ADVANCED PAPYROLOGICAL INFORMATION SYSTEM
GUIDELINES FOR CONSERVATION OF PAPYRUS

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January 2005

Contents

Appendices

Documentation
Before digitization all fragments should be inspected by the conservator for damage. For each fragment fill out a documentation sheet (see sample documentation form in the Appendices), as follows:

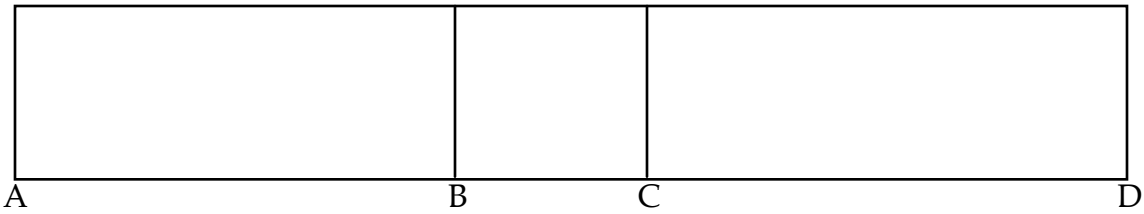
Inventory #: locally assigned inventory number

Date: date (or estimated date) of the fragment

Place: place (or estimated place) of origin of the fragment

Subject: brief description of the contents of the fragment

Size: Measure the fragment by placing it on top of millimeter paper. Measure the length from the beginning of the roll to the end; also measure the distance from the beginning to the end of any glued overlap (*kollesis*).



A= beginning of sheet 1
B= beginning of sheet 2
C= end of sheet 1
D= end of sheet 2
The overlapping of two sheets in the space B–C is called *kollesis*.

Color: e.g., light cream, light brown, medium brown, dark brown, charcoal brown

Consistency: e.g., strong, friable, delaminated fibers

Condition: e.g., pest, fire, water, or mold damage, mud, salt, dirt, other

Ink:
- lamp black (soot): black, 300 B.C.E.; usually stable in water
- iron-gall: brown, 3rd, 4th century; often one can detect ink burns
- mixed (lamp black and iron-gall) ink: brownish; mixed ink can be water soluble, so distinguish it carefully from lamp black ink!
- red ink
- green ink: verdigris from a pigment containing copper

Condition of ink: e.g., strong, flaking off, missing, rubbed off, faded

Direction of the fiber: The most common practice was to use the side with the fibers oriented horizontally as the recto (front)—the fibers are parallel to the long edge of the roll; on the verso (back) the fibers are vertical. In a few cases the scribe turned the sheet

90 degrees. Also watch for recycled sheets, where the first text is washed off and reused by a different scribe (this practice depends on period and type of text). Occasionally the recto may be written horizontally and the writing on the verso turned 90 degrees. This case can also be reversed. Pay attention to the color and consistency of the fragment. Usually scribes used the beautiful, even fibers of the lightest color on the recto and the inferior fibers on the verso.

Testing Ink

Before any treatment is started, test the inks in several different areas: with an eye dropper drop one tiny drop of water over the ink then cover it with a small square of blotting paper and a glass weight so you can see through. Check both the blotter and the ink after a few seconds (up to two minutes or longer, if you anticipate wet treatment) and make sure the color does not bleed or smear. Do the same test with ethanol or an ethanol: water mixture.

Photo Documentation

Include in the photo:

- a scale (in centimeters)
- inventory number
- side (recto or verso),
- "before," "during" or "after" treatment

Make sure the papyrus is not up-side down! For close-up shots, take note of exactly which part, direction, and distance are framed in the photo, so you take the same "after" shot.

Handling Papyrus

Boxes should always be carried and stored horizontally (fig. 1a,b). Folders should always be held flat and opened very slowly, so no suction of air will lift and damage the fragment inside the folder. To view the opposite side of the fragment, close the folder, place it between both hands, and turn the entire folder over slowly but steadily.

