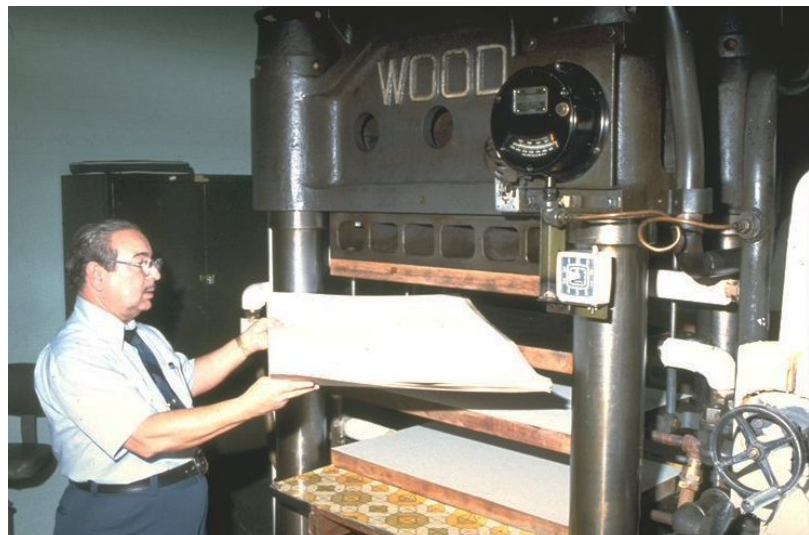


Fig. 2. Wood hydraulic laminating press, NARA

diplomats in April of 1803. And it took more to complete the Louisiana Purchase than the treaty itself. It involved more than a year's worth of delicate negotiations to work out the approval of the treaty by Congress, the raising of funds to finance the purchase, and the transfer of documents that completed the deal. There were agreements on how the deal would be financed and various delegations of powers of attorney to individuals carrying out the various functions—some thirty documents in all. Over the years, the Louisiana Purchase Treaty and the two side conventions, which stipulated how France would be compensated for Louisiana, have been part of the Department of State records held by the National Archives. A few have also been part of NARA's popular American Originals exhibit, which is now touring various cities around the country. The thirty documents that were created to implement the financial aspects of Louisiana Purchase were retained for many years at the Department of Treasury. At one point in the late 1930s, they were sent to the National Archives for lamination and returned to the Treasury Department. In 1951 the National Archives accessioned them, and in 2000 they underwent significant conservation treatment in the Document Conservation Laboratory in College Park, Maryland, in preparation for the bicentennial of the Louisiana Purchase this year.

#### THE ORIGINAL GOAL: BUYING NEW ORLEANS

Jefferson wanted to buy the port of New Orleans because for him, New Orleans was the key: whoever owned it would be America's natural enemy because that nation would control the channel through which produce from more than a third of the United States had to pass. Even as he was laying the groundwork for what became the Lewis and Clark Expedition, to explore Louisiana and



Fig. 3. Arbee rolling lamination press, NARA

the western lands, Jefferson gave his ambassador in Paris, Robert Livingston, instruction to negotiate with the French to buy New Orleans. Jefferson appointed fellow Virginian James Monroe as minister plenipotentiary and envoy extraordinary to join Livingston in Paris. Monroe was to work with Livingston on negotiations with France to purchase for ten million dollars the Isle of Orleans, on which New Orleans was located.

#### A SURPRISE OFFER AND A TIME CRUNCH

On April 11, 1803, a day before Monroe arrived in Paris, the French minister of foreign relations surprised Livingston by offering the United States not just New Orleans but all of the Louisiana Territory for fifteen million dollars. Now the real work of implementing the treaty and how the fifteen-million dollar compensation would be paid began. The United States would pay \$11,250,000 in stock with an interest rate of six percent. For the remaining \$3,750,000, the United States would assume the claims of American citizens against the French navy for seizure of property and goods from ships.

Two firms, Baring and Company of London and Hope and Company of Amsterdam, were selected to conduct the sale of the stock. In December 1803, the Louisiana Territory officially became part of the United States. But the story was not over for the documents of the Louisiana Purchase. It was just the beginning. Over the years, the thirty implementing documents, in the custody of the Treasury Department, survived extensive handling, excessive exhibition, and uncontrolled storage environments before they came to the National Archives in 1951 for good. But they had made several earlier visits to the Archives in the late 1930s—to be laminated, then a new technique. A typewritten note dated November 26, 1940,

tucked inside the first envelope in the transaction dossier, stated that the records had been “repaired and laminated by the Division of Repair and Preservation, the National Archives.”

The National Archives began laminating records using hydraulic (fig. 2) and rolling (fig. 3) presses to apply cellulose acetate film in 1936. The last lamination press was removed in the early 1980s, and documents are no longer treated by cellulose acetate lamination. The thirty laminated Louisiana Purchase documents represent a wide range of types and conditions. Some documents were very simple as physical objects, such as a single sheet of cream colored paper written in iron gall ink. Others were more complex: for example, a large piece of watermarked antique laid paper contained hand stamps, resin seals (fig. 4), and important signatures. Some were distorted, yellowed, and embrittled. Others, however, appeared to be in good condition; they were flat, supple, and written on paper that was no more significantly darkened than similar but unlaminated paper two hundred years old. While it is impossible to know how each document was treated and handled over the years, some plausible explanations exist for their varying conditions. They may have been laminated using excessive heat and pressure, the cellulose acetate film may have contained unstable plastizicers, or they may have been overexposed to light during long-term exhibition at the Treasury Department. Resin seals on some documents remain intact, while others have been crushed, which indicates that some documents were carefully laminated by hand to protect the vulnerable resin seals, hand stamps, and presidential signatures that they bore, while others were not.

#### BRIEF TECHNICAL HISTORY OF LAMINATION

Although we don’t know the exact date or dates, the note found with the documents states that they had come to the National Archives for preservation treatment sometime before November 26, 1940. In 1933, research into document lamination began at the National Bureau of Standards (NBS). In 1936, the National Archives began laminating records using hydraulic presses. Thus, the Louisiana Purchase documents were laminated very early in the history of lamination.

#### OVERVIEW OF CELLULOSE ACETATE LAMINATION

Cellulose acetate lamination, like its predecessor silk-ing, was a means of supporting and holding together fragile or fragmented paper. At the time of its dominant use, it was a state-of-the-art preservation technique, used to protect precious and inherently valuable historic documents. The Louisiana Purchase records, probably

laminated in the late 1930s, were among the first documents to be treated with this new technique. We now know that lamination could be applied poorly resulting in distortion of the original records, that some plastizicers used in these early films were later found to be unstable, and that environ-

mental conditions in storage are key to stability.

These important documents were written on a wide variety of handmade papers. Each manuscript is a unique object, in terms of its composition and history. The condition of the documents was the result of many factors, many of which are largely unknown, which contributed to their varying appearance. Several of the more popular documents in the collection had been on permanent public display while they were at the Treasury Department. It is likely that they were exhibited both before and after they were laminated. Some manuscripts were still in their vintage exhibition mounts when accessioned, attached to the back of window mats with pressure-sensitive adhesive tape, now yellowed and brittle. The matted records had been exhibited for many years judging from deterioration of the matboard, tape, and cellulose acetate lamination film.

#### DELAMINATING DOCUMENTS

Three documents were chosen for initial treatment to represent a specific conservation issue or problem of varying complexity. How these three prototypes responded to treatment would help determine the conservation of the other records. The three documents were:

1. The first document (fig. 5) was a letter from the minister of the Public Treasury of the French Republic to the Secretary concerning the arrival of Alexander Baring in America and the plans for carrying out the terms of the agreement. This double-sided single-page document on cream-colored antique laid paper bears the Dutch “Cobb & Co” watermark and is written in iron-gall ink. Like many of the Louisiana Purchase documents, it had a strip of cotton gauze adhered to its left edge. The gauze strips were sewn together and



Fig. 4. RG 56, page 17, Letter from the Secretary of the Treasury to the Register of the Treasury arranging for the stock to be delivered, February 7, 1804, NARA: resin seal on document before treatment

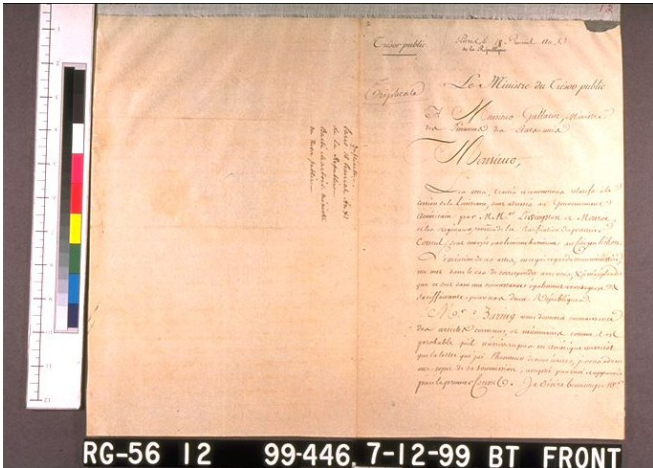


Fig. 5. Louisiana Purchase document, RG 56, page 12, Letter from the Minister of the Public Treasury of the French Republic to the Secretary concerning the arrival of Alexander Baring in America and the plans for carrying out the terms of the agreement, June 6, 1803, NARA: front, before delamination treatment

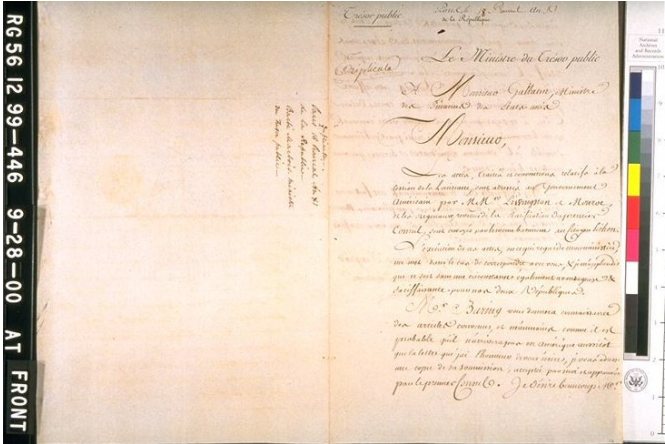


Fig. 6. Louisiana Purchase document, RG 56, page 12: after treatment

bound. There were smudges and surface dirt but the paper was in generally good condition (fig. 6).

- The second document (fig. 7) was a convention between the French Republic and the United States. This record was selected because it represented a group of popular documents that had been on permanent exhibition and, thus, was severely distorted. It was at first unclear whether the planar distortions could be reduced or eliminated during treatment. Pressure-sensitive tape had been applied to the back to hold the paper in position in its window mat during exhibition. Although the exact circumstances are unknown, sometime during the past the ink bled as a result of contact with water (fig. 8).
- The third document (figs. 9–10), a power of attorney given to Alexander Baring by Hope and Company to act in American matters relating to the negotiations of the American fund, was written on July 20, 1803. This document in the pilot project was selected because it, like several others, had a fragile resin seal (figs. 11–14). The seal was attached to the back near signatures and hand stamps in black ink.

Before treatment began, testing was done to determine whether the inks were soluble in the solvent selected for delamination. Fortunately, each document had a wide left border of cellulose acetate that extended beyond the paper itself, to allow it to be bound into a volume (fig. 15). This non-record salvage strip was removed and used to test the solubility of the cellulose acetate. These samples of laminated non-record material were also used for study and analysis and provided information about the early kinds of cellulose acetate film, including its components and plasti-

cizers. It was hoped that this analysis could provide information and insight to inform future conservation and preservation treatments. For example, information about the presence of specific types of cellulose acetate lamination film and plasticizers could have an impact that would help determine the solvents to use during delamination and environmental conditions to recommend for storage. (See Part 2 of this paper.) After several unsuccessful attempts to dissolve the lamination in acetone alone, as well as in more toxic solvent combinations, the conservator conferred with colleagues. They passed on an oral tradition well known in the early days of the conservation lab at NARA but news to this conservator—to use a mixture of acetone and water in the ratio of 3 parts acetone to 1 part water—and the lamination dissolved quickly. The delaminated cotton gauze was removed from the test beaker, dried, and examined. After delamination the previously yellowed appearance was gone. The gauze was white, clean, and when the solvent and water had evaporated, the fabric was flat.

#### CONSERVATION TREATMENT: PROTOTYPES

The explanation of the result of this solubility test is that as cellulose acetate changes over time, as it oxidizes and becomes brittle, it often loses acetyl groups and becomes less soluble in organic solvents. Acetone alone, the most commonly used solvent for delamination, cannot dissolve deteriorated cellulose acetate. A combination of acetone and a more polar solvent, water, was needed to solubilize this degraded cellulose acetate. Next, all inks, seals, hand stamps, and all other media were tested for solubility with the acetone and water mixture to determine that all materials were safe and would not bleed when immersed in the mixture during delamination. The red ballpoint pen ink was soluble in acetone, but the red annotations were on top of the cellulose acetate film and were not original notations; thus, the inked numbers were not an inherent part of



the record. Therefore, before the solvent bath, the red ink was removed with an abrasive eraser and the remaining pink ink residue was intentionally allowed to bleed with alcohol. Tenacious shadows of ink were removed with tetrahydrofuran, which was quickly absorbed into blotter squares. All other media and seals were found to be unaltered by the solvents chosen for delamination.

1. Each document was immersed in four successive baths of acetone and deionized water in a ratio of 3:1 for 20 to 30 minutes. Pieces of thin supportive tissue, when present, were removed from the front and back.
2. The documents were air dried and then examined for any residue of cellulose acetate. After delamination the documents were tested for pH. All tested in the range of pH 4.5.
3. Each document was immersed in a 50:50 mixture of ethyl alcohol and calcinated water for approximately 20 minutes.
4. Finally, each document was immersed in a shallow bath of calcinated water for 10 to 20 minutes, lightly blotted between Hollytex, and dried between lightly weighted blotters.
5. Resin seals, wafers, and embossed areas were protected during drying with blotters cut to shape.
6. Tears, losses, and fragile or vulnerable areas behind the seals or thick areas of highly acidic and corrosive iron-gall ink were mended and reinforced with Japanese paper and wheat starch paste. Folios separated during lamination were rejoined.
7. Fragile seals crushed during the previous lamination process were consolidated with B-72 in toluene, applied under magnification.
8. The documents were encapsulated in polyester film.

Information written on historic envelopes was photo-reduced and electrostatically copied onto permanent bond paper and adhered to 20-point paperstock folders.

A custom-made box was constructed to hold the records.

As noted above, upon initial examination many of the Louisiana Purchase documents appeared to be in relative-

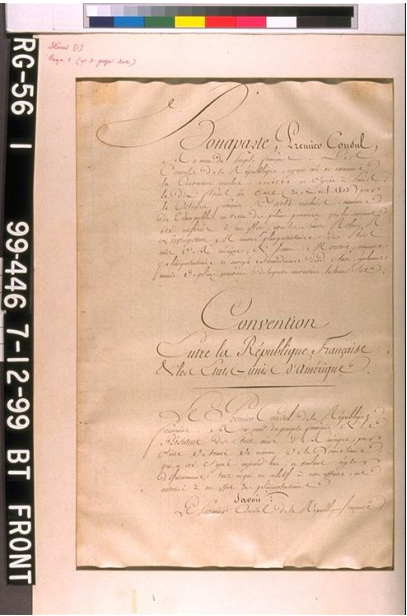


Fig. 7. Louisiana Purchase document, RG 56, page 1, Convention between the French Republic and the United States, April 30, 1803: front, before treatment

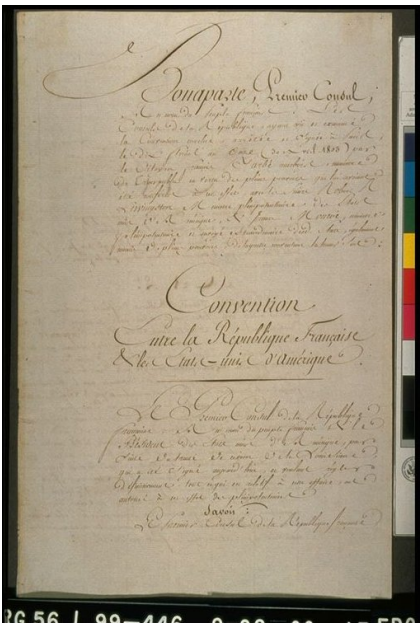


Fig. 8. Louisiana Purchase document, RG 56, page 1: front, after treatment

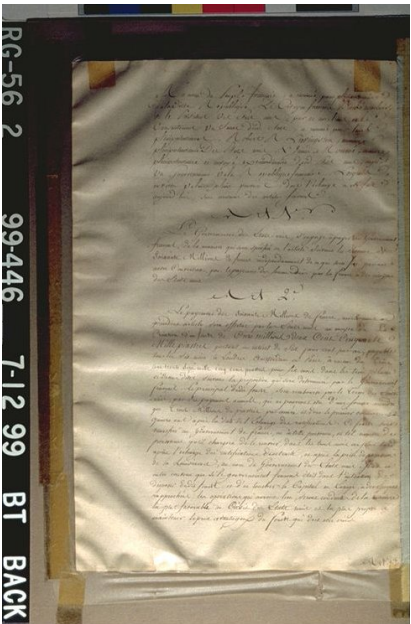


Fig. 9. Louisiana Purchase document, RG 56, page 1: back, before treatment, raking light angle

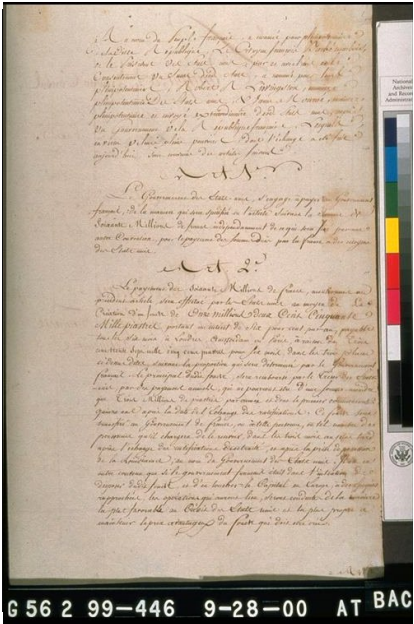


Fig. 10. Louisiana Purchase document, RG 56, page 1: back, after treatment

ly poor condition. But in fact, below the layers of cellulose acetate film and reinforcing sheets of thin tissue, the paper records were found to be intact and the integrity of the paper had been preserved. After delamination, the documents were brighter in appearance and the ink contrast and, thus, legibility, was greatly enhanced (figs. 16–18).



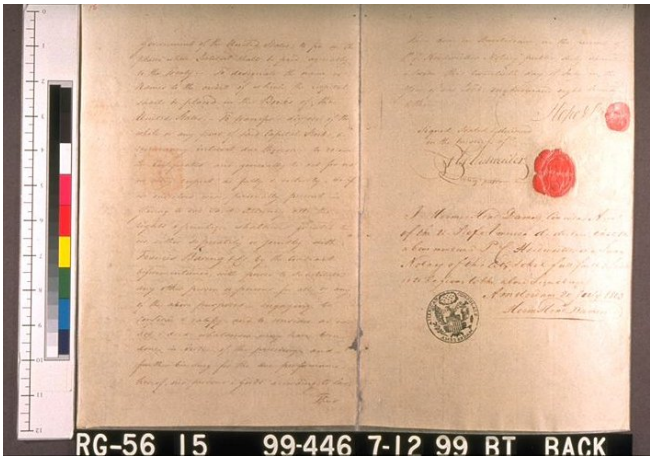


Fig. 11. Louisiana Purchase document, RG 56, page 15, Power of attorney given to Alexander Baring by Hope and Company to act in matters relating to the negotiation of the American fund, July 20, 1803: front, before treatment



Fig. 12. Louisiana Purchase document, RG 56, page 15: close-up of resin seal



Fig. 13. Louisiana Purchase document, RG 56, page 15: after conservation treatment

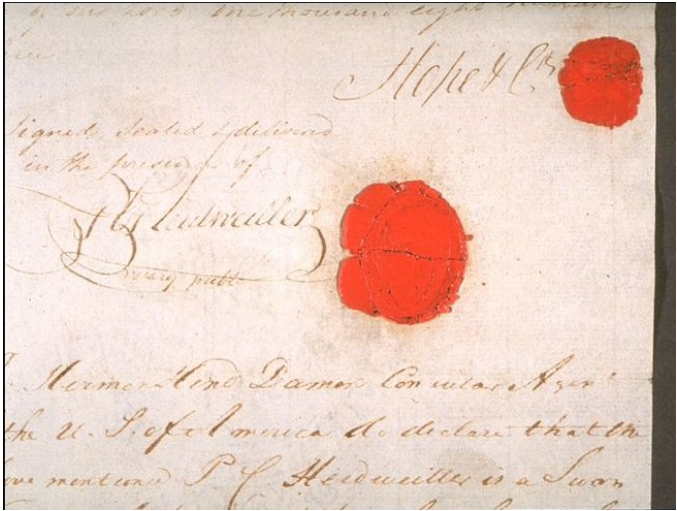


Fig. 14. Louisiana Purchase document, RG 56, page 15: close-up of seal after delamination and consolidation

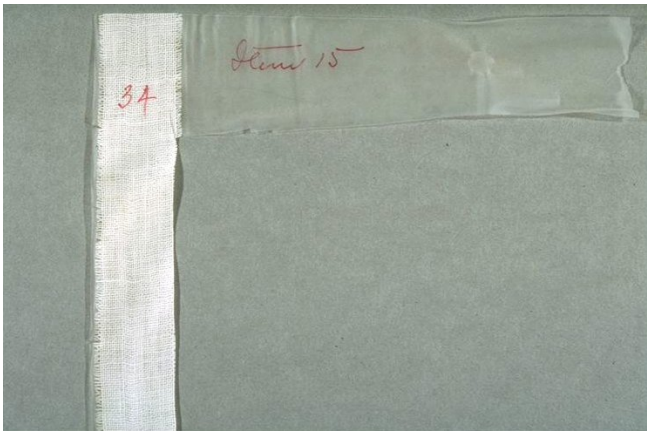


Fig. 15. Non-record material, used for analysis. See Mark Ormsby's article "Cellulose Acetate Lamination at the National Archives, Part 2: Analysis of Laminated Documents Using Solid-Phase Microextraction," pp. 61-66.

Following conservation treatment, a few of these documents were placed on short-term exhibit under low light levels as part of the National Archives' American Originals exhibition.

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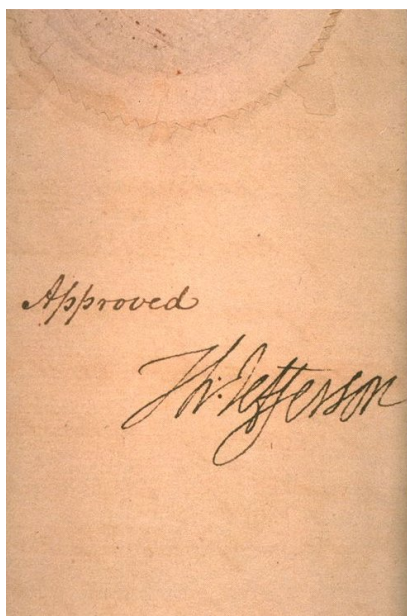


Fig. 16. Louisiana Purchase document, RG 56, page 24, Agreement between the Secretary of the Treasury, Albert Gallatin, and Alexander Baring, approved by the President, Thomas Jefferson, providing for the payment of the fund in four annual installments, December 22, 1803



Fig. 17. Louisiana Purchase document, RG 56, page 24



Fig. 18. Louisiana Purchase document, RG 56, page 15, Power of attorney given to Alexander Baring by Hope and Company, hand-stamped emblem in black ink, American Consulate, Amsterdam, July 20, 1803: after conservation treatment

## Cellulose Acetate Lamination at the National Archives Part 2: Analysis of Laminated Documents Using Solid-Phase Microextraction

### ABSTRACT

To evaluate the condition of a laminated document it is helpful to identify the plasticizers present in the cellulose acetate lamination film. Plasticizers degrade more readily than the polymer, and some are less stable than others. Solid-phase microextraction (SPME) in combination with gas chromatography/mass spectroscopy (GC/MS) analysis is a simple, nondestructive, and sensitive technique for studying plasticizers and other additives in laminated documents. In this project five types of SPME fibers were used to study experimental films that contained various combinations of plasticizers. Laminated documents related to the Louisiana Purchase were also studied. Plasticizers were easily identified as well as the possible degradation products phthalic anhydride and phenol.

### INTRODUCTION

As Susan Page discussed above in the first part of this presentation, the National Archives and Records Administration (NARA) laminated documents from the 1930s to the 1980s. During this time the laminating procedure evolved, including changes in the use of tissue reinforcement and deacidification (Stiber 1988). The formulation of the cellulose acetate (CA) lamination film also varied. At least three different brands of films were used (Gear 1958), and the composition of these may have changed over time depending on the manufacturer's formulation and quality control (Clements 1972).

The main difference between these films and others available was in the type and amount of plasticizers added to lower the softening temperature of CA. Without these additives the heat and pressure needed to melt the film for

lamination would damage the paper. CA lamination film typically contains 20 to 30% plasticizers by weight.

The National Bureau of Standards (NBS, now the National Institute of Standards Technology) conducted several research projects focusing on document lamination beginning in 1933 and culminating in 1959 with specifications for archival lamination films (Wilson and Forshee 1955; Wilson and Forshee 1959a; Wilson and Forshee 1959b). Research by NBS and others showed that some plasticizers are more stable than others. In fact, the plasticizer is typically more susceptible to degradation than the CA polymer (DeCroes and Tamblyn 1952; Shinagawa 1992). Therefore, to evaluate the condition of a laminated document it is helpful to identify the plasticizers present. This information may provide insight into the long-term stability of the document and may affect treatment decisions. For NARA, identifying the plasticizers can also suggest when a document was laminated since the time periods during which different films were used is known.

Fourier transform infrared (FTIR) spectroscopy is a commonly used method for identifying plasticizers (Ballany et al. 1998). Because CA has strong peaks in its FTIR spectrum that can overlap and obscure peaks from the plasticizers, it is often necessary to extract the plasticizers from the document. In addition, many of the commonly used plasticizers have similar spectra, so it can be difficult to positively identify a specific compound. The sample may also contain a mixture of plasticizers and other additives, further complicating the spectral interpretation.

