

Wesleyan University

From the Selected Works of Michaelle Biddle

August, 2008

Conservation in a Box: A Primer of Basic Paper Conservation Procedures and Treatments

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CONSERVATION IN A BOX

• A Primer of Basic Paper Conservation Procedures and Treatments •

• Michaëlle Biddle •

• August 2008 •

• Sokoto & Kaduna – Nigeria •

Paul Banks' Ten Laws of Conservation

Multiplication and dispersal increase chances for survival of information

- Books and documents deteriorate all the time
 - Deterioration is irreversible
 - Use causes wear
- No one can have access to a document that no longer exists
- The physical medium of a document contains information
 - Authenticity cannot be restored
- No reproduction can contain all the information contained in the original
 - Conservation treatment is interpretation
 - No treatment is entirely reversible

We must accept manuscripts, documents and artifacts as we receive them from past generations. To a certain extent damage and wear reflect their history. The task of conservation is to make items stable enough to allow safe handling and study, repairing only where absolutely necessary.

The most important principles of modern conservation are that any treatments should preserve an artifact while maintaining its historical integrity. All treatments should be reversible in case they prove unhelpful or inappropriate in the long term.

"The lyfe so short; the craft so long to lerne"
Chaucer, Parlement of Foules, 1386

Paul Banks (1934-2000) was Head of the Conservation Department and Laboratory at the Newberry Library in Chicago from 1964 to 1981. He left the Newberry Library in 1981 to establish the first United States degree granting program in library preservation at the Columbia University School of Library Science in New York City. This program is now at the University of Texas in Austin.

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Acknowledgement : nedcc.org and palimpsest.stanford.edu, as well as personal notes, were invaluable in compiling this primer.

What is Conservation? - The field of conservation has undergone changes in the last several decades. The aim of restoration is to return the work to its "original" appearance, often without regard for the long-term preservation of materials, the integrity of authentic components, or benign effects of aging and wear. Today, conservators are also concerned with aesthetic appearance, but it is only one criterion of many when examining and treating cultural materials.

Today, conservators of paper materials are expected to have a strong background in chemistry as well as history (particularly art history) in order to interpret, predict and arrest the destruction of paper and applied media. Treatment and preventive methods are combined to improve aesthetic appearance and the chemical and physical condition of art and archival materials.

Today the repair of individual works is combined with collections care procedures such as maintaining proper storage and display environments (air quality, humidity, temperature and light). All materials age and deteriorate over time - it is the paper conservator's task to prolong the life of materials which define our collective heritage for future generations.

Conservation Treatments and Procedures - Most of the following procedures should be performed by a conservator who specializes in the treatment of paper. The treatment chosen for any manuscript or collection should be the result of consultation between a conservator and the curator or custodian of the document - *after* the conservator has examined the document.

There are many variations and different levels of treatment and the conservator may offer alternatives. The procedures ultimately chosen depend on several considerations:

- the condition of the document
- its future use
- its aesthetic importance
- what the document will allow
- how much money can be allotted for the conservation treatment.

Examination and Initial Report - Treatment is always preceded by a careful examination of each document. Before beginning work, the conservator provides a written report outlining the proposed treatment and estimating its cost. Magnifiers are a useful tool that may be used during the examination. The solubility of all media is tested prior to any proposed water or solvent treatment.

Documentation - During the course of treatment the conservator should keep written notes on all procedures used, carefully noting any materials, adhesives and chemicals that are used. It is important to remember that water is a chemical and its use should be included in the report. If possible, photographs should be taken of each item before and after treatment, and occasionally during treatment. Photographs of selected individual items that represent the condition of a large group of similar objects may be sufficient when photographing each and every one would be impractical. Following treatment, a written report should be included with the manuscript, document or object.

Surface Cleaning of Paper

When to Clean - Although it is neither necessary nor desirable to remove all dirt or discoloration from old papers, surface cleaning sometimes improves the appearance of a document. Surface cleaning can also remove substances that might eventually damage paper, or that could be transferred to other papers during handling.