Removing Plexiglas, Mylar, or Cellulose Acetate

If the papyrus is housed between two sheets of Mylar, Plexiglas, or cellulose acetate and the housing has to be opened, using an ionizer can be a great help (fig. 2). The ionizer discharges the static electricity. The ionizer can be placed on the workbench next to the item to be opened, about five inches away. Push the ON button, with the fan speed on low, and after one minute check to see if it is safe to open the housing without delaminating the fibers. Sometimes it will be several minutes before the static is totally eliminated and the housing can be separated without delamination.

Fixing Ink

When ink is lifting or very flaky let some thin methyl cellulose run underneath it from a fine sable brush (no. 00) and tack the ink down very gently with a mini spatula. A very thin wheat starch paste can also be used.

Mechanical Cleaning

This procedure can be done when the fibers of the fragment are not too fragile. Be very careful or don't do it at all when fibers are already delaminated and weak or when the ink is lifting.

First brush loose debris off the fragment with a soft brush. Always brush in the direction of the fiber from the middle to the edges. In some cases where the mud is very heavy the dirt can be loosened up with a bristle brush (stiff) or a fine sable hair brush (gentler) with the bristles cut off very short, using short horizontal or circular strokes. Then gently blow the dirt off. With a sharp pointed tool (such as fine-pointed tweezers or dentist's tool) or a flat sharp spatula loosen dried up leaves, salt grains, little stones, and other debris when there is no writing beneath (fig. 3). Using very gentle strokes with a fine brush, remove the debris, as well as the sand and mud dust, always brushing in the direction of the fibers. I also use just air to remove loose particles by blowing with a rubber air bulb (available from a photographic supply shop)—but watch for fragile and loose fibers.

Both recto and verso should be cleaned this way if time is available.

Removing Old Repairs/Tape

First examine the fragment closely so you don't remove antique repairs! There may be small papyrus fragments that were used in ancient times to repair a fragment. These should never be removed because of their historical significance. However, do remove all other bridges, patches of glassine, brown paper, etc. In most cases these materials were used in a rush at the site (for the Karanis papyri, we have photographic evidence that brown paper tape and gummed glassine tape were applied to papyri at the site to secure the fragments). Work at the site was often so hurried that the fragments are not aligned correctly or parts are folded under.

Brown tape, glassine tape, and gummed stamp paper can be removed from the sheet when dampened: moisten it very lightly with a brush or damp blotter and after a few minutes just lift or peel away the tape (figs. 4-6). Don't peel away fibers and ink; if the patch does not come off easily repeat the damp treatment.

Large areas may be moistened from recto and verso (between damp blotters), but only for a short time. Check the fragment often; you don't want to turn it into mud. While working on one section, protect the adjacent areas with damp blotters. They should be checked frequently to make sure that the specimen does not dry up. Extra special attention is needed if there is writing on the fragment. Remember that every wet treatment weakens the fragment; as the fibers dry out they become more fragile.

Do not remove any particles or tape from very fragile areas that include writing: you will lose it. Check and make sure you don't lift any ink when removing a bridge. If in any doubt, leave the patch in place; the researcher will have to find other methods for resolving the text, such as ultraviolet light. If ink does come up with the carrier, set both the ink and the carrier back in place and secure them with a tiny drop of methyl cellulose, in order not to lose the ink.

Scotch tape can very seldom be removed. In some cases the tape carrier comes off when the adhesive has dried up. Then it can be removed just by lifting it very carefully. I have not been very successful dampening Scotch tape with 50:50 water: ethanol. If you try this method make sure you also lift the tiny little balls of adhesive left after lifting the carrier.

When papyrus is backed with cardboard it should be separated. Some early treatments are causing problems today, particularly where backing materials of an inferior quality were used. Paper from wood pulp, instead of from cotton rags, was introduced in the mid nineteenth century. Wood pulp paper is naturally acidic and additives, such as alum-rosin size, increase this tendency. The acidity of the paper increases with age and will contribute to the deterioration of any papyrus in contact with it. Another problem caused by backing paper is due to its sensitivity to fluctuations in relative humidity, which causes it to cockle. The differential movement of the backing paper in relation to the papyrus stresses the latter to the extent that it may crack, fracture, and, in time, pieces may lift off the backing. First, take notes where the papyrus is attached to the cardboard, then very carefully cut around the glued/attached area at an angle from the recto and try to free the papyrus. Then moisten the cardboard from the verso and peel off the remaining board/paper in very fine layers.