Solid-phase microextraction (SPME) in combination with analysis by gas chromatography/mass spectroscopy (GC/MS) is a convenient alternative method for identifying plasticizers. Invented in the early 1990s, SPME is a simple, sensitive, and economical technique that has become popular in a wide range of applications (Pawliszyn 1998; Pawliszyn 1999; Supelco 2002). In the conservation field it has been used to study pollutant gases and volatile degradation products as well as to screen materials to be used in exhibit and storage construction (Ryhl-Svendsen

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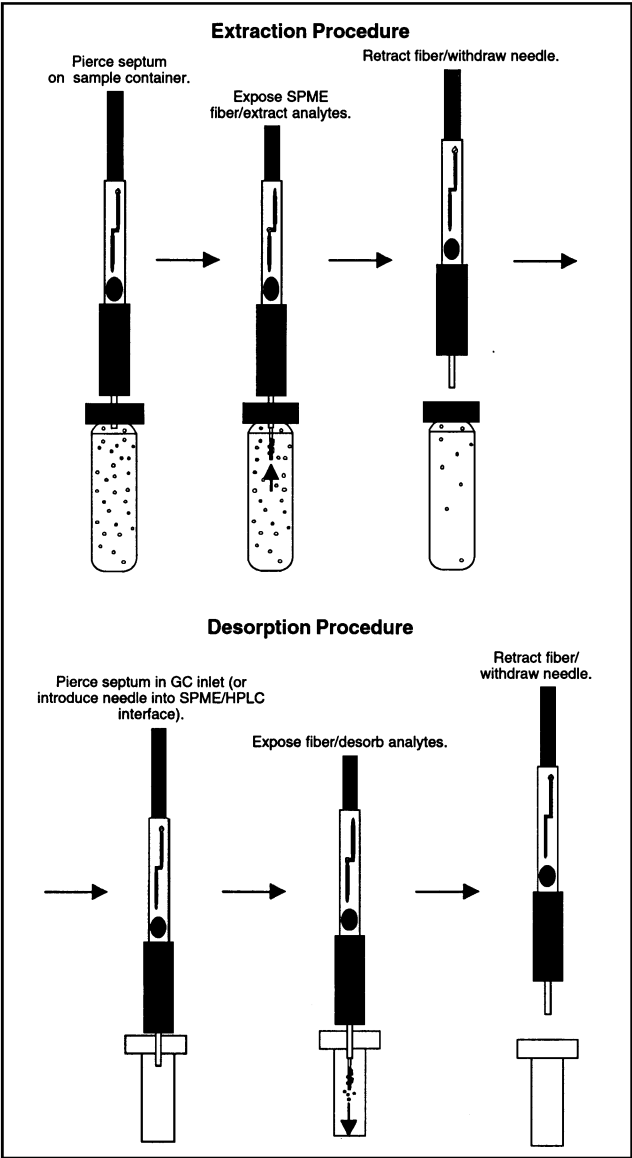


Fig. 1. The plunger of a SPME fiber is pressed to expose the polymer-coated tip to a sample. After a suitable exposure time the fiber is retracted into the protective hollow needle. The fiber is then inserted into the heated injector port of a gas chromatograph (GC). The heat drives off the sample from the fiber into the GC column for analysis. The fiber is then ready to be reused. Figure used with permission of Supelco, Bellefonte, PA.

and Glastrup 2002; Ryhl-Svendsen 2003; Maines 2002). SPME is well suited for conservation uses because samples can often be collected simply and nondestructively.

This paper describes the use of SPME-GC/MS for identifying plasticizers in CA lamination films. Various sampling methods were explored to refine the procedure. Laboratory samples prepared by NBS as part of its earlier research were studied as well as other materials in the collection of the NARA's Research and Testing Laboratory. These techniques were applied to documents from the

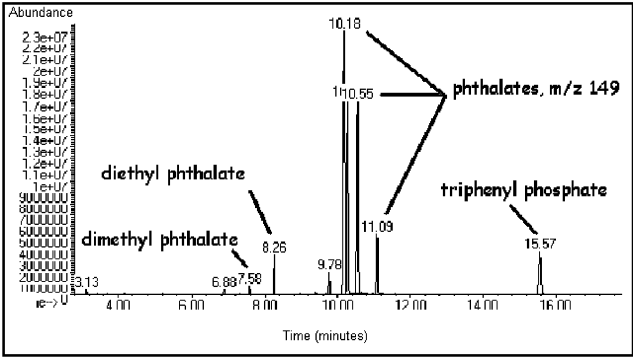


Fig. 2a. The GC separates a mixture of compounds into its components. In this total ion chromatogram (TIC) the peaks correspond to different compounds that emerge over time from the end of the GC column. These peaks are then identified using the mass spectrometer.

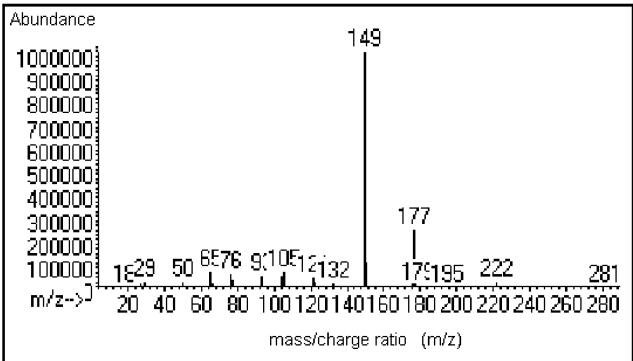


Fig. 2b. The mass spectrum of diethyl phthalate is shown. Peaks in figure 2a can be identified by comparing their mass spectra with a database of reference standards. Diethyl phthalate has strong peaks at m/z 149 and 177 in its mass spectrum. Many phthalates have only a strong peak at 149, so it is difficult to identify them based only on their mass spectra.

Louisiana Purchase that were delaminated as discussed in Part 1.

BACKGROUND

The basic steps of the SPME procedure are illustrated in figures 1 and 2. A SPME sampling device is similar to a syringe with a quartz fiber tip attached to a stainless steel plunger. The tip is coated with a polymer and is shielded inside a hollow needle. When the plunger is depressed the fiber extends, the polymer is exposed, and the sample is adsorbed onto it. After a suitable exposure time (a few seconds to a few hours, depending on the application), the fiber is retracted. To analyze the sample, the fiber is inserted into a GC (high performance liquid chromatography (HPLC) analysis is also possible). The heated injector port drives off the adsorbed compounds, which then flow into the GC column for qualitative or quantitative analysis. The total ion chromatogram (TIC) in figure 2a shows the peaks



Fig. 3. This newspaper was laminated in 1936 during the first run of the presses at the National Archives. The volatile plasticizers in the lamination film were sampled by placing a beaker upside-down on the document and slipping a SPME fiber underneath the lip of the beaker. The PDMS/DVB fiber was exposed for 40 minutes.

from the various compounds that have been separated by the GC column. For this project individual peaks were identified by using the MS to compare their mass spectra (fig. 2b) to a database of standards. Since the fiber has been “cleaned” by heating in the injector, it is ready to be reused.

The SPME fiber can be exposed directly to a liquid, or it can extract volatiles from the headspace above the sample. Both methods were used in this study of plasticizers. Figure 3 shows a simple setup for headspace analysis. A small glass beaker was placed upside down on top of a laminated document. The sample shown is a newspaper laminated in 1936 during the first run of the lamination presses at NARA. The tip of a SPME fiber was inserted under the lip of the beaker, and the fiber was exposed for 40 minutes. The chromatogram obtained from this sample is shown in figure 4.

Phthalates (fig. 5) are commonly used as CA plasticizers (Stannett 1950). Since they are semi-volatile, they are easily detected using the headspace technique. Triphenyl phosphate (TPP), another common plasticizer, is less volatile. To detect it, a drop of ethanol was placed on the laminated document, and the tip of the fiber was inserted into the drop for a few seconds. A drop of water may be used to extract some plasticizers, but

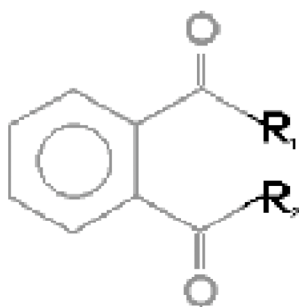


Fig. 5. The general structure of the phthalate family is shown. Phthalates are common plasticizers for CA as well as other plastics.

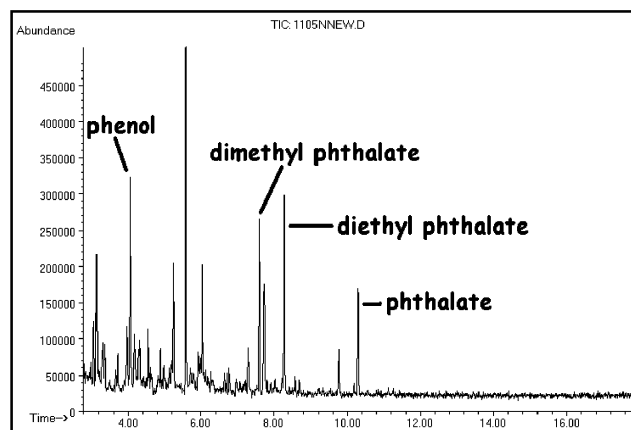


Fig. 4. The TIC from the laminated 1936 newspaper is shown. Several phthalate plasticizers are present as well as phenol. The other peaks are background from the beaker, the fiber, and contaminants.

ethanol was necessary for TPP since it is not water-soluble.

A variety of plasticizers can be found in CA, and several types of SPME fibers are available. To determine which fibers were most effective for extracting the plasticizers a set of lamination films was studied systematically. These samples were prepared by NBS as part of their research programs in the 1950s and are now in the files of the Research and Testing Laboratory.

#### PROCEDURE

Five types of SPME fibers with different polymer coatings were purchased from Supelco (Bellefonte, Pennsylvania). Some fibers are better suited for certain molecular weight ranges, for polar compounds, etc. For this study the fiber types used were: polyacrylate (PA), Carbowax/divinylbenzene (CW/DVB), polydimethylsiloxane/divinylbenzene (PDMS/DVB), polydimethylsiloxane (PDMS), and Carboxen/polydimethylsiloxane (CX/PDMS).

Analysis was performed on a Hewlett-Packard (now Agilent) HP5890/5971 GC/MS with a 30-meter HP5-MS (5%-phenyl)-methylpolysiloxane column. A narrow-bore inlet liner optimized for SPME (Supelco) was installed in the injection port. This was the only modification required to use SPME on the GC/MS system. All the necessary SPME supplies, including three reusable fibers, were purchased for less than \$800.

A splitless injection was made with the injector port at 250°C and the detector at 280°C. The oven was held at 80°C for the first 2.5 minutes, heated at 30°C/min to 240°C, and held at the final temperature for 10 minutes. These program settings were based on various references, including Environmental Protection Agency methods for

the analysis of semivolatiles. Further work will help refine these setting to reduce the time needed for each sample.

As part of its research projects in the 1950s, NBS prepared experimental CA films made with various combinations of plasticizers and other additives. Samples of these films were taken by cutting a small piece approximately 1 square centimeter and placing it in a 10-ml glass vial capped with a PTFE/silicone septum (Supelco). A SPME fiber was inserted through the septum, exposed to the headspace for 10 minutes, removed, and immediately analyzed. This procedure was repeated for five SPME fiber types and various experimental films. To compare the sensitivity of the fibers the area of the plasticizer peaks was calculated using the HP ChemStation analysis program.

These semi-quantitative tests indicated that the PA, CW/DVB, and PDMS/DVB fibers were suitable for headspace detection of the plasticizers dimethyl phthalate, diethyl phthalate, and triacetin as well as phenol, discussed below. These results agree with a study of fiber types used for detecting phthalates in water (Penalver et al. 2000). The PDMS fiber was much less sensitive to phenol. For all four compounds the CX/PDMS fiber had much lower sensitivity. It is excellent, however, for studying the acetic acid that is produced by degrading CA (Rhyll-Svendsen and Glastrup 2002).

As noted above, TPP is difficult to detect by headspace sampling because of its low volatility. It was easily detected along with the phthalates by placing a drop of ethanol on the film and inserting the fiber into the drop for a few seconds.

The procedure was modified for documents and objects from which a sample could not be cut and placed in a vial. When possible, a drop of ethanol was placed on the document. For headspace sampling, a small beaker or petri dish top was placed on the document, and the fiber was slipped under the edge of the cover.

## RESULTS

Figure 4 shows the results of headspace sampling from the newspaper laminated in the first run of NARA's presses in 1936. A peak for phenol is present along with the phthalates. The phenol is probably from the hydrolytic breakdown of TPP (Shinagawa et al. 1992; Glastrup 1995). This reaction occurs more readily in an alkaline environment (Muir 1984).

Figure 6 shows the TICs from two lamination films that were sampled with a PDMS/DVB fiber and an ethanol drop. The upper graph is from a sample of DuPont 88CA48 film that NARA used from the 1940s to 1956. The largest peak could not be identified. Its mass spectrum has a strong signal for  $m/z$  149, which is common for phthalates (George and Prest 2002). Based on the film's type and date, the peak is probably bis(2-methoxyethyl) phthalate

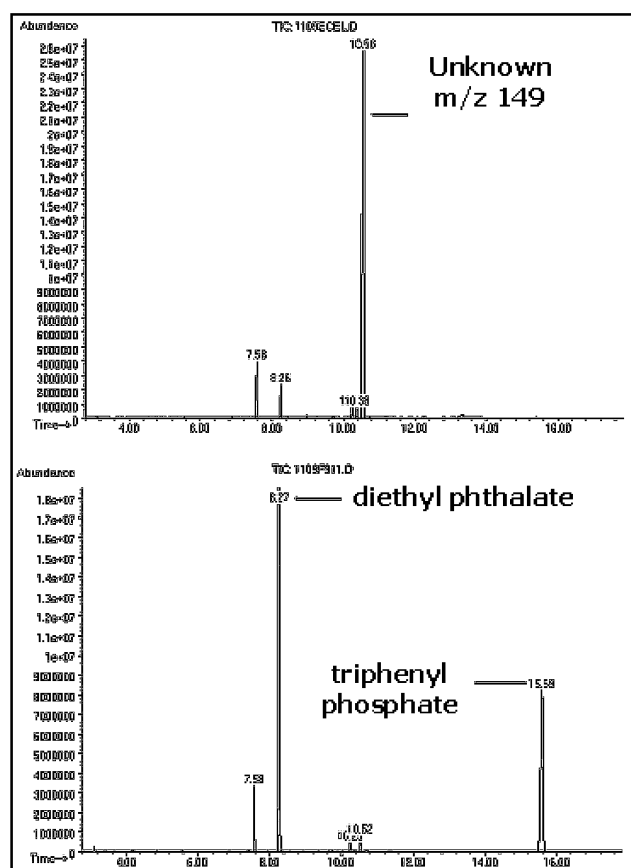


Fig. 6. The upper graph is the total ion chromatogram (TIC) of DuPont 88CA48 film with a large peak that could not be positively identified but which is probably bis(2-methoxyethyl) phthalate. The lower TIC is Celanese P911 film used by NARA after 1956. Both films were sampled with a PDMS/DVB fiber and an ethanol drop.

(Blair 1956; Stiber 1988; Conley 1998). NBS research in the 1950s showed that this plasticizer is vulnerable to degradation. As a result of these studies, NARA switched to P911 film from Celanese Corporation of America in 1956 and continued using this film into the 1980s (Gear 1958). The lower graph in figure 6 shows a TIC from P911 film. The three largest peaks were identified from their mass spectra as dimethyl phthalate, diethyl phthalate, and triphenyl phosphate.

The Louisiana Purchase documents had been delaminated and returned to storage at least one year before being analyzed with SPME. Scraps of CA were retained from the treatment and were sampled using a drop of ethanol. As shown in figure 7, dimethyl and diethyl phthalate were found as well as a number of compounds that could not be positively identified but which probably are phthalates based on the  $m/z$  149 peak in their mass spectra. A small peak from phthalic anhydride was also found in several CA scraps. It is used to synthesize many phthalates (Wilson 1995), and its presence may indicate that a plasticizer is

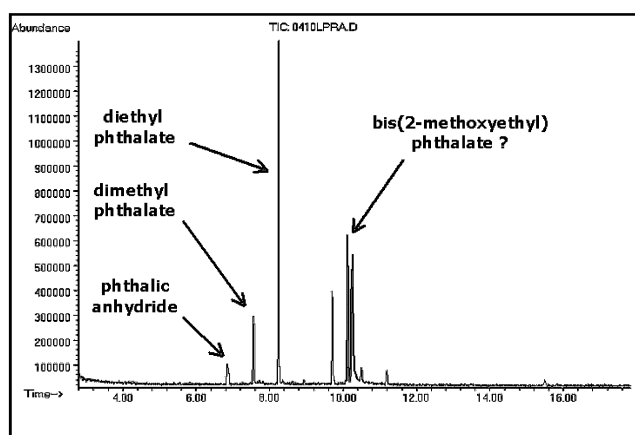


Fig. 7. Scraps of CA removed from some of the Louisiana Purchase documents during delamination were retained for analysis. Dimethyl and diethyl phthalate were present as well as a number of other compounds that are probably phthalates. Phthalic anhydride was also found. Used to synthesize phthalates plasticizers, its presence may indicate that a plasticizer is degrading. The sample was collected using a drop of ethanol and a CW/DVB fiber.

degrading (Shashoua 2001). In this project phthalic anhydride has only been detected in early CA films from the 1930s or in films that exhibited signs of deterioration.

One of the Louisiana Purchase documents was also sampled after delamination. As shown in figure 8, a PA fiber was placed on the document and covered with a top of a petri dish. The fiber was exposed for 75 minutes. The TIC in figure 9 shows that diethyl phthalate and other compounds (probably phthalates) were detected more than one year after the document had been delaminated.

## CONCLUSIONS AND FUTURE WORK

This project demonstrates that SPME-GC/MS is a very useful technique for studying plasticizers in CA laminated documents. The method is simple and sensitive, and data can be collected with minimal risk to the objects. These features make SPME an attractive option for many conservation applications.

Several common plasticizers were easily identified using this approach. Further work is needed to positively identify some phthalates. NARA has recently acquired a new GC/MS system that features positive chemical ionization and retention time locking, techniques that are useful for discriminating among the many phthalates (George and Prest 2002).

The presence of phthalic anhydride or phenol may indicate that certain plasticizers are degrading. This information may be useful in assessing the condition of a laminated document before conservation treatment. Plasticizers were also detected in one document that had already been delaminated. To better understand these



Fig. 8. This document from the Louisiana Purchase collection was analyzed more than one year after delamination. A PA fiber was placed on the document and covered with a glass petri dish. The fiber was exposed for 75 minutes before analysis.

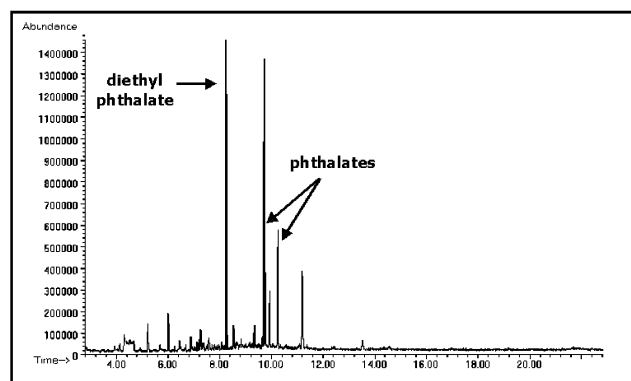


Fig. 9. Phthalate plasticizers were detected in the document shown in figure 8 more than one year after the CA was removed.

results it will be helpful to develop quantitative methods.

The practice of deacidifying documents before lamination did not become a standard procedure until the NBS studies of the 1950s. It would be interesting to explore the relationship between the hydrolysis of TPP and the pH of the document since TPP breaks down more readily in an alkaline environment.

These techniques for studying plasticizers in laminated documents can easily be adapted to many other types of objects and compounds. Thus far, the majority of work with SPME in conservation has focused on gaseous pollutants, but there are many other potential applications for this simple yet versatile technique.

## ACKNOWLEDGEMENTS

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## Considering the Choices for Aqueous Treatments of Iron-Gall Ink: Treatment Decisions in Light of Current and Past Research and the Case of the *Calligraphic Lord's Prayer* at the Colonial Williamsburg Foundation

### ABSTRACT

In 1997 the *Calligraphic Lord's Prayer* was made a gift to the Abby Aldrich Rockefeller Folk Art Museum at the Colonial Williamsburg Foundation. Dating from 1850, this drawing in iron-gall ink on wove paper was given with the stipulation that the work be exhibited although it was in very poor condition. Treatment goals included washing to deacidify, arrest acid-catalyzed hydrolysis, and remove soluble Fe II ions, thereby stabilizing the work so that it could be lined and losses replaced. The final decision to use calcium phytate and calcium bicarbonate solutions evolved over time, as earlier wet treatment proposals, including solutions containing calcium hydroxide and magnesium bicarbonate, were reconsidered. Phytates have been studied extensively at the Netherlands Institute for Cultural Heritage (Reissland and de Groot 1999; Neevel 2001). Calcium phytate complexes both water-soluble Fe II ions and water-insoluble Fe III ions, with the advantage of preventing iron-catalyzed degradation of cellulose (Neevel 1995).

The decision-making process reflects the scrutiny of current guiding principles regarding wet treatment of works executed in iron-gall ink. Our decision was influenced by dialogue with the Netherlands researchers and conservators familiar with the working properties of calcium phytate. As we examined the role of reactive Fe II ion migration in oxidative degradation processes discussed by several researchers, it became clear that we needed to consider this mechanism. The *Calligraphic Lord's Prayer* was extremely fractured and embrittled in media-covered areas, with serious structural losses in the decorative text. In consultation with the curator, the conservators decided that using an unconventional treatment approach was worth the risks. Preliminary testing indicated the greatest

risks would be increased solubility of the ink resulting in a loss of media; the possibility of crystalline phytate precipitates forming on the surface of the medium; and the unpredictable behavior of calcium phytate left in the work after treatment. At the very least the treatment would reduce future ink degradation as well as deacidify the entire document.

In recognition of our discipline's diverse perspectives regarding the treatment of works with iron-gall ink, did we treat this work appropriately in the quest to balance stabilization with curatorial expectations? Did we assign treatment priorities and balance those priorities with risks accurately? Did we choose the "correct" deacidification step, providing stabilization and minor media loss? Did we make a well-informed decision, helping to promulgate new information accurately? This paper examined these issues and presented the results of this calcium phytate treatment on a museum object.

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## Pretty in Pink: The Treatment of a Saint-Mémin Crayon Drawing

### ABSTRACT

From 1796–1810 Saint-Mémin was a prolific artist in Federalist America completing numerous profile portraits of well-known historical figures. Saint-Mémin had a systematic working method that included the creation of crayon drawings and engravings. A crayon drawing with numerous damages came into the National Park Service (NPS) Paper Conservation Laboratory for treatment. The drawing was attached along its outer edges to a wooden strainer and as a result of inherent vice and poor storage, tears were created near the inner edge of the strainer. The paper was surface dirty, stained, and abraded. Treatment options were limited because the portrait was drawn in graphite, black crayon, and white chalk on a pink ground layer. After careful examination and consultation with other conservators and curators, the drawing was removed from its wooden strainer during treatment using the Weidner Moisture Chamber (WMC).

### THE ARTIST

Saint-Mémin, born Charles Balthazar Julien Févret de Saint-Mémin in 1770, came to the United States from France with his father in 1793, a royalist exile during the French Revolution. His family had lost their fortune when the French revolutionary government abolished hereditary nobility (Miles 1994). While Saint-Mémin was exposed to artistic endeavors at a young age and studied art, he received most of his formal training in the French military. However, during his military career he continued to foster a special interest in art and often spent his free time painting and drawing landscapes. When Saint-Mémin first arrived in the United States and settled in New York City he was not a practicing artist, but it was

there that he began to study the art of printmaking and engraving (Miles 1994).

Even though several of Saint-Mémin's early business ventures failed he found his new skills as a printmaker to be profitable enough to support his family. Part of his early work involved making engravings of town plans and buildings for small villages in upstate New York. Through these projects Saint-Mémin became an established engraver which eventually led to a business partnership with a fellow Frenchman, Thomas Bluget de Valdenuit.

Together Saint-Mémin and Valdenuit created a portrait business using a recently invented drawing tool Valdenuit had learned about in Paris called the physiognotrace (Miles 1994). Gilles-Louis Chrétien developed the physiognotrace in the early 1780s. It functioned similarly to a well-known drawing tool, the pantograph. In fact, the physiognotrace was designed by turning a pantograph from its usual horizontal position to a vertical orientation in front of the artist. A sighting device attached to the top bar of the pantograph made the physiognotrace unique (fig. 1). Chrétien used the tool to draw accurate profile portraits that would then be made into engravings and his business was very successful. When Valdenuit moved to the United States profile portraits were gaining popularity. He was interested in the possibility of starting his own portrait business incorporating the use of Chrétien's invention. Saint-Mémin had become an established engraver and had the skills Valdenuit was seeking in a partner. In the partnership, Valdenuit created the drawings and Saint-Mémin transferred the drawing onto a copper engraving plate (Miles 1994).

This partnership lasted a little over a year until Valdenuit moved back to France. During their time as business partners Saint-Mémin observed Valdenuit and learned to use the physiognotrace. Upon Valdenuit's departure he decided to complete the drawings himself and stayed in New York working on his own until he moved his business to Philadelphia. Saint-Mémin

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Saint-Mémin helped to popularize the use of a decorative glazing technique called *verre églomisé*. Black paint and gold leaf were used on the reverse side of framing glass to form the effect of a window mat. He consistently used gilded frames offered in a variety of styles.

#### HISTORY OF THE PORTRAIT OF DR. ISAAC HENRY

Dr. Isaac Henry (1771–1829) was a U.S. Naval surgeon serving aboard the frigate U.S.S. *Constellation* when Saint-Mémin completed a drawing and set of engravings for him in 1802. Dr. Henry married and settled in Virginia shortly after leaving the Navy. In the 1820s the Henrys acquired the homestead now within the boundaries of Manassas National Battlefield Park. After Dr. Henry's death the original Saint-Mémin drawing continued to hang in the family home until the Civil War Battle of First Manassas (Bull Run) on July 21, 1861.

During the Battle of Manassas Judith Henry, Dr. Henry's widow, was killed and the Henry House was damaged. The surviving family members were forced to abandon their home taking the portrait drawing with them. The portrait remained with the family at a local farm until a new house was built in 1870. In 1922, Arthur L. Henry, grandson of Isaac, sold the property to the Sons of Confederate Veterans who established a museum in the Henry House as part of the Manassas Battlefield Confederate Park. The family loaned the portrait to the museum for display, but when dissatisfied with the way the portrait was being cared for, requested its return in the 1930s. In 1939, ownership of the Henry farm was transferred to the Federal Government and the following year Manassas National Battlefield Park was established. While park staff had knowledge of the portrait from available records, they were unable to locate the artwork.