Manuscripts, maps, book pages, and other documents may benefit from surface cleaning. Brittle newspapers, photographs, or fine art prints might be harmed by inexperienced attempts to surface-clean them. Examination of paints and thicker inks under magnification may reveal minute flaking not obvious to the naked eye, and documents with hand-applied coloring may be particularly vulnerable to optical changes or transfer of the color. Cleaning of all such delicate objects should be done with particular care if done at all.

Dry removal of sticky deposits and surface accretions can be considered a kind of surface cleaning. Sticky tape adhesives damage paper and can create the physical hazard of bonding papers to adjacent papers and enclosures. Some old tapes fall away as they age and leave thick, hardened adhesive residues. These residues, although unsightly, are not an immediate hazard. Tape removal is difficult. Sometimes, however, tape adhesive absorbs underlying text or image and the tapes cannot be removed at all. Insect excretions and rust deposits, such as those left by rusted paper clips, are not only disfiguring but also the source of ongoing damage to the paper. It is a good idea to remove these deposits when feasible.

Moldy materials are obvious candidates for surface cleaning, which may be all that is possible or necessary. Mold activity should first be stabilized by providing the affected materials with a prolonged environment of low relative humidity, generally below 50 percent, so that the mold goes dormant. Mold removal is a delicate procedure and requires careful work hygiene to avoid spreading contamination as much as possible. Mold can also affect your health, so protective equipment such as gloves and masks should be used when removing it. If fume hoods are not available the removal should be done outside.

Supplies and Equipment for Surface Cleaning - Several erasing compounds on the market are primarily intended for use by graphic designers and architects. They come in containers of granules to be sprinkled on soiled drawings, or in cloth bags that leak small amounts of granules as they are rubbed across the surface of the paper. These granules are potentially damaging because they are abrasive and chemically unstable. Do not use them.

Conservators prefer to use granules produced by grinding up vinyl block erasers, available commercially from conservation suppliers. This cleaning agent is less abrasive and breaks down less during use, so it has less of a tendency to leave residues behind. The erasers used to make these compounds are also sold as blocks, such as the non-colored Eberhard-Faber Magic Rub Eraser and the Staedtler Mars Plastic Eraser. The blocks are sometimes useful for surface cleaning and for removing pencil marks. They also will lighten biro marks.

More commonly used by conservators are vulcanized rubber dry-cleaning sponges, which were intended originally for soot removal following a fire. The sort recommended for cleaning papers is not the "chemical sponge" because conservators avoid sponges that contain solvents or cleaning agents. The preferred sponges do not leave damaging residues on paper and they are not abrasive. They degrade upon exposure to light and with age, so they should be stored in an air-tight container in the dark.

Creped rubber adhesive pickups are useful for lifting residues of pressure-sensitive tape and other sticky deposits. A flattened needle awl is good for picking off insect specks, rust deposits, and other small surface accretions.

For all dry-cleaning procedures a clean, soft brush is needed. Brushes intended for surface cleaning should not be used for wet work, and any brushes used on moldy materials should be labeled and kept separately, to avoid spreading mold to other papers.

How to Clean - To start work, clear a large, clean, smooth work surface. On it place a large sheet of inexpensive, clean paper that can be changed frequently. Begin cleaning by gently brushing the surface of an object with a soft brush to remove loose dirt and dust. (If this raises dust particles, wear a dust mask!) Under no circumstances should you brush over powdery media such as charcoal, flaking paint or flaking ink. Be careful to avoid enlarging tears by brushing in the direction of the tear. Brush both sides of the sheet. Every few strokes brush across a clean fabric or a "Dust Bunny" to dislodge dirt from the brush.

Gently rub sticky tape adhesives with numerous extremely short strokes of the creped rubber pickup eraser. This can be time-consuming, but numerous gentle strokes eventually pick up the adhesive without damaging the paper, as fewer, more forceful applications might. The adhesive is picked off the eraser with the fingers. As the eraser becomes soiled the soiled portion can be thinly sliced away.

