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Authors: Melina Avery and Ann Lindsey
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American Institute for Conservation
727 15th Street NW, Suite 500
Washington, DC 20005
info@culturalheritage.org www.culturalheritage.org

MELINA AVERY AND ANN LINDSEY

Repairing a 52-Pound Antiphonary at the University of Chicago

INTRODUCTION

In October 2017, the University of Chicago Library conservation laboratory started planning the treatment of the largest item in the library's Special Collections Research Center, call number MS 967. The book is an antiphonary for matins: a book of music for a choir, specifically for the early morning prayers at a monastery. The book is Spanish in origin, and the textblock is estimated to date to the late 16th century. It weighs 52 pounds and is known as a "whale folio." It is a popular teaching tool and is used several times a year at minimum. The antiphonary's call number, MS 967, indicates that it was the 967th manuscript acquired by the library. Beyond that, its provenance is unknown to current library staff.

Antiphonaries are large because the whole choir has to be able to read them from a distance. The dimensions of MS 967 are $33 \times 21 - 1/2 \times 5$ in. This includes 3/4 in. thick wooden boards covered in a thick leather hide. The hide is one single piece, so it must have come from a large animal, such as an ox. There is large brass furniture on the covers, including four corners and five bosses on each board. One corner and one boss are missing from the back, and one boss is missing from the front. The textblock is made of 77 parchment leaves. Because the pages are too large to form a conjoined folio from a single skin, each leaf is a single piece of parchment, attached to its folio mate by a stub at the fold, adhered with hide glue. In addition to the ox hide cover, 77 goats or calves gave their skins for this book. These were probably large calves given the size of the pages.

The antiphonary is a manuscript, with content made up of neumatic notation, an early form of written music, and text in Latin. The media is primarily black ink, with red, blue, and yellow media as well. The book is not highly illuminated, but there are some large decorative letters and designs throughout.

The antiphonary has some unexplained characteristics. Four pages were cleanly sliced out near the fold and are loose in the book, possibly for previous display in an exhibit or for sale, as single pages can be more valuable than an intact book. The pages were somehow reunited with the rest of the book before it came into the library's collection.

The case is probably not original to the textblock. The exact age of the case is unknown, although it is estimated to be from the 18th century, making the textblock at least 100 years older than its case. It is unknown if the case was made for the textblock or whether it was repurposed. Pagination is also inconsistent, indicating that the book has been reordered and that many pages are missing. The numbers are out of order and go up to almost 300, although there are only 77 parchment leaves. In the 1970s, a scholar speculated that this change had to do with a revision of the matins liturgy. Some of the missing pages were repurposed; segments of discarded pages have been used to mend and fill losses in the retained pages.

The textblock fits perfectly in its case, without overall evidence of the pages having been trimmed to fit. Natural parchment edges along the bottom and fore-edge indicate that the textblock has not been trimmed. However, the top edge may have been trimmed. The top edges are all cleanly cut, and one illumination was either cut off at the top or unusually designed to appear cut off. This is evidence that the case was repurposed and the textblock was trimmed to fit into it.

Additionally, conservators noticed a slightly sticky substance on the areas of the leather case that have been tooled. On the front cover, there has been some dust and soil accumulation that makes these areas visually apparent. On the spine and back cover, these areas are slightly sticky to the touch but not noticeable under natural light. In all areas, the substance is visible under UV illumination, with bright pale-yellow fluorescence, and an appearance consistent with having been painted over tooled areas. The tooling is blind, but this sticky substance may be an egg white glair layer, meant for gold tooling. The bright pale-yellow fluorescence is consistent with egg white. If this is the case, the bookbinder may have planned to tool with gold but did not follow through, as no evidence of gold is present (fig. 1).

CONSERVATION ISSUES

MS 967 was brought to the attention of the University of Chicago Library conservators because its heavy use was

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Fig. 1. Before treatment

exacerbating the poor condition of the book. The book was prioritized for conservation because the Special Collections Research Center curators did not want to limit its use or risk further damage from handling.

The volume had been rebound in the late 19th or early 20th century, and this repair had failed. The textblock had been sewn without supports, with heavy buckram fabric and hide glue lining the spine; this lining was still holding the outer folds of the textblock spine together. The inner hinges had broken, meaning that the case was entirely detached from the textblock. The sewing was broken, leaving many sections detached or coming apart. As described previously, four loose pages had been cut out and placed unattached in the textblock. This situation left the textblock extremely vulnerable when handled.

