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"*At once the most delicate and lasting of our materials*"
Considerations in the Treatment of a Late 18th-Century Cut-Hair Memorial

Abstract:

The treatment of a cased cut-hair memorial on ivory has inspired research into its process of manufacture and its social context. It is one of a class of composite objects created for the express purpose of commemorating important personal events like weddings, baptisms, anniversaries, and especially the deaths of loved ones. Hair carried symbolic weight as an authentic, persevering token of the "true" self, a static memento of a relationship. The use of the hair of individuals, once familiar but now anonymous, to create design components in these memorials complicates their conservation treatment both materially and ethically.

These memorials, popular in the late 18th to late 19th centuries in Europe and America, often functioned as public displays of grieving. They were both personal and consumer objects, sentimental reminders of loss and symbols of middle-class status. Hairworkers, both amateur and professional, employed techniques that were published widely in women's magazines of the day. These techniques had grown out of a related industry: the painting of portrait miniatures on ivory, the methods of which were also heavily documented in treatises. Using these historic texts to reconstruct mockups of the hairwork, it is possible to better understand both the manufacture and the stability of the memorial's constituent parts. Identification of materials is supplemented with instrumental analysis. Ultimately, an understanding of the significance of the memorial and its materials is instrumental in guiding decision-making during its treatment, namely, the questions of which lost elements to replace, and how.

Introduction:

In "The Mourning Ring," a short story published in *Godey's Lady's Book* in 1843, a young woman named Mary has lost her ring, which displays the hair of her paternal grandfather. While the object possesses great sentimental value for her, it also has significant financial value, and Mary's grandmother accuses her of having sold it for profit. At the story's conclusion, her father, who did not even know the ring was missing, discovers that it was stolen by identifying the thief when he recognizes his own father's hair in her ring. Although the unsavory character of the thief had worn it through her "merry-making," the ring is still important to Mary and her father, and the thief is convinced to part with it in exchange for a gaudier one.[1] For the conservator interested in the history and significance attached to treated

objects, this story reveals two crucial points. First, that hair removed from the body, worked, and repossessed was more than just a token or reminder, but an authentic stand-in for that individual, preserved through time and changing circumstances. Secondly, while hairworks are sentimental objects, they are also commercial ones.

Today, these objects have largely lost their commemorative and familial context. They are often treated as curiosities: mysterious and nostalgic keepsakes found at antique shops, flea markets, and occasionally in museums.[2] In recent decades, though, there has been a resurgence of interest in 18th and 19th century hairwork. In the last year, two large exhibitions of hairwork, "Woven Strands" at the Mütter Museum in Philadelphia and the online exhibition "Mementos of Affection" at the Cincinnati Art Museum have opened to the public. The current study, preservation, and restoration of these unique objects, however, more often falls to jewelers or collectors than to professional conservators.

In contrast to hairwork, objects from a historically related industry, the production of miniature watercolor portraits on ivory, have received much attention from the conservation community, and analysis and treatment of ivory miniatures has been widely written on and published.[3] However, a comprehensive survey of available literature found that no technical study or treatment of a cut-hair memorial has ever been published by a conservator. The following paper attempts to begin to remedy this.

This research began as the result of treatment of a framed cut-hair memorial on ivory with unknown provenance (Fig. 1). As hairwork represents an underserved category in conservation, the treatment provided an opportunity to investigate its historical significance, as well as the materials and methods of production. Technical analysis of the materials of this particular memorial yielded not only a rough date of manufacture for the piece and an assessment of its condition, but a chance to compare contemporary treatises on hairwork production with the methods seen in the memorial. Reconstructions of historic techniques of manufacture were intended to assess stability and condition of the object, with the hope that they might provide a basis for treatment methodology. Additionally, research into historical context and significance helped to guide decision-making during treatment.

Fig. 1
Framed cut-hair memorial on ivory (before treatment).
Probably French, late 18th c.
Human hair and watercolor on ivory veneer in a wood and brass frame.
Framed dimensions: 13.9 x 12.3 x 1.5 cm.
Private collection.

Historical Context:

It is useful first to unpack the contemporary perception of hairwork. The modern emotional reaction to these objects is typically as strong as it is complicated: a mixture of sentimentality, curiosity, respect for the high level of craft, and, of course, utter revulsion. These emotions are all remnants of hairwork's history and social context. Hair is a material that is both expressive and individual, and its ability in European culture to represent a person in their absence can be traced back to the Christian practice of venerating relics.[4] The title of this paper, "the most delicate and lasting of our materials," is quoted from a 19th-century advertisement for hairwork that expresses both the preciousness and permanence that we associate with relics.[5] In written documentation from the 19th century, "relic" and "memento" were used interchangeably to designate associative items from the past,[6] but the term is reductive when considering the whole of hairwork, which was more than simply a funerary art. It was also used in the celebration of life, of commitment to a spouse, friend or an entire

family. Familial wreaths, a mostly American and Scandinavian tradition, were made of the hair of living family members. An example from West Chester, PA by Amy Ida Williams incorporates her own hair along with the hair of 53 other family members, including her pony "Pollie" (Fig. 2).[7] This example is rare in that it retains its original label, a diagram indicating the identity of each person represented (Fig. 3). The Williams family wreath was made in 1883, but the Euro-American tradition of hairwork began much earlier.

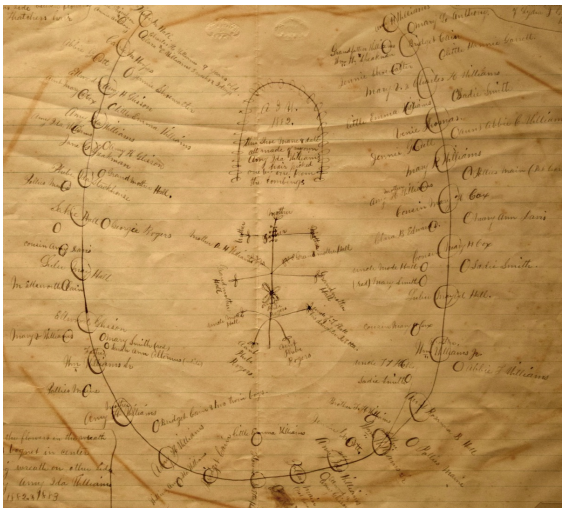

Fig. 2 and 3
Amy Ida Williams. Hairwork Familial Wreath (left) and associated label (right). West Chester, PA, 1883. Collection of John N. Whitenight and Frederick M. LaValley.