Pick off accretions such as insect specks and rust deposits with a flattened needle awl or tweezers, and keep a brush at hand to remove dislodged materials. Do not overdo this work; it is better to leave accretions alone when more aggressive efforts to remove them may inadvertently make a hole in the paper. For the same reason it is best to avoid inclusions embedded in the paper. Sometimes these are specks of metal that were in the paper when the sheet was formed, and that became visible as they oxidize over time.

Next, local deposits of grime may be reduced by gentle rubbing with a vinyl block eraser. Block erasers are not appropriate for cleaning larger expanses of paper. Rub in short, meandering strokes to avoid setting up a pattern of erasing marks, and check periodically with a close sideways examination across the surface to make sure the paper is not being abraded. Never rub over media, whether printed or drawn, and do not persist if no improvement is made. Unfortunately, surface cleaning does not remove aged finger marks in most cases.

Remember, however, that cleaning that is effective in only one area is counterproductive if it leaves the remainder of an object looking dirtier in contrast.

A bit more thorough cleaning can be achieved with a vulcanized rubber sponge. This tool is gentle but it is still not normally recommended for use on areas of manuscript text or design. The margins of an object often allow more thorough cleaning, and here successful cleaning can have the greatest visual impact. Sponges can also be used on the reverse to reduce dirt that might otherwise be transferred during handling, but take care to avoid notations on the reverse that might have historic significance. Again, rub gently and in random directions if there is any sign of setting up a pattern on the surface of the paper. These sponges can be washed with a mild detergent after using them but need to be dried for at least a day and dried out of the light. Finish by thoroughly brushing the paper with the soft brush to remove any crumbs.

Why Repair Paper Documents

Tears are repaired most often to improve the appearance of a torn paper document, to prevent a tear from lengthening, to keep fragments from separating, or to make a document safer to handle.

The generally accepted method of repairing tears and breaks in paper uses strips of thin acid-free paper adhered with a water-based adhesive that is acid-free, stable, and reversible. The following materials are recommended for the repair of documents, book pages, and other paper objects.

Papers - The preferred repair papers are made in Japan usually from *kozo* fibers. These papers (sometimes erroneously called rice papers) are manufactured in different weights with names such as *Sekishu*, *Tengucho*, and *Kizukishi*. The fiber content of Japanese papers varies, with some containing fibers that are not of conservation quality. To be safe, only papers made of 100 percent *kozo*, *mitsumata*, or *gampi* fibers, or a combination of these, should be used. These Japanese papers are appropriate for repairs because they do not discolor or become brittle over time, and they have long, strong, flexible fibers that produce a lasting repair. The lighter-weight papers are especially suited to the repair of documents, since they are translucent and unobtrusive, and may not obscure the text of a document. Most conservators use strips of paper with torn rather than cut edges, because a frayed edge makes a less visible repair and is less likely to deform or cockle the paper. Frayed edges distribute the stress mending paper places on the original document.

Adhesives - Use of a proper adhesive is essential. Any adhesive used for mending paper objects must have the following properties:

Sufficient strength - It should maintain its adhesion for an indefinite period.

No tendency to discolor - It should not yellow, darken, or stain the paper to which it is applied.

Reversibility - It should be possible to remove the repair paper used with moderate effort and no damage to the object, even after many years.

Few commercially available adhesives meet these criteria. Commercial library and wallpaper pastes may lose hold as they age, and they often contain harmful additives. Rubber cement and animal glues darken and stain. Several synthetic adhesives, such as "white glue," are very difficult if not impossible to remove once they have aged. Pressure-sensitive (self-adhering) tapes should be avoided. The adhesives on these tapes may cause staining over time and require toxic solvents and technical expertise for removal.

