Article: Pilot Project for the Treatment of Photogravures on Gampi Paper by Edward S. Curtis (1868-1952)
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In 1907 Edward S. Curtis, with seed money from J. P. Morgan and support from President Theodore Roosevelt, began a herculean undertaking to document the traditions and customs of all major Native American groups living west of the Mississippi. Curtis sought to document all aspects of their cultural heritage, and the more he lived among them, the more he felt the urgent need to preserve their way of life before it was obliterated by the forces of Manifest Destiny. Published in twenty volumes over twenty-three years *The North American Indian* was a tribute to the ‘vanishing race’. Its extensive text from years of field research was accompanied by photogravures based on Curtis’ iconic photographs. Each volume was complemented by a portfolio of larger gravures, the rarest being printed on Japanese gampi tissue, the subject of this paper. A photograph conservation studio received 722 images on gampi from the portfolios of one set for assessment. The gravures, presented in Van Gelder Zonen paper window mats and tipped onto one-ply backings, have become stained and distorted. A pilot project began with the selection of a sample set of ten representative gravures with the goal of establishing a reproducible treatment protocol, a cost estimate and a time schedule for conservation treatment and re-housing. This paper describes the challenges of finding methods that allowed for successful drying of these extremely thin and reactive gampi papers. Past research on the treatment of gampi was reviewed and incorporated into the trials. Drying techniques tested included friction drying between tissues; drying between rag board, polyester film (Mylar™), cotton blotters, felts, and two types of fabric membranes—Gore-tex® and Sympatex®; and restrained-drying of gampi tissue between Japanese papers adhered at edges to a smooth countertop. The trials produced a range of results, some very good but none that completely achieved the desired results, i.e. returning the surface texture to its original silken appearance. Throughout the trials we consulted with colleagues to expand our methodologies. The collaboration led to a satisfactory treatment method, a variation on a hard-soft drying package, described in this paper. Cost and the ability to re-use materials were considered in a final recommendation.

1. **INTRODUCTION**

For nearly thirty years, Edward S. Curtis sought to photograph and document the vanishing culture and way of life of the major Native American tribes in North America before it disappeared completely.

When he began his magnum opus *The North American Indian* he expected it to take five years but it was over 25 years later in 1930, when Curtis published the last volume with the help of his

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1 The title Curtis gave to Plate 1 of Portfolio 1, clearly conveying the intentions of *The North American Indian.*
daughter, Florence.

Curtis intended to produce 500 sets, but managed to complete 272. Each set is comprised of 20 bound volumes that contain 300 pages of text and 75 hand-pressed, copperplate photogravures. In these bound volumes Curtis documented the language, customs, and beliefs of each tribe. In addition, during this time, he made several documentary films of the tribes, and created over 10,000 wax cylinder recordings of their native languages and traditions so that they could be preserved and studied.²

For each volume he made an accompanying portfolio of larger photogravures, about 36 images in each that were unbound and intended to be stand-alone images. In each set, there were approximately 1500 images in the bound volumes and 722 images in the portfolios. Accounting for only about 10-15% of all folios produced, Curtis’ deluxe folios featured gravures printed on translucent and extremely delicate gampi tissue³.

The first volume contained a foreword by President Theodore Roosevelt, who had become good friends with Curtis. Curtis photographed Roosevelt’s daughter Alice on her wedding to Nicolas Longworth in 1906, and it was Roosevelt who wrote a letter of reference to J.P. Morgan asking him to support the North American Indian. Morgan agreed to finance the original fieldwork but not the printing or publishing of the sets, making it necessary for Curtis to undertake fundraising from the beginning.

Despite great financial and personal hardship, Curtis remained committed to the project, holding himself to the highest standards of scholarship and artistic output. In an unpublished memoir begun later in his life, Curtis said the Indians named him “The Man Who Never Took Time to Play.” Realizing a project of this magnitude was truly a labor of love.

²Some have been digitally remastered and are found here: http://www.indiana.edu/~libarchm/index.php/news/125-atm-and-mdpi-to-preserve-wax-cylinder-collections.html

³Curtis used gelatin silver glass plate negatives to make the 45-50,000 images he completed for the project. Gravure plates were backed with stainless steel before printing in order to strengthen them. In the photogravure process, the negative image is etched into the plate. The plate is inked and the paper is pressed into the etched lines, creating an intaglio print. The plate needed to be wiped and re-inked by hand for every image.
Over the course of the project Curtis worked with over 80 tribes, spanning territories west of the Mississippi River from north of the Mexican border, into Canada and through northern Alaska (fig. 3).

