Article: Conservation Treatment of Atlases, Foldouts, and Guarded Structures
Author: Katherine S. Kelly
Source: Book and Paper Group Annual 40, 2021
Pages: 44-62
Editors: Kimberly Kwan, Managing Editor, and Roger S. Williams, Assistant Editor Editorial Office: bpgannual@gmail.com
ISSN: 0887-8978

The *Book and Paper Group Annual* is published once each year in print format by the Book and Paper Group (BPG), a specialty group of the American Institute for Conservation (AIC).

The *Annual* is distributed as a benefit of membership to those who were members of the BPG in the date year of the issue. Additional copies or back issues are available from AIC. All correspondence concerning subscriptions, memberships, back issues, and address changes should be addressed to:

American Institute for Conservation
727 15th Street NW, Suite 500
Washington, DC 20005
info@culturalheritage.org www.culturalheritage.org

KATHERINE S. KELLY

Conservation Treatment of Atlases, Foldouts, and Guarded Structures

INTRODUCTION

This article discusses the varieties of folds, guards, attachment methods, and compensation that conservators encounter in books, how they affect the function of the book, and how conservators can best treat books with these elements. It draws on the author's experience as a book conservator at the Library of Congress and other institutions, and particularly from her experience repairing atlases. Although foldouts and guarded structures and their problems appear in many book genres, the author tends to focus on atlases, which have been a longtime interest of hers.

SCOPE AND SOURCE MATERIAL

The author's interest in this topic started in 2006 during her internship year working with Pamela Spitzmueller at Harvard University. Spitzmueller shared her notes and models from workshops she had given to various groups in the 1990s and early 2000s. Since then, the author has delved more into the topic, particularly because of treatments done while working at the Library of Congress.

The Library, of course, has huge collections, with a particular strength in atlases. As the book conservation liaison for the Geography and Map Division, the author has had the opportunity to do survey work, develop preservation plans, and perform treatment on a fair number of atlases, perhaps more than a conservator whose attentions are spread more broadly. She also has had the great privilege of working with many Advanced Rare Book Conservation interns as they worked on conserving atlases.

The Library's collections are high-use, which allows the author to see the effects of handling. Somewhat related to this, however, are the effects of heavy-handed ownership by the Library and former owners of its materials. Many of the atlases encountered were previously taken apart, each map lined with thick cloth, and then rebound. This was frequently done in the early 20th century by the Government Printing Office. Their methods were robust, but they used the materials available at the time—acidic paper, poor quality adhesives, and leather prone to red rot.

Starting in the 1970s, the Library of Congress adopted more sound conservation principles: moving away from a "one-style-fits-all" approach to rebinding, using better quality materials, and beginning to document condition and treatment actions. A review of treatment documentation dating back to the 1980s provided a sense of the changing practices in conservation and how earlier treatments have held up over time.

This article seeks to present helpful tips on understanding, conserving, and preserving atlases, foldouts, and guarded structures, drawing on the author's experience, published treatment reports, and historical binding manuals. Discussion is limited to traditional, fairly simple codex forms made of flexible paper. Although some of the terminology and discussion is borrowed from the Book and Paper Group (BPG) and Photographic Materials Group (PMG) publication, *Conservation of Scrapbooks and Albums* (Brown 2000; Horton 2000; Wootton, Boone, and Robb 2000), this article will not cover topics such as albums, stiff-leaf structures, pop-up books, lift-the-flap books, and artist's books. For those who are interested in the creative potential of folded structures, Hedi Kyle's article "The Fold: Evolution, Function, and Inspiration" (2017) focuses on variations on the accordion fold and also describes many other historical and modern folded structures.

STRUCTURES AND PRESERVATION CHALLENGES

The treatment of bound structures that include foldouts and guards presents several structural and preservation challenges. Most of these relate to fitting oversize pages into a more moderately sized book. When a page is too large for its codex, the common solution is to fold it up and allow the reader to unfold it when the need arises. This can lead to weakened areas along the fold and stress from repeated unfolding action. Once folded, the foldout has a disproportionate bulk

Papers presented during the Book and Paper Group Session, AIC's 49th Virtual Annual Meeting, May 10-June 25, 2021

within the codex. This affects the book both at rest and in action; compensation is needed to avoid a difficult-to-store wedge-shaped book, and bulky foldouts disrupt the flow of the pages being turned. Finally, foldouts frequently require guards to position and attach them to the binding. This creates a second flex point past the gutter that must work within the constraints of the binding.

Atlases, especially, are frequently oversize. The information they convey cannot be broken out onto multiple pages without losing its function, and large areas or density of detail can only be shrunk so far. This leads to other preservation challenges, as large books are more difficult to store, use, and repair.

Folds and Fold Position

Conservators usually do not get to choose how a page is folded or where a fold is positioned within a book. However, they may do so when adding a facsimile of a missing foldout, refolding a hopelessly confused foldout, or reattaching a loose page whose original position was unclear. Conservators may also strategically reposition a foldout during treatment to allow it to be used without causing damage. This article will consider the advantages and disadvantages of some of these choices (note 1).

A simple bifolio map whose fold runs parallel to the spine of the book can be attached at the center fold or on one end. Center attachment allows the vulnerable fold to be protected within the binding. However, it must be placed far enough away from the gutter to allow the map to open flat. Center attachment is very intuitive, as a reader turning pages naturally comes to the page. Side attachment is less intuitive, and a careless reader may tear the fold in an attempt to open the page. Folds located at the book edges are also subject to environmental damage as the fold is exposed to air, moisture, and pollutants (Spitzmueller 1996). Once unfolded, side-attached maps can face the text of the book. Attachment at the left side allows the book to be opened in a left-to-right reading pattern. Attachment at the right allows the map to face title pages. This is reversed, of course, for right-to-left reading patterns, as in Arabic and Hebrew texts.

For a two-panel map whose fold runs perpendicular to the spine of the book, it is easier to fold a panel up and away from the reader, particularly with very large books. This top-up configuration is also easier to display in a traditional book cradle. However, the bottom-down method appears to have been favored by binders, as it left a clean edge at the head that could be trimmed and decorated.

A 1903 bookbinding manual instructs the binder to align the edge of the map with the head of the book and fold up from the bottom, repeating as necessary until the foldout is reduced to the height of the book. Only then should the binder make vertical folds, and those in a zig-zag pattern. The author notes that when there are several maps in sequence, older manuals suggested alternating between flush to the head or tail, but that he recommends that they all be flush to the head to allow the book to be smoothly trimmed, as this prevents the penetration of dust and insects (Adam 1903).

For maps with multiple folds running parallel to the spine of the book, there are a few folding patterns to avoid. The "squashed scroll" is time consuming to refold and has many nested folds that can confuse the reader. Irregular folding patterns can also confuse the reader, leading to misfolded maps. An accordion fold, however, is regular and intuitive. Having the text face upward and the free end positioned near the fore edge also provides a visual cue to the reader about how to unfold the map.

Folds are slightly thicker than a double thickness of paper would be, and if many folds are stacked on top of one another or around each other, they add bulk. This bulk can be reduced by staggering the folds.

Cross folds occur when vertical and horizontal folds intersect. As they cross, one of the folds remains in one orientation—mountain or valley—and the other switches. When the map flexes, the mountain and valley folds are in conflict. This leads to tears that begin at the center point and propagate outward.

Cross folds can also lead to compression creases because the outer section must stretch around the inner, despite them being the same size (fig. 1). Paper can be squeezed and stretched up to a point. This allows cross folds to happen but results in weakened outer folds and crimped inner folds.

Consider an oblong map whose head is folded in once and then has multiple folds parallel to the book spine. If these are done in a repeated valley pattern, the folded-in head is always being forced into the smaller space. If the folding lines alternate between valley and mountain, as in an accordion, the compression alternates, and there is less stress overall. These observations about stress and compression have implications for mending strategies, and they are discussed in more detail in the following.

Guards

There are three main types of guards used for attachment of pages. The first is a reversed v-guard or meeting guard, where gatherings are sewn through their center folds onto guards (Conroy 1987; Minter 2015). The other two types of guards are adhesive. Figure 2 shows guards of uniform thickness. A moderately stiff paper extends from the plate to the gutter where it is folded over and sewn along with the rest of the book. Figure 3 is a laminate guard construction. Multiple layers provide stiffness in the gutter, and a single layer flexes across a small gap. The flexible gap allows plates to open flat without requiring the plate to flex.

Attachment

Plates or foldouts can be nonadhesively attached by sewing them along with the rest of the book through an extended

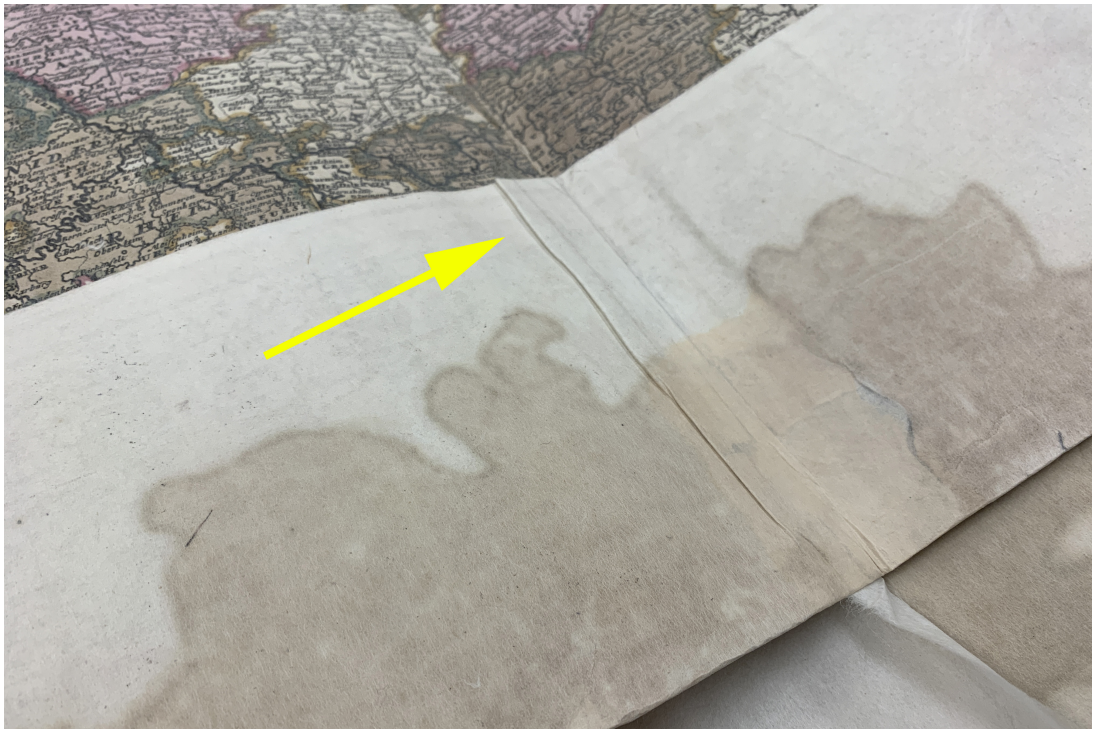

Fig. 1. Compression crease. Braakman, *Atlas Minor*, 1706, Library of Congress, Geography and Map Division.