Pressure-sensitive tapes advertised as archival are available from commercial vendors. These are probably more stable than other similar tapes, but because their aging properties are not proven, they should be avoided. They do become difficult to remove in time. The adhesives on commercial gummed tapes, which require wetting, are less damaging, but they may stain in time and are usually too strong and tend to deform the paper to which they are adhered. These tapes should also be avoided for objects of value. Commercial products in general should be avoided even if they are reputed to be safe, because their composition is subject to alteration without notice by the manufacturer.

Starch-Based Paste - Because starch based paste made from wheat or rice flour is an insect attractant it should not be used in West Africa.

Methyl Cellulose - This adhesive is made from cotton fibers treated with an alkali. It is sold as a white powder to be mixed with water. A simple adhesive can be made from methyl cellulose. Take the large plastic jar from your kit and mark 2.5 cm and 5 cm from the base. The 5 cm mark is equivalent to 1 cup of water. Pour hot de-ionized or distilled water in the jar up to the 2.5 cm mark. Mix three level spoonfuls, using the white plastic spoon in your kit, of methyl cellulose powder. This is a 1:11-12 mix – 1 part methyl cellulose powder to 11-12 parts water. Stir thoroughly until lump free. Add cool water up to the 5 cm mark. Let the mixture stand for several hours before use. It will thicken on standing but can be thinned, if desired, with water. A useful consistency is like very thick cream. Methyl cellulose may not be as strong as starch paste but it will hold adequately in most applications. Methyl cellulose keeps well for several weeks and does not require a preservative. When making this mixture always be sure that the jar has been thoroughly cleaned and dried before hand. Discard immediately if it smells musty.

Pour the methyl cellulose out of the jar with the clean spoon and place it on a palette prior to use. Do not ever place a brush in the main supply of methyl cellulose. This will contaminate the adhesive and it will spoil more quickly. If the made-up methyl cellulose ever smells musty discard it.

Mending Procedures

Tearing Mending Strips - It is desirable for mends to have a soft, fibrous edge to avoid deforming or even breaking a fragile paper along a sharp edge. To tear mending strips, use a bone folder or similar tool to incise a crease in the mending paper along a metal ruler or other straight edge. Draw a line of water along the crease with the smallest brush from your kit. Pull the strip away from the sheet while grasping it near the crease. Make strips of different widths to conform to different tears - one , two and three centimeters are useful. If a great deal of mending is planned, tear up a good supply of strips in advance. Tenjucho can be torn using fingertips.

Preparing to Mend - Prepare a work surface by covering a sheet of clean blotting paper with a sheet of non-woven polyester such as Reemay to prevent the documents being repaired from sticking to the paper because of stray or extruded paste.

Begin by mending the largest tears in a document first. Align the tear with the correct under and overlaps (shelf tears), as tears typically occur not with the sharp edge that a cut produces, but rather with beveled surfaces that may alternate between the front and the back of a sheet of paper. If any of the overlaps are sizable, they should be pasted, adhered, and dried as described below before applying the mending strip.

Applying the Mending Strip - Using pieces of an absorbent paper such as blotting paper as a substrate for pasting the mending strip, apply starch paste or methyl cellulose to a strip of Japanese paper with a flat brush similar in width to the mending strip. The blotting paper will draw out excess moisture that could cockle or stain the document. Then lift the strip with a tool such as tweezers or a spatula and place it over the reverse of the tear with the pasted side against the document. If a document has text on both sides, place the mend on either the side where it will not cover text or the secondary side, if text cannot be

avoided on both sides. Breaks in papers tend to pull apart when wet with paste. For this reason it is easiest to use strips not more than three or four inches long. For longer tears, several short strips may be applied and dried one at a time, placed end to end. Start with the termination of the tear; this usually means the edge of the sheet is mended last.

It takes practice to manipulate the thin, wet repair strips. Once the mending strip is in place, brush it into contact using a dry flat artist's brush. Then lay a sheet of non-woven polyester – Reemay – followed by another piece of blotting paper over the repair.

