

Line Up, Back to Back: Restoration of a Korean Buddhist Sutra in Accordion Book Format

ABSTRACT

East Asian Buddhist sutras are sometimes mounted in accordion book format and are commonly seen in China, Japan, and Korea. Sutra text is written mostly in gold or silver on indigo dyed paper. The indigo papers were either brush or vat dyed, lined with layers of paper, and then joined together as needed. A long, horizontal section of indigo paper may be folded into narrow pages, with wooden or paper covers attached to the ends. A Korean Buddhist sutra, *Dirghagama Sutra*, in 10-leaf accordion book format with both top and bottom paper covers was brought in for treatment to the Asian Conservation lab at the Museum of Fine Arts, Boston. Many of the condition problems of this sutra were likely linked to its function as a personal religious item. Problems included damage and losses due to excessive handling, an embossed circular impression likely from a vessel of some sort, substantial dirt and soiling, unknown attachments, and crude repairs (tape). Major treatment involving the disassembly and remounting of the sutra had to be considered to stabilize the sutra and permit its safe display and future handling.

This article presents the examination, documentation, and treatment of a Korean Buddhist sutra. Treatment included surface cleaning, structural stabilization, disassembling, tape removal, infilling, lining, and mounting. Conservators overcame several challenges, such as unifying the size of pages, infilling missing sections along folds, and readhering the front and back with fold lines aligned. During the course of treatment, several interesting discoveries were made involving the interior structure of the sutra, as well as the materials used to create the object. It is hoped that this case will be useful for the future conservation of other similar sutras mounted in accordion book format.

INTRODUCTION: KOREAN BUDDHIST SUTRA IN ACCORDION BOOK FORMAT

Korean Buddhist sutras can sometimes be mounted as an accordion book or in scroll format. During the Goryeo period (918-1392), indigo blue, ochre, and ivory white colors were used for Buddhist sutras, with indigo blue the most common color that appeared on earlier sutras. Sutras were produced by members of the ruling class or their families as a way to pray for the nation, their ancestors, or family members. Sutras were also produced when major national temples were built (Pak 2003).

Goryeo period sutras in accordion book format usually included several of the following elements: covers, a frontispiece (illustration), text, and a dedicatory (fig. 1). The covers were usually decorated with lotus flowers and a title slip with a lotus seat and canopy, which are two Buddhist symbols, in gold or silver. Some of the sutra covers that we see today have lost most of the silver pigment, with only gold pigment remaining. The frontispieces are often illustrated with scenes of the Buddha preaching and are decorated with borders of three-pronged pestles and wheel motifs. The composition of the preaching scenes may have been influenced by printed Buddhist sutras transported from Song dynasty China (Suan Huang 2011) (fig. 2). The text of the sutras was usually written in gold or silver with 14 or 17 characters per column. The dedicatory indicated the purpose, donors, and the date of the creation of the sutra.

For research, one of the authors viewed several confirmed Goryeo dynasty sutras in the United States and Korea, and also interviewed a modern-day sutra artist, Kyeongho Kim.¹ The interview with Kim focused on materials and the art form of making sutras since Kim has been studying and copying Goryeo dynasty sutras using traditional techniques.

ACCORDION BOOK FORMAT

There are two documented Goryeo period Korean sutras in U.S. collections. One is in the collection of the Metropolitan

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Fig. 1. The top cover and frontispiece of *Illustrated Manuscript of the Lotus Sutra* from the Metropolitan Museum of Art's collection.

Museum of Art, and the other is in the collection of the Cleveland Museum of Art (CMA). The same author also viewed two additional sutras from the collection of the National Museum of Korea in Seoul. The description and comparison of these sutras are shown in table 1.