The damage to the individual parchment leaves varied. Presumably, when in use for the choir or when on display, some pages would have gotten more use or more wear than others. Some of the leaves were quite soiled and had small tears and losses. Larger tears had been mended previously with sewn linen thread, a historic parchment repair technique. Some of these historic repairs were broken, leaving longer tears vulnerable to further damage during handling.

CONSERVATION TREATMENT GOALS AND PREPARATION

Treatment planning was a collaboration between conservation, digitization, and special collections staff. It was determined that the book should be brought back to the format in which it came to the collection. The primary goal was to get MS 967 back in one piece and safe for patrons to use. All original components of the textblock and case would be retained and reattached to each other. Rebinding would be based on the evidence of its prior binding. Parchment leaves and the leather on the case would be mended as necessary. The textblock would be sewn with thick thread onto double cords that would be laced into the boards. Additionally, the book would be digitized while disbound.

Digitizing loose pages of this size would be much easier for the preservation department photographer than handling the entire book. Because of the irregular pagination, the loose sections and the detached pages, MS 967 was carefully examined by conservation staff, special collections curators, and a University of Chicago music librarian to determine that the page order was correct before treatment began. Conservators also prepared for treatment by seeking advice from the conservation staff of the Newberry Library in Chicago. The

Newberry has a large collection of antiphonaries, and the conservation staff has treated many of them.

CONSERVATION TREATMENT

Surface Cleaning

Treatment began with surface cleaning. A rubber sponge eraser was used, and only blank spaces were cleaned so as not to disturb the media. The media was stable and did not require consolidation, but disturbing it during surface cleaning was not perceived to be worth the risk.

Cleaning The Spine for Disbinding

The next step was to disbind the textblock. Although many individual pages were fully or partially detached, the outer layer of the spine was still adhered together with thick hide glue and heavy buckram fabric spine liners. Typically, a conservator would expect hide glue to soften only under extended contact with hot water. Parchment is very sensitive to water, so directly applying hot water seemed risky. The necessary components of a safe and effective system were minimal moisture, sufficient heat, and extended contact.

The conservators decided to try a 2% gellan gum poultice. Gellan gum can be shaped to carefully control the size of the dampened area, and it is a relatively dry gel, so minimal moisture would seep through the spine linings into the parchment itself. Conservators were confident that using gellan gum for extended contact would be safe, as it releases moisture in a slow, controlled manner, and the progress and safety of the project could be monitored easily. Experimentation with cold gellan gum, held to the textblock spine with plastic wrap, was unsuccessful; the hide glue, unsurprisingly, did not soften. Conservators tried placing a heating pad over the plastic wrap to warm the cold gel. This was also unsuccessful, as the gentle heat of the heating pad did not warm the gel enough to warm and soften the hide glue.

Hide glue is known to soften at 140°F. Conservators experimented with methods to heat the gellan gum poultice to 140°F without causing it to dissolve. A probe thermometer was employed to take the internal temperature of the gellan gum, which was heated in a microwave. The most successful method was to warm a shallow water bath, then place the gellan gum poultice into the water bath and microwave for 20 seconds more. This method brought the poultice up to the required temperature just before it started to melt. The warm gellan gum was immediately placed against the textblock spine and was covered with plastic wrap, and the heating pad, to keep warm. Soft weights were placed against the heating pad to improve contact. Progress was checked regularly, and within 1 to 3 hours, the buckram could be removed from the area treated with the warm gellan gum poultice. The process had to be repeated to soften the hide glue beneath the buckram, as the moisture from the poultice did not penetrate through the buckram.

This method of spine cleaning required a fair amount of trial and error. Conservators tried to better control the heat of the system with a beaker warmer, which advertised precise temperature control. However, set to 140°F, it would spike to a surface temperature so hot that it would risk burning conservators and damaging the antiphonary. The heating pad, meant for home use, provided a lower but sufficient and safe source of heat. Efficiency was also attempted with longer pieces of gellan gum to soften more of the spine linings at the same time, but the dampened sections of the spine would cool too quickly to work with more than a few inches at a time. Once the glue cooled, it rehardened immediately.

After the second poultice process, the textblock sections could be fully separated. A thick layer of hide glue remained on the spine of each section, impeding flexibility. The folios are made of two pieces of parchment glued together at the spine, so flexibility was already limited. Very hot water was brushed on to reduce this glue layer, using a small brush, and once softened, the glue was mechanically reduced using a microspatula.