2. STRUCTURE AND COMPONENTS

Curtis offered subscribers their choice of three handmade or mould made papers: a Dutch Van Gelder Zonen etching paper, a Japanese Vellum paper, and a Japanese gampi tissue paper. Approximately 20-30 portfolio sets were printed on gampi. Curtis charged a premium for these as they were considered the finest and they are now the rarest (fig. 5).

In this set the gravures were tipped onto a 1-ply, Bristol board-like backing and over-matted with a window mat made from the soft and textured, wove Van Gelder Zonen paper. The total number of components under review for treatment were approximately 2,166. Each portfolio contains approximately 36 gravures on gampi with a frontispiece printed on Van Gelder Zonen paper at the beginning of the folio that lists the titles of each gravure (fig. 6).

The paper window mat was attached with a strip of linen tape or with direct application of adhesive to the 1-ply backing that has a yellow tone. The gampi is tipped onto the backing at its four corners (fig. 7 and fig. 8). On the treated set, all the backings were embossed with the Cranbrook Institute of Science blind stamp.

Some of the images were signed by Curtis, mostly on the earlier volumes, but typically, they were not signed. According to one Curtis authority, this set of folios is particularly rare because Curtis signed 110 gravures -- all the works in folios 1 (The Apache, The Jicarillas, The Navaho), folio 3 (The Teton Sioux. The Yantonai. The Assiniboin), and folio 4 (The Apsaroke, or Crows, and The Hidatsa). All gravures were printed by John Andrew and Son in Boston (fig. 9).
Fig. 5 Above: detail of the original brown half morocco portfolio.

Fig. 6 At right: frontispiece with stains imparted by contact with inner portfolio flaps and leather corner elements.

Fig. 7 Waiting for the Signal Nez Perce, Volume 8, Plate 261 Paper window mat lifted, showing the gampi tipped to the 2° support
3. CONDITION ISSUES

Many of the supports are cockled and creased, in part due to being tipped in at their four corners. This is a common condition issue noted in the gampi sets. Images may also be affected by brown mottled staining, most visible in unprinted areas, such as skies and borders (fig. 10).

Fig. 8 (left) Pima Ki, Volume 2, Plate 45 showing gampi gravure in Van Gelder Zonen paper window mat

Fig. 9 (top) Detail of Curtis’ signature and above it is the printer’s mark of John Andrew and Son in Boston

Fig. 10 Apache Reaper Volume I, Plate 8
Collector and Curtis scholar Christopher Cardozo, along with his printer and studio manager Peter Bernardy, have viewed many sets the *North American Indian*. They report having seen this type of discoloration on many of the gampi sets, in contrast to the sets on the Japanese vellum papers, which are generally in very good condition. The origin of this discoloration is unclear. It may be associated with pre-treatment of the paper prior to intaglio printing, or perhaps it is related to window mats, the paper wrappers/folders around each image, and/or the portfolio covers themselves, which are not fully archival.

Another condition problem affecting the gravures is a sharp line of discoloration (fig. 11). This is evident in several gampi gravures at The Morgan Library and Museum (which has the very first set issued to J.P. Morgan). From tests, we learned that the staining is water-soluble.

4. PRE-TREATMENT TESTING

4.1 Staining in support papers
Testing of the gampi primary paper support, paper mats and backings with deionized water showed that the discoloration and staining could be reduced with water washing (fig. 12).
4.2 Fiber Identification
The presence of gampi fibers was confirmed with microchemical testing carried out at The Conservation Center, New York University. Gampi tissue is a very thin, translucent paper with a silk-like surface texture and very few visible fibers. It is made of bast fibers processed from the bark of Japanese bushes in the Daphne family, including Thymelaeaceae Wikstremia Canescens (fig. 13). Gampi is relatively strong for its light weight; it wafts easily, similar to a sheet of gold leaf and wets out easily, yet is dimensionally unstable as it dries.

A few fibers from the window mats were tested with Graff’s “C” stain, and results indicated the paper contains a majority of bast fibers with some lignin-containing fibers in the mix.

5. GRAIN DIRECTION IN THE GAMPI SHEETS

Typically, the gampi sheets measure approximately 17 x 14 inches overall, and the paper mats approximately 18 x 13 inches. The grain direction of the gampi runs perpendicular to its format. We determined grain direction of many tissues - the gampi tissues from the pilot group; a test gravure with a large pre-existing tear donated for testing and not part of the publication; and numerous machine-made and handmade gampi tissues.