Cleaning/Flattening between Blotters:
Wet treatment is needed when a fragment has major folds, is very distorted, or is very dirty and the dirt cannot be loosened with the air bulb and brushing.

Spray two blotters with 50:50 water: ethanol solution; sandwich the fragment between the damp blotters. If the damp blotters are put down only on one side the fibers can delaminate and might tear, because one side is expanding and the other side is not. Place glass or Plexiglas underneath and on top of the damp blotters; let it sit for five minutes more or less, depending on the heaviness of the dirt and folds and the strength of the fragment itself. Better to check more often than too little. When the damp blotters are removed, yellow or brownish coloration on them will indicate dirt removal.

When unfolding a large fragment, leave parts you are not working on covered by damp blotters because the fragment will dry out fast and will cockle (fig. 7). Work from one end to the other and always have the other parts covered. Cover the flattened parts with dry blotters and put weights on them. Work in this way through the whole fragment until it is all flat and unfolded. Let it dry between dry blotters under light weight, changing the blotters frequently. The fragment should be allowed to dry thoroughly with an occasional change of blotters for days or weeks, depending on size. Store the fragment in a folder for several weeks before mounting it between glass, so the piece will have time to dry thoroughly.

Aligning/Bridging
Affix every fiber in the correct position, working with two fine sable brushes. Use your index finger as saliva carrier to moisten one brush and use your thumbnail for brushing off excessive methyl cellulose from the other brush. Using the fingers in that way is very practical because they are also close to the fragment.

With the damp brush moisten the edge of the fold to make the fibers soft and flexible. Wait a minute after wetting, then try to wet it from the opposite side of the same folded area. Press the fragment down gently, flatten it, and put a little weight on top and let it dry. If fibers are delaminated in the wrong place brush a small amount of methyl cellulose under the fiber and press it lightly into its right place. Work like this through

the whole fragment on recto and verso even where there is no writing. This treatment will strengthen the whole fragment (figs 8-9).

When fragment parts are loose or not in the right place align them, brushing methyl cellulose at the edges. I use a very small amount of the adhesive and apply it with a sable brush no. 0. Check the fiber direction on recto and verso so the writing is in alignment. Aligning the text often requires assistance from the papyrologist.

When making a join, brush methyl cellulose to the edges of the fragment or to the upper or lower fibers and press down lightly with a fine spatula. In very rare cases it may be necessary to make an angular cut to separate misaligned fibers so that they can be placed correctly. This should always be discussed with the papyrologist first.

Removing Mold

Fortunately at the University of Michigan we have never had a mold problem in our papyrus collection, but I have seen mold in other papyrus collections. I was told it is just scraped off with a spatula and then brushed with 50:50 water: ethanol. The mold I have seen appeared like a film of a greenish/gray/white color. Mold I have seen on papyrus mounted between glass was moving away from the papyrus towards the edges of the glass. If mold is attacking any fragments, they should be separated from the collection, treated, and checked frequently.

Rolls

First do photo documentation of the roll from all angles and determine exactly how the papyrus is rolled up (fig. 10). This is very important for the unrolling work. In complicated cases, make a model of the roll. Measure width, height, and thickness. The fiber damage demonstrates how the roll was opened. Reconstructing the alignment of damage from the fragment can help when the fragments have to be placed in the right position after unrolling. For instance pest damage (insects) has been an immense help in reconstructing fragments. Throughout several layers of damaged fibers one can place fragments into the right position.

Build a humidification chamber and humidify the roll slightly – it should not be too damp.[1] Watch it carefully. After a short while, you can see the roll relaxing. Start unrolling it very carefully and watch for folds and turns (figs 11-15). Place the unrolled papyrus between dry blotters under light weight, changing the blotters after an hour and again after a couple hours on the first day. Continue to let the papyrus dry for three weeks, changing the blotters if needed. If fragments break up during the unrolling process place them immediately in the area where they came from or make notes, for later alignment. The fragment should be allowed to dry thoroughly before mounting.