Through all of its history, beginning with mourning jewelry, hairwork functioned both publicly and privately. In the late 17th and early 18th centuries in Britain, mourning rings (sometimes containing hair) were distributed to kin at funerals, establishing a community of the grieving, and even a hierarchy within it. However, mourning practices began to change in the late 18th century, and hair ornaments became more invested with intimacy, representing a link not to other mourners, but directly to the deceased.[8] At this time, it also became popular to place hairwork on the reverse of framed portrait miniatures in jewelry.[9] Watercolor portraits on ivory were prized for their ability to render depth in the skin-tones and garments of their

subjects. The ivory's lustrous, luminous surface, and watercolor's translucency allowed for great verisimilitude in this respect. By the 1760's ivory veneers were being cut so thinly as to be translucent,[10] allowing for a watercolorist to lay down body colors on the reverse and achieve even greater depth.[11] With the development of photography, daguerreotypes were occasionally used in addition to the painted portraits. Helen Sheumaker notes, however, that ivory portrait miniatures were more than "accurate depictions of the physical appearance of the sitter but also were character studies revelatory of the individual's inner nature and true self . . . In fact, later forms of depiction, such as daguerreotypes in the 1840s, often were faulted for . . . their lack of insight into the human character."[12]

It is fitting, then, that the worked hair of the sitter would be placed as a counterpoint to the psychological portraits of the watercolorist. Although hair is always associated with the body, it is "lasting" and does not suffer the same kind of decay as flesh and bone upon death.[13] As a result, it was a marker for not just the individual, but for memories of and with that individual. Hair of the deceased fixed fleeting moments of the past into the present, symbolizing every emotion tied to a relationship that remains unchanged through circumstance.[14] This is sentimentality at work, and during the 18th century, there is also a measure of sincerity, of reserve, to this sentimentality. If a mourner were to wear a miniature of a lost loved one in the late 1700s, the hairwork, the physical relic, with all its emotions, would not be displayed, and instead a sober image of the departed would face outward. Because sincerity and authenticity were important values to late 18th-century Americans, hair-backed miniatures would become tools of socially acceptable conspicuous consumption, contributing to the building of a middle-class identity.[15]

In the 19th century, the increasing emphasis on the social and economic significance of hair jewelry meant that sentimentality demanded to be visible, and hairwork began to be featured more publicly and prominently. In accordance with Victorian social norms, the act of mourning in Britain became more codified, more tied to public performance. Queen Victoria herself, who wore an encased lock of Prince Albert's hair from the time of their engagement in 1839, played a role in this. After her Consort's death in 1861, Victoria's visible grief and sentimentality, as expressed in part through her use of personal effects, helped make hair jewelry one of the few acceptable accessories in the strictly prescribed dress code for mourning.[16] In France, "court mourning *(deuil de cour)* was observed more frequently, more

rigorously, and by more people than elsewhere in Europe."[17] French developments in mourning culture played out on a significantly earlier timeline than in Britain as well, with market saturation and relaxed mourning etiquette occurring as early as the 1780s.[18]

By the early 20th century, the sentimentality of the Victorian era began to be regarded with a degree of cynicism, and commemorative hairwork took on an air of the macabre.[19] This was coupled by the rise of modern hygiene and sanitary standards, the cultural root of the ickiness that modern viewers might feel when confronted with hairwork.

Manufacture and Reconstructions:

A lock of hair sent in a letter is a sentimental keepsake. However, the labor that goes into hairwork and its placement in a piece of jewelry or a fine frame hung in a parlor makes it a commodity as well. In the 19th century, crafting hairwork, like other types of fancywork, was an acceptable avocation for women of the leisure class, but it was also made by professionals. Traveling from city to city in America and often working from lodgings, these professionals were often hairworker, jeweler, and miniature painter all at once.[20] Regarding the methods of hairworking, however, the difference between amateur and professional is immaterial, since both women working in their parlors and travelling professionals used the same techniques, widely published in ladies' magazines of the day. Alongside advertisements for these professionals were often printed instructions for some of the very hairworking methods they would employ.[21] For the methods of painting ivory miniatures, multiple contemporary treatises of the 19th century describe in detail the preparation of the ivory surface, painting techniques, and the ideal pigments to use.[22]

Hairworking techniques are categorized as table-work, gimp-work, or palette-work. Table-work employs a donut-shaped round table with a hole in the center. Groupings of hair strands are woven together in the same manner as bobbin lace, using weights and counterweights to maintain tension (Fig. 4), eventually yielding complex structures (Fig. 5).

Fig. 4 and 5
Table-working setup, from *Godey's Lady's Book*, Vol. 42, 1851. Courtesy of HathiTrust.
Brooch, 1864. Hair and engraved gold. 2 x 2 11/16 x 3/8 in. Historic New England (https://www.historicnewengland.org/explore/collections-access/gusn/101232/, accessed 23 March 2018)

Gimp work was used mostly to create three-dimensional flowers and other vegetation used in wreaths. Hair was usually wrapped around a knitting needle while being tied into a chain with flexible wire. A Victorian hairworking workshop held at the Mütter Museum in conjunction with their recent show offered an opportunity for the author to practice this technique. The workshop was taught by Karen Bachmann, a jeweler who restores hairwork and works in the medium as an artist. As evidenced by the virtuosity seen in gimp-work wreaths, the technique can be modified to achieve a variety of forms.

The final category, palette-working, is the one most applicable to the treated memorial, and it encompasses techniques in which an adhesive or binder is employed to hold hair worked on a flat surface. Strands of hair can be combed out thinly and aligned to form a uniform sheet, which can range in thickness from a few strands thick, to a single strand's thickness, averaging 70 microns. The instructions in lady's magazines indicate that "gum-water" should be brushed over these sheets to hold them together. Scholars have suggested that this refers to either dilute gum arabic or gum tragacanth,[23] and instructions in an 1876 American publication directly

refer to a "gum-arabic mucilage."[24] Afterwards, the sheets can be cut to a desired shape and attached to paper backings to describe leaves and flower petals (Fig. 6). The application of heat using curling irons was also used to shape "feathers" of hair before applying the adhesive.[25] Over time, the sheets of hair can curl and begin to delaminate from their backings, likely due to changes in relative humidity. In the author's reconstruction, the formation of single-strand-thickness sheets was accomplished easily working with dilute gum arabic over silicone coated polyester film, adjusting, aligning, and smoothing the hairs with a pin and micro spatula.

Fig. 6
Palette-worked Pansies, c. 1855. Leather case, hair, original numbered key. Collection of John N. Whitenight and Frederick M. LaValley.