The height of each sutra page differed (between 20.7 and 35 cm), but the width of the pages was similar (about 11 cm). With exception of the CMA's sutra, the sutras' structure consisted of papers with a width of 55 to 60 cm that were joined by about one seam every five pages (fig. 3). Inscriptions could be seen at the seams (overlapping area at back) in some sutras, and they often indicated the sutra's name and the order of the sheets to be connected (fig. 4). The covers could be a separate piece with layers of paper to attach to the first sheet of the sutra, or they could be the first sheet and last sheet of the sutra itself folded over.

SUTRA PRODUCTION

In the interview with Kyeongho Kim, he mentioned that the sutra supports—the indigo papers—are usually acquired directly from art supply shops. These indigo papers were made using brush dye or vat-dyed techniques. The indigo



Fig. 2. Wang Yi and others, *Lotus Sutra*, Song dynasty, woodblock print, Taipei Palace Museum, *A Special Exhibition of Illustrations of the Lotus Sutra* Plate 7.

papers are sized with animal glue and then burnished using a stone, bone, or anything with a hard surface. This process may be repeated at least three times until the indigo papers appear shiny and smooth and become slightly water resistant to avoid bleeding during the sutra writing or painting. The indigo papers are then lined and joined into accordion format. The covers are made from many paper layers built up to form a laminate structure.

A 99% gold powder is used as pigment and animal glue as binding media. After mixing the gold pigment and animal glue in a small dish, Kim lets the mixture set for some time and then pours off the impurities that rise to the surface in the dish. He may repeat this process up to three times. During painting and writing, he changes the water in the paint mixture every hour; he replaces the whole thing after 1 to 2 days. Kim also mentioned how the climate in the studio impacted the painting process. He preferred to keep the studio at 70%RH and the temperature between 25°C and 45°C, depending on the different thickness of the painting lines desired. For example, when drawing 1-mm lines, the temperature of the studio should be around 25°C; when drawing 0.2-mm lines, the temperature of the studio should be around 30°C; and when drawing 0.1-mm lines, the temperature of the studio should be around 35°C. The thinner lines required the higher temperature so that the media on the brush had good flow. He also polished the gold on the sutra with bone folder after it was done.

THE CONDITION OF *DIRGHAGAMA SUTRA*

Dirghagama Sutra was inscribed with the date 1372. It was a 10-leaf sutra in accordion format with both top and bottom paper covers. The sutra contains Agama sutra text and paintings including the depiction of a Buddhist assembly with deities on one side and three Bodhisattvas and a heavenly king on the other side, and an inscription including a date and a list of donors and their deceased ancestors (fig. 5).

The sutra text and illustrations are written and painted with metallic pigment on blue paper, each leaf measuring 25 x 9.5 cm. The pages of the sutra were created by laminating at least four layers of paper together, with the distinct front and back sections each lined with one layer, creating two sets of two-layer laminates attached back to back. However, close examination revealed that the inner linings did not extend the length of the sutra, so the structure of the sutra appeared uneven. The covers were created by several layers of colored papers laminated together.

White and yellowish accretions were present on the inside front cover, and the front of pages 1 and 8. These appeared to be associated with water or other liquid migration (fig. 6). These accretions were analyzed using FTIR analysis, indicating that they were primarily calcium carbonate. Pressure-sensitive tape was used on tears and losses in the

Title	Illustrated Manuscript of the Lotus Sutra	Guardian Deities of the Avatamsaka Sutra	Illustrated Manuscript of the Lotus Sutra	Avatamsaka Sutra (Hwaomgyong)
Accession No./Collection of	Bongwan 5053/NMK	Bongwan 12728/NMK	1994.207/MET	1994.25/CMA
Dimensions of Pages	28.4 x 10.9 cm	35 x 11.7 cm	22.9 x 11.4 cm	30.9 x 11 cm
Thickness of the Papers	0.14–0.22 mm	—	About 0.13 mm	About 0.1 mm
Thickness of the Cover	0.6–0.8 mm	—	About 0.6 mm	—
Length of One Section	Every 5 pages (about 55 cm)	Every 5 pages (about 60 cm)	Every 5 pages (about 60 cm)	Every 9 pages (about 100 cm)

Table 1. Measurement of Four Goryeo Period Sutras in the U.S. and Korean Collection

original paper support, along the vertical fold between pages 8 and 9 (on both the front and back surfaces), to the right of the *Bodhisattva* on the reverse of page 6, diagonally along losses on the front and reverse of page 2, and horizontally between the top edges of the front of pages 6 and 7 (fig. 7).