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[1] On building a moisture chamber see, for example: Keiko Mizushima Keyes, "Some Practical Methods for the Treatment with Moisture of Moisture-Sensitive Works on Paper," and Marilyn K. Weidner and Shannon Zachary, "The System: Moisture Chamber/Suction Table/Ultrasonic Humidifier/Air Filter," in *Conservation of Historic and Artistic Works on Paper, Proceedings of a conference Symposium 88: Conservation of Historic and Artistic Works on Paper, Ottawa, Canada, October 3 to 7, 1988*, ed. Helen D. Burgess (Ottawa: Canadian Conservation Institute, 1994), 99-109.

Folders

Fragments not used very often and in strong condition can be stored in folders and, if necessary, can later be housed between glass. In our collection we use two standard size folders (see the Conservation Documentation Form in the Appendix) that fit into two standard size boxes (fig. 16). Our folders are made in-house from 20-point lignin-free buffered folder stock. The inside of the folder is lined on one side with buffered blotting paper, adhered with a 50:50 polyvinyl acetate: methyl-cellulose mixture that we make in-house. The surface of the blotting paper provides a gentle friction to prevent the papyrus from sliding freely when the folder is handled (fig. 17).

Materials for Mounting Papyrus

The materials and techniques used for mounting papyrus must be selected in the context and use of the collection. A sturdy fragment of papyrus may be hinged (with paste and Japanese tissue) into a mat of conservation or museum board. This technique is not practical for fragmentary or friable pieces. Complex mounts are impractical for large collections. If the papyrus is on permanent (or long-term) display, ultraviolet-screening glass may help reduce light damage. Avoid placing UV-screening materials in direct contact with the papyrus, since it is not known what adverse effect these chemicals may have over time.

Glass. At the University of Michigan the glazed part of the papyri collection is housed between glass in three standard sizes: 8 x 10 inches, 10 x 12 inches, and 14 x 17 inches. The glass is window glass, 3/32-inch thick, free from bubbles and flaws, with light seam edges (the sharpness of the edges is reduced just enough to make the glass safer to handle). For glazing oversize papyri we have used 1/8-inch thick glass.

Is window glass safe for storing papyrus or is a specialty glass required? Many papyri came into the collections at the University of Michigan, as to many other collections throughout Europe and the United States, already housed between window glass by the dealers in the 1920s and '30s. I have not observed damage to our papyri from the glass; I have talked to conservators for other large collections and have not heard reports of damage from the glass.

Glazed papyri need to be stored vertically, so the weight does not break it, or stored horizontally singly or in stacks of no more than three mounts with blotting paper cut as pads between them. I have never experienced broken glass during storage. Twice I have seen glass break when the person handling it was too rushed and let it slip to the floor. In this case the glass broke only on one edge; the package stayed sealed together and there was no damage to the papyrus. While shatter-proof glass is available, the cost is prohibitive for housing a large collection. The likelihood of damage in practice using window glass is too low to justify the added expense of using shatter-proof glass.

Plexiglas. Plexiglas (acrylic sheet) seems an attractive material, especially for housing oversize papyri, because of its lighter weight and resistance to breaking. Plexiglas presents several problems as a glazing material for papyrus, however. Plexiglas is susceptible to scratches: over time as the piece is handled the scratches obscure the piece, which will need to be remounted. Larger sheets of Plexiglas bend, potentially stressing the papyrus. The color of Plexiglas will turn yellow over time. But the most

critical danger in using Plexiglas is the static electricity developed between two sheets. If the fragment ever needs to be taken out, the static could lift off friable ink or even split the two layers of the papyrus fibers and destroy it. If you do have to open a Plexiglas housing use an ionizer to minimize the damage.

Mylar. Mylar (polyester film) is also attractive because it is lightweight and does not break. But like Plexiglas, Mylar creates static electricity that can break off and lift friable ink or fibers of papyrus. If you need to open a Mylar package use an ionizer to minimize the damage.

Mounting Papyrus between Glass

Fragments should be mounted between two layers of glass if they are very fragile or very large or if they are used often by researchers and students or for exhibitions. Make sure the fragment is dry and everything is in the right place and place it on the glass. If the glass mounts are stored vertically make sure the fragment is secured on the glass with 1 mm wide gummed glassine strips in discreet areas. The glassine strips are coated with dextrin, gum arabic, or other water-soluble adhesive. Wet a small brush with saliva or water, brush excessive water off on the back of your hand, then pick up a strip from a small glass dish (filled with 1 mm wide strips of different lengths) with the damp tip of the brush. Wet the strip and place it on the fragment and glass (fig. 18). Press it down slightly with your fingertip and make sure it is attached.