Also included in palette-working is hair-painting, alternately referred to as dissolved hair work, macerated hair work, and sepia work.[26] These are methods in which hair is finely chopped and mixed with this "gum-water" as if it were a pigment. Sometimes, it could be mixed with an actual pigment as well, usually a brown color. Use of this technique declined from the 1830s, and was no longer seen by the middle of the 19th century.[27] The collection of varying names used for the technique indicates that this was likely executed in a number of different ways. In order to experiment with different techniques, a lock of the author's own hair was chopped finely with razor blade on a glass plate, and half of that result was ground using a mortar and pestle. Used as pigments, these hair fragments were mixed with dilute gum arabic and painted out a test image on an old ivory veneer that was once part of a piano key (Fig. 7).

Although finely chopped and divided, the hair was difficult to spread into an even coating in a single pass. Fortunately, the gum arabic allows a long enough working time that a separate, damp brush can be used to manipulate the hair before it dries. Creating three-dimensional forms or mounds is straightforward and can be accomplished by building up successive layers or by using a brush almost like a scoop, and further manipulating the hair once it is in place. Whether the hair is pulverized after chopping or not, the general appearance of the hair-painting is not that different, but under the microscope, the difference is a little more clear. Predictably, hair that has only been chopped appears as a collection of tubes, while the ground hair is more flattened and fragmentary (Fig. 8 and 9). Perhaps with more extensive grinding, the lengths of the hair fragments can be made continually more uniform.

Fig. 7, 8, and 9
Left: Mockup of hair painting on ivory veneer, using chopped hair, both ground and unground.
Right: Photomicrographs at 40x of unground (top) and ground (bottom) hair painting.

Description and Condition of Treated Memorial:

These reconstructions allowed for a better understanding of the construction of the treated memorial, whose composition and iconography are worth noting as an introduction to the object. The memorial was initially encased behind a convex piece of glass in a wooden frame with a brass bezel. It is composed of palette-worked hair and watercolor on an extremely thin, translucent ivory veneer which is missing its bottom (Fig. 10). The substrate is identifiable as ivory both by its characteristic blue-white UV luminescence, as well as the grain of dentinal tubules that run vertically through the veneer, indicating that it is a transverse section of the tusk.[28] At roughly 0.25 mm thickness, it is far too thin to examine the transverse section for Schreger lines to identify the species of the animal.[29]

As to whether it is meant to commemorate a death or an engagement, its iconography is slightly ambiguous. It depicts a truncated tree, built up in three dimensions, with vigorous new growth. At the center, a grave marker or love altar displays the entwined initials "NB." It is surmounted by two linked flaming hearts and a swallow, a bird which mates for life, carrying a wreath. The cypress trees in the background point upward to the heavens. The pansy in the foreground protrudes out from the ivory surface and is a common symbol used for mourning hairwork. The name pansy comes from the French *pensée*, for remembrance, and the flower is frequently used in French examples of hairwork.[30] Using two different individuals hair in a commemorative memorial was common practice, for both aesthetic and sentimental effect,[31] and during examination of the hairwork under magnification, two distinct colors of hair were visible, one dark and one light, suggesting that the hair belonged to a couple. Overall, the iconography and three-dimensional composition are consistent with memorials made in France[32] during the 18th century.

Fig. 10
Unframed memorial (before treatment), 7.3 cm x 6.4 cm.

On the ivory's reverse, watercolor was added to describe a cloudy sky and create depth in the middle ground (Fig. 11). This is more easily observable in long-wave UV illumination. The ivory's characteristic blue-white fluorescence is quenched by the occluding paint (Fig. 12).

Fig. 11 and 12
Verso of unframed memorial during treatment, in visible (left) and long-wave ultraviolet (right) illumination.

Before treatment, the memorial was in a decidedly poor state. The frame's non-archival backing had been removed, leaving only a single unattached sheet of stained and torn laid paper behind the ivory veneer. Tide lines on the laid paper and on the ivory were clear indications that liquid water had penetrated from the reverse. This moisture had likely also been related to the loss of some of the watercolor painted on the verso. The thin veneer has also warped along the ivory's grain from the moisture and subsequent drying, causing a vertical crack to form in the middle of the veneer (most visible from the reverse, Fig. 11). Water wasn't the only thing that made it inside: insects, most likely dermestid beetles, had infiltrated the inside of the frame and eaten some of the proteinaceous hairwork, leaving larval casings and frass behind (Fig. 13). Additionally, white crystals had formed on part of the front surface of the ivory, possibly a result of manufacturing methods, or of unrelated degradation (Fig. 14).

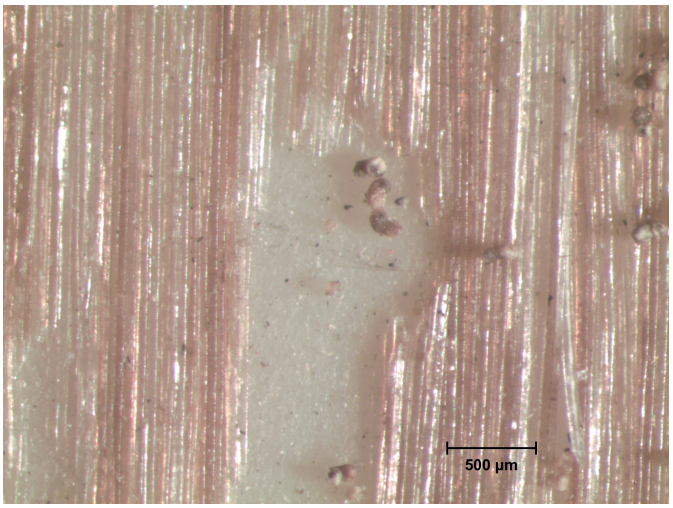

Fig. 13 (left)
Photomicrograph at 50x showing larval casings and frass from an old infestation of dermestid beetles.

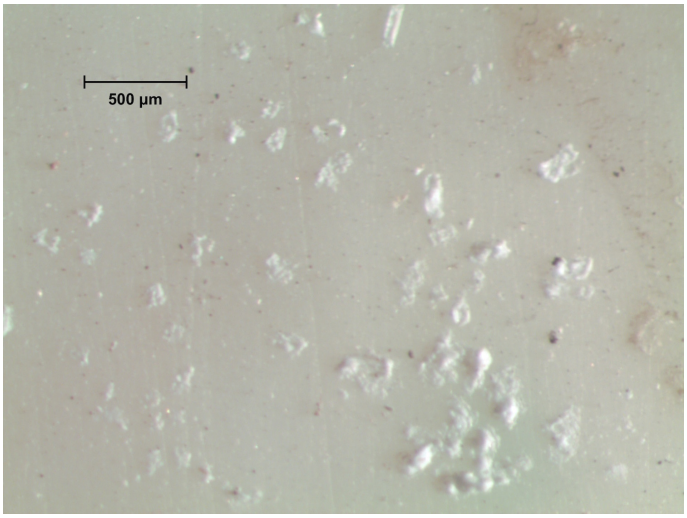

Fig. 14 (right)
Photomicrograph at 57x showing an area of white efflorescence on the ivory's recto surface.