Fig. 2. Guards of uniform thickness, original binding. Blaeu, *Atlas Maior*, vol. 11, 1667, Library of Congress, Geography and Map Division.

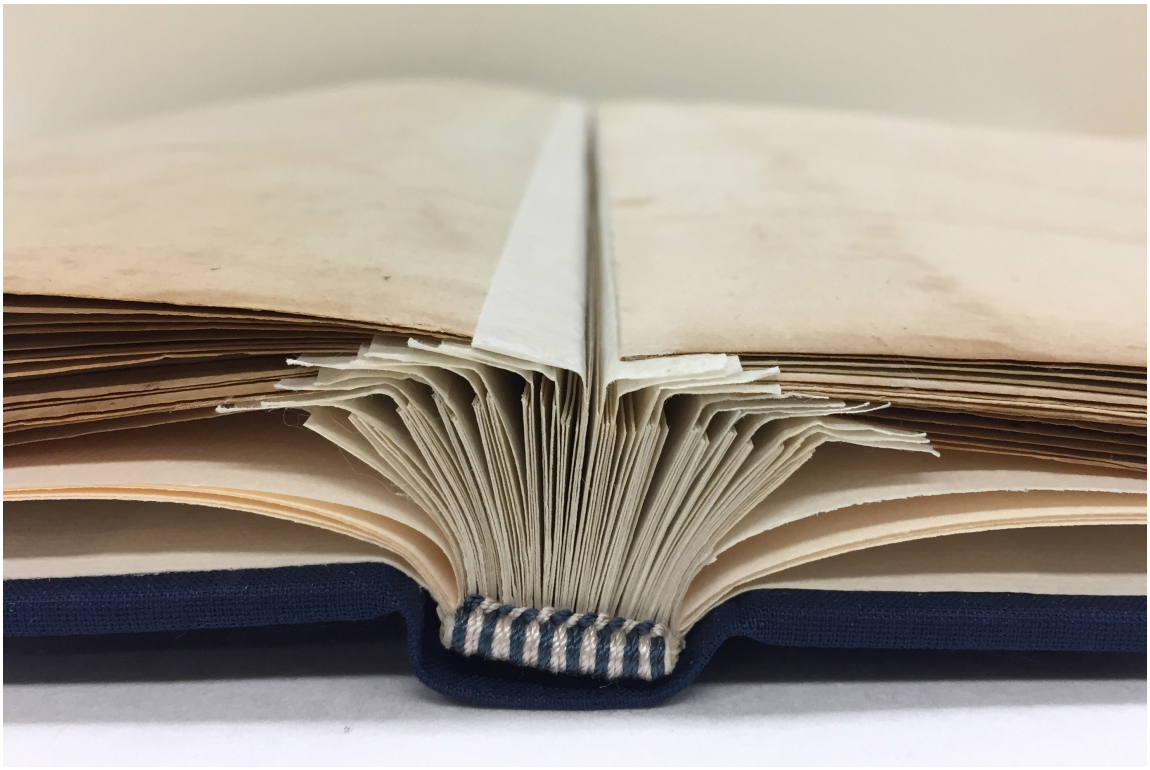

Fig. 3. Laminate guards, after 2018 rebinding. Carey, *American Atlas*, 1795, Library of Congress, Geography and Map Division.

edge. This is referred to as "guarded in" or "sewn in." More commonly, the plate or foldout is tipped to a guard or a leaf with a line of adhesive. That strip of map-adhesive-guard forms a thick sandwich. This can be unusually weak, if poor quality adhesive has caused chemical damage to the paper, or it can be excessively stiff and strong, leading to a breaking edge just to the side of the sandwich.

If a foldout taller than the book is sewn in or adhered near the gutter, it must be lipped, meaning that a part is cut away to allow it to fold into the book without catching in the gutter. This cutting away is discussed in a 1915 bookbinding manual (Pleger, 41–43) and in the appendix. This internal corner is vulnerable to damage and frequently tears as the map is handled.

Compensation

When a thick foldout is attached into a binding, it can make the book too thick at the fore edge. *Compensation* is the general term for material added in the gutter of a bound volume to compensate for the thickness of bulky material positioned toward the fore edge. Many bookbinding manuals discuss compensation, and a wide variety of materials and methods are suggested. Paper is most common, but cloth and board have also been used.

Figure 4 shows an even stack of paper used as compensation. These strips were probably folded at the spine and oversewn along with the rest of the book. Joseph Zaehnsdorf's 1880 *Art of Bookbinding* suggests that compensation should be formed of paper strips, folded to be ¼ to 1 in. wide and sewn through the fold along with the rest of the text block (Zaehnsdorf 1880, 10). John Pleger's 1915 *Bookbinding and Its Auxiliary Branches* describes using strips of paper glued together and then whip stitched as the common method, then recommends using perforated sheets as a newer method (Pleger 1915, 41–43):

> *A common method on side-stitched pamphlets containing a number of large maps is to trim the text after gathering, and to supply the thickness of the maps with stubs one-half to three-fourths of an inch wide on the binding end. The maps and stubs are put in place and the book stitched. This besides being very slow, is hardly in keeping with the progress of the times. There are obsolete signatures in all binderies which can be utilized to good advantage as fillers by perforating them one-half to three-fourths of an inch from the fold and gathering in sufficient number to take up the thickness of the folded map. The books can be sewn on a sewing machine or stitched, and the necessity for fillers to trim and forward is obviously eliminated. After the books are bound, the places provided for the maps are cleared at the perforation, leaving the regulation stub to take up the thickness. The maps are tipped on the stubs at the left end.*

Both of these techniques can leave a thick shelf of compensation against which neighboring pages can break. Figure 5 shows compensation stubs that are staggered or offset from

Fig. 4. Stiff block of compensation, 20th-century rebinding. *Carey's American Pocket Atlas*, 1801, Library of Congress, Geography and Map Division.

Fig. 5. Staggered compensation, 20th-century rebinding. Tanner, *A New American Atlas*, 1823, Library of Congress, Geography and Map Division.

each other. They do not offer the same even appearance but are more gentle on neighboring pages.

The Action of the Book Spine

All of the guarding, attachment, and compensation methods discussed previously have an effect on the action of the book spine. In his 1987 article "The Movement of the Book Spine," Tom Conroy analyzes the codex as a moving system and talks about how the spine structure directly affects the function of the book. Conroy discusses reverse v-guards or meeting guards, where gatherings are sewn through their center folds onto guards that position them out from the gutter. The length of the guards and the pliability of the spine must be balanced—a pliable spine allows the guards to fan out and raises the opening above the level of the neighboring pages. Sufficiently long guards allow the pages to open flat but still be supported by their neighbors. In Conroy's example, the drape of the paper is not very important because the gathering hinges at the point where it is sewn to the guard. The goal is to allow the book to open flat, even if the pages are very stiff (Conroy 1987).

Guarded structures can be designed for a variety of purposes. When the goal is a foldout that opens flat, Conroy's analysis works: the ideal configuration places the map far enough out from the gutter to escape the curve of the spine. In these cases, the book is said to have sufficient throw-up. Heavily rounded books, books with inflexible spines, and thicker books all need longer guards. This is particularly important when the map has a fold perpendicular to the spine of the book, as a flat plane of opening is necessary to avoid damage.

Conroy does not discuss structures where the plate is attached to the guard with adhesive. In these situations, the hinging does not happen along a line of action but is rather flexing across an area. This can either be a guard that curves up out of the gutter and is attached to a plate or it can be a stiff laminate guard, followed by a flexible hinge that is then adhered to the plate. The adhesive attachment of plate to guard usually causes a change in flexibility, from that of the guard, to the glued sandwich, to the plate alone. This affects the drape of individual pages and the flow of the book spine as the pages are turned (Albro et al. 2012).

Figure 6 shows a book that does not open well—the spine has no pliability, and the guards are too short. This forces the map to flex, which has caused the stiff paper to break as it attempts to curve out from the gutter.

Guarded structures are frequently irregular in construction, and this often causes problems with the movement of the spine. Text pages can break against the edge of a stiff stub. Unevenly thick gatherings and stiff blocks of compensation can lead to preferential openings.