Drying the Mended Sheet - Weight the repair while it dries. Weighting ensures good adhesion and prevents cockling of the paper. Repairs may be weighted as follows. First place small pieces of Reemay over the area to be dried. Then place a square of blotting paper, followed by a piece of glass or Plexiglas on top of the blotter. Finally, place a weight on top of the glass. Small bags of lead shot, pieces of lead covered with cloth, or any other small, dense object may be used as a weight. The blotting paper square may be changed in a few minutes, but the repair should be weighted for one hour or longer. During the rainy season the repair should be weighted overnight.

Filling Areas of Paper Loss - Holes or paper losses may be filled individually with Japanese paper, with paper pulp, or with a paper carefully chosen to match the original in weight, texture, color and contour. The latter is the most time-consuming (and consequently the most expensive) option, usually reserved for the most valuable and aesthetically important documents.

Leaf-casting is not recommended for West African Islamic MS.

Hazards of Mending Paper Tears - When tears are overly complex or when they cross through image areas in works of art or text areas on documents, it may be wiser to leave this work for conservators experienced in carrying out more challenging work. Some hazards to avoid include fragile art or writing media that may be disturbed by the manipulation or the moisture required for tear repair, or staining, breaking, or creasing of papers that are fragile, degraded, or overly sensitive to moisture. Some old tears cannot be restored to their original shape, as over time sheets can change their shape to conform to the altered tensions produced by tears.

Removing Accretions

Removal of Mold, Insect Residues, and Other Accretions - Accretions, including insect specks and mold residues, are normally removed by scalpels, flattened needle awls, aspirators, or specialized vacuum cleaners. Insect specks can be softened with minute drops of methylated spirit (isopropynol) if necessary. Mold and insect deposits are best removed individually by mechanical means. A needle awl is useful for lifting insect specks. A small vacuum aspirator or a HEPA vacuum cleaner is recommended for lifting mold.

It is not possible to eliminate all traces of mold, since the mycelia may be deeply rooted in the paper. Fumigation, once a standard treatment for mold and insects, is now seldom done because chemical fumigants can have adverse effects both on personnel and on documents. Anoxic treatment (storing items in an oxygen free environment for some time) may be appropriate to kill insects.

Removal of Backings, Old Repairs or Tapes - If an object has been backed with a support that is not part of its original structure and the backing is destructive or inadequate, it should be removed if it is possible to do so without putting the object at risk. Sometimes backing removal can be done in a water bath. If the object cannot be put in water, as is usually the case with Nigerian Islamic MS, dry removal by mechanical means is necessary. Steam or local application of moisture with a poultice can assist with mechanical backing removal, especially of the final layer of a backing immediately behind an object. Removing fragile paper from a solid backing is very time-consuming and therefore costly. It is often difficult for a conservator to know in advance how long a backing removal will take or how much it will cost.

In the past, repairs were often made using materials harmful to paper, such as commercial tapes and adhesives that stain. Repairs made with water-based adhesives such as animal glue can be removed by local application of a methyl cellulose poultice or a saturated blotting paper but only if the item to be removed is not on or near manuscript text or manuscript decorations.

A 1:1 mixture of methylated spirits (Isopropynol) and water can be used to remove backing papers, old repairs and any paper adhered to the surface of the paper than cannot be removed dry. Dampen the backing you want to remove with saturated blotting paper. The unwanted backing or old repair can then be removed carefully from the item as it lies face down on the plexi-glass.

Synthetic adhesives and pressure-sensitive self-adhering tapes usually have to be dissolved or softened with an organic solvent before they can be removed. This should only be done in a fume hood. Heat is sometimes helpful to remove these repairs. This requires specialized equipment, is an advanced technique and will not be covered in this class.

Other Techniques

Washing - Water washing is often beneficial to paper. Documents with soluble media, like West African Islamic MS, may be locally washed avoiding water soluble inks, float-washed, or washed on a suction table. This requires specialized equipment, is an advanced technique and will not be covered in this class.