There was also the matter of the missing bottom section of ivory veneer. Under UV illumination of the verso (Fig. 12), a lighter area along the bottom is visible, indicating where another piece was lap-joined to the back. The current bottom edge of the ivory has remnants of chopped hair, indicating that the original join was completely masked by the hair painting (Fig. 15). It was logical for the artist to choose an area of hair-painted ground to hide a join, as cuts of ivory are necessarily limited in size.

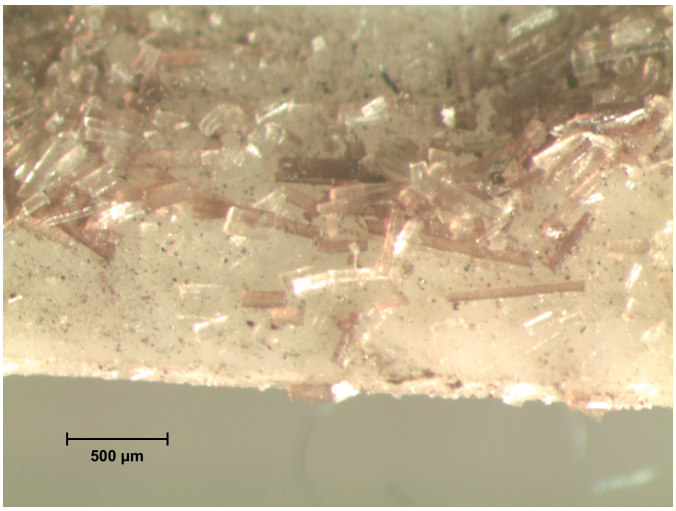

Fig. 15
Photomicrograph at 57x showing the hair-painting overlapping onto the bottom edge of the ivory. This indicates that hairwork was used to mask an old lap-join on the reverse side, confirmed by the brighter stripe visible in UV illumination of the verso (Fig. 12).

Material Identification:

Instrumental analysis of the object was conducted at the Metropolitan Museum of Art's Department of Scientific Research, with the aid of Marco Leona. The analysis had three objectives. The first was to identify the palette-working adhesive, the "gum-water" or "mucilage" referenced in contemporary instructions. The second goal was to identify the white crystals on the ivory surface and determine why they had effloresced, using the available conservation literature to determine what the identity of the mineral said about the ivory's preparation or degradation. Lastly, the identification of the pigments used in the watercolor would be useful in order to relate the production of the memorial to the related industry of ivory miniatures, using the knowledge base from both contemporary published treatises and modern analysis by conservators. This could also be helpful in confirming the object's date.

A sample of the translucent, yellow adhesive was obtained under magnification from the reverse of a hair-and-paper leaf that had been overturned due to prior damage. This sample was flattened on low-E glass (which reflects long-wave infrared radiation) and analyzed using a Bruker Hyperion 3000 FTIR Microscope in reflectance mode for 128 scans, with a resolution of 4 cm^{-1}. This was then referenced against the carbohydrate subgroup of the IRUG spectral database. Its spectrum is most similar to that of a reference spectrum for acacia gum obtained by the Victoria & Albert Museum (Fig. 16). Not every peak in the sample and the reference are aligned, but characteristic absorbances for alcohols and ethers are consonant with a polysaccharide gum. Because it is not a perfect match, the sample is best categorized generally

as a natural polysaccharide. This confirms loosely the use of "gum water" in the memorial, even if a specific species cannot be definitively identified.

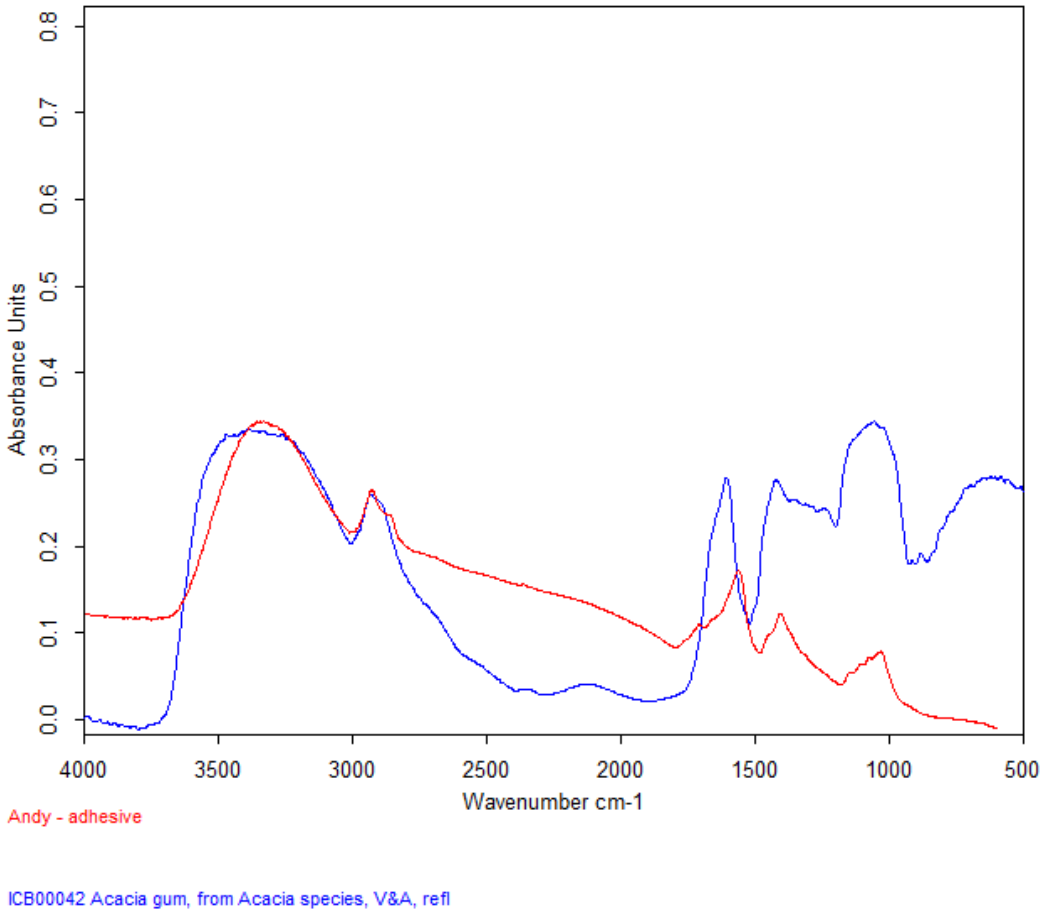

Fig. 16
FTIR reflectance spectra of the adhesive sample (red) and the reference for acacia gum (blue). The spectrum of the sample shows a broad absorbance in the O-H region, centered on 3300 cm^{-1}, as well as a weak peak for C-H stretching, at roughly 2900 cm^{-1}, consistent with saturated hydrocarbons. The peaks at roughly 1550, 1400, and 1050 cm^{-1} can be attributed to C-C stretching near C-O, C-H bending of methylene groups, and C-O stretching, respectively.[33]

