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Cover

Cambridge, Mass., Harvard Art Museums/Arthur M. Sackler Museum, Gift of Philip Hofer, MS 1984.463. fol. 61r: This folio shows in the middle at the right the riddle text in large letters in *thulūth* calligraphy. Between the five lines of this riddle is a part of an Arabic philosophical work in *naskhī* comprising three lines in each piece. In red, numbers and words are placed mostly below individual words of the riddle referring to letter magic. Around this centre piece, two brief Persian texts in *nastaʿlīq*, an Arabic table, and a triangular diagram between lines of an Arabic explanation can be found. Both Arabic pieces are written in *naskhī*. The Persian text above the table introduces the lunar mansions, which the table enumerates. The Persian text in the left margin, entitled „A gem on theoretical philosophy about true speech", deals with themes from *kalām*. The triangular diagram with its surrounding Arabic text treats the cosmological division of the universe in Muslim terms, beginning with God's throne and descending through the Ptolemaic planetary sphere to the four Aristotelian spheres of the sublunar world to the underworld.

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Technical Notes on the Illustrated Manuscript of a *Jung* (Multiple-text Manuscript) from the Harvard Art Museums

Penley Knipe, Katherine Beaty, Georgina Rayner, and Katherine Eremin | Cambridge, Mass.

1. Introduction

How an illuminated and illustrated manuscript was produced and its current state of preservation can provide important clues about its past. The relationship between content and structure can be critical in ascertaining dates and in determining what is original versus what has been modified. Thus, a full study of the binding, the collation, the paper and techniques of the illustrations of the *jung* manuscript was undertaken to complement the research into its provenance, the lacquer cover materials, pigments and, most importantly, the rich texts within.

This essay examines numerous technical aspects of the binding and textblock. To understand more about Islamic bindings, a good place to begin is Karin Scheper's *The Technique of Islamic Bookbinding: Methods, Materials and Regional Varieties*.[1] For specific terms used, there are two excellent resources online. The first is a thesaurus for book binding terminology *Language of Bindings* and the second is devoted to Islamic book terminology, *Terminology for the Conservation and Description of Islamic Manuscripts*.[2]

2. Paper

The manuscript Cambridge, Mass., Arthur M. Sackler Museum, Harvard Art Museums, 1984.463 (from now on: Sackler manuscript) is a collection of texts, tables, diagrams and various artistic forms made in 1098 H /1686-7 CE for the library of Shāh Sulaymān (r. 1077–1105 H/1666–1694 CE). It is written on a light to medium-weight handmade Islamic paper. The pages have been burnished and many, though not all, are sprinkled with gold. The pages range from .076–.127 mm in thickness but are consistent within each sheet and most pages are on the thinner end. Fibers were taken from two pages and they are bast fibers, as is common to paper from this era and region.[3] There is some screen texture visible in the papers and some pages have a slightly more pronounced laid texture that sometimes runs vertically and sometimes horizontally. This laid texture comes from the mould used to make paper.[4] The papers are one-ply, that is, not laminated.

Most of the pages are one piece of paper without added borders or inset textblocks. Each page has a pale red watercolor border band. Folio 0[5] has added borders – all the rest are done in dilute watercolor on the same piece of paper. This one page may have been damaged so the borders were replaced. The early pages' borders are mottled and very uneven but most, starting with fol. 3b, are pale swathes of color. The bands are clearly done by hand as some show washes that did not fill the area (fol. 26b, top) and tidelines from watercolor drying (fol. 23b). The borders are highly fluorescent with UV illumination and are likely an organic colorant based on this fluorescence. The colorants used in the

[1] Scheper 2019.

[2] See *Ligatus: Language of Bindings Thesaurus* (LoB) <https://www.ligatus.org.uk/lob/> and *Terminology for the Conservation and Description of Islamic Manuscripts* <https://www.islamicmanuscriptconservation.org/terminology/introduction-en.html>.

[3] Dr. Georgina Rayner of the Straus Center for Conservation and Technical studies did the fiber analysis. Dr. Rayner found that the fibers were bast, but cotton could not be ruled out. Jute was not present. Commonly found fibers in Islamic-world papers are linen and hemp. There was some evidence of burnishing in the fiber samples.

[4] This laid paper structure was much more evident in the MS London, British Library, Or. 12974. In that copy it also sometimes ran vertically and sometimes horizontally. Also, some pages appeared more 'wove', that is with little visible laid structure from the construction of the papermaking mould.