There were losses to the original paper support throughout, but the worst areas were as follows: the bottom edge of the front cover; outside vertical edge of the back cover; entire top section of pages 8, 9, and 10; and partial loss of the top section of page 7 (also seen in fig. 6). In addition, page 3 had two large areas of loss, the reverse of page 5 along the top edge, the reverse of page 5 central right, and page 10 front at center. Some of these losses were possibly due to insect damage.

One of the more intriguing issues was that some areas where the interior structure of the paper support was misaligned caused uneven thickness. Most of the corners of the pages showed damage from fold lines. The metallic media had loss, abrasion, and discoloration throughout.

The front cover had a layer of pink fibers throughout the top surface. This appeared to be a color transfer possibly from a pink-colored tissue paper that had been used as a wrapper by the previous owner. The highly soluble dye migrated into the original fibers of the sutra's front cover.

TREATMENT

After requisite photo documentation of the condition under visible light, transmitted light, raking light, and UV light, the overall format, losses, misaligned fragments, and tape repairs

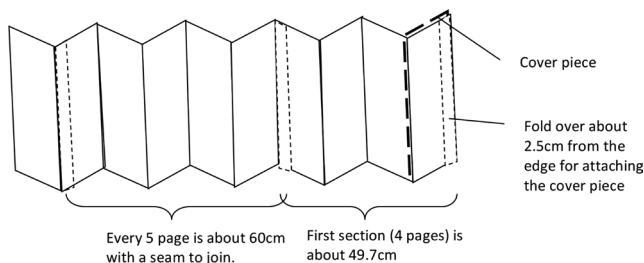


Fig. 3. Structure of Illustrated Manuscript of the Lotus Sutra from the collection of the National Museum of Korea.

were recorded on a “condition map” on polyester sheeting. The surface was cleaned with a brush, vacuum, kneaded eraser, and scalpel as needed for removing dust, soil, and white mineral deposits. Tears were checked and stabilized together with fragments around the losses using rayon paper strips and a 1% methyl cellulose gel. Since the blue color in the support and metallic pigment were both stable in the water solubility test, a small amount of water was applied with a brush, then blotting paper squares were used to wick away dirt and discoloration. The white mineral deposits and brown dirt did not respond well to water. However, they were softened by moisture and could be picked up with a fine scalpel or another mechanical technique and then removed with controlled suction from a vacuum. The pink dye found on the covers was water soluble and could be removed by wicking with blotting paper squares.

The tape adhesive was softened using a heated spatula, then the carrier was gently removed by pulling at a flat angle (fig. 8). After removing the carrier, the sections of the sutra were detached from the folding line between page 8 and

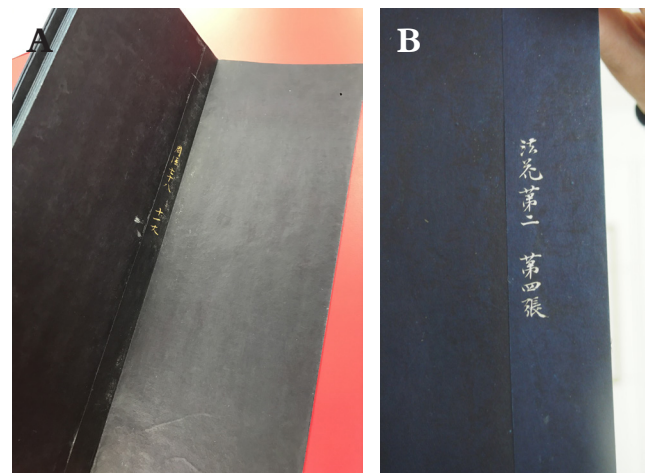


Fig. 4. (a) An inscription on the back of the sutra from CMA's collection that indicates “the 11th sheet of the 78th fascicle, translated in Restored Zhou dynasty (684–705).” (b) An inscription on the back of the sutra from Metropolitan Museum of Art's collection that indicates “the 4th sheet of the 2nd fascicle, Lotus Sutra”.