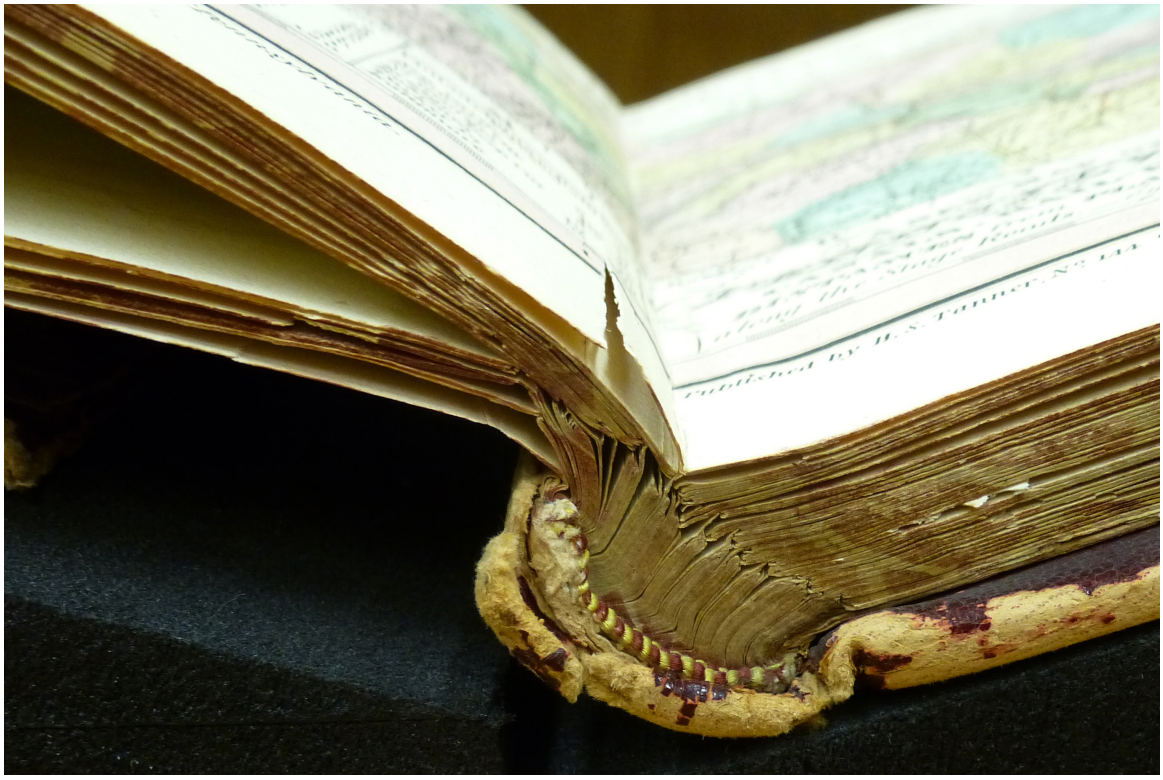

Fig. 6. Restricted opening, early 20th-century rebinding. Tanner, *Atlas of the United States*, 1835, Library of Congress, Geography and Map Division.

Other Preservation Challenges: Printing Methods, Annotations, and Color

Although the various media used in books, their aging characteristics, and their interaction with specific conservation treatments is a topic beyond the scope of this article, some cautionary thoughts relate specifically to atlases. Perhaps most obviously, the first complication is that the media and application technique used on map pages can be completely different from those used on text pages. Differences can occur because of relief printing versus intaglio printing, different mechanical press equipment, different paper, and sometimes even a different printing shop. Annotations are also commonly added to printed maps and can be difficult to see. And many printed maps from the 15th to the 19th century were hand colored. Although maps with printed color appear as early as 1511, hand coloring predominated until lithography became common in the mid-19th century (Woodward 2007). For more about the use of color in maps, a good source is the University of Michigan online exhibit *The Geography of Colorants* (Helm, Platte, and Rother 2018) based on Melissa Zagorski's 2007 thesis.

Hand coloring may have been done shortly after printing, or added later to enhance appearance and value. These colorants may cause deterioration, with verdigris degradation of copper-based green colorants being a particular challenge. The time period of hand coloring can be difficult to determine, but in addition to the usual techniques of observation and analysis, it can be useful to closely examine the media where it passes over a fold. A clean, uninterrupted field of color can be evidence that the hand coloring was applied before folding (Albro et al. 2012), whereas painting over a worn, well-used fold can lead to feathering or pooling of the media.

HISTORICAL TREATMENT METHODS

Conservators frequently find themselves undoing or working around the edges of previous treatments, and it is helpful to understand how those treatments were performed. A variety of historical techniques for treating and rebinding maps and guarded structures is summarized in the following.

Rearrangement, Rebinding, and Substitution

Atlases, more than many other genres of printed works, were freely and frequently rearranged and updated. For many early atlases, this process began before the work even left the printer's workshop. Atlas production methods in 17th-century Amsterdam have been described as a "bibliographer's nightmare": updated letterpress text was printed on the back of copperplate maps of many different states and dates, and "almost every atlas that left the printer's and binder's workshop is different from the next one in the same edition" (Van der Krogt 1996, 154).

A 19th-century publisher of atlases in Philadelphia advertised that his updated maps would be colored in a similar style so that substitutions could be made by the owner (Ristow 1985, 197–198). Substitutions can occur at many stages in the life of an atlas—an analysis of a 1513 Ptolemy revealed that one of the maps had been replaced with one from a newer edition shortly after printing, whereas another had been swapped out by a book restorer in the early 20th century (Albro et al. 2012).

Map dealers, collectors, and librarians frequently considered atlases to be mere collections of maps, to be broken up or rearranged to suit financial or organizational goals (Akerman 1991, 3–10). In addition to the map arrangement, the underlying structures of guards and prosaic bindings were rarely valued, and rebinding was common. Commercial rebinding in the 20th century frequently meant cutting off folds and oversewing, a particularly poor choice for books that need to open well. As a general statement, one should not assume that a printed atlas is a consistent, well-understood bibliographic entity. Binding, structure, and pages should be carefully examined for inconsistencies, and a conservator should use particular caution when spot-testing in preparation for humidification, mending, or washing.

Sectioning, Lining, and Lamination

Cloth lining of maps dates back at least to the 1660s (Bagrow 1975, 16). By the 19th century, maps were frequently lined with cloth (or "mounted") as part of their initial binding, and this was a standard restoration technique in the 19th and 20th centuries. Larger maps with multiple folds were commonly sectioned by cutting them along fold lines, followed by cloth lining. A gap was left between the sections to allow the map to fold. Zaehnsdorf, in his 1880 manual, calls for the linen gap to be the exact thickness of the paper. In his second edition, that is corrected to be "more than equal to the thickness of the paper" (Zaehnsdorf 1890).

A frequently cited 1950 guide to map preservation states, "Ideally, every map worth preserving should be mounted." The guide provides instructions for mounting and notes that linen is preferred for very valuable maps, but cotton percale is thinner and preferred when the map will be folded into a book. Crepeline or silk was used for fragile maps, either by itself or in combination with cloth. The linings were usually adhered with wheat flour paste, sometimes with additives like formaldehyde or alum to deter pests, or glycerin to improve flexibility (LeGear 1950).

From the 1930s to the 1970s, cellulose acetate lamination, sometimes accompanied by deacidification, was a common technique for preserving maps, especially in large institutions. Maps that would be folded into bound volumes were sectioned before lamination and the folds reinforced with cloth (Minogue 1943, 36–37). Other lining and lamination techniques included pressure-sensitive cellulose acetate linings or commercially prepared dry mount linings (LeGear 1950).

Media Stabilization

Media degradation is not a problem unique to atlases or foldouts, but it is frequently discussed in the published literature. In some cases, degradation results from the heavy handling and page manipulation that maps and foldouts undergo. In other cases, it is due to the pigments used to hand color printed maps.

Flat maps were sometimes protected with surface coatings like varnish, shellac, Krylon spray, or liquid cellulose acetate (LeGear 1950), and these might also have been used to protect or consolidate folded maps. Cellulose acetate dissolved in acetone was also used to stabilize water-soluble media prior to washing (Minogue 1943, 22–23).

Hand-colored maps commonly suffer verdigris damage. Large areas colored with copper-based green pigment become brittle, discolored, and extremely fragile. Damage sinks through the page and penetrates onto adjacent pages. A number of conservation publications describe the challenges and treatment options, but more research is needed. See Tsai 1992, Carlson 1997, Brostoff et al. 2011, and Albro et al. 2012.

Historical treatment for verdigris damage has included the application of alum-containing sizing solutions (Brostoff et al. 2011; Albro et al. 2012), bleaching to restore color, and consolidation with a variety of adhesives, including poly vinyl alcohol (Blank, Dobrusina, and Lebedeva 1984) and cellulose ethers (Dobrusina et al. 2019).

PREVENTIVE CARE AND SAFE HANDLING

Preventive care is the most effective means of preservation, and most of the recommendations for environmental control, pest management, and disaster preparedness apply equally across all library and archival materials. But a few safe handling precautions apply especially to atlases and foldouts.

Adequate space is essential. Reading room tables must accommodate large foldouts without having them extend past the edge of the table. Soft weights and book supports should be available, and staff should instruct patrons in their use. A limited angle of opening can prevent damage to bookbindings. Some books with foldouts, however, must be laid flat to allow cross folds to open clear of the gutter, so staff should not rigidly insist on the use of book supports. If possible, staff should be available to assist with difficult folding and unfolding. Books with foldouts are particularly vulnerable to damage if they are carelessly closed—the foldouts should be supported as the book is closed, especially if the book is very heavy.

DIGITIZATION PREPARATION

Digitization drives the workflow of many conservation labs, and foldouts are a recurring challenge both for conservators and scanning staff. Careful project planning and education are essential. Collections with large numbers of foldouts may require significant preparation, as tears and disfiguring creases are common.

For certain digitization projects at the Library of Congress, books with foldouts are scanned in stages. Digitization scans the bound volume, skipping any large foldouts. The book is then brought to conservation, where the foldouts are unfolded, mended, and opened out onto a support board. The books are returned to digitization, the foldouts scanned, and then conservators refold the maps into the bindings. Although this process is time consuming, it produces the best possible image while minimizing handling. For other projects, scanning staff are specially trained in safe folding and unfolding.

CONSERVATION TREATMENT

Mending

Foldouts are more frequently damaged than text pages because of how they must be handled—unfolded, stretched out over a surface, and then refolded. Folds are weaker than the surrounding paper and tear more easily. Foldouts are also sometimes printed on thinner paper or adhered with stiff glue. Mending techniques must accommodate these challenges.

