The Book and Paper Group ANNUAL

SPECIAL ISSUE ON VARNISHED WALL MAPS 2024

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KATHRYN BOODLE

The "One-Day" Conservation Treatment Method for Wall Maps at the Northeast Document Conservation Center

INTRODUCTION

The treatment of wall maps, as noted by other articles in this volume, is not for the faint of heart. The maps have several complex issues and considerations that change drastically depending on the layers of the map and the number of conservators available to treat the piece. The Northeast Document Conservation Center (NEDCC) conserves, on average, one wall map per month every year—a rate that is much higher than many of the other members who attended the Wall Maps symposium in September 2022, much to the surprise of all attending conservators. In treating many wall maps through the 50 years of its history, NEDCC has created a flexible methodology in which the bulk of the map treatment is completed in 1 day. The method can be done on most wall maps that are brought for conservation, but not all, and conservators attempting to undertake the method should review the considerations noted in this article to determine if it is appropriate for their collections. Note that the treatment also requires at least four conservators, as the wall map stays intact throughout the treatment process. In its final stages, it is drop-lined in one go after the washing and backing removal are conducted. The article will discuss the preparation process, main treatment steps, and options for rehousing and display after completion.

Components and Considerations of a Wall Map

When approaching wall maps for treatment, it is easy to become overwhelmed by the sheer size of the pieces compared to many of the other items within collections. Indeed, oversized materials are always daunting when approached alone, even by those who encounter them more frequently than others. It is also important to remember that although we have the traditional definition of oversized materials, we should also consider anything outside the norm of our collections' storage and space as oversized and in need of special handling and treatment consideration. However, outside of the size, the overall materiality of the pieces is the same, and breaking down the components into familiar groups may help with getting over the mental barrier in treatment to make things seem manageable. In the case of wall maps, as is common with many mass-produced items, there is some consistency in their composition that can be tracked through various timelines and production methods. Deviations primarily occur within the customization of the maps by the public or individual owners with watercolors or layered markings (note 1).

Even though all of these factors can add a level of complexity to the treatment, they do also open the door for the utilization of several different treatment pathways depending on the space, supplies, budget, and staff of any conservation laboratory, regardless of whether they are private, institutional, or an independent nonprofit conservation center. As such, the considerations and treatment detailed in the following sections are not a comprehensive definitive approach to wall maps but merely one of many options that should be contemplated when tailoring the treatment protocols for a specific situation (fig. 1).

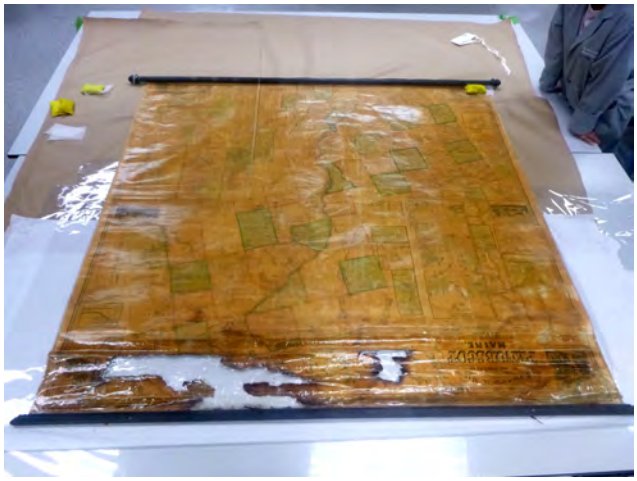

Fig. 1. Example of a 19th-century wall map awaiting treatment.

Proceedings from the AIC-sponsored event, "Varnished Wall Maps: A Collaborative Seminar to Investigate Treatment Methodology," September 14–16, 2022.

Primary Substrate: Paper

The paper used in wall maps can be either handmade or machine-made, although most maps treated at NEDCC are from the mid- to late 19th century and fall into the latter category. Qualitative observations from treatment and larger map collections, such as those at the Osher Map Library or the David Rumsey Map Collection, allow conservators to describe the primary substrate. Often the paper we encounter with these objects is a thin, wove paper imbued with a sizing that allows for both the crisp definition of a print and the diffused application of watercolors. From a more historical standpoint, the intersection of machine paper mills in America, especially along the eastern seaboard, and the rise in popularity of maps led to the creation of a specific paper noted in the literature as "map paper" during the 1800s (Brückner 2017, 93). Earlier ads (pre-1800) describe the origins of this map paper. As noted by Brückner in *The Social Life of Maps in America*, the earliest maps

> *[W]ould be 'printed on one sheet of imperial paper, 30 inches broad, and 22 inches high' with 'plain' copies being available 'on printing paper' and 'the colour'd ones, on superfine writing paper . . . 'with each colour'd map [will be] delivered in three or four sheets . . .' (2017, 29).*

Brückner's findings further confirm our observations even on more damaged wall maps, noting that papermaker Theodore DeVinne supplied "a thin, hard, sized paper, made from selected stock, with special reference to strength and flexibility" as well as a paper of "[a] commoner quality, not unlike that of fine book paper, but tougher" (2017, 93). The rags that compose the paper, regardless of any other damage or issues, means that it tends to be fairly accepting of aqueous treatment and the movement of water through the cellulose structure of the paper matrix (Banik and Brückle 2011, 264–268). Only in rare cases is the paper the primary concern when it comes to moving forward with treatment.

Having said that, the layering of the paper and the order in which the maps were created should be considered when trying to wash the object. As historic oversized paper-based items, these pieces are often composed of multiple sheets to create a complete picture. At minimum, conservators can expect to have at least three sheets of paper on an average-sized wall map, with up to 10 or more sheets on larger-sized pieces. As the water in the bath allows for easier separation from the secondary substrate, it also softens the adhesive along the paper joins, as it is often the same adhesive. This dissolution can lead to misalignment of the sections during the drop process if they are not carefully monitored. As such, aqueous treatment serves as a double-edged sword for the paper. It ensures equal saturation and expansion of the paper complex—and therefore theoretically equal shrinkage of the paper upon drying—but leaves the piece open to excessive manipulation of the sheets. If it is believed that the damage to the map has resulted in a compromising of the paper matrix, foregoing the 1-day treatment for a multistep process, such as those proposed by Irwin (2024) or Edmondson (2024) in this same volume, may prove to be more beneficial for the map overall and certainly much easier if you are limited in staff.

Secondary Substrate: Cloth

The cloth backing of maps comes in a variety of types. The most common is an untoned fine woven cotton or linen support; however, NEDCC conservators have also removed textiles that more commonly resemble cotton gauze, mull fabric, or rough burlap from the versos of some particularly unusual maps. Although the textiles used in the creation of wall maps may have been considered quality material, time is often not kind to them, and they are usually far more damaged than is worth saving unless they contain significant information. The textiles are almost always applied to the verso with a water-soluble adhesive. Testing of this adhesive with 3% tannic acid and iodine-potassium iodide solutions tends to show that they are a natural adhesive composed of protein, starch, or some combination of the two. In a few cases, adhesives like synthetic or rubber-based wallpaper paste have been removed from the verso, and these tend to be the worst offenders when it comes to cross-linking in this author's experience.

The other cloth components on maps that may be encountered on maps are the edge and nail ribbons. Even though both are decorative, they serve an important purpose when it comes to the reinforcement and protection of the map. The ribbons behind the nails are usually a small ribbon made of a colored textile comparable in weave to the primary backing cloth. Although the edge ribbons may be made of the same material as the nail ribbons, they are often more decorative and sometimes composed of silk rather than dyed cotton or linen. The edge ribbons are often hand sewn to the map, although some mapmakers may have adhered them with a paste like that used to attach the backing cloth, and it serves to protect the edges while the map is either hung or rolled. Depending on the level of mechanical damage to the map and the original fabric composition, these two types of ribbons may be entirely lost, with only minor evidence of their prior attachment. The ability and desire to replicate or reattach them varies from map to map and client to client.

Overall, the secondary backing and other cloth components are often loosely viewed as "expendable" in the conservation of wall maps by the majority of conservation professionals, and their destruction falls under the category of "acceptable loss," as is the case with most deteriorated secondary supports in paper conservation. On smaller maps, it is possible to preserve and reattach the cloth backing, but for larger pieces, it is often replaced in favor of preserving the primary substrate and information contained upon it. As further noted in the preparation section, it is therefore removed in small strips during the backing removal process so as not to disturb the paper alignment of

the composite sheets. Avoiding this and/or using the original backing again should be discussed further and considered by other stakeholders on the project before treatment starts.

Media

Very rarely are commercially produced wall maps fully hand drawn or composed of only manuscript media. Those types of maps tend to be reserved for land surveys that served as the foundation for the final product. The base information on wall maps is often printed using lithography, engraving, and/or etching processes with black printing ink. These inks are usually quite stable and generally not problematic when it comes to the overall treatment of wall maps. Having said that, they should still be tested and carefully checked over to confirm that additional manuscript markings or inscriptions have not been added by the owners during the time the map was used.

The hand-applied media that serves to emphasize the various aspects of the map tends to be much more problematic. Even though there does not seem to be a consistent coloring code agreed upon by mapmakers, it is believed that, at least in some cases, the color is associated with the population of the outlined areas for towns on county or regional maps or used as a way to communicate a point or statement more dramatically about the information presented (Brückner 2017, 68). It is noted that the hand coloring was done by, in at least some cases, the map manufacturers themselves at their studios. However, there are also cases where there are layers of secondary or tertiary watercolors applied on top of the map coating. If this is observed, the coloring may be indicative of a working map. In either case, common colors observed by NEDCC staff appear to be

- *Red*: Red madder or alizarin
- *Yellow*: Gamboge, chrome yellow, cadmium yellow, or yellow ochre (rarer)
- *Blue*: Prussian blue or cobalt blue
- *Green*: Verdigris (copper green), chromium oxide, blend of the yellow and blue media used in other parts of the map, or terra verte (green earth) (rarer)
- *Orange*: Rarer color, but if present, it is usually on later maps and either chrome orange or blend of the yellow and red media.

Given the composition of most of the colors, solubility in water or ethanol is a major concern. Another concern is the potential for a color shift in the case of the blended greens and oranges, where a fugitive yellow is used with a more stable red or blue—or vice versa. It is for this reason that the spot testing detailed in the preparation section is important but may also provide a false positive for stability.

Coatings

There is much debate over the nature of the coating on the surfaces of maps and how exactly it was applied, as well as what recipes were used (Brückner 2024). Maps are an oddity in the paper conservation field, as they are one of the few objects where an overall coating is consistently applied on top of the media as an intrinsic part of the object. We loosely use the term "varnish" for this final surface as a catch-all term; however, the surface coating may not necessarily be a true varnish in the traditional sense. Indeed, its use over the terms "glazing" or "coating," which may be more accurate in cases where we have no firm knowledge of the applied solution, comes from the historic use by mapmakers themselves, who often referred to them as "varnished maps" and the workers who applied the coating as "varnishers." As such, while we can turn to our painting conservation colleagues' far deeper breadth of knowledge on the subject, we should be wary to label the final layer as a "varnish" in our documentation process without the added historical context.

The applied coating is a bit odd, as it does not appear to fully penetrate the paper matrix on maps, although it does imbue the structure with a level of embrittlement that would not otherwise be observed. This lack of penetration may be attributed to one or several factors. First, there may be an intermediary isolation layer that was applied to the surface. Brückner notes that there are records of a layer of gum arabic being applied as part of the coloring and varnishing process (Brückner, pers. comm.).

Second, the hard sizing in the paper may itself serve as a protective coating and limit the overall level of penetration by the glossy finishing solution. Third, there may be something within the protective coating itself that does not interact well with the cellulose fibers and forces it to sit upon the surface.

Removal of historic coatings is usually straightforward. Regardless of the composition of the coating layer, be it shellac, varnish, or some other resinous material, it is often soluble in either ethanol or warm water. As noted by Edmondson (2024), some coatings may benefit from a slight pH bump in the water to facilitate the breakdown of the coating layer. Otherwise, removal via ethanol can be done locally or by immersion or spray, depending on the equipment and safety measures of the conservation laboratory. Greener methods would lean toward the limited use of solvents, but this is not always cost-effective for the conservation laboratory when weighed against the necessary associated labor. In cases such as these, proper chemical disposal and refinement is recommended. Further details on the coatings on wall map coatings and revarnishing can be found in the secondary article by this author and Natalia Paskova in this postprints volume.

Hanging Hardware

The last component of wall maps is most often the first to be removed to facilitate the impending treatment. The hardware applied to wall maps usually consists of a decorative piece of wood molding at the top and a circular roller rod with finials at the bottom. These were usually painted black, although

Fig. 2. Mechanical removal of handling rods and ribbons.

some may be colored with a wood stain instead. While decorative, historically the round rod also helped with the rolling of the map for transport and storage. The upper molding often had textile loops or a long cord that helped with the hanging of the map on the wall. Many times, these wooden components have warped or been damaged, requiring that they be replaced with newer, sympathetic materials. Alternatively, it is possible that the stakeholders involved do not wish to display the map for an extended period. In this case, the long-term storage of the item will be inhibited by the reattachment of these components, and so it is not always recommended that they be rejoined. In these cases, care should be taken to keep these pieces together in a manner that creates a housing that works for the object and storage space.

PREPARATION OF A WALL MAP FOR TREATMENT

A day or two before the "one-day" treatment is conducted, there is some minor work that needs to happen to prepare the wall map. After the before-treatment photos are taken, removal of secondary components such as hanging rods, iron tacks, or edge ribbons is done by mechanical means prior to aqueous treatment (fig. 2). The removal of these components at the start allows for easier handling of the object through the rest of treatment. Some conservators may prefer spot testing prior to this phase, depending on the level of deterioration affecting the map.

If you are limited in your available space, often it is easier to roll the piece onto a larger-diameter tube for support during the initial surface cleaning process. Surface cleaning on the recto is primarily done with vulcanized rubber sponges rather than block erasers, crumbs, or by vacuuming. The sponges are easy to cut into malleable sizes and shapes, making them versatile in their ability to clean the surface and remove larger debris without adversely affecting the often-fragmentary wall maps or leaving behind any debris that would interfere with the washing and lining procedures. Even though further surface cleaning can be conducted with smaller pore latex-free sponges in areas of significant surface dirt, extensive surface cleaning is not recommended, as much of it may be removed during the solvent baths to address the coating. If there is heavy dirt on the verso of the object and the textile lining is stable, debris may be removed using a screen and HEPA vacuum before using the sponges.

Local spot testing for solubility of the coating and media is then conducted. As the surface coating hides the true color and can bolster the stability of the media, discreet local removal with swabs is recommended. In some cases, the fragmentation of the map allows for more accurate testing of both components, as the conservator can fully immerse the small pieces/fragments in both ethanol and water, mimicking the overall treatment. Aside from further helping to guide the treatment choices around water temperature, bath duration, and/or pH adjustment, microtreatment of the fragments can help establish the acceptable loss parameters around color shift in the media and paper prior to beginning the treatment. In cases of large losses, it can also help with the paper toning preparation that is applied to the intermediary Kozo lining layer for a uniform color field.

Spot testing is indicative of the potential solubility of the various components; however, it is important to be prepared for a worst-case scenario prior to full immersion. In hand-colored oversized objects, the potential variations in color mixing over multiple areas may provide false positives more readily than on smaller pieces, especially given that even though the paper substrates are similar, they are not identical. As it is impossible to safely test the media to the extensive degree necessary without beginning treatment, if there is some concern around the results, a risk-benefit assessment should be discussed with other stakeholders, and other

treatments proposed in this volume may prove to be a better alternative for the object.

However, if the treatment is determined to be the best pathway after the testing phases, the map will move into a solvent bath for the removal of its coating. As noted previously, in this author's experience, the wall map coatings are nearly always soluble in ethanol to some degree. For the sake of efficiency and uniformity, as well as the large fume hoods available to NEDCC conservators, the maps are placed in a shallow ethanol bath for this stage. Occasionally, light agitation of the map to improve solvent dispersion and absorption is conducted by rolling and unrolling the piece around a polyester support. If the map is not too fragmented, the coating is brushed off with a solvent-safe soft brush to further facilitate coating removal. The agitation and removal process are repeated as necessary until the coating is deemed to be adequately removed. For most average-sized wall maps (less than 70 × 70 in.), this only requires a single shallow solvent bath but can still use up to 30 L (8 gal.) of ethanol. The solvent bath is then drained and packaged for hazardous waste pickup, while the map is laid flat within the fume hood area for safe evaporation, filtration, and venting of the solvents overnight. Assessment of whether additional surface cleaning is needed can be done after all solvent has evaporated.

The last preparation work that needs to be done is to cut the lining materials. A fine- or medium-weight linen is cut approximately 10 inches larger than the size of the board that the map will be drop-lined onto. Sections of a machine-made rolled kozo are cut to fit the backing board. The width of the pieces and where the join should be is determined by comparing the location of the original map seams and considering whether to line the piece with or against the grain. In either case, the seams of the new lining should not align with the old seams exactly but rather should be offset in some way. The historic joins tend to be where there are large areas of loss and continual breaks and often benefit from having a solid intermediary layer behind them. Nonwoven polyester supports are also prepared, along with wet-strength tissue, to help with handling.

A "ONE-DAY" CONSERVATION TREATMENT

On the day of treatment, prior to any immersion work on the map, the lining linen needs to be soaked in a dilute ammonium hydroxide solution (1:16 30% NH_4OH:H_2O v/v) to break any sizing and to soften the fabric. After soaking with light agitation, the textile is rinsed using a washing machine. An acrylic sheet is placed on a low table rough side up and lightly cleaned with water to remove any old adhesive residues from prior use. The map is placed between the nonwoven supports (Hollytex or Reemay) with wet strength tissue as needed on the face (fig. 3) to reduce the movement of loose segments or fragments of the map during washing. As the sink is filled

Fig. 3. Diagram of the washing sandwich supports.

with water, the map is first misted out with Dahlia sprayers and followed by further wetting using a Japanese water brush (*Mizubaki*) and filtered water until it is fully saturated.

The water level should be sufficient to immerse the map but shallow enough to prevent fragments from being dislodged. After placing a semirigid support in the sink—NEDCC has a custom oversized rigid screen for this purpose—the map is brought over and positioned on the screen for immersion in the water. At the beginning, discoloration tends to rapidly come out of the piece, resulting in the need to draw several baths in quick succession. The map is removed from the sink using the support, and the water is cleared away with a squeegee. The washing continues for most of the day until the water runs clear (fig. 4). On average, the process takes three to six baths that cumulatively total 3 to 4 hours of washing.

While the map washes, the lining is prepared. The damp linen is brushed and aligned onto the Plexi board and inspected for knots or flaws. If possible, these are either burnished or hammered down, in the case of knots in the fabric, to reduce their potential to transfer through to the map proper. If this does not adequately reduce the flaws, they may be lightly shaved down with a blade. If going this route, care must be taken to ensure that a hole is not cut into the textile. Once the textile is completely flat, the excess margins are trimmed off so that they are flush with the edges of the board. Wheat starch lining paste is then brushed out on the linen to allow for attachment of the kozo paper.

The kozo paper is applied rough side up to the surface in sections by a two-person team using a broad-bristle brush

Fig. 4. Wall map slightly raised during water exchange for a new bath.

or Japanese smoothing brush (*Nazebake*). The overlap of the seam should be between a quarter-inch and a half-inch wide, and the natural deckle of the rolled paper can be used as a guide for the join. It should be noted that if toned kozo paper is being used to facilitate even color fields in large areas of loss, it may be slightly more inclined to wrinkle while it is being brushed out due to the added properties from the acrylic media. Any creases or wrinkles should be initially worked out with the *Nazebake*, but if the efforts are ingraining them more, immediately moving on to the addition of the next lining paper is advised. The entire lining of Japanese paper should be pasted with the wheat starch lining paste, and at this point, all wrinkles in the lining paper can be smoothed out. The lining can be checked for areas of dryness by looking at the surface in raking light. A layer of 1% to 2% methylcellulose can then be applied to the surface of the lining. The methylcellulose serves two primary purposes during the map lining. The first and more vital role is that it allows for slip and manipulation of the map once it has been drop-lined. The second is that it slows the drying rate of the wheat starch paste and makes it easier to rehydrate the adhesive without wetting out the lining excessively.

The map is then removed from its final bath onto the rigid support, and the sink is drained and thoroughly dried. The map is lifted vertically to further drain the water from the surface and limit pooling of water. At this point in treatment, the full five-person team should be prepared to invert the map and return it to the sink face down. One member of the team serves as the observer to note any issues and offers corrections as needed. Two conservators (Team A) lift the map and its nonwoven polyester support materials straight up while maintaining surface tension to prevent distortions and creasing. At about the second to third point, the semirigid support board is removed from the area of work entirely by the other two team members (Team B). The map is held vertically for a moment or two if deemed safe to allow for water to drain off further. Team B then assists with transport into the sink by lifting at the lower corners in such a way that the map is now face down.

The verso nonwoven polyester is then removed. The cloth lining is removed in sections by the conservators by lifting and tearing away portions of the textile along the natural weave, taking care not to catch or fold any of the map fragments into the bundle. Any areas of backing cloth that have text, notations, or stamps are removed first and set aside to air-dry (fig. 5). The lead conservator will monitor the dampness of the lining and prepare the necessary tools (sponges, tweezers, and spatulas) for the adhesive removal stage while Teams A and B continue to remove the backing. The old adhesive, if not already fully dissolved in the bath, is gently removed with lightly dampened sponges and warm water (fig. 6). If there are sections of misalignment or places where the fragments have become extensively overlapped, the area can be lightly flooded with water from the sponge to allow for more extensive manipulation. However, the goal at this point is not to correct all misalignments, only those that will not be easily corrected once it has been drop-lined.

Fig. 5. Mechanical removal of the original lining canvas.

Once the secondary materials are fully removed, the map is then drop-lined. It is important that all members of the team are prepared to make the drop. A walk-through of the travel path as well as who will be setting the edge and who will bear the weight of the map is important to determine prior to lifting and moving the map out of the sink. One person on the team should be designated as the leader from whom all directions are delivered. This can be someone who will be handling the map or the individual who has been the observational conservator. The map should be lifted continuously upward out of the sink by Team A in the same way that it was lifted off the screen while Team B prepares to lift the opposite edge once it reaches the maximum handleable height by staff. The map is then lifted fully out of the sink under tension, and Team B lets go of their side to allow the map to hang vertically while it

Fig. 6. Adhesive removal with sponges and light pressure.

Fig. 7. Drop-lining the map as a team.

Fig. 8. Correcting small areas of the map while it is wet.

is walked over to where the lining is set up. Team B will then pick up the corners from the recto side of the map, and both teams will work to suspend the map in place over the lining and confirm that there is an equal margin on all four sides of the piece. Team B will then set down their end of the map and brush out the piece quickly while Team A controls the drape and tension. This entire process must happen quite quickly, as there is a risk of losing surface tension between the map and the Hollytex/Reemay/wet-strength tissue supports as gravity starts to take over (fig. 7).

Once down, the upper layer of the nonwoven polyester support is removed, and light manipulation and alignment of the map are done through the wet strength as needed. Keeping the wet-strength tissue in place will allow one to adjust large sections of the map without tearing it. To set areas, lightly rolling over the surface of the wet strength with paper towels or a rolled absorbent cloth can wick the water away and limit further movement. After alignment of the map, the wet strength is removed, and any fragments collected during the washing stage can be placed in their correct locations. Even though it is not important to place all fragments now, an effort should be made to secure any large pieces with text and printed media (fig. 8). When staff feel that they have completed the placement as best as they can, a fresh, clean nonwoven polyester support is brushed out on the surface with a broad-bristle or reed brush to set and fully adhere the map to the surface. If the paper is especially thick or there is concern about the fragments lifting, it can also be lightly pressed down with a rubber roller like those used in printmaking to apply ink to a plate.

As a last step, the edges of the lining are lifted up from the board and an application of polyvinyl acetate or a 1:1 mixture of 4% methylcellulose and polyvinyl acetate is applied in a narrow band along the margins, avoiding any application under the lined map. This helps to ensure that the lining does not lift away from the acrylic support while drying and helps to tension the stretch dry of the map more evenly. The map is then left to dry flat overnight, although full drying may take as long as 24 to 48 hours, depending on the ventilation, humidity, and temperature within the laboratory space. If it is still excessively damp the following morning, cross ventilation with box fans can be utilized to ensure full dryness.

Over the following days, conservators should be able to work either flat or vertically to place remaining fragments, improve the tone of the lining paper in exposed areas of loss, and insert additional fills and/or any other aesthetic work that may be deemed necessary to create full visual cohesion within the piece.

REHOUSING AND DISPLAY

Although the object may not be fully complete at this time, it is recommended that the formal color-balanced after-treatment photos or high-resolution digital captures be taken while the piece is still mounted to the board, as the object is much easier to transport and manipulate. The addition of a new surface coating that mimics the original finish of the map should also be done at this time, as the tensioned mount prevents warping of the map while the isolation layers and surface coatings are applied (note 2).

Once the object has been imaged and/or a surface coating has been applied, it can be removed from the board for the final stages. The extent to which the map lining is trimmed for rehousing and display varies depending on the final form the map will take and whether or not new edge ribbons will be applied. In general, the map is either trimmed to the edge of the paper if the original format with hanging hardware will be maintained or with a border of an eighth-inch to a half-inch in width if the map will be rolled onto an archival tube or framed. The most common rehousing method for whole maps is rolling onto a 6- to 12-inch-diameter archival tube,

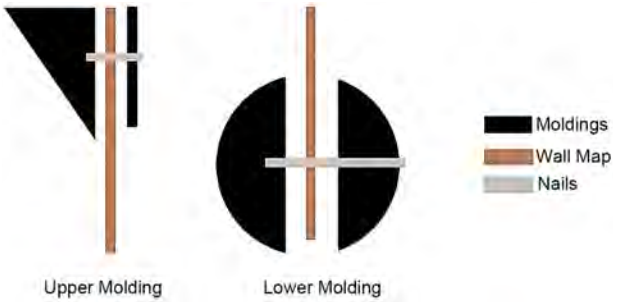

Fig. 9. Diagram of hanging rod attachment for display on a wall.

secured using polyester and twill ties. Doing so, however, means that reattaching the hanging rods and hardware is not done, as there is a risk that the rods will damage the map and/or complicate handling by staff.

In cases where the display of the map as it originally appeared is desired by library and archives staff, reattachment of the hanging rods can be done with the original tacks, assuming they have not become corroded and are reusable, or with new nails and brads. In many cases, the upper molding and lower rods are quite warped or damaged, so replacement with new pieces is recommended. By replacing the upper molding and using two half-rounds for the roller, the chance to limit further stress on the piece can also be avoided by sandwiching the map between two wood pieces (fig. 9). The original finials will be reused if present. Doing so can facilitate the attachment of a Z-bar or French cleat reducing the stress on the wood rod to create an even distribution of weight across the upper edge of the map.

The attachment of hanging rods provides a more authentic reading of the map; however, it also can lead to the potential for more damage while the map is displayed, as there is limited protection for the piece. Historically, NEDCC (and others) have tried to minimize this risk by encapsulating the maps prior to attaching the hanging rods if no other housing is provided and long-term display is desired by the institution; yet, this is not a perfect solution either, as it leads to a visual disruption over the map nearly negating the authentic read of the map. There are also complications and limitations around the welding capabilities of either an ultrasonic or a heat-welded encapsulation and conservation-grade polyester when it comes to dealing with materials of this size. As such, the center has been limiting the amount of map encapsulation that is done and leaning into advising display, in historic exhibition environments, either behind barriers or out of easy reach for patrons, as suits the budgets and spaces of its various clients in combination with protective coatings in the form of varnishes or natural resins.

CONCLUSIONS

Even though modifications to the treatment are possible, alternative methodologies proposed in this volume should also be contemplated by conservation staff prior to the start of treatment. Considerations around any annotations and media should be explored prior to the start of the treatment, as although not impossible, interrupting the process mid-way can be difficult given the size of the piece and the speed with which the corrections would need to be done. Additionally, ensuring that proper storage and display options have been considered by the various stakeholders of the map should be explored to determine if this method is right for any collections material that comes into the laboratory.

Overall, the "one-day" treatment is a viable, economical method for the stabilization of wall maps, provided that the conservation laboratory has the appropriate amount of space and staff to handle the map in one piece. The primary benefit of this treatment is that as the map is kept intact and treated as a single object throughout the washing process, the risk of misalignments from irregular paper expansion and shrinkage action is lowered. Additionally, the process provides ample time for portions of the map to be carefully manipulated by staff once drop-lined to correct any shifting that may have occurred due to movement of the piece. The end result of this treatment means that the map remains whole and closer to its original form than those that are cut into smaller sections for easier storage.

ACKNOWLEDGMENTS

I would like to acknowledge the work of many NEDCC conservators and technicians who have treated maps throughout the 50-plus-year history of the center. Without their skills and expertise, this method would not be as polished, nor as adaptable, as it is today. Special personal thanks are expressed to Suzanne Gramley, Michael Lee, Amanda Maloney, and Annajean Hamel, who taught me the foundations of the method back in 2015, as well as being there to assist with many wall map treatments until their departures (and returns!).

NOTES

1. Other papers in this postprints volume cover the breakdown of the components of a wall map in more detail. The information listed here is merely an overview if this work is read in isolation.
2. More information on the methodology and choices for the recreation of surface coatings can be found in "An Investigation into Alternative Recreations for Surface Coatings on 19th-Century Wall Maps after Conservation Treatment" by Kathryn Boodle and Natalia Paskova within this volume.

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FURTHER READING

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SOURCES OF MATERIALS

Clear acrylic sheet (SKU: ACRYCLR0.250PM72X96, 0.250 × 72 × 96 in.)
ePlastics
https://www.eplastics.com

Hollytex–3257 (SKU: TNW006021, 47 in. × 25 yd.), Kuroge Tsukemawashi Japanese mounting brush (SKU: TTB092005), Mizubake Japanese mounting brush (SKU: TTB092003), Methyl cellulose (Culminal MC 2000 S Methylcellulose; SKU: Methyl-cellulose), Reemay—2014 (SKU: TNW008007; 72 in. × 100 yd.), Wheat starch (previously Aytex-P; SKU: TAD003005, 5 lb.)
TALAS
https://www.talasonline.com

Flat smoothing bristle brush—12 inch, Zinnser (Model #98012)
Home Depot
https://www.homedepot.com

Lightweight natural linen fabric (Y1140NT120, 120 inches wide [no longer available]), Alternative: Medium weight natural linen fabric (Y1357NT120, 120 inches wide)
Ulster Linen
https://ulsterlinen.com

Rolled kozo machine made—RK29 (34 gm^2, Paper Nao [unable to ship to the United States], Alternative: R-101 Sekishu extra thick roll (30 gm^2, 38 in. × 60 m)
Hiromi Paper
https://hiromipaper.com

Takach jumbo Brayer 35 durometer rubber (#B4912, 12 × 3½ in.)
McClain's Printmaking Supplies
https://www.imcclains.com

Wet strength tissue—Tarantula tissue (PASWTT0100, 100 × 960 m)
Conservation by Design
https://www.cxdinternational.com

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KATHRYN BOODLE AND NATALIA PASKOVA

An Investigation into Alternative Recreations for Surface Coatings on 19th-Century Wall Maps after Conservation Treatment

INTRODUCTION

In the field of paper conservation, the Northeast Document Conservation Center (NEDCC) is known for the conservation of oversized items with a special focus on wall maps. Throughout NEDCC's 50-year history, a standardized but flexible treatment for wall maps has been designed and modified by the various paper conservators who have worked at the regional center (note 1). Despite the perceived complexity and occasional invasiveness of the conservation process of treating period wall maps, proper execution in treatment can help revitalize and breathe new life into these historically rich but often fragile artifacts. However, an area of the treatment that has been lacking, not only at NEDCC but in the field of wall map conservation overall, is the recreation or reapplication of a surface coating on wall maps after conservation treatment. Between 1980 and 2000, NEDCC, like other conservation laboratories, regularly encapsulated wall maps in clear polyester film to protect the map from accumulations of grime and direct contact. The polyester also served to add supplemental support when hung using wooden rods, resulting in relieving stress on the object.