One can also use a Japanese paper, such as *kizukishi* or *tokugawa,* and very dry wheat starch paste to mount papyrus. Cut 1 mm wide strips, set them on your fingertips, brush the wheat starch paste on and let it dry on you fingertips a few seconds, then place the strips in discreet areas.

Include the inventory number inside the glass package, centered at the bottom. Cover the fragment with the top sheet of glass and close the edges with Filmoplast SH (fig. 19). The glass and the Filmoplast permit very slow air exchange.

If the fragment is extremely brittle and I can not attach the fragment to the glass I place it on top of Japanese paper with the fibers "fuzzy side up," so the tiny fibers hold the fragment in place. Rub the Japanese paper gently against your lips or the back of your hand to distinguish the smooth side from the fuzzy side.

Oversize Papyrus (larger than 330 cm x 610 cm)

Oversize papyri may also be housed between glass. Because of the large size select 1/8-inch thick glass, which is sturdier. Larger pieces may be further supported with an aluminum picture frame cut to size (fig. 20). The four sections of framing are fitted together with screw fasteners at the corners and have clips on the back to hold the glass package in tightly. Alternatively, if there is no writing on the back side, an oversize papyrus may be supported on a combination of aluminum honeycomb support panel (available from Archivart) and an archival single-wall corrugated board next to the papyrus. Glass is used only on the front side of the package.

Salts

Sometimes mounted papyri show a "ghost" pattern on the surface of the glass that loosely follows the pattern of the fragment (fig. 21). It will appear more quickly in an

atmosphere of fluctuating relative humidity, but it still happens in very stable environments. This phenomenon is caused by the salt contamination with which papyri are commonly affected. As yet, I personally have not found a way to inhibit the bloom, but it appears to have no detrimental effect on the mounted papyri. The mount may be opened and the bloom wiped away with a damp paper towel. Analyses of the bloom have confirmed the identification as sodium chloride.

We also have some papyri with salt crystals imbedded between fibers, destroying the fibers and the writing (fig. 22). In this case I have no treatment recommendation. Even picking out some salt crystals from areas with no writing still leaves some sodium chloride behind.

Plaster

Some papyri have been removed from cartonnage. Cartonnage, a sort of ancient *papier-mâché*, is a composite material constructed from layers of linen or papyrus, which had been moistened and stuck together using a kind of paste. This layered material was then coated with a layer of lime plaster. It would then be molded into various shapes and left to dry. When it had dried it could then be painted or gilded. Papyri removed from the cartonnage may have a thick layer of plaster on the surface. Clean the plaster off using small brushes of different strengths, fine-pointed tools to break the plaster into tiny pieces if it is very thick, and Q-tips dampened in heated water to roll the plaster off the surface (figs. 23-25).

Seals

At the University of Michigan we have about eighteen papyri with clay seals (fig. 26). Some are still intact and attached to the papyrus, and in some cases the papyrus is still rolled up and sealed. The conservator and papyrologist work closely together to decide whether or not to detach a seal to reveal the enclosed text.

A special glass mount may be constructed for flat pieces with seals attached. The papyrus is housed in three sheets of glass. The center sheet is the thickness of the seal and has a hole cut out to the correct size and shape to accommodate the seal. The edges of the three-sheet package are sealed with Filmoplast SH. Because the middle glass must be thick and heavy to compensate for the depth of the seal, narrow (1/4 inch) spacers made from 4-ply mat board may be fitted around the margins of the glass. The spacers lift the weight of the glass off the papyrus.

To make the cut-out in the glass to accommodate a seal, create a template showing the outline of the papyrus with the exact location of the seal. Lay a sheet of tracing paper on top the papyrus and, with a soft pencil, trace the exact size of the fragment and the exact location of the seal. Take care not to press hard enough on the pencil to damage the piece. (Use tracing paper rather than Mylar to create the template, to avoid the possibility of static created by the Mylar.) Then measure the height and diameter of the seal with a pair of dividers. Add 2 mm around the seal and 3 mm to the height to make sure the glass will not be touching it. Take the measurements and drawing to a professional glass cutter. Have the glass cutter sand the cutout smooth.