White efflorescence is not uncommon on the surface of ivory objects, and the identity of the mineral present has been shown to reveal information about the ivory's ageing and treatment.[34] These crystals, various hydrates of magnesium phosphate, leach out of the ivory surface during prolonged exposure to high humidity. Ivory contains nearly six times as much magnesium as does bone, present as magnesium phosphates that may be adsorbed onto the surface of ivory's carbonate-apatite dahllite crystals.[35] The magnesium phosphates are more

readily mobile in solution than their surroundings, and can precipitate as different minerals depending on the pH environment. The minerals one might expect to find in this efflorescence are newberyite, bobierrite and struvite.[36] In the early 20th c., conservators recommended the use of ammoniacal hydrogen peroxide for the bleaching of yellowed ivory. This process damages the ivory surface and causes the later efflorescence of the mineral struvite ($MgNH_4PO_4 \cdot 6H_2O$).[37] Bleaching was also commonly done in the preparation of the ivory surface before miniature painting, though the use of this particular bleach is not mentioned in contemporary texts.[38] In instances where ammoniacal hydrogen peroxide was not used, newberyite ($MgHPO_4 \cdot 3H_2O$) has been found to effloresce in acidic environments (pH <6.2) and bobierrite ($Mg_3(PO_4)_2 \cdot 8H_2O$) in neutral or alkaline conditions.[39]

A Raman spectrum of the efflorescing crystals was acquired with a Bruker Senterra Raman Microscope, using a 785 nm laser and the minimum wattage required to yield a sufficiently legible spectrum. This was checked against references for the known possibilities in the RRUFF Raman database for minerals. The analysis definitively identified newberyite, indicating that an ammonia-containing bleaching agent was not used on the ivory during its preparation or during any prior interventions. The presence of newberyite is easily explained by the non-archival backing material clinging to the back of the memorial's frame and the infiltration of moisture made evident by tide lines on the laid paper backing and around the edges of the ivory itself.

Lastly, watercolor pigments were also analyzed using Raman spectroscopy, with the same instrumentation and settings as with identification of the white crystals. The acquired spectra were examined for characteristic peaks[40] and verified against references in the UCL pigment library. Interestingly, some of the pigments identified are not recommended in most ivory miniature treatises, likely because these texts insist on translucent pigments and applications that allow the white of the ivory to show through. The goal in painting the reverse of the ivory veneer isn't depth on the painted side, but to apply enough opaque color to give a diffuse effect on the recto side. This would explain why a combination of white pigments, a mixture of calcium carbonate and lead white (Fig. 17), was mixed in with the blue paint, identified as indigo. The identity of the white pigments, and the absence of a zinc or barium-containing white pigment, confirms an earlier date for the object, likely mid-to-late 18th

century, with the earlier end of that range being bounded by about 1760, when ivory veneers first could be cut extremely thinly.

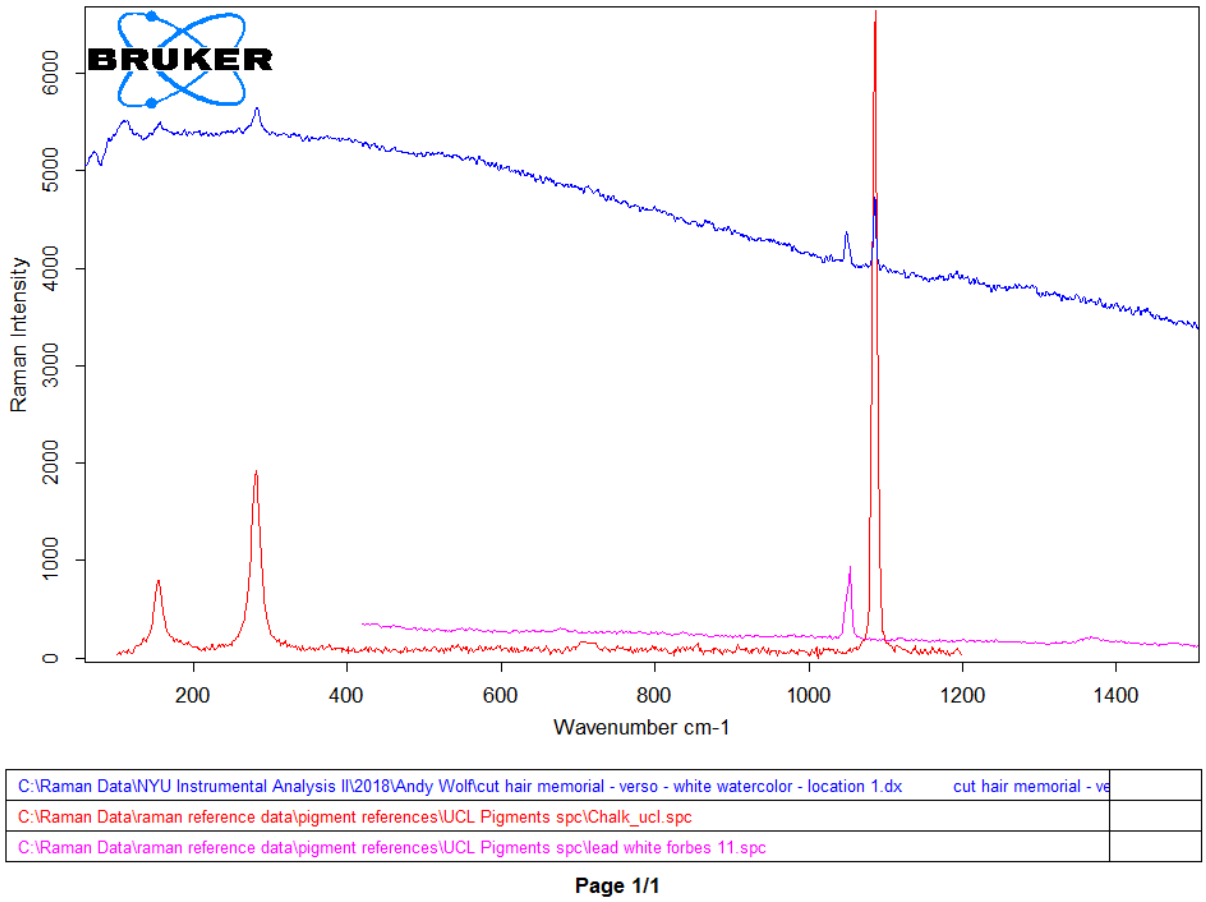

Fig. 17
Raman spectrum for the white watercolor. The spectrum of white watercolor (blue) includes peaks from both reference spectra of calcite (red) and lead white (pink).