The portrait was not seen again until 1998 when the executor of the estate of Edward Newman Henry, great-grandson of Dr. Henry, offered the portrait and other family heirlooms to the park. At this time it was bequeathed to Manassas National Battlefield Park for inclusion in its museum collection (Burgess 2003).

#### CONDITION

Unfortunately the drawing was severely damaged from a combination of inherent vice and improper handling and storage before the park acquired it. It was structurally unstable and much of the damage was visually distracting.

The drawing came to the NPS Paper Conservation Laboratory in a gilt frame with glazing (fig. 2). The framing package was carefully documented prior to removing the drawing. The style of the frame was compared with others used by Saint-Mémin and was examined by NPS



Fig. 2. Portrait of Dr. Isaac Henry, Saint-Mémin, 1802, black and white crayon and graphite on laid paper, 57.1 cm by 38.1 cm, Manassas National Battlefield Park cat. no. 22009; before treatment

wooden objects conservator Al Levitan. We concluded that the frame was most likely original to the drawing, as it was consistent in style and materials. However, the glazing looked distinctly modern. It did not have any of the visual characteristics of old glass nor did it have a decorative *verre églomisé* mat as would be expected for most Saint-Mémin drawings. Linear scratches and abrasions on the surface of the drawing indicated that the original glazing had probably broken in the past and been replaced. There was no mat or spacer between the surface of the drawing and the glazing. The drawing was backed with a piece of heavyweight paper and a wooden slat backing secured with modern nails.

Once the drawing was removed from its frame we could see many of the characteristics associated with Saint-Mémin's working style. The drawing was on a medium weight laid paper with a pink ground layer and was attached along its edges to a lap-joined wooden strainer. The paper measured 57.1 cm by 38.1 cm and was slightly smaller than the outer dimensions of the wooden strainer. The graphite outline of the sitter's profile drawn by the physiognotrace could be easily identified. A combination of black crayon and white chalk were used to define the sitter's features.



Fig. 3. Detail before treatment and removed from the frame

The paper was very brittle, discolored, and a light gray surface grime was visible overall. Dark brown flyspecks were found throughout the drawing, but were concentrated in the upper right corner. Because the drawing was only attached to the wooden strainer on its outer edges, severe tears had developed along the inner edges of the strainer. One horizontal tear measured over 30 cm in length and the left side margin had completely detached. Some small losses were associated with the tears and others were a result of insect grazing.

Stains disfigured the image. Contact with a liquid had caused dark gray tidelines that extended the entire length of the sheet. Many of the tidelines intersected the image. The liquid had also caused the pink ground layer to be displaced and lost in numerous areas. These areas exposed the color of the paper below and often appeared brighter than the rest of the sheet (fig. 3).

#### TREATMENT METHOD DEVELOPMENT

The park curator wished for the object to be stabilized and aesthetically improved to make the image more readable. NPS paper conservator Nancy Purinton and I agreed with the treatment objectives, but we were concerned about jeopardizing the safety of this very fragile object during treatment. Most of the treatment could not be performed without removing the wooden strainer. This endeavor would be challenging, since research and consultation proved that the strainer was probably original and should ideally be retained after treatment.

We sought out the expertise and advice of other conservators and curators who had worked with Saint-Mémin drawings to assist us in making treatment decisions. The head conservator at Colonial Williamsburg Foundation (CWF) Pamela Young was contacted because she had treated several drawings in the CWF collection. Some of the portraits had damages similar to the NPS drawing and she had performed tests to remove the drawing from the

strainer. During spot testing she found the adhesive that attached the drawing to the strainer was an animal glue (Young 2003). This prompted us to perform a water drop test on our adhesive and found it to be soluble. As a result of this test, visual examination, and positive result for the existence of proteins using the Biuret test it was confirmed that the adhesive was also an animal glue (Browning 1977).

The curatorial and conservation staff at the National Portrait Gallery (NPG) allowed us to view several of their Saint-Mémin drawings. The condition of their portraits seemed almost pristine compared to the NPS drawing and had never been removed from their strainers. Seeing the drawings close to their original appearance made us more confident in our decision to attempt the removal of the NPS drawing. When comparing a number of drawings side by side a range of tone in the pink ground layer from a warm, bright pink to a cooler, blue-gray pink was apparent. Susan Barger and Deborah Mayer had analyzed samples of the ground layer from several Saint-Mémin portraits. Their results indicated the presence of red lead and vermilion (Miles 2003). To obtain the identification of the pigment present in the ground layer of the NPS drawing, a sample was taken from an area on the reverse. NPS conservation scientist Judith Bischoff performed analysis using polarized light microscopy and Fourier-Transform Infrared Spectral (FT-IR) analysis. The results were consistent with the properties of red ochre. This was not surprising since Saint-Mémin was an itinerant artist for part of his career and this probably resulted in his using a variety of locally available materials.

#### EXPERIMENTATION AND TESTING TO REMOVE THE WOODEN STRAINER

Preliminary testing had proved the adhesive to be water soluble and we hoped to remove the drawing with the local application of moisture. The use of small humidity chambers was the first method chosen for testing. After three hours using this type of humidification the adhesive had not softened enough to allow for the release of the drawing paper. Next small, local Gore-Tex packages were introduced which gave the same unsatisfactory results. In order to apply a greater amount of moisture, water was applied with a small brush and was wicked under the drawing. This allowed for a small corner of the drawing to be released, but revealed several concerns. The paper needed to be very wet for the adhesive to release causing the paper to expand and split at the wet/dry boundary. Once the areas were allowed to dry, tidelines were visible. In hopes of creating a more gradual transition along the wet/dry boundary steam was locally applied to the edges. The steam worked too quickly and could not be adequately controlled.

Since methods for the local application of moisture had been exhausted we began exploring overall humidification.



The standard design for a temporary humidity chamber incorporates a deep-walled tray that houses the object and the humidity source with a Plexiglas covering. Our concern regarding this option was maintaining a high and constant level of humidity while still providing adequate access to the object. The Plexiglas top would need to be removed for access to the object, allowing much of the built-up humidity to be lost and creating a potential for the drawing to dry out. Since the drawing would be very vulnerable to damage from handling when humidified we wanted to be able to release the drawing with minimal movement. We anticipated the walls of the humidity chamber would prove cumbersome while working on the drawing.

Since the results of our investigation into a temporary moisture chamber were not desirable we explored the use of a Museum Services Corporation (MSC) Moisture Dome. The MSC Moisture Dome seemed to have added design features, which would accommodate our treatment needs, such as side portals to access an object being humidified. Although the concept of the portals is valid, the amount of mobility inside the dome did not seem sufficient. Another attractive addition was that MSC Moisture Domes are normally fitted to the dimensions of a suction table, allowing for future treatment steps such as bathing to be performed inside the dome. Unfortunately, the suction table in our paper lab is quite large, much larger than the space needed to treat the modestly sized drawing. The dome seemed to be an inefficient use of space in terms of treatment and within the lab. Looking at other design elements of the MSC Moisture Dome we noticed it provides humidification through only one opening at the end of the dome. This could be a problem for achieving the even humidity distribution we desired.

On the advice of NPG paper conservator Rosemary Fallon, we contacted Marilyn Kemp Weidner, a pioneer in the field of paper conservation. Marilyn had treated Saint-Mémin drawings in the past and had used her patented Weidner Moisture Chamber (WMC) to remove the drawings from their strainers (Weidner 2003). We discussed her previous treatments and were pleased to hear the capabilities of the WMC.

In the WMC an ultrasonic humidifier attached to one side of the chamber creates a very fine mist. The WMC directs the source of moisture throughout the chamber by a series of attached plastic tubes. One tube directs the mist into the chamber and then splits to form a “ring” of adjoined tubes along the inner sides of the chamber. The tubing has intermittent holes, which evenly releases the mist. The sides of the WMC have large hinged panels that can be opened for access to the object allowing us to work inside the chamber while maintaining high humidity. We predicted the amount of space provided by the side panels would allow two conservators to work simultaneously on

the object as warranted. Like the MSC Moisture Dome, the WMC comes equipped with a specially designed suction table that fits into the bottom of the chamber, but was available in a size more appropriate for the dimensions of our drawing.

The unique characteristics and design elements of the WMC seemed the most viable and safe option for the treatment of the Saint-Mémin drawing. We asked Marilyn if she would assist us with our treatment since she had such valuable experience. Marilyn agreed to work with us and even offered to bring a prototype model of her moisture chamber for use in treatment.

#### TREATMENT

Before the drawing was humidified flyspecks were reduced mechanically with microspatulas and scalpels. Cotton swabs and small brushes were used to attempt the reduction of surface grime, but this step displaced the media and made the surface texture appear slightly glossy in raking light. Even if a certain amount of change in the surface texture was deemed acceptable the surface cleaning did not greatly affect the appearance of the overall gray tone. For these reasons all further surface cleaning efforts were halted.

The drawing was now ready to be placed inside the WMC. Because the drawing was so vulnerable, the original wooden backing board was left on the reverse of the drawing to support it inside the chamber. The humidifier was turned on and the mist filled the chamber (fig. 4). Marilyn commented that when she had treated Saint-Mémin drawings in the past it took several hours of humidification in the WMC for the adhesive to swell and the drawing to be safely released. Moisture had only been introduced to the NPS drawing for approximately twenty minutes before the adhesive was soft enough to allow for the release of the drawing. This time discrepancy could be the result of various factors including the amount of adhesive used, its formulation, or its level of degradation.

To remove the drawing from the strainer, Te flon spatulas were carefully inserted under the edges of the paper and Hollytex was inserted under the released areas to prevent reattachment (fig. 5). All work was performed inside the WMC and the drawing was fully released in about ten minutes. The drawing suffered no additional damage during its removal from the strainer and was placed on a piece of Hollytex and blotter to dry (fig. 6). Once the drawing was dry the media proved to be only very slightly friable, allowing us to turn the drawing facedown onto a smooth piece of Hollytex to reduce the residual adhesive on the reverse. Microspatulas were used to mechanically remove heavily applied areas of adhesive. Residual adhesive was reduced using cotton swabs moistened with deionized water. The tears were then aligned and mended on the





Fig. 4. Drawing being humidified in the Weidner Moisture Chamber

reverse using wheat starch paste reinforced with thin strips of Japanese paper.

Since the paper was very discolored and there were numerous tidelines throughout the drawing, the suction table in the moisture chamber was used for bathing. Most of the bathing was performed using the gentle mist supplied by the humidifier, but select areas of staining required the use of more moisture. In those cases a side panel was opened and a dahlia sprayer supplied additional moisture. The bathing process allowed the paper to regain some of its flexibility and the overall tone of the paper on the reverse was lightened. Unfortunately, many of the tideline stains on the front were not reduced.

Because the paper was still vulnerable to further damage, we decided to line the drawing with a *tengujo* Japanese paper adhered with wheat starch paste. The WMC was used to gently humidify the object before lining and once the lining was attached, the suction table inside the WMC was used to ensure good contact between the drawing and the lining paper.



Fig. 5. Detail of drawing being released from the wooden strainer

Small losses to the paper support were filled with a toned cellulose powder adhered with wheat starch paste. The drawing was now more structurally stable but the



Fig. 6. Marilyn Kemp Weidner with the portrait after it was released from the wooden strainer



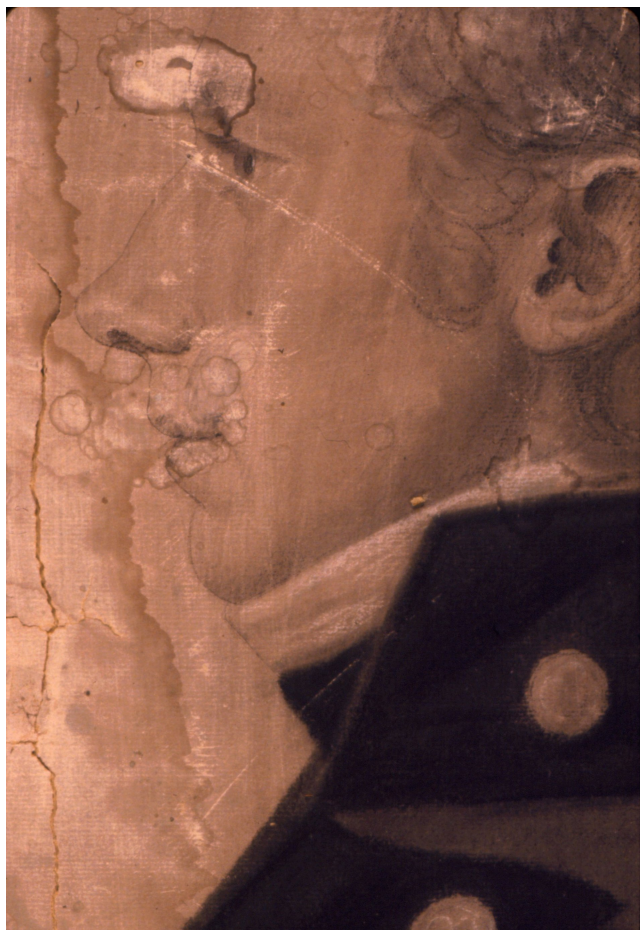


Fig. 7. Detail before treatment

image legibility needed improvement. The drawing was very mottled overall and had a rough, matte texture. The areas of loss in the ground layer were isolated with methyl cellulose and then inpainted with a combination of Winsor & Newton watercolors and Rexel Derwent pastel pencils. Some of the tidelines crossed throughout the sitter's forehead and nose and were visually distracting. They were very dark and could not be successfully overpainted. Viewing the tidelines under magnification revealed they were composed mostly of surface dirt and debris. Since we felt confident we would only be removing a minimum amount of media we decided to carefully reduce the tidelines using the gentle mechanical action of a cotton swab. Some of the darker, heavier tidelines were further reduced by gently scraping with a microspatula. These areas now appeared slightly lighter than the surrounding paper tone and were inpainted with the same combination of media mentioned above (figs. 7–8).

The treatment was now complete and the drawing was ready to be rehoused for exhibit. It was hinged into a museum-quality sink mat with Japanese paper and wheat starch paste. The walls of the sink mat were hinged so they could open for easy access to the drawing in the future. A



Fig. 8. Detail after treatment

black window mat was cut to resemble the *verre églomisé* decoration Saint-Mémin typically used in his framed works. The modern glass was replaced with UV Plexiglas. Although Plexiglas is not normally used to frame crayon drawings we felt it was appropriate in this case because the media had proved to be secure, the drawing was to be transported, and its storage conditions in the future may not be ideal. A sealed package was created using 3M No. 850 polyester-based tape and a layer of Mylar on the reverse. It was then placed in its original frame (fig. 9).

After a temporary exhibit, the drawing will be placed in storage. A good quality photographic reproduction of the image and reproduction frame will replace it permanently on the wall in the Henry Hill House. The original strainer and backing board will accompany the drawing in storage, but were housed in a separate sink mat.

#### CONCLUSION

The goals of this treatment, which at first seemed daunting, were made attainable by the WMC. The WMC provided the desired amount of humidity and access to the drawing during treatment. If not for the use of the WMC,



Fig. 9. After treatment housed in original frame

the full treatment would not have been possible. We were able to successfully stabilize and aesthetically improve a very damaged drawing to reflect its original beauty.

#### ACKNOWLEDGMENTS

First, I would like to thank NPS paper conservator Nancy Purinton for her help and support during treatment and in writing this paper. Fondest thanks go out to Marilyn Kemp Weidner for her expertise, the thoughtful loan of her moisture chamber, and her constant devotion to the field of conservation. Sincere appreciation goes out to Ellen Miles, Rosemary Fallon, and Emily Jacobson at the National Portrait Gallery. Ellen Miles' wonderful *catalogue raisonné* of Saint-Mémin made his life and work easily accessible. Thanks to Pamela Young for her constructive conversations, Dr. Judith Bischoff for her analytical work, Jim Burgess for a synopsis of the history of the drawing, and Hugh Shockey for the wonderful rendering of the physiognotrace.

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## Similar Problems, Different Solutions: Treatments of Two Mexican Incunabula Part 1: Treatment of a *Psalterium*

### ABSTRACT

Two volumes printed by Mexico's third printer, Pedro Ocharte, have recently received conservation treatment and exemplify different treatment approaches. One volume, a *graduale* printed in 1576, is held by the Library of Congress and received a "full treatment," or disbinding, washing, and rebinding. The other volume, a *psalterium* printed in 1584, is held by the Benson Latin American Collection at the University of Texas at Austin (UT) and received treatment to stabilize the binding and text block in a minimally invasive manner.

### INTRODUCTION

In book conservation, a few of the guiding factors in making a decision on how to treat an object are the condition of the volume, the value and history of the text block, and the value and history associated with the binding. Treatment choices sometimes reflect a high priority on preserving the text block, which may mean the binding must be altered. However, at other times the necessity of preserving the binding places limitations on the treatment of the text block. Evaluation of a book and the determination of a treatment, given all these considerations, is one of the greatest challenges in book conservation.

I treated a *psalterium* printed by Pedro Ocharte in 1584 as part of my final semester of coursework in the Preservation and Conservation Studies Program at the University of Texas at Austin (UT). My treatment decisions were based on the findings of my research into the history of printing in Mexico, the history of religious texts, and physical evidence found in the volume itself.

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### DESCRIPTION AND CONDITION

In 1939 the Benson Latin American Collection at the University of Texas at Austin acquired the *Psalterium*, *An[t]iphonarium Sanctorale cum Psalmis & Hymnis*, printed in 1584, as part of the collection of Joachim Icazbalceta, an avid collector of early Mexican imprints. The *Psalterium* was selected for treatment because previous paper mends were causing damage throughout the text block.

The *Psalterium* (fig. 1) is bound in reddish-brown, vegetable-tanned sheepskin over shaped, quarter-sawn oak boards with leather clasps on the fore edge. Blind-tooled lines are faintly visible on the spine around the sewing supports and the sewing supports were laced into the boards. All of the sewing supports were intact along the back joint, but most had broken along the front joint. Parchment patches between each support partially lined the spine but did not adequately cover the spine to provide optimum support. An endband channel was found on the upper board, but not the lower board, and there was no evidence of a sewn endband in the text block.

The text block is cream, handmade, antique laid paper that varies between medium- and heavyweight. No watermarks were visible. Wax was found on several pages and a few pages had a visible layer of gray specks that felt gritty, and could have been from incense (fig. 2). The text block had been severely and unevenly trimmed, sometimes

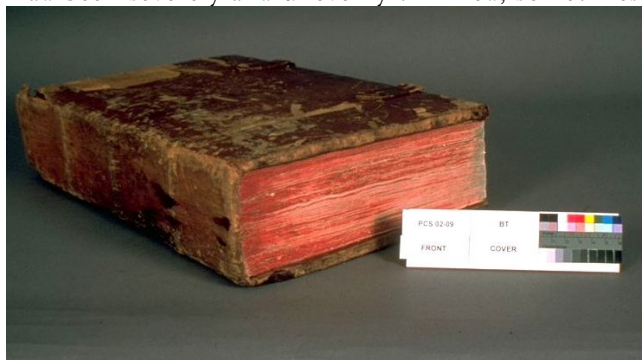


Fig. 1. Before treatment, whole volume



Fig. 2. Example of wax that had dripped onto the pages during use



Fig. 3. Tear mended with glassine tape and linen sewing thread

were present throughout, probably due to the failure of the spine linings. Media present in the text block were black and red printer's ink, cochineal, iron-gall ink, and graphite.

The volume was sewn at least four times. Three of the four times, supports of alum-tawed thongs or coarse twine were utilized and the sewing was all-along. The fourth time the volume was sewn, sections of text were whip-stitched together. Types of thread used differed each time and included thin linen thread, medium-weight hemp cord, and thick hemp cord.

Large quantities and several types of paper mends were present. The types of mends included sewing (with linen or green silk thread), glassine tape, or multiple layers of text-weight paper (fig. 3). In some places, the text-weight paper mends were four layers deep. Most of the mends had been applied without regard to aesthetics, but some mends had been shaped around the text. Pages were breaking at the transition point between the thick, stiff mends and thinner, flexible pages (figs. 4–5). Insertions were also found throughout the volume; some pages had one third of the page removed and a new section inserted with carefully hand-drawn staff, notes, and verse (fig. 6).



Fig. 4. Verso of title page breaking due to multiple layers of mends



Fig. 5. Close-up of title page break

After examining the volume, I examined its history. I wanted to answer the following questions: (1) What was the history of printing in Mexico? (2) Who might have used this volume? (3) Who might have bound this volume? and (4) Who mended the volume?

#### HISTORY OF PRINTING IN MEXICO

Printing in Mexico was established in the sixteenth century. Documentation, both legal contracts and volumes printed, is in existence which demonstrates that Juan Pablos began printing in Mexico in 1539, but some evidence exists that a press and printer were operating in Mexico City in 1534.

The Spaniards conquered Mexico in 1522 and Cortez requested that the King of Spain send holy men to New Spain "whose lives might be a fitting commentary on their teaching" (Prescott n.d., 123–4). In answer, Juan de Zumarraga was sent to Mexico in 1528. In 1533 Zumarraga returned to Spain and was consecrated as bishop. He returned to Mexico in 1534 and evidence suggests that he took a printing press with him because he realized that converting the natives to Christianity would be easier if books were printed in their native language.

Dispute over the arrival of the first press remains though, as others have written that the first press was taken





Fig. 6. Example of one hand-drawn insertion

to Mexico by Viceroy Mendoza in 1535 when he arrived to begin his duties in New Spain. Clearly though, a press was in Mexico and in use in 1538 when Zumarraga wrote to Charles V stating, “Little progress can be made in the matter of printing on account of the scarcity of paper” (Hanson 1954, 3). Whether the press to which Zumarraga refers arrived in 1534, 1535, or another year is unclear. The only possible conclusion is that at least one press was being utilized but possibly two.

If a press did indeed exist in the city in 1535, it would have been put to use and not left idle. Substantial evidence exists that Esteban Martín, a master printer, was in Mexico in 1534 and thought to be working between 1535–38. He was made a citizen of Mexico City in 1539, which means that he must have been a resident there for several years prior to 1539. However, if he was printing from 1535–38 nothing remains of his work. His presence in Mexico City, though, may explain a puzzling fact about the agreement between Juan Pablos, the accepted first printer of Mexico, and Juan Cromberger, Pablos’s employer, when establishing another press in Mexico City.

Juan Pablos was an employee of the Cromberger printing house in Seville, Spain, in the sixteenth century. Cromberger was the leading printer in Spain and decided he would open a print shop in New Spain as a branch of that in Seville. This decision was solidified when Bishop Zumarraga enlisted his aid in printing a catechism in Nahuatl, the native language of New Spain. Cromberger began the job in Seville, but realized daily contact with native speakers in New Spain would produce a better book. Therefore, he signed a ten-year contract with Juan Pablos to set up a print shop in Mexico City. Pablos began printing in Mexico City in 1539 with an edition of the booklet *Breve y Mas Compendiosa Doctrina Christiana*.

The contract between the Cromberger printing house and Juan Pablos is very detailed but presents one puzzling stipulation: that Pablos must print three thousand sheets each day. Many suggestions have been given that would

account for such a high number, as documentation exists for the daily output by pressmen of that time. Daily averages ranged from 107–167 sheets for one pressman to 655–1725 sheets if two pressmen were working together. Therefore, three thousand seems an exorbitant requirement. Possible explanations include scribal error or the substitution of *sheet* for *impression*. Both seem implausible because (1) the entire document was very carefully written so one scribal error of this magnitude seems unlikely and (2) a document written by two experienced printers would not be likely to substitute two words that have vastly different connotations. One explanation does make sense. If Cromberger wanted to ensure that his press would operate at maximum capacity, it is possible that he wrote (and meant) that it should produce three thousand sheets a day because he knew of the press being operated by Martín. He may also have intended to lure the pressmen from that operation into his own.

Regardless of the answers to these questions about the history of printing in Mexico, the one thing that remains certain is that the early printers worked closely together and were reliant upon each other. Cromberger died soon after the establishment of his branch in Mexico City, but Pablos continued to operate it. In 1548 he applied for and received from the Viceroy of Mexico the exclusive privilege of printing in Mexico for the next six years. One of the original agreements with Cromberger was that any worn-out type would be melted down, not sold off, in an effort to reduce competition. (This agreement may also point to the existence of an earlier printing press in operation if competition was a consideration.) After ten years of printing the type had worn down and Pablos had to decide whether to import new type or hire a type founder. He chose the latter. Antonio de Espinosa, a type founder in Seville, was enlisted and agreed to move to Mexico City and enter the employment of Pablos. He took with him Diego de Montoya and both agreed to cut and cast type for the print shop. Espinosa returned to Spain in 1559 in hopes of securing the right to print in New Spain. He was granted this privilege and is now considered the second printer of Mexico.

Pedro Ocharte, the printer of the *Psalterium*, followed Espinosa as the third printer of Mexico. Ocharte was born in Rouen, France, in 1532 as Pierre Charte. He worked as a merchant with his father before moving to Mexico and marrying the daughter of Juan Pablos, soon after Pablos’s death. The widow of Pablos rented two presses to Ocharte along with type, images, and adornments in 1563, and thus Ocharte became the third printer in Mexico.

The Mexican Inquisition was at its height during this time and Ocharte, who printed several religious texts, was accused of speaking out against the Pope and printing books that contained Lutheran statements against the veneration of saints. He was imprisoned for this reason from

1572–74, but managed to continue to conduct business from jail with help from his wife. The *Psalterium* was printed ten years after his release from jail, but one may imagine that Ocharte was careful to print only material that would be approved of by the Pope and religious orders in Mexico City. In fact, the whole title of the volume, *Psalterium, Antiphonarium Sanctorale, cum Psalmis, Hymnis, positis in suis locis propriis uniuscuiusque, diei sexti totius anni, nunc primo cum licentia excussum*, translates as “A Psalter, and Antiphonal with Psalms and Hymns, placed in their proper position, on the sixth day of the year, now for the first time selected with permission.” There is some debate about the etymology of the word “licentia” in medieval Latin. The last phrase could then read either “selected with permission,” or “boldly selected” (Prince 2003).

#### JESUITS IN MEXICO

Determining a specific Christian religious order to which the Antiphonal belonged was difficult. Two professors in the department of music at the University of Texas at Austin with expertise in sixteenth-century Latin American and Spanish liturgical music examined the volume. After examination of the text, they were unable to assign it to any specific order.