The full spine cleaning process took 3 weeks. The result was the separation of the sections to facilitate resewing, the reduction of the glue to a thin layer, and the return of flexibility to the folds.

Parchment Repair

The next step was to repair damaged pages. First, methods were tested on modern parchment. Repair materials need to be compatible with the original parchment, and need to have sufficient strength to mend the large pages. The material that performed the best in testing was goldbeater's skin, a transparent and robust material made from the intestinal lining of an animal. It is a commonly used, stable, and traditional repair material for parchment. Its strength, transparent appearance and flexibility would be assets in mending the antiphonary's parchment pages.

The adhesives tested were room temperature 5% photography-grade gelatin mousse, warm 5% photography-grade gelatin, and purified hide glue. All were effective for small mends, but warm gelatin and hide glue were the most effective for large mends.

For small mends and fills, gelatin mousse was chosen. This room temperature gelatin, worked through a sieve, is a weaker adhesive than hot gelatin and does not penetrate the materials as much as the warm adhesives do. These mends and fills are sufficiently strong, and they affect the original materials the least. The transparent goldbeater's skin did not obscure the color and texture of the parchment. Historic mends were also re-repaired with gelatin mousse and goldbeater's skin as needed.

Reattaching the loose cut-out pages required stronger mending materials. There is more pressure on those mends because the slice is only an inch from the fold, and the fold is quite stiff. The fold includes two layers of parchment, a stiff material to begin with, and they are adhered with hide glue, which further impedes flexibility. The mends along the cut edges needed to be very strong so that pressure from turning the pages would not cause the mends to fail. Because parchment reacts so strongly to humidity, and because decades have passed since the pages were sliced out, the two lines of the slice were both warped and wavy, no longer perfectly lining up. Stronger versions of the mending materials were chosen: thicker goldbeater's skin and warm 5% gelatin.

Tests had indicated that these materials would work, although no parchment scraps of such a large size were available to test the repair over the full 33 in. This repair had to be done very carefully, several inches at a time, to ensure that the edges lined up correctly and were adhered securely. The pages were successfully reattached, with goldbeater's skin mends on both sides of the page.

The full mending and page reattachment process took 6 weeks. Reattaching the sliced-out pages was the most time-consuming part of the process.

Digitization

After repair of the parchment leaves and before resewing, the preservation department photographer digitized the book. He was able to use the large sewing frame with a magnetic crossbar, built especially for this project, to position the pages. Digitizing a book of this size while disbound was much easier for him than digitizing it bound or in its delicate state before treatment.

Resewing

The next step in treatment was to sew the textblock onto cords in the same style used in its previous incarnation. The size of the cords was known, as they were still partially intact and laced into the wooden boards. High-quality linen cords in the required size were not available for purchase. The conservation team made new cords of the appropriate size by twisting thick linen thread into a new cord, using a hand drill. Eight double sets were made that were similar in size to the originals. Team members started out by standing 20 ft. apart, and eventually twisted and folded the thread down to 3-ft. lengths of cord. Making all of the cords for this project took 2 days.

The sections were prepunched and the cords arranged on the sewing frame according to measurements from the case. Glue and damage from the prior rebind obscured the original sewing holes, so measurements taken from the case were more reliable. The correct placement of the cords was especially important, as the leather spine of the case had raised areas to accommodate cords, and the boards have channels and holes that would be reused. Heavy shoemaker's thread was used to sew the book. It is the same size as the original linen thread, segments of which were found in the textblock folds. It is much thicker than typical bookbinding thread, although is the same high-quality linen that is used to sew smaller books. New parchment endsheets were also incorporated and added to protect the first and last pages, as well to help with board reattachment. Because new paste-downs were not desired or needed, the flyleaf endsheets had stubs that would be adhered under the original paste-downs during board reattachment. Sewing the book took a week. A large sewing frame on wheels, which had been built for this project, was also integral to facility security measures. The partially sewn book had to be returned to the conservation laboratory's secure vault every night and wheeled back out every morning.

Pressing

Once the textblock was resewn, it was then pressed. Increased textblock size is often a consequence of rebinding. This is not much of a concern if a new case is being made. For this project, however, pressing was necessary because the original case was fully intact, and there was added bulk from the new sewn-in endsheets. The textblock needed to be the exact size it used to be.

Spine Lining

While the textblock was pressing, the spine was lined. The first layer acted as a reversibility layer and was made up of heavy Japanese paper adhered with gelatin mousse. The second layer was an extended spine liner that would aid in reattaching the case and was made from thick cotton strips. These were placed between the cords and adhered using purified hide glue. Finally, a heavy paper was adhered between the cords, also using hide glue, to provide support.