Alkalization (De-acidification) - Chemicals may cause alteration or even damage to certain components of a manuscript. Some colors, for example, may change if subjected to alkaline conditions. This change may be immediate or may occur over time. The materials used in West African Islamic MS are extremely variable and therefore this procedure is not recommended for West African Islamic MS.

Inpainting (Retouching) - This is done by judicious application of watercolor, acrylic, gouache, or pastel to filled areas of loss or to minor surface losses such as scratches, abrasions, and media losses along tears. The goal is to make these damages less distracting. Care should be taken to confine the retouching to the area of loss. Normally areas of design are not replaced, although simple design areas such as borders may be completed. Conservators do not attempt to make their retouching absolutely invisible. They are obliged to make it possible to distinguish their work from the original when a researcher or other viewer examines the work closely. Incidentally, retouching or "strengthening" of faded writing is always inappropriate for a conservator.

Bleaching - Bleaching is time-consuming and tricky. It is warranted only when staining or discoloration compromises the aesthetic value of a work of art or exhibition material. When possible, bleaching should be undertaken by exposure to artificial light or to sunlight, or it can be done with chemicals. Conservators often prefer bleaching with light because it is gentle and not harmful to cellulose, the major component of paper. Some stains, however, require the use of chemicals. Sometimes a combination of bleaching methods is needed to achieve a desired result. Some stains, such as the brown spots referred to as "foxing," seem more liable to reappear if they are exposed to excessive relative humidity after treatment. Bleaching does not enhance the preservation of a work of art, only its appearance. Bleaching is an advanced technique and will not be covered in this class.

Flattening - Flattening is always necessary following aqueous treatment. It is usually done between dampened blotters or felts under moderate pressure. Experts do not necessarily expect paper objects to lie perfectly flat. Paper naturally undulates as it responds to environmental fluctuations. It is common in thick West African Islamic MS, *Qur'ans* for instance, for the paper to tunnel since the paper is often used in a combination of long and short grain. In these cases there should be no attempt at flattening. This "tunneling" provides an ideal haven for insects and if it is severe, acid free "E" flute boards could be inserted between sections.

Ink Corrosion Stabilization - Ink corrosion is not common in Nigerian Islamic Manuscripts. Current research into iron gall ink degradation is complicated by many factors: the existence of hundreds of ink recipes, the often unknown age of the ink and a reluctance to use potentially destructive analysis techniques. Non-treatment usually consists of strict temperature and humidity control and an acid free environment. Individual leaves exhibiting ink corrosion should be placed in acid-free paper folders, smooth side toward the leaf. This will minimize handling and keep all parts together.

Storing Paper Documents

Housing - Once an object has been treated, it must be properly stored in an archival folder or other enclosure such as a box. Special housings such as matting, framing, and polyester film encapsulation give extra protection to objects. In some instances these enclosures eliminate the need for more invasive reinforcement procedures. Boxed documents are easier to keep clean since they are easier to dust than individual envelopes or folders.

Polyester Film Encapsulation - For archival documents, the need to repair tears can sometimes be eliminated by simply placing the papers in archival-quality Melinex or paper folders. This method of protection and reinforcement is the most appropriate for archival research materials, as it provides excellent protection during handling. Encapsulation is done by sandwiching the object between two sheets of polyester film (Melinex), usually 4 or 5 mil thick, and sealing the film at all edges. Double sided tape can be used but extreme care must be taken to ensure that the document encapsulated does not come in contact with the double sided tape.

Because polyester carries a static charge, encapsulation is not recommended for materials with loose, flaking media, nor should it be used for acidic papers. It has been demonstrated that the deterioration of acidic materials is accelerated by encapsulation and leaving corners of the encapsulation open has little if any effect on this problem. In some situations the need to protect materials during handling may outweigh this concern. In this case including

a buffered sheet of paper, paper with a pH of 8 or more, in an encapsulation behind an acidic document is recommended.