Fig. 5. (a) The front of *Dirghagama Sutra* overall before treatment. (b) The back of *Dirghagama Sutra* overall before treatment.

page 9. A kneaded eraser and crepline rubber eraser were used to remove adhesive residue mechanically. The fragments released from the tape areas were stabilized at the same time. The front covers were removed from the sutra mechanically using a bamboo spatula. The front and back of the main body of the sutra were gently separated as well (fig. 9). Care was taken around the areas of loss. Any unattached fragments were held in place using rayon paper strips and 1% methyl cellulose gel as needed.

After disassembly, it was discovered that the structure of the sutra was composed of two sections of laminate, one longer than the other and joined together in a complex overlap at page 7. The structure of the joined area is illustrated in the following and was made up of at least eight paper layers irregularly layered on top of each other. Some of the inner paper layers (linings) emerged through uneven areas on the

surface of the sutra. Several of these exposed inner linings had been directly inscribed with text and images using the metallic pigment (fig. 10). These observations resulted in



Fig. 7. (a) Tape along the vertical fold between pages 8 and 9. (b) Tape applied diagonally along losses on the front of page 2.



Fig. 6. White and yellowish accretions at the front of page 8; large losses along the entire top section of pages 8, 9, and 10 and partial loss of the top section of page 7.

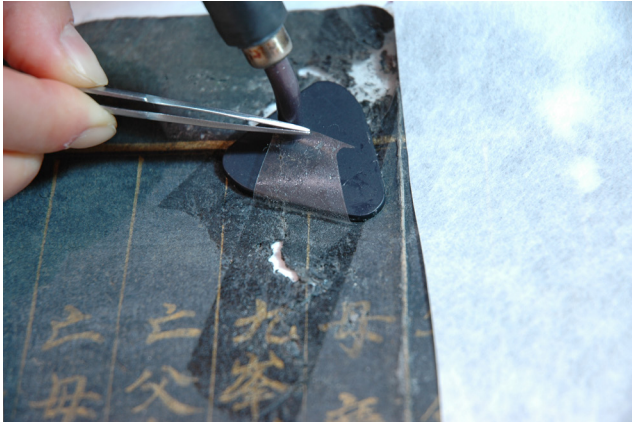


Fig. 8. The carrier was gently removed by pulling at a flat angle after applying heat.

the decision to preserve all of the paper layers for the reasons described in the next section.

Scientific analysis indicated that the tape used for repairs on the sutra was rubber based. It appeared tacky, sticky, and transparent, which suggested that it was in the early stages of aging and would require a low-polarity solvent to remove (Feller and Encke 1982). A solvent test was undertaken to determine the most effective solvent solution to clean the tape residue. Toluene, acetone, and ethanol were all tested by applying them to a piece of tape carrier removed from the sutra, and the result shows that toluene had the best and most immediate cleaning effect for the tape residue. However, a solvent that works more slowly and is more controllable is preferred when used on the actual object. Several more solvent tests were undertaken to determine the optimum mixture. Acetone was mixed with toluene, and this made the solvent mixture more polar and slowed the cleaning for more control. The solvent mixtures were tested on pieces of tape removed from the sutra, and the test results are shown in table 2.