Studying the slightly pink areas in the white watercolor, it became clear that red pigments had indeed been added to this same white mixture. Examination revealed the presence of two types of red pigment particles scattered in the white: a small red particle and a larger pink particle (Fig. 18 and 19) The Raman spectrum of the small, red particle clearly indicated vermilion. However, the larger pink particle's spectrum showed only peaks from the surrounding white pigments, along with a great deal of fluorescence, even at 785 nm excitation (Fig. 20). This would seem to imply the presence of an organic red colorant whose peaks either extend beyond the measured range or are masked by the fluorescence. This hypothesis is confirmed upon close inspection of the verso (Fig. 11), which reveals that the red coloration

has largely faded due to light damage in all areas not shielded by the opaque hairwork on the recto. Knowing that the clouds on the reverse were originally pink was of particularly interest because now it was clear that this scene takes place at a specific time: sunset, or perhaps, sunrise.

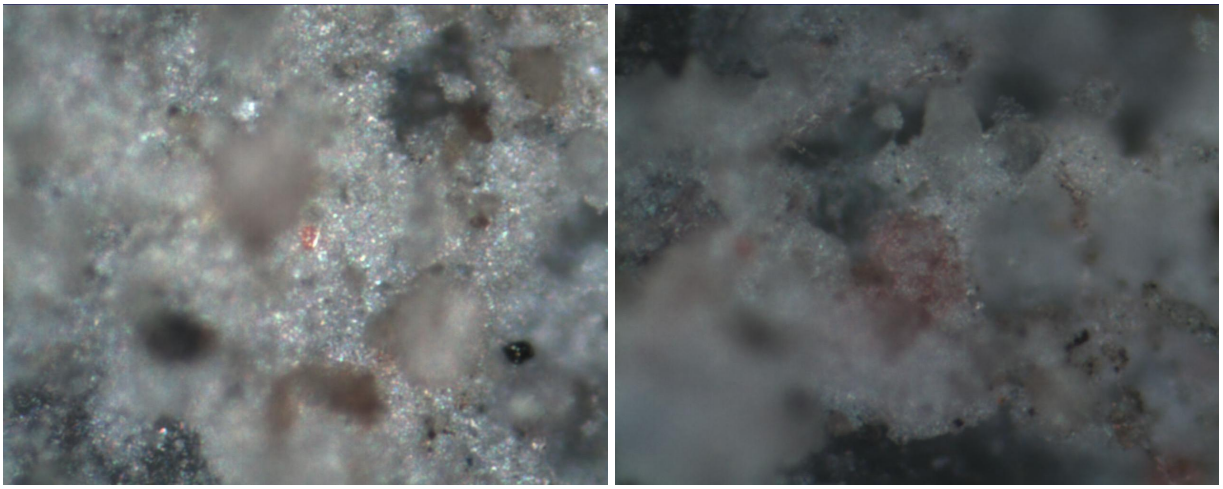

Fig. 18 and 19
Micrographs at 500x of the red pigment particles. At left, in plane-polarized light, the small red-orange particle is visible at center. At right, in partially-crossed-polarized light, the larger pink particle is visible at center.

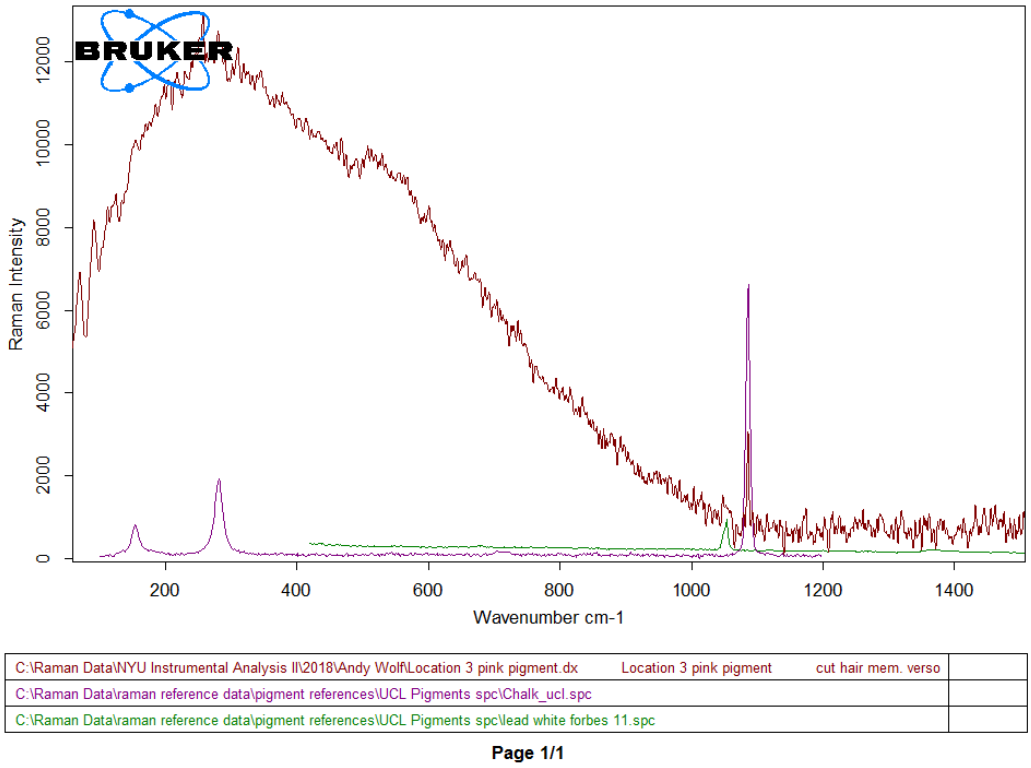

Fig. 20
Raman spectrum for the larger, pink pigment particle. The spectrum of the sampled pigment (red) contains only the peaks of calcite (pink) and lead white (green), as well as a great deal of fluorescence, suggesting the presence of an organic red colorant.