Case Repair

Only minor repairs to small tears along the joints were needed for the case. Otherwise, the case was in excellent condition. After consolidating the original leather with Cellugel in isopropyl alcohol, Jade 403 adhesive was used to affix small pieces of Moriki paper of similar color to the original leather. The Moriki was chosen for its similarities in color to the original leather.

Board Reattachment

To reattach the case, sufficient access was needed to the lacing-in areas of each board. The original parchment paste-downs were lifted using a microspatula, as was the leather near the

Fig. 2. Before treatment

spine. The old cords were removed from the channels and holes, and lifted off the board where adhered.

Relacing the boards to the textblock made for a strong board attachment. This book is large, heavy, and difficult to handle; the hinges are the most vulnerable breaking point, and they had to be secured in multiple ways. In addition to lacing the boards, heavy cotton spine liners were also adhered between the boards and the original leather. Purified hide glue was used to adhere the cord, cotton, board, and leather layers.

The stubs of the sewn-on parchment endsheets were dampened with a sponge and left overnight to form to the board. Once they fit in place, they were adhered down against the board, and the original paste-downs were adhered over the top using purified hide glue. The hinge came together neatly, and the board attachment is very strong.

The leather spine was not adhered to the case. As such, the textblock is securely in the case but reversibility is better maintained, and scholars can more easily access the inner spine of the case (figs. 2, 3).

Treatment Conclusions

The result of treatment is that the antiphony is now back in one piece and safe for library patrons to handle. Every page is securely in place, with the added protection of the new parchment endsheets. The sliced-out pages, newly repaired, function well with mends that are flexible and strong. The textblock fits perfectly back into its case and the book opens easily, with good flexibility in the spine.

The treatment was highly successful and allowed conservation staff to develop solutions not only for MS 967 but also to set solutions in place for similar challenges in the future. MS 967 was returned to the Special Collections Research Center, where it returned to its previous life as a treasure of the collection and a popular teaching tool for University of Chicago faculty.

HOUSING

MS 967 is stored flat, and University of Chicago conservators were inspired by the Newberry Library's minimalist "sled"