However, a thesis on the *Psalterium* written in the 1970s concluded that Jesuits probably commissioned such a piece. The conclusion is due to an inscription that appears at the end of the Saints’ Office that ends with, “beatissime Ignatij martyris.” Three Ignatii were on the Roster of the Venerable in 1584, but because the Ignatius mentioned is called a martyr, two of the Ignatii can be eliminated, and Ignacio de Azevedo is the only choice left. He was an influential Jesuit in the sixteenth century and a missionary in Brazil. Azevedo became a Jesuit martyr when a ship he was on was raided by pirates and all aboard were brutally murdered. Such brutality would have left an indelible impression on the Jesuits, so making him a martyr and printing such a dedication as is found in the *Psalterium* would have been plausible.

Another strong indication that the Jesuits may have been responsible for commissioning the *Psalterium* is that they needed religious texts for the schools they had established: the Collegial Seminary of San Pedro y San Pablo, San Ildefonso, and the Colegio Máximo. All were well established by 1582. The numbers of students eligible and enrolled in these schools increased from three hundred students in 1574 to eighteen hundred students in 1583. With such growth in schools, printing an edition of the *Psalterium* does not seem unreasonable, since the books would have been used in schools as well as churches. But, despite these arguments, the evidence substantiating Jesuit connections must remain inconclusive.

#### LITURGICAL BOOKS

The questions regarding who bound this volume and repaired it are still unanswered; not having an answer influenced my treatment decision. I read about books used in liturgical services and found that an antiphonal (contained in this *Psalterium*) contains the chants used for the Office, or eight daily rounds of prayers. Conversely, a gradual contains the chants used in the Proper of the Mass, or that portion of the Mass which includes Communion, the holiest portion of a service. This understanding meant that the *Psalterium* I treated was not used for Mass, or the most religious portion of a service—one possible explanation for the plain binding. If time and materials were limited, it seems plausible that they would have been spent on a text containing the Mass.

The question of who might have mended the volume still remains, but if the volume was used in a school setting, perhaps students were responsible for mending the religious texts. Or, perhaps the church or school had a set schedule for cleaning the church, mending the *Psalterium*, washing the windows, etc. This theory would certainly explain the various styles of mends, especially if those duties rotated among the members.

#### BOARDS AND INSERTIONS

The boards probably came from a previous binding, as not all the lacing channels line up with the sewing supports and the endband channel is present only in one board, at one end. After my treatment was complete, I had the opportunity to have the *Psalterium* scanned by a professor in the geology department at UT; I found that another set of holes exist on either side of the present clasps. These holes seem to indicate that the clasps were in a different position prior to the present location and raised another question: where are the boards from? Did early Mexican binders make their own boards, or was it possible that the Spanish government, in shipping binding supplies to Mexico, also shipped boards from old Spanish bindings to be reused?

The insertions were intriguing, due to the care taken in blending them in stylistically. Perhaps they were nothing more than a cheap method of creating cancels for the text block. The normal method of printing cancels and inserting them may have been too costly and this method may have proved more expedient. Or, perhaps different parishes inserted their own individual prayers for local saints and martyrs, and could not have had them printed individually. Regardless of the answer, the insertions provide an integral part of the history of the volume.

My research yielded an appreciation for the *Psalterium* in its current condition. As I sifted through the history of printing in Mexico, Ocharte’s life and imprisonment, and the history of treatment of the volume, I decided that a

minimally invasive treatment would benefit both the volume and future researchers.

#### TREATMENT

I decided to treat only those sections of the *Psalterium* that were under the most stress, specifically those at the beginning and end of the text. My decision was based on the following: (1) the mends provide documentation of the history of the book's use over time; some of the mends were now integral parts of the text—namely those that had been inserted to replace text originally cut out and containing hand-drawn portions in the style of that printed; (2) the mends in the middle of the text were not placed under the same strain; if the spine were relined in such a manner as to support the opening, those mends would cause less damage; (3) if middle sections were removed and conserved, treatment might have interfered with the interlocking nature of the volume—any change in the page dimension might result in damage to the edges or change the action of the opening; and (4) the curator at the Benson wanted to retain the history and current “look” of the volume.

I had considered replacing the binding because the present binding was not contemporary with the printing. However, I did not know conclusively when the text was put into its present binding. The cover was protecting the text block adequately and contained important history itself regarding early binding in Mexico. Another liturgical work by Ocharte owned by the University of Texas at Austin, the *Psalterium de Tempore* printed in 1589, was compared with the *Psalterium* from 1584. The wooden-board binding styles were similar, as were the type of page repairs in the 1584 and 1589 volumes. I decided to preserve this lineage, although it is still unknown who the binder was. Based on these reasons, I decided to repair and retain the binding.

I mechanically released the leather on the spine and cleaned the spine with 2.5% methyl cellulose. I removed the first two and the last four gatherings of the text block whose mends were under the most stress. The mends were softened in a Gore-Tex humidification pack, then removed mechanically with a microspatula (fig. 7). The gatherings were reconstructed to the size of the text block. The inner portion of each folio was guarded with *kizukishi* and the outer portion of each folio was guarded with *kozo hiromi* heavyweight. The adhesive used to guard was a 50:50 mix of 2.5% methyl cellulose and wheat starch paste. Tears in the pages were mended with lens tissue and wheat starch paste prepared 4:1 water to starch. The tears in areas where stress would continue to be present when pages were turned were mended in an “over/under” fashion that allows the page to flex in the same place without further breaking.



Fig. 7. Mends removed

Inner stays were made for each section that was to be re sewn from Twinrocker handmade, laid, linen rag paper. An overhanging lining of *kizukishi* was adhered with wheat starch paste and covered the entire spine including the supports. The first and last gatherings were re sewn to the text block through this overhanging lining, using unsized 18/3 linen thread. The overhanging areas of *kizukishi* were then folded over and adhered to the spine with wheat starch paste. An overhanging spine lining of airplane linen was adhered only between the supports using a 50:50 mix of PVA and methyl cellulose over the fully dried Japanese paper release layer and allowed to dry. The linings were anchored to the spine by sewing through them in three different gatherings using 18/3 unsized linen thread using pamphlet stitches.

Mini hollow tubes were constructed for each panel of the spine using heavy, handmade 100% *kozo* paper (100% *kozo*, Hiromi HM-10). The hollow tubes for the head and tail were shortened so as not to cover the turn-ins from the leather covering. The tubes were adhered one on/one off with 50:50 methyl cellulose and wheat starch paste and were allowed to dry overnight. The overhanging linen lining was adhered to the inner face of the front and back boards (underneath the pastedowns) with wheat starch paste. The patches of linen were sculpted around the existing supports in order to allow the historical evidence to be



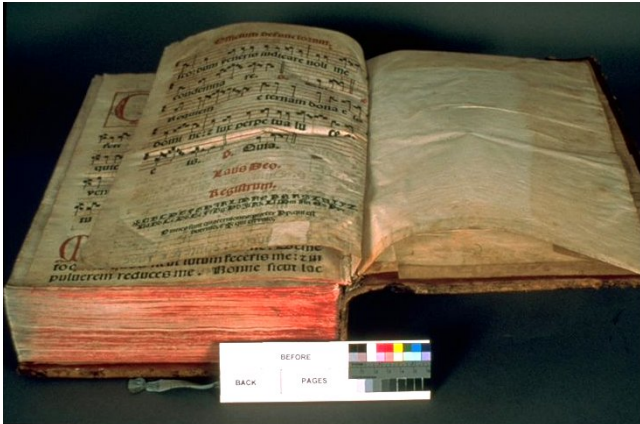


Fig. 8. Before treatment: last page stuck to back flyleaves

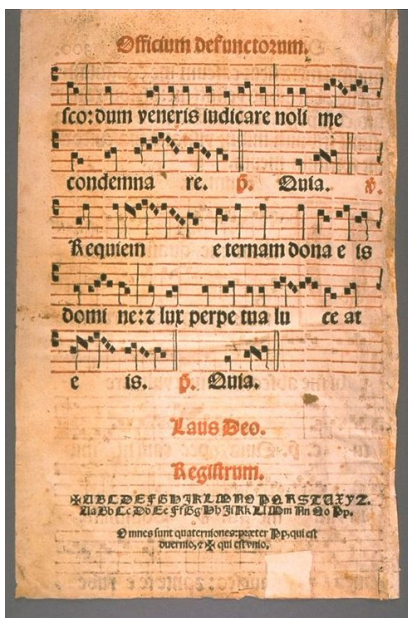


Fig. 9. During treatment: last page released from back flyleaves

clearly visible. The pastedowns were not readhered so that the multiple, previous historical lacing patterns could be easily viewed. Heavyweight 100% kozo Japanese paper (Hiromi HM-10) was toned and used to fill in the loss and support the two sides of a tear in the leather cover. Areas of delamination on the cover were readhered to the cover with wheat starch paste. A phase box was constructed with text block supports for the final housing.

The result of this treatment procedure was that the most harmful mends were replaced in the text block (figs. 8–10). By cleaning and relining the spine, the throw-up of the gutter, or the point of flexing, was moved beyond the mends remaining in the gutter (figs. 11–12). The historical evidence of the text was thus retained, while making the volume safer to use by researchers in the future.

#### ACKNOWLEDGMENTS

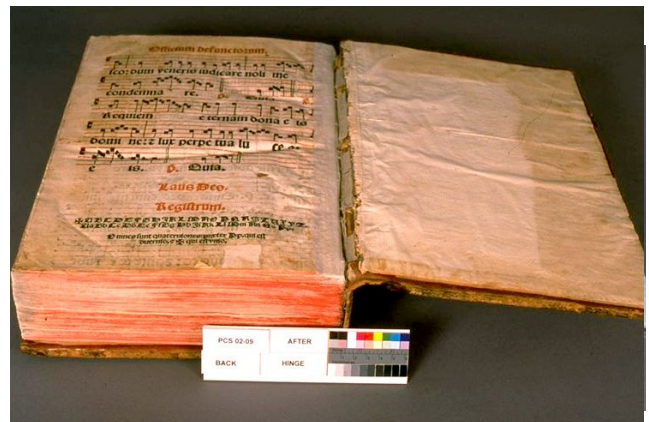


Fig. 10. After treatment: last page resewn to text block

I would like to thank Chela Metzger for her guidance; Drs. Rebecca Baltzer and Frank Candelaria for their musical expertise; Martha Romeo for answering questions about Mexican bindings; Drs. Timothy Rowe, Matthew W. Colbert, and Richard A. Ketcham for scanning the *Psalterium*; Michael Hironymous for allowing me to treat the *Psalterium*; and Mary Wootton for working with me on the AIC presentation.

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Fig. 11. Before treatment: opening of text block with little spine support and harmful mends



Fig. 12. After treatment: opening of text block with spine relined and supported

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## Similar Problems, Different Solutions: Treatments of Two Mexican Incunabula Part 2: Treatment of the *Graduale Dominicale* of Pedro Ocharte, 1576

### ABSTRACT

The condition, treatment decisions, and conservation treatment are described for the Library of Congress copy of Pedro Ocharte's *Graduale Dominicale*, printed in Mexico in 1576. A review of evidence for the historical authenticity of the binding suggested that the binding was not original to the text. This observation informed the decision to disbind the book, treat the damaged paper, and rebind it in a new, period-appropriate binding. The binding that was removed was retained off the book. Previous repairs that were damaging the paper were removed. Manuscript facsimiles of missing text that appeared on the old repairs were photocopied onto Japanese paper, which was then used for new infills.

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The *Graduale Dominicale*, printed by Pedro Ocharte in Mexico City in 1576, was chosen for conservation treatment by the Library of Congress's Music Division because of its distinction as the earliest American imprint held in that Division. It is a rare volume. Only three copies of this edition of the *Graduale* are known to exist. But it is especially admired as a supreme example of the beautiful printing that was being practiced in the New World long before the printing press had arrived in colonial North America. The sophistication of these early New World printers in handling the complexity of printing music notation is magnificently displayed in the pages of this volume. And, as April Smith described in her paper, these early volumes played significant parts in a fascinating period of history.

Much of April Smith's description of the condition of the Benson Library's 1584 *Psalterium* could also apply to

the Library of Congress' *Graduale*. The volume was in a wooden-board binding and the text block had received many repairs, paper hinges, and insertions to fill losses (figs. 1–2). Many insertions contained manuscript that completed missing areas of text (figs. 3–4). The text paper appeared to be extremely heavily sized, as it was stiff and inflexible (fig. 5). The numerous repairs had been done with a variety of handmade papers, which were all much heavier in weight than the original text paper. There were areas where the differences in the weights of these papers was creating breaking edges and damaging the original text

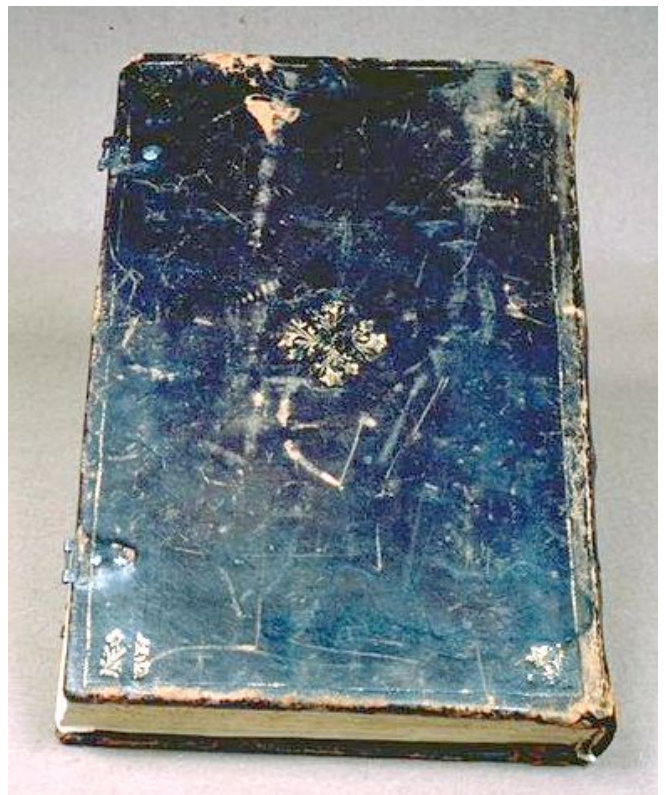


Fig. 1. Pedro Ocharte, *Graduale Dominicale* (1576), Music Division, Library of Congress: before treatment, binding

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Fig. 2. *Graduale Dominicale* pp. 24(v)–25(r): before treatment, previous repairs with heavy paper



Fig. 3. *Graduale Dominicale* pp. 181(v)–182(r): before treatment, manuscript infills on previous repairs



Fig. 4. *Graduale Dominicale* pp. 181(v)–182(r): before treatment, manuscript infills on previous repairs, detail.

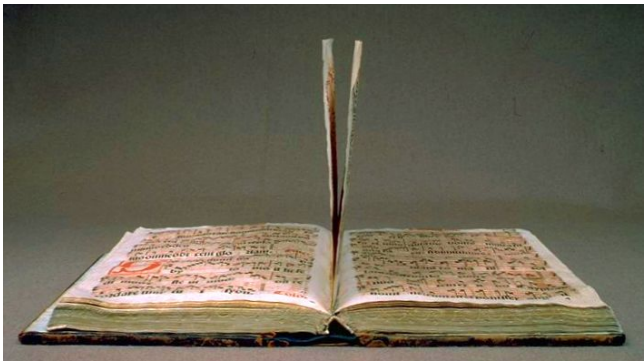


Fig. 5. *Graduale Dominicale* before treatment, stiff paper interfering with opening of text

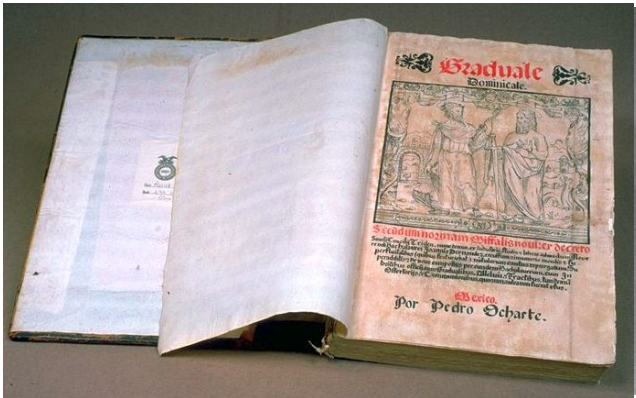


Fig. 6. *Graduale Dominicale*: before treatment, manuscript copy of title page from earlier restoration

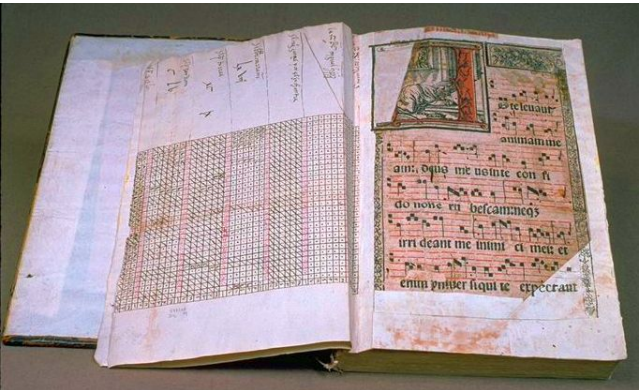


Fig. 7. *Graduale Dominicale*: before treatment, verso of inserted manuscript title page, with unrelated manuscript text

paper. Excessive, discolored adhesive had been used in attaching mends and repairs, which added to the damaging stiffness of the mends. In addition, a few entire pages, including the title page and the colophon, were missing. They had been replaced with extremely faithful hand-drawn pen and ink copies of the missing pages (fig. 6). There was no attempt to disguise the fact that these pages were copies, since they were drawn on reused handmade paper, as is evident from the presence of manuscript on the backs of the copied pages (fig. 7). It is not known when



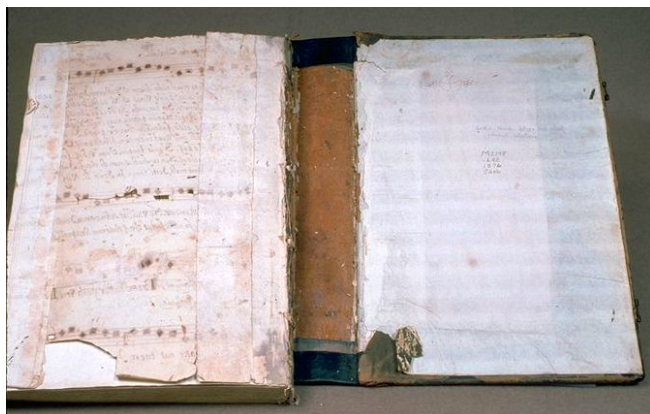


Fig. 8. *Graduale Dominicale*: before treatment, text block detached from binding



Fig. 10. *Graduale Dominicale*: before treatment, gilt edge decorated with a pattern of dots and stars



Fig. 9. *Graduale Dominicale* pp. 1(v)-2(r): before treatment, previous repairs are pierced by the sewing, demonstrating that the sewing is not original to the text block

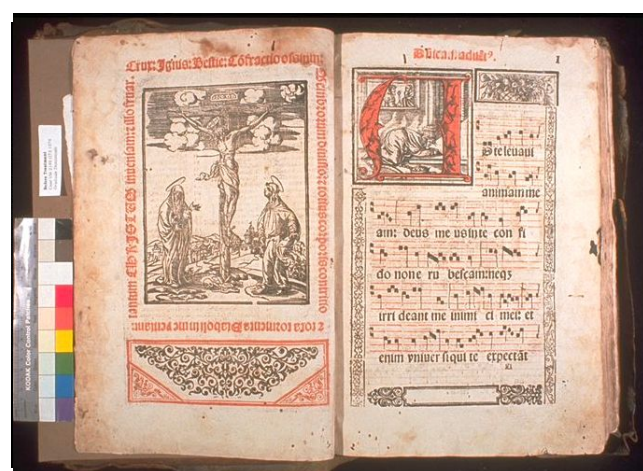


Fig. 11. Pedro Ocharte, *Graduale Dominicale* (1576), Newberry Library: verso of title page showing large margins around text. Photo courtesy Susan Russick.

these pages were added. (What is especially provocative is how a book restorer had access to a copy of the title page and colophon, considering the rarity of this volume today.)

The text block, which had been sewn on thin alum-tawed thongs that had been laced into the wooden-board binding, was now completely separated from its cover (fig. 8). It was clear that the sewing was not original since many of the paper repairs and hinges were incorporated in the present sewing (fig. 9).

The binding was puzzling. It appeared to be “in the style of” a binding that may have been original to this volume, but there was some evidence that this was not the first binding on this volume. One indication was that there were two places where edges of pages had been turned over and had escaped trimming. When these page fragments were flattened out they indicated a larger page size and a red-colored edge to the text block. The current edges are uncolored and are impressed with a pattern of repeating dots and stars (fig. 10). A solid colored edge would have been more consistent with Mexican binding practices in the sixteenth and seventeenth centuries.

Another indication that the volume had been trimmed is that the margins are narrow and uneven. On comparison to another copy of this volume in the Newberry Library in Chicago, there is clearly substantial page margin that has been lost to trimming in the Library of Congress volume (fig. 11). The trimming even cuts off some of the printing on the top edge of some pages. One theory that was suggested was that the volume may have been trimmed expressly to fit into this binding which was old but was not original to this text.

The binding was not in good condition. The wooden boards were weakened by insect damage, most components of the clasps were missing, and the endcaps had been previously repaired. It would have required major restoration to reattach the text to this binding. With skepticism as to whether the binding was even original to the text it seemed that the best approach would be to retain the binding intact, unrestored and available for any future interest in it.



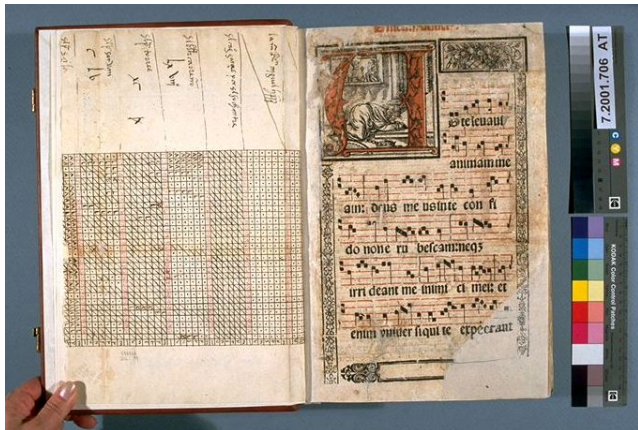


Fig. 12. *Graduale Dominicale*: after treatment, verso of manuscript title page replaced in the text block



Fig. 13. *Graduale Dominicale* pp. 1(v)–2(r): after treatment, paper repaired with Japanese paper onto which the prior manuscript infills had been photocopied



Fig. 14. Convento de Santo Domingo Capellanius [Dominican Order in Puebla, Mexico, 1591–1724], H. A. Monday Collection of Mexican Colonial Material, Library of Congress: example of an early Mexican limp vellum binding

Because of the stiffness of the paper, the presence of excessive discoloring adhesives, and the damaging stiffness of previous mends, it was felt that the text would benefit greatly from aqueous treatment and removal of mends and adhesive. With the decision that the binding would be replaced it was possible to proceed with disbinding and paper treatment. The pages were washed in deionized water and previous repairs were separated from the original paper. Enzymes were used in poultices to assist removal of some heavy deposits of adhesive. The pages were bathed in a calcium hydroxide solution to add an alkaline buffer to the paper. The volume was reassembled and the pages were guarded and mended with Japanese paper and wheat starch paste (fig. 12). Where previous fills had had inscriptions Japanese paper was photocopied and the new fills were constructed retaining the inscription (fig. 13).

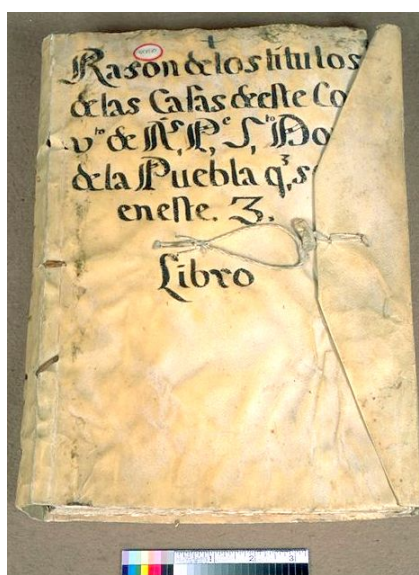
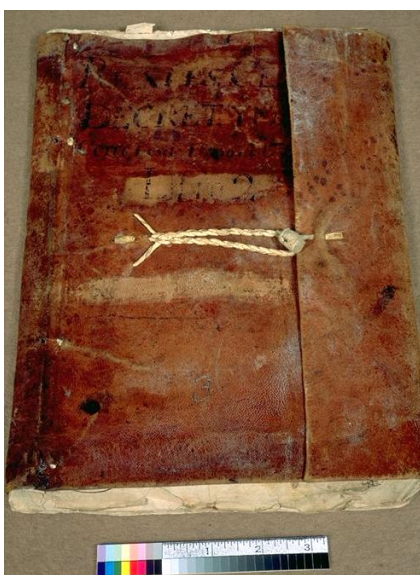


Fig. 15 (far left). Juan de Sernal, *Relacion de Meritos* (1577), H. A. Monday Collection of Mexican Colonial Material, Library of Congress: example of an early Mexican limp leather binding

Fig. 16 (near left). Legal papers and reports (1617–1754), Province of San Miguel and Santos Angeles, Mexico, H.A. Monday Collection of Mexican Colonial Materials, Library of Congress: example of an early Mexican limp vellum binding



Deciding how to bind the *Graduale* was an interesting project in itself. With the help of Terry Boone, one of the Conservation Division liaisons to the Library's Manuscript Division, I was able to survey some of the Mexican Colonial materials in that Division. Most early Mexican books are not bound in stiff wooden boards, but in limp vellum or leather wrappers (figs. 14–16). The texts are sewn on leather or tawed thongs, which are laced into the covers. The covers most often have a fore-edge flap that is secured to the front cover with leather ties or some kind of a toggle and loop. Books that were intended for use in a church for the purposes of prayer or the Mass appear not to have been bound in these wrapper structures. A large volume, which was going to be displayed in a semi-vertical manner, would need the support of a rigid cover. Moreover, these books were not intended to be carried around—they were designed to be permanent furniture in a church. A few examples of these wooden board structures are: the 1576 Ocharte *Graduale* in the Newberry Library in Chicago (fig. 17), an Ocharte *Antiphonarium* believed to be dated 1572 in the Rosenwald Collection of the Rare Book Division of the Library of Congress (fig. 18), a 1602 choir book in the H. A. Monday Collection of the Manuscript Division of the Library of Congress, and a

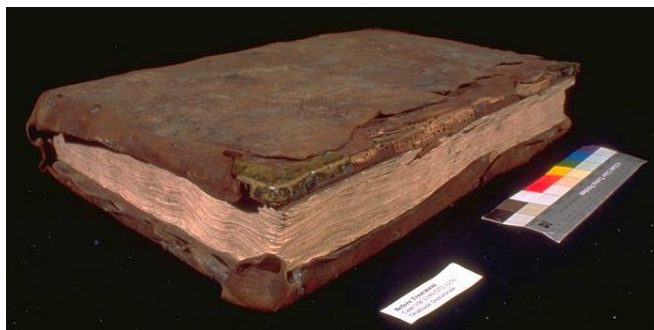


Fig. 17. Pedro Ocharte, *Graduale Dominicale* (1576), Newberry Library: example of an early Mexican binding in leather over wooden boards. Photo courtesy Susan Russick.