Despite the protection offered, the encapsulation does not provide a suitable aesthetic for those maps that are to be placed in situ in a historic house, museum, or historical society, given the reflective nature of the film. Furthermore, there are limitations in the ability of conservators to adequately weld the polyester, either ultrasonically or via heat, given the sheer size of the maps that must be considered. Likewise, there are limitations on size when it comes to the conservation-grade polyester available. In many cases, the result of encapsulation sometimes left irregular overlapping seams in the polyester or uneven welds, given the length of the arm on the ultrasonic devices. Another issue with the encapsulation is that once sealed, the wall map must remain flat either vertically or horizontally to avoid stressing the welds. This limits the overall storage options for the individuals who oversee the care of the item, resulting in the wall maps being on display for an extended period keeping them exposed to light without suitable protection.

Given these imperfect protective solutions, NEDCC undertook an investigation into the potential for recreating the surface coatings on wall maps using both historic and modern materials. The conservation community often discourages the introduction of a varnish-like coating to the surface of the paper (Holden 1984; Fleygnac, Martin, and Rouchon 2014); however, the distinctive characteristics of wall maps prompt reevaluation of this practice. The following research is not a definitive or an exhaustive analysis of the materials available to conservators. Rather, it is merely an initial foray into the exploration of the reapplication of surface coatings to answer preservation questions of how to protect a map's surface without encapsulation or exposing the artifact to additional risk. It is hoped that the information presented in this article expresses the complexities that come with navigating the selection of materials available while providing conservators, regardless of their working environment, a reliable approach that intersects heritage science, practicality, and safety.

COATINGS ON WALL MAPS

Before embarking on the methodology for selection criteria of new surface coating materials, consideration had to be given to the use of surface coatings on wall maps in general. Maps are interesting objects as they sit at an intersection of practical information and fine art. In the same way that one might read religious iconography, in maps—aside from the obvious indications of the physical locations of places—one can read the color coding, pattern details, and illustrations to understand the movement of people and goods throughout the history of humanity. During the 19th and 20th centuries, as the mass production of information became cheaper to produce and more readily available, so did maps. The exploration of the

Proceedings from the AIC-sponsored event, "Varnished Wall Maps: A Collaborative Seminar to Investigate Treatment Methodology," September 14–16, 2022.

Americas, as well as other parts of the world, also contributed to the increase in both the interest in and need for accurate maps. Wall maps became items of conversation within homes, necessary in encampments during war, and complemented the understanding of trade routes throughout the country by those who lived in various towns and cities (Brückner 2017).

There is much debate over the nature of the coating on the surfaces of maps and how exactly it was applied, as well as what recipes were used (Brückner 2024a). Maps are an oddity in the paper conservation field as they are one of the few objects where an overall coating is consistently applied on top of the media as an intrinsic part of the object. We loosely use the term "varnish" for this final surface as a catch-all term; however, the surface coating may not necessarily be a true varnish in the traditional sense. Indeed, its use over the terms "glazing" or "coating," which may be more accurate in cases where we have no firm knowledge of the applied solution, comes from the historic use by mapmakers themselves, who often referred to them as "varnished maps" and the workers who applied the coating as "varnishers." As such, while we can turn to our painting conservation colleagues' far deeper breadth of knowledge on the subject, we should be wary to label the final layer as a "varnish" in our documentation process without the added historical context.

Given the protective quality of varnish on paintings, it makes sense that the individuals involved in the map trade felt that varnish would imbue similar protection to their paper maps. As conservators well know now, though, the introduction of any surface coating to paper does not necessarily grant the same protection that it does to painted surfaces. It is generally assumed by the conservation community that most wall maps were historically coated in natural resins. These often discolor and can become embrittled as they age over time, often imparting this brittleness in the cellulose matrix of the paper. Mapmakers must have realized this as well, as there are references that an introduction of a layer of gum arabic in between the paper and the "varnish" was soon introduced as an isolation layer, potentially to counteract this (Brückner 2024a, 2024b). Gum arabic was well known among watercolorists as a protective layer to prevent lightening of pigments, creating a local richer hue, and as a material that assisted with the dispersion and diffusion of water to allow more working time and even tone. As such, its addition, although perhaps not present on all wall maps, is not out of place, and it was likely used either alone or in combination with other natural resins and gums.

RE-"VARNISHING" OF WALL MAPS

Although NEDCC lacks the capacity to quantitatively analyze the surface coating of maps by either FTIR or GCMS, it can qualitatively note that most of the coatings are soluble in polar solvents, most commonly either ethanol or ethanol and water combinations. Given the period of the maps, it is likely that the coating is made from "soft resins" like mastic or damar given their prevalence and use in paintings during the same period (Petukhova 1992; Mayer 1995; Epley 1996). However, it is suspected that shellac was also used on some items, although its presence is more easily identified as it fluoresces orange in UV light (Holden 1984; Measday 2017). Regardless of the composition, the removal of these coatings is necessary to facilitate most treatment for the stabilization of wall maps, in the same way that its removal is often necessary in paintings conservation. Removal of the varnish layer results in the loss of a historical part of the object, and thus this action should be appraised carefully. Conservators should consider the level of damage to the map, how treatment will affect the surface finish, the presence of secondary information on the surface, and whether any other issues would arise should the coating be kept intact when determining the overall treatment to be done (Petukhova 1992; Treacey 2017). Understanding the coatings and the way they were removed served as the first step in determining the aspects needed to recreate the surface coating (Samet 1995, 1997b).

Conservators at NEDCC set out to find a material that would mimic the original surface coating and help to protect the map below from moisture, dust or other airborne pollutants, and abrasion as originally intended by the mapmakers. However, it was hoped that by cross-examining those solutions favored by paintings conservators, the final ideal coating would also improve the protection of the map by

- offering resistance against UV light;
- being easy to apply and safe for the conservator regardless of their space or budget;
- being easily reversible in solvents or water; and
- aging well, with a focus on being able to maintain its color properties, surface sheen, flexibility, and durability overall.

A list of recommended coatings was compiled from those that were acceptable for use by paintings and objects conservators. It was then narrowed down to 10 likely candidates based on the preceding criteria, with consideration given to the historically available materials, the porous nature of paper, and the knowledge that an isolation layer would be applied as part of testing (table 1). This list was divided into three broad categories for comparison:

- *Water based*: Maimeri Matte and Maimeri Brillante;
- *Solvent based*: Paraloid B-72, BEVA Matte Varnish, BEVA UVS Finishing Varnish, Gamblin Gamvar Gloss, Golden Archival Varnish (Gloss), and Golden Archival Varnish (Satin); and
- *Natural resins*: Crystalac and Lemon Shellac.

Prior to testing on a sample map, small applications of each were applied to an 8-ply 100% rag card to determine how

Coating	Classification	Color	Preparation requirement	Application method
Crystalac #500	Natural resin, flakes	No color/clear	Dilution in ethanol	Brush or airbrush
#1 Lemon Shellac	Natural resin, flakes	Yellow	Dilution in ethanol	Brush or airbrush
Maimeri Matte	Water-soluble synthetic varnish	No color/clear	N/A	Brush or airbrush
Maimeri Brilliante	Water-soluble synthetic varnish	No color/clear	N/A	Brush or airbrush
Gamblin Gamvar	Hydrogenated hydrocarbon resin	No color/clear	N/A	Brush or airbrush
BEVA UVS Matte	Hydrogenated hydrocarbon resin	No color/clear	N/A	Brush or airbrush
BEVA UVS Gloss	Hydrogenated hydrocarbon resin	No color/clear	N/A	Brush or airbrush
Paraloid B-72	Acrylic resin, pellets	No color/clear	Dilution in acetone, ethanol, toluene, or xylenes	Brush or airbrush
Golden Archival Varnish (Matte)	Acrylic resin	No color/clear	N/A	Spray
Golden Archival Varnish (Satin)	Acrylic resin	No color/clear	N/A	Spray

Table 1. Surface Coating Property Table

easily each might be able to be applied to the surface of an object and what the overall working time was. No isolation layer was applied to the card so that the conservators could get a feel for each solution and note how it was absorbed by a hard-surfaced material. In the case of the water and solvent-based materials, except for Paraloid B-72, the solution was used directly from the containers with no further dilution to ensure clear results in the initial testing phase on the rag cards. When applied to the sample map, the solutions were diluted, as noted on the instructions for each material. Two solutions of Paraloid B-72 were mixed to a 10% w/v concentration in both acetone and ethanol to compare evaporation and absorption rates. Both Crystalac #500 and the Lemon Shellac were mixed in concentrations of 5%, 10%, 15%, and 20% w/v in ethanol, as they were believed to be the closest type of natural resin that may have been used for the historic coating. In the end, the 10 finalists expanded into 17 possible solutions, given these variations.

As can be seen in figure 1, the coatings reacted in the ways that one would expect when placed under UV light (Measday 2017). The standout material in this phase was the Golden Archival varnishes, as both fully absorbed the UV light in both long and short wavelengths, creating even black-brown rectangles on the surface of the card. All coatings were relatively easy to apply, although the evenness and working time was an issue on the Maimeri Picture varnishes. In contrast, the BEVA UVS was the most forgiving, allowing time for smoothing of the surface with the brush.

Moving forward, the next phase of testing was conducted to try and reduce the number of potential coating materials and home in on the ones that met the most desired criteria. A portion of a sample wall map from NEDCC's study

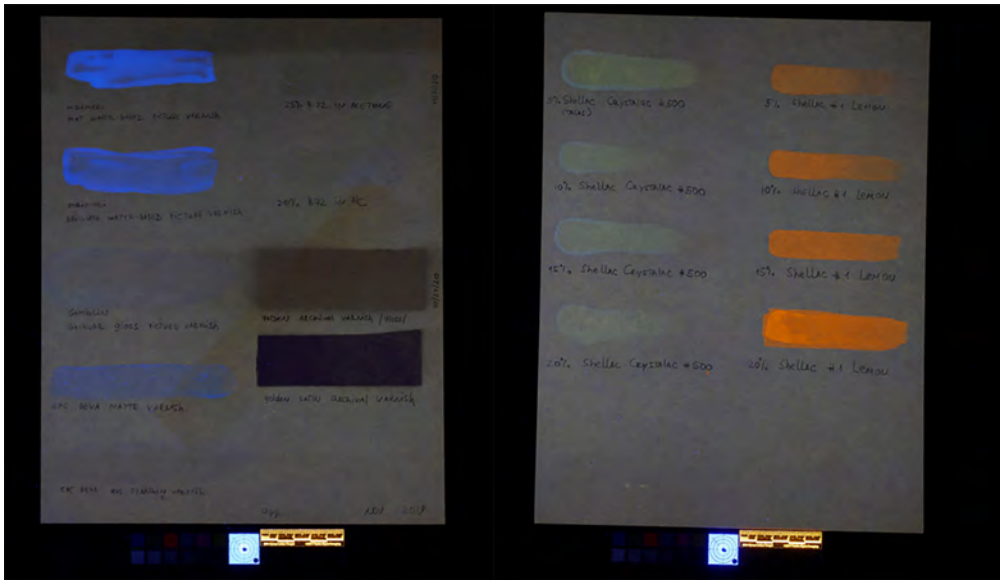

Fig. 1. Test sample cards in long wave UV light.

Fig. 2. Wall map test sample with all coating options. From left to right, samples are over 3% methylcellulose, 2% methylcellulose, 4% methylcellulose, 5% methylcellulose, and the control section (no isolation layer).

collection was taken through the center's "one-day" stabilization method, except for including a linen backing, as it was known that most conservators did not reapply a textile along with the Japanese tissue paper lining. The map was divided into five vertical sections with thin strips of Japanese tissue paper to act as a barrier in preparation for the isolation layers. One section was left as a control, meaning that it had no isolation layer, whereas the other four sections had 2%, 3%, 4%, and 5% methylcellulose in water applied. Methylcellulose was chosen over gum arabic because it has compatible properties with the cellulose of paper, is more easily purchased in bulk, and is a common choice when it comes to serving as an isolation layer for watercolors in paper conservation. The 2%, 3%, and 4% sections had two layers of methylcellulose applied, with time to allow the first to fully dry overnight before the second coat was applied; however, the 5% methylcellulose was found to be too thick to easily manipulate and thus only had one layer. Once fully dry, the map was divided horizontally into 18 sections, each measuring approximately 5¾ × 1 in., and the coatings were applied (fig. 2).

Overall results from testing the sample map showed that the concentration of the methylcellulose did not matter, and no penetration from the applied coating was seen outside of the control area. The concentration also did not affect the specular reflectance of the coating in any notable manner on such a small scale. In the areas where no isolation layer was applied, any areas where there was cracked or weakened paper experienced some penetration through to the lining material. The Lemon Shellac, Gamvar, and BEVA Matte showed the most penetration through to the lining material in these areas. Furthermore, the Lemon Shellac, both Maimeri varnishes, and 10% B-72 in acetone faced immediate elimination from further testing due to issues that resulted in uneven application, color change, and irregularity in the final surface texture. The other coating solutions had enough positives when it came to ease of application and final surface finish

Coating	Control	Over the isolation layer	Notes
5% Crystalac #500	3	4	Final sheen is comparable to the overall map finish; longer working time would be helpful
10% Crystalac #500	2	3	Final sheen is comparable to the overall map finish; longer working time would be helpful (decreases as concentration increases)
15% Crystalac #500	2	3	Final sheen is comparable to the overall map finish; longer working time would be helpful (decreases as concentration increases)
20% Crystalac #500	1	1	Too thick to easily manipulate into a thin layer
5% #1 Lemon Shellac	0	1	Color and finish unacceptable overall
10% #1 Lemon Shellac	0	1	Color and finish unacceptable overall
15% #1 Lemon Shellac	0	0	Too orange and too difficult to manipulate at this concentration
20% #1 Lemon Shellac	0	0	Too orange and too difficult to manipulate at this concentration
Maimeri Matte	0	1	Dries too white/hazy over paper and difficult to manipulate
Maimeri Brilliante	0	1	Dries too white/hazy over paper and difficult to manipulate
10% Paraloid B-72 in ethanol	3	3	Application method/drying time and finish could be viewed as a positive or a negative; solid middle of the road contender
10% Paraloid B-72 in acetone	0	1	Evaporation rate too rapid; no working time and uneven finish
BEVA UVS Matte	0	3	Bleed-through and flat surface eliminate the solution from further testing
BEVA UVS Gloss (Finishing Varnish)	3	3	Did not bleed through like BEVA Matte; high sheen shows promise as a glossier coating material
Gamblin Gamvar	0	4	Bleed-through on control leads to slightly lower favorability, but the final application over the isolation layer indicates that further testing should be pursued
Golden Archival Varnish (Matte)	4	4	Lower ranking than the satin only due to the flatness of the matte finish
Golden Archival Varnish (Satin)	5	5	Top choice in all categories

Results are ranked from 1 to 5, with 1 meaning low favorability and 5 meaning high favorability, based on the combination of ease of application, final surface appearance, and color. A 0 denotes failure in all categories or a negative aspect that negates all positive aspects.

Table 2. Surface Coating Preliminary Results

(both visually and as perceived durability) that they were moved forward to the next stage of testing. More summary notes on the results of each coating are presented in table 2.

Based on the overall results of the coatings, six finalists were chosen to determine how well they handled environmental stressors. These were Crystalac at concentrations of 5% and 15%, Gamblin Gamvar Gloss, 10% w/v B-72 in ethanol, BEVA UVS, and Golden Archival Varnish (Satin). The six coating solutions were applied on a second sample map that had been prepared in the same way as the first one and divided into 18 sections that each measured approximately 2 × 8 in. Testing was conducted to determine how well they performed when applied over a larger area than the 5¾ × 1 in. rectangles and how that might contribute to choices by conservators within the space or protective limitations of their laboratories. More summary notes on the results of each of the finalist coatings are presented in table 3.

All materials were found to be easy to apply with a varnishing brush, although there were nuances in the final surface finish and number of layers that might be needed for each coating. The exception to brush application was the Golden Archival Varnish (Satin), as it comes in an aerosolized can. Of the six finalists, it has the lowest margin of customization by the conservator, and any surface change is controlled by the spray distance, speed, and number of layers. Of the materials tested, it also had the longest drying time overall. Crystalac was found to be easier to apply at 5% than 15% over a large area, with its application appearing to provide the largest opportunity for specific finishes and control by the conservator. Paraloid B-72 behaved as expected and was a familiar material to the conservators among the other contenders. Aside from the level of comfort with understanding how it interacts with paper over time, its semigloss finish was probably the closest in terms of surface texture to many of the coated wall maps that come into NEDCC, with the Golden Archival Varnish coming as a close second. As noted previously, BEVA UVS's longer working time to ensure an even surface gave it a slight edge over the other candidates when combined with the fact that this also meant that only a single layer was needed to provide adequate coverage. Last,

Fig. 3. Finalist coatings prepared for further testing (left) and being placed in the baking oven (right).

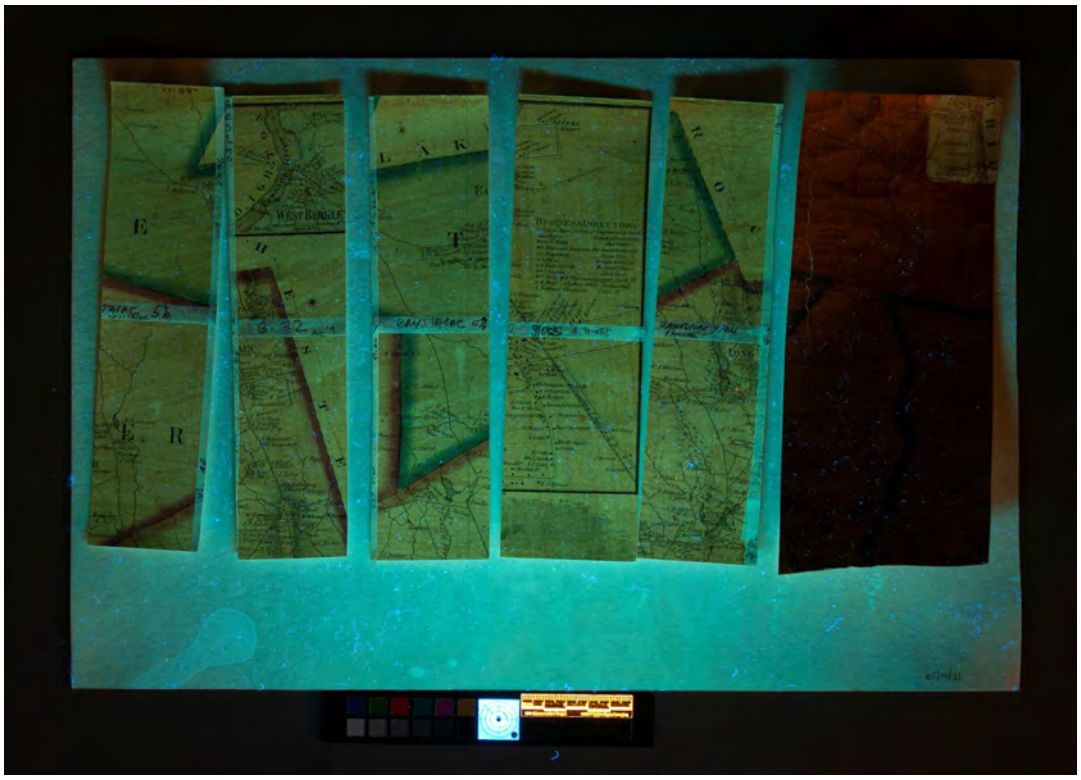

Fig. 4. Finalist samples under long wave UV light after the dust test.

the Gamblin Gambar was highlighted as the favorite overall for its smooth, even dispersion over the surface of the isolation layer. Its favorability was not surprising, as it contains 35% Regalrez, which is preferred in the painting conservation community for its seamless integration over larger areas.

Once dry, the map samples were divided into sections and physically manipulated to simulate the common handling of a usable wall map prior to testing for aging characteristics (note 2). Samples were placed in the oven for 3 hours at a time over 28 workdays at 65°C (fig. 3). The purpose of the testing, although speculative, was to stress the material through a series of rapid temperature fluctuations to impose any color alteration, observe any heat-related tackiness, or observe the formation of surface cracking of the coating to determine the feasibility for conservation applications on paper-based substrates.

Proper accelerated aging and additional testing should be conducted in the future; however, the initial results of all 6 finalist coating materials were promising. None of the samples showed a color shift or major surface disruption, although some brittleness and very minor loss of flexibility were noted on all. Whether this can be attributed to the desiccation of the coating or to the Japanese paper lining is unclear. Additional testing at higher temperatures for longer periods of time would be possible within NEDCC's laboratory, but these have not been pursued due to time limitations by staff and heavy need by the audio department for their oven in the time since the research was initially undertaken.

Six of the 18 sections of the map were prepared to see how well the coatings protected the surface from dust and if the slow drying time of some coatings would result in debris being lodged in the layers. The samples were left out for 6 months in a high-traffic area above a file cabinet so that they were out of the way. They were checked visually periodically to make sure that they had not been disturbed but otherwise remained untouched. After 6 months, they were removed from the space, and although significant dust accumulation was present on the surface of the blotter the sample sections rested on, there was minimal buildup on the sections proper when observed under magnification or when a latex sponge was used to clean the surface. Such results indicated that the surfaces on even the matte finish coatings were likely too smooth for the dust to catch and build up in this time. It is hypothesized that vertical hanging combined with the coatings will likely serve as a solid surface protectant within standard archival environmental parameters.

The final environmental test conducted was the protection of the object from light. As encapsulation offers no additional light protection, framing certainly can, and both offer physical protection from mechanical damage when it comes to displaying maps. Protecting the map from light was not the most critical factor in the overall reapplication of surface coatings; however, conservators felt that if one or more offered such protection, it could tip the balance of preference when it came to treatment choices. Overall, the standout performers for UV protection were the Golden Archival varnishes. In UV photography tests, the areas applied with these solutions showed a complete absorption of the UV light resulting in blacked-out samples. UV Plexiglas was compared with the varnish and showed similar levels of absorption. Some of this was expected based on the initial varnish card tests, but in applying over a wide area to mimic actual treatment, the results were undeniable (fig. 4).

Surface coating	Aging	Dust	UV protection	Permeability	Reversibility	Notes
5% Crystalac #500	4	5	2	1	5	Solubility in water leads to high permeability and reversibility; could be considered more historically accurate
15% Crystalac #500	4	5	2	1	5	Solubility in water leads to high permeability and reversibility; could be considered more historically accurate; higher concentration makes it slightly more difficult to apply to a larger surface quickly
10% Paraloid B-72 in ethanol	4	5	2	2	4	Slightly better protection from moisture than Crystalac; reverses in ethanol but needs a longer dwell time than the Crystalac as well
BEVA UVS Matte	4	4	2	4	3	Longer drying time showed that some dust became embedded in the surface, but not much; reversing took a little bit of manipulation with solvents but was within acceptable parameters
Gamblin Gamvar	4	5	4	4	3	Reversing took a little bit of manipulation with solvents but was within acceptable parameters
Golden Archival Varnish (Satin)	4	5	5	4	3	Has a slight edge over other solutions due to UV protection; reversing took a little bit of manipulation with solvents but was within acceptable parameters

Results were ranked from 1 to 5, with 1 meaning low favorability and 5 meaning high favorability.

Table 3. Surface Coating Finalists

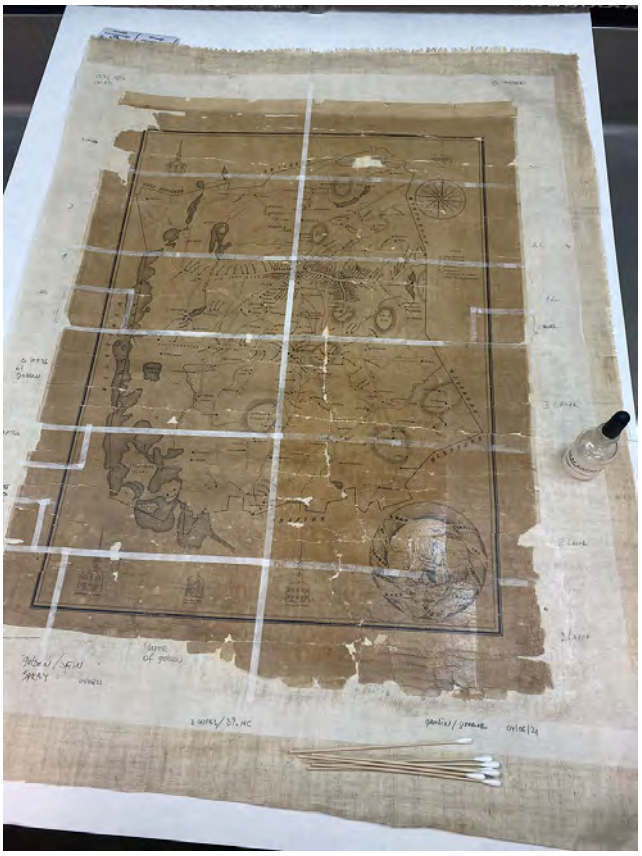

Fig. 5. Map sample testing permeability and reversibility over a larger area. Clockwise from upper left: 10% B-72 in ethanol, 5% Crystalac #500, Gambin Gamvar, and Golden Archival Varnish.

When testing the reversibility and permeability of the coatings, there were no surprising results. Coatings that were created by dissolving concentrates in water or ethanol tended to fail the permeability tests, whereas those that were premade synthetics or dissolved in nonpolar organic solvents tended to be more durable (fig. 5). None of the coatings would likely provide significant protection in an extensive water event such as a flood, but there is significantly more working time available to clear any stray moisture on those that were not easily soluble in polar solvents. The polar-based coatings also tended to blanch more readily in the water—something that makes them highly reversible but could also put water-soluble media at risk.

The most successful nonpolar solvent used for reversing the coating was found to be naphtha, whereas ethanol was found to be the most successful polar solvent for removing the coatings. Both pose health, flammability, and environmental risks for their use that are compounded exponentially by the sheer quantity of solvent that would be needed to remove the coating from a large surface area. Although some laboratories may be better equipped to conduct the removal of coatings with these solvents using fume hoods, half-mask respirators, and other personal protective equipment to mitigate the risks, this consideration should be included as part of the decision-making process by the treating conservators. This is especially true if they are institutional laboratories that will oversee the treatment in the future and know their own internal limitations. Greener chemical alternatives may be able to be safely pursued on the removal of coatings, but more extensive testing was not done as a part of this study in the initial phases.

CASE STUDY OF A 19TH-CENTURY WALL MAP: MAP OF BOSTON IN THE STATE OF MASSACHUSETTS BY J. G. HALES

The treatment of a small wall map was conducted shortly after the preliminary research investigation was completed. The map seemed to be an ideal candidate as a final case study in applying a new coating after treatment, given its intended display, lack of hand-applied media, degree of mechanical damage, and size (fig. 6). The map in question was a smaller wall map, only 40¼ × 29¼ in. (102 × 74 cm), and the client wished to display it in the traditional manner on its hanging rods with no other protective measures. Conservators evaluated and discussed the potential coatings internally before approaching the client with the proposal modification. Some factors that went into choosing the coating solution used were the overall appearance match, ease of application, and evaluation of the environmental protection test results of the six finalist solutions in more detail.

In the end, Golden Archival Varnish (Satin) was chosen for use, but a 5% solution of Klucel G in ethanol was chosen as an isolation layer instead of methylcellulose, given its faster evaporation rate, limiting the risk of additional surface sheen, and the desire to not disrupt the paper and linen lining with an influx of moisture. The Golden varnish was chosen, as its finish on the samples most closely matched that of the original map, and its performance during testing showed that it provided the most protection from a variety of factors. Its ease of application was also thought to be beneficial as a case study for other conservation labs with minimal staff or supplies, as it allowed for the least amount of preparation and object manipulation by the conservator.

The map was taken through aqueous treatment after surface cleaning and removal of the rods, as noted in the "one-day" method article within this volume. After applying the isolation layer, Golden Archival Varnish (Satin) was applied while the map was still stretched on an acrylic board to allow for coverage around the perimeters (fig. 7). The application was done in four coats, allowing the varnish to dry completely between each layer, to ensure full coverage and prevent gaps or areas of uneven coverage. Conservators found that approximately half a can was needed to varnish this object in the manner described. The overall final visual

Fig. 6. Map of Boston in the State of Massachusetts before (left) and after (right) treatment.

Fig. 7. Lead Preparator, Annajean Hamel, applying Golden Archival Varnish (Satin) to *Map of Boston in the State of Massachusetts*.

appeared historically accurate when treatment was done and was aesthetically pleasing when placed in its display location.

CONCLUSIONS AND FUTURE WORK

As noted at the beginning of this article, even though the research is not considered to be exhaustive, it has narrowed down the list to the potential surface coatings that provide the most flexibility and differing variables to a group of four. The coatings deemed to have the most promise for treatment use by any conservation laboratory were found to be Crystalac, B-72, Gamvar, and Golden Archival varnishes. Although the tables in this article more clearly outline the aspects of each that should be considered for treatment decisions, this list provides a mix of traditional materials and newer conservation-grade compounds that should undergo further assessment for their use in paper conservation. NEDCC staff would like to have their experiments replicated by other conservators that take the samples through more strenuous environmental testing, including formal accelerated aging tests, to further determine the long-term stability and reversibility of the various coating materials. If additional testing reinforces the results already seen in these initial research phases, it is quite possible that they prove to be the obvious choice in the nuanced realm of varnish application

by bridging the gap between practicality and visual authenticity needed to preserve historical wall maps.

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NOTES

1. This treatment approach is described in more detail in the article "The 'One-Day' Conservation Treatment Method for Wall Maps at the Northeast Document Conservation Center" by Kathryn Boodle in this volume.
2. NEDCC does not have the capability to perform empirical accelerated aging tests; however, a drying oven is available for nonempirical desiccation assessment without humidification controls. The readily available Thermo Fisher Heratherm oven is a general-purpose model that provides prolonged heating and drying but does not allow for humidity regulation.