An alternative to a full sheet of thick glass with a cutout is to place spacers around the margins of the glass; the spacers separate the two sheets of glass sufficiently to

accommodate the seal. Square profile acrylic rods (Plexiglas or Perspex) 1/4 inch by 1/4 inch may be cut to size as spacers; set them along the four margins of the glass and fix them to the glass with very small slips of Japanese paper and wheat starch paste. Set the papyrus in place and anchor it with Japanese paper and wheat starch paste. Place the second sheet of glass on top and seal the edges of the package with Filmoplast SH. With this method care must be taken not to dislodge the papyrus or the seal by turning the package over. The advantages of this method are that it is simpler and easier to construct and does not risk crushing the papyrus under the weight of the glass.

Some papyri have seals already detached from the fragment; these may be housed in a three-layer glass mount to keep the seal with its papyrus. Store glazed papyri with seals flat, not vertically. Seals with no associated papyrus may be housed as objects in a museum cabinet (fig. 27).

Often the clay seals are cracked or broken. They may be very fragile at the edges, and in some cases there may be loose clay that is barely attached. The seals may be consolidated with methyl cellulose. Mix the methyl cellulose to a very thin consistency. With a very fine brush or a syringe insert the methyl cellulose into the crack and let it dry. When applied with care the methyl cellulose leaves no visible residue on the surface of the seal. Alternatively the seal can be fixed with Paraloid B-72, an acrylic resin adhesive. Paraloid B-72 can leave a shiny film on the object; while excess B-72 may be removed with acetone, often the clay seal is too fragile to withstand such treatment. I have used Paraloid B-72 to consolidate a seal that was powdery almost to the point of disintegration, just to salvage what was left of it.

Development

Conservation will always be in the state of development. New techniques are being invented and old treatments are being revised and renewed. This document records the methods I am using now for treating papyrus, several of which changed or were refined while I was writing it. I hope it will encourage others to explore, experiment, and share their experiences and so build a common knowledge of best practices for conservation of papyrus.

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Acknowledgements
I wish to express my profound gratitude to Julia Miller, conservator, bookbinder and book artist, for introducing me to the treasures of papyrology and taking me under her wing; to Shannon Zachary for her editing, generous advice, immense support, and powerful encouragement.; to Ursula Freimark, my friend and mentor; to Myriam Krutzsch, Diploma Restaurateur of Papyrus, of the Egyptian Museum, Berlin, Germany, for her generosity in sharing her knowledge with me; to Lorna Kirwan, Papyrus Conservator, University of California, Berkeley, for sharing her experience and the training she had received in Vienna; to Suzanne Davis, objects conservator at the Kelsey Museum of Archeology at the University of Michigan, for her advice about treating clay seals; and to Professor Ludwig Koenen, Professor Traianos Gagos, and Dr. Paul Heilporn for their encouragement and support. The photographs were taken by myself, Pamela Spitzmueller, and Terry Szymanski at the University of Michigan and at the University of California, Berkeley.

Appendices

Papyrus Conservation Documentation Form

UNIVERSITY OF MICHIGAN ∞ UNIVERSITY LIBRARY ∞ CONSERVATION UNIT

Papyrus Conservation Treatment Record

Inventory #

Contact person _Traianos Gagos **Other** _____

Description _____

Number of pieces:

Format	___ papyrus	___ flat	___ ink recto/verso
	___ parchment	___ scroll	___ black ink
	___ cartonnage	___ other	___ other color
	___ other	___ ancient repair	
Glass	___ 8 x 10″	___ 14 x 17″	___ 13 x 24″
	___ 10.25 x 12″	___ 12 x 18″	___ other
Folder	___ 11.5 x 16.5′	___ 13 x 22″	___ other