We measured samples when dry and wet, noting dimensional changes. From this we realized that in gravures in a vertical format, the grain ran horizontally, and thus expanded more from top to bottom when wet; likewise, in horizontally-oriented gravures, the grain direction ran vertically, and the sheet expanded laterally when wet (fig 14). We also measured lens tissue, as it is easy to handle and economical. Its grain direction paralleled the machine direction (and length) on the roll.

6. TESTING DRYING TECHNIQUES

6.1 Friction Drying between Blotters
Friction drying is a common paper conservation technique, described in a 1984 publication by Keiko Keyes (see bibliography). It can work well to flatten lightweight, thin, and dimensionally unstable papers while retaining original texture. The damp object is brushed out between two damp sheets of tissue and dried between felts and/or blotters under weights. An important factor to the success of the technique is matching the direction and the amount of expansion and contraction of the artwork with the drying papers.

Friction drying tests of other gampi art surrogates were carried out between two sheets of Gampi paper, and two sheets of lens tissue. All layers were placed between blotters, under an acrylic sheet and weights.
The results were less than optimal, as there was tight cockling noted in areas of the test sheets (fig. 15).

This led us to consider other drying and pressing techniques. We consulted with colleagues Joan Wright, Betty Fiske, Jennifer Perry, Yoshi Nishio and Pauline Webber, who helpfully shared their experiences with flattening gampi tissue. They suggested treatment options including variations on restrained friction drying on a karibari board, drying with fabric membranes, and drying in a hard-soft sandwich. A literature search revealed a Tip Session piece that described four similar techniques for flattening gampi paper by L. Neufeld at the 42nd Annual AIC Meeting, 2014, and we achieved similar results in our tests described below.

6.2 Friction Drying on Countertop
This test involved friction drying a surrogate sheet of gampi, similar in texture to the Curtis images, between different tissues using the countertop as a substitute Karibari to restrain the edges. No blotters were used. The tissues tested included gampi, lens tissue and kozo-fibered Usomino paper. The edges of the tissue were pasted out with methyl cellulose, the package turned face-down, and adhered to the countertop. Again, some cockling was noted after drying.
6.3 Drying against Mylar using Sympatex® and Matboard
Several variations of this method we tried included drying the prints directly against Mylar™ after taking the samples straight out of the water on the Mylar™, blotting the face overall to remove excess moisture and taping down the Mylar™ to the countertop along its edges. After drying, mat board was then placed on top of the sample, and the stack was weighted under glass. In another variation, the test print on Mylar was covered with a sheet of Sympatex®—a polyester non-porous membrane, placing its smooth side against the art. A thick piece of glass was placed over the Sympatex. (fig.16). Sympatex is a polyester, moisture-permeable material, used in the same way as Gore-tex. It has a smooth side and a fluffier quilting side, but feels quite different than Gore-tex, mainly it is not as smooth and compact as Gore-tex®.

These tests were promising as they were easy to execute and gave overall good results but not consistently.

6.4 Hard-Soft Package using Sympatex® and Goretex with Blotter and Corrugated Board
For this method two types of fabric membranes - Gore-tex a polytetrafluorethylene film, and Sympatex® - were tested. This technique employs semi-permeable membranes on either side of the dampened gampi to facilitate slow and even drying. Blotters are placed on either side of the membrane and a wooden board or cardboard is positioned on top. A sheet of acrylic and weights are placed above the entire package. After drying, the fabric membrane was replaced with mat boards to help keep the gampi planar during drying. After drying, there were some areas of cockling noted but overall this method was promising.

7. TREATMENT

7.1 Initial Steps - Washing of Frontispiece, Window Mats and Backings
After their disassembly, a few of the window mats and backings were washed in ammoniated water (pH 8-8.5) followed by a water bath alkalized with calcium hydroxide at pH of 8.25. Washing reduced discoloration and improved the flexibility and visual appearance of both window mats and backings.

Treatment of the Frontispiece proceeded as above, but also involved light bleaching, which improved sheet tone and reduced localized staining, likely caused by contact with flaps and corners in the original portfolio cover (fig 17).
We began by float washing the prints on a support sheet of Mylar™ and it soon became clear the prints could be safely immersed. The water baths allowed the distortions in the prints to relax completely and the washing removed much discoloration into the water bath (fig. 18). *Coming for the Bride* responded well to an hour of light bleaching after washing (fig. 19).
Under ultraviolet radiation examination, it appeared that microbial growth and degradation were successfully washed out of *Pima Ki* (fig. 20).