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TALAS
https://www.talasonline.com
Golden Archival Spray Varnish—Gloss (#21717-1010; Golden Code: 7731-Archival Varnishes; 10 oz.), Golden Archival Spray Varnish—Matte (no longer available; Golden Code: 7741-Archival Varnishes; 10 oz.), Golden Archival Spray Varnish—Satin (#21717-1020; Golden Code: 7736-Archival Varnishes; 10 oz.), Golden Archival Spray Varnish—Semigloss (no longer available; Golden Code: 7746-Archival Varnishes; 10 oz.), Gamblin Gamvar Gloss varnish (#00456-1706; Secondary Code: 953036; 500 mL [16.9 oz.]), Gamblin Gamvar Matte varnish (#00456-1211; Secondary Code: 953037; 250 mL [8.5 oz.]), Gamblin Gamvar Satin varnish (#00456-1221; Secondary Code: 953037; 250 mL [8.5 oz.]), Maimeri Picture Varnish—gloss (#01565-1166; Secondary Code: 58670-Auxiliary Products; 500 mL), Maimeri Picture Varnish—matte (#01565-1196; Secondary Code: 58674-Auxiliary Products; 500 mL)
Blick Art Materials
https://www.dickblick.com

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Varnished Maps and Social Chemistry in Early America: A Material History

INTRODUCTION

When I discuss wall maps with students, librarians, or collectors, some of my favorite talking points are about the visual quality of historical maps. Inevitably, the topic of varnish comes up, but not so much as a point of discussion than as an existential question. What I am often asked is: does maintaining a large varnished map make sense, with "sense" standing in for a range of concerns about the object's stability and cost of repair, not to mention the map's visual appearance? As it turns out, for many non-conservators, addressing varnish and historical maps in the same sentence comes with mostly negative connotations. Quickly identified as the cause of discoloration and cracked paper, the consensus seems to be that varnish transforms historical maps into unsightly objects, diminishing both their material and historical value. In my work as a map historian, I have found that in many collections, wall maps tend to be unvarnished after having undergone conservation treatments. This choice of outcome, or perhaps more importantly, what appears to be the collecting market's preference for unvarnished wall maps, is almost diametrically opposite to the ways in which mapmakers and consumers experienced varnished wall maps before 1900.

With varnish being the subject of the 2022 AIC Varnished Wall Map Symposium and the 2023 AIC Varnished Map Colloquium, varnish removal was front and center during presentations. Yet, there also was a conversation about the virtue of revarnishing restored wall maps. Having had the privilege to participate in both events as a non-conservator, I was struck by the way paper conservators who were debating the pros and cons of restoring varnished wall maps were essentially engaging in a debate that also informs historians of cartography who study the "look" and historical uses of maps. While I am not equipped to join the technical conversation, in this article I hope to provide some historical context for better understanding the significance of varnish in relation to pre-1900 wall maps and why I believe in the value of revarnishing them. In what follows, a series of historical contexts illustrate the pervasiveness with which varnish affected map production and consumption in early America. An additional analysis of select varnishing manuals, handbooks, and advertisements examines how varnish acted not only as a crucial ingredient in the transmission of map knowledge but also greatly contributed to map-specific social chemistry. An appendix provides a working bibliography and select excerpts of historical sources discussing map varnish and varnishing practices published between 1666 and 1900.

MAPS AT AN EXHIBITION

By the mid-19th century, varnished wall maps were not only ambassadors of industrial innovation and the fine arts but were at the heart of the greatest map show in early modern history (note 1). The setting was the Crystal Palace in New York, which was hosting the 1853 "Exhibition of the Industry of all Nations." According to the *Official Catalogue*, in a section called the "Machine Arcade," objects like naval equipment (meaning large cannons), textiles (think enormous tapestries), and industrial hardware (imagine power looms) all vied for the visitors' attention. Eye-catching as these goods were, they were staged against an unprecedented spectacle. Along one side of the diamond-shaped arcade hung dozens of varnished wall maps. Conspicuously placed in raking light from the high window panels, they would have created an eye-popping visual effect (fig. 1).

The maps on display were not just any maps providing a glossy background. According to the catalog, they were sample specimens of some of the best-known maps made in the United States. On display were wall maps produced by publishers like Henry Tanner and Samuel Munson, who might have shown their medium-sized "Ornamental" or "Embellished" maps measuring 3 × 4 ft. (fig. 2). Other publishers showed wall maps measuring in the 4 × 5 ft. range, like those made by publishing houses, like Ensign & Bridgeman,

Proceedings from the AIC-sponsored event, "Varnished Wall Maps: A Collaborative Seminar to Investigate Treatment Methodology," September 14–16, 2022.

Fig. 1. Nagel and Weingärtner. *Interior View of the New York Crystal Palace for the Exhibition of the Industry of All Nations* (New York, NY: Goupil & Co., ca. 1853). Lithograph with two tint stones; 102 × 75 cm. Library of Congress, Prints & Photographs Online Catalog. http://hdl.loc.gov/loc.pnp/ppmsca.08321.

Fig. 2. S. Bishop Munson. *A New and Embellished Map of the United States* (Cincinnati, OH, 1845). 92 × 119 cm. David Rumsey Map Collection, David Rumsey Map Center, Stanford Libraries, https://www.davidrumsey.com, Creative Commons License.

or by commercial mapmakers, like Albert Alden, whose *Pictorial Map of the United States* (1845; fig. 3) illustrates the visual intensity of the exhibition's map spectacle. His border elements connected cartography to popular fiction and landscape prints. Located on the top panel is the Catskill Mountain House, made famous by James Fenimore Cooper's novel, *The Pioneers* (1823), which afterward had been reworked by several artists of the Hudson River School, including the painter W. H. Bartlett (1836). The perhaps most impressive maps on display were super-sized works spanning 6 × 7 ft. or 7 × 8 ft. made by the Colton Company of New York or the Mitchell Company of Philadelphia. In form and content, their maps competed against wall maps, such as William Chapin's *Ornamental Map of the United States* (1846/1853; fig. 4), which used washes of watercolor to delineate state and county boundaries but also added iconographic elements that aligned the map with the figurative idea that the nation resembles a physical construct, represented here as an architectural framework replete with Neoclassical pillars and decorative trimmings.

The names of these mapmakers mean nothing to most of us today. Nor do we remember specific maps by title. Looking at historical scholarship, we certainly have not been aware of the presence of maps at the New York exhibition. And lost to us are recollections of the vivid map colorings, the sheer material heft of maps, and the scent of fresh varnish. But in 1853, the maps exhibited at the Crystal Palace entered an arena abuzz with competing expectations about the materiality of maps, including how map varnish entered into American everyday life.

At the time of the New York exhibition, wall maps represented a newly industrialized product. For map producers, the genre of wall maps stood for a scaled technology attracting venture capital and a new labor force affected by mass production. For map consumers, wall maps offered an array of new horizons through which to view the world and how to position oneself in relation to the nation, regions, and local places. In the public sphere, shopkeepers and government officials kept standing orders for the latest map giant, with

Fig. 3. Albert Alden. *Alden's Pictorial Map of the United States of North America* (Barre, MA, 1845). 105 × 134 cm. David Rumsey Map Collection, David Rumsey Map Center, Stanford Libraries, https://www.davidrumsey.com, Creative Commons License.

the goal, as one newspaper keenly pointed out, "to overcome ignorance… and for the information of capitalists" (Brückner 2017, 122). Popular magazines and academic journals debated at length the pedagogic and economic contributions made by maps. Looking at the private sphere, the archive shows that ministers and teachers, businesses, and homes were in a constant shopping mode for the perfect wall map supporting the buyers' aspirational bottom lines, from missionary or imperial politics to commercial or social interests to aesthetic taste and interior decoration. But while expectations surrounding map content were as diverse as the people visiting the Machine Arcade, when it came to the concept of "map form," the expectation raised by publishers as well as the press was rather single minded: according to map orders and advertisements, people wanted maps to come in different sizes, be portable, be colored, and, when possible, be treated with a coat of varnish.

THE MATERIAL CULTURE OF WALL MAPS

Taking our cue from the New York exhibition and setting the stage for talking about the culture of map varnishing, it is important to know that wall maps constituted a unique print genre. The actual term "wall map" is a neologism coined during the 1870s. Modern cartographic handbooks state that a wall map is a map "set or fixed against a wall," intended for periodic display in public and private spaces where they served multiple, often overlapping functions informed by political culture, the decorative arts, and information technologies. This definition is rather general and unwieldy. Any map attached to

Fig. 4. William Chapin. *Ornamental Map of the United States* (1846; rpt. New York, NY, 1853). 125 × 143 cm. David Rumsey Map Collection, David Rumsey Map Center, Stanford Libraries, https://www.davidrumsey.com, Creative Commons License.

a wall would have to be considered a wall map. But if we think historically, since the advent of printed maps during the late 15th and then 16th century, mapmakers and printers advertised "wall maps" as a materially enhanced paper construct. Variously called "large map," "glazed map," "framed map," "hanging map," or "map on rollers," wall maps distinguished themselves from other printed maps by their physical format and material environment (Brückner 2017, 122).

Considering format first, unlike medieval maps, early modern maps were paper products—a fact that is so obvious that scholars tend to overlook it, even though by the 18th century, European and American paper mills were producing special "map paper." In 1796, the Brandywine Paper Mill in Wilmington, Delaware, provided special map paper for Mathew Carey's first American atlas. This kind of paper was described as "thin, hard, and sized paper . . . with special reference to strength and flexibility" (Brückner 2017, 59, 93). Yet, it was also considered soft enough to retain heavy inks and thick washes of watercolor and varnish. Strong paper was needed because wall maps were printed on imperial- or elephant-sized paper that had to be sturdy enough to bear the weight of rollers and withstand frequent handling. Large wall maps were multisheet affairs, printed in sections, with each sheet containing a portion of the map's overall design. Only when fully assembled would wall maps become fully legible, their legibility frequently being guided by the contents of the map's ornamental cartouches, legends, or other graphic inserts. Map engravers and printers accommodated the wall map's sectional makeup by using extra wide margins for stronger paper joints. During the production phase

Fig. 5. Jan Van der Heiden. *Beschryving der nieuwlijks uitgevonden en geoctrojeerde slang-brand-spruiten* (Amsterdam: Jan Rieuwertsz, 1690). Special Collections, University of Delaware Library, Museums and Press, Newark, DE. Folio TH9557.H45 x1690.

called "map finishing," wall maps were further equipped with linen or cotton backings to stabilize the paper; rollers and knobs were attached for display and storage purposes; watercolors and varnish were added to the map surface; silk, linen, or cotton ribbons were sewn into the paper edges for additional protection; and finally, packaging hardware, ranging from metal rings to leather straps, and pulley systems to wooden cases, all added to the material heft of a generic wall map.

Turning to the material environment next, if we go back in history, we discover that display practices from the Renaissance paved the way for the 19th-century map spectacle in New York City. Although the concept of the wall map emerged during the 16th century, it was not until the 17th-century fascination with "map galleries," maintained by European monarchs and courtly institutions like the Paris Observatory or government offices like the British Board of Trade, that wall maps gained public exposure. It was during that period that wall maps emerged as prized possessions of the emerging middle classes, as documented by genre paintings such as Jan Vermeer's *Officer and Laughing Girl* (1658) or technical engravings like Jan Van der Heiden's *Beschryving der … Slang-Brand-Spuiten* (1690; fig. 5), a handbook describing fire-fighting technologies. In these illustrations, wall maps presided conspicuously over other large-sized wall decorations. Shown next to tapestries, mirrors, and paintings, wall maps ascribed to sitters and viewers the role of the worldly traveler or imperial geographer who was consuming maps as people were rapidly consumed by a burgeoning commodity culture.

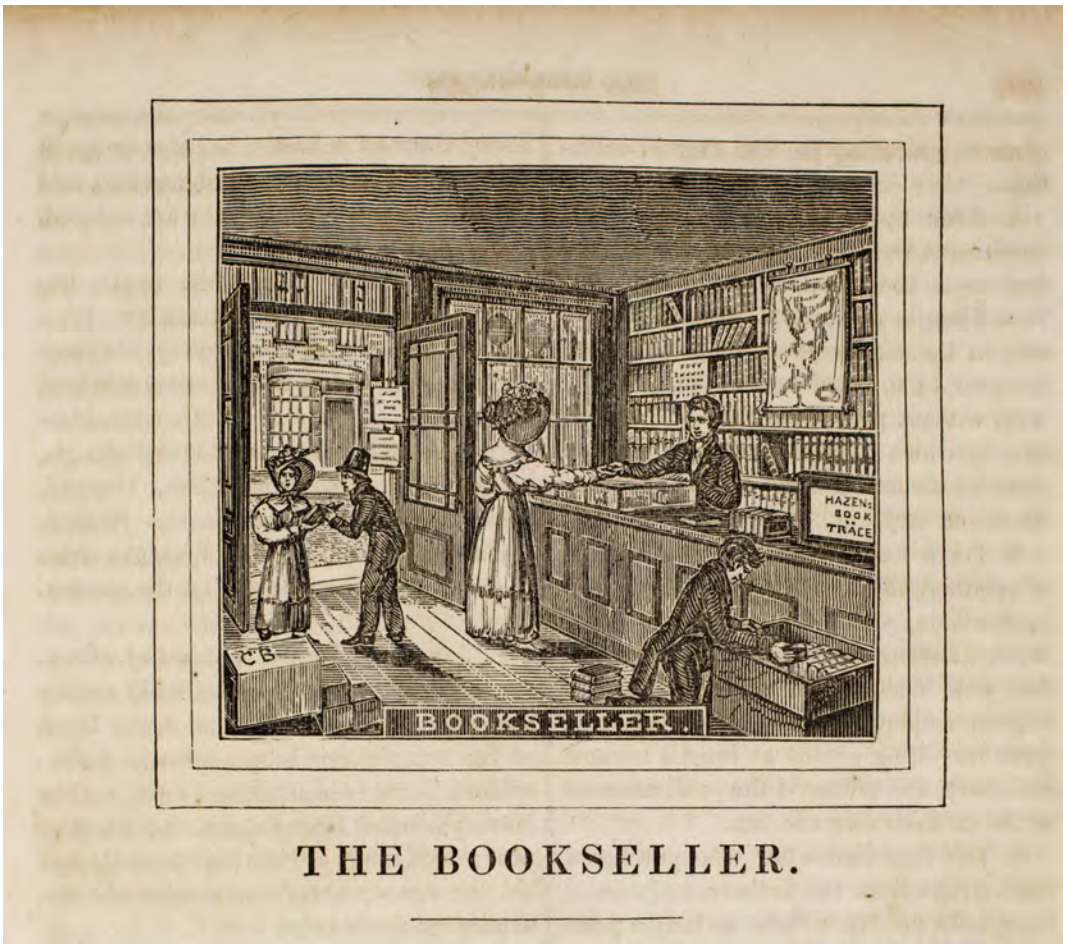


Fig. 6. Edward Hazen, *The Panorama of Professions and Trades; or Every Man's Book* (Philadelphia, PA, 1836). Courtesy, American Antiquarian Society.

If we jump forward to the New York map exhibition, it also was rooted in a more recent culture of commercial marketing. Already by the mid-18th century, colonial American shopkeepers hoisted up wall maps in front of shelves or behind shop windows (fig. 6). When in 1816 John Melish opened the first map business exclusively devoted to making and selling maps in the United States, it coincided with an insatiable demand for new wall maps triggered by the War of 1812. Advertising campaigns intent on bringing maps into American shops, offices, and schools were amplified by commercial exhibitions. There, map displays were a regular feature at urban fairs, like those hosted by the American Institute in New York or Baltimore's "Exhibitions of American Manufactures," or at national fairs, such as Philadelphia's Centennial Exhibition of 1876 (fig. 7) or Chicago's World's Fair of 1893.

In American homes, wall maps were staple displays since the early 18th century. Estate inventories indicate that wall maps were decorative objects competing for visual attention along with other large wall hangings, such as mirrors, prints, and wallpaper. Unwieldy, disproportioned in relation to most house objects, and difficult to handle or store, the maps' very materiality readjusted people's visual horizons and offered a unique training ground for prospective map users. Importantly, by the late 18th century, new educational schemes carried large varnished maps from American homes into schools and back again.

Beginning in 1783, when Noah Webster's famous spelling book promoted catechistic map lessons, varnished wall maps entered the school curriculum, thereby creating their own pedagogic rituals and social patterns of material use. By the 1820s, the educator Joseph Lancaster had introduced the monitorial teaching method to public schools, which resulted in widely advertised interactive map exercises (fig. 8), especially map-pointing. By the 1840s, map lessons were also turned into a form of song. Schoolteachers like Frances Willard commented that "[students] sing the capitals and [the] bound[aries of] the states…, while they point out the places on the map" (Brückner 2017, 290). Some educators took the sing-the-map exercise on the road. In 1851, a Massachusetts broadside advertised a lyceum-style "geographical concert and public

Fig. 7. Centennial Photographic Co., A. S. Barnes and Co.'s Exhibit, 1876. Courtesy of the Free Library of Philadelphia, Print and Picture Collection. Dig # c021049.

Fig. 8. Alexander Robb. *Specimen of Printing Types and Ornaments* (Philadelphia, PA, 1846). Courtesy of the Winterthur Museum, Garden, and Library. Z250 R63.

Fig. 9. Universal Exhibition of Vienna. American rural schoolhouse, interior. Amerikanische Schule: Inneres (n.p., 1873). Library of Congress, Prints & Photographs Online Catalog. http://hdl.loc.gov/loc.pnp/cph.3b07391.

recitation," showing a student performing her map knowledge in front of a super-sized wall map. That varnished wall maps were portrayed as an integral part of American education can be seen in photographs from the 1873 Universal Exhibition of Vienna (fig. 9). By then, as captured by the photograph's depiction of glossy map surfaces, we can assume that varnished maps not only had gone mainstream but that as mass-produced commodities and display objects, they were indicative of a new phase in map circulation and map meaning.

A BRIEF HISTORY OF MAP VARNISH

So far, I have shown different contexts in which varnished maps were consumed between 1700 and 1900. They were popular display objects in public and domestic interiors and staples of the emerging American school curriculum, and when examining inventories and wills, they were treated as prized possessions listed next to decorative art objects. When looking closely at some of the preceding illustrations, varnish has crept into the visual record documenting historical maps. Zooming into high-resolution images of maps made available by digital databases, like the David Rumsey Map Collection or the Library of Congress, further reveals the often unstated presence of varnish. An additional layer of evidence is provided by late 19th century photographs of maps and their settings. Cameras not only captured the sheen of map varnish but also the way in which light tended to bounce off unevenly from the varnished map's surface.

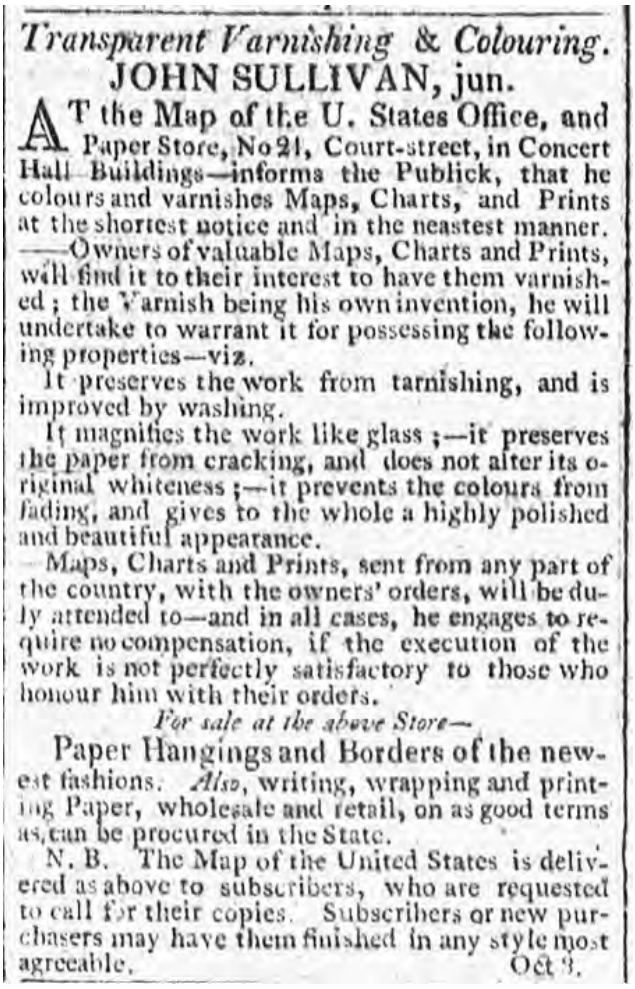
Prior to photographic evidence, the best sources for tracking the relationship between varnish and mapmaking in the English-speaking archive consist of handbooks, broadsides, and newspaper advertisements. Two of the earliest published references to the practice of varnishing maps appears in the handbook *Academia Italica. The Publick School of Drawing, or, The Gentlemans Accomplishment* (1666) or in William Salmon's *Polygraphice; or the Art of Drawing, Engraving, Etching, Limning, Painting, Washing, Vernishing [sic], Colouring and Dying* (1672). Both manuals mention varnish more in passing than as a focused concern, with the former's advice centering on backing maps with additional paper before coloring (and how to use ear wax for fixing mistakes). The latter includes instructions on the "Washing … of Maps and Printed Pictures in proper Colours, or else … to vernish [sic] them" (p. 201).

Although the late 17th and early 18th century saw a massive increase in the circulation of handbooks and advice

literature—much of which was driven by the scientific publications of the Royal Society of London—digital databases, such as *Early English Books Online* (EEBO), *Eighteenth-Century Collections Online* (ECCO), and *Early American Imprints* (EAI), are surprisingly silent on the topic of map varnish. Keyword searches for the period between 1600 and 1780 frequently register the term "varnish"—but just not in conjunction with maps. Over the decades, the most popular reference to varnish was metaphorical, describing human or physical attributes, followed by handbooks describing varnish's role in oil paintings and the production of varnish as such. The 18th-century sales catalogs published by premier London map sellers, such as John Bowles or Robert Sayer, also fail to mention varnish. Having looked closely at advice literature published between the 1670s and 1770s, the pattern I found is that although mapmakers advertised maps as ornamental engravings that came with a variety of material choices (wide margins, watercolors, pasted-on paper, cloth-backing, or mounted on rollers, etc.), no mention was made about varnishing maps as a concern or practice.

Of course, advice literature is carefully worded by authors addressing a select customer base. In that context, we need to remember that for handbooks or sales catalogs not to offer advice on how to varnish maps did not mean that maps were not varnished. I say this because once I started researching 18th-century newspapers, it appears that beginning in the early 1760s, British American advertisers added the term "varnish" when selling maps. Consider, for example, Robert Kennedy's advertisement that he "varnishes papered Rooms or Hangings, Family Pieces, Maps and Prints of all Kinds, &c. Paper thus varnished is much admired by People of the best Taste and Fashion in England, for its good Qualities (excells [sic] all others) as it will bear washing when soiled, and proves as lasting as the Plaister it is put on, and looks always bright, &c." (Kennedy 1). In 1762, Kennedy still needs to explain why varnishing a map would be in the consumer's best practical interest. A decade later, in 1774, the American mapmaker John Reed considers varnish to be a simple matter of map aesthetics when he states: "Any Gentleman inclining to have their Maps framed, painted, gilded and varnished, may have them done in the neatest manner" (Reed 4).

By the early 1800s—and here I can only speak for the U.S. marketplace—newspaper ads, shop inventories, and business papers suggest that the practice of map varnishing permeated the work orders of shopkeepers and artisans. In an 1806 ad published in the Boston newspaper *The Repertory*, John Sullivan, the owner of a Boston paper shop, describes a new set of expectations concerning varnished maps (fig. 10). Having "inform[ed] the Publick, that he colours [sic] and varnishes Maps, Charts, and Prints," he tells "Owners of valuable Maps, Charts, and Prints" that the varnish is his own invention. He proudly lists its virtues, namely that it preserves the work from tarnishing and is improved by washing; that



Transparent Varnishing & Colouring.

JOHN SULLIVAN, jun.

AT the Map of the U. States Office, and Paper Store, No 21, Court-street, in Concert Hall Buildings—informs the Publick, that he colours and varnishes Maps, Charts, and Prints at the shortest notice and in the neastest manner.

—Owners of valuable Maps, Charts and Prints, will find it to their interest to have them varnished; the Varnish being his own invention, he will undertake to warrant it for possessing the following properties—viz.

It preserves the work from tarnishing, and is improved by washing.

It magnifies the work like glass;—it preserves the paper from cracking, and does not alter its original whiteness;—it prevents the colours from fading, and gives to the whole a highly polished and beautiful appearance.

Maps, Charts and Prints, sent from any part of the country, with the owners' orders, will be duly attended to—and in all cases, he engages to require no compensation, if the execution of the work is not perfectly satisfactory to those who honour him with their orders.

For sale at the above Store—

Paper Hangings and Borders of the newest fashions. *Also*, writing, wrapping and printing Paper, wholesale and retail, on as good terms as can be procured in the State.

N. B. The Map of the United States is delivered as above to subscribers, who are requested to call for their copies. Subscribers or new purchasers may have them finished in any style most agreeable. Oct 8.

Fig. 10. Sullivan, John. "Advertisement." *Repertory*, vol. III, no. 83 (October 17, 1806).

varnish "magnifies the work like glass," that it "preserves the paper from cracking, and does not alter its original whiteness," and so on. What makes the Sullivan ad unique is that it offers his varnishing services along with the sale of a specific map listed by name and title. Sullivan is selling Osgood Carleton's wall map, *A New Map of the United States* (1806; fig. 11), showing the nation before the Lewis and Clark expedition and, important for our purposes, illustrating how local commercial venues sent varnished wall maps into circulation.

That varnished maps circulated in large numbers during the first decades of the 19th century we can deduce from the account books kept by Philadelphia map finishers like Lydia Bailey. Widowed in 1808, Bailey found herself learning how to manage a print shop without a partner. While seeking to reboot the business and to make ends meet, Bailey turned to the business of "map finishing," which involved map painting, framing, and, above all, varnishing. A transcript of her account book's entry for June 8, 1808, shows the range of supplies and materials involved:

Fig. 11. Osgood Carleton. *A New Map of the UNITED STATES, OF AMERICA Including part of Louisiana Drawn from the Latest Authorities* (Boston, MA: John Sullivan Junr., 1806). 120 × 139 cm. David Rumsey Map Collection, David Rumsey Map Center, Stanford Libraries, https://www.davidrumsey.com, Creative Commons License.

12 Pair Nobs [sic]	.75
4 Sets Rollers	.75
6 yards muslin @ 25 cts per	1.50
2 quarts varnish	3.28
16 Sets nobs for Mr Careys maps	1.00
2 Sets ditto	.12½
12 Sets ditto for Hills [Survey of Phila]	.75
1 pint Spirits of Terpentine	.19
1 Gill varnish Copal	.25
6 Peases Tape	1.12½

(Bailey, Account Book, Vol. 4; see the appendix)

Bailey placed orders like this on a regular basis from 1808 until 1841. References to muslin and tape, nails, knobs, and rollers acknowledge materials necessary for the assembly of wall maps. Ordering large amounts of copal varnish, turpentine, or isinglass, however, is evidence that in Bailey's map business, the application of varnish was a crucial work step before the maps were returned to her customers.

Indeed, Bailey's account book reveals how varnished maps circulated in the city of Philadelphia. For more than three decades, she recorded the names of people who placed map finishing orders. Scanning these, we discover orders made by

Philadelphia's commercial elite, like the merchant Stephen Girard or the publisher Mathew Carey, or by major institutions, like the City Library and the Philadelphia Athenaeum. The largest number of map orders came from young women, either attending local academies or participating in after-school map exercises (Brückner 2017, 308–309). With dozens of individuals placing map finishing orders per year, Bailey's account book conjures up the image of a Philadelphia streetscape that would have included frequent scenes of young women dropping off maps at Bailey's shop at No. 10 North Alley Street or, conversely, carrying newly varnished maps back to their homes or school buildings. Unfortunately, Bailey did not write down the women's addresses, but a brief effort of cross-referencing their names with city directories indicates that from the 1810s to at least the 1830s, varnished maps measuring on average 4 square feet were at the center of a vast, young adult social network.

The pervasive presence of varnished maps is perhaps best explained when we realize that map varnishing was becoming vertically integrated into the workflow of early 19th-century map manufacture. When the nation's first independent map publisher, John Melish, went bankrupt after the financial crisis of 1819, the Philadelphia court provided a shop inventory that can also be interpreted as an organizational chart of Melish's business model. Located in a four-story townhouse on Chestnut Street, his map shop included multiple departments ("Store," "Printing," "Binding," etc.), including a separate "Varnishing Department." On the day of Melish's bankruptcy, the assessor recorded "6 Gall copoll [sic]" and assorted "varnishing brushes" (Brückner 2017, 75–78, 330). A decade later, in 1834, when a reporter for the *National Gazette* wrote a puff piece about the "Geographical Establishment" of Melish's competitor, Henry Schenck Tanner, the essay's tour of the map factory ended inside a varnishing shop and, given the emphasis on how maps were "nailed upon rollers," a major clue about the prominent role varnished wall maps played in the mapmaking business:

> *Every part of this business is performed by females. The process of mounting is commenced by stretching a sheet of canvass [sic] over a square frame, on which the several sheets composing the map (previously coloured [sic]) are joined and pasted. When sufficiently dry, two or three coats of transparent size are applied, intended to produce a uniform surface and to present the varnish (which is subsequently spread over its face) from sinking into the paper. When the varnish is thoroughly dry, which is usually the case in two or three days, according to the state of the weather, the map is cut from the frame, bound on two of its edges, nailed upon rollers, and thus prepared, it is ready for use. (National Gazette 1834, 2)*

The exposé about the Tanner business was published at the onset of three major technological innovations that would change everything concerning basic mapmaking lore. By the 1830s, the invention of machine-made paper diversified and granted greater access to the raw material of maps while diversifying the quality and size of map paper. The printing technique of lithography transformed the look of maps, allowing for more detail and speedy corrections while also lowering overall production costs. The third change in technology affecting map production and consumption emerged from the use of steam-powered rotary presses (especially the ones capable of handling large printing plates; see fig. 12). For comparison, prior to steam power, a manually operated printing press generated about 12 large prints per hour, and a steam-powered press allowed for print runs of nearly 1000 copies per hour (Brückner 2017, 93–95). Varnish continued to be a central part of map production. An 1877 commercial pamphlet, printed for itinerant map sellers by the "Haasis & Lubrecht Map and Chart Establishment" in New York City, not only indicated that map publishers specialized in the production of wall maps but that varnished maps were standard goods and selling wholesale "Finely Colored, Varnished and Mounted on Rollers" (Haasis and Lubrecht 1877, 4).

Fig. 12. Detail from "Haasis & Lubrecht Map and Chart Establishment." Advertisement. Coll 214, 84x85. Joseph Downs Collection of Manuscripts and Printed Ephemera, Winterthur Library. Courtesy of the Winterthur Museum.