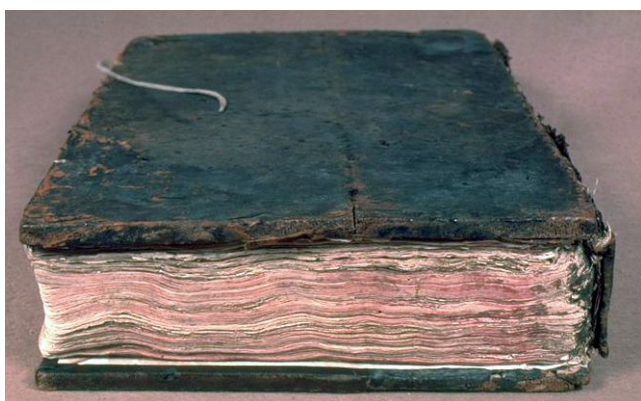


Fig. 18. Pedro Ocharte, *Antiphonarium* (ca. 1572?), Rosenwald Collection, Library of Congress: example of an early Mexican binding in leather over wooden boards.

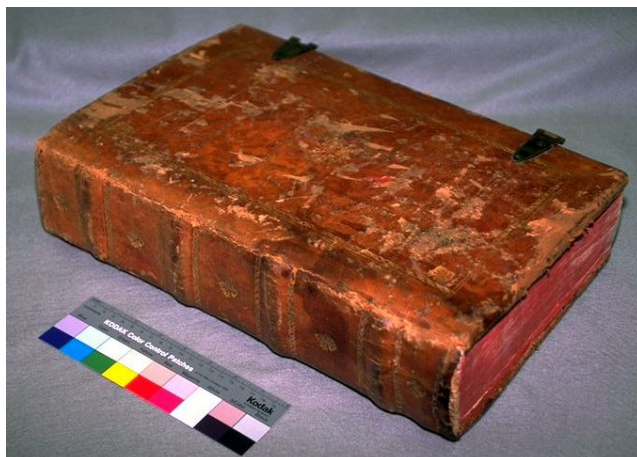


Fig. 19. Pedro Ocharte, *Antiphonarium* (1589), Benson Library, University of Texas: example of an early Mexican binding in leather over wooden boards. Photo courtesy April Smith.

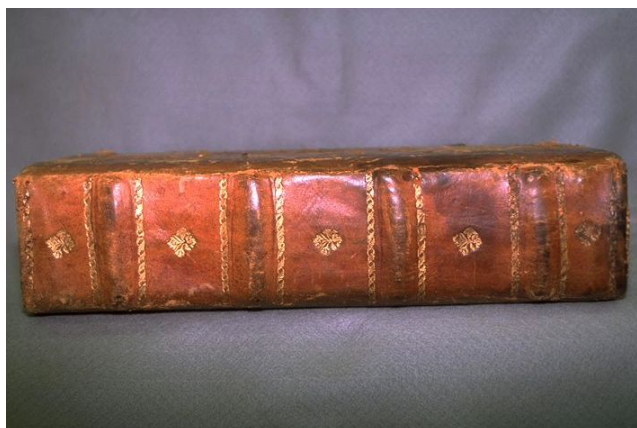


Fig. 20. Pedro Ocharte, *Antiphonarium* (1589), Benson Library, University of Texas: spine detail. Photo courtesy April Smith.



Fig. 21. Pedro Ocharte, *Antiphonarium* (1589), Benson Library, University of Texas: detail showing fore edge and clasp. Photo courtesy April Smith.



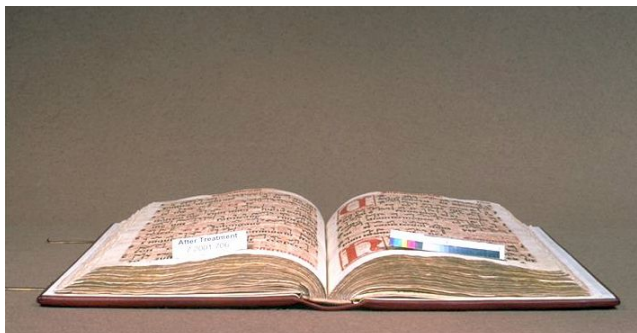


Fig. 22. *Graduale Dominicale*: after treatment, opening of text block



Fig. 23. *Graduale Dominicale*: after treatment, new binding showing tooling on sides

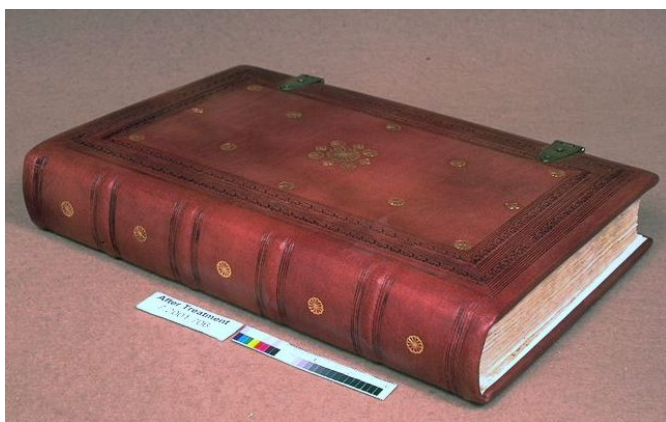


Fig. 24. *Graduale Dominicale*: after treatment, new binding showing tooling on spine

1589 Ocharte *Antiphonarium* in the Benson Library at the University of Texas at Austin (figs. 19–21). And of course there is the 1584 *Psalterium* that April Smith discussed in Part 1 of this paper. While it is not known whether all of these bindings are original to the volumes, it clearly shows a pattern in binding style for volumes containing music for worship. In my effort to determine a historically appropriate binding style for the *Graduale* it was quite clear that it would have to be bound in wooden boards.

In his book *Sixteenth-Century Gold-Tooled Bookbindings in the Pierpont Morgan Library*, Howard Nixon described the binding on the Benson Library's 1589 Ocharte *Antiphonarium*. He felt that this binding looked "like one would expect of a sixteenth-century Mexican example" (Nixon 1971, 256). Based on this recommendation I used the Benson Library's *Antiphonarium* as my general guide in the rebinding of the *Graduale*. The Benson Library curators were kind enough to take snapshots of the binding for me since there were no published photographs of this binding that they knew of. The photographs were helpful in giving me a sense of the general shape and appearance of the volume, the rose-colored leather, the relatively flat spine, the shallow raised bands and the construction of the fore edge clasps.

The *Graduale* was sewn on split raised thongs and bound in full Restoration calf over wooden boards (fig. 22). Two brass clasps were constructed for the fore edge of the volume. The tooling consists of a combination of both blind and gold tooling. A few decorative tools are used repeatedly to create the design (figs. 23–24). This kind of decorative scheme was used on a binding dated 1597 that Howard Nixon illustrated in his book and was also present in several early Mexican bindings I studied.

A block and wrapper were constructed to store the *Graduale*'s previous binding and it is housed with the volume in a clamshell box (figs. 25–26). Previous paper repairs, which were removed during paper treatment, were also retained and are stored with the volume.

As April Smith mentioned in her paper, choosing an approach to treatment of an object is an individual judg-

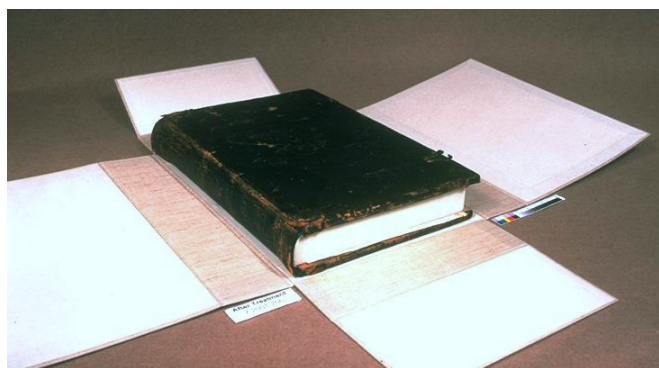


Fig. 25. *Graduale Dominicale*: after treatment, previous binding supported on a block and enclosed in a four-flap wrap

ment and one always hopes that future generations of scholars will respect your choice of treatment. In the case of the Library of Congress's *Graduale*, the decision to pursue a full treatment was based on concern for the condition of the volume, deep skepticism about the authenticity of the present binding, and a desire to retain as much information as possible, while making the volume safe for limited use and handling. At the same time it is hoped that the volume is returned to something that is closer in function and appearance to the way that it was when it was originally in use.

#### ACKNOWLEDGMENTS

I'd like to thank Ann Seibert with whom I collaborated in treating this volume and who performed most of the paper treatment. I'd also like to thank Tom Albro, Maria Nugent, Jesse Munn, Terry Boone, Lynn Kidder, Sylvia Albro, Susan Russick, Bill Minter, and April Smith for all kinds of help, encouragement, and advice.

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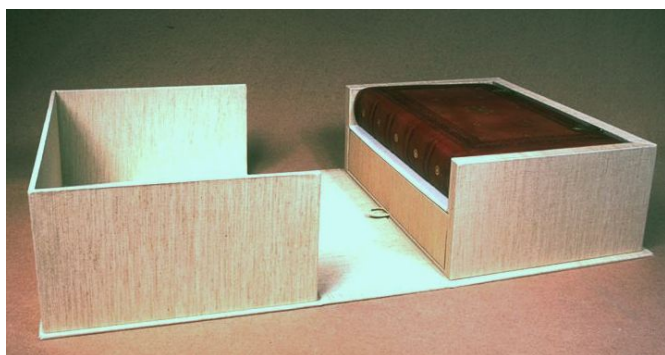


Fig. 26. *Graduale Dominicale*: after treatment, rebound book and previous binding housed together in a box

## Archives Conservators Discussion Group 2003: Flattening and Drying

Notes and bibliography by: FRANK TRUJILLO AND KRISTEN ST. JOHN

### ABSTRACT

The article is a summary of the Archives Conservators Discussion Group at the 31st Annual Meeting of the American Institute for Conservation in Alexandria, Virginia, June 9, 2003. The general topic was flattening and drying of archival material on paper. The topic was a continuation of the previous year's session on humidification and flattening. The session included presentations on *karibari*, techniques used in textile conservation, and research into the effects of humidification on letterpress copy inks. A short list of references is included.

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The topic for the Archives Conservators Discussion Group session was a continuation of the previous year's discussions on humidification and flattening. During that earlier session, participants expressed interest in different flattening and drying techniques. For this session, three participants gave prepared presentations. Three other participants could not attend, but sent information and samples for the session. Throughout the session and at the end of the prepared presentations, members of the audience asked questions and added comments of their own.

The first presentation was by Kathleen Kiefer, a textile conservator at the Winterthur Museum, Garden, and Library. Ms Kiefer worked as an archives conservator early in her career. Her presentation explained how textile conservators treat objects that require humidification and

flattening. Ms Kiefer spoke about some of the problems facing textile conservators during treatment. Many of the solutions have relevance to the humidification and flattening of paper documents. Localized humidification is often used to flatten objects. Overall flattening is not typically undertaken due to the dimensionality of textiles. Much like trying to retain plate marks on a print, retaining creases as evidence is important to textile conservators.

Some of the tools Ms Kiefer uses are familiar to book and paper conservators. She spoke of using Gore-Tex, high-density polyethylene, blotter, weights, and at times a Preservation Pencil to create localized humidification. Large humidification chambers are used when treating an oversize object, though textile conservators treat large objects "in the round" rather than under a domed suction table. At times a garment steamer is used for intractable problems, although it was pointed out that use of a steamer is considered aggressive treatment. Ms Kiefer explained some wet cleaning techniques textile conservators undertake. One technique is to spread a drying cloth over a wet textile and blot the textile through the cloth with towels. Degradation products move from the object to the drying cloth in a controlled manner. The presentation provided an opportunity to gain insight into the topic of humidification and flattening through a different point of view, allowing book and paper conservators to re-evaluate and compare their own methods.

The second speaker was Yoshiyuki Nishio, director of the Nishio Conservation Studio. Mr. Nishio's topic was a simplified way of making a *karibari* board. A traditional *karibari* has ten layers of Japanese papers adhered to a core usually made of white cedar. In the 1980s, Mr. Nishio began using a Gatorboard foam *karibari*. The Gatorboard is first prepared by sanding both sides to facilitate easy paper adhesion. Mr. Nishio recommends using a heavy Japanese paper. The edges of the Japanese paper to be used over the Gatorboard must be feathered. The Japanese paper is adhered to the Gatorboard with a strong paste. Mr. Nishio uses a mix of wheat starch paste and Rhoplex AC33. Only

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a couple of layers of Japanese paper are needed for the simplified method of *karibari*. After paper adhesion to the Gatorboard, the *karibari* is dried upright overnight and then sealed with an acrylic. The simplified *karibari* is more sensitive to moisture than the traditional form and can be more easily warped. In addition, there is a lack of airflow between the layers of Japanese paper and the Gatorboard. On the positive side, the easy *karibari* weighs two-thirds the total weight of a traditional one, costs less than the \$600-800 needed to complete a traditional *karibari*, is easily transportable, and does not require up to two years for the color of the persimmon juice used in a traditional *karibari* to cure. Mr. Nishio uses the simplified *karibari* for adhering lining paper to objects. He recommends using methyl cellulose as an adhesive between lining paper and *karibari* to avoid loss of paper on the board after drying. He inpaints on the simplified *karibari*. He points out that the application of weights is possible on the solid core Gatorboard.

Next Barbara Rhodes, conservator for the Department of Library Services, American Museum of Natural History, spoke about her research into letterpress copy inks. The use of copy press paper was popular for over one hundred years from the early 1800s to the early 1900s. A letterpress copy document was made by pressing a damp paper against the surface of slow drying ink. Some of the inks used were iron-gall copy ink, logwood bichromate ink, and aniline inks. Aniline inks are also found in copy pencils of the same time period. Ms Rhodes's research is an effort to answer the question of how to humidify such slow drying inks. Potential problems for humidification include the solubility of the inks, the widespread use of humectants in the inks, and the fact that the iron-gall and logwood bichromate inks oxidize and seal. Ms Rhodes passed around samples she prepared as part of her research that showed how inks are affected by humidification. Her work on the topic continues and should provide helpful information as many collections are full of this once popular form of document reproduction.

After these presentations, discussion group co-chairs Nora Lockshin and Kristen St. John shared information from three other conservators. Even though these conservators could not join the session, they graciously shared their research and new techniques.

Spanish conservator Salvador Muñoz Viñas has been developing a large-scale vacuum-based system for the flattening of paper sheets of any size that he has used successfully in a project of restoring large-format (1.6 by 1.25 m) movie posters. His system involves lining fragile posters and drying them on suction tables using an oscillating vacuum. The project is described generally in a lay text article (in Spanish) titled "Los carteles de la colección Ortega del IVAC: Trabajos de conservación" (Muñoz Viñas

2003). He is currently writing a technical article on the process.

Tim Vitale sent notes about his recent research in paper drying. In the early 1990s Mr. Vitale and Jane Sugarman published seminal work on the chemistry of drying paper (Sugarman and Vitale 1992; Vitale 1992a and 1992b). His recent work has focused around paper texture size domains (micron, millimeter, centimeter, decimeter, and meter). Through the use of a texture ruler he encourages conservators to consider how various actions of humidifying, drying, and flattening change paper texture. He notes that small-scale differences in the evaporation of water from the sheet reaching equilibrium will cause cockling or distortion on the decimeter scale (two to four inches). As the evaporation is more uniform, distortion occurs on the meter scale as curl rather than cockling.

Finally Janice Schopfer and Scott Homolka of the Western Regional Paper Conservation Laboratory sent samples of synthetic, non-absorbent materials they have been using in an air-flow drying system. In addition, they sent an illustrated handout describing recent experiments. The forced-air drying system in use at the Western Regional Paper Conservation Laboratory was initially developed in the 1970s. A current version was developed by Bob Futernick and Kim Nichols in 1998. The more recent version of the press began with the use of stacks of archival, corrugated board, mat board, blotter paper, and/or non-woven polyester sheets in which the paper to be flattened is sandwiched. Once these sandwiches are layered they are placed into a press with a uniform drying surface of 40 by 60 inches. A blower provides continuous airflow through the stack. Papermaker Lee McDonald has developed a modification of this system using synthetic materials in the place of the corrugated board and blotter paper. The new stack contains: non-woven polyester (Hollytex), polypropylene felts, polyethylene screens, polyethylene/polypropylene corrugated mats, and archival quality mat board. Advantages of synthetic materials include longer material reuse and decreased drying time of items in the stack. Contact information for Lee McDonald: P.O. Box 200264, Charlestown, Massachusetts 02129 ([www.toolsforpaper.com](http://www.toolsforpaper.com)).

The co-chairs would like to thank all of the participants and audience members who contributed to this session. The co-chairs would like to especially thank Frank Trujillo for taking notes during the session.

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## Library Collections Conservation Discussion Group 2003: Library Security

### ABSTRACT

The Library Collections Conservation Discussion Group (LCCDG) focused on issues relating to the much-requested topic of library security. Presentations and discussion touched on day-to-day security of library collections as well as security during periods of construction; the use of a radio frequency identification (RFID) system at the University of Connecticut; and the four-level security system used at the Library of Congress.

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The Library Collections Conservation Discussion Group (LCCDG) focused on issues relating to the much-requested topic of library security. Several people offered prepared presentations and discussion was lively throughout the session.

The discussion began with a brief summary of a survey reported in the Association of Research Libraries' SPEC Kit on management of library security. Common challenges identified by libraries included unsupervised areas, unsecured doors, too wide a distribution of keys and access cards, unaffiliated users, poor cooperation from campus security, and clearing buildings during emergencies and at closing.

Successful elements of security programs identified by respondents included surveillance and videotaping at entrances and exits, continuous police patrols, panic devices at staff desks, two-way radios for staff, developing

good working relationships with campus security, and working with the campus legal counsel.

Ethel Hellman, collections conservator for Widener Library at Harvard University, shared information gleaned from an interview with security personnel regarding collections security. At Widener Library attention is focused on two areas: preventing damage and deterring theft. Routine procedures for damage prevention included leak protection on all sinks (required by code) in the stacks and on all pipes that supply the sinks: "intelligent" cable alarms to pinpoint the location of any leak, limited outflow at each sink, and no hose connections at any sink.

Security during periods of construction includes relocating items during the construction period, sealing off the construction area, and constant monitoring of the stack areas by security personnel.

Routine procedures to deter theft include card access to the library building and also to all stack areas. The access cards activate pop-up photos at the guard desk and immediate ID validation. All bags are checked at all exits. Camera surveillance, motion-activated lighting in the stacks, motion detectors, alarms, and emergency phones in the stacks are also employed. Security personnel continuously patrol the stack areas. All library items are provided with security strips and are edge stamped. The discovery of theft activates crime scene procedures: staff members are instructed to refrain from touching or moving anything and to immediately report the situation to security personnel. Materials particularly vulnerable to damage and/or to theft are used in secure supervised reading rooms, where all ducts are grated and motion detectors, alarms, and glass-break monitors are all in place.

Carol Dyal, library conservator at the University of Connecticut, Storrs, offered information on the radio frequency identification (RFID) system at Babbidge Library. In a collection that has few users from outside the institution, her library chose a system that incorporated security and inventory control. This system allows information capture without opening a book, permits self-checkout,

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and triggers a surveillance camera when an uncharged book is taken through an exit, tagging the photograph with the bar code number of the uncharged book. On the inventory control side, the system permits shelf reading with a wand. Location of the radio chip in/on individual volumes generated much discussion among group participants.

A customer service representative from a major security system vendor described a number of security devices sold by her company and responded, in relatively good humor, to questions, observations, and suggestions from the members of the group.

Debra McKern, chief of the Binding and Collections Care Division, Library of Congress (LC), described the sorting system that is used in implementing the security plan at LC. Items are sorted into four value levels and the level of security is tailored to the value of the materials being secured. LC also divides the concept of collection security into four subgroups: physical security, inventory management, preservation, and computer security. Materials are also subdivided into five “life cycle” stages: in process, in storage, in use, in transit, and on exhibit—with security measures tailored to the needs of the materials at each stage of the life cycle. Debra also discussed LC’s stamping, marking, and labeling practices and the preservation division’s goal of reducing the number and variety of owner marks an item might acquire as it proceeds through its life cycle. One item of particular interest was a laser engraver that, from a scanned bar code, generates an engraved date of receipt, source of acquisition, and bar code onto the hub of a CD in eye-legible characters. Debra also described the design and use of secure trucks for transporting items from department to department.

Topics generated during group discussion touched on a number of areas, including:

- The use of a micro-dot embossing tool to place an identifying mark on an item (paper, plastic, or metal).
- Use of a commercially available plastic tube designed to enable quick and proper placement of CD tattle tape patches.
- Actinic ink for marking library items. Actinic ink, which is a pure carbon suspension, contains no solvents and therefore does not bleed through. Negative experience has been that it requires an intricate application process, a long drying time, and a more involved clean-up procedure than a rubber stamp and office stamp pad.
- Solutions for securing accompanying materials. One suggestion is to construct a pocket for the materials. Another suggestion is to construct an enclosure to house the main item and accompanying item(s). In both cases there is a concern about charging the accompanying material when the main item is charged to a patron. One participant described the “control Z stop” command in the cataloging system in her library that adds to the catalog record an instruction that will not permit the

completion of the charge of a multi-part item until all parts of the item are charged. Another solution for securing accompanying materials is separating the items, with the accompanying material shelved separately from the main item in a designated location in the library.

The 2003 session of LCCDG marked the end of the co-chairship of Meg Brown and Ethel Hellman. Beth Doyle, Collections Conservator, Duke University Libraries, and Heather Caldwell-Kaufman, Preservation Services Librarian/Collections Conservator, Massachusetts Institute of Technology, were warmly welcomed as the new co-chairs of the discussion group.

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# Use of Adhesives on Leather Discussion

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Bibliography by:  
JESSICA S. JOHNSON, OLIVIA PRIMANIS, and KRISTEN ST. JOHN

### ABSTRACT

This summary of the leather and adhesives discussion group covers the four presentations given, as well as the discussion points. A working bibliography on skin and hide follows the summary as appendix 1. Book conservation concerns were emphasized, but the topic brought together conservators from many specialty groups. Major topics addressed included: combination adhesive systems made from starch paste and synthetic adhesives; Lascaux 498HV and Lascaux 360HV; alcohol-remoistenable mending strips; and unmixed starch pastes. Also included are discussions of working methods for preparing and applying adhesives to new and deteriorated leather and mending strips. Many of the presentations and questions included the interrelated topics of leather consolidation and leather coatings, also of concern to a variety of conservation specialties.

### TOBY RAPHAEL: MIXTURES OF PASTE AND ACRYLIC ADHESIVES

Toby Raphael, an ethnographic conservator, started off his talk on adhesives for leather and skin products with a quote from his friend Richard Beauchamp, whose motto was “Choose a simple adhesive and get to know it well.”

As it turns out, starch paste applications (an obvious choice for adhesive) are not always strong enough for bonding heavier skin products or joints under stress. Toby has pioneered the controlled use of simple multi-compo-

nent or combination adhesive systems. By mixing synthetic resins with paste you potentially get a variety of effects: a stronger bond, slower drying time, more plasticity, more resistance to biological organisms, better aging properties, and excellent reversibility—all with less wetting of the substrate. These combination adhesives can be mixtures of wheat starch pastes and polyvinyl acetate (PVA) or polyvinyl alcohol, or wheat starch paste and acrylic dispersions. Formulas that are most useful typically contain 5%, 10%, 20%, and 50% resin to paste. By changing their proportions, these mixtures have a wide range of characteristics useful to conservation practitioners. These mixtures can be useful for bonding untanned, semi-tanned, mineral-tanned, and vegetable-tanned skins. The key to the combination adhesive is that its strength is controllable and therefore can be matched to the materials and objectives of each treatment. Toby repeated Anne Clapp’s criteria for a good adhesive: it works for the job at hand, is easy to prepare, has a reasonable shelf life, remains readily soluble, is not subject to insects or discoloration, retains sufficient bond performance and function, and remains acid-free (though this factor may not be as important when we are working with acidic materials to begin with).

An example of a combination adhesive in use since the 1960s is the “mix”: a blend of paste and PVA. The idea is thought to have come from England and was pioneered in the U.S. by Bill Minter. Bill originally used a 50/50 CMC (sodium carboxymethylcellulose) and PVA. Since 1978 his “mix” has consisted of 50% PVA, 25% CMC, and 25% wheat paste.

Norbert Baer did a study on a paste and PVA mixture in 1975, with positive results. The U.S. National Park Service (NPS) had the Canadian Conservation Institute (CCI) test the resin/paste mixture using Dura Tech, a PVA equivalent of JADE 403, chosen by Jane Down. Various percentages of the mixes of these resins and pastes were tested for swelling, dissolvability, and reversibility. There was no alteration of dissolvability compared to unmixed

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wheat starch paste in the 5-50% resin to paste formulas. In general Toby is happy with the function of these mixture adhesives and hopes to have more long-term aging tests done in the future.

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ALAN PUGLIA AND PRISCILLA ANDERSON:  
SOLVENT-SET MENDING STRIPS

Alan and Priscilla's complete Book and Paper Group talk and step-by-step instructions may be consulted elsewhere in this *BPG Annual* [pp. 3-8] and will not be reprinted here. The abstract prepared for the discussion group is below. Alan and Priscilla restated their formal talk for the discussion group participants and focused on working methods and supplies used. The mechanics of this repair technique for leather-bound books may be usefully compared with the Japanese paper hinge repair detailed in the 2001 *BPG Annual* Board Attachment Discussion, pp. 82-86. Alan and Priscilla distributed a handout and samples of the repair strips to interested participants.