[5] The Sackler manuscript is catalogued starting at the first endleaf, whereas the scholars using the volume globally refer to the pages by their Arabic numbering, which starts 5 pages in from the Harvard Art Museum's numbering system and leaves out 3 original unnumbered pages and the modern front endleaf. We have followed the latter system here, so the numbering is off by 4 when compared to the Harvard Art Museums' system. The three unnumbered pages are denoted -2, -1, and 0.

Sackler manuscript are discussed in the essay 'Color in the Illustrated Manuscript of a *Jung* (Multiple-text Manuscript) from the Harvard Art Museums' by Katherine Eremin, et al. in this volume. With a few exceptions, this essay will not address this aspect of the manuscript.

3. Book Structure

The textblock is made of 19 gatherings, whose construction is quite variable. A gathering is a group of folded or single leaves which combine with other gatherings to make a textblock. Most of the *jung*'s gatherings are composed of 5 bifolia[6] (10 leaves[7] or 20 single-sided pages), but there are several gatherings consisting of 3–6 bifolia[8]. This kind of inconsistency, especially at the beginning and end of a manuscript is not unusual, particularly when the manuscript may have been rebound. At the end of the textblock, there are 2 leaves of which the conjugates cannot be determined. It is possible that these leaves were previously detached and have been tipped on during the most recent binding campaign and their conjugates are lacking. The front and back endleaves are a Western, modern-laid machine-made paper. Modern-laid papermaking is a technology dated to 1790 and later. Both the front and back endleaves contain either a watermark or a fragment of a watermark (Figs 1 and 2). At the front, there is a full anchor in a shield over the date 1863, and in the back a ' …G (?) & Gregory / …NDON', presumably 'London'. This watermark has not yet been identified in the numerous printed and online databases, but it is possible that the paper was originally one made for a company, such as a solicitor's firm.[9] Both sheets are burnished for export to the Islamic world market. The chain lines are 26 mm apart and the laid lines are 7 per cm. The papers appear to be two ends of one sheet based on their very similar appearance and structure. Since the endleaves are tipped on and pierced by an endband thread, the 1863 date of the watermark is likely the earliest date of the repair and re-sewing (see below).

The gatherings in the Sackler manuscript appear to have been sewn in an unconventional manner which is not fully understood. Radiographic images of the sewing were attempted multiple times, but the presence of gold ruling lines and borders blocked the digital capture of the sewing. Because the spine is intact, we may never know exactly how the spine is sewn. What we do know is the Sackler manuscript is sewn at four sewing stations with an undyed fiber thread, which is common.[10] [11] The sewing is unsupported, which means there is no material along the spine which the sewing passes over. Even though the spine is a tight back construction, we should feel the bulk of a sewing support through the leather of the binding or see them in the X-ray image and we can do neither. Between the four sewing stations, thread is only visible between stations 1 and 2, and again between 3 and 4 (Fig. 3). And while the position of the 1 and 4 sewing stations appear to line up, sewing stations 2 and 3 vary in position by as much as 3.5 cm. This meandering of the sewing stations and the pathway the thread is taking in the gutter is not characteristic of a typical link stitch sewing structure but could correlate to an all-along sewing method.[12] Unfortunately, due to the tightness of the opening, further exploration of the sewing is not possible. At the head and tail, there are sewn endbands executed with green and purple threads, creating a chevron pattern, which is 'typically Islamic'.[13] It is clear that the endband is later because the tie downs pierce gutter repairs. The atypical nature of the sewing may point to it being a later campaign, but the quality of the endband points to a binder trained in traditional Islamic binding techniques.

4. Binding

The text is bound in an Islamic lacquer binding with a lacquered envelope flap with a leather filigree doublure. The black leather spine was left undecorated, but the hinge of the fore-edge flap is gold tooled on the outer surface. The binding is attached to the textblock by adhering and overlapping two leather flanges on the spine. The leather flanges were attached to the boards prior to the execution of the lacquer. There is no evidence of rebacking or major repair

[6] 'bifolia', in *Ligatus: The Language of Bindings Thesaurus* <http://w3id.org/lob/concept/1342>.

[7] 'leaves', in *Ligatus: The Language of Bindings Thesaurus* <http://w3id.org/lob/concept/2378>.