A (1:2) mixture of toluene:acetone was determined to be the optimum cleaning solvent for the tape residue on the



Fig. 9. Separating the front and back of the main body of the sutra using a bamboo spatula

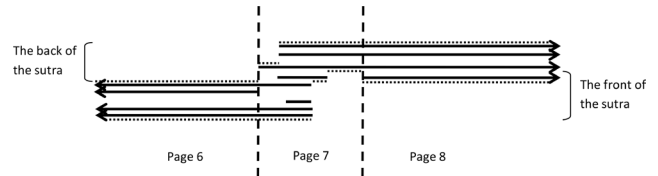


Fig. 10. Structure of the joined sections on page 7.

sutra because it could achieve an effective and controllable cleaning process. The solvent mixture was spot-tested on the paper support and the pigment on the sutra, and they were fairly stable. The solvent mixture was applied to the back of the sutra using a small brush. Outlines of the tape areas were traced on tracing paper for the conservator to use as a guide for the tape residue placement when working from the back. To avoid tide lines, the cleaning treatment was done with a suction platen underneath to remove the extra solvent mixture.

REMountING

A description of the wet treatment process related to the remounting of the sutra, such as infilling, lining, and reassembly back to accordion book format, follows.

The interior structure of the main body of the sutra was not consistent in the number of linings and in the positioning of these linings. Some previous linings did not extend all the way to the edges of the sutra; some linings showed through abraded areas on the surface of the sutra, or in corners, and had lines from borders, text, or image on them. To preserve as much of the surface text and image as possible, and also to leave information intact relating to the sutra structure, it was decided to preserve rather than replace all layers of the previous linings. Sometimes this involved infilling the lining papers and the sutra surface to create a more uniform structure.

Once the sutra was moistened, the previous linings loosened and could be peeled off temporarily to access the sutra surface for treatment. These were put back in place after infilling. A *misu*-type Japanese paper was chosen for its similar characteristics to the original for filling losses. The infill papers and new lining papers were toned to three different shades using stick pigments of indigo earth colors and carbon ink to match the tones in different areas of the sutra. Losses were infilled using starch paste with a slight overlap, and previous linings were placed back where they had been using starch paste.

Solvent Mixtures	Cleaning Results
Toluene:Acetone (2:1)	Cleaned the adhesive right off from the tape.
Toluene:Acetone (1:1)	Good cleaning effect.
Toluene:Acetone (1:2)	Good cleaning effect, but it needed repeated applications to achieve the desired cleaning result.

Table 2. Result of Solvent Mixtures Test

There was concern that the paper size could expand unevenly during wet treatment. The folding lines of the front and back section needed to be aligned, meaning that every page size must remain the same. To control distortion, the outline of the front sutra section was traced once it was moistened and fully expanded overall (fig. 11). This template was used as a guide for the other section of the sutra during the lining process to ensure similar expansion. For infilling the large areas of loss between the detached pages 8 and 9, another template based on two average-size pages was traced on a polyester sheet to determine the size of the infills (fig. 12) after placing the long section and short section of sutra with templates underneath as guides. After infilling and reattaching the previous linings, each section of the sutra was pressed between blotting paper under light weights.

New linings to both the front and back sections were applied overall as a support. Each page of the sutra was carefully moistened using the traced outline as a guide. This allowed for maximum control in the expansion of the sutra. Once the front and back sections each had an overall lining