VARNISHED EXPECTATIONS

This is where my expertise ends in setting up the historical context for future conversations about the treatment of varnished wall maps. Having plumbed the commercial history and cultural practices linking maps and varnish, my major takeaway for paper conservators today is that since the late 17th century, the practice of varnishing maps had created—and here I borrow a term from literary theory—a unique "horizon of expectation." Producers and consumers alike expected varnish to fulfill a set of different functions. Skimming through the sources collated in the appendix, readers will find that these functions included the following expectations:

- Varnish protects the map and enhances its longevity.
- Varnish allows maps to be washed if soiled; map hygiene is a perennial talking point.
- Varnish not only allows but encourages tactile engagement with maps, including the drawing and erasing of school assignments.
- Varnish serves the function of protective glass and, according to one handbook, literally enhances the look of a map like a magnifying glass.
- Varnish maintains map colors.
- Varnish adds polish and luster.
- Varnish was offered as an optional refinement of the final product, raising the map's price but also adding to its social capital; during the long 18th century, catalogs put maps on equal footing with pictorial prints.
- Varnish was considered an integral component of the finished wall map by the mid-19th century.

With handbooks and advertisements raising these expectations, the people who did the actual map varnishing regularly consulted manuals and encyclopedias, professional periodicals, and DIY recipes. The sources compiled in the appendix offer select access for finding detailed varnish recipes, step-by-step descriptions of the varnishing process, or even registering concerns about chemical poisoning and the varnisher's health.

Upon examining the texts listed in the appendix, my additional takeaways as a nonconservator but consummate reader of technical handbooks are fourfold. First, two kinds of varnish recipes come up repeatedly, namely spirit wine varnish and copal varnish seem to be the go-to materials for map varnishers (one handbook advocates the use of caoutchouc). Second, map varnishing continued to be part of the map production process far into the 20th century, meaning that varnish continued to be integral to the materiality of the finished map as well as to the map users' expectations vis-à-vis wall maps and its attending rituals. Third, textual descriptions linking varnish to maps became increasingly proficient over time. Although early entries mentioned map varnishing only in passing, by the 19th century, it was common for advice literature to provide detailed instructions—like Charles Tomlinson writing in *Cyclopaedia of Useful Arts* (1854): "*Crystal varnish* for maps, prints, coloured drawings, &c.—Dissolve 2 lbs. of mastic, 2 lbs. of damar, without heat, in one gallon of turpentine; or mix Canada balsam and oil of turpentine in equal parts" (p. 898).

By the end of the 19th century (if not earlier), and that is the fourth takeaway, the process of varnishing maps had jumped scales from being part of industrial manufacture to entering the home as a DIY practice. Publications like *Blakelee's Industrial Cyclopedia. A Simple, Practical Guide for the Mechanic, Farmer, Housewife and Children* (1884) included instructions like these:

> *Varnish for Maps.—A good varnish for mechanical and architectural drawing, maps, etc. is obtained by dissolving in one quart of alcohol, one-fourth pound of white shellac, one ounce of camphor, and half an ounce of balsam fir. This varnish dries rapidly.*
>
> *Another Formula.—A good varnish for maps is made of one ounce Canada balsam and two ounces spirits of turpentine. This is laid on with a soft brush over a thin coating of isinglass previously dried." (p. 170)*

The expansion from industrial to DIY map varnishing is underscored by professional journals like *The English Mechanic & World of Science*, where on March 8, 1889, readers reported their varnish recipes in forum-styled entries like the one selected next (fig. 13):

> *[67966.]—Varnishing Maps.—Try sizeing [sic] with very weak glue (soak the glue all night before melting), and then varnish with white rosin 1 lb., gum Arabic 2 oz., Venice turpentine 2 oz., linseed-oil 2 oz. First melt the rosin and strain it very hot, steep the gum in olive-oil till dissolved, and strain it. Put to this the turpentine and rosin, and mingle them over a slow fire till dissolved. Use it hot. Bournemouth. Miles." (p. 37)*

***

In conclusion, and I return to the essay's opening, my foray into the world of varnish and its effect on the history of pre-1900 wall maps has me wonder this: knowing that maps were varnished on purpose for a host of economic, social, and aesthetic reasons, what is our responsibility when restoring varnished wall maps? For many collectors and also scholars, stripping old maps of all varnish is often considered the preferred path, the assumption being that the clean and unvarnished map gives more immediate access to the map's unvarnished truth, meaning the fantasy that we may get to see the map in its original state as if it was coming fresh of the printing press in black ink on white paper and thus uncorrupted by the damage caused by varnish exposed to light or soot or flies, not to mention the coarser signs of physical map use. However, as this article hopes to have demonstrated,

whistle, shutting off steam, ringing a bell, placing a miniature signal arm to danger, exploding a fog signal, and even applying a continuous brake. I have examined models and apparatus during the past few months which claim to carry out all these objects. Of course they may all work very well in model form, or experimentally; but in daily practice dust, dirt, ice, and snow would render such appliances perfectly unreliable. It therefore follows that if a man has to be employed to watch the self-acting fog-signalling appliances to see that they work, he may just as well place the fog signals on the rails by hand.

CLEMENT E. STRETTON, C.E.

[67954.]—**Dynamo.**—Your machine should give 45 to 50 volts and 6 amps. at 1,800 revs. per minute. Five 20c.p. lamps are the most you can expect. I would advise lamps of a lower candle-power, say, 16, and requiring only 1 amp. each. No. 14 gauge will do for the mains, and carry the current with very little loss, the resistance for the distance being barely ½ an ohm. An engine to do the work comfortably should not be less than ¾H.P.

W. A. WALTON.

[67955.]—**Book-Keeping.**—Perhaps if "Trader" will add his "trading expenses" and "bad debts" to his net profit, he will arrive at what he wants; but if he will advertise his address, probably I can help him. ACCOUNTANT.

[67955.]—**Book-Keeping.**—I am not acquainted with Pitman's system by name; but, if "Trader," provided in the mean time he has not discovered his difference, can manage to let me see a statement of his accounts, from which, if explicit enough, I shall be able to help him, without reference to any entries; but the latter may be necessary.

W. E., Chartered Accountant.

[67957.]—**Voss Machine.**—For full information on influence machines, see paper by Dr. S. P. Thompson—"The Influence Machine from 1788 to 1888," *Journal* of the Society of Telegraph Engineers, Vol. XVII. No. 74. pp. 569 et. seq.

W. PERREN-MAYCOCK, A.I.E.E.

[67957.]—**Voss Machine.**—Has "W. B. C." thoroughly warmed his machine before using it?—for if it has been put aside for some time, no doubt it has got damp. Thoroughly overhaul the machine, warm and dry it, and put a little amalgam on rubber, and then try. F. W. MASON.

[67957.]—**Voss Machine.**—There was a full description of the Voss machine in the back volumes of the ENG. MECH.; but as mine are at the binder's I cannot quote the number. Perhaps our kind Editor can oblige you by quoting the volume. In all probability your machine is dirty. Clean all the spaces between the bosses with a little bit of flannel dipped in benzoline. Dry well before the fire (not too near, lest you crack the plates).

S. BOTTONE.

[67958.]—**Centres of Shafting.**—No rule as to distance—generally a matter of convenience. But you should not be less than 20ft. between centres.

Bristol. T. C.

[67959.]—**Engine Query.**—If this is to be condensing, have l.p. cylr. 26in., and h.p. cylr. 15in. Cut off at ¼ in h.p. and ⅛ in l.p. It is called 9 expansions under the circumstances you name. Use a double belt (on wheel 15ft.) 30in. wide. Why not drive with 1¼in. hemp or cotton rope (7 ropes)?

Bristol. T. C.

[67959.]—**Engine Query.**—You could not do with smaller cylinders than the following:—h.p. 11¼in., cut-off ·5; mean pressure 48lb.; l.p. 22½in. diam., cut-off ·5; mean pressure 14lb.; terminal pressure 6lb. above back pressure. The above mean pressures are those which would be found in actual working, not theoretical pressures, which are useless in practice. Rule for rate of expansion = ratio of cylinders ÷ cut-off, or 3 ÷ ⅓ = 9. A 20in. single belt would be a good size to use. The diam. of flywheel is rather small; the usual size is between 3—4 times the stroke. Weight would be 4½ tons; or 5½ would be better, as the load will be an irregular one. MCGILL.

[67960.]—**Starting Compound Condensing Engine.**—1. Without seeing arrangement it would be difficult to say. They may be for starting, if opening into cylinder; if not, for steam to jackets. 2. If you keep the injection open while air-pump is not working, you stand a great chance of filling the cylinders with water and blowing cover off. The best way of starting is to blow all air out through snifting valve, then close blow-through and snifting valves, and admit a little injection water to get vacuum. MCGILL.

[67960.]—**Starting Compound Condensing Engine.**—1st. The valve mentioned on the l.p. cylinder is no doubt an auxiliary valve. This valve is placed on nearly all compound engines so as to render them handy at starting at any position of the cranks, live steam being admitted either on the top or bottom of the l.p. piston. 2nd. The injection valves should be opened before starting. 3rd. If the condenser will not take the injection, stop the engine and throw a few buckets of water over the condenser so as to cool it; this will get you over the difficulty.

Longsight. J. STOKES.

[67962.]—**Bluing Solution for Steel.**—The object of the process is evidently to form a thin film of sulphide. SIX.

[67962.]—**Bluing Solution for Steel.**—I am afraid "W. T. E." will not get much of a result from that he mentions. I tried it some time back, and am sorry to say I cannot recommend it.

F. W. MASON.

[67965.]—**Aquatic Beetles.**—Wide-mouthed bottles of a fair size containing a little meat fastened to the bottom, and sunk upright in the ponds, may suit the purpose, especially if the inquirer adds some arrangement of string and a lid, whereby they may be closed before being drawn up.

Uttoxeter. N. S. R.

[67965.]—**Aquatic Beetles.**—If "Dytiscus" will procure a half-dozen wine hamper, remove the lid and fasten a strong cord to each handle, then place a brick or large stone inside, and get a companion to pull one cord while he pulls the other, by drawing this arrangement through the ponds he will be able to catch dytiscus. Should more be taken than wanted, a supply of males would oblige.

Great Yarmouth. J. J. OWLES.

[67966.]—**Varnishing Maps.**—I spoilt my first in same way, but now use the size (made of gelatine or clear glue) cold, so as to keep it on surface of paper. I like mastic varnish best. KANET.

[67966.]—**Varnishing Maps.**—Dissolve some isinglass in water by simmering it over a fire, and strain it through fine muslin. If the size glistens when applied to moderately warm paper, it is too thick; if it sinks in it is too thin; it should merely dull the surface. Give your map two or three coats of it when you have got it right, and then varnish with the best mastic. J. S. MANDANE.

[67966.]—**Varnishing Maps.**—I do not know anything about "patent size," and possibly the fault may lie there. One coat of gelatine (1oz. to 10 of boiling water, strain, and keep hot on a sand bath) I find to work very well. Paper varnish not being so deeply coloured as ordinary copal, suits better for maps.

Plymouth. B.Sc.

[67966.]—**Varnishing Maps.**—Try sizeing with very weak glue (soak the glue all night before melting), and then varnish with white rosin 1lb., gum arabic 2oz., Venice turpentine 2oz., linseed-oil 2oz. First melt the rosin and strain it very hot, steep the gum in olive-oil till dissolved, and strain it. Put to this the turpentine and rosin, and mingle them over a slow fire till dissolved. Use it hot.

Bournemouth. MILES.

[67967.]—**Engine and Boiler.**—If your boiler is well made it could be worked with 60lb. on safety-valve, taking care to keep crown-plate of furnace well covered. You would get 2H.P. by running your engine at 350 revolutions. MCGILL.

[67967.]—**Engine and Boiler.**—If the boiler is properly constructed you could carry a pressure of 150lb. in perfect safety. Assuming that you have a pressure of 100lb., engine making 200 revolutions per minute, and with a cut-off at ⅔ stroke, the engine would develop 2 horse-power.

Longsight. J. STOKES.

[67972.]—**Dynamo.**—It is pretty evident that there must be very serious leakage of current somewhere for you to be able to get a spark from the F.M. wires, even when the commutator is not in contact with brushes. This is further proved by the fact that it will not work as a motor. If you can't find out the fault, send it to me (carriage paid), and I will put it right for you, free of charge.

Carshalton. S. BOTTONE.

[67973.]—**Small Dynamo.**—1. The armature or field-magnets leak. 2. The wire is too fine to give a large current. 3. The resistance of the bell is too small to allow the field-magnets to excite themselves to the full. Insert a yard or so of No. 30 iron wire between the dynamo and the bell, and try again. S. BOTTONE.

[67975.]—**Bottled Fruits.**—Consult a cookery book, e.g., Mrs. Beeton's "All About Cookery."

SIX.

[67978.]—**Fucus.**—This is one of the "brown sea-weeds" or Melanophyceæ — the chlorophyll corpuscules being brown. The branches of the thallus of Fucaceæ often contain air-cavities for floatage (hence the term "bladder-wrack"), and the cell walls are very gelatinous. The reproductive cells occur at the ends of certain "fertile" branches of the thallus, and line depressions or pits (conceptacles). The female cells (oospheres) are developed from mother cells called oogonia, each oogonium producing four or eight oospheres. In other conceptacles the male cells (antherozoids, each a body or "brown spot" with two long hairs) arise from antheridia, each antheridium producing many antherozoids. The fertilised egg (oospore) at once develops into a new fucus. In Fucaceæ the epidermis adds to the growth of the plants, unlike its behaviour in higher plants, where it remains a simple layer. "H. W." will see that I have supposed him somewhat familiar with technical terms and general reproductive phenomena of plants.

Uttoxeter. N. S. R.

[67979.]—**Elementary Biology.**—Morgan's "Biology," published by Rivingtons, is just the book I fancy "H. W." is in need of. It is written for the Inter.B.Sc. (London) Exam., which, I fancy, "H. W." has in view. I used it for this exam. Huxley's "P. Biology," new and revised edition (10s. 6d.), will enable one to get a practical knowledge of the development of "Rana." McNab's "Classification of Plants" (1s. 6d.) has a short account and drawings of the several parts of the plant "fucus." SUTTON-ON-HULL.

[67979.]—**Elementary Biology.**—Foster and Balfour's "Elements of Embryology" will be "H. W.'s" best aid to a knowledge of the history of the chick and rabbit. He should add as much practical work to his reading as possible, and, of course, should have dissected the adult forms before he begins. When he has gone through the above carefully, he will be able to understand Balfour's "Comparative Embryology," Vol. II., or Haddon's smaller "Introduction to Embryology," for the differences presented by amphibian development; but if he has done no embryology before, he must stick to the chick till he masters it.

Uttoxeter. N. S. R.

[67980.]—**Recovering Sulphate of Copper.**—Precipitate the copper by means of solution of sodic hydrate (caustic soda); collect this, strongly heat, boil in strong sulphuric acid, evaporate down low, then stand and let crystallise; dissolve again, and recrystallise. F. W. MASON.

[67980.]—**Recovering Sulphate of Copper.**—Filter off through slag-wool or asbestos; evaporate in earthen vessels until it crystallises on cooling. Collect the crystals. If not pure enough, redissolve in clean hot water and recrystallise. Or precipitate all the copper by adding scrap-iron or zinc to the filtered solution as long as any brown copper powder is precipitated. Collect this, wash it on a filter, redissolve it in dilute sulphuric acid, and crystallise. This will give a very pure sulphate.

S. BOTTONE.

[67981.]—**Accumulators.**—To light an 8-volt 5c.p. lamp for four hours you will need four cells, exposing 9in. by 9in. of positive surface. You will have to run your dynamo for six hours.

S. BOTTONE.

[67984.] — **Forming Accumulators.** — The plates rapidly improve by continuous usage.

No SIG.

[67984.]—**Forming Accumulators.**—At best, your accumulators will not give much more than two ampère hours. To form, send the current in one direction till the acid begins to boil briskly. Now let the cells discharge. Now reverse the connection of the battery, and charge the contrary way. Again discharge, reverse, and repeat these operations till your plates retain as you desire. Then afterwards always charge in one direction, and do not entirely discharge. S. BOTTONE.

[67985.]—**Engine.**—This will run at 290 revs., according to size of ports. If steam is carried ⅔ of stroke you may get ¼H.P. Vertical boiler, say, 16in. by 9in., with firebox. Burn fine coke and coal or gas, as will suit you.

Bristol. T. C.

[67986.]—**Practical Electric Bell-Fitting.**—Try nitrate of silver, 30 grains; common salt, 30 grains; cream of tartar, 3½ drachms. Mix, and moisten with water for use; or you can immerse it in a solution of cyanide of potassium, which will silver it. F. W. MASON.

[67986.]—**Practical Electric Bell-Fitting.**—I have found the following a good silvering paste for brass-work. Pour 1oz. strong nitric acid into a gallipot; set this on the hob near the fire. When the acid boils throw in about 1dwt. of silver wire; when this is dissolved add a good tablespoonful of common salt; then make the whole into a paste with powdered whiting. As soon as the action ceases you can use the paste. But you must be very careful not to inhale the fumes given off when you add the silver, as they are very poisonous. Have your work quite clean and free from grease, rub a drop of dilute sulphuric acid over it, and then rub some of the paste on with a bit of rag tied round the end of a stick. A coating of silver quickly forms, which can be polished with an old wash-leather.

Forest Hill. J. MINUTO, Electrician.

[67990.]—**Counting Speed of Quick-Speed Engines.**—Use an ordinary counter; but if speed is very high, gear down the counter with a pair of wheels 5 to 1.

Bristol. T. C.

Fig. 13. DIY map varnish recipes. *English Mechanic & World of Science* 49 (1250): 37. March 8, 1889.

varnished maps were varnished regularly and for many different purposes, thus providing a different entry point to the maps' cultural and material history because, as varnished objects, they fulfilled specific social functions and stood for unique historical experiences. Varnished maps were meant to be put on display in broad daylight, to be touched and handled, and, following the advice of good housekeeping or educational instruction, washed and rewashed. Varnished maps were used objects, and the varnish itself was as much part of the map's material structure as it is now the patina reflecting its historical experience. If technology allows, I root for refurbishing historical wall maps with some kind of modern noninvasive varnish so that we may recapture their historical function in all its messy forms.

ACKNOWLEDGMENTS

I am profoundly grateful to Seth Irwin for inviting me to join the discussion of all things related to varnished wall maps. Meeting him and the working group was inspiring, and I am indebted to our many conversations.

APPENDIX. "MAP VARNISH"—SELECT PRIMARY SOURCES, 1666–1900

The following working bibliography of primary sources cross-references terms related to "varnish" and "map." Assembled in chronological order, its sources include handbooks, sales catalogs, newspapers, and magazines, among others. Sources were cross-checked using databases like EEBO, ECCO, EAI (Part 1), *America's Historical Newspapers* (AHN), ProQuest's *American Periodicals*, or *Google Books*. Select quotations are included, with "map" and "varnish" bolded for easy reference.

1666. *Academia Italica. the Publick School of Drawing, or, the Gentlemans Accomplishment* 2nd ed. London: Printed by Peter Lillicrap, 1666.

*"How to make Prints and **Maps** lie smooth and even on Cloth or Paper" (14)…*

*"…. Then hang them up on Lines to dry, and when they are you may prepare them to make them bear Colours [sic] and **Varnish**." (p. 14)*

1672. Salmon, William. *Polygraphice; or the Art of Drawing, Engraving, Etching, Limning, Painting, Washing, Vernishing [sic], Colouring [sic] and Dying…* London: Printed for Richard Jones, 1672.

"Ch XIX. Of Washing, and the Materials thereof.
*By washing, here we intend nothing else, but either to set out **Maps** or Printed Pictures in proper Colours [sic], or else to **vernish** [sic] them." (p. 201)*

1762. [Kennedy, Robert]. "To be TAUGHT, THE ingenious and curious Amusement of Painting on Glass, in its Perfection, by ROBERT KENNEDY." *Pennsylvania Gazette*, no. 1762 (July 29, 1762): 1.

*"He likewise **varnishes** papered Rooms or Hangings, Family Pieces, **Maps** and Prints of all Kinds, &c." (p. 1, supplement)*

1774. [Reed, John]. "Advertisement." *Pennsylvania Gazette*, no. 2381 (10 Aug. 1774): p. 4.

*"Any Gentleman inclining to have their **Maps** framed, painted, gilded and **varnished**, may have them done in the neatest manner." (p. 4)*

1793. [Reading, Howell]. "Advertisement." *Federal Gazette* (10 Jan. 1793): p. [3].

*"THE SUBSCRIBER Has now the pleasure presenting to you, and the World at Large, His MAP of the STATE ... He colours [sic], **varnishes**, and fully completes the said **Maps**, on Rollers, or Frames, in a style superior to those done in London." (p. 3)*

1804. Tingry, P. F. *The Painter and Varnisher's Guide*. London: G. Kearsley, 1804 (see also 1830 and 1832 editions).

*"The word **varnish** is a general expression used to denote every dry or liquid substance, the extension of which over solid bodies gives to the surfaces of them a certain lustre [sic] by a combined effect of the reflection and refraction of the rays of light." (p. 104)*

1806. [Sullivan, John]. "Advertisement." *Repertory*, vol. III, no. 83 (17 Oct. 1806): 4.

*"Transparent Varnishing & Colouring [sic]. John Sullivan, Jun. […] [I]nforms the Publick [sic], that he colours [sic] and **varnishes Maps**, Charts, and Prints …" (p. 4)*

1808–1841. Bailey, Lydia. Account book, MS, Historical Society of Pennsylvania, Philadelphia.

1811. [Cottu, Mr.]. "Advertisement." *Evening Post*, no. 2720 (11 Feb. 1811): 1.

*"MAPS, PAINTINGS, & DRAWINGS Varnished at the shortest notice … Mr. Cottu respectfully informs the public, that he has on hand, a constant supply of superior varnishes, &c. … **Spirit wine varnish for maps**, &c." (p. 1)*

1815. Melish, John. "Geographical Establishment in Philadelphia." *The Port-Folio, Vol. 6*, Iss. 5 (Nov 1815): 519.

*Mr Melish will shortly publish by subscription, … A six sheet map of the United States … The map will be either mounted on rollers and **varnished**, or put in the portable form like a book. (p. 519)*

1816. [Street, John]. "Advertisement." *Poulson's American Daily Advertiser*, vol. XLV, no. 12359 (27 June 1816): 1.

*"**Copal Map Varnish**—this is a substitute for spirit of wine **varnish**, and has been proved by several to be superior to any heretofore used for varnishing on papers; its elasticity and quality of resisting water, whereby it can be washed and freed from dirt, are the principal advantages—one coat of this gives the paper a beautiful gloss, whereas two or three of the other is requisite." (p. 1)*

1817. [Street, John]. "Advertisement." *Poulson's American Daily Advertiser*, vol. XLVI, no. 12625 (12 May 1817): 1.

"Copal Map Varnish—this is a substitute for spirit of wine varnish, and has proved superior to any before used for paper or maps—it resists water so that maps or rooms varnished with this varnish, can be cleaned at pleasure." (p. 1)

1824. Parker, Dr. M. *The Arcana of Arts and Sciences, or, Farmers' & Mechanics' Manual; Containing a Great Variety of Valuable Departments of Human Knowledge, Many of which were Never before Published*. Washington, Pennsylvania: Printed by J. Grayson, 1824.

*"**VARNISHES** are those smooth, glossy, enamel-like coverings which are laid on metals, wood, leather, and paper, &c for the purpose of adding to the beauty of their surface, and to preserve them from the effects of dampness, dust, &c.*

*"Thus lacquers, Japan liquors, &c. are a kind of varnishes, as well as those used by cabinet-makers for their furniture, and the **map** and picture-makers to preserve their work from being soiled by dust, flies, &c…. (p. 156)*

*"A **Varnish** for Copper Plate Prints or **Maps**. …*
"19. First lay on a coat of water (in which some isinglass has been dissolved) with a very fine brush; then another made of true spirit of wine, half a pound; gum elemi, two drachms; and sandarac, three drachms, dissolved together." (p. 160)

1827. [Leggett, Charles]. "Advertisement." *Providence Patriot*, vol. 25, no. 22 (17 Mar. 1827): 3.

*"Looking-Glass Manufactory.… Glasses repaired, **Maps varnished** and mounted, and window Cornishes furnished, at short notice." (p. 3)*

1831. [Mackenzie, Colin]. *Mackenzie's Five Thousand Receipts in all the Useful and Domestic Arts*. Philadelphia: James Kay, Jun. & Co., 1831. (4th American Edition).

[From chapter on "Varnishes."]
To prepare wash colours [sic] for **maps**.
For yellow. *Dissolve gamboge in water; or French berries steeped in water, the liquor strained, and gum Arabic added. …* For red … For blue … For green … *To keep water-colours [sic] from sinking… If the prints are to be varnished, wash them all over with white starch, before beginning to lay on the colours [sic]." (p. 53)*

1841. "NEW YORK SCHOOL APPARATUS." *Connecticut Common School Journal*, Vol. 3, No. 8 (15 February 1841): 127.

*"The cards and **maps** in the following list are neatly put upon binder's board, bordered with red paper, and **varnished**; and are fitted to be hung, as literary ornaments, on the walls of a school room." (p. 127)*

1842. *The Practical Mechanic and Engineer's Magazine*. Vol. 1 (Glasgow, Scotland; March 19, 1842): 158.

*"How is **Map Varnish** Prepared?*
Take 1 part of pulverized gum mastic, 1 balsam of Canada, 2 spirit of turpentine; mix and keep it in a warm place until the ingredients are dissolved, and the varnish is fit for use. N.B.—The maps must be sized with isinglass, before the varnish is applied,—J.A.E."

J. Stanton, of London, gives a recipe nearly the same as the above, and adds the following:—Dilute ¼ lb. Venice turpentine, with about a gill of spirit of wine, which will make a varnish of about the consistence of milk, but which when dry will be perfectly transparent. (p. 158)

1854. Charles Tomlinson. *Cyclopaedia of Useful Arts, Mechanical and Chemical, Manufactures, Mining, and Engineering… Vol. II* (London: George Virture & Co., 1854).

"Varnish. **Crystal varnish *for maps***, *prints, coloured [sic] drawings, &c.—Dissolve 2 lbs. of mastic, 2 lbs. of damar, without heat, in one gallon of turpentine; or mix Canada balsam and oil of turpentine in equal parts. (p. 898)*

1859. Thompson, Francis Benjamin (ed.). *The Universal Decorator*. Volume the Third. London: George Vickers, 1859.

"186. **Crystal Varnish for Maps**, Prints, Charts, Drawings, Paper Ornaments.—*Procure a bottle of Canada Balsam, draw out the cork, and set the bottle at a little distance from the fire, turning it round several times, until the heat has thinned it; then have something that will hold as much as double the quantity of balsam; carry the balsam from the fire, and, while fluid, mix it with the same quantity of good turpentine and shake them together until they are well incorporated. In a few days the varnish will be fit for use, particularly if it be poured into a half-gallon glass or stone bottle, and kept in a gentle warmth. (p. 34)*

1866. *The Country House: A Collection of Useful Information and Recipes: Adapted to the Country Gentleman and His Household, and of the Greatest Utility to the Housekeeper Generally*. London: Horace Cox, 346, Strand, W.C., 1866.

*"**Varnish** for Pictures, **Maps**, Etc.*
No. 1.—Equal parts of Canada balsam and spirits of turpentine, applied as thin as possible. The picture must first be sized. To make size, boil down strips of leather; an old white kid glove will do. They should boil till nothing is left of them but a sort of residuum, which comes to the top of the liquid. The mess, when cold, becomes a perfectly strong jelly." (p. 13)

1873. "Winter and Early Spring Flowers." ***Godey's Lady's Book*** **(Philadelphia: September, 1873): 289.**

"SAVE THE LEAVES.— It is becoming a favorite amusement to select the rarest variegated autumn leaves; … To prepare these leaves, press them under heavy weights for a few weeks, ***varnish*** *them with* ***map varnish*** *if you desire a shiny surface, and arrange them as fancy dictates." (p. 289)*

1875. "Advertisement." ***Columbian Register*****, vol. LXIII, no. 3243 (16 Jan. 1875): 3.**

"BIG INVENTION. Lloyd, the famous map man, who made all the maps for General Grant and the Union army,… has just invented a way of getting a relief plate from steel so as to print Lloyd's Map of the American Continent … on one entire sheet of bank-note paper, 40 × 50 inches large, on a lightning press, and colored, sized and ***varnished for the wall*** *so as to stand washing and mailing anywhere in the world, for 25 cents, or unvarnished for 10 cents. (p. 3)*

1877. "Haasis & Lubrecht Map and Chart Establishment." Advertisement. Coll 214, 84 × 85. Joseph Downs Collection of Manuscripts and Printed Ephemera, Winterthur Library.

1882. Andres, Erwin. ***A practical treatise on the fabrication of volatile and fat varnishes, lacquers, siccatives, and sealing-waxes*** **… trans. and ed. by William T. Brannt. Philadelphia: Baird, 1882.**

"Insoluble **Varnishes** for Copper-plates and **Maps**
When copper-plate engravings, maps, and paper in general are to be coated with a thin layer impervious to water, but nevertheless elastic, the following process is used…" (p. 140)

"**Caoutchouc Varnishes**"
"Caoutchouc varnishes possess the exceedingly valuable property of offering a complete resistance to the influence of water, and in this respect surpass all other varnishes. … [A]rticles coated with this varnish will show no cracks." (p. 172)

1884. Blakelee, George E. ***Blakelee's Industrial Cyclopedia. A Simple, Practical Guide for the Mechanic, Farmer, Housewife and Children of every Thrifty Household in Town and Country*****. New York: Baker & Taylor, 1884.**

"Varnish for Maps." (p. 170)

1888. Fenner, B. ***Fenner's Complete Formulary, Being the Sixth Edition of Fenner's Formulary, ... A Complete Formulary and Hand-Book of Valuable Information for Pharmacists, Manufacturers of Chemical and Pharmaceutical Preparations, Physicians, and Students of Pharmacy and Medicine*****. Westfield, N.Y.: B. Fenner, Publisher and Proprietor, 1888.**

*"***Crystal Varnish** *is made from Canada Balsam mixed with an equal volume of Oil of Turpentine. It is also known as* **Map Varnish** *and is used diluted with oil of turpentine for making tracing paper…." (p. 1193)*

1889. Map Varnish recipes. ***English Mechanic & World of Science*****. Vol. 49, No. 1250 (March 8, 1889): 37.**

*"[67966.]—**Varnishing Maps**.—I spoilt my first in the same way, but now use the size (made of gelatine or clear glue) cold, so as to keep it on surface of paper. I like mastic varnish best. Kanet" (p. 37)*

1897. Ebert, Albert E. and A. Emil Hiss. ***The Standard Formulary: A Collection of Nearly Five Thousand Formulas for Pharmaceutical Preparations, Family Remedies, Toilet Articles, Veterinary Remedies, Soda Fountain Requisites, and Miscellaneous Preparations Especially Adapted to the Requirements of Retail Druggists*****. Chicago: G.P. Englehard & Co., 1897.**

*"**Varnish, Map**.*
Saturated solution of borax……..fl.oz. 12
Shellac, fine powder……av oz. 6
Shake together, but apply no heat." (p. 468)

1899. Livache, Ach. ***The Manufacture of Varnishes, Oil, Crushing, Refining and Boiling and Kindred Industries. Describing the Manufacture and Chemical and Physical Properties of Spirit Varnishes and Oil Varnishes; Raw Materials, Resins; Solvents and Colouring [sic] Principles; Drying Oils, Their Extraction, Properties and Applications; Oil, Refining and Boiling, The Manufacture, Employment and Testing of Various Varnishes*****. Translated by the French. London: Scott, Greenwood & Co., 1899.**

*"***Map Varnish**.—*A gutta-percha varnish is the one particularly selected for coating maps and manuscripts. Ten parts of gutta-percha cut into thin strips and well dried are placed in a vessel containing 40 parts of bisulphide of carbon and 20 parts of eucalyptus oil; the whole is allowed to digest and agitated from time to time until the whole is dissolved, after which it is set aside to clarify and the clear liquid decanted. If this solution be too thick it is thinned down with benzol. Objects before being covered with this vanish ought to be very dry. It is very durable, and its surface can be written upon, which is an advantage." (p. 208)*

1900. Dick, William B. ***Encyclopedia of Practical Receipts and Processes. Containing Over 6400 Receipts, Embracing***

***Thorough Information, in Plain Language, Applicable to Almost Every Possible Industrial and Domestic Requirement*. New York: Fitzgerald Publishing Corporation, 1900.**

> *"2920.* ***Map Varnish*** *is prepared by pulverizing 1 ounce of sandarach, ¼ ounce mastic, ¼ ounce elemi, dissolving them in ½ ounce of Venice turpentine, and adding to it a solution of 4 ounces shellac, and 3 ounces oil of lavender, in 12 ounces of alcohol." […]*
>
> *"2935.* ***French Transparent Colorless Vanish****. To make white French transparent colorless vanish for maps, the solution…. has to be bleached…" [followed by long recipe] (pp. 267–269)*

NOTE

1. The paper draws on research from Martin Brückner, *The Social Life of Maps in America, 1750–1860* (Chapel Hill: University of North Carolina Press and Omohundro Institute of Early American History and Culture, 2017). Sources referenced in the essay are cited in the appendix.