In response to a backlog of items in need of repair, many requiring minimal or simple structural repairs, standard book repair techniques were reviewed for suitability as quick, on-site repairs.

Japanese tissue repair techniques using paste require long drying times, risk permanent darkening and hardening of the leather, and are difficult to reverse without placing the leather at further risk from moisture. Tissue repairs with PVA reduce the risk to the leather and dry quickly, but are irreversible without damaging the leather surface.

This paper presents the development and techniques for use of a custom-toned, alcohol-remoistenable, repair tissue using an acrylic adhesive, Lascaux 498HV. Consolidating the leather with a solution of Lascaux 498HV in alcohol, instead of other less effective consolidants, prepares the leather surface for improved adhesion. The Lascaux-coated tissue allows for quick repairs, generally less than forty-five minutes, which are more readily reversible without endangering the leather. The repair technique is simple enough that it can be performed on site. Although designed for quick, simple repairs, the material and techniques may be applied successfully to more complex treatments undertaken in a laboratory setting.

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OLIVIA PRIMANIS: ADHESIVES AND REUSING  
DETERIORATED LEATHER

Olivia focused her comments on the effect of an adhesive on the overall structure, function, and color of leather. We may know about an adhesive in its pure state, but specific details about what is happening to a leather coated with an adhesive are not always easy to find. Olivia compared slides of both new and deteriorated leather under magnification and discussed how to evaluate the state of the leather fibers before a treatment begins.

She commented that in recent conversations with Glen Ruzicka at the Conservation Center for Art and Historic Artifacts (CCAHA), she found that book conservators there are saving and reusing old leather on boards and spines much more often than they used to. This means they are reusing aging and/or damaged leather fibers and need to understand the effect different adhesives have on those fibers.

Olivia suggested we take an organoleptic approach, using all our senses as we watch what an adhesive and/or consolidant does to leather, both in color and handling. While Olivia's training and preference in book conservation was to use starch paste on leather, she began experimenting with the acrylic adhesives when they became more prevalent. When a conservator needs to reuse leather in an area where the material will need to move, like the spine or joint of a book, the final flexibility of that leather is key. This flexibility is clearly maintained, in one degree or another, by an adhesive like Lascaux 498HV or 360HV, whereas paste may lead to a stiffening of the leather, in her experience.

While the discussion group examined a slide illustrating the physical role tannins play in vegetable tanned leather, she reminded the audience that water is "the universal solvent." Given that tannins maintain spaces between the fibers of vegetable-tanned leather so it can flex, she worries about what water and water-based adhesives might be doing to already degraded and powdery leather fibers.

Could it be washing out tannins as well as shortening the fibers?

Finally, on the topic of consolidating a leather surface, Olivia has had good luck using Klucel G diluted 2% or less, applying several coats as needed.

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MATT JOHNSON: ADHESION OF NEW LEATHER  
AS DISCUSSED WITH DON ETHERINGTON

Matt stood in for Don Etherington, who was unable to attend the AIC annual meeting this year. Matt shared Don's answers to a set of questions he and Gillian Boal created. Below are the prepared notes for Matt's presentation. Don's responses to the questions follow.

Q. What have you found to be the most effective adhesive for leather?

A. Rice starch paste

Q. What differences do you find in the use of synthetic versus naturally derived adhesives?

A. Synthetics or mix do not penetrate leather, which causes the leather to be unyielding; you cannot manipulate it well. They also dry too quickly; you cannot work corners the same as with paste. The pulling of boards is less than when using paste.

Q. How (if at all) does your adhesion technique differ with conservation binding as opposed to fine/design bindings?

A. Conservation bindings: If using linen over boards for attachment purposes, I would use a mix, as paste alone does not stick well over Irish linen. Design binding: I paste twice when I need to manipulate over raised areas or with sunken areas. Also, I tend to spend more time on covering design bindings.

Q. What leather preparation techniques/processes affect your adhesive choice, i.e. highly thinned, full thickness, pale toned, calf versus goat, etc.

A. For calf bindings with a smooth spine, I would use a mix of Jade 403 and rice starch or methyl cellulose and rice starch. The important thing is to wet the outside evenly. For goat, I would use paste alone, but on raised bands I will coat the spine first with Jade 403 to get good adhesion close to the bands.

Q. Dampening the leather is generally part of the leather binding process, aiding primarily in the workability of the skin and extending the working time of the adhesive. Are there circumstances where the combination

of dampening and the use of certain adhesives is not desirable?

A. Alum-tawed skins should only be lightly dampened on the outside. I generally would dampen the inside of the skin.

Q. Has your approach to leather adhesives changed over your career? If so, how?

A. No.

Q. Outline any humorous and/or insightful anecdotes about leather binding from your career.

A. Always check inside the boards for bone folders before pressing or placing a newly covered book under weights. I did this once on a new binding as I was coming up.

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SUMMARY OF QUESTIONS AND GENERAL  
DISCUSSION

Testing on Adhesives

A clarification was made as to the adhesives tested by CCI for the National Park Service in 1998: they were paste and the mixture of paste with an acrylic adhesive.

Solvent-Set Tissue Strips Coated with Lascaux  
498HV

A clarification was made as to the transparent nature of the paper chosen for the Lascaux board hinging technique. Alan and Priscilla deliberately chose a transparent, smooth, and long-fibered paper, which will be even more transparent after being coated with the Lascaux. They also noted that grain direction was not an overriding concern for the repair paper, since the adhesive inhibits all grain expansion and contraction. They do not typically use heat to activate the adhesive, out of concern for damaging the leather. Sometimes when they are having trouble getting the strips to stick around the bands they do use a tacking iron. There is a Lascaux adhesive (360HV) that activates at a lower heat than the 498HV, but they have not used it, out of concerns that the permanently tacky adhesive might seep out the edges of the exposed mend.



### Lascaux 360HV

One discussion participant had used Lascaux 360HV to adhere a Japanese paper lining to the inside of a leather spine and found it remained very flexible. In this treatment context, the potential movement of adhesive would not be of concern.

### SC6000

There was concern that the recipe for SC6000 (an acrylic wax sold by the Leather Conservation Centre in England) had changed recently. Participants noted they sometimes mixed this wax with either ethanol or Klucel G to create a thinner leather coating/consolidant. Both Bill Minter and representatives of CCAHA noted using a thinned mixture of SC6000. There has been nothing published on this so far. After the meeting Bill Minter provided a note from his forthcoming (in *JAIC*) review of *Surface Coatings for Leather Bindings* by Betty Haines:

... the old formula SC6000 was replaced by SC7400 in 1996 to meet British Health and Safety Standards. Since then, this new formulation has been supplied under the original name—SC6000. The new/modified formulation has not been thoroughly and scientifically evaluated. Some practical tests on the new formula were conducted and the results were essentially similar to those determined in the 1979–80 British Library trials using the product having the old name SC6000.

### Starch Paste

One participant noted that the two problems associated with starch paste—water and stiffness—could be controlled though proper preparation and use of the paste. Diluting paste with water after cooking was not recommended, as the added water would then not be fully absorbed into the starch. It was recommended that paste be prepared with the desired final viscosity in mind and used undiluted. The member noted that shattering the dried layer mechanically, with stiff brushes or some other implement, could alleviate the final stiffness of a paste film. This will not generally affect the adhesive bond created. Applying a thin coat of thick paste to leather as a size and letting that dry can provide a barrier layer against unwanted wicking of starch adhesive used later.

### Relationship of Traditional Bookbinding to Choice of Adhesives on Leather in Book Conservation

Some participants noted that paste was traditionally used on leather in bookbinding to facilitate traditional gold tooling techniques. When tooling is eliminated as a goal, other adhesives serve well to adhere the leather covering to boards and spine. Animal glue was mentioned as a good adhesive for leather when no traditional gold tooling was planned.

### Working Methods

A participant noted that in ethnographic work it is recommended that a barrier layer be placed on the material before any adhesive, and that a mechanical treatment solution be considered over an adhesive one. In terms of covering a book in leather, it was mentioned that in a new leather binding or reback, coating both the leather and the book-board surface with paste while working could improve adhesion. When working with alum-tawed skin, moistening the flesh side before using it to cover a book could keep the moisture in the paste from wicking too far into the skin.

### Research on Leather and Adhesives

While many book conservators commented on the lack of research in some areas of leather and adhesives, one objects conservator noted that there was a great deal of information to be found in publications dealing with natural history collections. The Step Project in Europe was mentioned as analyzing amino acids in deteriorated leather, but not the effect of leather dressings or consolidants on deteriorated leather. A 2002 study by Betty Haines discusses new leathers and how they react to various coatings, but many of these commercial coatings, like shoe polish, were not ones typically used in conservation. Participants noted that there are research centers for leather conservation in England and in Amsterdam. In addition, there is a group of leather chemists in Cincinnati who have a testing lab for leather research. The AIC group Research and Technical Services (RATS) was mentioned as a good place to take proposed research questions.

### Final Thoughts

The discussion group ended with a call for further research on this topic, in order to help conservators make informed choices about adhesives when working with leather. Fortunately, this research need will begin to be addressed at a symposium on leather and adhesives in late September 2003 sponsored by the Folger Shakespeare Library and the Library of Congress. In addition, AIC is sponsoring a leather conservation workshop at the Conservation Center for Art and Historic Artifacts (CCAHA) in November 2003.

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# Vivak: An Alternative to Conventional Plexiglas and Museum Board for Exhibition Mounts

## ABSTRACT

The installation of exhibitions at the Folger Shakespeare Library led us to the discovery of co-polyester sheets, Vivak 099, from the company Makroform Ltd. We have found uses for Vivak 099 ranging from mounting small- to medium-format books, which are typically set up vertically or horizontally (with a twenty-five degree inclination), to creating supports for small-format frames and holding description labels. Previously we mounted objects using acid-free museum board, but we found that museum board has a strong visual appearance that interferes aesthetically with the visual aspect of the display case. Vivak 099, on the other hand, is a transparent, hand-pliable sheet and therefore does not compromise the appearance of the object being displayed. Vivak has the advantage of being inert, thus posing no threat to the item on display. The Vivak 099 sheet remains hand-pliable at room temperature up to a thickness of 0.062 inch, thus reducing work time extensively in comparison to the typical Plexiglas cradle. The Folger Shakespeare Library has mounted three exhibitions successfully using Vivak for various types of supports. The results have been very pleasing.

## INTRODUCTION

Our involvement in the installation of exhibitions at the Folger Shakespeare Library led us to the discovery of the co-polyester sheets, Vivak 099, which we use to mount books, to create supports for small-format frames, and to hold description labels (fig. 1). In the past, at the Folger we cradled books using acid-free museum board that was scored and bent to fit the size and opening of the book. These cradles are typically set up vertically or horizontally (with a twenty-five degree inclination) in the exhibition

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case. The vertical mounting requires two perforations that are punched or drilled into the backside of the cradle to accommodate the supporting brass nails, which are shot into the back wall of the case with a brad nailer. Aesthetically, museum board has a strong visual appearance that interferes with the visual aspect of the display case. Vivak, however, is a transparent, hand-pliable sheet and does not compromise the appearance of the object being displayed. It also has the added advantage of being inert.

## MATERIAL DESCRIPTION

Vivak and Vivak UV are co-polyester sheets that have been patented by the company Makroform Ltd. Uses range from construction and visual communications (displays, vending machines) to medical purposes. Vivak Clear



Fig. 1. Display supports made from Vivak co-polyester sheets





Fig. 2. To shape Vivak, clamp it in the board cutter . . .

099 is what we have found most suitable to our exhibition needs. It is a thermoplastic co-polyester with good manual thermoforming properties at room temperature up to a thickness of 0.062 inch.

The sheet is available from a minimal thickness of 0.020 inch to a maximum thickness of 0.500 inch. The 0.062-inch Vivak is a thickness that can be bent to shape manually without scoring or preheating and will support most small-to medium-format books. With this material, work time is reduced in comparison to the typical Plexiglas cradle, which demands additional time to draw the template, to cut the Plexiglas, and to polish the edges of the cut pieces. Moreover, Plexiglas requires heating prior to shaping and this step, in turn, requires a certain skilled hand and special equipment when bending with heat.

The Vivak 099 sheets:

- are cost-effective (not more than a standard sheet of museum board!),
- have good chemical resistance,
- are inert,
- have good adhesion qualities.

#### CRADLE MAKING

Record folds to be made according to book opening. (For more on basic cradle making, see Linda Blaser's 1992 article.) The sheet is cut slightly shorter than the height of the book to be cradled, making sure that the grain of the sheet runs from head to tail of the book, to facilitate the bending procedure. The sheet is then placed into the board cutter, using a ruler to measure the first bend (fig. 2). Clamp down and bend the Vivak 099 back and forth until the material becomes pliable (fig. 3). This process is repeated for every fold to be made, by sliding the sheet under the board cutter's clamp to the next measured fold. To achieve



Fig. 3. . . . and bend it back and forth until pliable.

the desired angle after the initial bending, remove the Vivak 099 from the board cutter and "over bend" each fold approximately twenty-five degrees before setting it into its final form. The protective sheet on both sides of the Vivak 099 is then removed. Once the Vivak has been bent into position, it will retain that memory and will set into that position.

#### CONCLUSION

The Folger has mounted several exhibitions using Vivak for our cradles, for V-shaped stands for flat objects, and for suspending description labels. The results have been very pleasing, greatly enhancing the overall look of our exhibitions.

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## Big Paper, Big Problems: Rigid Support Options for the Mounting and Display of Large Format Works on Paper

### ABSTRACT

A research project in the paper conservation laboratory of the Fine Arts Museums of San Francisco involved issues surrounding storage and exhibition of large format works of art on paper. This study yielded a multitude of solutions regarding innovative display methods and materials.

Current exhibition aesthetics, as well as size-related problems of handling, often dictate the use of non-traditional framing or mounting methods for works on paper. Lightweight rigid panels, including those developed for use in architectural and signage industries, have found practical application in the field of paper conservation. These composite materials provide versatile solutions for the preservation of large format works of art.

This poster was designed to supplement the AIC conference presentation by Michelle Facini and Debra Evans, "Big Paper, Big Problems: Preservation Issues of Large Format Works on Paper." It provided conservators with hands-on access to specific materials discussed in the presentation. Product samples were accompanied by information on manufacture and composition, weight, maximum dimensions, cost, availability, and industry-related technical data.

### INTRODUCTION

The paper conservation laboratory of the Fine Arts Museums of San Francisco was involved in a year-long research project exploring the exhibition and storage of large format works on paper. Made possible by the Samuel H. Kress Foundation, this study provided the opportunity to survey conservators and other keepers of collections about current storage and display methods. Materials used in the signage and architectural industries were investigat-

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ed. Portions of the rigid support panels highlighted in this research have not been created specifically for the preservation market. However, these products are constructed of materials commonly used in conservation.

### SAMPLES

The samples displayed on this poster (fig. 1) range from traditional paper supports to more modern polycarbonate plastics and aluminum honeycomb products. Each of these panel materials can be useful for both storage and exhibition of large format works on paper.

#### Archival Paper Supports:

Foam-X®, Gatorfoam®, Gatorplast®, Foam-X®, Tycore®, Honeycomb Core

- High quality, acid-free materials
- Lightweight
- Cost effective
- Easily manipulated using sharp blades
- Available in large panel sizes

#### Plastic and Polycarbonate Supports:

Coroplast®, Macrolux®

- High quality, rigid materials
- Lightweight
- Cost effective
- Easily manipulated using sharp blades or woodworking tools
- Available in large panel sizes
- Polycarbonate panels can be seamed or fitted together
- Available in a wide range of thicknesses

#### Aluminum Supports:

Alucobond®, Alupalite™, Aluminum Honeycomb Panels, Dibond®, D-Lite™, Econolite™, Max-Corr™, Teklam

- High quality, rigid materials
- Lightweight





## CONCLUSIONS

Cost effective and versatile, rigid support panels have many potential uses in the storage and display of large format works on paper. Panels have been successfully used to safely handle oversized works, in custom housing constructions, as secondary supports for temporary exhibits, in the design of storage furniture, and as backing materials for framing. In order to guide appropriate panel choices, the individual needs of each object must be identified on a case-by-case basis. Since manufacturers often change product compositions without notice, contacting suppliers for up-to-date materials information is recommended. In-house testing of materials should always be considered to evaluate the appropriate nature of materials for specific projects.

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## ACKNOWLEDGEMENTS

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Supplier	Product Name	Price per Sq. Foot /USD	Thickness mm inch	Weight Pounds/Sq. Ft.	Largest Panel Available
Alcan Composites USA Inc. Alusuisse Composites, Inc. P.O. Box 507 208 W. 5 <sup>th</sup> Street Benton, KY 42025 Phone: 800-626-3365 Fax: 502-527-1552 www.alcancompositeusa.com	Alucobond® Material Two skins of coil aluminum .020", with a polyethylene core. All material supplied with mill edge.	6.14	3 1/8	.92	5 x 16 ft 1.5 x 4.8 m
		6.75	4 3/16	1.12	
		7.40	6 1/4	1.49	
	Dibond® Material Two skins of 0.012" coil aluminum with a polyethylene core. Finished with a baked-on polyester paint. Bendable	2.59	2 1/16	.60	4 x 10 ft 1.2 x 3 m
		2.96	3 1/8	.79	
		3.46	4 3/16	.98	
Amerimax Building Products, Inc. 1140 All Pro Drive Elkhart, IN 46514 Phone: 888-325-1180 Fax: 219-266-9880 Email: inquiries@amerimaxbp.com www.amerimaxbp.com	Max-Corr™ Corrugated polypropylene core with .015 painted aluminum faced on two sides.	3.75	6 1/4	.82	Standard size 5 x 10 ft 1.5 x 3 m Widths up to 5 ft are available. Length determined by handling and shipping limitations.
		5.00	10 3/8	1.18	
		3.00	6 1/4	.63	
	Max-Corr Lite™ Corrugated polypropylene core with .015 painted aluminum faced on one side and a light gauge, aluminum-mill finish backer.	4.75	10 3/8	1.00	
Archivart® A Division of Heller & Usdan, Inc. 7 Caesar Place Moonachie, NJ 07074 Phone: 800-804-8428 Fax: 201-935-5964 Email: sales@archivart.com	Aluminum/Aluminum Honeycomb Panel Aluminum honeycomb, aluminum face material with polyurethane adhesive. Basswood edges.	35.00	14.2 9/16	.8	Supplier will customize panels to size.
	Fiberglass/Aluminum Honeycomb Panel Aluminum honeycomb, fiberglass face material with polyurethane adhesive. Basswood edges.	40.00	12.7 1/2	~1.2	
		41.00	15.8 5/8	~1.2	
		42.00	25.4 1	~1.2	
	Tycore® Mounting Panel Acid-free, buffered paper Item #7-1404: 48" x 96" x 1/2" Item #7-1405: 40" x 60" x 3/4"	3.17	12.7 1/2	.19	4 x 8 ft 1.2 x 2.4 m
		4.39	19.0 3/4	.33	3.3 x 5 ft 1 x 1.5 m
	Honeycomb Core Core structure without covering skins made from acid-free, lignin-free chemical pulp. Neutral pH. (Unexpanded: 60 x 12 in / 5 x 1 ft / 1.5 x .3 m Expanded: 48 x 192 in / 4 x 16 ft / 1.2 x 4.8 m)	.06	11 7/16	.06	4 x 16 ft 1.2 x 4.8 m

Supplier	Product Name	Price per Sq. Foot /USD	Thickness		Weight Pounds/Sq. Ft.	Largest Panel Available
			mm	inch		
<b>Coroplast®, Inc.</b> 4501 Spring Valley Road Dallas, TX 75244 Phone: 800-666-2241 Fax: 972-392-2242 www.coroplast.com	<b>Coroplast®</b> Extruded twinwall plastic sheet products based on a high impact polypropylene copolymer. (Archival Grade) Available thickness 2, 3, 4, 5, 6, 7, 8, 10 mm.	.31	4	3/16	.16	Standard size 4 x 8 ft 1.2 x 2.4 m Widths up to 8.5 ft are available. Length determined by handling and shipping limitations.
		.63	10	3/8	.41	
<b>Foam-X®</b> Alcan Composites 55 West Port Plaza, Ste. 625 St. Louis, MO 63146 Phone: 800-382-6445 Fax: 314-878-7596 www.aluisse-comp.com	<b>Foam-X®</b> Sandwich board with extruded polystyrene center. Acid-free paper liners, 2% reserve calcium carbonate buffer. Acid-free paper ranges in pH from 7.5-8.5.	.81	3	1/8	.145	4 x 8 ft 1.2 x 2.4 m Custom widths and lengths available.
		1.10	4	3/16	.149	
<b>Laminators Incorporated</b> 3255 Souderton Pike Hatfield, PA 19440-1731 Phone: 800-523-2347 Fax 215-721-4669 www.signboards.com	<b>Alumalite™</b> Aluminum composite panel with a high density corrugated plastic core (polyallomer). Both sides are faced with .016 inch finished aluminum.	2.96	6	1/4	.78	5 x 12 ft 1.5 x 3.6 m
	<b>Econolite™</b> Aluminum composite panel with a high density corrugated plastic core (polyallomer) faced with .016 inch finished aluminum and a lighter gauge backer. <b>D-Lite™ 1</b> Aluminum composite panel with a high density corrugated plastic core (polyallomer) faced with .012 inch finished aluminum and a lighter gauge backer. <b>D-Lite™ 2</b> Aluminum composite panel with a high density corrugated plastic core (polyallomer) faced with .012 inch finished aluminum and a lighter gauge backer. Stronger material compared to D-Lite 1.	5.18	10	3/8	.99	
		2.56	6	1/4	.64	
		3.75	10	3/8	.84	
		2.12	3	1/8	.42	
		2.30	3	1/8	.53	4 x 10 ft 1.2 x 3 m

Supplier	Product Name	Price per Sq. Foot /USD	Thickness		Weight Pounds/Sq. Ft.	Largest Panel Available
			mm	inch		
Macrolux® Co-Ex Corporation 5 Alexander Drive Wallingford, CT 06492 Phone: 800-888-5364 Fax: 203-679-0600 www.co-excorp.com	Multiwall Polycarbonate Sheet Twin, triple, four, five and M-wall Available thickness 6, 8, 10, 16, 20, 25, 32 mm	3.12	6	3/16	.16	4 x 39 ft 1.2 x 11.8 m
		7.81	25	1	.80	6 x 39 ft 1.8 x 11.8 m
Museum Services Corporation 1107 E. Cliff Road Burnsville, MN 55337-1514 Phone: 800-672-1107 Fax: 952-895-5298 www.museumservicescorporation.com	Aluminum Honeycomb Panel Aluminum skin, aluminum core, basswood edges. (Product #: 0511, 0512, 0513)	28.00	12.7	1/2	1.12	Maximum size for single aluminum panel 4 x 8 ft 1.2 x 2.4 m  Supplier can seam panels to construct larger sizes.
		28.00	15.8	5/8	1.2	
		33.00	25.4	1	1.4	
	40.00	12.7	1/2	1.0		
	40.00	15.8	5/8	1.1		
	42.00	25.4	1	1.2		
	Dibond® Composite Panel Faced with .010 gauge aluminum skin, polyethylene core. (Product #: 0531, 0532)  Tycore™ Acid-free paper panels with acid-free paper honeycomb core. (Product #: 0570-1404)	15.00	2	1/8	1.12	
		21.00	4	1/4	1.12	
		3.17	12.7	1/2	.19	

Supplier	Product Name	Price per Sq. Foot/USD		Thickness		Weight Pounds/Sq. Ft.	Largest Panel Available
		mm	inch				
Small Corp P.O. Box 948 Greenfield, MA 01302 Phone: 800-392-9500 Fax: 413-773-7386 www.smallcorp.com	Aluminum Support Panels Panels have a .016 aluminum skin with a sealed poplar frame and an aluminum honeycomb core. Panels over 48" x 96" have pieced aluminum skins joined to form a continuous flat surface. Supplier can provide panels faced with museum board or fabric.	12.7	1/2	~1.00	4 x 8 ft 1.2 x 2.4 m		
	Photo Mounting Panel 2-ply conservation board surface laminated to a 1/2" aluminum honeycomb panel. Panel is set into a 7/8" black powder-coated outer frame. Panels include hanging cleat. Maximum seamless width for paper is 90".	14.2	9/16	~1.00	Maximum size for single aluminum panel 4 x 8 ft 1.2 x 2.4 m Supplier can seam panels to construct larger sizes.		
	Sandwich Panel .025" aluminum facings with 3/8" aluminum honeycomb core.	12.7	1/2	.83	4 x 12 ft 1.2 x 3.6 m		
Teklam Corporation 1121 Olympic Drive Corona, CA 92881 Phone: 909-278-4563 Fax: 909-278-0389 www.teklam.com	Gatorfoam® Lightweight foamboard with a polystyrene core and patented veneer laminate face. Available thickness 3/16, 3/8, 1/2, 3/4, 1, 1 1/2, 2 inches.	4.0 12.7	3/16 1/2	.247 .296	5 x 10 ft 1.5 x 3 m		
	Gatorplast® High impact polystyrene facers laminated to a strong extruded polystyrene center. Available thickness 3/16, 1/2, 3/4, 1, 1 1/2, 2 inches.	19.0 25.4 38.1 50.8	3/4 1 1 1/2 2	.277 .370 .449 .513	4 x 8 ft 1.2 x 2.4 m		
		4.0 12.7 19.0	3/16 1/2 3/4	.204 .257 .297			

\*Support panels listed in this chart are constructed of materials commonly used in conservation. Product information is subject to manufacturer's change.  
Prices per square foot are based on quotes from local California distributors or list prices posted in conservation catalogues. Contact manufacturers for authorized dealers in your area.



## In Search of a Remedy: History of Treating Iron-Gall Ink at the Library of Congress

### ABSTRACT

As a prominent player in the early field of preservation, the Library of Congress has been on the forefront of many major trends aimed at stabilizing paper documents, as well as those ravaged by corrosive iron-gall ink. At first the focus was on physical support for damaged documents. By the mid-nineteenth century, a diversity of transparent materials were used in the United States and Europe to reinforce iron-gall ink manuscripts without significantly obscuring the text. Tissue paper appears to have been the first material applied as an overall support and was adapted at the Library in early 1899. However, later that same year the Library transitioned into the silking process, a new technology, to arrest the increasing deterioration of its eighteenth- and nineteenth-century manuscripts.