[8] Collation formula: $A^{4}B^{10}C^{8}D^{6}E^{6}F^{12}G^{6}H^{10}I^{6}K^{10}L^{6}M^{10}N^{6}0^{10}P^{4}Q^{8}R^{6}$(lacks R^{5-6}).

[9] A query about the paper has been made to Peter Bower, British paper historian. He also thinks it is stationery and he suggested solicitors as a possible business. Thus far he has not found reference to this company in British directories. Why letterhead would be burnished for the Islamic market is unknown.

[10] Scheper 2019, 64.

[11] The thread was only observed visually. It appears not to be silk and is therefore either cotton or bast fibers.

[12] 'all-along sewing', in *Ligatus: The Language of Bindings Thesaurus* <http://w3id.org/lob/concept/1196>.

[13] Scheper 2015, 32.

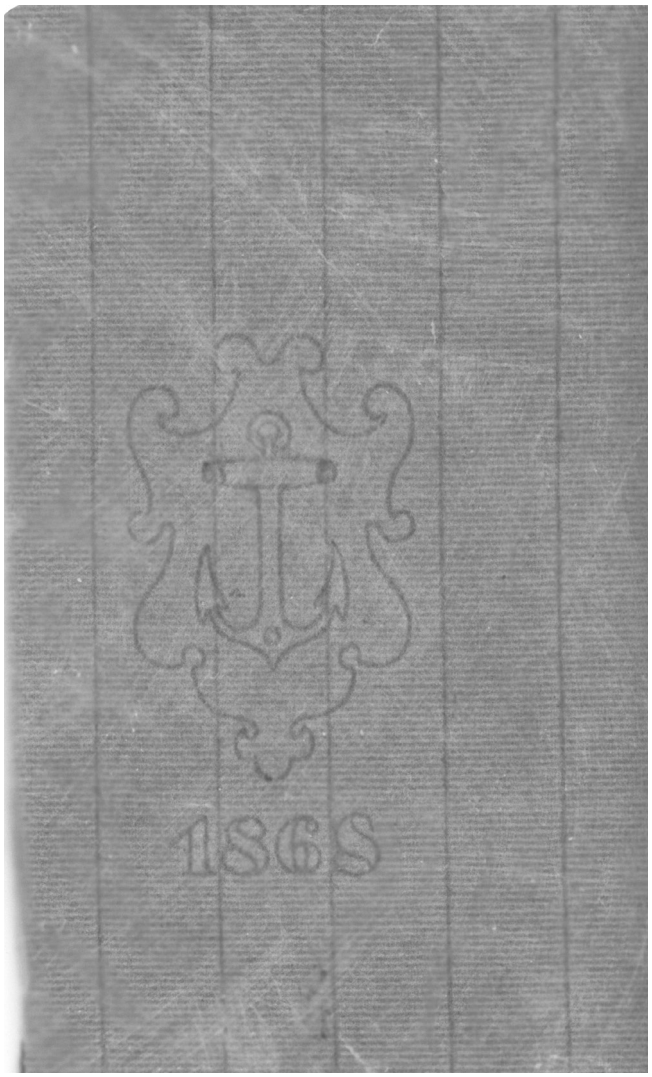

Fig. 1: Sackler MS 1984.463, front endleaf: Digital beta radiograph, no. 698, 30 mins exposure.