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An Aqueous Alternative for the Removal of Varnish from 19th-Century Wall Maps

INTRODUCTION

This article describes a method for varnish removal that was demonstrated at the Varnished Wall Map Symposium held at the New York Public Library in September 2022.

To be perfectly clear, it is important that it is understood that the information presented in this essay regarding conservation treatment procedures and all observations and conclusions drawn from them are not based on objective scientific research and analysis. Rather, these are empirical observations from more than 40 years of experience with repeated successful results from about 1980 in my first studio in Torrington, Connecticut, until the closing of the Heugh-Edmondson Conservation Services studio in Kansas City, Missouri, in 2019. Furthermore, this essay can only be written in the first person because it is a personal account of how the removal of varnish from 19th-century maps was achieved without the use of solvents such as ethanol, isopropyl alcohol, or other polar solvents of that nature that would be effective on natural resin varnishes.

THE BACKSTORY

I was first introduced to the treatment of 19th-century wall maps during an apprenticeship at what was then the New England Document Conservation Center (NEDCC) in Andover, Massachusetts, in the mid-1970s. The process was straightforward, to use that term loosely, and started with some degree of dry surface cleaning to remove the worst of the soiling, followed by immersion in water baths to initiate cleaning of the paper component and set the stage for removing the cloth/linen backing. (As those who treat these items know, they are frequently badly shattered in one or more areas, and washing and the subsequent removal of the linen backing creates a logistical problem in keeping track of the fragments. Exactly how that aspect of map treatment is handled has as many approaches as there are conservators solving that problem.) A new cloth backing was prepared by prewashing and pasting a high-quality artist's canvas to a tabletop with wheat starch paste, and a layer of Japanese paper was applied overall. The old linen backing was removed, and the map was faced with polyester film, usually in its sections, and reassembled on the new backing. All/any loose fragments were repositioned as best as possible, and after a final smoothing brush-down, the map was left to dry, usually (but not always) by the next day. This procedure was started in the morning and completed by the end of the day. After the map was thoroughly dried, the varnish was manually removed with cotton swabs and ethanol. This is the point where my discontent with the process remained for many years because the manual removal of the varnish allowed enough to penetrate the paper and leave it as brown as the discolored varnish layer had been.

My first studio was on the second floor of a late 19th-century commercial building in downtown Torrington, Connecticut. It was at the back of the building and consisted of two good-sized rooms totaling more than 1100 square feet, with very high ceilings and a large skylight in the center of the deep front room that augmented the two 8-foot fluorescent fixtures fitted with UV filtering sleeves where I had my two sinks and an office area where I would meet clients when they came into the studio. At the back of the office/sink/wet area was a large opening into the second room that was nearly square and had two huge double-hung sash windows. The sinks were top-grade stainless steel and were manufactured by a local metal shop. It as requested that the largest sink be 6 ft. × 4 ft. × 6 in. and its companion to be half the length. (Due to the vagaries of metal fabrication, all measurements ended up being shy by fractions of inches.)

I opened the Torrington studio in the spring of 1978. By the early 1980s, I had already received several requests to undertake the treatment of varnished wall maps and had done so following the general NEDCC protocol described previously, with one exception. I chose to use unbleached cotton muslin as my new lining fabric instead of an artist's canvas for

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a few main reasons. First, muslin has a much tighter weave and is closer in appearance to the usually lightweight and finely woven linen found on these maps. The second reason was simply that the cost of good artists' canvas is comparatively high. A third reason was that the artists' canvas frequently imparted a weave texture into the newly remounted map, which required an interlining of Japanese paper, and which meant more work and more expense. I did not have any solvent fume extraction capability, so I would leave the studio for a couple of hours after manually removing the varnish with ethanol and cotton balls. The issue of driving dissolved varnish into the map continued, and there was a pattern of discoloration all over the light-colored muslin backing that matched any losses and/or breaks and cracks in the paper, which was very disfiguring to the verso. This left even the most successful treatments unsatisfactory.

A FORTUITOUS MISJUDGMENT

My private practice was six or seven years old and finally consistently paying for itself (and sometimes even for me), when a map of unusually promising appearance was brought to me for treatment. Even through the discolored varnish layer, it was obvious that the applied colors were still there, and the physical damages that were enough to require a new backing were not catastrophic in and of themselves. I was eager to see this piece at completion but was struggling to finish a project to clear the table surfaces that would be required to reline the map. Both sinks were available because the wet work on the other project had been completed, and it was only a matter of finessing the mending and aesthetics. I did the usual preparation work to prepare the map for washing, which included separating it at the horizontal seam so that it could be stacked in two halves in the large sink and washing the muslin that I kept rolled and in a plastic bag in my studio refrigerator. A modification to the NEDCC protocol that I had adopted was to make the water of the first few baths as hot as could be had from the tap and to add a few tablespoons of baking soda to the very first bath. This did seem to facilitate the washing and separation of the maps into the usual four sections and made completing a treatment in a day make more sense to me.

The preceding operative words in this scenario are "it was only a matter of finessing the mending and aesthetics" for the project I was trying to complete. As we all know, finessing mends and aesthetics easily becomes a rabbit hole that can be quite difficult to get out of. Redoing a fill or loosening a mend to get a better alignment of edges starts with just a few minutes to initiate but ends with hours to complete. In this situation, what I had anticipated to be a few hours of work became a marathon that dragged on for about a day and a half. In the meantime, the wall map was waiting in the only place where there was room for it: lying stacked in the large sink, immersed in water. To avoid the development of mold, it was necessary to change the water baths every hour or so during the day and leave the map in a fresh change of water before going home in the late evening—and thinking to myself all this time that maybe we would not tell anyone about this. Two days later than intended, I was finally able to move forward with the map treatment.

Throughout this prolonged immersion, I kept checking the condition of the paper. I was relieved that it was showing no sign of increased deterioration since the first wash, nor was there any evidence of microbial contamination; this last may be due to the very hot water and raised alkalinity of the initial bath. What did surprise me was that when I touched the surface of the map, the varnish layer, now very much blanched, disintegrated and floated off into the water. I used a soft-bristle brush and tested a couple of random areas and had the same result. With rising hopes, I turned back the screen carrying the top sections of the map to assess what was happening in the underlying sections. There was some similar degradation of the varnish, but not to the same degree. After taking an hour or so to evaluate the situation, I realized that even though the amount of immersion time in the baths was the same, the map sections on top of the stack had been exposed to the ambient light in the studio from the skylight and the fluorescent lights, whereas the underlying sections had not. I separated the two top sections at the seam and cut the linen backing, then transferred them to a fresh bath in the adjacent smaller sink to hold until the bottom half of the map had been exposed to light for one more day. That one more day proved sufficient to complete the breakdown of the varnish, and removing the varnish from all sections using a soft-bristle brush was completed. All four sections were gently rinsed with running water to get rid of the loosened varnish and placed in a final rinse bath prior to mounting on a new muslin lining. Even while still wet, it was obvious that the paper was quite bright and fresh looking, and all applied colors remained intact.

For the record, my lining technique is not significantly different from that of most of my colleagues except for the use of unbleached muslin and the absence of the inserted layer of paper between the map and the textile, which some might consider significant differences.

Before use, I always washed the muslin at home in warm water without a detergent and stored it damp in a plastic bag until it was time to paste it. I had a large (6 × 6 ft.) piece of eighth-inch Plexiglas that I built a frame for to make it easier to handle and to keep it flat as the map(s) dried. I always sanded the surface of the acrylic sheet with a medium grit wet or dry paper to provide tooth to allow the pasted muslin to stick during the drying phase. I applied a liberal amount of freshly cooked wheat starch paste using a Liebco 10-knot pure bristle brush (and if you do not have one of these, good luck getting one) until the muslin was uniformly coated and smooth with no air bubbles. Most of the maps I worked on were printed in four sections and mounted with half-inch overlapping seams

starting with the bottom right quadrant. I found that the easiest way for me to handle them was to transfer each section from its washing carrier face down onto 5-mil polyester film and transfer the map section to the desired location on the pasted muslin. The clear polyester film allowed me to properly align the succeeding sections until the lining was completed. A final brush-down was done through a Hollytex interleaf to remove air bubbles and set the contact with the muslin. The drying time ranged from 12 to 24 hours, depending on the environmental conditions. There are always finishing and/or finessing issues that must be dealt with, but the most rewarding result of this procedure was almost always a fresh and creamy paper tone that allowed the printed and colored details of the maps to have a strong and clear contrast.

CONCLUSIONS/OBSERVATIONS

It is important to remember that the procedure discussed previously is most valuable for the independent paper conservator working in a small studio with little or no means of effective and efficient solvent fume removal.

Although it cannot be denied that this aqueous treatment to remove a natural resin varnish from paper, a wall map, or otherwise is unorthodox, neither can it be denied that it works. Over the years, I have had to adjust my thinking and attitudes about certain tenets that are held regarding the conservation treatments of works on paper. Obviously, whatever is on the paper support also must be able to tolerate any aqueous procedure(s), so the only caveat that can be stated on this subject is that the degree of solubility of any applied colors usually cannot be determined until well into the treatment because the varnish acts as a fixative until it is gone, no matter the methodology for its removal. Therefore, document the locations and colors of any fields one does not want to see permanently removed and have this discussion with the owner/curator beforehand.

Until that forced prolonged immersion event, I had pursued aqueous treatments as needed, wanting to get the most improvement with the least risk. After completing the preceding and subsequent map treatments, I came to conclude that there are two general types of paper-based artifacts: those that can tolerate aqueous treatments and those that cannot. These are usually quickly distinguished (and once a piece of paper is saturated with water, it cannot get any wetter). The whys and wherefores of this are too complex and numerous for this document, but it does remind me of a theory a philosophy professor told me: that ultimately there will only be two kinds of squirrels, those that will successfully cross a road and those that will not even try.

In the early years of my career, one of the "understood" tenets of paper conservation was the incompatibility of paper and textiles, which I had no reason to doubt. At NEDCC, it was one of the main reasons for applying a layer of Japanese paper to the new canvas backing (along with preventing embossing the map with the weave texture of the canvas). As I treated more and more wall maps, I could not help but think that the broken condition of the maps did not have anything to do with being lined with a textile; rather, it was the result of how they were handled over the years. When such a lining takes place, the textile is saturated with water and starch paste and is as contracted as it can be, and the paper is saturated with water and therefore is as expanded as it can be. And that is how they dry. In my opinion. Which is based on well over 40 years of doing and observing—but most important of all, thinking about what I have been doing and observing.

A POSTSCRIPT

In early February 2024, Denise Stockman (NYPL-LSC) sent an e-mail to the participants of the Varnished Wall Maps Symposium describing the treatment of a varnished wall map using a house-made heat-set tissue (Sekishu paper coated with a 1:3 mixture of Lascaux 498HV and water) to face some areas of potential fragmentation and stabilize them during treatment. With Denise's permission, I mention this here because I believe that the procedure has great potential. Rather than paraphrase, I quote: "I applied a facing of heat-set tissue only in places that had small pieces that would detach when the fabric backing came off; then I washed it, lined, and removed the heat-set tissue. It just peeled off while the map was still wet." After pressing in a blotter stack, "I noticed that the varnish had been unevenly (but cleanly and without disturbing the media) removed in the places where the heat-set tissue had been" (Stockman, pers. comm.).

Perhaps instead of "unevenly," "selectively" might be more descriptive; nevertheless, the point I make is that it appears that the wet treatment phase broke the bond between the map paper and the varnish layer, and the thermal-activated adhesive retained its bond with the varnish, and it was lifted away. Nice! This procedure needs to be thoroughly and extensively explored, as it has the potential to drastically reduce the dependence on solvent removal of varnishes from maps and reduce the aqueous approach down to hours.

Trust me, the irony of this is not lost on me.

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Varnished Maps Treatment Protocol at the Conservation Center for Art and Historic Artifacts

INTRODUCTION

The Conservation Center for Art and Historic Artifacts (CCAHA) is a regional laboratory based in Philadelphia, Pennsylvania, serving collections across the United States. Specializing in books, photographs, and paper objects, CCAHA conservators treat objects for a wide range of clients. Our clients include private individuals, large institutions with their own conservation departments, and everything in between. The objects that our clients select to send for treatment may be based on our recommendations through collection surveys but more often come from the client's judgment of their most vulnerable and important objects to be preserved. There is often some plan for display after treatment, although clients' goals may also include digitization or general collections stewardship.

Varnished wall maps are frequently selected for treatment both because of their importance and their precarious condition. For many local historical museums or archives, a historical map of the area is an important grounding framework to understand the rest of their collection. Private clients often feel a great connection to a historic map because of their connection to the area depicted. At the same time, these maps can be extremely fragile due to their history of use. Their size and composite nature make them a challenge for treatment, storage, and display.

In response to the unique needs of varnished wall maps, CCAHA has developed a fairly standard treatment protocol. Our choice to generally treat large maps intact is based on our clients' preferences, but it also allows the map to be experienced as it was intended. Treating a large map in one piece requires adequate space, supplies, and personnel—CCAHA is fortunate to have both large open work spaces and a depth of staff.

Proceedings from the AIC-sponsored event, "Varnished Wall Maps: A Collaborative Seminar to Investigate Treatment Methodology," September 14–16, 2022.

MATERIALS OBSERVED

Although individual examples may differ, a typical wall map is printed on paper, mounted on fabric, hand-colored with watercolors, and varnished with a water-resistant resin. It may be attached to wooden bars at the top and bottom edges and have separate edge bindings (fig. 1).

The paper is typically a medium-weight, machine-made wove paper. It may be either a single sheet or multiple sheets that are joined with approximately a half-inch overlap. The paper would be neither too stiff nor too thin to tolerate repeated rolling and unrolling. The fabric mount would provide additional support for rolling and for hanging a display. Almost universally, the fabric is adhered with a water-based adhesive. In many cases, the adhesive is a quite bulky starch or flour paste that can bridge the gaps between the flat paper and the textured weave of the fabric.

The lined map will be fastened to wooden bars at the top and bottom edges with small nails; in some cases, the edge is inserted between two bars that are joined around it. The upper bar is used to hang the map on the wall, and the lower bar mostly serves as a weight to keep the map from curling up when on display. Frequently, the right and left edges will have an edge binding: a colored ribbon wrapped over the edges and sewn through the paper and both layers of fabric. When the ribbon is made from silk, it may be almost completely disintegrated. This edge binding originally offered protection to the edges as well as an attractive finished appearance. Once removed, there will be a line of perforations along the edges from the sewing.

In the late 19th and early 20th century, wall maps were typically printed with black lithography inks. Colors could be applied either through printing or by hand. Most coloring was executed in flat shapes to distinguish natural features, properties, towns, counties, or states, frequently with a darker edge along these political outlines. After the image was created, the maps would be coated with a protective resin to make them more durable. The coatings are always insoluble in water but are usually soluble in ethanol. If ethanol does

Fig. 1. Wooden bars and edge binding. Map of Jefferson County, West Virginia, 1883. Private client. Courtesy of CCAHA staff.

not dissolve the coating, further testing will be carried out to determine an effective solvent.

CONDITION ISSUES

The most striking condition issue can be described as fragmentation (fig. 2). Wall maps tend to develop a network of horizontal and vertical creases due to their repeated rolling and unrolling. There is also a fundamental incompatibility in a paper-on-cloth lining. In humid conditions, paper will expand whereas cloth (spun threads) will contract, which causes innate tension. Over time, the creases will develop into splits in the paper and eventually split through the cloth backing as well. Where the paper has split or torn, the exposed edges will begin to detach from the cloth, leading to growing areas of loss. A loose weave or heavy cloth will also have many gaps where the rounded threads are not in contact with the flat paper: this may be bridged by a bulky adhesive or may just limit the areas of adhesion.

Typically, there will be a band of extreme damage along the edge that was on the exterior of the roll, reflecting the greater handling and exposure of that section, whereas the interior will be less fragmented. There may also be splitting from increased stress along the attached wooden bars or in areas of tenting. It is also common to see historic repairs of this splitting, which may include pressure-sensitive tape on the verso or adhesives inserted between the cloth and paper in areas of damage. These repair adhesives seem more likely to discolor than the original mounting adhesives.

Overall discoloration can become so severe that the image becomes difficult to read. This can be a combination of both the paper and the varnish yellowing. Even if the black lines remain legible, the overall yellowing can interfere with viewing the colors that are used to distinguish separate areas, particularly if both green and blue were used. Yellow pigments may not even be detectable until after the discoloration is reduced. Fading of the colors is common, and copper-based pigments may discolor to brown, also inducing discoloration of the paper that is visible on the verso.

The varnish may also begin to flake or wear off along creases (fig. 3). These areas will look like whitish marks with

Fig. 2. Fragmentation. Lippincott Family Tree, 1880. Private client. Courtesy of CCAHA staff.

Fig. 3. Varnish flaking along creases, exposing underlying color. Courtesy of CCAHA staff.

many extending white tendrils—this is the underlying paper core color contrasting with the yellowed varnish.

TREATMENT PROTOCOL

Initial Steps

Initial spot testing will determine if a map can undergo CCAHA's standard treatment protocol. If there is a varnish present, the first step is to confirm that the varnish is soluble in ethanol. Ethanol (denatured alcohol) is our preferred solvent for varnish removal because it is effective on most varnishes and usually safe for the media, but it is also considered the least harmful to the conservators. Some varnishes have required acetone or a 2:1 mixture of ethyl acetate to xylene.

Because testing must be carried out before proposing the treatment to a client, we try to test discreetly but thoroughly enough to accurately propose and price the treatment. After testing for varnish removal, the media is tested in both the chosen solvent and the potential wash water solutions. Media testing under a layer of varnish can be challenging. CCAHA conservators generally use a combination of testing in areas where the varnish has flaked, locally removing varnish before testing, and testing existing detached fragments. Even with careful testing, we advise clients that some reduction of the color may occur. Typically, the clarity gained by reducing the varnish and paper discoloration makes the color appear more vivid than before treatment, even if minor pigment loss occurs. In some cases, small areas may also be sealed with cyclododecane or cyclomethicone D5 before washing.

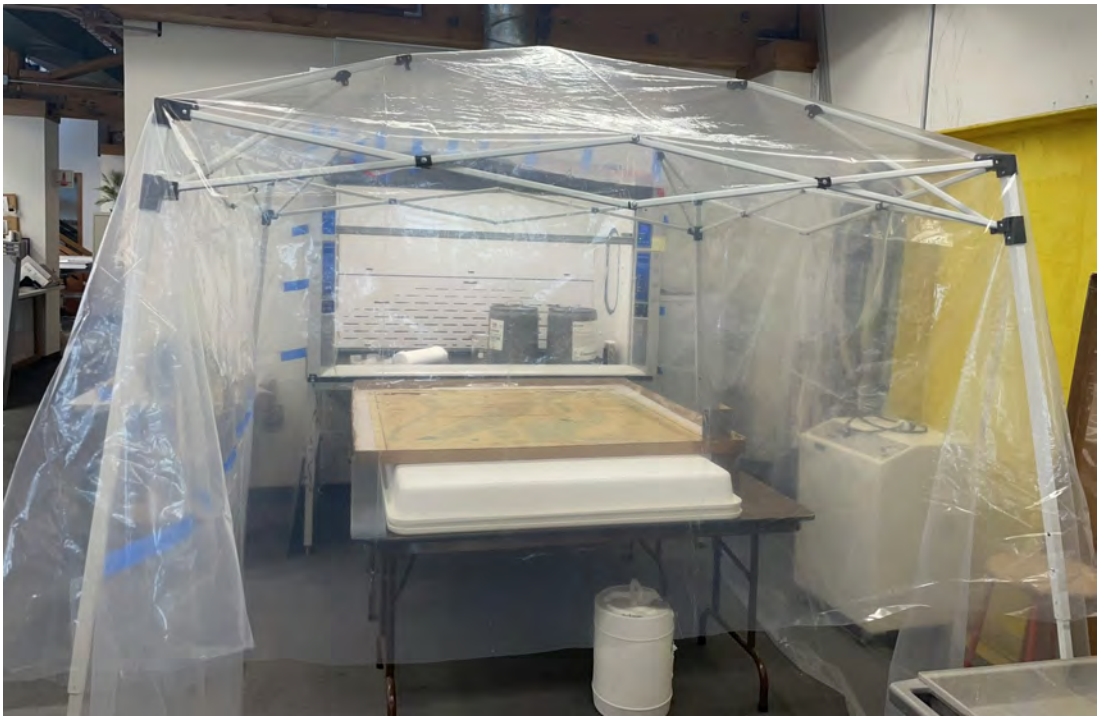

Fig. 4. Pop-up tent frame draped with plastic, with airflow provided by the fume hood. Courtesy of CCAHA staff.

As the first treatment step, the wooden bars and edge binding ribbons will be detached by removing the nails and stitching. Typically, the bars are returned to the client separately. In some cases, the client may request that they be reintegrated into the map's display housing.

Loose surface grime on the recto will be surface cleaned with additive-free polyurethane sponges to the extent possible. The fragmented nature of the surface generally prevents aggressive cleaning or the use of eraser crumbs. However, one benefit of the varnish layer is some protection from engrained surface grime in the paper support.

Varnish Removal

After surface cleaning, the varnish is removed. This step is done with a full immersion in ethanol (or another solvent). During the immersion, the map is still adhered to cloth lining for support, but it is also supported on Hollytex (spun-bonded polyester fabric). If the map is wider than a roll of Hollytex, the Hollytex can be joined with an ultrasonic welder.

Such a large solvent treatment requires some adjustments to normal procedures. CCAHA is fortunate to have a 6-foot-wide fume hood, but most varnished maps are larger than a laboratory fume hood in at least one dimension. To control the solvent fumes, a temporary negative pressure room is built to extend the protection of the fume hood. This is constructed by erecting the frame from a pop-up shade tent against the open fume hood, then draping the tent frame with a polyethylene sheet painter's plastic (fig. 4). The plastic sheet is not airtight, so air is drawn from the laboratory out the fume hood exhaust. Inside the tent, conservators wear solvent respirators. There is no detectable solvent odor outside the tent.

For the actual immersion, a cardboard tray is constructed to fit the object. Polyethylene sheeting is draped over the tray and secured to the walls with binder clips to form a temporary solvent sink. Before using the sink, a small section in one corner of the cardboard tray is removed (fig. 5). This allows the solvent to be drained from the sink without removing the map.

When the map is immersed in the solvent bath, the varnish usually solubilizes quickly. It can be gently agitated without dislodging paper fragments by rubbing with cotton through a layer of thin Hollytex #3249 (15 gsm). The solvent bath usually becomes quite yellow and will be changed at least once until it remains clear. The solvent is removed by draining through the precut hole in the cardboard tray and then blotting the map (fig. 6); the map is left inside the negative pressure room until any residual solvent has evaporated. The drained solvent is collected by a hazardous waste company.

Washing and Backing Removal

Once varnish removal is complete, the map can move immediately to washing, backing removal, and relining, or it can be kept for another day. Once the washing begins, it will cause further damage if the map is allowed to dry, either attached to the cloth lining or with no lining. Treatment must continue until lining is finished, so washing should not be started too late in the day.

Fig. 5. A corner cut out of the cardboard tray. Courtesy of CCAHA staff.

Fig. 6. Draining the sink by pushing the plastic through the hole to a Mylar funnel. Courtesy of CCAHA staff.

Wall maps are generally larger than the sinks available, and immersion washing would also risk displacement of the many fragments. Instead, the map is washed on layers of Tek-Wipe saturated with calcium-enriched deionized water. Tek-Wipe is a nonwoven fabric composed of cellulose and polyester fibers; CCAHA uses Tek-Wipe to blotter wash many fragile objects. To prepare the washing surface, Tek-Wipe fabrics are dipped in the wash water, then spread on a large table and smoothed flat with a squeegee. Tek-Wipe is sold in 34-inch rolls, so usually two sheets are butted together to make a wide enough surface. Two layers of Tek-Wipe provide an adequate reserve of wash water. The level of saturation of the Tek-Wipe can be adjusted to either provide a film of water or capillary washing action.

The map is supported between Hollytex sheets and sprayed with a 50:50 solution of water and ethanol to promote even wetting. It is then transferred to the Tek-Wipe washing surface. The map may need to be smoothed down through the Hollytex to ensure adequate contact with the Tek-Wipe. The first wash is used to soften and release the cloth lining adhesive and may take up to two hours.

When the cloth lining is releasing easily, the face of the map should be covered with Bondina to hold all fragments in their original location. Bondina is a spun-bonded polyester similar to Hollytex but with a very smooth finish. The fragments will be held in place by the surface tension of the water, not an adhesive-based facing. The Bondina must be smoothed down to achieve full contact. A 5-mil Mylar (polyester film, also called Melinex) will be laid over the Bondina on the face to provide additional support during moving. For extremely large maps, an even thicker Mylar may be used. The map is lifted off the washing support with Mylar and Bondina on the face, the map on its cloth lining, and then the Hollytex support on the verso. The map will be flipped over and laid face down on a second table (fig. 7).

With the map face down, the cloth lining can be removed. It should detach easily; if it resists to the point of endangering the map, it should be returned to the Tek-Wipe wash until it can be removed safely. To avoid disturbing the fragments, linings are usually removed in strips; the degraded fabric will tear easily (fig. 8). The fragments should remain adhered to the Bondina facing with surface tension. Adhesive residues on the verso of the paper are removed at this point with cotton wool, microspatulas, and cotton swabs. Adhesive reduction may take up to two hours on highly fragmented maps.

Once the adhesive has been reduced to the extent possible, the Hollytex support is replaced on the verso of the

Fig. 7. Laying the map face down on Bondina and Mylar.

paper. Again, the Hollytex must be laid smoothly on the map because any cockles will prevent contact with the Tek-Wipe wash layers. The sandwich of Hollytex, map, Bondina, and Mylar is then flipped to lie face up on fresh Tek-Wipe, again saturated with wash water. The Mylar is removed during washing but is helpful whenever the map is being transferred between washes. Hollytex, not Bondina, is still used below the map, as we have found that water and discoloration move more easily through Hollytex.

One potential pitfall of washing on Tek-Wipe is a tendency for capillary action to draw discoloration to the face of the object during evaporation; this can be reduced by spraying the face with water that will be drawn down into the slightly drier Tek-Wipe. If the media solubility allows, additional saturated Tek-Wipe on the face will also avoid this, as well as encourage faster washing. Capillary action can also be used to advantage by letting the ends of the Tek-Wipe hang over the side of the table so that the water drips away from the map, drawing discoloration with it. The Tek-Wipe are changed for fresh ones approximately every 30 minutes; washing generally continues until little to no discoloration is visible on the Tek-Wipe after 30 minutes of washing.

Fig. 8. Peeling the backing away in strips. Courtesy of CCAHA staff.

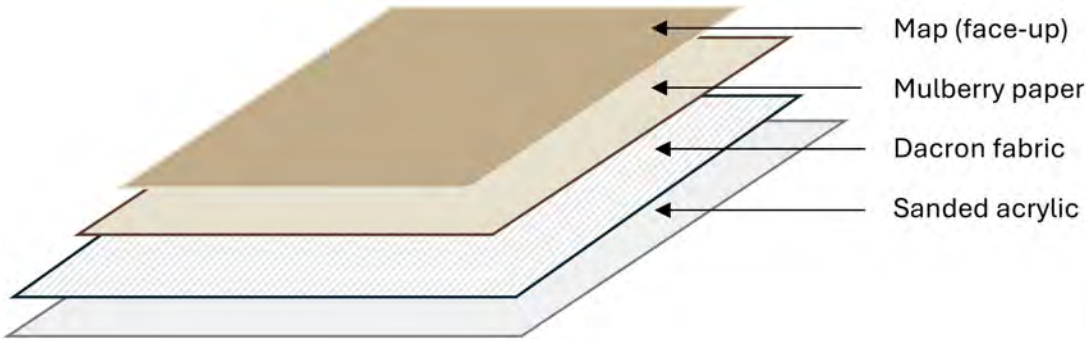

Fig. 9. The layers of a Dacron lining.

Dacron Lining

Once the backing is removed and the map has been washed, it must be lined before drying. Allowing the map to dry before an overall support is attached would risk expanding the tears and losing the position of the fragments.

Lining materials and supplies are prepared during the washing process. This includes presoaking the paste brushes and Dacron fabric; cooking, straining, and thinning a paste; preparing an instant paste; preparing a 50:50 mixture of wheat starch paste and methylcellulose; and preparing the mulberry paper pieces and Mylar supports. For large linings, it may be necessary to use more than one piece of mulberry paper joined by overlapping water-torn edges. CCAHA conservators generally use machine-made mulberry paper on a roll for large linings; the grain direction is with the length of the roll. Some of these tasks could also be completed the day before, especially for a lengthy lining.

The Dacron lining method has been previously described in the *Book and Paper Group Annual* (Albright and McClintock 1982). In a Dacron lining, the object is lined face up, with the lining adhered to layers of Dacron fabric and acrylic that are detached once dry (fig. 9). The original Dacron material, which CCAHA still uses, is no longer available for purchase, but testing has identified a suitable replacement (Cuoco and Hamilton 2008). This lining method is ideal for large wall maps because it dries in plane, avoiding an enormous blotter stack. Having the map face up and uncovered also allows for small adjustments to the fragment alignment after lining.