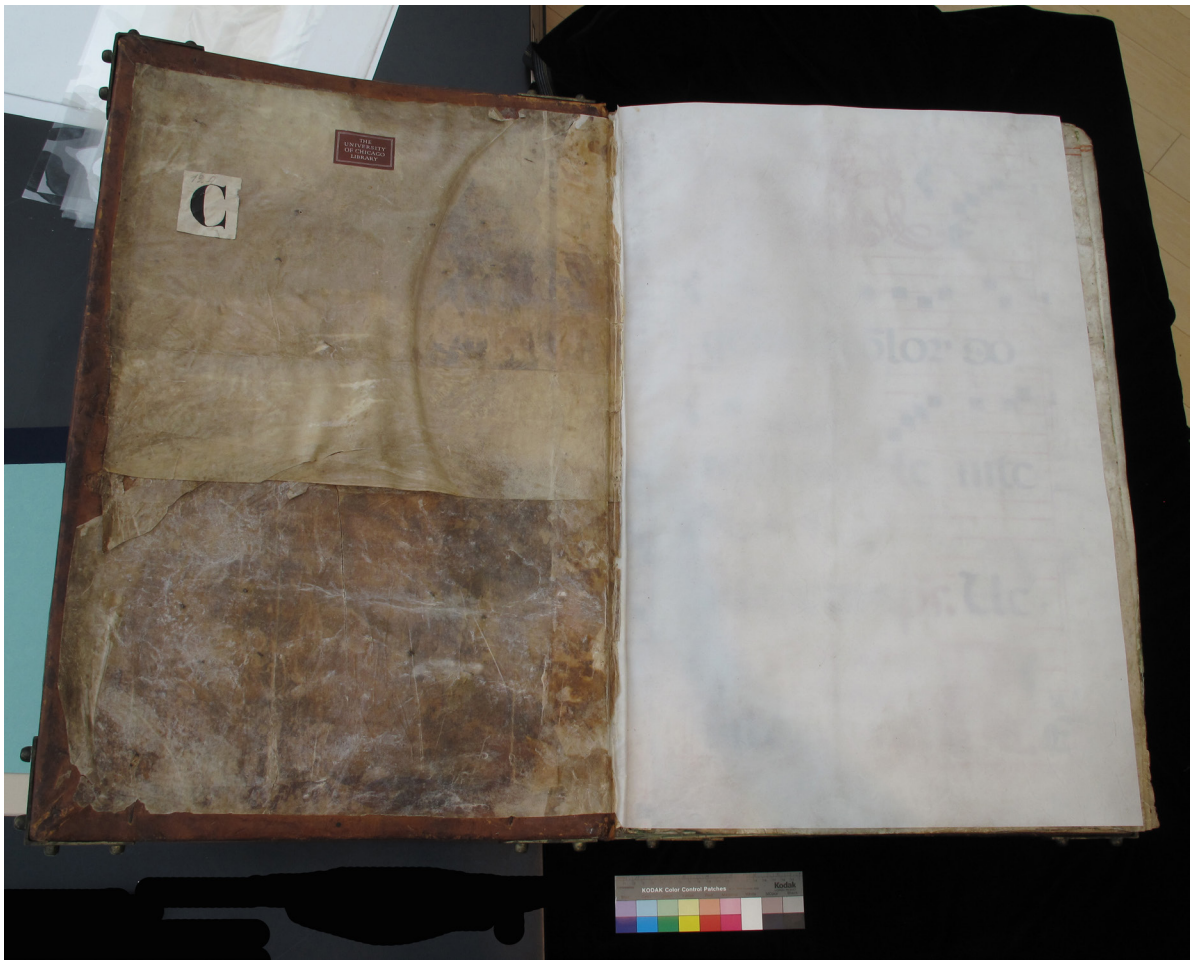

Fig. 3. After treatment

housings for their antiphonaries, also stored flat. Ann Lindsey built a large, double-walled corrugated polypropylene sled for MS 967, with handles, so that staff can more safely retrieve and return the heavy book. The sled has three high sides to protect the sides of the book, with a tail that is left open so that the book can be retrieved and returned easily. The inner bottom of the sled is lined with acid-free binder's board, which prevents the book from sliding as the sled is moved. There is a removable Velcro strap across the tail to further prevent the book from sliding out. The smooth polypropylene of the outer bottom of the sled slides easily against the metal shelf, and the handles make retrieving and returning the book safer and more comfortable for staff.

FABRICATING AN OVERSIZED SEWING FRAME AND PRESS

To complete the treatment of MS 967, it was clear that oversized equipment would be required. The conservators had been successful in the past, setting up temporary solutions for large items, but there was a concern that previous solutions would not work for something as large and heavy as MS 967. Of chief concern was that the textblock had to fit back into the case; there was little to no room for swell. The treatment would need a sewing frame and a press, neither of which are commercially available in the size required. The equipment had to be mobile to reduce handling of the object, convertible between the sewing frame and press, and collapsible and repurposed for reasons of space. In short, the equipment would have to be fabricated, and the decision was made to do that in-house.

A butcher block table on wheels was purchased. Two holes were needed for the sewing press, but to double as a press, four holes were drilled and threaded, one in each corner. Two additional holes were drilled, and a channel was sawn between them to allow the cords to pass through. For the uprights, 1-in. dowels that were 36 in. long were threaded from each end, leaving an area approximately 6 in. long to be used as a hand hold. Four wooden nuts were constructed and threaded to move up and down along the

Fig. 4. Using the oversized sewing frame

uprights. Crossbars were constructed to be placed over the uprights. One crossbar was intended to secure the cords, whereas the second crossbar was planed to create a flat side. Metal strips were attached to this flat side using small brass nails, and wooden handles were created to hold powerful earth magnets. During use, the two uprights were screwed into the table, and the first crossbar was secured with two of the wooden nuts. The second crossbar was similarly secured, and along with the metal strip and magnets, it was used to hold the manuscript leaves open during sewing.

The press component used four shorter 1-in. dowels that were threaded similarly, although these dowels were only 12 in. long and threaded along the entire length. Four heavier wooden nuts were also constructed. During use, the four shorter dowels are placed in each corner, and a Plexiglas sheet with corresponding holes is lowered over the dowels and secured with heavy wooden nuts.

In the end, the equipment met all of the requirements, was mobile, and quickly converted from a sewing frame to a press, and the parts are collapsible and can be stored for future use. (fig. 4)

MELINA AVERY
Conservator
University of Chicago Library
Chicago, IL
melinaavery@uchicago.edu

ANN LINDSEY
Head of Conservation
University of Chicago Library
Chicago, IL
annlindsey@uchicago.edu