There are many factors to consider when mending paper, and the following discussion is largely based on mending moderate-weight Western paper using wheat starch paste and kozo paper or heat-set tissue. The conservator must weigh these recommendations with the normal considerations of paper weight, sensitive media, readability of underlying text, productivity, and skill level.

The first tip is to mend with as little adhesive and the thinnest tissue as possible. Mends should be strong enough to withstand handling but weak enough to allow the paper to flex overall and to fold along the desired line. If a heavy mend is made on a paper that needs to be handled a lot, it may cause a tear to appear elsewhere.

That said, mends over folds sometimes do need to be stronger than mends on flat paper. For example, wheat starch paste or Lascaux is sometimes preferable to heat-set Aquazol 200 or 500, to prevent the mend from detaching from the fold as it is flexed (Kelly et al., 2022).

The second tip is to not rush to fix problems that relieve stress. Figure 7 shows a compression crease that occurred inside a cross fold. It is not obscuring text, and if flattened, it may just reappear or relocate once the map is refolded.

Figure 8 shows a small hole that has formed at the intersection of two folds. It may be better to mend up to, but not over, the hole. Hedi Kyle described a small medieval magical charm folded into 25 panels, as discovered by Pamela Spitzmueller. The person who made the charm snipped off the corners, relieving the tension and allowing the booklet to be compactly folded (Kyle 2017). This principle can be

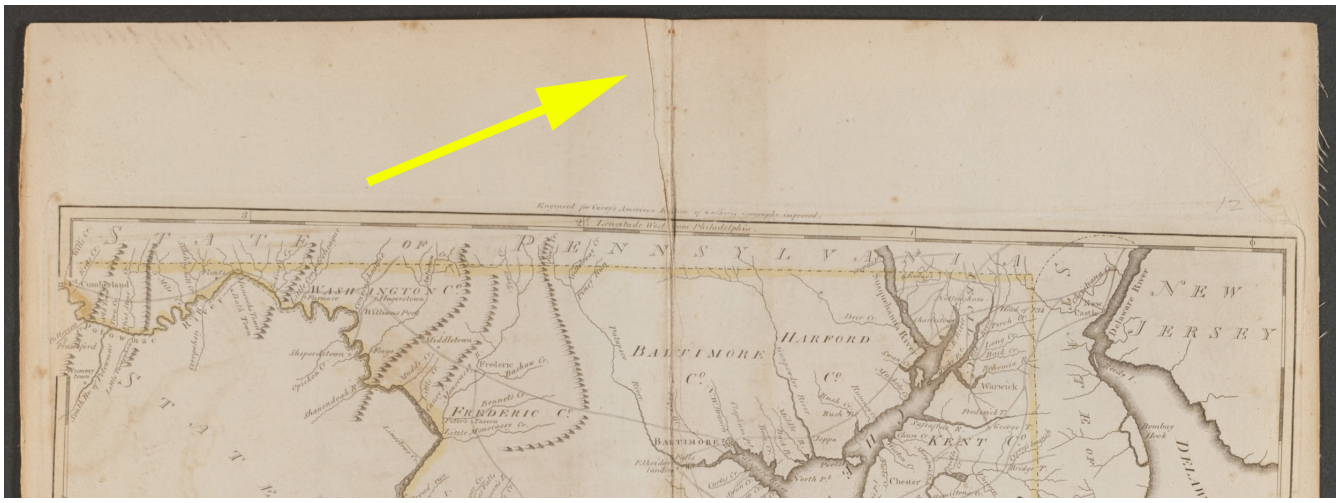

Fig. 7. Compression crease, during treatment. Carey, *American Atlas*, 1795, Library of Congress, Geography and Map Division.

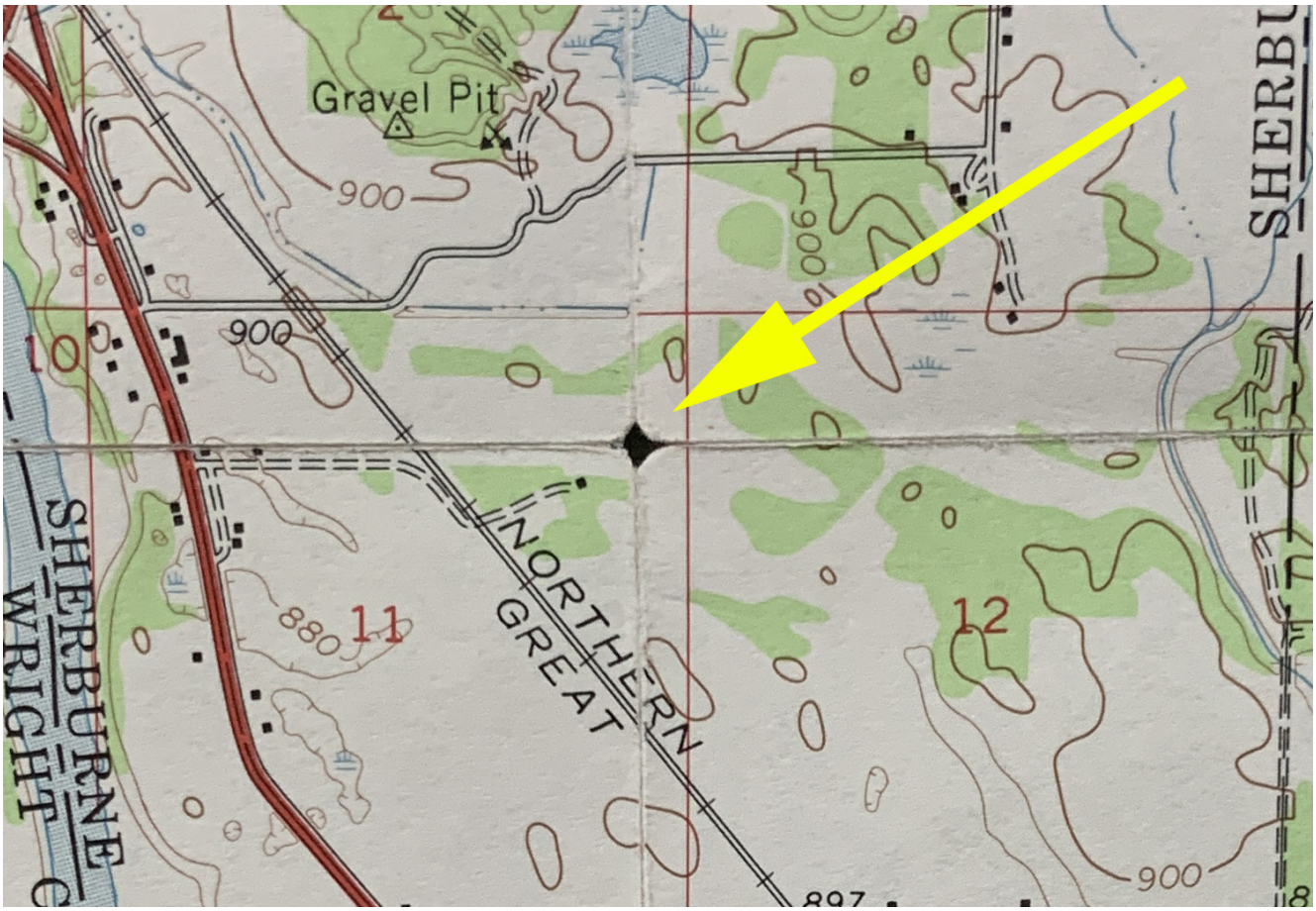

Fig. 8. Small hole at fold intersection. Model made by author.

applied during mending—by leaving intersections unmended, one may prevent the recurrence of the stress that led to the tear. If mending over the hole, make certain that the new material is flexible and compressible.

Figure 9 is a book from 1820 in its original binding. The binder added slits in the paper to allow the foldout map to more easily escape the gutter. Although this has led to small tears at the end of the slit, the tears did not propagate into the map. If those cuts were mended, the point of stress would move up to the internal corner, and the new tear could be worse.

Double-sided mending can be a useful technique. A thicker kozo tissue can be used on the verso and a very lightweight tissue on the recto. The author's favorite pairings are 5 and 12 gsm kozo papers, or 5 and 8 gsm kozo papers. These mends should not create an even sandwich, but instead one should be narrower and the other wider to avoid creating a hard breaking edge. A thin remoistenable tissue applied over the recto of a tear can smooth down rucked up edges, whereas a thicker and stronger tissue can be used on the verso of the map.

The order of mending can make a difference. With double-sided mending, and with nested folds, the author always tries

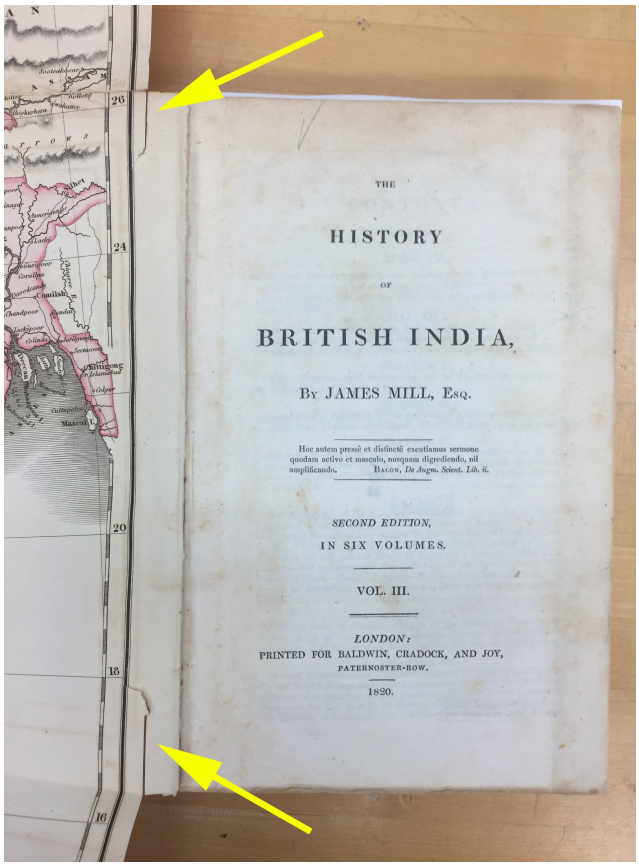

Fig. 9. Foldout frontispiece with slits to facilitate opening. Mill, *The History of British India*, 1820, study collection.

to work from the inside out. When book conservators mend nested folds in gatherings, they frequently work from the inside out, mending the innermost bifolio before the outermost, and allowing the mends to dry with the bifolios closed. This allows the mends to accommodate the added bulk of the mending paper and conform to the final configuration of the gathering. Similar principles can be applied to foldouts, with a few refinements to allow the final page to both lay flat and sit closed with equal ease.