CCAHA conservators have introduced slight modifications to the Dacron lining method for efficiency. The steps we use are as follows:

1. Soak the Dacron to remove any residual paste.
2. Begin soaking the paste and water brushes early in the day to swell the bristles.
3. Prepare "instant paste," wheat starch 301 from Talas, in a blender to a pourable yogurt consistency.
4. Cook and strain standard jin shofu wheat starch paste, then divide into two parts: one larger and one smaller.
5. Mix the smaller portion of wheat starch paste with an equal amount of 5% A4C methylcellulose in water.
6. Thin the jin shofu wheat starch paste and the 50:50 mixture of paste and methylcellulose to the consistency of heavy cream.
7. When the map is washed and ready to line, it should be flipped between sheets of Mylar to be face up, with the Bondina and Mylar from the face removed. This is the "jigsaw puzzle" step, where any misalignments are corrected. Spraying with water will allow fragments and sections to slide on the Mylar; when they are correctly aligned, blotting with a dry Tek-Wipe will lock them into place.
8. Replace the Bondina and Mylar on the face, then flip the map again to lie face down and remove the verso Mylar.
9. While the map is face down and correctly aligned, lay thin, toned mulberry paper behind zones of large loss. Mulberry paper can be pretoned with acrylics; commercially available toned mulberry papers can bleed color and must be washed before use.
10. Paste out a sanded Plexiglas support with the "instant paste."
11. Stretch the Dacron fabric between two or more conservators, then lay it on the pasted Plexiglas. Smooth the fabric with a stiff-bristled brush, print brayer, or gentle squeegeeing.
12. Paste out the fabric with the 50:50 mixture of paste and methylcellulose.
13. Wet out each piece of mulberry paper, rough side down, on its own slightly larger sheet of Mylar, using a sprayer and a water brush.
14. Drop the mulberry paper onto the pasted Dacron by holding the Mylar between two conservators, lowering it onto the Dacron surface, and smoothing it through the Mylar with a tamping brush. The Mylar is removed by rolling it into a cylinder or peeling at an acute angle, leaving the mulberry paper behind.
15. If more than one mulberry paper is needed for the width of the map, water-torn edges can be slightly overlapped

Fig. 10. Lowering the map onto the pasted-out lining paper. Courtesy of CCAHA staff.

without additional paste. Drop the following mulberry paper in the same way. If an additional layer of mulberry paper will be used, the steps will be repeated with the second layer applied cross-grain to the first.

16. Paste out the mulberry papers (now adhered to the Dacron) with thinned wheat starch paste.
17. Lower the map onto the pasted mulberry paper, using the surface tension of water to hold it to the Bondina and Mylar layers on its face (fig. 10). The Mylar should be held fairly taut. The map may not have enough surface tension to support itself in this stage if it is either too wet or too dry, so use caution. This step may require three or four assistants; if the assistants are not experienced at performing Dacron linings, one person should be clearly instructing their movements. As the map is lowered onto the pasted support, one person brushes through the Mylar with a stiff brush to ensure smooth contact and good adhesion. The surface can also be tamped through the Mylar once it is fully laid down.
18. Peel or roll the Mylar away at an acute angle, separate from the Bondina.
19. Peel or roll the Bondina away, taking care that fragments and tears in the map are not lifting as the Bondina is removed.
20. Allow the map to dry on the Dacron for several days. If the layers dry too fast, cracks in the map may pull apart or the Dacron may detach from the table. The drying can be slowed by building a cardboard and plastic sheet cover, elevated about 6 inches above the surface, that also protects the map. The map can also be covered with felts to slow drying further if needed.
21. When the map is fully dried, any toning and fills may be applied while it is still held in plane by its adhesion to the Dacron and Plexiglas.
22. The Dacron, with the map attached, is removed from the table with a large Teflon spatula.
23. The Dacron and the attached map are flipped face down, and the Dacron is peeled away from the lining.
24. The extending lining edges are trimmed.
25. In some cases, edge strips of mulberry paper may be applied to offer further protection and improve the appearance of highly fragmented edges. To apply these neatly, a remoistenable adhesive of 50:50 methylcellulose and wheat starch paste is applied to the selected mulberry paper. When dry, strips are cut, placed neatly on the edges, and reactivated with either water or additional wheat starch paste.

CONCLUSIONS

Although CCAHA's treatment of large maps may be lengthy to describe, it feels quite simple and straightforward throughout.

Maps up to approximately 6 × 8 ft. can be accommodated with our current laboratory space and supplies. Major advantages of this treatment are the relative time efficiency and the

overall low risk to the object. In particular, the combination of using Tek-Wipe for washing and Bondina as a nonadhesive facing minimizes any movement of the fragments. After washing and lining the treated maps are a great deal more stable, both physically and chemically. Our procedure also allows collections to keep their maps intact. Once treated, they can be digitized, exhibited, or stored safely.

Some disadvantages that we have recognized are the necessary use of solvent, the limits to testing the colored media for solubility before washing, and the risk of leaving some traces of varnish sinking into and remaining in the paper fibers. Additionally, a large map treatment can be a long and labor-intensive day for the conservators. Clients also need to understand and plan for the future transport and storage of the map, whether it is framed, placed in a large folder, or rolled on a large alkaline tube.

Even though this treatment has been successfully executed many times at CCAHA, we continue to evaluate and improve all aspects. New knowledge and techniques from conservation colleagues have suggested additional possible treatment strategies, particularly for maps that are poorly suited to our usual approach. This treatment is well suited to most maps encountered at CCAHA; serves the needs of most of our clients; and can be performed with the equipment, space, and staff available.

REFERENCES

Albright, Gary E., and Thomas K. McClintock. 1982. "The Treatment of Oversize Paper Artifacts." *Book and Paper Group Annual* 1: 1–6.

Cuoco, Debra, and Heather Hamilton. 2008. "Alternative Fabric Supports for the Dacron Lining Technique for Paper Objects." *Book and Paper Group Annual* 27: 119–122.

MATERIALS USED

Varnish removal:
- Support Hollytex #3257 (minimum 2 inches larger than map)
- Thinner Hollytex #3249 to lay on the face
- Custom cardboard sink frame
- Polyethylene sheeting
- Binder clips
- Pop-up tent frame
- Fume hood
- Table the height of the fume hood
- Ethanol (denatured with isopropanol, formula SDA 3C) or other solvents
- Appropriate gloves for the solvent selected
- Solvent waste disposal container
- Fit-tested solvent respirators for each conservator

Washing and backing removal:
- Hollytex 3257, minimum 2 inches larger than map, seam with ultrasonic welder as needed (Talas)
- Bondina (Preservation Equipment)
- Tek-Wipe (Polistini)
- Calcium-enriched purified water
- Squeegee
- Cotton wool and swabs
- Two tabletops, each larger than the map

Dacron lining:
- Two sheets of Mylar, 5 mil, minimum 2 inches larger than the map
- One sheet of Mylar for each piece of mulberry paper
- Water-torn Sekishu rolled mulberry paper, weight depending on the size and weight of the map (Hiromi Paper)
- Pretoned mulberry paper pieces for zones of loss
- Bondina: at least enough to cover areas of fragmentation, does not need to be a joined sheet
- 10- to 12-inch-wide paste brush
- 6-inch wheat starch paste brush
- 6-inch Japanese water brush
- Squeegee or tamping brush
- Cooked wheat starch paste (jin shofu or similar)
- Instant precooked wheat starch paste #301 (TALAS)
- A4M methylcellulose, prepared in water
- Dacron or Oxford polyester fabric (Testfabrics), larger than the map
- Sanded Plexiglas (quarter-inch thick), larger than the map

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Mapping the Crossroads: The Conservation of County Wall Maps from the Indiana State Library

INTRODUCTION

The Indiana State Library (ISL) is the primary public institutional custodian of paper-based objects related to the history of the state of Indiana and a significant part of the history of the Ohio River Valley, including the Northwest Territory. Within the ISL holdings is a rare map collection of more than 11,000 maps, a large portion of which are held nowhere else. The historical importance of this collection cannot be overstated. The maps in the collection represent state, city, county, and regional subjects. Roads, rivers, property owners, populations, businesses, and communities are some of the vital information in the historic map collection. Within this collection, there are approximately 70 mid-19th-century varnished maps listed in a "condition critical" state. These maps are oversized, varnished, and lined onto fabric. For most of these maps, even the act of handling them causes pieces to fall off. Due to their extreme condition issues, they cannot be digitized, exhibited, or used in any manner. They are all listed as restricted and unavailable to researchers. This article will summarize the processes and procedures conducted by the ISL Martha E. Wright Conservation Lab to treat and store these maps.

HISTORY

The historical importance of the Indiana maps created from 1850 to 1910 parallel the growth of the state and reflect demographic shifts across the nation. The maps depict the establishment of the last new Indiana county in 1859, the impact of natural gas discoveries in establishing manufacturing centers in the 1880s, and the movement of new Hoosiers across the National Road and to the growing city of Indianapolis. The maps show the crisscrossing railroads that made Indiana "the Crossroads of America" and the population boom that doubled the population of Indiana from 1850 to 1880. As land was stolen from Indigenous peoples, bought, and sold, as settlements were platted, named, and populated, as towns and cities emerged, maps were always part of the process. These resources show the growth of rural and urban communities and the shifting demographics brought by war, industrial growth, the Great Migration, and transportation innovation.

Following the introduction of more adaptable mapmaking and printing technology, it became profitable to commercially produce town, county, and city maps. These large-scale maps dive deep into communities and reveal snapshots in time: businesses, landowners, places of worship, transportation routes, natural features, and even private homes. Because they contain so many details, they are often very large, measuring 4 to 6 square feet. These maps supplement textual records, such as deeds or farm directories, and offer a visual record that adds context to data.

TREATMENT CONCERNS, LIMITATIONS, AND CONSIDERATIONS

In 2020, the ISL Conservation Lab assessed the varnished wall map collection and began creating a protocol for every aspect of its preservation, from documentation to treatment and storage. The preservation protocol required considering the limitations of both the ISL Conservation Lab and the storage of the maps upon completion of treatment. In addition, budget limitations for treatment were factored in.

The ISL Conservation Lab, constructed in 2014, is a fully equipped conservation laboratory, but much of the equipment was not purchased with the consideration of treating oversized objects such as varnished wall maps (figs. 1, 2). The laboratory sink was not large enough to accommodate a fully intact map, there were not enough large tables in the laboratory, and the suction table was not big enough to encompass an entire map. Budget was also a strong consideration in developing the protocol. The common traditional approach to removing the varnish on a wall map is to allow the map to bathe in a bath of ethyl alcohol. This approach would require

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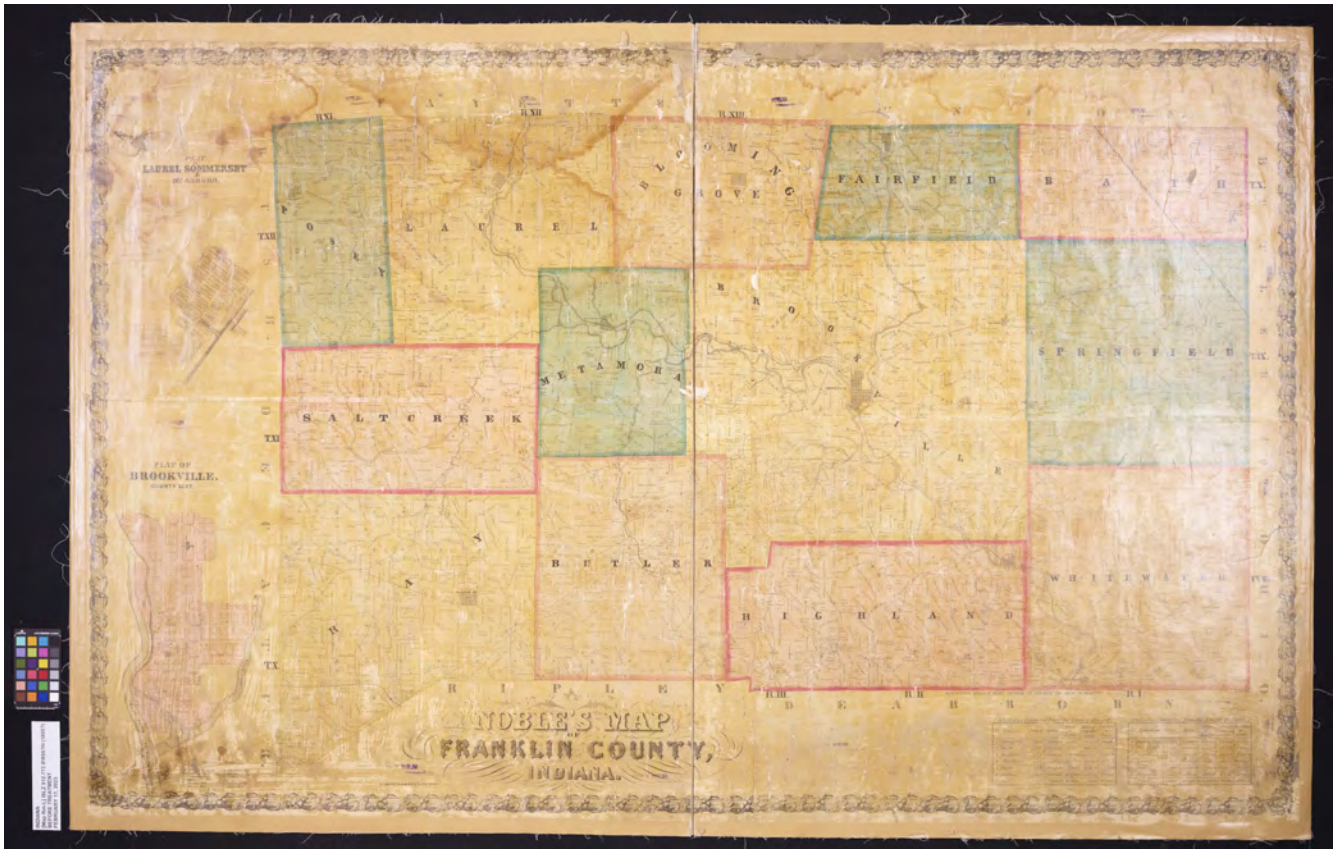

Fig. 1. Before treatment of the 1885 Noble's map of Franklin County, Indiana.

large amounts of ethyl alcohol to be purchased at an average cost of $100 a gallon (before shipping and hazardous materials charges), and due to the size, each map would require several gallons. There was the disposal cost of the used alcohol to consider as well. This approach would have resulted in a prohibitively expensive treatment material and disposal cost of approximately $400 to $500 per map. This cost estimate would have either prevented the project from happening or limited the number of maps that could be treated. To get around this, the treatment protocol would need to account for the use of solvent in a manner that was more budget friendly and did not result in any secondary solvent waste that required disposal.

Storage of completed maps was also a consideration. The ISL has very limited storage for oversized paper objects. The library has very few oversized flat file cabinets (4 × 6 ft. drawer sizes), and many of the wall maps were even larger than these oversized cabinets could accommodate. There is also no mechanism for storing oversized objects rolled either, and there was no ability to either adapt or add additional storage. The treatment protocol needed to account for completed maps being stored in the ISL's existing storage.

Staffing limitations also needed to be considered. The ISL Conservation Division is staffed by one conservator. Although it was possible to occasionally ask for a second set of hands for assistance, this was not always reliable. The treatment protocol needed to be structured so that it could be accomplished by one person with sporadic assistance from library staff with no conservation experience.

TREATMENT PROTOCOL

Step 1: Testing

Testing of both the varnish and underlying media was conducted on a suction table, and one would be done in one of two ways. The first method would be to utilize a fractured piece that had already detached from the map or was about to detach (fig. 3). The second method would be to place the map face down on a blotter on a suction table or suction platen. Multiple types of alcohols were tested, and all maps showed varnish solubility in ethanol, isopropyl alcohol, and denatured alcohol. With the map face down on a suction device, alcohol was applied, through the backing fabrics, using a plastic pipet. This action would solubilize the varnish and pull it out of the

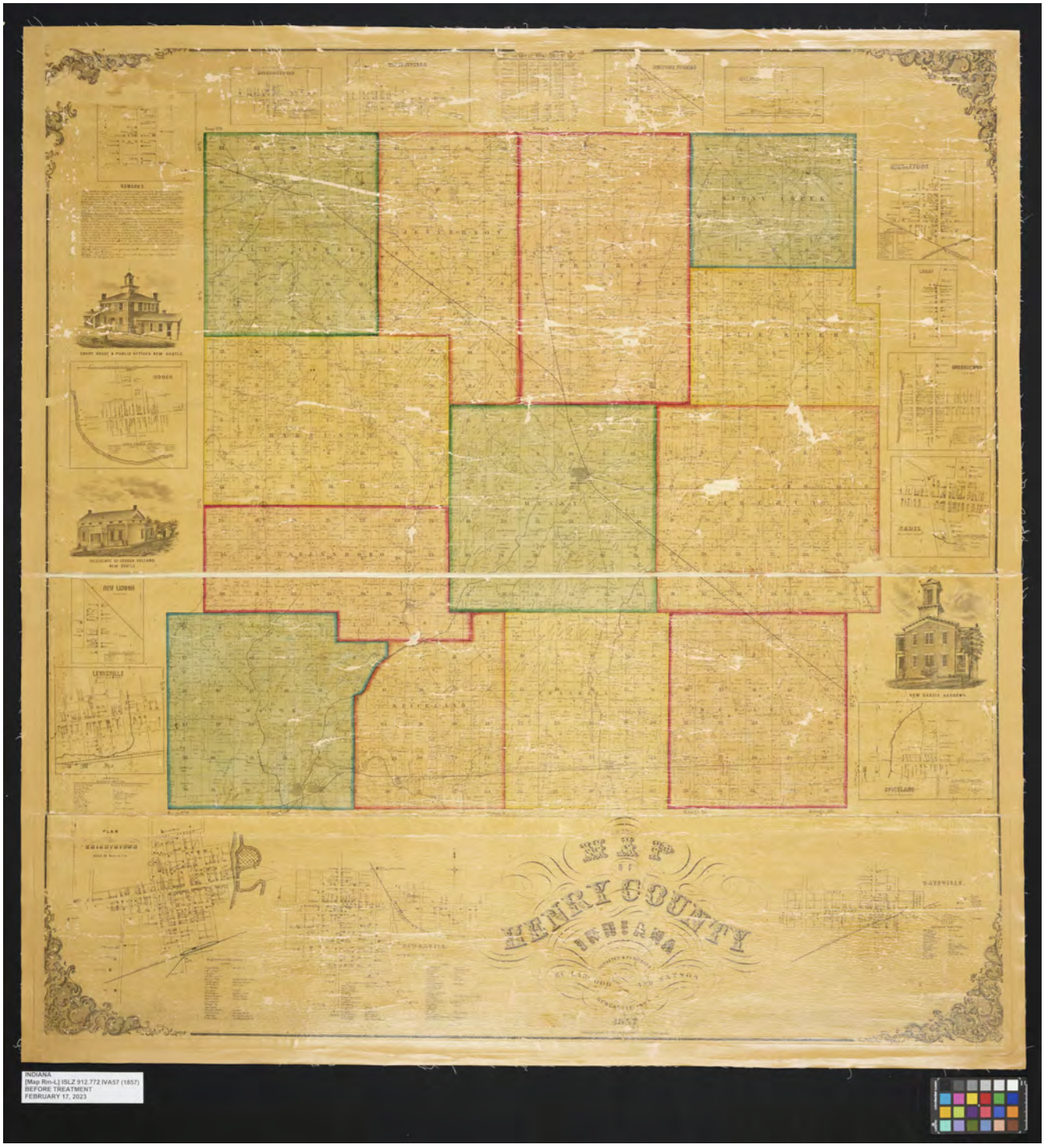

Fig. 2. Before treatment of the 1857 map of Henry County, Indiana.

Fig. 3. Varnish removal and washing of the test piece.

front of the map and into the blotter (fig. 4). The blotter was then inspected for any media transfer. Solubility testing with heated reverse osmosis water was conducted in the test areas where varnish was removed. Most maps showed no evidence of solubility issues with either the alcohol or water. If there were color solubility concerns, these concerns were relayed to the ISL Indiana Division map librarian. In these circumstances, the treatment was usually still allowed to continue based on the pretext that whatever minimal color loss did occur, it was considered an "acceptable loss" to save and stabilize what was generally considered to be an unusable map.

Step 2: Separation of the Map Panels

Once testing was completed and the treatment was allowed to proceed, the next step would be to separate the panels of the map. Most 19th-century varnished wall maps are not one single sheet of paper but rather individual panels that were seamed together before the map was lined onto fabric. For ease of treatment and accommodating the size limitations of both the sink and the suction table, the protocol dictated separating the panels along the seams.

To separate the panels, the varnish was first removed along the seams. This was done by placing the map face down on the suction table on Hollytex and blotter. The backing fabric was removed, with the application of lightly applied water, 1 to 2 inches on each side of the seam. Alcohol was then applied through the back of the map, in the exposed area. The map was then turned face up and, using a Jiffy Steamer with a

Fig. 4. Valinda Carroll conducting a varnish removal test on the suction table.

Fig. 5. Valinda Carroll using a Jiffy Steamer to separate the map panels.

focused nozzle, steam was applied to the seam while gently separating the panels with a microspatula. Blotter was placed around the working area to protect the rest of the map from dripping from the steamer (fig. 5).

Step 3: Varnish Removal

Most of the maps selected for treatment were highly fractured with pieces barely attached to the fabric. Often the fabric was the only structural element holding the map together. It was therefore essential that the treatment protocol minimize the risk of pieces of the map falling off either during the varnish removal or the washing process. This was to avoid the additional work of trying to find the location of any loose fragments afterward. To help prevent fragments from coming loose, conservators typically apply a temporary facing to the front of the map. Rather than applying a separate facing layer, this treatment achieved the effect of a facing simply with the application of a protective spun-bound polyester sheet: Hollytex was applied to the front of the map while removing the varnish face down on the suction table; as the alcohol solubilizes the varnish, it causes the varnish to act as an adhesive for the Hollytex, thereby making the Hollytex act as a facing until the washing step. The map is placed face down on a sheet of Hollytex and then placed face down on blotter on the suction table. The suction table is turned to its highest power setting, and alcohol is continuously sprayed through the fabric (fig. 6). The map is routinely lifted, by the Hollytex, to inspect the blotter for any movement of any media and to ensure that the varnish is successfully being removed (fig. 7). The blotter is changed routinely until all varnish has been removed. When no more varnish is showing up on the blotter, the map is turned face up, and any remaining areas of varnish can be removed with the use of alcohol on cotton. It may require several occasions of flipping the map to remove all of the varnish. Then the map can be placed face up and the Hollytex carefully removed by spraying it with alcohol.

The use of the suction table to remove the varnish has several advantages over the more traditional approach of an alcohol bath for varnish removal. First, this approach used significantly less alcohol. Second, since all of the alcohol is consumed during the treatment, there is no secondary solvent waste to dispose of. Third, the use of the suction table helps to prevent pieces from coming loose. Fourth, the direction the alcohol and varnish travel while being solubilized,

Fig. 6. Marissa Maynard conducting the varnish removal of a map on the suction table.

Fig. 7. Marissa Maynard lifting the map panel during varnish removal to check the blotter for media transfer.

working face down on the suction table, appears to remove the varnish and prevent it from being driven further into the map.

Step 4: Washing

It was determined at the beginning of this process that there was a danger of conducting the washing without taking precautions to prevent loose fragments from floating around during the washing process. This would result in uncontrollable movement of loose pieces, thereby resulting in extensive work trying to find locations for all of the loose fragments at the end of the treatment. As with the varnish removal, the treatment protocol for washing was entirely designed around preventing pieces of the map from coming loose and, should any pieces come loose, making sure that they stay in their correct locations throughout this step.

The washing of the panels is conducted one panel at a time. The panels are placed on a sheet of Hollytex or Reemay on a sheet of quarter-inch acrylic. The acrylic is placed into the sink, and the drain of the sink is plugged. The sink is slowly filled with hot water until the map is barely submerged. Careful attention is paid to making sure that no pieces lift off the map while the sink is filled with water. If possible, water is gently run over the front of the map, taking care to avoid any areas that are fractured. The map is left submerged for at least an hour. To prevent any pieces from lifting or moving around, the water is not disturbed in any way to avoid any rippling or motion. For very fractured maps, a Dahlia sprayer can be used to apply water to the front of the map. After an hour, the sink drain is slowly lifted to allow the water to drain very slowly to prevent any movement of loose pieces. If any loose pieces start to move or come off the map as the sink is draining, they are put back in their correct locations. Once the sink is completely drained and there are no more visible pools of water on the front of the map, the acrylic sheet is slowly lifted at an angle and allowed to rest on the edge of the sink.

Working across the map, gently spray the front of the map with a Dahlia sprayer while gently brushing the surface with a small brush (figs. 8, 9). It is helpful to work in a grid system corresponding with the information on the map. This removes any remaining varnish and dislodges any surface grime. This process will allow for better control of loose fragments. If any loose fragments become dislodged,

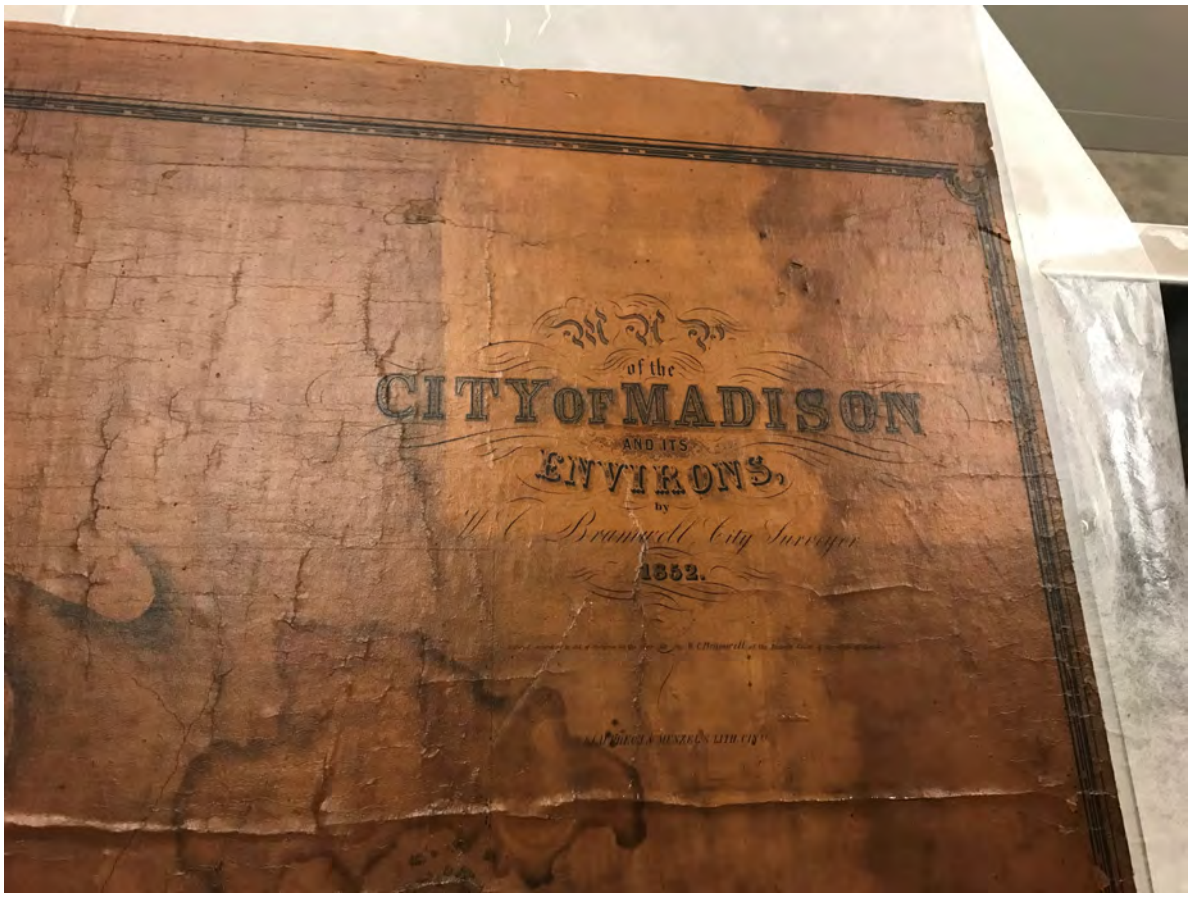

Fig. 8. Washing/cleaning of the 1852 map of the city of Madison, showing the cleaned area in the upper right.

Fig. 9. Cleaning of the map with a Dahlia sprayer and brush.

they can be carefully put back in their correct locations. Every attempt is made to keep all loose pieces in their correct locations throughout this entire process. The map may need to go through several rounds of baths during the step. If this process requires more than a day, the map panel is allowed to stay submerged overnight. Until the panel is ready to be lined, it must remain wet.

Many of the varnished wall maps in the ISL collection were silked during the early 20th century and still contain silk on the entire recto. For many of the maps, the silk had severely deteriorated and migrated into the varnish layer. Testing showed that once the varnish layer was removed, the silk would lift off during the washing process most of the time (figs. 10, 11).

Step 5: Lining the Sections

It was recognized early in the project that storage for completed maps was going to pose logistical challenges, as the ISL has limited oversized flat file storage and no storage for oversized rolled material. Many of the maps were also larger than the 4 × 6 ft. oversize flat file drawers. There was no feasible plan to add or change the existing storage in the ISL. Given these limitations, the decision was made that the map panels would not be rejoined at the end of each treatment. The panels would be separated at the beginning of each treatment and left separated. This solved the storage problem, allowing the maps to be stored in standard flat file drawers, and still allowed for the rejoining of the panels in the future.

The lining of each panel is conducted directly after the washing step. As soon as the map panel is completely cleaned and no more baths are required, the water is drained from the sink, the map is lifted out of the sink on its acrylic support sheet very slowly, and all remaining water is allowed to drain off. Lifting the map by the Hollytex (or Reemay) support, the map is transferred to a sheet of polyester film. The panel is sprayed out with water, and a second sheet of Hollytex is applied to the front of the map. A sheet of polyester film is then put on the sheet of Hollytex. Holding the panel between the two layers of Hollytex and film, the panel is turned over (face down), and the film and Hollytex are removed from

Fig. 10. Conservation preprogram intern Lily Duncan removing silk from the front of a map.

Fig. 11. A close-up of silk being removed from a map.

the back of the map. The backing fabric is then very carefully removed from the back of the map, taking care to make sure that any loose pieces do not come up with the fabric (fig. 12). The fabric can be torn if necessary to aid in its removal. If the map is quite fractured, the fabric removal would start in the middle of the panel and progress toward the edges. If loose pieces start to come up with the fabric, the fabric is sprayed with additional water. Once all the fabric is removed, the Hollytex and polyester film are put back on the back of the panel, and the panel is turned face up again.