### 7.3 Drying Methods in Practice

After achieving satisfactory results with water washing, we turned to the challenge of developing reliable, reproducible techniques for safe and effective pressing of the Curtis gampi gravures. Analysis of our early drying tests of wet and dampened gampi surrogates led us to determine that hard-soft packages with Gore-tex produced the best results. Sympatex was tested as a more affordable alternative. We were mindful of factors such as the scale of the project, re-usability of materials, and managing treatment of multiples in an active lab setting.
7.4 **Hard-Soft Package with Sympatex®** *Apache Reaper* was dried in a hard-soft package with Sympatex®. While this was an improvement over the friction drying methods, some cockling visible in raking light was noted along the margins (fig. 21).

![Fig. 21 Apache Reaper Volume 1, Plate 8](image1)

Results of Hard-Soft Package with Sympatex®
Left: After drying treatment in normal light  Right: After treatment in raking light

Another gravure, *Ankara Medicine Fraternity*, was dried in a hard-soft package between sheets of Sympatex®. On this image Curtis’ signature in black ink (fig. 22) was found to be water-sensitive, and was first fixed with Paraloid B-72 in xylene, applied with a fine water color brush to both recto and verso. After drying, the print looked good in normal light, but in raking light, it did not appear as silken in texture as hoped for.

![Fig. 22 Ankara Medicine Fraternity, Volume 5, Plate 157](image2)

Results of Hard-Soft Package with Sympatex®
After treatment  Left: in normal light  Right: in raking light

7.5 **Hard-Soft Package with Sympatex® and less weight applied**
Of the prints in this set (fig. 23) was dried in a hard-soft package under light weight to avoid cracking the densely inked print. In after-treatment inspection, we found a slight degree of cracking (measuring 0.3 millimeter in width) in a media-rich area of the gravure.

**7.6 Hard-Soft Package using Gore-tex**
Ultimately within our study set we achieved the best results when pressing the gravures in a hard-soft package using Goretex as the fabric membrane (fig. 24). Drying was more controlled, and fewer planar deformations were observed when using Goretex. But again, when viewed in raking light, the results were not completely as hoped for in a final surface texture (fig. 25). We had concerns about the supply and cost of the Goretex, but recognized the advantage of using it.
Fig. 24  Hard-Soft package Nootka Spearfishing Volume 11, Plate 374
Soft side of Goretex positioned closest to gravure

Fig. 25  Nootka Spearfishing Volume 11 Plate 374
After treatment Left: in normal light  Right: in raking light
8. CONCLUSIONS

To remove discoloration and stains from the gravures and window mats, water washing followed by light-bleaching worked most effectively. Light-bleaching was not necessary for the 1-ply backings in this set.

The Hard-Soft Package is acceptable as a way to dry and flatten the gravures on gampi paper. Gore-tex® is recommended over Sympatex® because it is easier to use, works more slowly than the Sympatex®, and it has a smoother, more compatible surface to the gampi.

The edges of the gampi dry more quickly which contributes to planar deformations as it dries; it can be helpful to spray the edges of the fabric membrane to promote even drying.

We are hopeful that a source for Gore-tex can be found, as it has many useful applications here and in conservation in general.

Drying the print on Mylar on a countertop gave promising results and is a straightforward technique, requiring less handling of the gravures. Good results could not be reliably replicated for this project, but the method might be appropriate for other treatments with gampi. We also recognize that some of the other restrained-drying techniques on a karibari could work very well with more practice using them.

Lens tissue worked equally as well as a Japanese tissue for drying.

Particular caution was necessary with densely inked images. Perhaps a very slow humidification before washing and slow drying method after washing would work better. If not necessary, washing is not recommended.

Not all gampi papers respond in the same way. It is likely the materials Curtis used over time changed due to their availability and that the materials in Volume 1 varied significantly from those in Volume 20 two decades later.

9. FURTHER CONSIDERATIONS

Time permitting, it would be useful to investigate and determine the various causes of deterioration in the prints.

Given the massive number of prints, and given the fragility of densely inked gravures, is it acceptable to treat some gravures and not others?

For a project where each image has so many components to treat, what are realistic goals? Which steps could be done by technicians, and which require the hands of experienced paper conservators?

In our roles as conservators and advisors, how can treatments be designed to be scalable and use materials that are re-usable and affordable?
In an age where likenesses are immediately captured by our ubiquitous smart phones, these works on tissue are indeed remarkable, not only for the information and beauty they convey, but also the craftsmanship and technology used to create them. With time, diligence and resources, it should be possible to preserve these incredibly important records that honor the first Americans.

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Online Databases
Friction Drying and Methods of Humidifying and Pressing Reactive Papers


Gampi Tissues


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