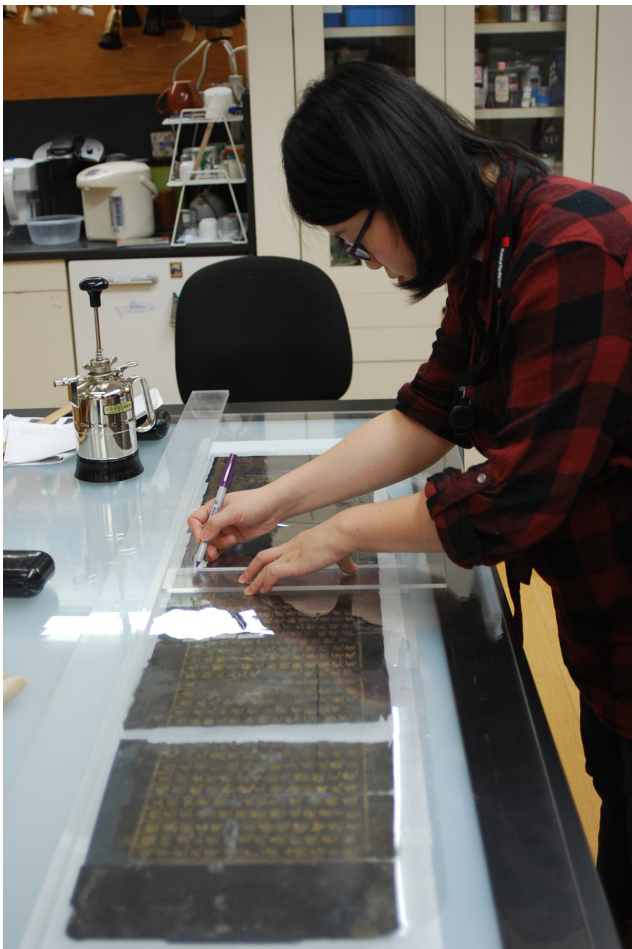


Fig. 11. Tracing the outline of moistened sutra on Mylar as a template

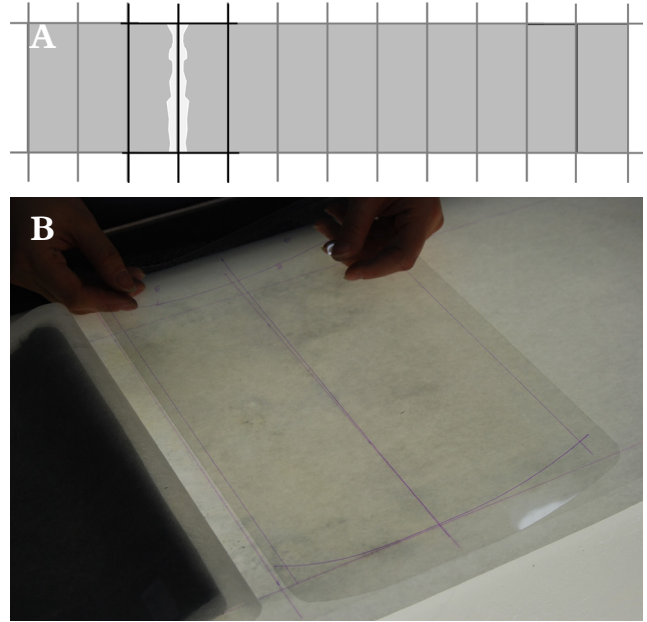


Fig. 12. (a) Several templates were used to determine the infills between page 8 and page 9. (b) Placing the template based on two average size pages, shown in darker color.

for support, the rates of expansion became more uniform. Paper reinforcements were set into every fold after adding the lining (fig. 13). The front and back sections of the sutra with new linings were then stretch dried on a drying board.

The front and the back sections of the sutra were then reattached using starch paste. Although the expansion of the front and the back sections were more uniform as a result of lining, the size of each page on the front section and back section was still slightly different. In addition, with one section of the sutra facing down, and with the extended lining paper margins, it was difficult to know where the folds and outer edges were to align them accurately. Therefore, the outline of the sutra was

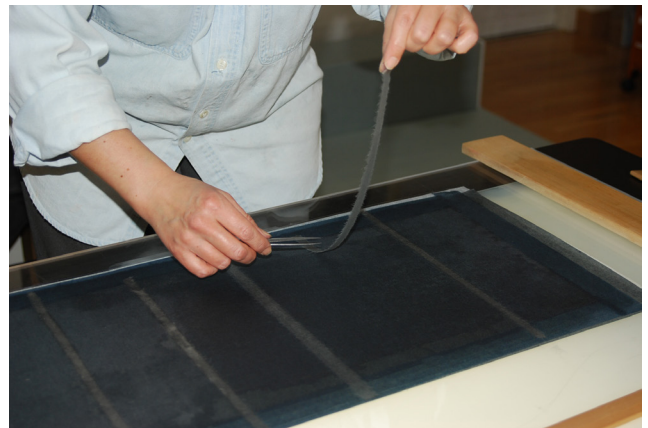


Fig. 13. Paper reinforcements were set into each fold after adding the lining.