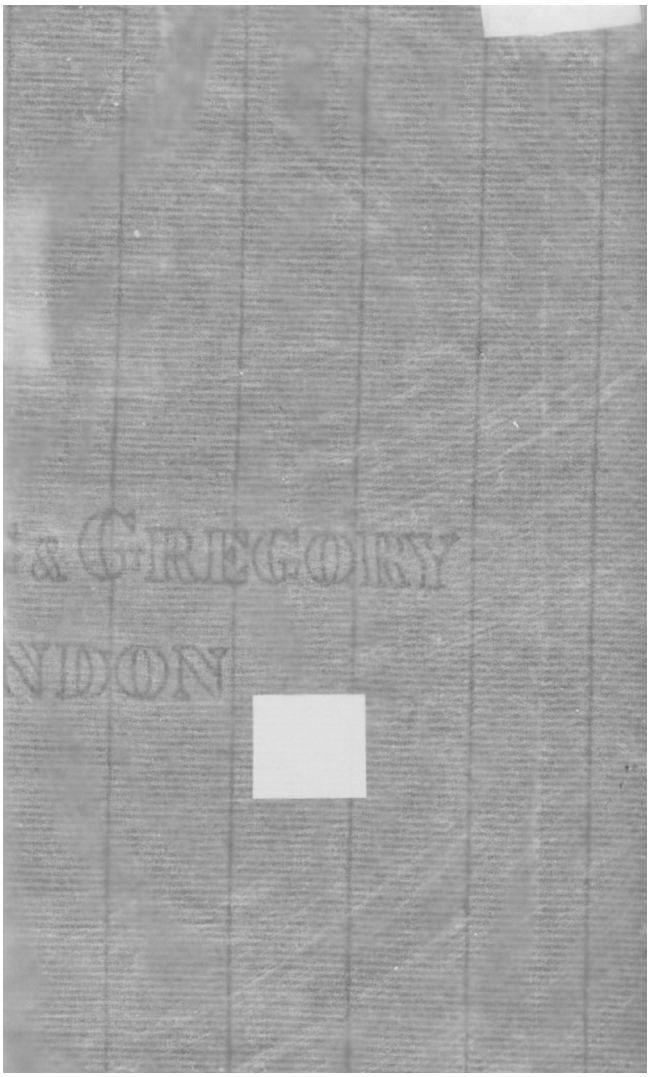

Fig. 2: Sackler MS 1984.463, back endleaf: Digital beta radiograph, no. 699, 30 mins exposure.

on the spine of the binding or hinge of the flap. The doublure, or inner surfaces of the cover, are covered in red leather. The red leather doublures are decorated with blind stamping, leather and paper filigree work, as well as shell gold painting and gold tooling. The filigree work and the lacquer binding are typical of the Safavid period (1501–1722 CE).[14] The boards measure 3 mm in thickness and are constructed from pasteboards, as can be seen in the delaminating corners. The pasteboards appear to be made from a mix of bast and cotton fibers.

5. Rebinding

Evidence suggests that the volume has been re-sewn and the binding reattached or rebound. Atypical for an Islamic binding, the envelope flap extends from the front cover when the book is closed and wraps around to the back cover. The envelope flap should extend from the back cover and wrap around the fore-edge. When the book is closed, it should tuck underneath the front cover. This odd orientation could occur if the textblock was placed upside down when the binding was attached – such an unusual feature suggests either a rebinding or reattachment of the binding.

There is evidence that this is a re-used binding from another book. The fore-edge flap is too wide for the textblock – there is a crease along the middle that is caused by the width being wider than the textblock. The spine does not have this, but the spine is made of two flanges that overlap, as is typical, and those are easy to reposition or trim during rebinding. There is also evidence that the textblock has been trimmed. The textblock is slightly smaller than the boards

[14] Scheper 2015, 24.

Fig. 3: Sackler MS 1984.463, fols 78b and 79a: Detail photograph of sewing.

of the binding, leaving a small square of 2–3 mm on all three sides. An original Islamic binding should be flush with the edges of the textblock. The paper page-markers at the fore-edge are mostly missing and the remaining three are severely cut down[15] (Fig. 4). This indicates that the margins were larger before and the textblock was trimmed, possibly to fit into this repurposed binding. There are catchwords in the gutter which are very nearly inaccessible. This could also happen during rebinding. Finally, the gatherings have been heavily repaired in the gutter, through which the current sewing travels. This indicates that the gutter repairs pre-date this sewing, so the sewing is not original. The reuse of covers was widespread, the practice addressing a damaged or worn-out original binding.[16]

6. Comparison with MS Istanbul, Süleymaniye Library, Ayasofya 4875

There is another possible scenario to consider for the binding. A related *jung* manuscript at the Süleymaniye Library in Istanbul, Ayasofya 4875 (from now on: Ayasofya manuscript) is said to have the same binding as the Sackler manuscript. While the authors were not able to see this manuscript in person, a digitized version is available. The bindings are quite similar in some significant ways, as will be described below. Taking into account all of the irregularities recounted above, one explanation is that the Sackler manuscript was disbound and the same binding was reused following the textblock trimming, repairs to the gatherings, resewing, and endbanding. This would explain the strong evidence of rebinding while accounting for the bindings' similarities.[17]

The two manuscripts are similar in many ways, as mentioned. The overall appearances are close. The sizes are similar. Some of the decorations in the stamping and painted buds are very similar, such as the inside cover elements surrounding the center medallions. The medallions themselves are differently-shaped. Both bindings share an atypical hinge width. The Ayasofya manuscript appears to have similarly colored thread and the sewing (visible between fols 4 and 5 where the red and green endband is also visible at the top) is similarly placed, at least in this one opening.