Special requirements

___ required for exhibition by [date] _____
___ required by researcher by [date] _____ [name] _____
___ other

Condition

___ weak/brittle/fiber delamination
___ dirt/accretions, salt/plaster
___ folds major/minor
___ general discoloration
___ pest damage
___ missing pith
___ old repairs: brown paper backing (tape)/pressure-sensitive tape
___ friable ink
___ stained: water/mold/fire
___ misaligned
___ other:

Testing inks

___ water recto _____ verso _____
___ ethanol recto _____ verso _____
___ ethanol:water recto _____ verso _____

Treatment Proposal

___ alignment: fragment/fibers
___ mending/bridging
___ rehouse: glass mount
___ rehouse: folder
___ mechanical clean
___ clean/flatten between blotters
___ remove old repairs/tape
___ rehouse: special enclosure

Treatment Report

Time Action

___ unfold
___ mechanical clean – brush
___ align fragments/fibers
___ remove old repairs/tape

Materials or chemicals used

___ pH neutral water
___ ethanol
___ 50:50 ethanol/pH neutral water
___ methyl cellulose Dow A4M
___ wheat starch paste

Photodocumentation:

___ B&W	B/A	Date:		B/A	Date:
___ color print/slide	B/A	Date:		B/A	Date:

Work by:_____ **Date** _____ ___ **APIS Grant Project** **Total hours** _____

sz 4/24/04

Tools and Equipment for Papyrus Conservation

Cassell's #2 spatula, small (6 inch) (Talas)
palette knife, 6-1/2 inch with 3 inch blade
Wiss sewing & embroidery scissors #764
2 Petri dishes, 3 inch diameter
Fiskars shortcut scissors
tweezers #2
tweezers #3
steel rules, 6 inch and 12 inch
plastic triangle with steel edge (Talas)
Airmist (hand pump) spray bottles
photographic air bulb
small weights ca. 1/2 to 1 oz. (25 g), covered in paper or fabric
scalpel, #3 handle
scalpel, #4 handle
scalpel blades #15, #22
assorted brushes, for example:
    brush, #000 sable watercolor
    brush, 6 mm (1/4 inch) Winsor & Newton Galeria One Stroke/wash
    brush, 3 mm (1/8 inch) Winsor & Newton Galeria One Stroke/wash
    brush, #4 Winsor & Newton S round
    brush, 1/8 inch One Stroke, natural grip
    brush, #1 Winsor & Newton series 240 Goat Hair Wash Brush
brush, #3 Winsor & Newton series 240 Goat Hair Wash Brush
    brush, #5/0 Grumbacher 178 Spot-Rite Red Sable Round
    brush, #0 Grumbacher Renoir Red Sable (?Bright?, Round?)
    brush, #6 Utrecht series 209-B Bristle Bright for oils and acrylic
    brush, 1-1/2 inch Japanese hake brush
3m/10' retractable tape measure
Pentel vinyl eraser
dull knife
pressing boards (of wood or Plexiglas) and light weights, ca. 1/4, 1/2, or 1 lb (110-454 g)
cotton gloves
Abbey pH pen
apron
magnifiers, 5-10x power
Optivisor (head magnifier), 2 or 2-1/2x power
self-healing cutting mat, 12 x 18 inches
toolbox
flex-arm task lamps
lightbox
binocular microscope (most work is done at 10x magnification)

Materials Used in Papyrus Conservation

Perma/Dur folder stock, 0.20 point, Buffered (University Products)
lightweight blotting paper (University Products)
Japanese paper (Japanese Paper Place)
ionizer, Z stat 6440 (Ion)
ethanol (scientific supplier)

methyl cellulose A4M (Dow Chemical Co.; available from BookMakers)
wheat starch (University Products)
Filmoplast P (Talas)
Filmoplast SH (Talas)
drop spine boxes, acid-free (BookLab II)

Suppliers

Archivart (mat board and other archival papers and board)
7 Ceasar Place
Moonachie, NJ 07074
(800) 804-8428
http://www.archivart.com

BookLab II (custom archival boxes)
1724 McCarty Lane
San Marcos, TX 78666
(512) 392-2363
http://booklab.bookways.com/

BookMakers (bookbinding and book conservation supplies)
6701B Lafayette Ave.
Riverdale Park, MD 20737
(301) 927-7787
http://www.bookmakerscatalog.com