To do this, the valley side of the fold is mended first, allowed to dry flat, and then the mountain side of the fold is mended and left to dry folded. This is particularly important with water-based mending techniques where the adhesive and the mending tissue expand when wet and contract while drying. Other conservators have recommended allowing the mends to dry at a 90° angle (Spitzmueller 1996; Vidler 2013).

Because of the stresses on folded maps, it is not uncommon for gapping tears to significantly affect the map's function. These tears can frequently be realigned with repeated cycles of humidification and drying under weight. Realignment of text can be facilitated with temporary bridge mends using non-water-soluble adhesives, like a precoated tissue that can be applied with heat or solvent (but not water). These mends stay in place during humidification and can be removed before final mending.

As discussed earlier, foldouts are particularly vulnerable when there is an internal corner, which occurs when the plate folds out from the head or tail. That vulnerability is the result of stress being directed at a single point. This can be mitigated by creating a rounded internal corner to distribute that stress. Figure 10 shows a model that has been deliberately cut this way. If fixing tears in that area, consider trimming the mending tissue, not to a right angle but extended beyond the paper to make a rounded corner.

Pamela Spitzmueller taught this mending technique when the author was a book conservation intern, but the author had never seen a historical example until recently. A 1903 bookbinding manual, in English but translated from German, shows the rounded internal corner in an illustration, but the text does not discuss it (Adam 1903, 26–27). A real-world example then turned up in a set of books published in Berlin (Agrippa von Nettesheim 1916), as discussed by William Kiesel in his article on foldouts in esoteric and magical literature (Kiesel 2015). Since these examples are both German in origin, it is possible that there is more mention of this technique in German language bookbinding manuals or sources.

One other interesting thing about these examples is that in addition to being rounded, the internal corners are offset from a fold. If a tear starts, it will run diagonally but not immediately hit a weak fold. This makes them just a bit more resistant to damage.

Fig. 10. Rounded internal corner. Model made by author.

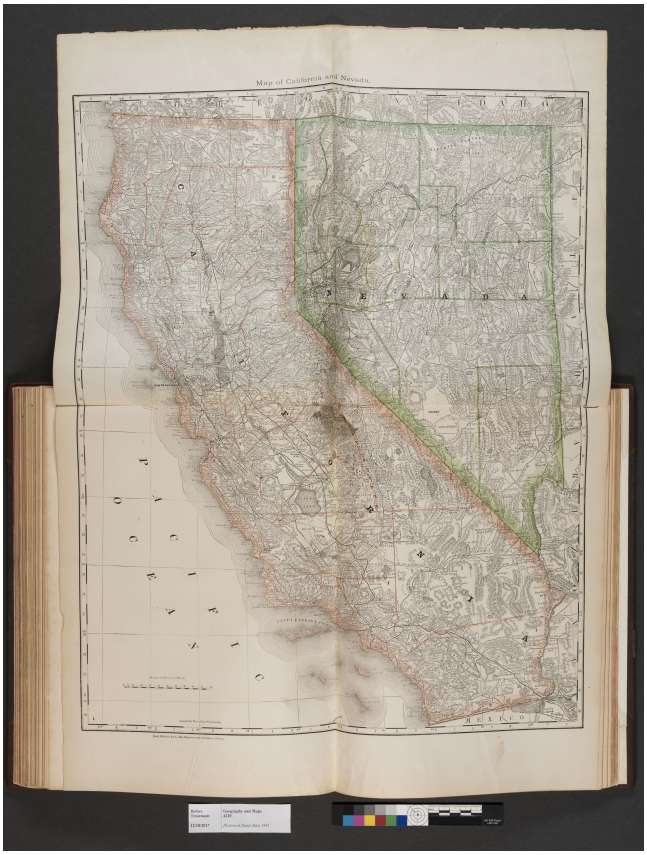

Fig. 11. Center attached four panel map, before treatment. *Historical Hand-Atlas*, 1881, Library of Congress Geography and Map Division.

Repositioning of Maps

Once a conservator has mended the foldouts, what is next? Limited interventions that allow foldouts to be used safely may be more appropriate than complete disbinding. These options should be weighed carefully against the artifactual value of the book in its current arrangement, and they are more applicable to mass-produced modern books than for rare or significant earlier works in original bindings.

If a foldout cannot be used safely because of how it fits into a binding, it can be removed and either rehoused or put back into the binding with improved methods. This can include making a longer guard, trimming compensation guards that interfere with the map, or changing the attachment position of the map.

Figure 11 shows an 1881 atlas with a four-panel foldout attached at a center fold. The tight binding did not allow the map to open flat in this configuration, so the thin map paper tore, starting at the fold intersection. There was not space to move the map out from the gutter, so the conservator removed the map and reattached it on an edge. This allowed the map to open flat off to the side. Other conservators have described their decision to reposition foldouts, as in Karen Vidler's 2013 series of blog posts on the "Proeschel Atlas Conservation Project" and Hannie van Herk's blog posts on the treatment of the University of Amsterdam's *Atlas der Neederlanden* (2010–2014).

Guarding

Once plates are being moved around, the conservator needs to think about guards. In book conservation, *guarding* refers to mending the center fold of a section, as well as to adding additional material to the binding edge of plates or foldouts to move them away from the gutter. The second definition is what this article is addressing.

Earlier in the article, three types of guards were identified. The first is a reversed v-guard or meeting guard, where gatherings are sewn through their center folds onto guards. This is a good structure to use when center folded bifolios must open all the way to the gutter, or when the attachment method must be nonadhesive. It also offers the advantage that none of the original surface is covered by a guard.

For adhesively applied guards of uniform thickness, the guard must be stiff enough to support the plate out from the gutter. This usually means a text-weight Western paper or a very substantial kozo paper. This kind of guard was the

standard choice for books with foldouts tipped to guards, starting in the 1500s. Therefore, if a primary goal when rebinding a book is to match a historical original, this is a good choice. The challenge is that the paper in the gutter is the same paper that is getting glued to the plate, which can be hard on fragile originals and can add a lot of thickness. Some bookbinding manuals discuss thinning the plate at the point of overlap to reduce swell (Cockerell 1901, 56–62), although this would be a questionable choice for a conservator because of the loss of original material.

For guards with a flexible gap, the laminate can combine various kozo papers, or kozo paper(s) with Western paper(s). The paper weights should be appropriate to the size of the book and the thickness and quality of the plates. In general, a thicker paper is laminated to a thinner paper. The thick paper provides the necessary stiffness to lift the plates out of the gutter and to provide compensation for the thickness of the plates. A thin, strong paper provides flexibility across the gap and does not add too much bulk where it is adhered to the plate (Parks and Muratore 2021). Stiff laminate guards are particularly important for heavy foldouts or plates—a floppy guard will collapse into the gutter under the weight of a bulky foldout. Some combinations that the author has used include laminates of 15 gsm handmade kozo, laminates of 32 gsm machine-made kozo, or that same 32 gsm kozo laminated to 85 gsm, machine-made, 75% cotton paper. The guard material must adhere well to the foldout, and strong adhesives like wheat starch paste are necessary.

Variations of this laminate structure have been used in early photograph albums and late 19th century bindings. In those cases, cloth was generally used as the flexible element that crossed the gap. The author has not observed laminate guards in original atlas bindings before the mid-19th century, and so their use on older books seems to always indicate a rebinding. Despite the anachronistic appearance, the author has used laminated guards with kozo hinges to rebind 18th- and 19th-century atlases.

Cloth-Lined Maps

Before thin and strong kozo papers began to be used widely in Western book conservation, cloth was the best choice for linings and flexible hinges (Matthews 1929, 30–34). It may still have a place when conservators treat cloth-lined maps. As mentioned earlier, the Library of Congress has many atlases in which each map was lined with cloth and then bound. For obvious reasons, the treatment of these books frequently leaves these linings in place.

Although paper sticks very well to paper, sticking paper to cloth can provide poor results. Instead, cloth laminate guards can be better for hinging cloth-lined maps. To prepare the guards, first size thin aerocotton by brushing thick A4M methylcellulose (3%–4% w/v in water) onto both sides of the cloth, then let the cloth air-dry, smoothed out on polyester sheets or Plexiglas. This makes the dried cloth a little stiffer, as well as much easier to handle and cut to size. Laminate the cloth with Western paper, leaving a flange of cloth off to one side. This flange is then adhered to the map, with a small gap between the plate and the laminate to allow flexing. A space-filling adhesive like PVAC or PVAC-methylcellulose mix works well for adhering cloth guards to (nonoriginal) cloth linings. The cloth is flexible and strong, and the stiff laminate positions the plate away from the gutter.

When guarding with paper, the usual method of applying guards to plates is to fully adhere the overlapping parts. *Partial tipping*, however, is when the guarding material is left unadhered along the free edge to provide a softer transition between the three layers of guard-adhesive-plate and the single layer of the plate (fig. 12). This is similar to the feathered edges of kozo paper used in paper mending. When using a thin kozo guard, a feathered edge may be best. When using a thicker kozo or Western paper guard, partial tipping can be useful and is much more efficient than trying to pare the edges of each paper hinge. Note that partial tipping should not be done at the binding edge of the plate. If failure occurs there, it is preferable that it happen in the guard rather than in the plate. Some partial tipping has been observed in original bindings dating back to the 17th century. This may sometimes have been done intentionally, and sometimes it was an accidental by-product of how binders glued things.