The bindings and the pages within have some significant differences. The Ayasofya manuscript is much longer, with 197 pages versus 132 in the Sackler manuscript. The Ayasofya manuscript's endleaf at the back is marbled paper whereas Sackler's are modern-laid, burnished English paper. The main decorations on the Ayasofya binding are in the landscape format and seem to be landscapes with animals and buildings, whereas the Sackler's are vertically oriented and use floral imagery. Sackler's pages have red painted borders and numbers in black ink. The Ayasofya manuscript's margins are uncolored and the page numbers are encircled and done in red ink. It has a much more elaborate title page and a blank blocked-out page to start. The Ayasofya manuscript also has a red spine that appears to be a repair. Significantly, the Ayasofya manuscript's envelope flap is at the back, in the traditional position. This last fact only reinforces that the Sackler manuscript has been rebound. The authors' general consensus is that the manuscripts appear to be related in key material ways, but the bindings are in no way identical.

7. Technique

The texts are executed in many colors, including black, yellow-orange, green, blue, red, and gold and in the brown decorated panels there are colors such as white, purple, pink, gold and silver turned gray. This richness of colorants is unusual for most Islamic manuscripts. The text lines are not ruled but there is some pricking at corners and ends of lines to align elements, especially in boxes. The use of a compass in various circles and arcs was observed and seems to be common in the book.[18] There are many illuminated decorations, both in the corners of the pages and in the center, towards the gutter, executed in opaque watercolor.

The brown decorated panels are not inserted, as is often the case, but rather they are colored on the same paper and heavily speckled with gold. The coloring of these panels is slightly uneven and with UV illumination the area bleeds a little more into the untoned paper. There may have been some sort of mask used which shifted in some cases and that shifting accounts for the bleeding of the colorant into

[15] Fols 3a, 112a/b, 126a/b. There is the ghost of a partial page marker on fol. 12a, meaning the marker is lost but a dark stain remains.

[16] Scheper 2015, 25.

[17] Sometimes comparing the textblock sizes can help determine by how much our block has been trimmed from the original size. The Ayasofya binding is said to be 265 × 155 mm and the textblock is 210 × 155 mm, according to the digital library record. The Sackler binding is 274 × 165 mm and the textblock is 268 × 155 mm. These numbers do not line up enough for us to make anything significant of this and we haven't measured the Ayasofya manuscript ourselves. We thank Taha Yasin for this information. As a third comparison, the British Library *jung* textblock is 264 × 157 mm, as measured by Knipe in February of 2020. The three copies are close in size and the Sackler manuscript and the British Library manuscript have been rebound which can impact the overall textblock size.

[18] Fols 43b, 46a, 48a, 56a, 76a, 104b, 108b, 109b.

Fig. 4: Sackler MS 1984.463, fol. 126a: Detail photograph of page marker.

the textblock. In some pages there is a clear brush pattern, which is particularly visible when viewed with ultraviolet illumination (Fig. 5). Whether this brushwork was the preparation for the gold or an actual added tone is unclear. Were the panels colored by blowing a colorant as the soft edges suggest or is it all brush work? The areas of clear brush strokes may be related to the sizing for the shell, or powdered, gold. The gold, sprinkled from a tin box, is sometimes applied to the paper over the wet size or even over dry paper and then rubbed with the hand and burnished. A third way to apply the gold is to add a gold emulsion (shell gold in glue) to a brush and then flick it at the paper but the wet size approach seems more likely in this case, based on the brush strokes.[19]

There is the occasional correction in the text, such as in the text box on fol. 3b and in the bottom left circle on fol. 48a (Fig. 6), done by scraping away the ink and top layer of paper and writing over the slightly disrupted fibers. There is also at least one inserted paper section, at the top center of fol. 109b, where original paper was cut away and the insert put in with skillfully chamfered edges so as to be unobtrusive. These alterations appear to be contemporary to the writing of the manuscript (Fig. 7).

