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Mist Consolidation: future treatment potential for deteriorated iron-dyed yarns

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INTRODUCTION

A needlework map sampler was slated for exhibition at The Art Museums of Colonial Williamsburg (fig. 1). Based on Samuel Lewis' 1796 *A Map of the United States*, the sampler was embroidered and painted on a plain weave silk ground to imitate hand colored printed paper maps. This poster focuses on the various fine, dark-colored silk yarns used to denote latitude and longitude lines and the border scale.

Fig. 1. Sampler (CWF accession #2019-70), by Ann E. Colson, Pleasant Valley School, NY, 1809 Front, before treatment

Fig. 2. Three locations of damaged and disintegrated dark-colored silk yarns on the sampler.

OBJECT CONDITION

The sampler was discolored overall with aged brown tidelines along the bottom edge from water events. The silk was weak around the edges and in the tidelines, with tears and losses. The fine, dark-colored silk yarns used across the map were friable and brittle, some to the point of disintegration (fig. 2). In this state, handling, exhibition, and any treatment would result in further damage and loss to the yarns.

ANALYSIS

SEM-EDS analysis indicated iron in the dark-colored silk embroidery yarns. Fracturing of the silk filaments was visible, particularly within the blue-black yarns (fig. 3). The presence of metal ions in silk, whether from weighting processes of the late 19th and early 20th centuries, or in this case, from the dye itself, strongly absorbs radiation in the ultra-violet range and can cause oxidative degradation.

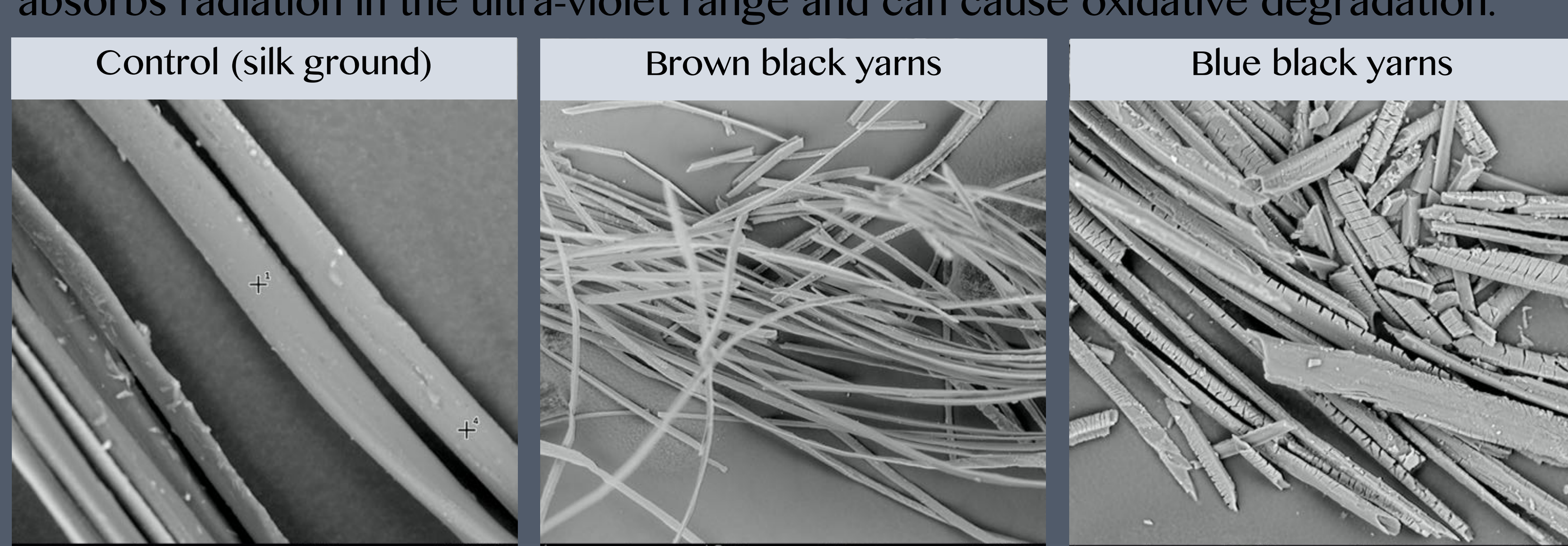

Fig. 3 Silk embroidery yarns examined using scanning electron microscopy. Extent of fracturing of the dark-colored silk yarns can be compared to the unfractured silk ground of the sampler.