Treatment:

The treatment for the memorial was multifaceted and was made all the more difficult by ivory's hygroscopic nature. Most of the time, the veneer was kept in a sealed and gasketed microclimate with silica gel conditioned to 50% relative humidity. Of course, documentation and treatment require it to leave that environment for brief periods. When dealing with an ivory veneer thin enough to be translucent, fluctuations in relative humidity can quickly cause drastic distortions. Relative humidity values of 30% can introduce a severe warp along the ivory's grain in less than five minutes, so working in at least a partially controlled environment is essential. Using a humidifier locally may create problems of its own if only one side is exposed to added moisture, so this should be done with caution. Naturally, for the sake of the ivory, the hairwork adhesive, and the watercolor, use of water in conservation materials must be severely limited.

As the object was treated during the winter, with the conservation laboratory's relative humidity hovering in the 30s, time spent outside of the microclimate was limited to a few minutes. Between reacclimatizing periods in the sealed container, the memorial was cleaned and stabilized. Under the microscope, the larval casings and frass were gently removed with a slightly damp fine brush. Lifting and fraying areas of hairwork were consolidated and stabilized with a 5% solution of Paraloid B-72 in acetone. The vertical crack in the ivory was stabilized using Japanese tissue fibers dipped in the same acrylic solution. Bridging the crack on the verso between areas of watercolor, the fibers were not visible from the front.

In order to compensate as much as possible for the lost watercolor and the faded areas of pink on the verso, a sheet of laid paper was painted to visually restore the diffuse colors of the cloudy sky when seen from the front. This sheet rests, unattached, behind the ivory veneer in its frame and can be easily removed. The difference with the painted sheet in place is subtle, but it restores significant depth (Fig. 21-23).

The compensation of the hairwork proved the greatest challenge. Given the significance and individuality of these objects, it rapidly became clear that using hair as an in-kind replacement would be unethical. Even the anonymous hair from a set of hair extensions ordered on the Internet had once belonged to an individual, a person who was never intended to join those tied to the object. In conferring with a collector who performs restorations on some of the work in his collection, I was saddened to learn that he occasionally adds human hair as a fill material.[41]

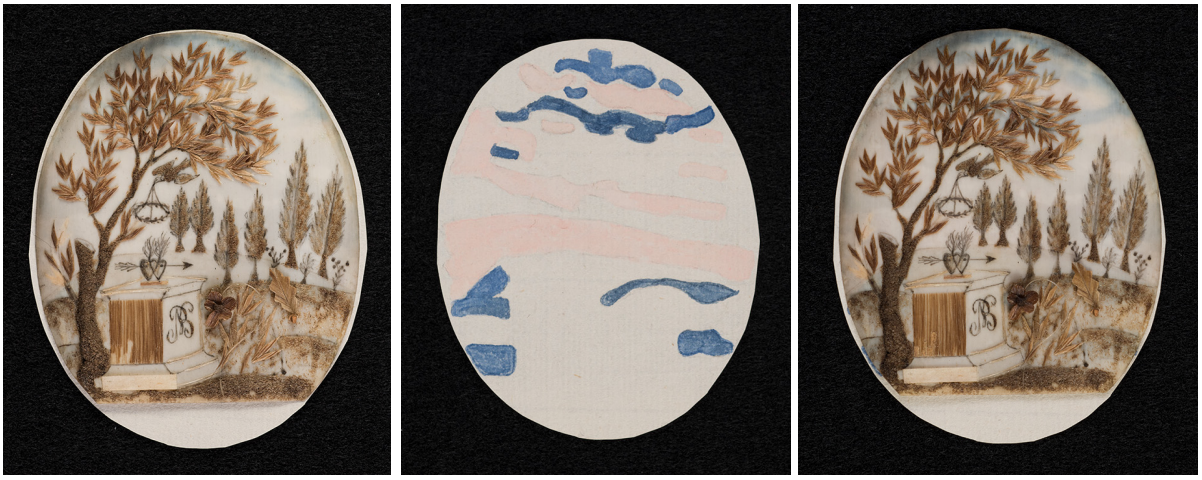

Fig. 21 – 23
At left, the memorial with a blank sheet of laid paper. At center, the same sheet painted to visually restore the lost watercolor. At right, the memorial with the removable sheet in place.

Synthetic extensions were investigated briefly. They are available in a variety of different polymers, from acrylonitrile, to polyvinyl chloride, polyethylene terephthalate, and a number of what appear to be proprietary mixtures. In limited tests with these materials, attempting the same reconstructions made with the author's own hair, they had too fine a texture and were extremely brittle.[42] The larger issue of compensation with fibrous material is that of reversibility. Any palette-worked fill must use adhesives that will not fully dissolve during removal or adjustment, causing the fibrous compensation to break apart and preventing clean removal. Instead of using fibrous materials construct fills in areas of loss, sheets were used to imitate a fibrous appearance.

For the missing bottom, with its covering of hair-painting, several laminated layers of spunbonded polyester sheets of Reemay were toned with watercolor. The fibrous appearance provided a good base for further texturing. A dilute PVA resin was applied to the front, and toasted cellulose fibers were sprinkled on it to give a more textured and mottled appearance. The different tones of the painted Reemay and the toasted cellulose fibers imitate the different colors of hair used, and the dusty texture approximates the fine maceration of the hair-painting. A thin shelf was carved into the back of the laminated Reemay, so the ivory veneer can loosely rest on it in the frame.

As for the missing palette-worked hair found in the flat square plane of the grave marker or love altar, there is no paper backing present, and the palette-worked sheet is roughly a single strand thick. A very thin sheet of Japanese tissue was inpainted to imitate the variegated bands of color in the hair, cut to size, and adhered in place with a dilute solution of Paraloid B-72. The memorial with its compensation reunifies the composition and restores a sense of the object's materiality (Fig. 24).

Fig. 24
Memorial during treatment, with watercolor compensation, palette-work compensation, and hair-painting compensation resting loosely in place. In its final re-framing, these elements will fit together more seamlessly.

Aside from the memorial itself, the treatment for the rest of the object involved washing, mending, and applying of fills to the original backing paper, as well as gentle cleaning of the slightly-crizzled glass in the frame. Because the object will be returned to an uncontrolled environment, the ivory memorial will be encased in a microclimate envelope with a Marvel Seal barrier to mitigate future deformation.[43]

Conclusion:

While the compensation portion of the memorial's treatment was successful, more research and experimentation is required to develop new, more imitative techniques, perhaps using fibrous materials. Furthermore, the methods employed here, where the lost hairwork was simple in its design and form, may not be effective in compensating for lost hairwork in more complex shapes. More generally, though, as interest in these objects continues to grow in a museum context, their treatment needs to transition away the crafty connoisseur's worktable and into the conservator's laboratory.