The paintings of constellations at the end were sketched in with dilute black ink and then painted in a concentrated black ink. There are passages of other colors, such as brown in the chair on fol. 128a and transparent pink in the winged horse's head on fol. 128b. The gold is shell gold. There is a lot of seemingly random pricking in this section of the manuscript. It is outside of the figures and does not seem to relate to the images on the reverse. Perhaps a different set of illustrations was first envisioned here and the pricking lays out the unrealized drawings.

The illuminations do not have underdrawing, unlike the constellation illustrations. The painting is generally thick and multi-layered with distinct colors on top of each other. The black is often for ruling and for decoration, appearing both underneath other colors and on top, showing that it was used throughout the illumination process. See for example folio 47a in the illumination at the bottom right corner of the page where the Indian yellow goes over the black ruling line but the black zig-zags are a final touch on top at the edge (Fig. 8).

8. Colorants

There are scattered areas of yellow that have high ultraviolet-induced visible fluorescence and they have been identified as Indian yellow.[20] Most of these yellows are in the illuminations, not in the text. In both the illuminations and the text, the yellows appear to be original, not overpaint; bare paper is visible below, with no hint of abrasion or another original color underneath. Many of the pages with these yellows are conjugates – that is, they are the same piece of paper within gatherings. This could suggest that the pages were altered later in batches, such as during a rebinding, which was a question raised by scholars when Indian yellow was first found. However, the yellows appear to be original and not later alterations. The presence of original Indian yellow in a Persian manuscript of this date is significant and is further explored in Eremin et al.'s essay in this volume.

[19] Behzad 1939.

[20] Indian yellow is an organic pigment produced in India from the 15th to the 20th century. It is magnesium euxanthate and it was made from the urine of cows fed only mango leaves. It was outlawed in 1908 because its production was considered animal cruelty.

Fig. 5: Sackler MS 1984.463, fols 94b and 95a: Ultraviolet-induced visible fluorescence photograph.