Matting - While many museums routinely use mats for storage of prints and drawings, this type of housing is especially suited to works of art, documents or photographs intended for display framing. Mats are usually composed of a window and backboard of 4-ply 100 percent rag board or lignin-free archival board. The object is attached to the backboard with hinges of Japanese paper and methyl cellulose adhesive or with corner supports or edge strips. The window mat provides separation of the object from the glazing in a frame or from the next mat in a stack. If there is an inscription on the back of an object, a second, smaller window can be cut into the backboard to reveal it. Matting protects study collections when researchers handle them because they handle the mat, not the item.

Framing - Once matted, an object can be safely sent to a framer for a new frame or it can be returned to an existing frame. If an existing frame is reused, it may need alteration to make it acceptable from a conservation point of view. For example, if the frame fits so tightly that the edges of the object come in contact with the wood, the frame opening should be enlarged or lined with a barrier material. Some frames with shallow openings must be deepened to accommodate the total thickness of a mat, the glazing, and the backing layers needed to protect the document. Frames can be made deeper by building up their back with strips of wood screwed in place. Ultraviolet-filtering acrylic or glass is recommended as a glazing. Acrylics such as UF-3 Plexiglas carry a static charge, so they are not appropriate for pastels or other objects with flaking or powdery media.

Documents, whether manuscript pages or photographs, should not come in contact with the glass. To do so invites damage by mold growth or condensation of moisture along the edges of the framed item. Photographs can stick to the glass so firmly that they cannot be removed from the glass. It is advisable to display reproductions rather than the originals when the item is to be displayed for more than a few weeks or if the light levels cannot be strictly controlled. Framed documents should not be hung on exterior walls. Framed documents should have spacers attached to the backs of the frame so that there is some air circulation around the framed item.

Preventing Insect Infestations

This is best accomplished by regular cleaning and by inspection of the dark spaces behind and beneath bookcases, cases, boxes and picture frames. Particular attention should be paid to areas which tend to be damp or dark. When insects are detected removing items to an anoxic (oxygen free environment) is the preferred treatment. A guide to creating anoxic microenvironments is available at <http://www.spnhc.org/files/leaflet1.pdf>

Preventing Mold

Mold is a primitive, opportunistic organism. A temperature above 20°C and relative humidity above 70% are optimal conditions for mold growth. Mold is a destructive fungi that can eat paper materials. In some forms such as foxing it can leave dark stains on the paper. It is possible for molds to grow in environments with significantly lower ambient relative humidity and temperature because it is the humidity and temperature of the objects

themselves that support mold growth. Paper is highly hygroscopic. During times of high humidity it absorbs water from the atmosphere and only slowly dries out during times of low humidity. High heat and humidity also encourage insect infestation and also increase the rate of paper deterioration by accelerating acid hydrolysis, which precipitates acid into paper. Acid hydrolysis results in embrittlement and fading inks.

Mold does not like moving air nor light. In cases where temperatures are above 20°C and relative humidity above 50% installing a fan that runs 24/7 can reduce the likelihood of mold growth.

Glossary of Paper Degradation

Abrasion - worn away by friction, scraped or scuffed

Accretion - substances accumulated on the surface

Aging - natural or chemically assisted changing with time, oxidating

Breakage - disruption of surface by force or as result of age and fragility

Cockled - wrinkled or puckered, usually as a result of high humidity or water damage

Corrosion - gradual destruction by chemical action

Crease - bent or folded over and pressed or crushed

Delamination - separation into thin layers, peeling away

Dirty - marked by or covered in dirt or pollution; soiled

Discoloration - change in the original or desired color: fading, darkening, yellowing

Distortion - bending, twisting, stretching, or forcing out of normal shape

Dusty - covered with or containing dust

Embrittlement - becoming brittle or fragile, usually as a result of aging or oxidation