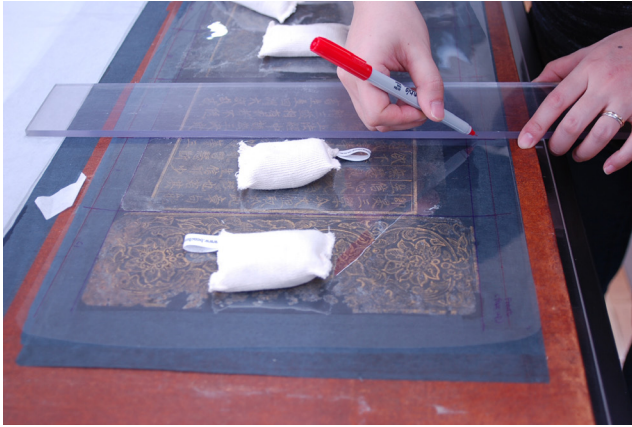


Fig. 14. Another template of the whole section of the sutra was made.

traced again to determine every fold line and the position of the top and bottom edges (fig. 14). The new top and bottom edges were slightly askew from the original ones to accommodate the irregular dents and losses along the edge, which also meant that the sutra would be slightly larger in height. Notches were cut at the top and bottom of the extended paper lining to indicate where the folds and top and bottom edges were for proper positioning. One section of the sutra was moistened with the outline guide underneath. One piece of polyester sheeting was placed as a moisture barrier while positioning the top sutra. The top sutra was placed with the central folds aligned, then verified that the other folds aligned. Each page was still slightly different, so conservators gently manipulated each page while applying more moisture with a brush to get the folds in close alignment. Once the top sutra was in position and expansion was set, the top sutra and polyester sheeting was flipped halfway aside and paste was applied on the bottom sutra, brushing vertically (to avoid extra horizontal expansion). Half of the polyester sheeting was then cut off, and the top sutra was laid down page by page with more moisture added as needed to expand and achieve proper alignment. In the event a top page was bigger than a bottom page, the fold first was laid down and the page evenly smoothed trying not to create any creases. Good adhesion was ensured by gentle smoothing by hand, not brushes, to avoid the pages being brushed out of their positions (fig. 15). After checking that each page was attached with no creases, overall brushing was done to ensure that both sections of the sutra had good contact.

The sutra was flattened on a drying board. After flattening, the sutra was burnished on both sides with polishing beads through a protective layer of Reemay to ensure proper and even adhesion between the paper layers. The sutra was then folded into accordion format along the original folds using a straight edge and bone folder (fig. 16). The inner covers were attached to the sutra using starch paste and then pressed between blotting papers, wood boards, and weights. After the



Fig. 15. After pasting the bottom sutra and removing the Mylar, the top sutra was laid down page by page and smoothed by hand. Notches cut to indicate position of fold lines can be seen on the paper margins in this photo.

covers dried, the edges of the sutra were trimmed of excess lining paper, and the whole sutra was pressed, folded, and put under weights for 1 to 2 weeks.

As a result of treatment, the sutra was safer to handle and display. Deteriorating pressure-sensitive tape used in repairs was removed, losses were filled, and folds were reinforced. The uneven internal structure of the sutra was addressed by infilling interior lining papers and applying overall linings to the front and back sections. The appearance of the sutra was improved by reducing the white and yellow accretions, resulting in greater legibility of text. These results would not have been achieved by minor treatment. (figs. 17, 18).