Partial tipping can also be useful as the guarding material approaches a cross fold. These are very vulnerable areas on a map because conflicting mountain and valley folds must pop away from each other. This is especially true near the gutter of a book where the opening is restricted. Partial tipping at this point allows the map to reshape itself more gently, over a larger area.

The map in figure 13 may have originally been glued right up to the fold but has popped up off the guard through use. This is another example of how a map has relieved itself at a stress point. Dabbing a little glue in there to "fix the problem" would be a mistake.

Partial tipping does create a potential point of delamination, but with good quality adhesive and paper, this is not a significant concern. Cloth-to-cloth connections, however, tend to delaminate easily, and so partial tipping should not be used. Cloth-to-cloth connections are also most likely to arise when guarding cloth-lined maps, which tend to be very robust and unlikely to crack along a breaking edge.

Resewing and Rebinding

The choice to take a book apart and rebuild it is not one to take lightly. First, this choice inevitably destroys a portion of the material history of the object. Even when the structure is not original, there may be interesting provenance, use, or cultural information represented in the existing binding. Second, rebinding and the associated removal of thread,

Fig. 12. Partial tipping. Winterbotham, *The American Atlas*, 1796, Library of Congress Geography and Map Division.

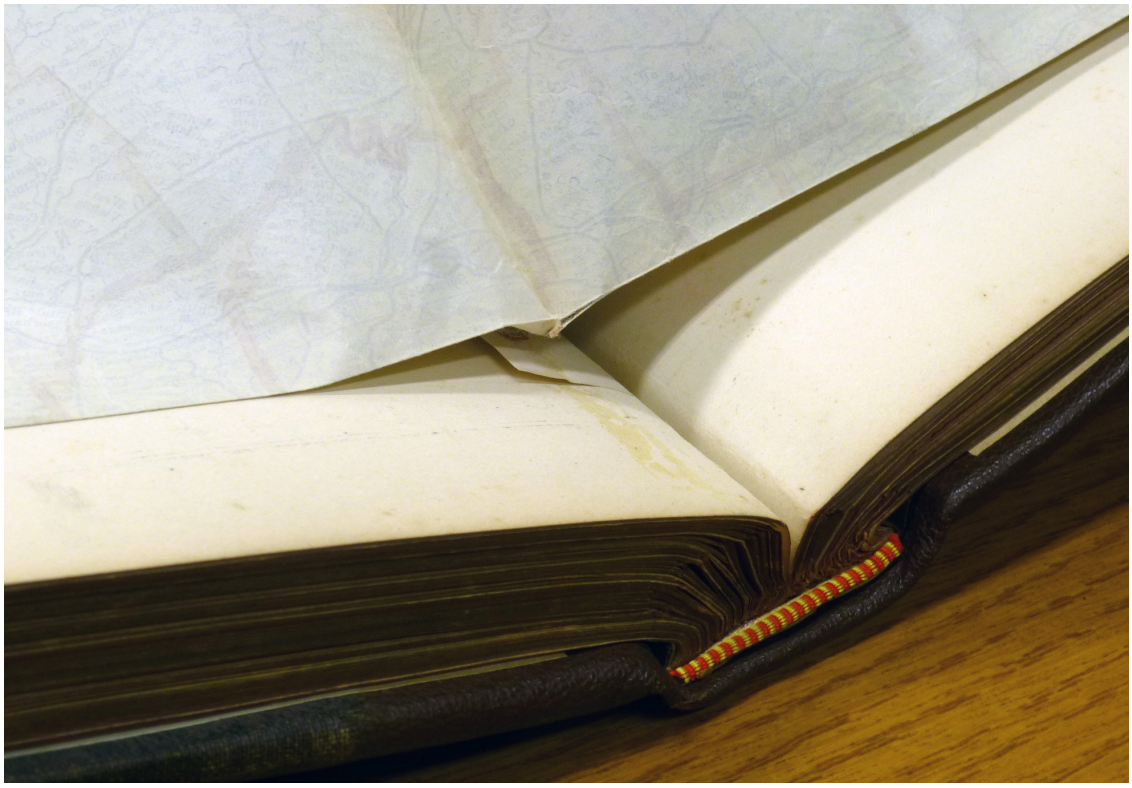

Fig. 13. Partial tipping at fold intersection. *Historical Hand-Atlas*, 1881, Library of Congress Geography and Map Division.

adhesive, linings, guards, and so forth always poses some risk to the object. Skill and experience mitigate but cannot eliminate those risks. In addition, rebinding is very time consuming, especially when guards, hinges, and compensation strips are added in. Despite this, rebinding a guarded structure is sometimes the best way to resolve structural problems and can allow a volume to be handled and used safely.

To help make the work of guarding multiple pages more efficient and consistent, jigs are essential. A variety of straightedge widths can make quick the work of precutting and folding guards. Brass spacers can ensure even and consistent distancing of plates from their compensation. A template or tray of binder's board can help to position each plate on its guard so that the heads and fore edges are well aligned (Bainbridge 2012).

One of the author's favorite jigs is designed to facilitate the partial tipping recommended earlier. Since the name "Guard-O-Matic" was already claimed for a different labor-saving device (Brooks 1984), this will be dubbed the "Atlas Guard-O-Matic" (fig. 14). To make the Atlas Guard-O-Matic, weld together three pieces of Mylar, forming a lower base layer and two upper flaps, with a quarter-inch gap between them. Place the guard into the sleeve so that the area to be glued is exposed and the free edge of the guard is masked by Mylar.

Fig. 14. Atlas Guard-O-Matic.

Apply adhesive, remove the guard from the sleeve, and place the foldout on the guard, leaving just the edge of the guard unadhered.

When a book is rebound, many choices affecting how it opens need to be considered. There needs to be a careful balance between the flexibility of the materials, the width of guards, and the pliability of the spine. The width of the guards should be proportional to the size of the book, and larger and thicker books need wider guards.

To give a sense of the variation, the largest atlas the author has rebound was 24½ in. tall and 2½ in. thick with cloth-lined, center-attached maps that unfolded out from the head and tail. Cloth-laminate guards that extended 1½ in. from the gutter and had a ¼-in. cloth gap were constructed and then hinged to the maps with a ½-in. overlap. For an atlas with similarly sized pages, but 1 in. thick and with center-attached bifolios, laminate kozo paper guards that extended 1 in. from the gutter and had a ¼-in. single-layer kozo paper gap were made and hinged to the maps with a ½-in. overlap. Smaller books have received ½- to ¾-in.-wide guards and ⅛- to ¼-in.-wide gaps.

Each book is different, and some may need to open more than others because of their paper qualities or how the plates unfold. The sewing method and spine linings of course have an effect on the opening. In general, it is best to avoid oversewing or excessive spine linings, because the guards should fan out at the spine and assist with the opening of the plates.

Once materials have been selected and cut to size, the order of assembly needs to be considered. This can be done several different ways. Oversize guards can be made first and folded along the spine edge; the excess width is trimmed, gatherings formed and pressed, and the plates adhered so that everything is aligned to the head. Excess guard lengths at the tail are then trimmed, and the book is sewn. However, for a book that needs gold-edged guards to match the plates, plates can be attached after sewing and edge gilding.

There can be some challenges during the sewing stage. For large books and books with foldouts, it can be difficult to support heavy pages while opening the text block to the fold. In addition, the heavy pages can collapse at that second hinge and make positioning difficult. Conservators have come up with all sorts of clever ways of supporting oversize pages using magnets, wire, binder's clips, or stiff boards (e.g., Peachey 2019; Avery and Lindsey 2019). If the structure of the book permits, the easiest solution to this problem is to position the short compensation guards consistently to one side of the sewing. When sewing from the correct side, only the guards need to be lifted, rather than the entire sheet. Of course, some books have plates adhered to both sides of the guard, and a way to suspend the pages during sewing needs to be devised.

When resewing a very large volume of cloth-lined maps, each bifolio can cling to its neighbor through cloth-to-cloth friction, making it difficult to jog pages to the head or even

shift a gathering into position for sewing. This problem can be resolved by placing a sheet of glassine between the pages that need to be shifted, then removing the glassine to lock the pages into position.

It may also be possible to attach large plates to the guards after rounding and backing, as is sometimes done in production bindery work (Van Herk 2010–2014). Especially for very large books, this is an attractive option because it is very difficult to get large books in and out of a job backer.

As a final caution, most of the preceding tips were designed for text blocks with guards of matching widths and fairly consistent structures. Guards are designed to push pages out past the gutter of the book and must be stiff enough to hold the page there without collapsing. The placement of that stiff material can cause problems when neighboring, unguarded pages or endpapers must flex against it. Treatment decisions need to consider not only how the book functions as individual guarded leaves and gatherings but also as a moving system.

For books with many bifolio pages on guards, there is a tendency to end up with a wedge-shaped book, as the overlapping guards and plates exceed the thickness of the pages at the fore edge. Cockerell (1901) and Banks (1972) both discuss pressing after the plates are attached to guards to reduce the thickness of the overlap, and older books may have been beaten.

Encapsulation and Post-Binding

A final and entirely different option for rebinding is polyester encapsulation. Deteriorated plates can be encapsulated and then resewn with an otherwise strong text block, or the entire book can be encapsulated and put into a post-binding. These bindings can even include foldouts, with the foldouts sectioned or intact (Ruzicka 1983). Encapsulation can be a good choice for high-use brittle books. However, encapsulated books triple in thickness and oversize atlases can become incredibly heavy.

CONCLUSIONS

The conservation of atlases, foldouts, and guarded structures cannot be formalized to a list of standard steps, but hopefully the preceding discussion can help guide conservators through some of their choices. In the author's experience, these treatments are rarely standard and always require creative problem solving.

A better understanding of these structures can also help conservators understand how the books were produced, marketed, used, and valued. In many published works on cartography and atlases, the physical structure is ignored or misunderstood. A conservator's experience is a valuable tool in correcting those errors and can provide insight into the significance of an object. As an example, the University of Michigan based its exhibit *Mr. Vignaud's Maps: Unraveling a Cartographic Mystery from the Golden Age of Dutch Cartography* on their efforts to understand the successive bindings and arrangement of composite atlases based on physical evidence (Utter and Platte 2018).