Conservation Resources International, Inc. (supplies for library, archives, and museum storage; conservation tools)
8000-H Forbes Place
Springfield, VA 22151
(800) 634-6932
www.conservationresources.com

Hollinger Corporation (boxes for library, archives, and museum storage)
P.O. Box 8360
Fredericksburg, VA 22404-8360
(800) 634-0491
www.hollingercorp.com

Ion (ionizers to neutralize static electricity)
1005 Parker Street
Berkeley, CA 94710
(800) 367-2452
http://ion.com/

The Japanese Paper Place (Japanese papers)
77 Brock Avenue
Toronto, Ontario, Canada M6K 2L3
(416) 538-9669
http://japanesepaperplace.com/

Talas (tools and supplies for libraries and hand bookbinders)
568 Broadway
New York, NY 10012
(212) 219-0770
www.talas-nyc.com

University Products (supplies for library, archives, and museum storage)
P.O. Box 101
517 Main Street
Holyoke, MA 01041-0101
(800) 628-1912
www.universityproducts.com

Deionized pH Neutral Water

Mix deionized pH neutral water from deionized water—water from which heavy metals including iron, copper, zinc, magnesium, calcium, organic materials, and particulate materials are removed by reverse osmosis filtration. Add small amounts of saturated aqueous calcium hydroxide solution to bring the deionized water to a pH neutral level, testing with a pH indicator strip.

Methyl Cellulose Recipe (A4M)

(makes 1 gallon)

2250 ml of pH neutral water,
1 cup and 2 tbsp. A4M methyl cellulose powder (firmly packed)

Heat half of the pH neutral water (1125 ml) to simmering, chill other half in ice water. Add methyl cellulose to hot water and stir for about 3 to 4 minutes for complete dispersion.
When dispersed, add ice water and stir; the mixture will thicken and clear instantly. Stir constantly until dissolved.

Store the methyl cellulose in a clean jar with a screw-top lid. Under normal conditions it will keep for at least a year. I work with methyl cellulose from a small glass dish and when it thickens over time I thin it with pH neutral water. Use methyl cellulose to adhere delaminated fibers and to hinge loose fragments.

Wheat Starch Paste Recipe

Ratio is 1 part dry wheat starch to 4 parts water.

Put wheat starch in enamel pan (no aluminum, no Teflon), put water in at room temperature and mix it up. Let it stand at room temperature for 15 minutes or so if you have time. Use double boiler if you are using electric heat, because electric heat singes the pan (use tap water or deionized water in the bottom of the double boiler). Or, you can use gas heat. Use high enough heat to keep water boiling in the double boiler, since the steam is what cooks the paste.

The smallest quantity of paste that can be made successfully is about 50 ml to 200 ml water.

Heat the mixture of starch and water. Cook the paste for 35 minutes, stirring constantly. After you have cooked it for 7 to 10 minutes, the paste starts to become a translucent gel. It will remain gel-like until the end of cooking time. As it cools, it thickens and become opaque. Cooking past the 7 to 10 minute mark until the 35 minute mark moves the paste from merely usable paste to a enhanced state, which means a more tacky, workable, preferable paste. Take the pan off heat and whip the paste for one or two minutes. Pour the paste in a glass bowl or beaker trying not to get any on the sides. Add water to the beaker submerge paste in water. Change water once or twice as the paste cools.

To store the paste, rinse the ball or paste and change the water every morning (the ball of paste is solid and water does not soften it until it gets too old to use). Let the beaker and paste stand, uncovered, at room temperature. Do not refrigerate. The paste will keep three to seven days—good quality water and frequent rinsing help keep the paste fresh longer. When the paste ball starts to feel slimy, discard it.

To use the paste, cut off what you need from the paste ball (rinse the ball and change the water) and strain it three times through a stainless steel or strong plastic strainer. The paste is so tough that it could rip horsehair out of a horsehair strainer. Put the strained paste in a glass dish. Beat/whip the paste with a bristle brush until it is smooth, sticky, and slightly translucent, five to ten minutes. If a thinner paste is needed, gradually add drops of pH neutral water and continue to beat the paste until the desired consistency is reached. The paste thins best if you beat it completely smooth before you start adding water.