CONCLUSION

Books or sutras in accordion format experience more frequent handling than Asian artworks in other formats because of their function. When major treatment becomes necessary

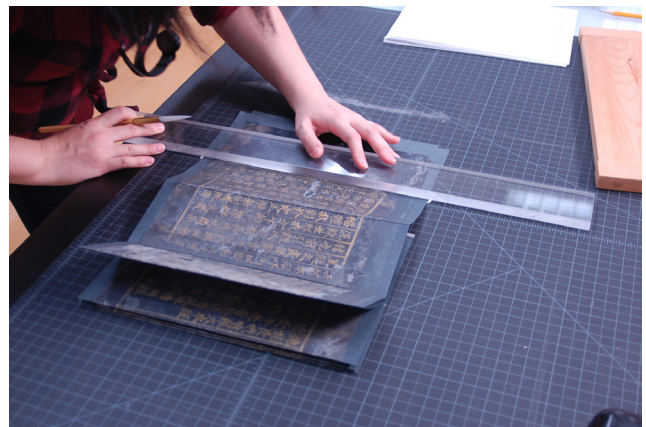


Fig. 16. Folding the sutra back to accordion book format.



Fig. 17. (a) The front of *Dirghagama Sutra* overall after treatment. (b) The back of *Dirghagama Sutra* overall after treatment.

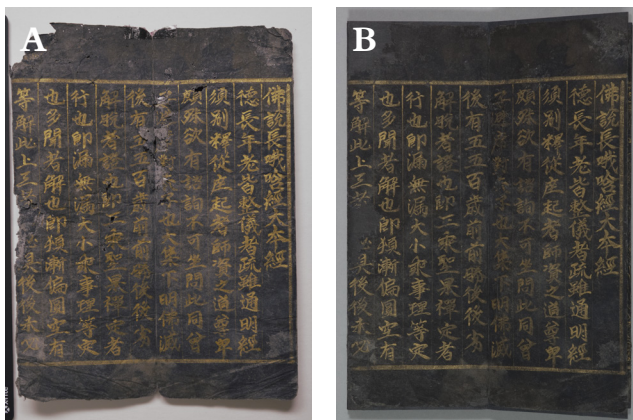


Fig. 18. (a) Two pages of *Dirghagama Sutra* before treatment. (b) Two pages of *Dirghagama Sutra* after treatment.

to address condition problems arising from excessive handling and use, one of the challenges lies in reassembling this format with folds and pages properly aligned.

In the case of the Korean Buddhist *Dirghagama Sutra*, several levels of approach were used to control the expansion and sizes of the pages:

1. *The use of templates.* Several different templates were made to document the position of each page, especially when one section of the sutra was moistened and expanded during wet treatment and during the process of lining. A template was also used as a guide to control expansion of the two sections during the process of lining and reattachment.
2. *An overall lining as support.* In this case, the interior structure of the sutra was not even, making some areas with more paper layers absorb more moisture and expand

more than others. Providing an overall lining helped hold the paper layers together and control rates of expansion when applying moisture from the back/lining.

3. *Controlling the amount of moisture.* Even with the same rate of expansion during wet treatment and with overall linings to both sections of the sutra, the sizes of the pages were still slightly different. Once the central folds were aligned, even slight differences of each page could still cause increasing discrepancies in the folds progressing outward from the center. Conservators were able to control this by varying the amount of moisture applied relative to the alignment situation of both sections of the sutra.

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grand prize in the first-ever Buddhist Scripture Transcribing Contest co-organized by the Jogye Order of Korean Buddhism and Eastern Calligraphers' Association. He has presented numerous solo exhibitions, including 15 shows organized by the Korean State. He has also taught traditional Sageong at universities, on Buddhist television channels, and at Dong-A Cultural Center. He has been invited by many prestigious organizations to give special lectures and demonstrations. As the highest authority in Sageong, he serves as the president of the Korean Transcribed Sutra Research Association.

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NOTE

1. Kyeongho Kim is the author of *An Introduction to Sageong* (sutra writing/painting), the first unique publication on Sageong in modern times in Korea. In 1997, he won the

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