GOALS and RATIONALE

The main goal was to address stabilization of the sampler, starting with the silk yarns. Due to the sensitivity and fineness of the yarns, typical stitched or adhesive stabilization treatments were not possible. Mist consolidation to retain these fibers and prevent future loss was explored. If no treatment was performed, it was determined the risk of loss was high enough to warrant the irreversibility of a consolidation treatment.

TESTING

Solutions of 2% Aquazol 500, 1% Klucel G, 1% isinglass, 1% gelatin, and 0.5% Methocel A4C in deionized water were tested. Each percentage resulted in the same viscosity across the consolidants. Testing was performed on yarns pulled from a piece of study collection shattered silk. The consolidants were applied using a Pulmomate nebulizer modified with Mylar to create a finer nozzle for precise application. 5 and 10 passes of each consolidant was tested. The maximum limit of consolidation was tested using 20, 30, 40, and 50 passes of Aquazol 500 and Methocel A4C, the two consolidants most successfully used in the literature.

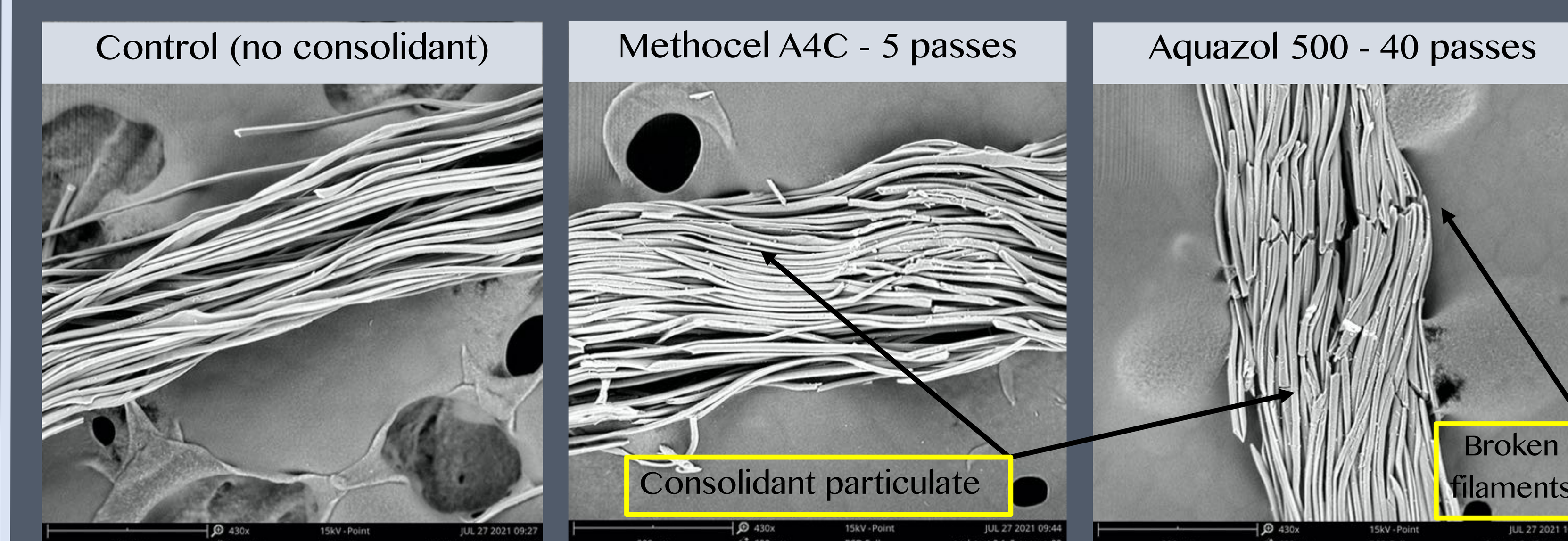

Fig. 4. Shattered silk yarns mist consolidated examined using scanning electron microscopy.