This article is an initial attempt to gather together information about these structures. Research will be continued, with a particular focus on the history of foldouts in books, traditional binding methods, and older conservation techniques. Input from others and suggestions for continued exploration of this topic are welcomed.

ACKNOWLEDGMENTS

This research was based on the work of many others, and the author is particularly indebted to the Rare Book Conservation interns who have taken on so many treatments and to colleagues at the Library of Congress, Elmer Eusman, Jennifer Evers, Alan Haley, Bailey Kinsky, Cathie Magee, Natalia Maliga, Karissa Muratore, Katherine Parks, Diane Schug-O'Neill, and Shelly Smith, and to Rebecca Smyrl and Pamela Spitzmueller. This article is in memory of Ed Redmond for his stewardship of the Library's atlas collection for so many years.

APPENDIX. GLOSSARY

There is a wide variety of terms used to describe foldouts, guarded structures, and atlases. This glossary gives preference to Roberts and Etherington's *Bookbinding and the Conservation of Books: A Dictionary of Descriptive Terminology* (1982) and the Ligatus *Language of Bindings Thesaurus*. Other terms were adopted from sources listed in the Terminology section of the Bibliography.

Apron: "The extra amount of unprinted paper left to serve as the binding edge of a leaf which folds out" (Roberts and Etherington). A **full apron** is an apron of extended length that allows a foldout map to be fully visible when a book is closed. Note: The terms throw out, full apron, and foldout have overlapping meanings in various glossaries.

Atlas: A collection of tables, charts, plates, or maps.

Compensation: Material added in the gutter of a bound volume to compensate for the thickness of bulky material positioned toward the fore edge. Also called **compensation guards** (Roberts and Etherington) or **compensating guards** (Ligatus). Simple strips of board or paper are sometimes called **compensation stubs** (Wootton, Boone, and Robb 2000; Brown 2000).

Composite atlas: A collection of previously issued maps from various sources, gathered together into a binding. Also called **atlas factice, Lafreri atlas,** or **Italian assembled-to-order**

(IATO) atlases. The last term was "coined by George H. Beans to describe the sixteenth-century Italian atlases assembled for clients by map publishers from a stock of separately published maps" (Woodward 1982). **Composite atlas** is the Library of Congress Genre/Form term. When differently sized maps are gathered into a binding, strips of paper adhered to the map edges, or **marginal strips**, are sometimes added to create an even book block (Woodward 1987).

Cross fold: Two folds that intersect, generally at right angles (Angsüsser 2013). Also called a **right angle fold** in the paper industry. A **French fold** refers to a single sheet of paper folded into fourths using a cross fold.

Foldouts: "Inserts that are larger than the trim size of the book or other publication and which must be folded before insertion" (Roberts and Etherington). Also called a **throw out** (Glaister 1996, 476).

Guard: "A strip of cloth or paper on which an illustration, map, etc., may be attached and sewn through with the section, thus allowing free flexing" (Roberts and Etherington). Ligatus distinguishes between **leaf guards** for single leaves or bifolios, and **extension guards** for foldouts. Also called a **conjugate guard** (Woodward 1982).

Guarded in: "Plates which are inserted into a book without being tipped to one of the leaves of the book. The paper area of the plate is wider than the leaves of the book, the projecting part being wrapped around the fold of the section. A narrow strip of paper appears elsewhere in the book as a consequence" (Roberts and Etherington). Could also be called **sewn in**.

Guarded in pairs: "A method of securing two plates to one guard. While the positioning of the guard within the section may or may not allow for either or both sides to be located near the accompanying text material, guarding in this manner may help alleviate some of the swelling caused by the thickness of the material used for the guards" (Roberts and Etherington).

Hooked: The formation of a fold at the spine edge of a leaf to allow the leaf to be sewn into the binding (Glaister 1996, 233). This is called a **returning guard** in Brown (2000).

Lipped: "A method of accommodating a [foldout] that is longer than the trimmed height of the book. A portion of a leaf to be folded adjacent to the gutter margin is cut away, i.e., lipped, so that the remaining portion may be folded without buckling and creasing the binding margin" (Roberts and Etherington). Glaister calls this **nibbed** (1996, 343). This cutting away is discussed in bookbinding manuals (Pleger 1915, 41–43).

Reversed v-guard: "A folded guard . . . to which a section is sewn, the folds of the guard meeting in reverse. The guard consists of several strips of paper folded with the two open ends being folded back on the guard, either together or in opposite directions . . . Also called 'meeting guard'" (Roberts and Etherington); see also **continuous guard** (Roberts and Etherington) and **meeting guard** (Horton 2000, 24).

Simple fold: A fold consisting of a single crease. The orientation can be either **mountain fold** or **valley fold**.

Stub: "[A] strip of paper or cloth tipped to the gutter edge of a leaf to match the thickness of a flat object, such as a photo or map, mounted to the leaf. Several strips of stubbing may be needed if the mounted object is thick" (Horton 2000, 26). "1. That part of an original leaf which is left after most of it has been cut away from its conjugate leaf. See also: Cancel. 2. A narrow strip of paper or linen sewn between sections of a book for the purpose of attaching plates, maps, etc." (Roberts and Etherington).

Throw-up: The curving of the book spine when it is opened. Throw-up helps the leaves lie flat (Greenfield 1998).

NOTE

1. Folding patterns are difficult to describe in words, and even then, terminology varies significantly from one author to another. Stephan Angsüsser (2013) states, "Folds with vertical folding lines are called horizontal folds, while those with horizontal folding lines are called vertical folds." But many authors use "horizontal fold" and "horizontal folding lines" interchangeably. To reduce confusion, this article will try to specify whether folds are perpendicular or parallel to the spine of the book.

REFERENCES

Adam, Paul. 1903. *Practical Bookbinding*. Translated from German by Thos. E. Maw. London: Scott, Greenwood & Co.

Agrippa von Nettesheim, Heinrich Cornelius, Petrus de Apono, Georg Pictorius, Gherardo, and Johannes Trithemius. 1916. *Heinrich Cornelius Agrippa's von Nettesheim magische Werke*. [3 aufl.] Berlin: H. Barsdorf.

Akerman, James Richard. 1991. On the shoulders of a titan: Viewing the world of the past in atlas structure. Ph.D. diss. The Pennsylvania State University. Available from ProQuest Dissertations & Theses Global. https://www.proquest.com/docview/303973784.

Albro, Sylvia, John Bertonaschi, Dan DeSimone, Lynn Brostoff, Fenella France, and Eliza Spaulding. 2012. "The Papers of the Ptolemy Puzzle." In *Papers of the XXXIst International Congress of Paper Historians* 19. 123–134.

Angsüsser, Stephan. 2013. "Map Folding Techniques in the Digital Age." *Proceedings of the 26th International Cartographic Conference. Dresden, Germany, August 25–30, 2013*. https://icaci.org/files/documents/ICC_proceedings/ICC2013/_extendedAbstract/431_proceeding.pdf.

Avery, Melina, and Ann Lindsey. 2019. "Repairing a 52-Pound Antiphonary at the University of Chicago." *The Book and Paper Group Annual* 38: 1–8.

Bagrow, Leo. 1975. *A History of the Cartography of Russia up to 1600.* Wolfe Island, Ontario: Walker Press.

Bainbridge, Abigail. 2012. "Disbinding Gabriel Tatton's Maritime Atlas of the East Indies" and "Rebinding Gabriel Tatton's Maritime Atlas of the East Indies." *West Dean College of Arts and Conservation Blog*. Accessed November 15, 2021. https://www.westdean.org.uk/study/school-of-conservation/blog/books-and-library-materials/tatton.

Banks, Paul N. 1972. "The Treatment of an 1855 British Paper Specimen Book." *Bulletin of the American Group: International Institute for Conservation of Historic and Artistic Works* 12 (2): 88–95.

Blank, M.G., S.A. Dobrusina, and N.B. Lebedeva. 1984. "A Search of Procedures for Restoration and Stabilization of 16th and 17th Century Netherlands Atlases Damaged by Green Paint." *Restaurator* 6: 127–138.

Brooks, Connie. 1984. "The Guard-O-Matic." *The Book and Paper Group Annual* 3.

Brostoff, Lynn, Sylvia Albro, John Bertonaschi, and Eliza Spaulding. 2011. "The Relationship Between Inherent Material Evidence in Cultural Heritage and Preservation Treatment Planning: Solving the Ptolemy Puzzle, Part II." *The Book and Paper Group Annual* 30.

Brown, Barbara, comp. 2000. "Glossary of Terms for the Photographic Album Survey." In *Conservation of Scrapbooks and Albums: Postprints of the Book and Paper Group/ Photographic Materials Group Joint Session at the 27th Annual Meeting of the American Institute for Conservation of Historic and Artistic Works.* Washington, DC: AIC. 85-92.

Carlson, Lage. 1997. "An Interim Treatment for Paper Degraded by Verdigris." *The Book and Paper Group Annual* 16.

Cockerell, Douglas. 1901. *Bookbinding, and the Care of Books; a Text-Book for Bookbinders and Librarians.* London: J. Hogg.

Conroy, Tom. 1987. "The Movement of the Book Spine." *The Book and Paper Group Annual* 6.

Dobrusina, S.A., N.I. Podgornaya, N.S. Volgushkina, and V.M. Tsitovich, V. M. 2019. "Preservation Evaluation of the Collection of Western European Engraved Atlases of the 16th–18th Centuries. The Electronic Passport of the Atlas's Condition." *Conservation Update—Publication of the ERC*, 1/2019 (April).

Glaister, Geoffrey A. 1996. *Encyclopedia of the Book.* 2nd edition. New Castle, DE: Oak Knoll Press.

Greenfield, Jane. 1998. *ABC of Bookbinding.* New Castle, DE: Oak Knoll Press.

Helm, Sarah, Erin Platte, and Grace Rother. 2018. *The Geography of Colorants*. Online exhibit by the University of Michigan. Accessed June 3, 2021. https://apps.lib.umich.edu/online-exhibits/exhibits/show/the-geography-of-colorants.