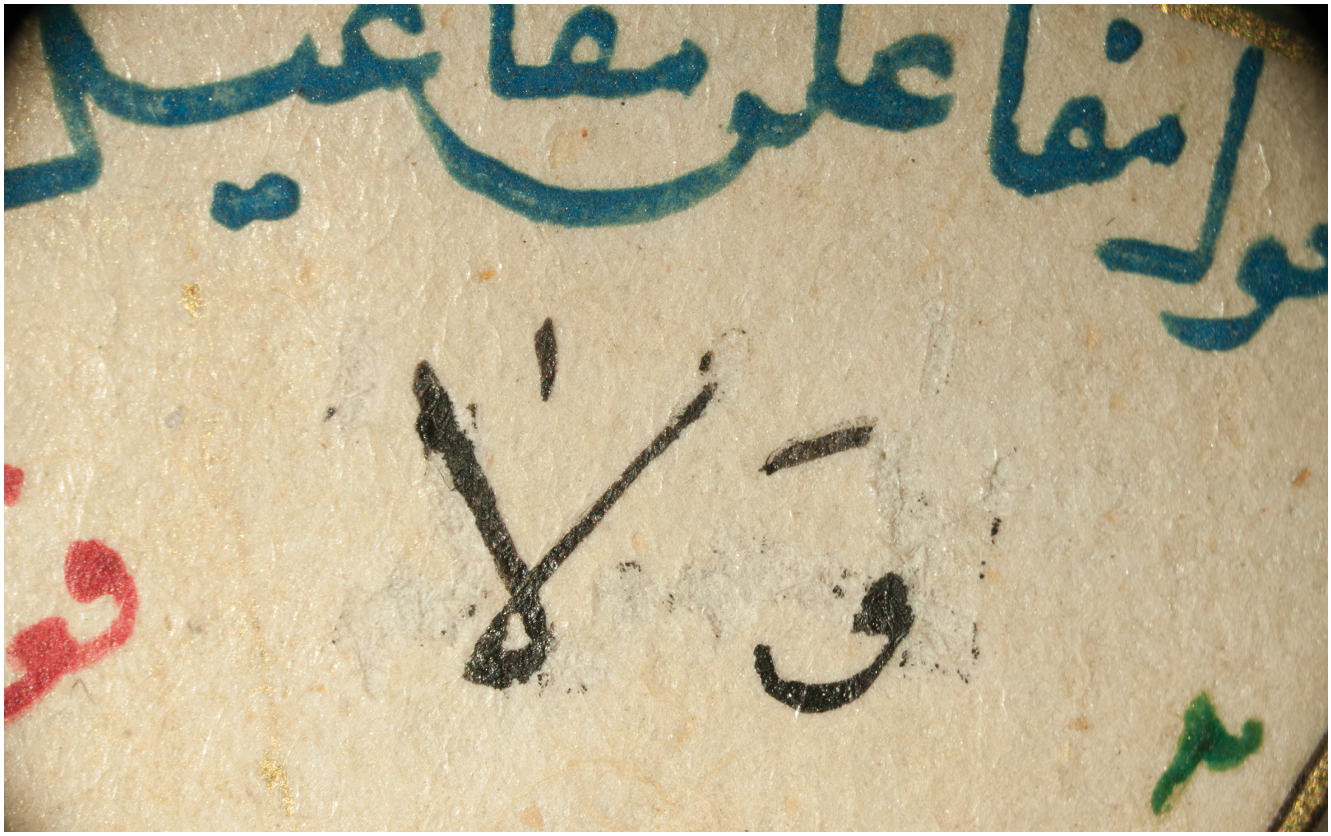

Fig. 6: Sackler MS 1984.463, fol. 48a: Raking light micrograph, 19 mm field of view.

Fig. 7: Sackler MS 1984.463, fol. 109b: Detail raking light photograph.

The gold used is a mix of gold leaf and shell gold. Shell gold seems to predominate, even in areas where the gold appears burnished and at first appears sheet-like. Shell gold, finely ground gold applied over a glue or other sticky sizing material, can be seen on the hand on fol. 66a (Fig. 9), whereas an example of leaf can be seen on fol. 6b in the impressed medallion. Transmitted light can assist with this distinction, as this lighting technique can show the brush strokes associated with shell gold. Shell gold is also used for the smaller decorations and the text. Using shell gold for the script and fine decoration makes sense as applying leaf to such small curvilinear lines would prove difficult. Brush application of shell gold would be easier. Leaf can be identified by breaks at the edges, the size (adhesive) sometimes showing at the edges and some creasing in the gold where the sheet did not lay down perfectly, but in this manuscript the distinction is hard to make.[21] There is some blind punchwork in the gold, mostly in the small flowers throughout.

9. Condition

In terms of condition, the binding is relatively stable. There is some limpness to the flap hinge and the crease along the length and there is a long break in this joint. The lacquer is discolored, brittle and has flaked away in some areas. The covers appear to have been re-lacquered or re-coated. The flap lacquer is much brighter so it probably has not darkened from light exposure and it may not have been re-lacquered. The pasteboards are delaminating at the corners. Some of the filigree work in the inside covers has been lost. The textblock, which is relatively well aligned and planar, has scattered edge tears and some small areas where the paper surface has adhered to its neighbor and sheared off from its original place. The modern endleaves are brittle and are partly splitting along the spine edge. This has to do, in part, with being tipped on, which doesn't allow the paper to bend but rather causes a hard crease which breaks over time. The

[21] We thank Emily Klayman Jacobson, Former Paper and Photographs Conservator at the National Museum of Asian Art, for helping generally with the identification of leaf versus shell gold in Islamic manuscripts.

Fig. 8: Sackler MS 1984.463, fol. 47a: Micrograph, 31 mm field of view.

colors are in excellent condition and show very little loss, even in the whites which are often the first color to flake. Some of the copper green pigments have slight haloing around them, due to the corrosive nature of these colorants but even this is minimal.

10. Conclusion

In conclusion, the manuscript, while in good condition, has features that point to a rebinding, either reusing the original cover or using a recycled cover that was not a perfect fit for the text. These common practices often meant that the textblock was trimmed, either following repairs or to fit into a smaller binding. As the Sackler binding and the Ayasofya binding are so close, it makes the most sense that the original cover was reused. Furthermore, the expertise of the endbands suggest that the rebinding was done by a skilled binder trained in traditional Islamic binding. The fact that the binding is attached upside down could simply be a

Fig. 9: Sackler MS 1984.463, fol. 66a: Detail transmitted light photograph.

mistake by the binder or it may indicate that the textblock was reattached at yet another repair campaign. In either case, the complex history of the binding does not detract from its importance nor the importance of this collection of multiple texts. The colors on the pages appear to be original and they are present in a wide range and used in varied ways to great effect. The highly colored and beautifully decorative nature of the calligraphy, the illuminations and the images underscore the significance of the words, numbers, tables and diagrams collected inside.

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PICTURE CREDITS

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