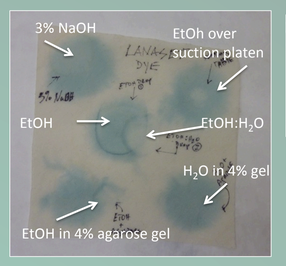
Feeling a Little Blue (Green):
Effort to Reduce Staining on a Flood Damaged Zuni Textile

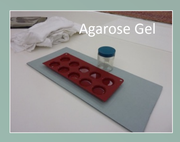
National Museum of the American Indian

Cathleen Zaret, Andrew W. Mellon Fellow in Textile Conservation 2013 – 2015

Zuni me'ha, handwoven and embroidered. (62" X 39") (before treatment). A meha is worn/danced during religious ceremonies. Before treatment, the appearance was mottled with green-blue dye. Two stains were more pronounced, one with a yellow cast. Also present, scattered small stains of what appeared to be pigment and paint. The textile had been commercially dry-cleaned by the owners.

Introduction: In 2011 and 2012 A Cargill grant made it possible for the National Museum of the American Indian (NMAI) conservators and fellows to conduct a place based education program with Pueblo and Navajo communities in the Southwest. During both visits, the team met Zuni master potters, Milford and Randy Nahohai. As the Nahohai family shared their process of creating pottery, an ongoing relationship of friendship and trust developed. In 2012 the Nahohai family asked the visiting conservators if they would examine and consider attempting to reduce or remove stains on a flood damaged family textile. This was an opportunity for NMAI to do a favor-in-kind, giving back to the community. In 2013 as a new Mellon Fellow, I was entrusted with the care and treatment of their textile, a meha. Mindful of the challenge it would be, and conscience of the weight, responsibility, and honor caring for this family heirloom held, many treatment options were carefully pursued. This poster examines the processes and techniques used in the effort to reduce discoloration and staining due to the migration of dyes from colored wool embroidery yarns onto a white cotton ground.





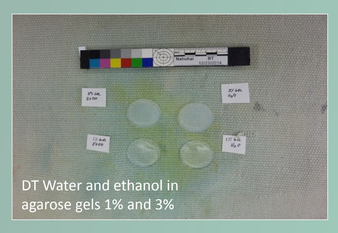
Goal of Treatment: Reduce the staining and improve the appearance of the textile

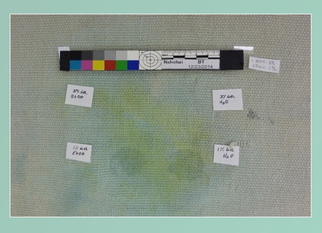
Initial Investigation of Aqueous Solvents: Nonpolar solvents had no effect on the dyes found on the cotton ground. It was presumed acid dye from wool embroidery yarns migrated to the cotton. Muslin was stained with 0.2% Lanaset dye (for protein fibers) and tested with solvents in agarose gel, and by direct application to the fabric. It was hoped that agarose would be a mechanism for wet cleaning without full immersion.

Additional solvents:
4% Agarose gel and *EDTA pH 8
4% agarose gel 0.5% citric acid pH6
10% Acetic acid pH 2.5
No effect on stain

Result: A mixture of 50:50 Ethanol and DI water was the most effective. The next stage was testing the staining on the meha.

*Ethylenediaminetetraacetic acid





Testing on Meha: Agarose gel with DI water and ethanol pictured here. EDTA (pH 8) and Citric acid (pH 6) chelators were also tested and had no effect on the blue-green staining. The one percent gel deposited its solution on the textile, as the capillary action action of the textile was powerful, and the gel matrix open.

Purple-red staining in the lower right corner moved a little with water.

Puzzle: Acid dyes for protein fibers release/reverse under basic conditions, and basic dyes for cellulosic fibers release in acid conditions. Conditions, which remove dye from one element of the textile, may fix it to the other.

Research of Dye Literature: One industrial technique for the removal of fugitive dye suggests boiling the textile. TOO HARSH, however water between 65°C and 85°C was delivered using syringes to the purple-red staining. Precut blotter paper was used to absorb water and released dye.

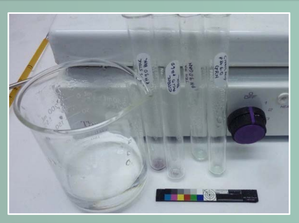
Cyclododecane was considered for use as a resist while applying water to the purple-red staining found in the corners. Ultimately, the method was rejected due to lack of time for complete sublimation from the thick textile, *and* water temperatures would exceed its melting point of 58°C to 61°C

Drying cloths were used. Soft brushes were used for tamping down the cloths to achieve optimal contact during drying, and pull additional fugitive dye away from the ground cloth.

The purple-red dye was successfully reduced, but the blue-green staining did not respond to elevated water temperatures.

Visit to the International Dry-cleaning and Laundry Institute: Brian Johnson and Susan Heald at the International Dry-cleaning and Laundry institute, where a "steam gun" and "spotting board" supplied higher temperatures and controlled drying for blue-green stain reduction. The steam did not reduce the green-blue staining as hoped to any significant degree, and the steam and suction were forceful, extended exposure might damage the handwoven textile.

Right: A drying cloth stitched into position to wick away the released dye by capillary action during drying. The frayed edge of the drying strip encourages wicking (Francis 1992). Stitching a barrier of wicking cloths where the black embroidery meets the white cotton, prevented the dye from moving into the white ground weave.