Horton, Richard. 2000. "Glossary of Terms Relating to Photo Albums." In *Conservation of Scrapbooks and Albums: Postprints of the Book and Paper Group/Photographic Materials Group Joint Session at the 27th Annual Meeting of the American Institute for Conservation of Historic and Artistic Works*. Washington, DC: AIC. 21–27.

Kelly, Katherine S., Jennifer K. Herrmann, Alisha Chipman, Andrew R. Davis, Yasmeen Khan, Steven Loew, Katharine Morrison Danzis, Tamara Ohanyan, Lauren Varga, Anne Witty, and Michele H. Youket. 2022. "Heat- and Solvent-Set Repair Tissues." *Journal of the American Institute for Conservation* 61 (1): 24-54.

Kiesel, William. 2015. "Folding Plates in Esoteric Literature." *The Journal of the Book Club of Washington* 15 (1): 41–60.

Kyle, Hedi. 2017. "The Fold: Evolution, Function, and Inspiration." In *Suave Mechanicals*, vol. 3, edited by Julia Miller. Ann Arbor, MI: Legacy Press. 160–195.

LeGear, Clara Egli. 1950. *Maps: Their Care, Repair and Preservation in Libraries*. Washington, DC: Division of Maps, Library of Congress.

Ligatus. n.d. *The Language of Bindings Thesaurus*. Accessed February 2, 2016. http://www.ligatus.org.uk/lob/.

Matthews, William. 1929. *Bookbinding; a Manual for Those Interested in the Craft of Bookbinding*. New York: E. P. Dutton & Co.

Minogue, Adelaide E. 1943. *The Repair and Preservation of Records.* Washington, DC: U.S. Government Printing Office.

Minter, Bill. 2015. "The Meeting Guard: Its Use Historically and Its Use in Fine Bookbinding, Conservation and Artist Books." Handout from the 2015 Guild of Book Workers Standards of Excellence.

Parks, Katherine, and Karissa Muratore. 2021 (forthcoming). "Rebinding Two American Atlases with a Laminated Guard Structure at the Library of Congress." In *Book Conservation–One Philosophy–Many Interpretations.* Krems, Austria: European Research Centre for Book and Paper Conservation-Restoration.

Peachey, Jeff. 2019. "A Simple Fixture to Hold Leaves Upright on a Sewing Frame." *Peachey Conservation Blog*. Accessed June 3, 2021. https://jeffpeachey.com/tag/sewing-big-books/.

Pleger, John J. 1915. *Bookbinding and Its Auxiliary Branches: Part II: Punching, Crimping, Cycletting, Pamphlet and Quarter Binding*. Chicago: Inland Printer Company.

Ristow, Walter W. 1985. *American Maps and Mapmakers: Commercial Cartography in the Nineteenth Century*. Detroit: Wayne State University Press.

Roberts, Matt T., and Don Etherington. Drawings by Margaret R. Brown. 1982. *Bookbinding and the Conservation*

of Books: A Dictionary of Descriptive Terminology. Washington DC: Library of Congress.

Ruzicka, Glen. 1983. "Polyester Encapsulation in Signatures." *The Book and Paper Group Annual* 2.

Spitzmueller, Pamela. 1996. "A Sourcebook on Atlas Structures." Workshop notes prepared for the Andrew W. Mellon funded Advanced Conservation Workshop Series at the University of Iowa Libraries Conservation Department, February 27–March 2, 1996, Iowa City.

Tsai, Fen-Wen. 1992. "Sixteenth and Seventeenth Century Dutch Painted Atlases: Some Paper and Pigment Problems." In *Conference Papers, Manchester 1992*, edited by Sheila Fairbrass. London: Institute of Paper Conservation. 19–23.

Utter, Tim, and Erin Platte. 2018. *Mr. Vignaud's Maps: Unraveling a Cartographic Mystery from the Golden Age of Dutch Cartography*. Online exhibit from the University of Michigan Library. Accessed June 6, 2000. https://apps.lib.umich.edu/online-exhibits/exhibits/show/rediscoveringvignaud.

Van Der Krogt, Peter. 1996. "Amsterdam Atlas Production in the 1630s: A Bibliographer's Nightmare." *Imago Mundi* 48: 149–60.

Van Herk, Hannie. 2010–2014. "Atlas der Neederlanden." Series of blog posts on the conservation of the University of Amsterdam's *Atlas der Neederlanden*. Accessed April 22, 2021. http://atlasderneederlanden.blogspot.com/ (Google Translate of Dutch text).

Vidler, Karen. 2013. "Proeschel Atlas Conservation Project." Series of four blogs posts. *National Library of Australia*. Accessed November 15, 2021. https://web.archive.org/web/20140309030710/https://www.nla.gov.au/blogs/author/kvidler.

Woodward, David. 1982. "The Techniques of Atlas Making." *The Map Collector* 18: 5.

Woodward, David. 1987. "The Analysis of Paper and Ink in Early Maps." *Library Trends* 36: 85–107.

Woodward, David. 2007. "Techniques of Map Engraving, Printing, and Coloring in the European Renaissance." In *The History of Cartography*, vol. 3, Part 1. Chicago: University of Chicago Press. 591–610.

Wootton, Mary, Terry Boone, and Andrew Robb. 2000. "The Structure's the Thing! Problems in the Repair of Nineteenth-Century Stiff-Pages Photograph Albums." In *Conservation of Scrapbooks and Albums: Postprints of the Book and Paper Group/Photographic Materials Group Joint Session at the 27th Annual Meeting of the American Institute for Conservation of Historic and Artistic Works.* Washington, DC: AIC. 37–44.

Zaehnsdorf, Joseph W. 1880. *The Art of Bookbinding*. London: G. Bell & Sons.

Zaehnsdorf, Joseph W. 1890. *The Art of Bookbinding: A Practical Treatise*. 2nd ed. London: G. Bell & Sons.

Zagorski, Melissa. 2007. *The Geography of Significant Colorants: Antiquity to the Twentieth Century*. Thesis from George Mason University. Accessed September 23, 2020. https://hdl.handle.net/1920/2951.

FURTHER READING

Akerman, James R. 1995. "From Books with Maps to Books as Maps: The Editor in the Creation of the Atlas Idea. In *Editing Early and Historical Atlases: Papers Given at the Twenty-Ninth Annual Conference on Editorial Problems, University of Toronto, 5–6 November 1993*, edited by Joan Winearls. Toronto: University of Toronto Press.

Banks, Paul N. 1976. "The Conservation of Maps and Atlases." In *The 1976 AB Bookman's Yearbook*. Newark: Bookman's Weekly. 53-62.

Boyle, Lucinda. 2015. "Reproduction of Maps—Folding Strategies." *The History of Cartography*, vol. 6. Chicago: University of Chicago Press. 1336–1338. https://press.uchicago.edu/books/HOC/HOC_V6/HOC_VOLUME6_R.pdf.

Diehl, Edith. 1980 (1946). *Bookbinding: Its Background and Technique.* Two volumes bound as one. New York: Dover Publications.

Ehrenberg, Ralph E. 1982. *Archives & Manuscripts: Maps and Architectural Drawings.* SAA Basic Manual Series. Chicago: Society of American Archivists.

Federici, Carlo, and Margaret Hey. 1975. "Problems Involved in the Restoration of a Mercator Atlas." In *ICOM Committee for Conservation preprints*. *4th Triennial Meeting, Venice*. Paris: ICOM. 1-19.

Fontaine Verway, Herman de la. 1971. "The Binder Albert Magnus and the Collectors of His Age." *Quaerendo* 1 (3): 158–178.

Fontaine Verway, Herman de la. 1981. "The Glory of the Blaeu Atlas and the 'Master Colourist.'" *Quaerendo* 11 (3): 197–229.

Geraty, Peter. 2019. "A Manual Approach to Stiff-Board Parchment Binding." In *Suave Mechanicals*, vol. 5, edited by Julia Miller. Ann Arbor, MI: Legacy Press. 124–197.

Johnson, Arthur W. 1985. *The Practical Guide to Bookbinding*. New York: Thames & Hudson.

Lister, R. 1965. *How to Identify Old Maps and Globes*. North Haven, CT: Archon Books.

Miller, Ann-Marie, and Lesley Hanson. 2010. "The Maker and the Monk: Conservation of the *Mercator Atlas of Europe*." *Journal of the Institute of Conservation* 33 (1): 29–39.

Monmonier, Mark. 2017 "Folding, Unfolding." In *Patents and Cartographic Inventions*. Palgrave Studies in the History of Science and Technology. Cham: Palgrave Macmillan. 105–135.

Nicholson, James B. 1856. *A Manual of the Art of Bookbinding*. Philadelphia: Henry Carey Baird.

Pardo, Luciano. 2003. "Restauración del Atlas Mayor o Geografía Blaviana: nuevas técnicas de intervención

(Conservation of the Atlas Major or, the Geografía Blaviana: New Intervention Techniques)." *Revista PH* 11 (43): 89–99.

Stillo, Stephanie Elizabeth. 2016. "Putting the World in Its 'Proper Colour': Exploring Hand-Coloring in Early Modern Maps." *Journal of Map & Geography Libraries* 12 (2): 158–186.

U.S. Government Printing Office. 1962. *Theory and Practice of Bookbinding*. U.S. Government Printing Office Training Series. Washington, DC: U.S. Government Printing Office.

Valk-Falk, Endel. 1975. "The Conservation of the Atlas-Incunabula of Francesco Berlinghieri's 'The Geography by Means of Pulp-Filling Apparatus.'" In *ICOM Committee for Conservation preprints. 4th Triennial Meeting, Venice*. Paris: ICOM. 75/15/14-1-10.

Winearls, Joan. 1993. *The Atlas as a Book, 1490 to 1900*. Toronto: Thomas Fisher Rare Book Library, University of Toronto.

KATHERINE S. KELLY
Senior Book Conservator
Library of Congress
Washington, DC
katherineswiftkelly@gmail.com