The consolidated samples had a more robust handle and were visually unaltered. Consolidant particulate was found on all samples compared to the unconsolidated control when examined using SEM (fig. 4). At and above 30 passes of consolidant, the filaments had a "stuck together" appearance and brittleness and breakage was observed. Number of passes had a greater impact on consolidation than the type of consolidant used. As such, treatment proceeded with 10 passes of 0.5% Methocel A4C, due to its excellent long-term stability and frequent previous successes in similar published treatments.

TREATMENT

A mount to hold the map at a 30-degree angle was fabricated to aid in consolidant application, as the sampler could not be placed vertically (fig 5). Consolidant was applied to the yarns most susceptible to damage from movement and handling. On the front, this consisted of the long floats of the latitude and longitude lines and the scale bar border (fig. 6, *left*). On the back this consisted of the loose tied-off thread ends (fig. 6, *right*).

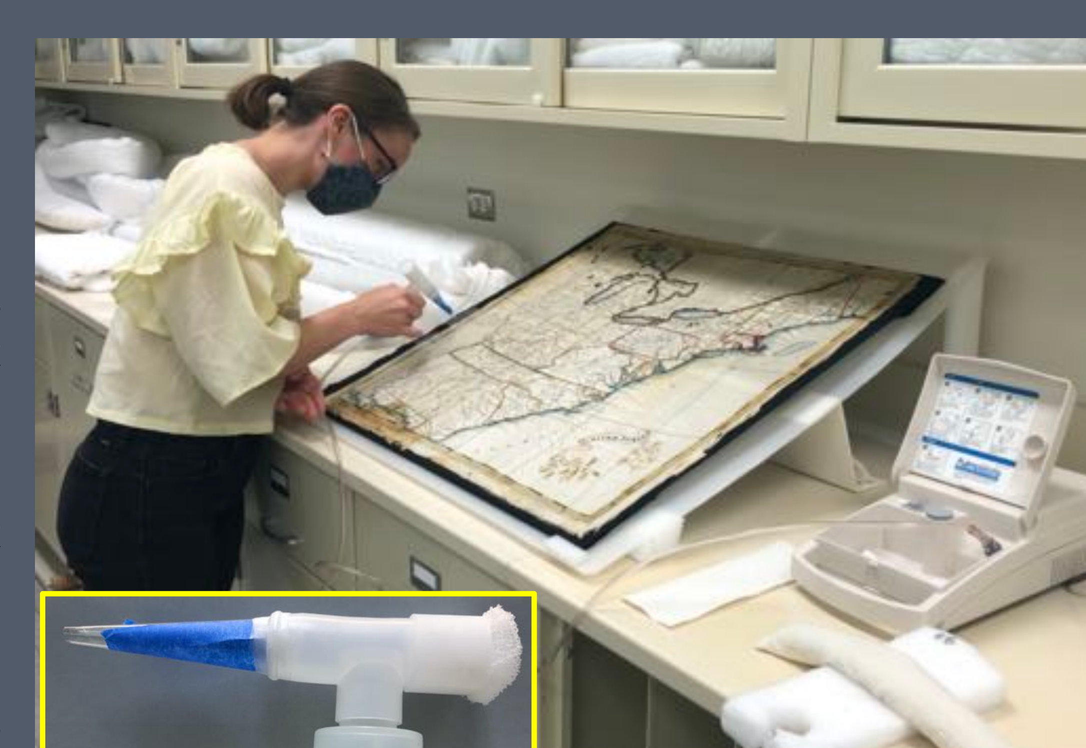

Fig. 5. Mist consolidation treatment in action. Sampler placed on a mount at a 30-degree angle. Inset image: Pulmomate nebulizer modified with a Mylar to create a fine nozzle.