Fading - losing color or brightness gradually

Fold - bend or crease with resulting damage to the fibers

Foxing - random reddish or brown somewhat circular staining of fibers, perhaps due to mineral deposits from water used in manufacture or organisms which feed on those minerals

Ink corrosion - as iron gall ink slowly deteriorates, turning from blue-black to dark brown, it can "eat" its way through to the back of the paper. This can eventually lead to the total loss of the paper wherever the ink was applied

Insect damage - losses, accretions, flakes, or stains due to activity of insects

Losses - also called lacunae: holes or missing edges

Mat burn - discoloration of edges that have been in contact with acidic mats

Mold - fungus that causes organic matter to decay

Pulpy - soft or spongy condition due to manufacturing process and/or aging; floccular

Puncture - hole produced by sharp object such as a staple or pin

Scorched - discoloration of the surface caused by heat

Shelf tear - a tear with an over and under flap

Soiled - covered by material which may become embedded in the fibers

Splitting - separating along a fold, or delaminating

Staining - chemical discoloration of fibers, can be result of foxing, adhesive residue, tape, mold, or mat burn

Tear - ripped or pulled apart, usually with stretched, ragged edges

Tideline - stain from the accumulation of chemicals at the edge of a liquid spot

Warp - a twist or distortion out of shape

SUPPLIES FOR "CONSERVATION IN A BOX" WORKSHOP

	TALAS	GAYLRD	ARTSTR	HRDWRE	MISC
Awl - student type TTS004006	X				
Battery 9 volt				X	
Blotters - 25 sheets KB-UBP30402		X			
Bone Folder #3 Extra long tapered TTS001009	X				
Brushes- Polar Flow 700B talon set			X		
Cheesecloth					X
Cutting Mat- Creative Mark 12x18			X		
Double sided tape-415		X			
Dust Bunny cloth KB-DB18		X			
Dusting Brush-Hake Mandalay 2"			X		
E-Flute Corrugated Board		X			
Eraser-Mars Plastic			X		
Crepe pick up square					X
File folder for mending papers					X
Gloves - cotton knit KB-A36900		X			
Jars - polycarbonate - large wide					X
Measuring spoon					X
wood stirring stick					X
Jars - polycarbonate - tall small			X		
Knife - Exacto TTB023001	X				
Knife - Exacto Refills TTB023002	X				
Melinex sheets 5ml 9 3/8x 12 3/8 TFM009001	X				
Methyl Cellulose powder adhesive 8 oz TAD016002	X				
Pastel for toning paper					
Pencil				X	
Pencil Pointer Ellipse			X		
pH detection pen KB-PH65		X			
plexi glass 1 sheet 9x12					X
poly screening for vacuuming				X	
Reemay Grade 2014 - 4 sheets 9x12 TNW008003	X				
Ruler - 24" Stainless cork back TTB036003	X				
Sand Paper 300				X	
Scissors-5" Dahle TTB025001	X				
Sharpie pen - black permanent ink					X
Spatula straight end KB-MIC		X			
Sponge - rubber dry cleaning type KB-A016		X			
Spray Bottle Holbein Watercolor Square C Thru F90-6			X		
Surgical Mask					X
Tweezers- 3CU bent smooth nose TTB030004	X				

Vacuum Mini TTB077001	X			
Ziploc bags - several sizes			X	
Washer - for cutting thumb hole in boxes			X	
Gripper for washer				
PAPERS:				
Okawara 60 gsm TPB105001	X			
Tengucho 7gsm KB-51039		X		
L-tissue 9gsm KB-51078		X		
Kizukishi 21 gsm KB-JTPK		X		
Grid paper for cutting practice				X
Newsprint			X	
Wax Paper				X
Plastic Wrap - Cling Film				X
Methylated spirits (Isopropynol)				X
www.talasonline.com		www.gaylord.com		

Further Reading:

Balloffet, N. and Hille, J. *Preservation and Conservation for Libraries and Archives*. Chicago: American Library Association, 2005.

Preservation 101. <http://www.nedcc.org/education/online.php>

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