By 1940 William Barrow convinced Library officials that cellulose acetate lamination was the method of choice for supporting weak documents, including iron-gall ink manuscripts. Also around this time Barrow shifted his focus to the acidity which undermines iron-gall ink and paper alike. He was responsible for an innovation that involved deacidifying documents prior to cellulose acetate lamination, with consecutive immersions in calcium hydroxide followed by calcium bicarbonate. This method was practiced by the Library of Congress.

In compensation for the risks of this highly alkaline treatment and in the interest of efficiency, Barrow promoted the use of single immersion in magnesium bicarbonate in the 1960s. While the scientific community extolled the benefits of deacidification in general, Library conservators experienced an array of deleterious side effects from treatment with saturated magnesium bicarbonate. Consequently, for the past three decades they have

modified magnesium bicarbonate with various dilutions of deionized water and/or ethanol. Non-aqueous deacidification methods, such as methylmagnesium carbonate and Bookkeeper, have been selectively applied to treat especially water-soluble iron-gall ink, as well.

The Conservation Division staff became greatly interested in the promise of the anti-oxidant calcium phytate treatment proposed by Han Neevel and Birgit Reissland in the late 1990s. Currently the Library is testing and comparing the two-step calcium phytate/calcium bicarbonate technique to iron-gall ink treatments practiced by staff conservators in recent times. Meanwhile, the Library is interested in coordinating its resources with relevant iron-gall ink research underway in other laboratories. This paper reviews the institution's research initiatives and treatment approaches from the perspective of the Library of Congress' two-hundred-year history. The study does not include research done by other institutions that nonetheless has influenced Library staff, or address the complex problems of retreatment of iron-gall ink materials.

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From the vantage of the Library of Congress's two-hundred-year record, we are afforded a window on the changing aesthetic, technical, and philosophical approaches to manuscript restoration and conservation. As a prominent player in the early field of preservation, the Library has been on the forefront of many major trends aimed at stabilizing paper documents, as well as those ravaged by corrosive iron-gall ink.

The Library did not staff its own "restorers" until 1967. Instead, in 1897, restoration technicians from the Government Printing Office were detailed on site to mend and repair Library collections. At first the focus was on physical support for iron-gall ink damaged materials. Repairs and patches with hand-made and machine-made papers, of medium to tissue weight, were a common early

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This paper is based on a lecture presented at the History and Treatment of Works in Iron-Gall Ink workshop conducted by Dr. Han Neevel and Birgit Reissland, Smithsonian Center for Materials Research and Education, September 12, 2001. Received for publication Fall 2003.

remedy for the Library's manuscript collections. To remove cockles, manuscripts were simply moistened and flattened in a screw press.

By the mid-nineteenth century, a diversity of transparent materials were used in the United States and Europe to reinforce iron-gall ink manuscripts without significantly obscuring the text. Transparent paper appears to have been the first material applied as an overall, sandwich-style, support and was adapted by the Library in early 1899 (Marwick 1964).

However, later that same year, the Library of Congress transitioned to the silking process, a new technology publicized by the Vatican to arrest the increasing deterioration of its eighteenth- and nineteenth-century manuscript collections. Silk's greater transparency likely stimulated this transition. Unfortunately, some silked documents were observed to show deterioration within seventeen to thirty years. The presence of alum in the Library's silking paste recipe, recorded in 1913, probably was a contributing factor in the degradation of silked collection materials (Fitzpatrick 1913). It is widely accepted that, at certain concentrations, alum catalyzes the deterioration of iron-gall ink, paper, and silk, potentially rendering manuscripts extremely acidic, brittle, and unusually discolored over time while contributing to the occurrence of ink "strike through."<sup>1</sup>

Descriptions from the same 1913 source tell us that in preparation for silking, manuscripts would have been flattened by dampening between moist sheets of newspaper, then placed between smooth pulp boards in a letterpress. Those which were stained may have been washed by immersion in warm water, blotted between towels, and flattened as previously described. Based on conservators' observations, the consequences of these treatments for iron-gall ink manuscripts include excessive overall flatness, often accompanied by embossing from the silk texture. The results of aqueous-based treatment, in some but not all cases, has been seen to include bleeding, sinking, and changed color or intensity of the ink.

As the deficiencies of silking became evident, the Library continued to search for solutions that might be more cost effective and durable. In the context of the period, silking of manuscripts was time consuming and required highly skilled labor. In 1928 the Library of Congress and the National Bureau of Standards (NBS) experimented with cellulose acetate applied as a dip coating or spray, and with cellophane as a laminating film (Gear 1965).

The modern age of plastics had arrived. By 1946, these experiments and the persuasive entreaties of William Barrow convinced Library officials that cellulose acetate lamination was the method of choice for supporting weak documents, including iron-gall ink manuscripts. Perhaps the most treasured Library document treated in this man-

ner is the Rough Draft of the Declaration of Independence, written in iron-gall ink in Thomas Jefferson's hand. It previously had been silked in the early twentieth century. Degradation of the silking had progressed to the point that, while displayed on the *Freedom Train*, the silking split along a horizontal crease, probably due to stress on the embrittled silk from fluctuating environmental conditions. The *Freedom Train* was a seven-car locomotive which toured the country from 1947 to 1950, carrying a patriotic exhibit featuring a number of important American documents such as the Mayflower Compact, Lincoln's Gettysburg Address, and the Bill of Rights (U.S. National Archives 1950). As a consequence of damage occurring on the *Freedom Train*, the Rough Draft was "desilked" in a water bath, immersed in calcium bicarbonate, cellulose acetate laminated, and then returned to the *Freedom Train* in 1947 (Stiber 1997).

Typically, items were laminated by sandwiching a document between two sheets of cellulose acetate film, and this package was subsequently sandwiched between two sheets of tissue; the five-sheet composite was passed through a roller press, which was heated to 315°F–320°F (180°C–190°C) and exerted pressures of over seven hundred pounds per square inch, according to Barrow's own estimate (Barrow 1955; Stiber 1998). Predictably, Library-laminated iron-gall ink documents are uncharacteristically flat and inflexible compared to eighteenth- and nineteenth-century paper. Details of handwriting are veiled by the laminating tissue.

Around this time, Barrow shifted his focus to the acidity which undermines iron-gall ink, and paper generally. In the early 1940s, he and NBS scientist, B. Scribner, were responsible for an innovation that involved the "alkalization" of documents prior to cellulose acetate lamination. "Alkalization" had the dual effect of lessening the yellowing of documents when heated during lamination, Barrow's principle concern, and the more important effect of slowing the rate of deterioration of the paper documents. Although the relationship between the acid content of the cellulose acetate and the destabilizing effects of acid on the film did not appear to be understood by Barrow at the time, his "alkalization" step did mitigate acid-induced deterioration from the laminating film as well.

"Alkalization" involved an aqueous treatment (known as the "Barrow Two-Step" or "Two-Shot") with consecutive, twenty-minute immersions in saturated calcium hydroxide,<sup>2</sup> followed by calcium bicarbonate (Kelly 1972).<sup>3</sup> The treated manuscripts were air dried. For subsequent flattening, every tenth or fifteenth sheet was dampened with a sponge and gently weighted in a stack for one or more hours. About six sheets were removed from the stack at a time, and placed between blotters or chip boards in a screw press. Use of saturated calcium hydroxide often caused deposits of calcium carbonate on the surface of treated manuscripts and exposed treated materials to pH

values as high as 12.5. As a result of the Barrow protocol, which was employed at the Library, some iron-gall inks inevitably changed color or intensity (Waters 1973). In compensation for the potential risks of this treatment and to minimize the time required for “alkalization,” Barrow promoted the use of saturated magnesium bicarbonate in the mid-1960s, known as the “Barrow One-Step” or “One-Shot” (W. J. Barrow Research Laboratory 1964).<sup>4</sup>

The sixties marked a turning point for the Library, as well. In 1967, the Preservation Office was established with a research and testing laboratory and its own staff of paper and book “restorers.” Conservation theory and practice underwent close scrutiny by its own preservation team. Peter Waters was appointed Preservation Officer in 1971. Notably, immersion in “super saturated magnesium bicarbonate” is common practice in conservation treatment reports from this time.<sup>5</sup> In a January 1973 memo, Waters explains to the Research Officer, Dr. John C. Williams: “Calcium hydroxide in combination with calcium bicarbonate which has been used in this Library for a number of years and as general practice in other libraries and archives where the Barrow lamination technique is practiced, has been observed by us to often change the color density of some writing inks from a deep tone to a lighter one or from brown to orange. No doubt this is due to the high pH which is achieved by the hydroxide solution. Because we must lessen the possibility of tonal, color, or other changes likely to occur as a result of a treatment we have replaced the hydroxide solution with a warm water wash. Of course, water washing is followed by calcium or magnesium bicarbonate immersion to buffer the paper” (Waters 1973). His description of the writing ink that changes from brown to orange as a result of highly alkaline water-based treatment is entirely consistent with conservators’ observations of some iron-gall ink.

While the scientific community extolled the benefits of deacidification in general, a number of Library conservators experienced an array of deleterious side effects from treatment with saturated magnesium bicarbonate,<sup>6</sup> including some of the same alterations to iron-gall ink observed with the “Barrow Two-Step.” Similar to the surface precipitation of calcium carbonate resulting from the use of calcium hydroxide, deposit of magnesium carbonate crystals on manuscripts was a problem. Regarding this phenomena, which staff conservators referred to as “gritting,” Waters speculated that one cause was the concentration of the magnesium bicarbonate. He suggested that diluting the solution to “half saturated strength” might be appropriate for some deacidification treatments, but cautioned that: “We do not have specific guidelines for selection of an aqueous technique where one is indicated. I have taken the view that we need to find out a great deal more about the requirements of and reactions to treatment of the LC material before we formalize standards” (Waters

1974). Deacidification treatments using even “half saturated strength” magnesium bicarbonate, such as that given select pages of Thomas Jefferson’s 1776, multi-page manuscript, *Notes on the Proceedings of Congress, Containing the Text of the Declaration of Independence*, are testament to the degree of change iron-gall ink could potentially undergo.<sup>7</sup> The iron-gall ink on the pages treated in this manner is orangish brown and diminished in intensity when compared to untreated portions of the manuscript (figs. 1–2).

Options for treating especially water-soluble iron-gall ink were expanded when methylmagnesium carbonate, a non-aqueous deacidification system, was patented by Library chemist George Kelly in the mid-1970s. In 1974 the Library’s Research Office began to confront some of the many practical issues and theoretical questions arising from the myriad deacidification treatments available. In support of this program, Waters organized a Restoration Office Deacidification Committee, “to insure that the right questions are asked” with respect to conservation practices (Waters 1974). Conservators were concerned about how much alkaline reserve was desirable for various materials and how to evaluate adequate alkaline reserve after treatment. Further queries revolved around whether aqueous versus non-aqueous deacidification techniques were ideal, and how best to apply them. Appropriate treatments for iron-gall ink entered into the discussion. The Deacidification Committee chair, Norvell Jones, succinctly summarized the sentiments of the conservators: “We are at a stage where every advance in knowledge raises more questions. The water will probably seem much muddier before it clears” (Jones 1976).

One outcome of this collaborative period between the Library’s scientific and conservation staff was a set of guidelines from Waters to deacidify iron-gall ink manuscripts with magnesium bicarbonate only, not calcium hydroxide,<sup>8</sup> unless recommended by Waters himself. Conservators were advised to reduce the concentration of magnesium bicarbonate so that no precipitation occurred. The strength of the solution might have to vary from one paper to another. The prevention of “gritting” would override concern for the degree of alkaline reserve achieved (Waters 1977).

It was also in the early seventies that Waters persuaded the Library to abandon lamination in favor of polyester film encapsulation to provide physical support for weak and damaged manuscripts. He developed a non-aqueous adhesive formula for “heat-set mending tissue” using Rhoplex ethyl acrylate/methyl acrylate copolymer, as well. This was especially helpful in repairing water-soluble iron-gall ink manuscripts.

In 1976, the Library set out in earnest to tackle the treatment of iron-gall ink and contracted Margaret Hey to research deacidification and stabilization of this medium.

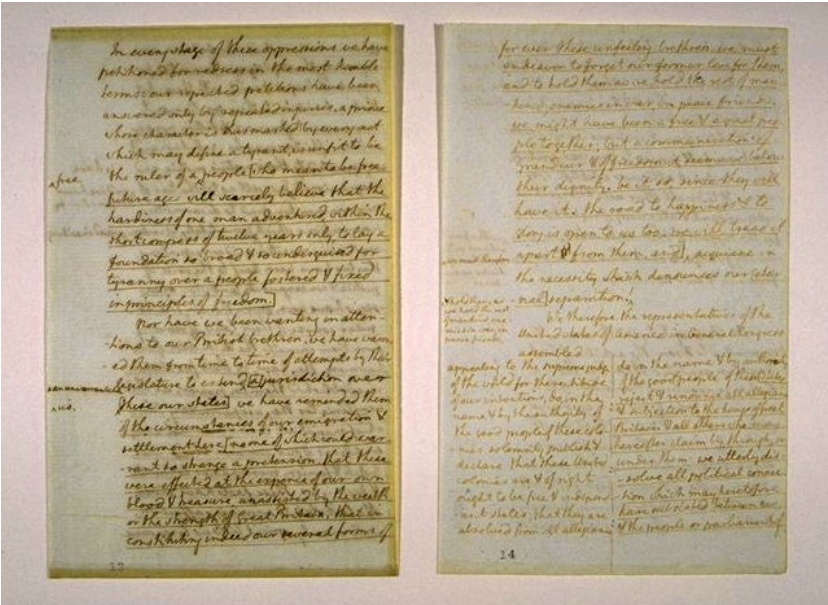


Fig. 1. Notes on the Proceedings of Congress, containing the text of the Declaration of Independence, written in iron-gall ink by Thomas Jefferson, 1776. P.11 untreated (on left); p.12 immersed in deionized water followed by saturated magnesium bicarbonate diluted 50% with water (on right).

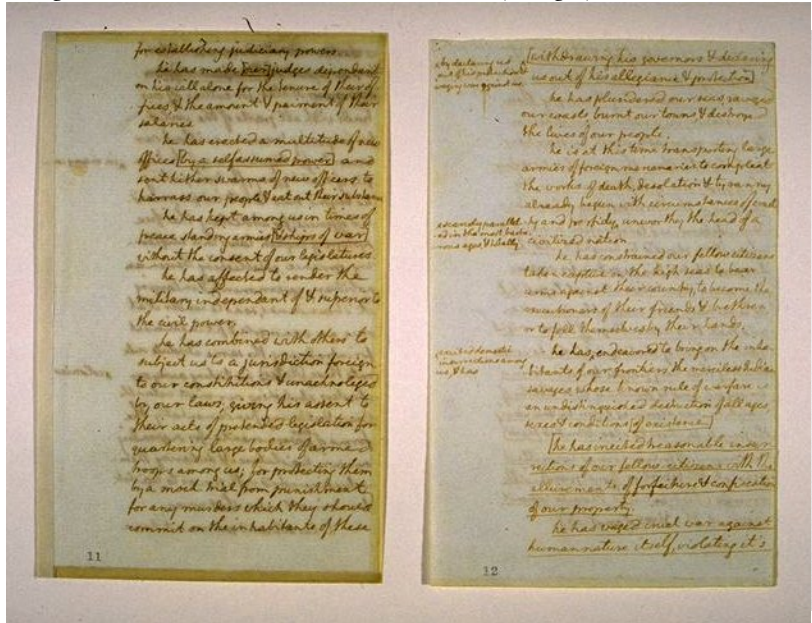


Fig. 2. Notes on the Proceedings of Congress, containing the text of the Declaration of Independence, written in iron-gall ink by Thomas Jefferson, 1776. P.13 untreated (on left); p.14 immersed in deionized water followed by saturated magnesium bicarbonate diluted 50% with water (on right).

Her experiment was designed to investigate the effect of alkaline compounds on sulfuric acid and ferric oxides in paper, and not the consequences for iron-gallotannate. The study samples were made of cellulose pulp containing different concentrations of iron oxides.<sup>9</sup> They were immersed in 4% sodium borate; “1/2 saturated calcium hydroxide;” magnesium bicarbonate (concentration not specified but

presumed to be saturated); and methylmagnesium carbonate “dissolved in Freon plus methanol.” Hey concluded that the higher the ratio of calcium or magnesium carbonate to iron, the greater the protection conferred on the cellulose. Understandably, the sodium borate performed poorly. She recommended washing well in water prior to deacidification (Hey 1981–82).

By 1979, Library chemist Lucia Tang and conservator Norvell Jones demonstrated that washing with distilled or deionized water, which was retreated by passing it through calcium carbonate chips, was more beneficial to paper longevity than washing with non-calci-nated distilled or deionized water (Tang and Jones 1979). Immersion in “calcinated” deion-ized water has since become a standard washing procedure and pre-deacidification treatment at the Library of Congress, and indeed, in the United States and elsewhere.<sup>10</sup>

Library interns Lois Price and Diane van der Reyden studied the effectiveness of various application techniques for methylmagnesium carbonate, also in 1979. They discovered that an approximately 1% alkaline reserve, by then considered an ade-quate amount, was deposited by both spraying and immersion methods (van der Reyden and Price 1979). Because methylmagnesium car-bonate is mixed with methanol and Freon, both fast-evaporating solvents, it is possible to inadvertently deposit uneven quantities of alkaline reserve in treated paper. This poten-tial has continued to raise concern about resulting differential aging, though it has not been demonstrated experimentally.

Treatment records of the 1980s reveal that “1/2 saturated magnesium bicarbonate” diluted with water was the aqueous deacidification method most commonly employed for non-water-soluble iron-gall ink manuscripts. By the middle of the decade washing alone, or pre-washing prior to deacidification, with ethanol-water mixtures was introduced as well. In a 1991 presentation to an American Institute for Conservation/Book and Paper

Group deacidification panel, conservator Terry Boone summarized the alkalization treatments in use at the Library of Congress then. Calcium hydroxide was added to wash water to modify its pH, saturated magnesium bicarbonate was diluted with 75% to 85% water, and methylmagnesium carbonate was spray or brush applied when an aqueous treatment was not indicated. She noted



that magnesium bicarbonate was observed to cause a “warmer, more reddish-orange color to some iron-gall ink after treatment.”

In the early 1990s, Dr. Chandru Shahani and Frank Hengemihle, of the Library’s Research and Testing Division, investigated the relative efficiency of aqueous versus non-aqueous deacidification methods to extend the life of paper. The research concluded that even low alkaline deposits delivered in an aqueous solution were more effective than eleven times as much alkaline reserve delivered non-aqueously, based on fold endurance performance after humid oven aging (Shahani and Hengemihle 1991). These data would inspire conservator Heather Wanser’s 1996 study of various treatments for iron-gall ink, including magnesium bicarbonate diluted with ethanol (Wanser 1996). The research indicated that, with respect to total alkaline reserve achieved, papers<sup>11</sup> immersed in a fully aqueous solution containing 25% saturated magnesium bicarbonate performed similarly to ethanol-diluted solutions also containing 25% saturated magnesium bicarbonate (these mixtures were comprised of 50% and 65% ethanol, respectively). On average, the fully aqueous magnesium bicarbonate treatment resulted in depositing approximately 0.6% alkaline reserve, while the 50% and 65% ethanol-diluted solutions deposited approximately 0.7% and 0.55%, respectively. A second phase of the study compared the effect of fully aqueous and ethanol-diluted solutions of magnesium bicarbonate on six iron-gall ink documents dating from the eighteenth and nineteenth centuries. A 70% ethanol-diluted magnesium bicarbonate solution performed best, causing no visible alteration to any of the six iron-gall ink manuscripts. It is noteworthy that two fully aqueous treatments of 100% and 25% saturated magnesium bicarbonate caused loss of intensity and color change in the ink of four of the six documents. Though not based on a statistically valid sampling, the test results suggested that the addition of ethanol to magnesium bicarbonate could precipitate an adequate alkaline reserve and preserve the visual appearance of aged iron-gall ink.

Bookkeeper non-aqueous deacidification technology was introduced at the Library in 1995 and since 1997 has been applied to selected iron-gall ink manuscripts, among other materials. Bookkeeper contains sub-micron sized particles of magnesium oxide dispersed in perfluoroalkane and, at the time of its introduction, a surfactant of perfluoropolyether derivative. When sprayed, the sub-micron particles of magnesium oxide become lodged in paper. The theory is that ambient moisture reacts with the particles to form magnesium hydroxide. In a 1998 study of this non-aqueous system, conservators Terry Boone, Lynn Kidder, and Susan Russick found that spray application achieved uniform and adequate alkaline reserve (Boon, Kidder, and Russick 1998).

Over time, the concept of acceptable change and appreciation for the consequences of treatment have evolved, influenced by scientific research, empirical observation, and aesthetic taste. Consequently, for the past three decades, Library conservators have modified wash water with ethanol, magnesium bicarbonate with various dilutions of deionized water and/or ethanol, or simply employed non-aqueous deacidification methods to abate the corrosion of those iron-gall inks which were unacceptably altered by even ethanol-diluted magnesium bicarbonate.

Yet questions concerning the stabilization of iron-gall ink still exist. Conservation Division staff became greatly interested in the promise of the antioxidant calcium phytate treatment proposed by Han Neevel and Birgit Reissland, of the Netherlands Institute for Cultural Heritage (ICN), in the late 1990s (Neevel 1995; Reissland and De Groot 1999). Library and visiting conservators collaborated with staff scientists in discussion groups to debate the recent technological advances in understanding and treating iron-gall ink, and also to establish a research plan to better evaluate new treatments. Practical experience was gained through in-house workshops in the application of the two-step calcium phytate/calcium bicarbonate protocol.

Currently a team of Library conservators, including the author and Cindy Ryan, Elmer Eusman, Heather Wanser, and Holly Krueger, are testing and comparing the calcium phytate technique to iron-gall ink treatments practiced by staff in recent times. Performance of the calcium phytate/calcium bicarbonate protocol will be evaluated against treatments such as 25% saturated magnesium bicarbonate diluted in 75% deionized water, and 25% saturated magnesium bicarbonate diluted in 65% ethanol and 10% deionized water, among others. A further variation on the ICN’s experiment includes accelerated aging at conditions of 90°C and 50% relative humidity, which are broadly accepted by the conservation science community, instead of the extreme conditions chosen by Neevel and Reissland, of cycling between 80% and 35% relative humidity every three hours. The Library’s storage conditions generally do not manifest extremes of cycling relative humidity. In addition, the Library’s study will include gelatin-sized experimental samples, as well as unsized sheets similar to those used in the ICN research. Use of gelatin-sized sheets is thought to approximate more closely the characteristics of original iron-gall ink manuscripts or drawings. The results of these experiments will lead to the eventual testing of expendable antique iron-gall ink materials before possibly assimilating the calcium phytate treatment into common conservation practice. Meanwhile, the Library is interested in coordinating its resources with relevant iron-gall ink research initiatives underway in other laboratories.

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## NOTES

1. "Strike through" is a term used to describe corrosive penetration of iron-gall ink through a support, such that the ink can be seen on the support verso.
2. Calcium hydroxide made with calcium oxide.
3. 0.2% calcium bicarbonate made with calcium carbonate.
4. The 1964 Barrow Research Laboratory article makes the first suggestion known to the author of adding alcohol to magnesium bicarbonate, in this case to reduce cockling of spray-deacidified bound book pages.
5. Author's survey of treatment reports dated 1971 through 1985 in the Conservation Division, Library of Congress. In the Preservation Office, supersaturated magnesium bicarbonate was made to achieve a titration of 25ml EDTA to end point.
6. Made with magnesium carbonate.
7. Four pages from the Notes of the Proceedings of Congress were immersed in deionized water prior to immersion in saturated magnesium bicarbonate diluted 50% with water. Library of Congress Preservation Office treatment report number 001998, April 1, 1975.
8. Preservation Office treatment records of this period for a wide range of materials indicate that immersion in saturated calcium hydroxide diluted 50% with water was common.
9. The cellulose pulp contained 16 ppm, 399 ppm, and 525 ppm iron respectively.
10. Tang's further research of 1979 provided evidence that paper immersed in deionized water with even small quantities of calcium, (9.2 and 11.4 ppm calcium respectively) substantially increased fold endurance compared with unwashed paper (Tang 1981).
11. Three types of papers were tested: rag waterleaf made by the Library of Congress Preservation Research and Testing Division; antique rag from a 1768 publication; and ten-year-old newsprint. The alkaline reserve data represents an average of the uptake of all three types of papers with respect to each immersion protocol and is expressed in percent calcium carbonate equivalents.

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## So Tasteful: A Note About Iron-Gall Ink

### ABSTRACT

Iron-gall ink was not used for writing in historical Japan, but the compound did have a long tradition for aesthetically blackening teeth. This note summarizes the history of the practice and the materials, implements, and methods used.

### INTRODUCTION

Although iron-gall ink was not used for writing or drawing in historical Japan, where black and gray shades were made with lamp black pigments (usually produced from burnt pine wood or rapeseed oil), the ink was used for another purpose—blackening teeth. This cosmetic practice extends back many centuries in several East Asian countries, including Vietnam, Indonesia, and possibly China (Casal 1966).<sup>1</sup> Its earliest history in Japan is unknown: whether the practice was imported and, if so, where from; when the custom was first observed; and the original reason(s) for undertaking it. Eventually a darkened mouth—which might also be interpreted as the absence of obvious teeth—came to be seen as aesthetically pleasing. In Japan, the custom was called by several names, most commonly *ohaguro* (*o* = esteemed, *ha* = teeth, *guro* = black).<sup>2</sup>

### HISTORY OF USE

Whether social hierarchy dictated ancient blacking practice seems to be unknown, but in early historical periods the custom was restricted to men, women, and children of the court. Like any cultural practice or fashion, blackening teeth waxed and waned with prevailing social forces. In the Nara period (710–784), Chinese culture dominated the Japanese court, so men abandoned what came to be

seen as a barbaric taste. Women, or at least those who were married, maintained the practice.

With the overweening refinement of the Heian court, around the ninth century the style again became vogueish with ladies, and girls were initiated after puberty. Some male courtiers also resumed the practice, and by the twelfth century the custom was again widespread with men at court (Casal 1966; Kojima and Crane 1991, 253; Chamberlain 1980, 63–4). Boys also blacked their teeth after puberty.