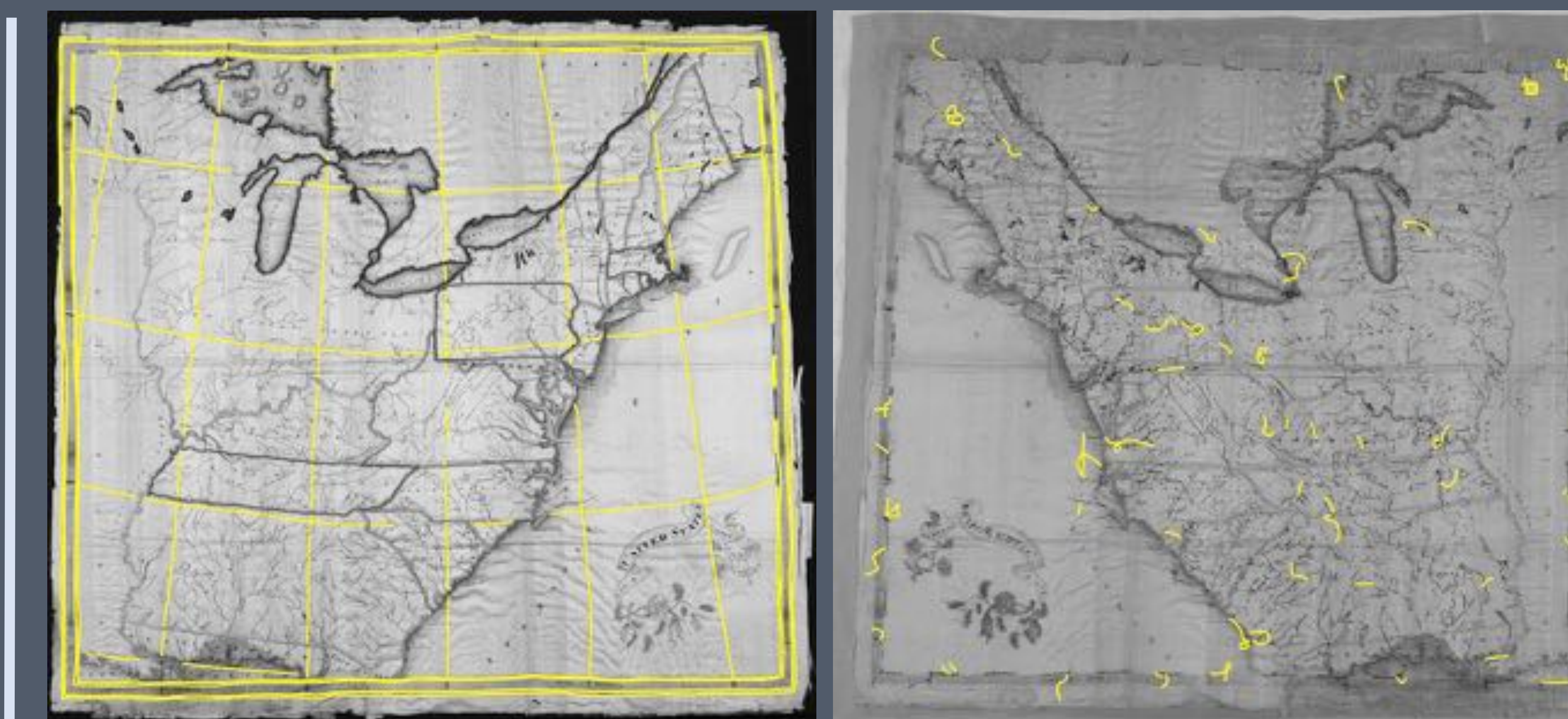

Fig. 6. Locations of consolidated dark colored silk embroidery yarns, *left*: front, *right*: back.