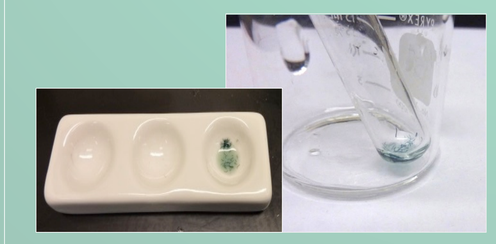


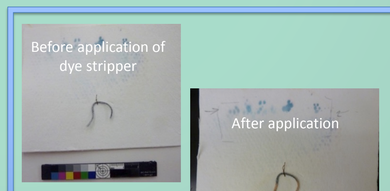
Dye Extraction: Small black and green samples of embroidery yarn (tails from the reverse) were removed. Could the dyes be made to run? The yarn samples were heated in solutions of "Tris" buffering solution (**tris(hydroxymethyl)aminomethane**), pH of 9, and citric acid solution, pH 6. The **black dye** moved into the **basic solution**, but was not the blue-green color found on the textile. The green yarn also released some dye in the basic solution, but was not a color match for the staining found on the meha.

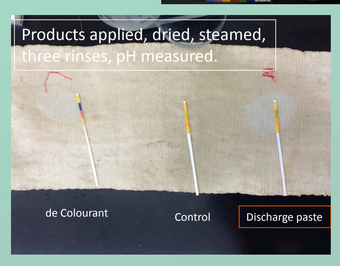
A sample of aged cotton yarn was placed in the alkaline black dye test tube to see if the cellulose would take up / be colored by the dye, it was.

Dye identification Following Dr Helmut Schweppe's preliminary test, concentrated sulfuric acid was added to black wool fibers. The solution turned bluish-green, water was added and a greenish-blue precipitate formed. Indicating the dye may be CI Acid Black 1 (Amido Black 10B). ***This early synthetic azoic dye does not have good wet fastness.***

Research of Dye Literature: E.R. Trottman in *Dyeing and Chemical Technology of Textile Fibers Sixth Edition,* offers a method of dye removal; after boiling the textile for 35 – 45 minutes in a solution that contains sodium dithionite (and other reagents), follow this by a final bath which includes sodium hypochlorite. (Not a solution for this textile.)



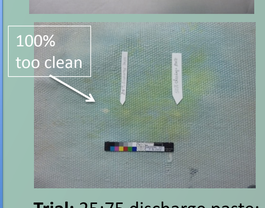




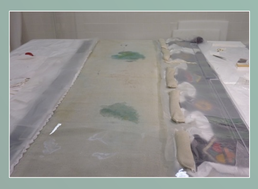
Last Resort - Dye Stripper: This is the sample of aged cotton thread dyed with the black dye extraction (above right). With permission from the Nahohai's dye strippers were purchased; "de Colourant" and "Discharge paste." There is a danger with the use of dye stripping agents that dye will change color and not be removed.

DeColourant is Sodium Hydroxymethanesulfinate (made from Sodium Dithionite and formaldehyde) a reducing agent, and sodium carbonate (also known as washing soda or soda ash, used in dyeing fiber reactive dyes on cellulosic fiber.)

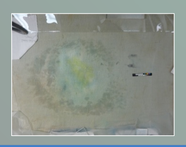
Discharge paste contains ammonia 3%, urea 5% and water 70%. Each end of the dyed yarn was painted with one of the products, and both appear to reduce the dye. However, after rinsing the discharge paste from the fabric, the pH was neutral.



Trial: 25:75 discharge paste: water, and 50:50 discharge paste: water shown on the white cotton ground above, and the blue-green staining below.



Application of the Discharge Paste: The embroidered edges were protected with high-density polyethylene. The discharge paste was applied with a sponge. The 50:50 mixture was applied in the center, and the 25:75 mixture feathered on the perimeter to blend and soften the effect.



A second application of the 25:75 was applied to the outer edge of the treated stains.

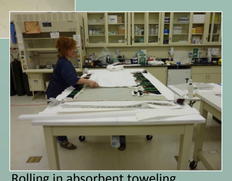
Final Rinse: The embroidered sections and tassels were elevated on ethafoam blocks, and covered with high-density polyethylene. A table covered with plastic sheeting was elevated at one end to allow water to freely run off. Warm DI water was delivered from a hose with a sprinkler attachment, the conductivity fluctuated from approx. 35 to 65 (just the nature of the mechanism). Napped paint rollers were used to move the water along the textile. This wet treatment lasted just a few minutes, enough to dissipate tidelines from discharge paste treatment. The meha was immediately rolled in towels to remove moisture.

Wicking cloths previously stitched to the perimeter of the embroidery remained in place for this wet cleaning, pulling fugitive dye and degradation products away from the ground textile during drying.

Ready for aqueous cleaning.

Drying meha on a rack with extraction nozzles and hairdryer for good measure.

Detail of wicking cloth.



Rolling in absorbent toweling.

After treatment image of the meha, the staining was reduced, and the owner was pleased with the result.

The meha was return to Milford Nahohai in April of 2015 and has gone back into ceremonial use. Here he demonstrates one of the many ways the meha is worn.

Author Biography
Cathleen Zaret was an Andrew W. Mellon Fellow in Textile Conservation at the Smithsonian National Museum of the American Indian when this project was completed. November of 2015 she launched her private practice *Zaret Textile & Costume Conservation LLC,* and since then has been conserving and mounting three-dimensional and flat textiles for museums and private clients in Washington DC, Maryland, and Virginia.

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