After the majority of noble men and women resumed blacking, the convention was adopted by many of the samurai class—men, women, and children who had reached puberty. Samurai men took as much care to refresh the blackening in preparation for battle as before social events. During the Heian wars (1180–1185), the Heike/Taira faction, who had adopted Kyoto court fashions, could be identified by their darkened teeth, while the Minamoto/Genji partisans kept theirs white. Casal aptly summarized the tradition's early history: “. . . what probably began as a totem superstition, after passing through a stage of perverse sensuality, turned into an emblem of a warrior's true and faithful spirit!”

Because the Taira won the wars, they dictated taste in the Muromachi period (1336–1568). The fashion spread to other classes, even commoners, although outcasts such as leather workers, beggars, and others deemed “dirty” or socially unacceptable were not allowed to use any makeup. Young people continued to follow the custom after puberty. During the fourteenth century, the Noh drama developed, and by 1349 its actors were blackening their teeth as part of their theatrical dress (Frédéric 1984, 222). Their carved and painted masks, which continue to be highly valued as art objects, often show darkened teeth.

In the Momoyama period (1568–1603), Bernardino de Avila Girón, a Spanish merchant who settled in Japan, wrote that “. . . maidens and widows do not stain their teeth in this way” (Schilling and de Lejarza 1934, 17–18; quoted in Cooper 1965, 39, 48).

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However, later accounts reported that in certain regions young men had girls' teeth forcibly blackened as a way of committing them to marriage (Curizuka 1904; Mossman 1873, 477), and during the Edo period (1603–1868) *ohaguro* was an important part of the rites that transformed apprentice courtesans into women at about age fourteen. To assure their professional success, the initial staining materials were collected from friends and applied at a ceremony sponsored by friendly "iron parents" (*kane oya*) (Casal 1966, 25). Edo women were required to blacken their teeth after they married, the practice having come to signify marital fidelity. Casal speculates that this new meaning may have derived from the earlier fidelity of warriors to their lords. Widows, no matter how young, were expected to maintain the practice as a sign of undying loyalty to their late husbands. Edo men observed the custom from the age of fifteen or sixteen.

After Commodore Matthew Perry's expedition forced Japan to reopen intercourse with the world in 1853, the nation became aware of foreign technological advancements and grew anxious about related cultural discrepancies. At the beginning of the Meiji Restoration, an imperial decree on January 30, 1868, announced that nobles were no longer "obliged" to blacken their teeth. This indicates not only that the government was sensitive to Western aesthetics, but that at some previous time the custom had mutated to a requirement for those at court. Despite the edict, the Emperor maintained the tradition for a while. Then in the spring of 1870 another decree was issued: men were forbidden from blacking their teeth. In March 1873 the Empress let it be known that she had discontinued the practice, sending a signal that ladies of the court quickly followed. The change flowed down through society, although some women in remote rural areas continued the practice for nearly a century.

#### STAINING MATERIALS AND METHODS

Early blacking methods are not known; since the procedure was traditional, the method documented during the Edo period probably was similar to earlier techniques. "Mr. A. B. Mitford, in his amusing *Tales of Old Japan*, gives the following recipe for tooth-blackening, as having been supplied to him by a fashionable Yedo [Tokyo] druggist: 'Take three pints of water, and, having warmed it, add half a teacupful of wine. [By "wine," he must of course mean Japanese *sake*.] Put into this mixture a quantity of red-hot iron; allow it to stand for five or six days, when there will be a scum on the top of the mixture, which should then be poured into a small teacup and placed near a fire. When it is warm, powdered gall-nuts and iron filings should be added to it, and the whole should be warmed again. The liquid is then painted on to the teeth by means of a soft feather brush, with more powdered gall-nuts and iron, and,

after several applications, the desired colour will be obtained'" (Chamberlain 1980 quoting Mitford 1904). *Ukiyoe* prints often depict women brushing on the concoction.

Some modern references describe the dye as being made from oxidized iron shavings soaked in vinegar and powdered gallnuts (Kojima and Crane 1991; Salmon 1975, 18), perhaps reflecting the observation of Luis Frois, a sixteenth-century Portuguese missionary, who remarked, "European women use artificial means to make their teeth white; Japanese women use iron and vinegar to make their mouth and teeth black" (Frois chap. 2, no. 16; quoted in Cooper 1965, 39, 48, 420). Several modern writers say that tea was used (Shimizu 1988, 380; Pekarik 2003). Avila Girón reported that "the bark of a tree" was used [to provide tannic acid] (Cooper 1965, 39), and Casal said that the snake gourd (*Luffa petola*, called *hechima* in Japanese) was used. Thus, it seems that as with Western iron-gall inks, a variety of ingredients were used to intensify the acidity of a recipe. Because the Japanese colorant was used orally, one would not expect the water-soluble gum binder, provisional colorants, or gloss enhancers that were incorporated into Western iron-gall inks to have been added; but one source says "things such as candy were also added" to the iron, water, and tea or vinegar mixture (Pekarik 2003).<sup>3</sup>

During the tenth and eleventh centuries, it became stylish to store cosmetics and toilet implements in sets of nesting lacquer boxes, which upper class women took to their husbands' households as part of their dowries. The often elaborately decorated sets sometimes contained more than fifty pieces altogether and remained popular through the Edo period; examples can be seen in the lacquer collections of fine arts museums (Montreal Museum of Fine Arts 1989, 203–4; Shimizu 1988, 292–295). Among other accoutrements, the boxes held polished metal hand mirrors, feather and hair brushes, water ewers for mixing powders into pastes, basins for rinsing the mouth between ink applications, and thin papers for removing make-up. In addition to white face powders (e.g. white lead and chalk, pulverized rice), the boxes held black powders: lamp black for eyebrows (Casal 1966, 16; Frédéric 1984, 84; Salmon 1975), powdered gallnuts—called *fushi* or *fushiko* [五倍子粉] (Montreal Museum of Fine Arts 1989)—for teeth, and possibly a powder of fully formed, desiccated stain.<sup>4</sup>

Less wealthy people probably stored their powders and liquids in a variety of containers. Kilns in Echizen province (now Fukui prefecture) were famous for rough, functional stoneware jars made especially for tooth blackening materials ("Major ceramic kilns of Japan," [2003]), and humble brushes included reed or willow wood sticks fibrillated at one end (Casal 1966, 24).

The first time teeth were blackened, two or three days of applications were required to create a desirably dark shade

(Casal 1966, 24). Even after establishing the color, the preparation wore off after a few days, and Avila Girón opined that one function of women's red lip color was "to hide the dye which comes off on their lips when they stain their teeth" (quoted in Cooper 1965, 40). Before restaining, it was recommended that most of the residual color be rubbed off using finely powdered charcoal or red cuttlefish bones and a fibrillated stick brush (Casal 1966, 24).

#### IN CONCLUSION

Of course there are always those who rebel against social custom. A famous Heian story describes a young girl who ". . . thought that people's artificial manners were hateful. . . . She declared that teeth-blackening was . . . harmful and dirty . . . and her smile displayed astonishingly white teeth. . . . People were scared and ill at ease before her and shunned her [and another lady of the household said of her]: '. . . her teeth [look] as naked as a skinned animal. . . .' "<sup>5</sup>

#### ACKNOWLEDGMENTS

I am grateful to Andrew Pekarik, a scholar of Japanese literature and visual arts, for translation assistance and to Colleen Hennessey, archivist at the Freer-Sackler Galleries of the Smithsonian Institution, for access to library materials.

#### NOTES

1. Casal's "Japanese Cosmetics and Teeth Blackening" is a fascinating article by a Swiss businessman, lacquer collector, and highly regarded scholar of traditional Japanese culture. Casal wrote that teeth blackening was not practiced in China, where "beautiful teeth should be like pearls of the purest color." However other sources say the practice was observed in parts of the country. See, for example, Qionchua 2001 and Machar 1882.

2. Casal also listed the names *tesshoo* (iron-juice) and *dashigane* (metal extract), noting that commoners called the preparation *okane* (the noble metal) as well as *ohaguro*.

3. Shimizu states that both vinegar and tea were used.

4. This author's speculation, based on the assumptions that a powder of the fully constituted stain would have been useful when traveling and that specific preparation methods varied in Japan as much as they did in the West.

5. "The princess who loved insects," from the collection of ten anonymous stories called *Tsutsumi chuunagon monogatari*, which might translate as "Riverside counselor stories." As translated in E. O. Reischauer and J. K. Yamagiwa, 1951.

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## Storage of Architectural Materials at the Syracuse University Library

### ABSTRACT

When the Department of Special Collections at the Syracuse University Library acquired the papers of Werner Seligmann, an architect and former dean of the Syracuse University School of Architecture, the opportunity presented itself to develop a model storage system that could be applied to the other architectural drawings in the department. While not large in comparison to these other collections, the Seligmann Papers were sizable enough to give us a better understanding of the storage issues involved if we decided to undertake the task of rehousing our other drawings. If such a task were to be undertaken, a new storage system would need to be compact, scalable, economical, and archivally sound. This paper describes the challenges, preservation, cost, and space issues we addressed as well as the method of work we followed to house the Seligmann drawings.

### BACKGROUND

The Syracuse University Library has a long history of collecting the papers, including drawings, of leading architects. Notable among them are William Lescaze, Marcel Breuer, Pietro Belluschi, and Werner Seligmann. These papers have increasingly attracted intense interest from individuals outside the University—owners of property, architectural historians, and museum curators to name only a few.

The collections vary considerably in content, format, and physical condition (fig. 1). In addition to tracings, sketches, plans, blueprints and other reproductions, the collections contain office records, consisting of correspondence, financial data, specifications, photographs, and printed material. It is the oversized visual materials, those exceeding standard letter and legal formats, which have caused the most concern, and frustration, to collection

custodians at the Syracuse University Library. Architectural materials at the Syracuse University Library are stored by architect and then by the architect's "job number," with the various forms of media kept together. While this is not ideal, especially with materials considered by some to be "works of art on paper," the size and use of the collections make this the most practical way of grouping and storing them.

The Library for years has housed plans and renderings in flat storage files. As more large-scale material was added some years ago, it was necessary to turn to more space-efficient storage—hanging files in "Plan Hold" cabinets. Drawings and mediums of all sizes were aligned along one edge in a large folder which was grasped by a metal clamp with wing-nuts to close it tightly. Each large hanging folder was hooked into a rack with the clamp. The rack then slid in and out of the cabinet on small wheels allowing folders to be retrieved (fig. 2).

Awkward at best, and damaging to materials due to the clamping mechanism, this system was continued until the early 1990s. A shift from one off-site storage facility to another in the early 1980s proved how damaging the Plan Hold approach is. The cabinets were shifted full, with the



Fig. 1. Packed materials on shelf

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Fig. 2. Plan Hold cabinet



Fig. 3. Damage from Plan Hold cabinet

result that they arrived in the new facility with the contents in conditions ranging from still perfectly aligned to slumped on the base of the Plan Hold cabinet (fig. 3). However, the number of Plan Hold cabinets was finite and new materials, arriving as rolls or in tubes (cardboard and metal), were left as is. Meanwhile, use of these materials increased. New owners of historic homes and exhibition curators were requesting more and more material. As materials were used, it became clear that it was extremely difficult to return plans to the Plan Hold system, and the decision was made to no longer return materials there.

The same problem also occurred with materials in tubes, which were often over-filled and rolled so tightly that removal was very difficult, and reinserting impossible. As a result of these problems, plans were placed in large oak-tag (a heavy, acid-free paper) folders, labeled, and stacked flat to a height of roughly six to eight inches on tables in the Special Collections stack area. Material stored vertically in tubes settles, crushing the lowest edges, with the top edges being damaged when the tube is closed. Often the tubes were so tightly packed staff could not roll the materials tightly enough to return them to the original tubes. Initially materials were stored flat, as described above, but when available flat space ran short, we returned to rolling the plans, allowing them to “loosen,” wrapped the new rolls in oak-tag, labeled them, and stored them horizontally on regular manuscript shelving. The two-shelf pass-through approach was used to provide support for the entire length of the roll. Handling a roll, of any diameter, is also far easier than a large folder, and requires less physical effort because one can safely get one’s arms around it.

Current policies stipulate that items originating from the Plan Hold cabinets are not returned there. If they come from a tube, the plans may or may not be returned to the original tube. While this approach may be safer for the materials, it makes a mockery of organizational and control systems. Finding aids, which are tied to shelf, Plan Hold, or tube locations, can no longer be relied upon. While interim lists of what is “checked out” are available, a great deal of staff memory is required, memory which resides in a limited number of individuals.

Further attempts at control have focused on preparing lists of plans belonging to a specific project when it is requested. The long-term benefit of this sporadic investment of time is that, once done, future handling is reduced. Early on, we realized that large-scale lists, such as item-level inventories, while desirable, were impossible, impractical, and unnecessary. Aside

from the owners of buildings, projects seem not to be of equal importance to historians and preservationists, with those groups concentrating on well-known structures and “firsts,” such as design elements and materials.

#### STORAGE METHODS

Preservation concerns with this variety of architectural materials include flaking media, abrasion, acid and alkaline migration, and physical damage from handling. A point of contention in the debate over architectural records is whether they are to be considered works of art on paper, which many certainly are, or simply “papers” in the archival sense. Ideally, graphic materials should be stored flat in appropriate individual folders or mats and separated by medium. Failing that option, roll storage, if properly done, is the best alternative. While pressure on the bottom of the roll where it is in contact with the shelf may be a concern, having the weight of the roll spread out along its entire length reduces this pressure.

#### THE WERNER SELIGMANN PAPERS

The Seligmann Papers, 1948–1998 (bulk 1955–1998), came to the Department in the summer of 2000 and included an extensive slide collection, models, presentation boards, several boxes of photographs, specifications, competition programs, articles, newspaper clippings, reports, studies, and other items. Also included were several thousand drawings in approximately 230 cardboard tubes and bags, or in some cases, rolled with rubber bands. Blueprints, sepias, and original drawings on trace were



mixed together. All of this was not very different from how other architectural collections were received.

The task of identifying, sorting, describing, and re-housing the papers was undertaken by a faculty member from the School of Architecture and one manuscript processor who was hired by the Library for the project. Both worked part-time while the preservation and access librarian designed the storage system, ordered supplies, and worked with Syracuse University Central Facilities to coordinate construction of the units.

Identifying, sorting, and describing the contents of the 230 tubes took place over the summer and fall of 2001 and rehousing the materials, including transporting the tubes in batches to the remote storage facility, started in December of 2001 and was completed in April of 2002.

#### THE IDEA

Ideally, graphic materials should be stored flat in individual folders or mats and separated by medium. Flat files and folders for all the items proved too expensive and would have required more floorspace than was available.

The system designed for the Seligmann Papers is based around a tube within a tube (fig. 4). By rolling the materials around an inner tube, wrapping it with a protective enclosure, inserting it into a larger tube, and storing it horizontally, the materials are well protected, yet accessible for use. These tube pairs are then nested within “boxes” holding fifty-six tubes (for the vertical units).

#### METHOD OF WORK

While all tubes are acid-free, additional protection was added by wrapping the outside of the three-inch diameter inner tube with acid-free, buffered Permalife paper, and rerolling the drawings around the outside of the tube (fig. 5). A sheet of Mylar, with Velcro coins to hold it closed, then wraps around the roll. For items which may receive heavy use, a tie ribbon can be substituted as the Velcro coins may separate from the Mylar with repeated opening and closing. In addition to keeping the materials on the roll, the wrappers also protect against abrasion incurred as rolls are removed and inserted into the outer tubes. By rolling the materials around a three-inch diameter tube, one is able to get more material on the roll than one could get inside, and still have it fit very comfortably into the six-inch diameter outer tube. As the collection is housed at the remote storage facility, a work surface where materials



Fig. 4. Tube-within tube storage



Fig. 5. Tube-within-tube storage, detail

could be unrolled, viewed, and rerolled was also required. This was accomplished by laying a “box” on its side and attaching a work-surface (fig. 6).

The large tubes are nestled together in a framework resembling a honeycomb, allowing for a high storage density in a relatively small area. The vertical “boxes” hold fifty-six tubes, the horizontal “boxes” fifty-eight tubes. For the Seligmann Papers, this meant that four “boxes” were required, two vertical and two horizontal with top. Vertical units require 36-inch width by 48-inch depth of floorspace, horizontal units 90-inch width by 48-inch depth. The horizontal units incorporate a work-surface critical for viewing these oversized materials.

#### CONSTRUCTION OF THE UNITS

Each storage unit is constructed of three metal shelving frames, 1 x 2s, and half-inch plywood (fig. 7). By reusing



Fig. 6. Work surface on top of a storage unit on its side



Fig. 7. Overall view of tube-storage units

surplus library shelving frames, we were able to easily ensure a very rigid and stable frame and reduce overall construction costs. Appendix 2 depicts the working drawings prepared by Syracuse University's Central Facilities.

In addition to building the "boxes," Central Facilities cut down the inner tubes by two inches so that the endcaps would fit into the larger tubes to protect against dust, and adhered the back caps to the tubes. With the units back to the wall, it was essential that the caps could not be knocked out, as there would be no way to retrieve them save removing all the tubes.

#### NEXT STEPS

Based on the success of the prototype, the decision was made to expand the tube storage units. During the Spring of 2003, work began to rehouse architectural drawings from the Breuer and Belluschi collections. These were housed in thirty-three Plan Hold cabinets, each with twelve hangers, for a total of 396 groupings of drawings. The actual number of drawings per grouping varied wildly. Added to that number are approximately two thousand tubes and folders with drawings and loose items from these and other collections. Current storage was clearly inadequate, with materials originally from one tube, or Plan Hold grouping, scattered at different locations. The most immediate need was to rehouse the materials in the Plan Hold cabinets, and reunite some of the scattered materials with their "parent" tube. In beginning this second phase, we assumed a 1:1 transfer from the Plan Hold groupings to the tubes, requiring the construction of seven additional storage units. The space available along the North wall of the Hawkins Building allowed for the construction of fifteen units, in addition to the four already there, an additional capacity of 444 tubes beyond the 396 tubes required for a total of 840 tubes.

In order to store and transport materials within the library a mobile mini-unit on casters is also being con-

structed. This unit will hold ten tubes, making it possible to move them around as needed without undo effort, especially when researchers request larger quantities of materials.

Staffing and logistical issues surrounding this project were critical. Logistical issues in constructing the new storage units included bringing in the raw materials and rehousing the drawings in a very cramped space. Based on the experience with the prototype, final assembly of the units will happen very quickly. Prior to clearing out the Plan Hold cabinets, the new storage units and tubes were ordered with delivery of the tubes in two batches. The Plan Hold cabinets were then cleared out, and materials temporarily stored on shipping pallets, in a total of 1.5 days by three full-time equivalent staff. The empty cabinets were then removed before the new units arrived. Syracuse University's Central Facilities carpenters assembled the storage units in their shop and delivered them to their final location in two batches. Tubes were precut to their final length prior to shipping so that the back endcap could be attached immediately upon arrival and the tube pair nested in the units. This process was needed, as storage space for this quantity of tubes is unavailable. During the Special Collection Research Center's closure week in May, the materials formerly stored in the Plan Hold cabinets were rehoused into the new units, the inventory updated and annotated, ensuring a higher level of access than previously available, and tubes and endcaps labeled. An informal condition survey was also done at this time. A librarian, a conservator, and an intern from the Museum Studies Program at Syracuse University completed this final phase. Based on the experiences gained during this phase, we believe that further materials can be rehoused using one trained staff member with assistance from an intern or work-study student. With over half the tubes still empty, a schedule is being developed to systematically rehouse the many materials still in inadequate storage conditions.

#### SUMMARY

While the Werner Seligmann Papers are a relatively small collection, properly housing the architectural materials posed the same set of challenges faced by the other collections. The tube storage unit described here had to meet four criteria. It had to be compact, scalable, economical, and archivally sound. It met all four, and in doing so provided the Syracuse University Library with invaluable experience as it seeks to tackle many of the problems relating to the use and storage of large quantities of architectural materials. The second phase of this project affirmed the validity of the plan described.

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APPENDIX 1: TABLE SHOWING COSTS FOR SUPPLIES (INCLUDING PART NUMBERS) AND LABOR

Initial Order For Seligmann Project - 4 Units Total (2 Vertical / 2 Horizontal) Completed Spring 2002							
Gaylord Part No.	Size	Price / UM	UM	UM Needed	TOTAL	Actual	
ROLL - 4316	4' X 3"	\$74.19	10	24	\$1,780.56		
ROLL - 468	4' X 6"	\$27.49	2	120	\$3,298.80		
PLUG - P206	6"	\$4.49	2	240	\$1,077.60		
MYLAR WRAPS - MJTS	20" X 36"	\$7.60	6	41	\$311.60		
VELCRO COINS - 271012	3/4" dia	\$5.50	40 pairs	23	\$126.50		
Construction Costs - To SUL General Facilities		\$800.00		4	\$3,200.00		
				TOTAL @ 4 Units	\$9,795.06	\$9,795.06	
				Average Cost / Unit	\$2,448.77		
Plan Hold Cabinet Replacement - Northwall of Hawkins Building (15 Vertical Units) Completed Spring 2003							
ROLL - 4316	4' X 3"	\$74.19	10	90	\$6,677.10	\$3,865.50	Difference between catalog price and actual price shows value of buying in larger quantities and competitive bidding.
ROLL - 468	4' X 6"	\$27.49	2	450	\$12,370.50	\$7,600.50	
PLUG - P206	6"	\$4.49	2	900	\$4,041.00	\$2,268.00	
MYLAR WRAPS - MJTS	20" X 36"	\$7.60	6	150	\$1,140.00	\$871.50	
VELCRO COINS - 271012	3/4" dia	\$5.50	40 pairs	70	\$385.00	\$293.30	
Shelving Unit Frames - GB1231-060-179	36" x 90"	\$66.25	ea	45	\$2,981.25	\$0.00	Surplus frames from Library used
Construction Costs - To SUL General Facilities		\$800.00		15	\$12,000.00	\$12,000.00	
Planhold tube need = 400    Surplus tubes = 444    Additional needed to rehouse entire estimated 2000 tubes/pkg of architectural materials = 1556							
To complete rehousing of architectural materials in Plan Hold cabinets @ 15 units:					\$39,594.85	\$26,898.80	
Complete Rehousing of Remaining Architectural Collections							
To complete rehousing of remaining architectural materials @ 28 additional units:						\$73,920.00	



APPENDIX 2: CONSTRUCTION DIAGRAMS  
*Prepared by Joseph Guadagnolo, Carpenter's Shop, Syracuse University Central Facilities*

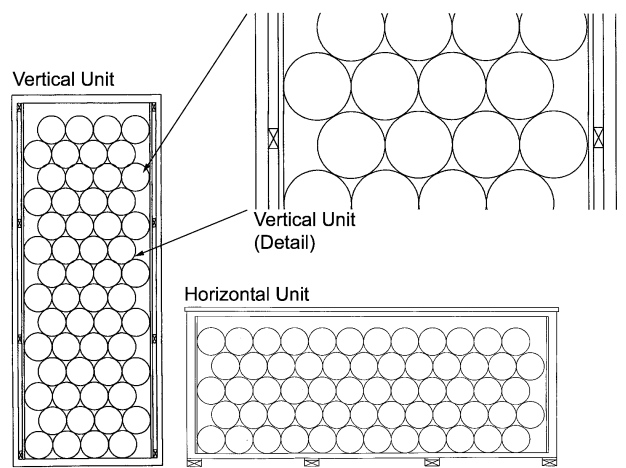


Fig. 8. Diagram of vertical and horizontal storage units

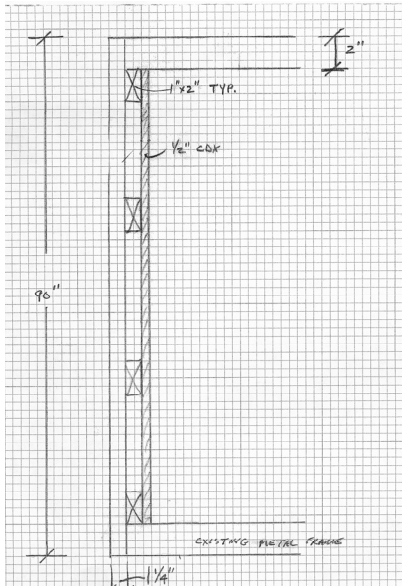


Fig. 10. Vertical dimensions

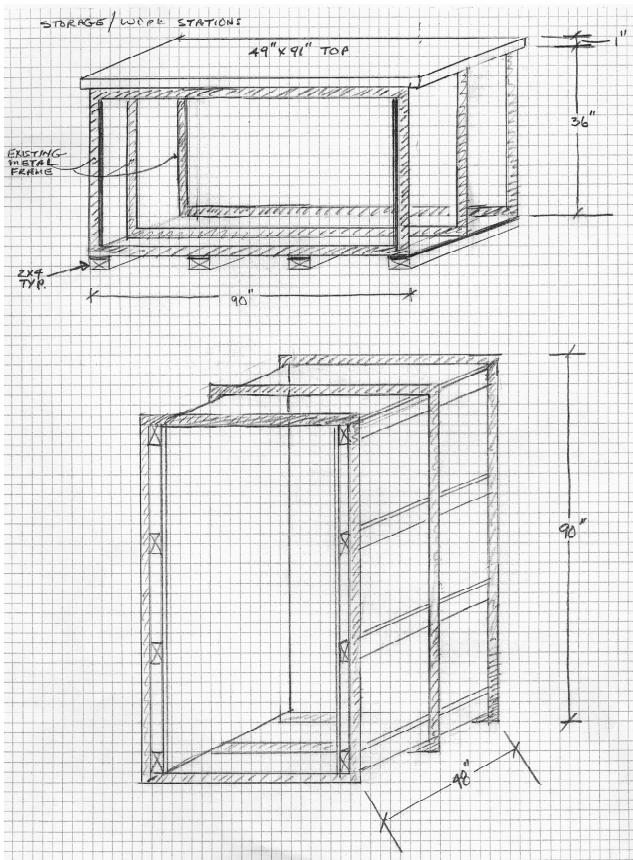


Fig. 9. Overall dimensions

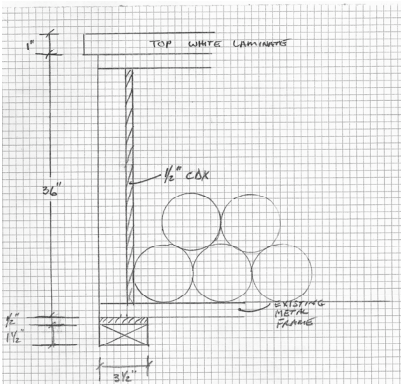


Fig. 11. Horizontal dimensions



Fig. 12. Construction detail



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6. Format notes as endnotes. Do not use the word-processing program's automatic endnote formatting feature; simply type the text at the end of the paper.
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