It is common with extremely fractured maps to find many of the pieces misaligned, in which case rivers, roads, and text may not line up correctly. These details would require correcting before the map is lined. Once the fabric is removed and the map is turned face up again, the Hollytex and film on the front of the map are removed. To prevent pieces from lifting when the Hollytex is removed from the surface, the Hollytex is sprayed down heavily with water. Once the Hollytex is removed, all the misaligned pieces can be corrected. This usually requires working around the entire map repeatedly in circles, as correction on one end will affect the alignment of details on the opposing end (figs. 13, 14). Once

Fig. 12. Seth Irwin removing the backing fabric following the washing.

Fig. 13. Valinda Carroll aligning map fragments.

Fig. 14. Valinda Carroll aligning map fragments.

Fig. 15. Valinda Carroll preparing the Japanese paper for the lining.

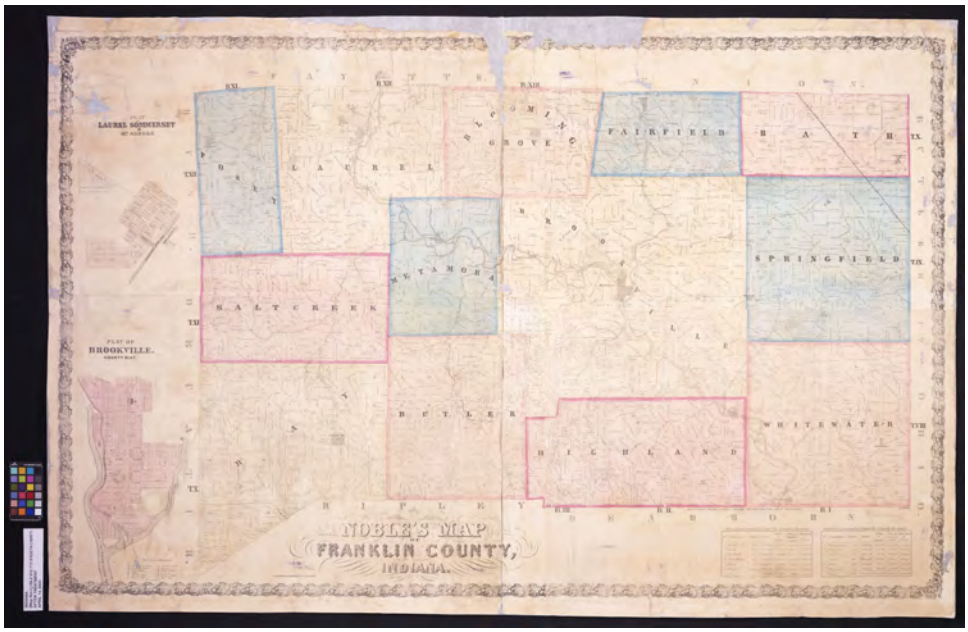

Fig. 16. After treatment of the 1885 Noble's map of Franklin County, Indiana.

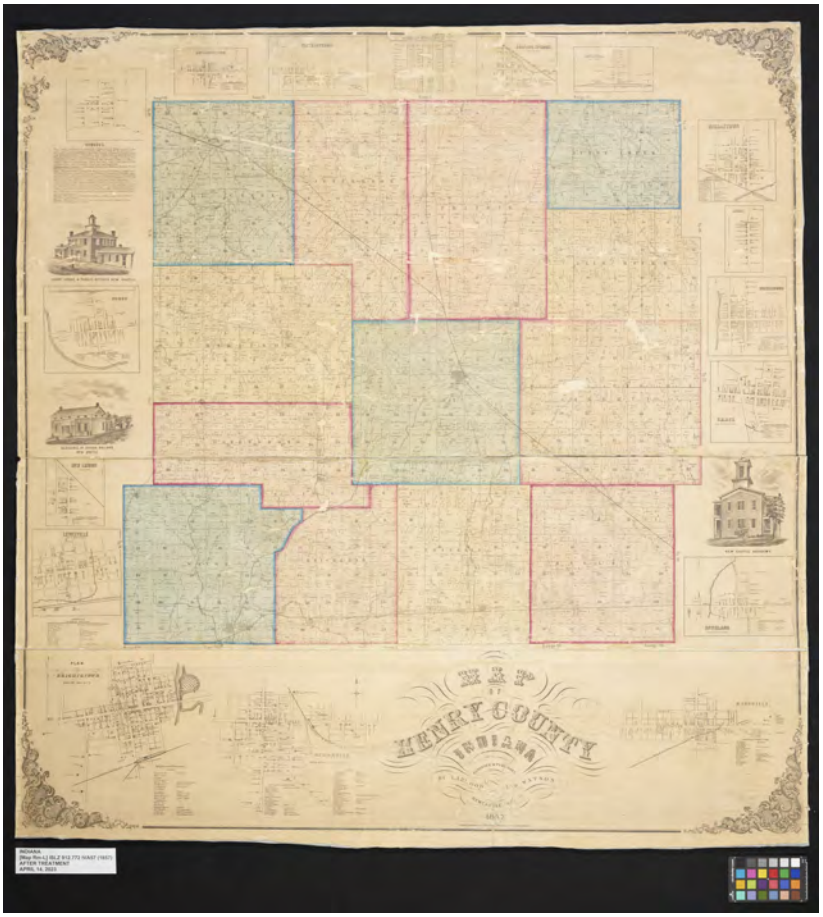

Fig. 17. After treatment of the 1857 map of Henry County, Indiana.

everything is aligned correctly, a fresh sheet of Hollytex is applied to the front and the film is put on the Hollytex. It is important that a brand-new sheet of Hollytex be used for this step as opposed to a previously used sheet of Hollytex that had been cleaned. The use of a previously used sheet runs the risk of sticking to the front of the map after the map is dry. Using a plastic card or printing brayer, the panel is smoothed out flat. The map is then flipped face down again, and the Hollytex and film are removed from the back.

For simplicity, budget, and color, 20-gsm Sekishu Medium rolled Japanese paper was the chosen lining material for all maps. Once the map panel is aligned correctly and the Hollytex and film are removed, a sheet of Japanese paper is pasted out on film and applied to the back of the map. A sheet of Hollytex is applied on the Japanese paper and then smoothed out with a printing brayer or a smoothing brush. The panel is then placed between wool felts to dry (figs. 15–17).

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Treatment of a Map of Pike County, Ohio, at the Intermuseum Conservation Association

INTRODUCTION

One of the biggest treatment issues when dealing with oversized maps is the need to safely remove the varnish layer. The varnish layer is initially applied to protect the paper, but as it ages, the varnish becomes yellowed and darkened. This discoloration obscures the map's visibility and can make it illegible. This article will discuss an approach to successfully removing the varnish from an oversized map.

BACKGROUND/HISTORY

In 2019, while heading the Paper Department at the Intermuseum Conservation Association (ICA) in Cleveland, the author received a call from the director of the Garnet A. Wilson Public Library, located in Waverly, Ohio. The director wanted someone to come and assess an oversized varnished map that had been on permanent exhibit in the Pike County Courthouse.

The map in need of conservation treatment was a Pike County map (ca. 1884). The Pike County Courthouse went through renovations in the 1980s, and the map had been a permanent exhibit ever since. The director of the library and one of the judges had a common interest in preserving the map for the future. They procured an IMLS Library Services and Technology Act (LSTA) grant, and the judge offered his own money to conserve the print with hopes that this would stir interest in another renovation of the courthouse.

The ICA scheduled a 3-hour on-site visit for May 2019. This visit included a consultation with the library director, plus an in situ examination and testing to provide the client with a cost estimate and treatment proposal.

The courthouse is a brick colonial building deeded to the county in 1866 and located one block away from the Garnet A. Wilson Public Library. The entrance is simple, with swinging glass doors that lead into a corridor that extends the length of the building. This corridor is wood paneled along the bottom half with white drywall above and fluorescent tube lighting down the center of the ceiling.

The oversized Pike County map was behind a thick piece of glass and attached to the wall with stained wood frame molding just past security within the main entrance corridor. It measures 182.88 cm high and 349.25 cm wide, which roughly translates to 6 feet tall by 11½ feet wide.

CONDITION ISSUES

The map is an oversized intaglio map of Pike County, Ohio, printed in black ink with hand-applied watercolors in blue, yellow, pink, and green. It is printed onto two sheets of thick cream-colored wove paper coated with a varnish layer and backed overall to linen. It was behind half-inch-thick glass secured to the wall with stained wood molding strips that create a frame.

The map was on permanent exhibit in the corridor where the overhead fluorescent light was consistently on during business hours, plus indirect outside light exposure from the front door. The environmental controls were limited to heat only, with no control over the relative humidity. Over the course of the permanent exhibit, the map had also been exposed to indoor and outdoor pollutants, such as smoking and unfiltered outdoor air, as windows and doors were left open during warm and hot seasons. All of these factors added to the map's deterioration and damage over the decades (fig. 1).

An image sent by the director of the library (seen in fig. 1) showcased that the map had many condition issues, such as being very large, dark, embrittled, and in contact with the glazing. There were undulations throughout with dark speckling that mimicked the appearance of parchment. There was much debris and grime on the surface of the map that was trapped under the glazing. The darkening and difficulty in reading the map were the major concerns of the client.

These identified issues raised many questions for treatment. What is the current strength of the paper? Could this

Proceedings from the AIC-sponsored event, "Varnished Wall Maps: A Collaborative Seminar to Investigate Treatment Methodology," September 14–16, 2022.

Fig. 1. The Pike County map on exhibit in the Pike County Courthouse. Image shared courtesy of the library director.

map be parchment? Is the map adhered to the glazing? How is the map attached to the wall? Will it fall immediately once the glazing is removed? Many of these condition issues were taken into consideration as the on-site examination was scheduled and conducted.

OBSTACLES

The large size of this map presented many obstacles throughout the project. The examination, transportation, imaging, and treatment all required special considerations and accommodations. The initial examination, documentation, and testing needed to be conducted on-site due to the map's permanent display and size. To aid with reporting and testing, court security maintained a perimeter around the map, and an outside glazing vendor provided staff to remove the half-inch sheet of glass and replace it once examination was complete (fig. 2). Doors and windows were opened, and a fan was provided to dissipate the small amount of solvents used for testing.

Another obstacle during this project was safely transporting a map of this size. Fortunately, the ICA had a team of technicians experienced in packing, handling, and transporting oversized objects. It was determined the best way to transport the map would be rolled. The map was wrapped around a 2-foot diameter cardboard tube with a sheet of polyester used to create a barrier around the tube, with another sheet of polyester around the rolled map. A wooden crate was created to secure the map while in transport.

Due to the map's sheer size and weight, it could not be imaged vertically in the photo studio; therefore, it needed to be imaged horizontally on the floor. To get the proper distance for photodocumentation, imaging had to be conducted from the second floor of the building through a floor hatch. The map was placed on the first floor with a plastic barrier underneath. It took a team of four people with the photographer to photograph and move the map around safely.

Special considerations were imperative for the treatment of this map, as a significant amount of organic solvents would be used for varnish removal, but because of the size of the map, it could not be placed on a suction table, in the fume hood, or in the spray booth. The only viable option for ventilation was the elephant trunk in the paper laboratory, which was used in conjunction with a respirator. The treatment

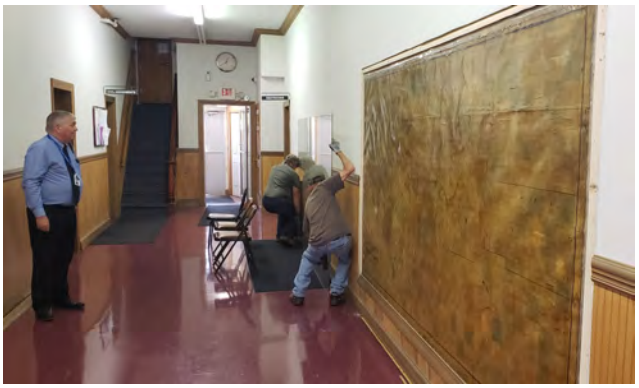

Fig. 2. Glass removal for map examination.

work time was also limited to short intervals, and check-ins with other ICA staff were conducted to ensure that organic solvent exposure was limited.

TESTING AND TREATMENT

Testing to remove the varnish needed to be conclusive during the initial on-site visit; therefore, a range of polar to nonpolar solvents was tested. It was determined that ethanol was the safest and best solvent to remove the varnish layer. The following is a list of the test results to remove the varnish layer from the Pike County map:

1. Deionized water removed some surface soil only.
2. A process with 2.5% methylcellulose in deionized water, with a 5-minute application, did not swell the varnish layer or visibly remove soil.
3. Isopropyl alcohol partially solubilized the varnish layer and grime slowly, but it solubilized inks.
4. Ethanol swelled and solubilized the varnish layer and grime easily, safely exposing the paper layer and ink. It did not solubilize the inks or the watercolor.
5. Acetone removed the gloss to coating and blanched the surface.
6. Methyl ethyl ketone slowly swelled the varnish layer. It did not remove inks or watercolor.
7. Ethyl acetate slowly swelled the varnish layer, but not as quickly or easily as ethanol. It did not remove inks or watercolor.
8. Toluene did not swell the varnish layer or surface soil.
9. Xylene did not swell the varnish layer or surface soil.

Once the map was transported and photodocumented, testing was conducted a second time to confirm the original testing results. The full treatment proposal included surface cleaning, tape removal, adhesive reduction, accretion removal, varnish removal, debacking, washing, tear repair, infills, and relining.

Surface cleaning was conducted on both the recto and verso of the map. A vacuum was used with a hake brush to remove loose surface soil and accretions, then followed up with white nonlatex hydrophilic foam wedges (makeup sponges), and then natural rubber sponges (soot sponges). There was clear packing tape adhered around the perimeter of the map that was removed using a hot air pencil. This method removed the tape carrier with most of the adhesive. The remaining adhesive was further reduced manually with a crepe eraser.

The varnish removal was the biggest concern for this treatment. Testing determined that the least volatile and best organic solvent to remove the varnish was ethanol: 200-proof, food-grade undenatured alcohol. The varnish removal process started with the use of ethanol-dampened cotton swabs that were rolled over the surface, utilizing the same procedure as the testing process, but due to the thickness of the varnish layer and the overall size of the map, it was quickly determined that this method would break the time and supply budget.

A revaluation of the removal process was needed; therefore, other methods were tested. Initially, larger swabs and then cotton balls were used to expedite the varnish removal process; however, the removal was still too slow and was quickly eating up the supply budget. Further testing was conducted using a humidification chamber with ethanol (fig. 3).

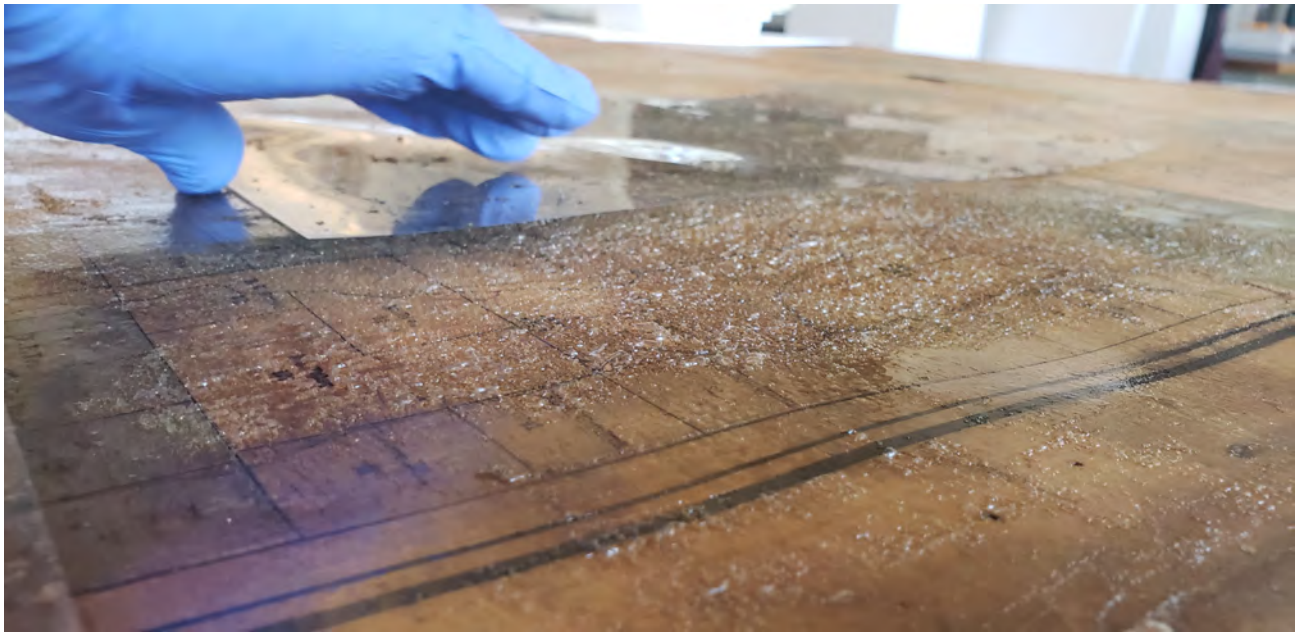

Fig. 3. The swelled varnish layer with an ethanol humidification chamber.

Fig. 4. Manual varnish removal with a microspatula after humidification.

This humidification method easily and quickly swelled the thick varnish layer, which allowed for full manual removal using a microspatula (fig. 4).

The humidification chamber was created by misting ethanol onto the varnish surface and then covering it with a piece of clear polyester sheeting. The polyester sheet allowed the surface to be visually monitored during humidification to determine the ideal swelling time. The humidification process

Fig. 5. The map before treatment.

was modified during removal to include the use of a piece of ethanol-dampened blotter under the polyester. The dampened blotter could be reused for other chambers. This also allowed for even less solvent and fewer supplies to be used overall because each new chamber did not require misting. The second modification included creating larger chambers, from 3-inch squares to 9 × 12 in. rectangles. Then multiple chambers were consecutively implemented to allow for the varnish to be removed on a rotating and ongoing basis. A final cleaning of the surface was performed by swabbing the surface with ethanol. These changes expedited the process and allowed the varnish removal to be completed within 1 week, which came in below the time and supply budget (figs. 5–7).

SUMMARY

A typical varnish removal from paper can be conducted in a few ways, such as using swabs, a suction table, or even bathing; however, this map was not typical. It was found that the use of a humidity chamber with organic solvents was the best process to remove the varnish layer for this project. The varnish swelled quickly and easily; once swelled, the varnish layer was removed effortlessly with a microspatula, making the reduction of the varnish layer on the Pike County map a success.

The manual varnish removal by humidification was successful on this specific project for a few reasons. The paper was thick with a hot-pressed finish, and the varnish layer was heavily and unevenly applied. The size of the map would not allow for the varnish removal by suction table or a chemical bath. The paper was mostly structurally sound, with minimal tears and breaks.

The lesson learned from this project is that all treatments should be individually assessed and reevaluated during the process. A reassessment not only saved time and money by expediting the project, but it ultimately helped formulate a more successful treatment plan that was more environmentally friendly by using fewer supplies and chemicals.

Fig. 6. The map during varnish removal.

Fig. 7. The map after varnish removal.

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Initial Characterization of Wall Map Varnishes Using UVA, Solubility Tests, and ATR FTIR

INTRODUCTION

Reducing the varnish layer is sometimes part of a treatment for varnished wall maps, particularly when the varnish has discolored to the point that it obscures information. This article discusses an investigation into varnish layers carried out following the AIC Varnished Wall Maps Symposium with the intention to better understand the varnishes used on maps in order to inform treatment decisions and provide historical context.

A major part of the symposium discussion focused on techniques and solvents for removing the varnish layer, although the actual compositions of the varnishes remained unclear. The most common solvent mentioned was ethanol for dissolving the varnish, but ethanol was not successful in every case. An online survey of conservators who treat varnished paper objects indicated that about half of respondents found that ethanol was the most effective solvent, whereas the other half found that a different solvent or solvent mixture was required to remove the varnish layer.

This initial investigation of varnish layers on varnished wall maps attempts to identify historically used resins with nondestructive or minimally invasive methods commonly available to conservators: Attenuated Total Reflection Fourier Transform Infrared Spectroscopy (ATR-FTIR) and longwave ultraviolet-induced visible fluorescence photography. The goal is to provide a path for more targeted approaches to varnish reduction.

BACKGROUND

Varnished Maps

The New York Public Library (NYPL) collections include more than 400,000 single-sheet maps. NYPL does not note whether a map is varnished during cataloging, so the number of varnished maps and exact dates can only be guessed without a thorough survey. At least 5% (or 20,000) of those maps are varnished. Anecdotally, most of the varnished maps date to the 19th century, so we have chosen to focus on that time period for this research.

The primary reason for varnishing a map was to provide a protective coating, ease of cleaning compared with unprotected paper, and a more refined appearance. The varnishing (or "finishing," which might also involve hand coloring, linen backing, and attaching wooden rods) may have been done before purchase by the customer, or the customer could bring it to a map finisher after purchase (Brückner 2017). It is likely that map finishers and customers knew that the varnish could deteriorate and yellow but probably assumed that this would happen long after the map's useful lifetime.

We found historical varnish recipes in artist, technical, and household manuals that could have been used in the 19th century. Varnishes are resins dissolved in a solvent to make a film, which is applied to a surface in a thin layer. The solvent volatilizes over several hours or days, leaving a solid layer. There can be other ingredients added, such as a drying oil, dimethyl ether, benzene, borax, or zinc chloride. A mixture of more than one resin can also be used (Lillard 1884; Dick 1900; Fenner 1904, 1510). When a drying oil is added to the varnish recipe, it is known as an "oil-resin type varnish" (Feller 1985; Mills and White 1987). There are many factors that could affect the properties and analytical results for a varnish, such as cooking time, impurities, or additives. There were imitation varnishes made during the 19th century, called "factitious" varnishes (Dick 1900), although it is unclear if these would have been used by reputable mapmakers.

Resins are water-insoluble sticky exudates of trees and plants (or insects, in the case of shellac) produced as a by-product of metabolic systems in the plant. "Resin" is a nonscientific term referring to materials that become amorphous when mixed with a solvent and form a film when the solvent evaporates. Because natural resins are obtained from nature, their exact composition can be variable, but they are largely composed of compounds belonging to the chemical class known as terpenoids (Mills and White 1987).

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Common resins used were copal varieties, dammar, mastic, sandarac, shellac, Canada balsam, and Venetian turpentine. Many older varnish recipes call for distilled turpentine, spirit alcohol (from wine: 80%–90% pure ethanol), mineral spirits, "rectified spirits" (generally about 97% ethanol), or "oil of turpentine" (a.k.a. camphene) as the solvent to dissolve the resin. Turpentine is a liquid derived from distilling the resin from trees, usually pine trees. Mineral spirits are derived from crude oil. Both are a variable mixture of compounds with a boiling point range (rather than a specific boiling point) and vary in composition. In this study, we used pure ethanol to dissolve the resins in order to limit variables.

It is likely that a sizing layer was commonly applied to the paper before varnishing to protect the paper, limit penetration, and prevent the paper from becoming transparent. Materials used for sizing in the 19th century include gum arabic, gelatin, albumen, egg white, isinglass, alum, and parchment size. In this study, we used gum arabic because it was readily available and simple to make.

History of Varnished Map Treatment

Removing the varnish from a paper object is a drastic treatment but is sometimes necessary because varnished paper, especially when also mounted to fabric, can crack and flake, causing losses of the paper and the media. The varnish may also become darkened to the point that the map is unreadable. These effects are variable, likely depending on the past conditions the map has endured. Even when these conditions are present, there can be good arguments for choosing not to remove the varnish layer, such as the presence of annotations added to the varnish layer by a user or concern about loss of its material history.

Alternative treatments for varnish removal include "reforming" the varnish to smooth out craquelure (Feller, Stolow, and Jones 1985; Treacy 2006), pasting down flaking segments, or backing with a stiff material to prevent flexing.

From 2016 to 2018, NYPL conservator Denise Stockman treated six multisheet varnished maps. She developed a technique for treating and lining the maps on a suction table to keep the fractured pieces intact. This method was presented at the AIC Annual Meeting Tips Session and published in the *Book and Paper Group Annual* (Stockman 2018). In all six maps, ethanol was effective in dissolving the varnish layer.

In January 2024, we conducted a survey of conservators who treat varnished paper objects. Of 29 respondents, 16 found that, in their experience, ethanol was the most effective solvent; 11 found that a different solvent or solvent mixture was required to remove the varnish layer in some cases; and 2 did not use solvents for the treatment of varnished paper. A better understanding of historic varnishes could help clarify whether it is the resin used to varnish the map, aging characteristics of the resin, or additives such as a drying oil that affect whether ethanol can be used to effectively remove the varnish.

SAMPLES

Known Samples

Seven resins were applied to discs of Fisherbrand Filter Paper (grade P2) to use as references in comparison with historic (unknown) samples. The resins used were selected from historic recipes compiled in unpublished research by Jim Flatness, which was included as a resource for the AIC Varnished Maps Workshop. Solid resins were mixed with ethanol, as recommended by the AIC Wiki (Samet 1997). Premixed, bottled varnishes were applied unaltered, with the exception of Venetian turpentine, which was heated and thinned with Stoddard solvent. The preparation of each varnish is summarized in table 1.

Some resins mentioned in historic recipes, such as Canada balsam and copaiba balsam, could not be obtained for this study. Canada balsam is still produced but could not be found in the New York City area at the time of the study. Copaiba balsam was excluded, as it could not be found in retail except as an essential oil.

Gum arabic was prepared in a 1:4 w/w mixture with deionized water at 140°C, brushed onto half of the filter paper discs, and allowed to dry fully. Each of the seven varnishes was applied by brush to both sized and unsized discs of filter paper. A sample of filter paper sized with gum arabic

Kremer varnish name	Abbreviation	Product #	Solvent used/Notes
Venice turpentine	VT	62010	Stoddard solvent (20-mL varnish mixture in 8.5 mL of solvent); the product comes as a viscous liquid
Sandarac	SA	602	Ethanol (3.19-g resin in 21.4 mL of solvent)
Mastic varnish for Claude Yves gel	MA	79351	Turpentine oil (premixed in the bottle with about 40% solids)
Shellac	SH	60453	Ethanol (donated to the laboratory premixed)
Dammar varnish, glossy	DA	79301	Turpentine oil (premixed in the bottle with about 50% solids)
Manila copal	MC	6015	Ethanol (3.46-g resin in 30 mL of solvent)
Congo copal	CC	6016	Ethanol (2.79-g resin in 20 mL of solvent)

Table 1. Summary of Reference Samples and Preparation Method

only (no varnish) and a sample of plain (no size, no varnish) Fisher paper were retained.

This resulted in 16 samples, which were cut in half. One half of each was placed in a south-facing window for 45 days to encourage light aging. The other halves were stored in the dark in anticipation of differing analytical results between light-aged and dark-aged samples.

A smaller set of oil-resin varnishes (four total: mastic, Congo copal, shellac, and dammar) was prepared later in the study when preliminary FTIR data indicated that some of the unknown samples may contain drying oils. To prepare this set, the filter paper discs were sized with gum arabic, and the varnishes were applied by brush as mentioned previously. There were no unsized samples prepared for this set because drying oils are known to saturate and transparentize paper, so it is unlikely that an oil-resin varnish would have been historically applied without sizing.

For each mixture, the premixed varnish product or varnish (as prepared previously) was mixed in a 2:1 v/v ratio with linseed oil. The Congo copal and sandarac mixtures were immiscible at room temperature and were heated slightly before application to the sized paper. After air-drying in a fume hood, the samples were placed in the window for 37 days.

Unknown Samples

On the hypothesis that the varnish recipe used by a mapmaking firm would have been consistent within a given year, we decided to note the mapmaking firm and the date rather than other details such as what the map depicts, who designed it, the reproduction method, the paper type, or any other variables. It is our hope to broaden this sample set in the future.

Varnished maps stored in Mylar sleeves were examined for loose pieces inside the package. If the original location of the loose piece could not be determined (and could therefore never be set back into place), the piece was collected for testing. In this manner, we were able to obtain the following 10 small samples:

- J. H. French (Philadelphia) 1860. eBay purchase
- John E. Gillette (Philadelphia) 1854. NYPL MapDiv 16-5990 (note 1)
- J. W. Canfield 1860. NYPL MapDiv 17-5072
- A. Pomeroy (Philadelphia) 1867. NYPL MapDiv 17-5146
- Sidney & Neff (also S.B.Brown) 1851. NYPL MapDiv 16-6-40
- J. H. French & E.A. Balch (Philadelphia) 1858. MapDiv 16-5988
- A. Blondeau 1814, NYPL not cataloged
- H. F. Walling (D.R. Smith & Co.) 1857, NYPL not cataloged
- F. W. Beers (Mecklenburg, N.C.) 1877, NYPL not cataloged
- Carhart, Mead & Co. 1860. NYPL MapDiv 17-5071

TESTING

UVA-induced Visible Fluorescence Examination and Photography

For UVA-induced visible fluorescence photos, samples were illuminated with an Ultra-Violet Products 3UV-38 3UV Lamp set to 365 nm. Images were captured with a Nikon D750, using an AF Nikkor 50mm f/1.4D lens filtered with a Kodak Wratten 2E pale yellow filter and PECA 918 visible pass filter. Images were processed in Capture One using the UV Innovations Ultraviolet Photo Standard Target for white balance and exposure adjustment. All images were adjusted using the lightest gray swatch on the "low" fluorescence target so RGB values equaled 200/200/200.

FTIR Instrumentation

A Bruker Optics ALPHA I compact FTIR benchtop/portable spectrometer equipped with an ATR diamond probe was used. Each spectrum was accumulated from 32 scans with a resolution of 4 cm^{-1} in a range of 400 to 4000 cm^{-1}. The spectrometer was fitted with a permanently aligned interferometer based on a Bruker Optics patented RockSolid design and a DLATGS detector operating at room temperature. All spectra were collected with the varnish layer directly in contact with an ATR diamond probe.

Solubility Testing

Blotting the varnish with solvent-saturated Evolon was selected as a cleaning method for consistency of application. Samples of Evolon (1-cm squares) were placed in sealed jars for one hour with four times the Evolon's weight in solvent, assuming a 100% "solvent load" (Tauber et al. 2018). The solvent selection was based on availability and having been mentioned by survey respondents: Stoddard solvent, xylene, acetone, isopropanol, and ethanol.

Saturated Evolon squares for each solvent were applied to the sized, light-aged varnish samples for 60 seconds while covered with Mylar and rolled lightly with a swab. The efficacy of cleaning was evaluated visually under normal and UVA lighting conditions.

RESULTS

UVA Examination and Photography

The prepared known samples generally showed a blue-green fluorescence (fig. 1). The exceptions were the unsized shellac and Venetian turpentine samples, which fluoresce orange and yellow under UVA, respectively. The sized shellac and Venetian turpentine samples are much bluer in color and more difficult to distinguish from the other varnishes. The fluorescence of the light-aged shellac samples was less intense than that of the dark-aged samples.