Acknowledgements:

The author would like to thank his interviewees John Whitenight and Karen Bachmann; his instructor and advisor Michele Marincola; his classmates Bryanna Knotts, Lia Kramer, Soon Kai Poh, and Chantal Stein; the faculty and staff of the Conservation Center at the Institute of fine Arts, NYU, including Margaret Holben Ellis, Norbert Baer, Hannelore Roemich, Kevin Martin, Jessica Cayer, and Amelia Catalano; Marco Leona and the Metropolitan Museum of Art's Department of Scientific Research; the Mütter Museum and the Cincinnati Art Museum; and the Hagop Kevorkian Fund.

Notes

[1] H. Hastings Weld, "The Mourning Ring," *Godey's Lady's Book* 26 (Jan.-Jun. 1843): 277-284. Helen Sheumaker also relates this story in her comprehensive book on hairwork, *Love Entwined: The Curious History of Hairwork in America* (Philadelphia: The University of Pennsylvania Press, 2007).

[2] A handful of museums across the United States have noteworthy collections of hairwork: the Winterthur Museum, Garden & Library, the Cincinnati Art Museum, the Minnesota Historical Society, and Leila's Hair Museum (a specialized museum in Independence, MO run by a retired cosmetology teacher), to name a few.

[3] For an overview, see Carol Aiken, "Literature that addresses the characterization and the conservation of portrait miniatures," *Studies in Conservation* 45:sup3 (2000): 3-9. Pigment analysis using Raman microscopy is extensively covered in Alan Derbyshire and Robert Withnall, "Pigment Analysis of Portrait Miniatures Using Raman Microscopy" *Journal of Raman Spectroscopy* 30 (1999): 185-188; and conservation is discussed in Bernd Pappe, "Porträtminiaturen auf Elfenbein: Bewahrung und Restaurierung," *Zeitschrift für Kunsttechnologie und Konservierung* 9, part 1 (1995): 18-48. Several other analysis and treatment-related sources are cited in Aiken.

[4] Teresa Barnett, *Sacred Relics: Pieces of the Past in Nineteenth-Century America* (Chicago: University of Chicago Press, 2013), 18.

[5] "Hair Ornaments," *Godey's Lady's Book* 60 (1860), 380.

[6] Bartnett, 23.

[7] John Whitenight, *Under Glass: A Victorian Obsession* (Atglen, PA: Schiffer Publishing, 2013), 87.

[8] Arianne Fenneteux, "Fashioning Death/Gendering Sentiment: Mourning Jewelry in Britain in the Eighteenth Century," in *Women and the Material Culture of Death*, eds. Maureen Daly Goggin and Beth Fowkes Tobin (Burlington: Ashgate, 2013): 28-30.

[9] Helen Sheumaker, *Love Entwined: The Curious History of Hairwork in America* (Philadelphia: The University of Pennsylvania Press, 2007),15.

[10] "Portrait Miniatures." The Cleveland Museum of Art, created 2013, accessed 13 September 2017, https://www.clevelandart.org/sites/default/files/documents/gallery-card/Portrait%20Miniatures_complete_final_032113.pdf.

[11] Verena Flamm, "Die Konservierung und Restaurierung der Habsburger-Miniaturen," *Restauratorenblätter* 21 (2000): 51.

[12] Sheumaker, 15.

[13] Michelle Iwen, "Reading Material Culture: British Women's Position and the Death Trade in the Long Eighteenth Century," in *Women and the Material Culture of Death*, eds. Maureen Daly Goggin and Beth Fowkes Tobin (Burlington: Ashgate, 2013): 247.

[14] Sheumaker, 28-29.

[15] Sheumaker, 16-17.

[16] Irene Guggenheim Navarro, "Hairwork of the Nineteenth Century," *The Magazine Antiques* 159, no.3 (March 2001): 485-486.

[17] Kimberly Chrisman-Campbell, "Mourning and *La Mode* at the Court of Louis XVI," *Costume* 39 (2005): 64.

[18] Ibid., 75-76.

[19] Navarro, 487.

[20] Sheumaker, 1-3.

[21] Sheumaker 33-34. In addition to ladies' magazines, publications devoted to the crafting of hairwork were available by the 1860s. An example is Mark Campbell's *Self-Instructor in the Art of Hair Work*, published in New York and Chicago in 1867.

[22] John Payne, *The Art of Painting in Miniature on Ivory* (London: Robert Laurie and James Whittle, 1797) and Arthur Parsey, The Art of Miniature Painting on Ivory (London: Longman, Rees, Orme, Brown, and Green, 1831) are two examples.

[23] Sheumaker, 35; John Whitenight, email message to author, January 24, 2018.

[24]C.S. Jones and Henry T. Williams, *Ladies' Fancywork: Hints and Helps to Home Taste and Recreations* (New York: Henry T. Williams, 1876), 6.

[25] Sheumaker 36.

[26] Ibid.

[27] Navarro, 489-490.

[28] Arthur MacGregor, *Bone, Antler, Ivory & Horn: The Technology of Skeletal Materials Since the Roman Period*, (Totowa, NJ: Barnes & Noble, 1985), 17.

[29] Mary-Lou E. Florian, *Protein Facts: Fibrous Proteins in Cultural and Natural History Artifacts* (London: Archetype, 2008), 35-36.

[30] Navarro, 490.

[31] Sheumaker, 35.

[32] Navarro, 490; John Whitenight, email message to author, January 29, 2018.

[33] Michele R. Derrick, Dusan Stulik, and James M. Landry, *Infrared Spectroscopy in Conservation Science* (Los Angeles: Getty Conservation Institute: 1999), 93-108.

[34] Anke Freund, et al., "On the Occurrence of Magnesium Phosphates on Ivory," *Studies in Conservation* 47, no. 3 (2002): 155-160.

[35] Ibid., 158.

[36] Ibid.

[37] Ibid., 156.

[38] Parsey, 75; Payne, 23-24.

[39] Freund, 158.

[40] Ian M. Bell, Robin J.H. Clark, Peter J. Gibbs, "Raman Spectroscopic Library of Natural and Synthetic Pigments (pre ~1850 AD)," *Spectrochemica Acta Part A 53* (1997): 2159-2179.

[41] John Whitenight, email message to author, January 29, 2018.

[42] These tests were not attempted with hair silk, commercially available silk thread used in textile repair, which may have the desired texture and strength.

[43] Alan Miller, "Marvel Seal Envelopes at the Metropolitan Museum of Art," in *Facing Challenges of Panel Paintings Conservation: Trends, Treatments, and Training*, eds. Alan Phenix and Sue Ann Chui, (Los Angeles: Getty Conservation Institute, 2009): 207-208.

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