TREATMENT (continued)

To protect the silk ground during consolidation, silicone release mylar was placed under the yarns (fig. 7). To prevent condensation build-up on the silicone release mylar, the consolidant was applied in five sets of two pass increments. Each set was spaced a minute apart to allow for evaporation before proceeding. In some locations, the yarns were realigned as needed when damp (fig. 8).

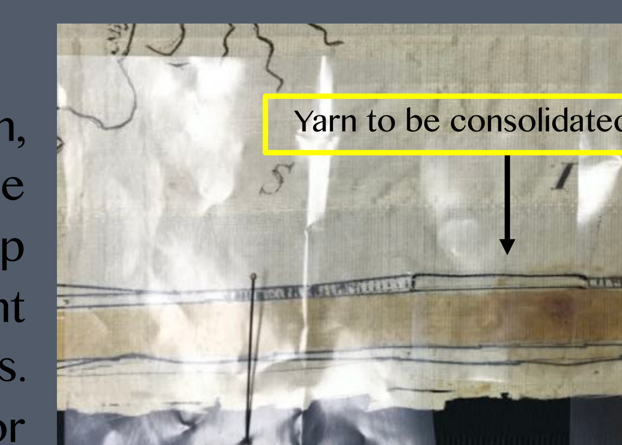

Fig. 7. Silicone release mylar used during consolidation to protect the silk ground of the sampler.

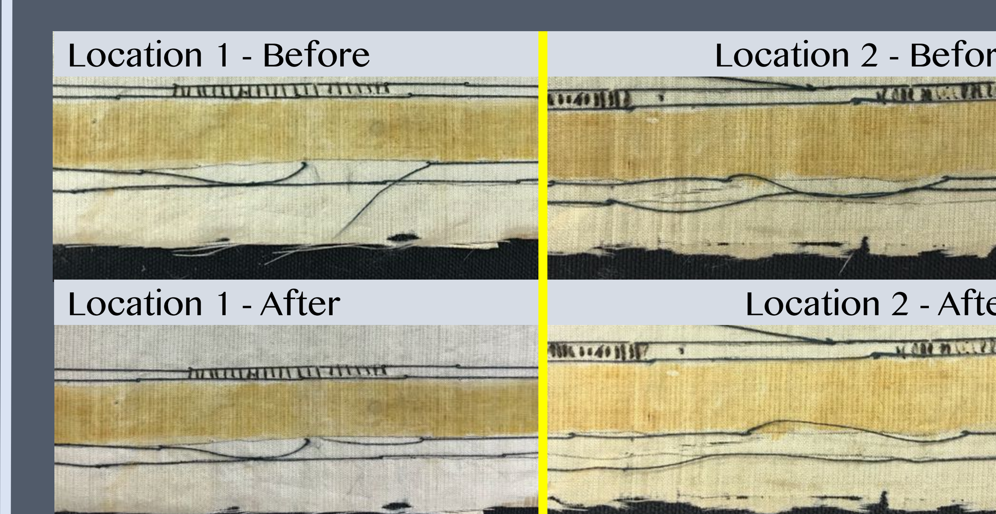

Fig 8. Two yarn locations before (top) and after (bottom) consolidation and realignment.

RESULTS and CONCLUSIONS

Mist consolidation did not prove as effective on the most degraded yarns on the sampler and minor loss to some of these yarns occurred during treatment. Recent studies (Zheng 2021) using fibrion for consolidation could prove useful for the treatment of these yarns. Nevertheless, using Methocel A4C provided structural integrity to the yarns overall, which allowed for more ease of handing, display, and further treatment of this object.

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