The four oil-resin samples are overall less intensely fluorescent than the other prepared samples. These samples are

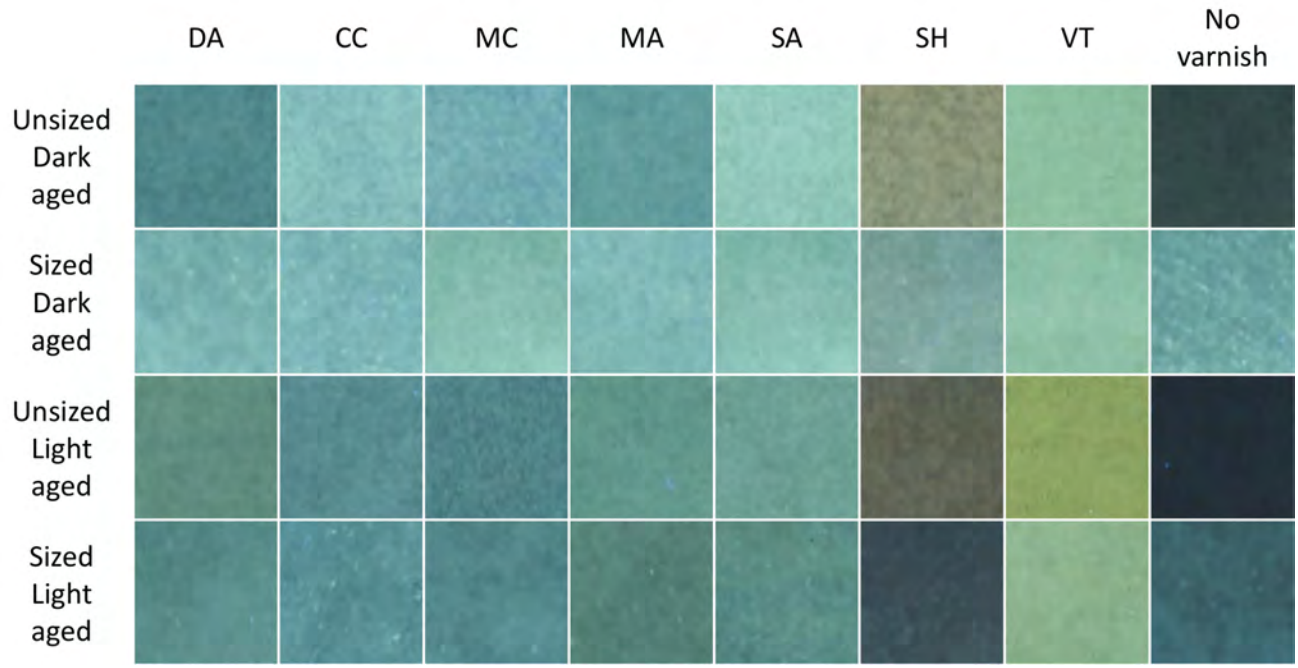

Fig. 1. Details of UV-visible fluorescent photographs captured of known samples. Most of the varnishes show a similar blue-to-green color under UVA with the exception of shellac and Venetian turpentine.

slightly translucent, assuming an error in preparation that would not have been made by professional mapmakers but a factor that affects their appearance in UVA illumination.

The historical samples are very small, making visual comparison difficult. They generally had a yellow fluorescence of medium intensity under UVA, although the Blondeau and Neff samples were darker and more orange (fig. 2). The paper, sizing, and past storage conditions are additional unknowns which may contribute to the perceived fluorescence of the samples. The unvarnished areas of the historic

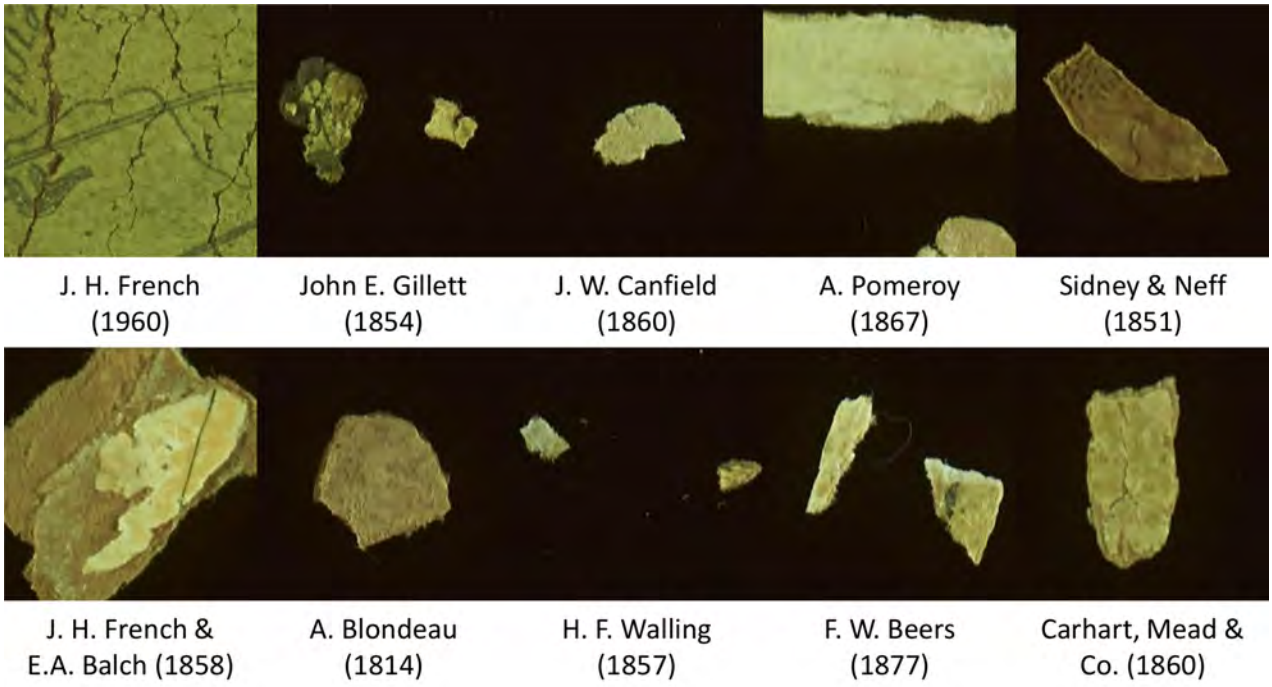

Fig. 2. UVA-visible fluorescence photographs of unknown samples. The historical varnishes generally fluoresce a very yellow color compared to the new, known samples but are also too small to meaningfully evaluate visually.

samples range from nearly nonfluorescent and dark to light orange in fluorescence under UVA.

ATR-FTIR

The FTIR spectra of the known standard samples prepared on paper both sized and unsized displayed very similar spectra, which was thus in distinguishable from each other under our experimental conditions. These samples were intended to be used as standards for comparison with the historical sample spectra; however, due to time constraints, we focused on comparison of the unknown historical samples with spectra obtained from previous studies and from the IRUG database (De la Rie 1989; Russo and Avino 2012; Azémard, Vieillescazes, and Ménager 2014; Price, Pretzel, and Lomax 2014; Cortea, Christache, and Sandu 2016; Martín-Ramos et al. 2018).

We surmise that the following peaks are most notable for natural resins:

- A broad band can be found in the 3500 cm^{-1} region due to the stretching of O-H groups.
- Methylic (-CH_3) and methylenic (-CH_2) give sharp, strong peaks in the ranges of 2960–2930 cm^{-1}, 2875–2865 cm^{-1}, and around 2844 cm^{-1} (C-H stretching).
- Bands between 1467–1448 cm^{-1} and 1387–1382 cm^{-1} are present due to the C-H bending.
- Bands at 1644 cm^{-1}, 1315 cm^{-1}, 3050–2990 cm^{-1}, and 1230–1270 cm^{-1} can indicate C=C stretching.
- Signals in the fingerprint region (below 1000 cm^{-1}) can be a good source of information for distinguishing among the resins. However, it will depend on the signal-to-noise ratio and FTIR conditions and setup.
- A weaker signal may be found at 1240 cm^{-1} due to C-O groups.
- A strong signal was noted between 1715 and 1690 cm^{-1} due to the absorption of C=O groups.
- Aged drying oils have characteristic bands at 3400, 2930, 2855, 1780, 1735, 1713, 1459, and 1418 cm^{-1} (strong); 1245 and 1178 cm^{-1} (medium); and 1097, 980, and 725 cm^{-1} (weak).

Some differences can exist between the spectra for aged and nonaged varnish films, although these differences can be better picked up with other methods, such as Raman spectroscopy (Dietemann et al. 2009; Nevin et al. 2009).

All unknown (historical) samples displayed typical terpenoid signatures for resins—methylene bands circa 1450 cm^{-1} and a doublet between 2900 and 2800 cm^{-1}, along with carbonyl bands between 1710 and 1650 cm^{-1}—but do not distinguish the particular resin or resin mixture present. In addition, J. H. French (1860), Gillette, and F. W. Beers show broader carbonyl peaks spanning from 1770 to 1700 cm^{-1} (Gillette and F. W. Beers) and from 1750 to 1690 (for J. H. French), suggesting that drying oils were mixed with the resins to make the varnishes in these maps. The low signal-to-noise ratio of some spectra is attributed to the smaller size of these map samples, which did not cover the measurement area completely. However, even in these cases, it is possible to discern the key bands for their assignment as natural resins (figs. 3, 4).

Solubility Testing

Ethanol and isopropanol were the most effective cleaning solvents for all varnishes except dammar. In some applications of ethanol and isopropanol, 100% solvent load was more than necessary and some solvent ran from the application area (fig. 5). In all effective cleaning tests, the varnish was visibly absorbed by the Evolon within seconds of application, and 60 seconds may have been a longer application than necessary for reducing the varnish.

In some applications of acetone, the solvent evaporated from the Evolon before the application was complete and the blotter stuck to the surface, so the evaluation of acetone for cleaning these resins is incomplete. The sample papers swelled locally where xylene was applied. The dammar sample blanched immediately in the cleaning area when ethanol and isopropanol were used. Xylene was not an effective solvent for most of the samples but did remove some varnish from the dammar sample without blanching.

DISCUSSION

This study was limited in scope. We were not able to obtain all of the resins that were mentioned in historical recipes, most notably Canada balsam. This study does not account for how the structure of the varnished map (media, paper composition, application method) may affect treatment. We only used gum arabic sizing, although others were mentioned in historical literature, such as gelatin, albumen, isinglass, and parchment size, all of which may affect the FTIR spectra, fluorescence, and solubility of the varnishes differently. We did not use any of the historical varnish solvents, such as turpentine, instead using pure ethanol.

The FTIR spectra for the historical (unknown) samples gave signatures for terpenoid resins, and three of them also suggested the presence of drying oils. We had a limited number of historical samples, some of which were quite small and gave low absorbance signals and a low signal-to-noise ratio, most likely because the diamond cell was not completely covered by the sample. The standard known samples we prepared were run at a later time, showed a low signal-to-noise ratio, and were not suitable for comparison. Due to time constraints, we were not able to repeat these measurements and instead used information from the literature that allowed us to distinguish the presence of terpenoids and terpenoid/drying oil mixtures in the historical samples. However, we expect to remeasure these samples at a later

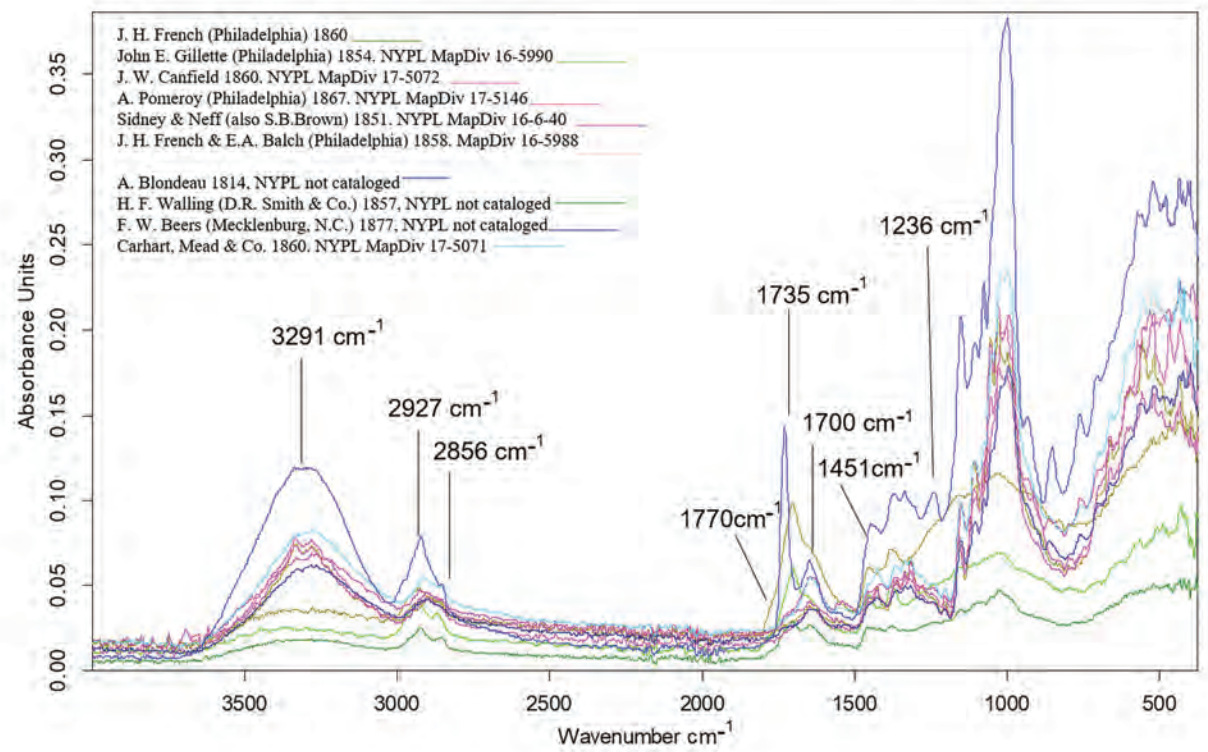

Fig. 3. Overlay of FTIR spectra collected from historical samples.

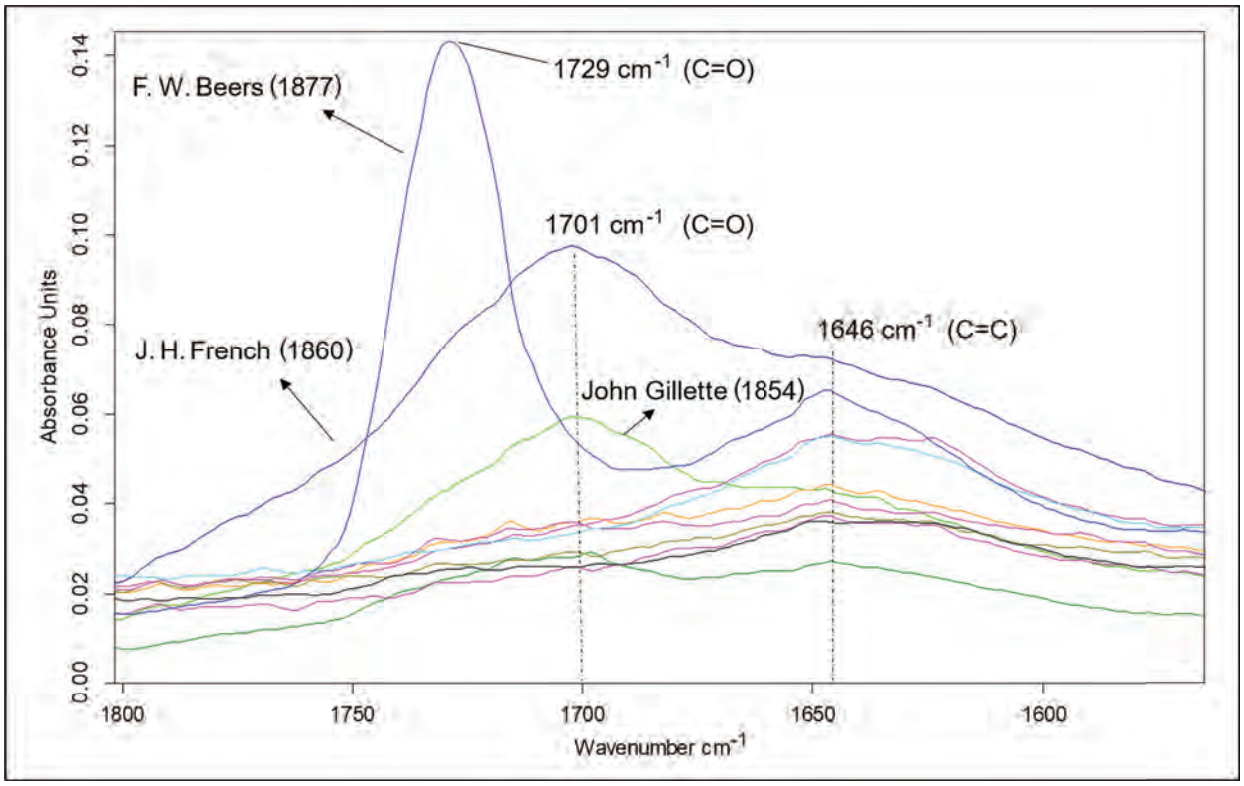

Fig. 4. Major peaks between 1800 and 1500 cm^{-1}.

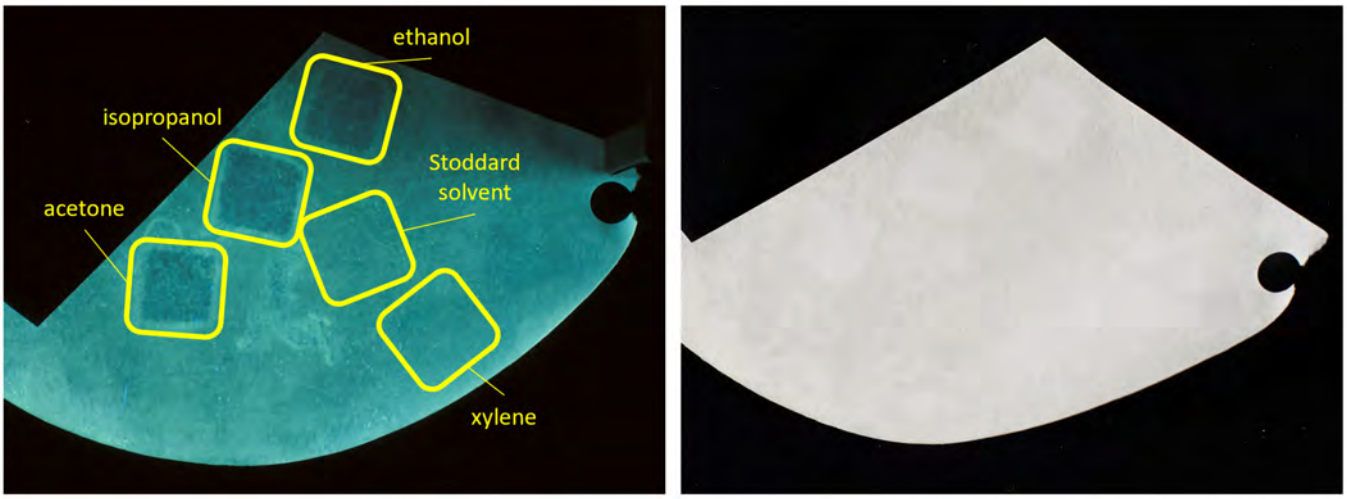

Fig. 5. Manila copal sample after cleaning tests under UVA illumination (left) and normal light (right). The isopropanol ran from the application area, resulting in some solubilized varnish accumulating in the center of the sample.

time to determine whether it is possible to distinguish among the resins using prepared samples with this instrument.

This preliminary study leaves room for future work with several possible directions for identifying resins on varnished wall maps. This could include repeating the FTIR analysis of our known samples, recreating the known samples with quantified aging, and comparing FTIR data of cleaned and uncleaned areas of the samples. External reflectance FTIR could also be useful for analyzing larger samples of maps in situ. Other analytical methods may prove advantageous over FTIR, including Raman spectroscopy, gas chromatography-mass spectroscopy, and NMR-MOUSE stratigraphy. Cross-section microscopy of historic samples could provide new insights into the structures of varnished maps. Once a testing method is optimized, testing may be expanded to a larger sample set of historical maps. In treatment cases, solvent testing can also be systematically performed on historical maps.

CONCLUSIONS

Cleaning tests confirm that ethanol was an effective solvent for all of the samples except when a drying oil is added to the varnish recipe. Ethanol did, however, cause some blanching of the dammar sample. Xylene was generally not an effective solvent and caused paper swelling.

UVA examination produces ambiguous results for varnishes on paper, but a trained eye might be able to distinguish shellac, especially if it has been dark aged.

The FTIR spectra for the historical samples found that they were made of varnishes containing terpene resins with and without a drying oil. Our data was unable to distinguish which specific resins were used.

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NOTE

1. NYPL has maps by mapmaker John E. Gillette with his name spelled "Gillet," "Gillett," and "Gillette." The name on this particular map is spelled John E. Gillett."

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SOURCES OF MATERIALS

2-propanol (purified grade), Filter paper (qualitative P2, 15-cm diameter; catalog number 09-803-5F), Stoddard solvent (Acros Organics)
Thermo Fisher Scientific Inc.
https:/www.thermofisher.com

Congo copal (crystalline form; product #6016); Dammar varnish, glossy (product #79301; 1:2 dissolved in double-rectified turpentine, not UV stabilized); Manila copal (product #60150); Mastic varnish for Claude Yvel gel (product #79351); Sandarac (product #602–historic number); Shellac polish transparent (pre-prepared; product #60453); Venetian turpentine (product #62010)
Kremer Pigments Inc.
https://kremerpigments.com

Ethanol (200-proof, anhydrous USP; CAS 64-17-5)
Decon Labs Inc.
https://deconlabs.com

Evolon CR (product #TNW002002), Gum arabic
TALAS
https://www.talasonline.com

Gamblin refined linseed oil (product #00456-1604)
Blick Art Materials
https://www.dickblick.com

Kodak #2E pale yellow optical Wratten 2 filter
B&H Photo
https://www.bhphotovideo.com

PECA 918 IR cut camera filter
Image Science Associates
https://imagescienceassociates.com

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HEATHER WANSER AND HOLLY KRUEGER

Treatment of a 19th-Century Varnished Map in the Library of Congress Geography and Map Division

INTRODUCTION

Pearce's *New Map of the State of North Carolina* (ca. 1870) is a very large map in the Library of Congress Geography and Map Division. It is an engraving with red, orange, green, and blue hand coloring. Due to its illegible condition and research value, it was brought to the Conservation Division for treatment. A treatment was proposed to improve the map's readability by removing the obscuring silk facing and blanched varnish while addressing other condition issues.

Originally, the map measured 60 × 82 in. and consisted of six conjoined sheets of paper. It was presumably issued as a wall map, varnished, and attached to two rods for rolled storage. However, with use over time, tears, numerous losses, and fractured areas developed in the primary support.

As an early 20th-century preservation intervention, the map had been removed from the rods, cut into eight sections, lined with paper and a heavy white fabric, and faced with a sheer silk gauze that was pasted to its surface to prevent further losses. This was a common preservation strategy practiced by the Government Printing Office for large-formatted works (fig. 1).

Fig. 1. Lower right section before mending compared to the seven untreated ones.

Proceedings from the AIC-sponsored event, "Varnished Wall Maps: A Collaborative Seminar to Investigate Treatment Methodology," September 14–16, 2022.

TESTING AND TREATMENT

Pretreatment testing determined that the starch adhesive was water soluble, and the varnish was soluble in ethanol. The ink and color washes appeared stable in water and ethanol. During the examination, it became clear that the paper, in addition to numerous tears and losses, was also structurally weak and delaminating in many areas.

The presence of a paper lining in contact with the original map support made it possible to remove the cloth backing mechanically by tearing it off in strips. To remove the paper lining and silk facing, the decision was made to use alpha-amylase enzymes (Sigma A6381) to break down the multiple adhesive layers to minimize the mechanical impact on the map's fragile paper. Each map section was saturated with enzyme solution, placed between two sheets of clear polyester film, and floated over a tray of warm water to increase the activity of the enzymes (fig. 2). After 30 minutes, the paper lining was removed by placing the map face down on nonwoven polyester webbing and clear polyester film. The thick, softened adhesive was scraped off with a spatula and by rolling damp cotton wool over the surface.

The map was rinsed on an incline by gently spraying it with water until the solution ran clear. The silk facing was left on until the last step, as it held multiple small paper fragments in place while allowing the adhesive to be rinsed through the open weave of the silk. Once the silk was removed, the map was placed between sheets of nonwoven polyester webbing for a final rinse.

At this point, the map was given a temporary lining of rayon paper adhered with A4M methyl cellulose adhesive and dried under weights. This lining is more easily reversed than Japanese tissue adhered with wheat starch paste.

As expected, the varnish blanched further during the aqueous treatment. Once dry, each of the map sections was immersed in a series of ethanol baths to remove the varnish. Cotton wool was used to gently brush the surface to disperse the varnish. The varnish was completely removed after the third bath, and the map sections were allowed to air-dry in the fume hood.

The final steps were to align the pieces that had shifted during washing, infill the areas of loss, and apply a final lining.

Fig. 2. Map section in alpha amylase solution between two sheets of clear polyester film floating over a tray of warm water.

Fig. 3. Placing paper pulp in the areas of loss with the aid of transmitted light.

The temporary rayon paper lining was easily removed by spraying the map section with water while it was supported on nonwoven polyester webbing. The numerous small pieces were aligned while the map was still wet and face up on clear polyester film on a light table. It was necessary to continually spray the map with water to keep the pieces adhered to the clear polyester film to prevent drying.

Paper pulp was created to infill the areas of loss by macerating old papers that matched the color of the map in a blender. The map was placed face down on a sheet of nonwoven polyester webbing and clear polyester film while continuing to work on the light table. Tweezers were used to pick up fibers suspended in a pulp slurry and placed in the loss (fig. 3). Transmitted light helped to gauge the right amount of fibers to add and to distribute them evenly in the loss. Once an area of loss was filled, the water was blotted off through polyester webbing to set the fibers in place prior to lining.

Two map sections were lined together with machine-made kozo sheets (19 gsm) adhered with wheat starch paste, thus reducing the number of map sections from eight units to only four quadrants. The sections were dried between nonwoven polyester webbing, blotters, felts, and weights until dry (fig. 4). Each map quarter was encapsulated in clear polyester film with an insert of acid-free buffered bond paper behind it.

Fig. 4. The four completed quadrants placed together.

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Temporary Facings on a Varnished Wall Map

WHEN A TEMPORARY FACING CAN BE ADVANTAGEOUS

Most varnished maps are backed with a cloth material. This can be a thin linen or cotton, but it is often quite deteriorated and no longer offering support. It can also be extremely dirty and frayed. Considering that these maps can be fragmented and brittle, removing the cloth so as to obtain access to the map itself can cause more damage (fig. 1).

To remove this backing, the map can benefit from being temporarily held together from the image side. Whether or not the cloth backing is removed, either dry or with moisture, these maps behave best when consolidated from the front. A temporary facing can help enormously, ensuring that pieces are not lost or shattered even further (fig. 2). The facing material needs to be lightweight and easily removed; we have found that a thin rayon paper, applied with a water-based adhesive, works best. We have applied temporary facings of rayon paper in the following manner.

First, dry surface cleaning is undertaken, if possible. Squares of thin rayon paper are cut to approximately 8 × 8 in. and applied in an overlapping pattern with a very thin "paste water." The rayon square is placed onto the map, starting at one corner and pasted through very quickly—the adhesion only needs to be sufficient to hold the rayon lightly in place, and the adjacent square is quickly laid down with maybe a half-inch overlap. The whole process is best done quickly and executed by two people. The idea is to get the face of the map covered rapidly so that "tidemarks" do not appear from the application of a water-based adhesive (which is mostly water). Each square, once in place, forms a kind of quilted pattern (much like the facing technique used in fresco removal). Once in place, sheets of polyester webbing like Hollytex can be placed over the surface and wool felt or other heavyweight material laid over that while it dries. The degree of adhesion should be just enough to hold the fragmented map together but not enough to deposit much adhesive onto the image (fig. 3).

Fig. 1. 1892 map of Marin County. Mounted to deteriorated cloth. 55¼″ × 53¾″.

Fig. 2. 1892 map of Marin County. Mounted to deteriorated cloth. 55¼″ × 53¾″. Raking light.

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Fig. 3. 1892 map of Marin County. After application of rayon facing with a thin paste wash. Dried under Hollytex and felts.

Once dry, the map can be turned over onto a polyester support, like Melinex, and the cloth backing dry-cleaned as needed. If the deteriorated cloth is particularly weak, it can be removed mechanically by tearing it off in narrow strips or removed with moisture applied by spraying water on the material (fig. 4).

The map's verso is now exposed and can be dry-cleaned as needed before wet cleaning (fig. 5). A second support of Melinex is necessary for turning the map over and accessing the front.

We have, at times, also done the following. If it is determined that the existing varnish is soluble in alcohol, after application of the temporary facing and drying of the map

Fig. 4. 1892 map of Marin County. In progress: mechanical removal of cloth backing.

Fig. 5. 1892 map of Marin County. In progress: wet cleaning between two sheets of thin Hollytex by spraying with filtered water and blotting.

in its entirety, we have sprayed the back of the cloth with an 50:50 mixture of alcohol and water mixture and peeled it off that way. Then the front can also be sprayed with alcohol, and the temporary facing carefully lifted off, taking a good deal of the varnish layer with it. Any residual varnish can be reduced or removed with alcohol and cotton or blotters. In these cases, a thicker rayon material is helpful for absorbing

Fig. 6. 1892 map of Marin County. Completion: backed with one layer of medium-weight Sekishu and wheat starch paste. Stretch-dried and flattened under felts and weight. Once completely dry, residual varnish was reduced/removed with fine sandpaper. Losses were filled with toned paper and narrow strips of similar toned Japanese paper wrapped around the margins, applied with paste. To be framed.

some of the dissolved varnish. Backing with one to two layers of Japanese paper (Sekishu RK 12 and 13) from Hiromi Paper is then done in the usual manner.

CONSERVING WALL MAPS IN A PRIVATE PRACTICE

Most of the wall maps that our studio has conserved in the past three decades, varnished or not, have been privately owned; those clients have different expectations and desired displays.

These maps are often framed and hung in homes or public places, as opposed to being housed in flat files or even dismantled for easier storage. Some are returned to their original hanging dowels. In addition to wanting them preserved, the desire is for them to be as legible as possible and to look attractive. Since a discolored varnish layer is often an impediment to legibility, there is a mandate to remove that disfiguring layer and then provide a new backing of paper and rigid support. The backing is of Japanese paper; the rigid support is usually a Tycore honeycomb panel or Falcon board faced with 100% rag. When the cleaned map is backed with Japanese paper, the margins are left larger than the map and then used to wrap around the rigid support. The map itself is not adhered directly to the board but is held only by the paper margins. In this way, the consolidated map can easily be removed at a future date (fig. 6).

If the owner wishes that the map to be returned to its original dowels, we will first check to make sure they are straight and not warped (if the latter, they are replaced). Then, the dowels will be cleaned, stained if necessary, and sealed. The added paper margins can be used to attach the map to the dowels.

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