



Portrait of Pauline

## Preliminary results from an investigation into the color shift from purple to brown in a set of madder-dyed cylinder-printed furnishing fabrics from the Winterthur Museum

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Portrait of Quintilla

### SUMMARY:

A curious shift in color from purple to brown has been observed in some of the printed textiles within the Winterthur Museum collection. Presented here are the preliminary results of the investigation into the color shift found in a set of quilted furnishing fabrics. Originally purple in color, the fabric has undergone varying, inconsistent degrees of discoloration; while some objects remain purple, others have shifted to brown.



Interior view of the Empire Bedroom, with the furnishing fabrics in situ, from the Museum Archives, dated 1959.

Concurrent analysis was carried out by Chris Cole, Andrew W. Mellon Fellow in Conservation Education, using liquid chromatography-mass spectroscopy (LC-MS). Analysis indicated that no degradation products associated with alizarin or purpurin, the main colorants in madder, are present in the discolored areas.

Since the colorant molecules are still intact, they are not responsible for the color shift, and there is an unknown factor(s) that is causing the textiles to discolor.

### RATIONALE:

The aim of the project was to use the set of furnishing fabrics as a case study with which to investigate the color shift, a phenomenon that has been observed on other madder dyed objects within the collection as well.

Specifically, by examining the context of the furnishings within the museum, the goal was to form a greater understanding of the possible factors involved in the deterioration.

### METHODOLOGY:

Various areas were investigated, using many sources gathered from the museum's archives. Broadly, these included:

- The origin of the fabric and its history of use
- The environment within which the furnishings were displayed
- The current condition of the textile objects
- The degradation pathways associated with the major materials cotton and madder.

The objective was to gather as much information about the objects as possible, in order to formulate hypotheses regarding the discoloration.

**ACKNOWLEDGEMENTS:** The authors would like to thank Linda Eaton, Chris Cole, Joy Gardiner, Jim Schneck and Amanda Holden for their advice, guidance and assistance.

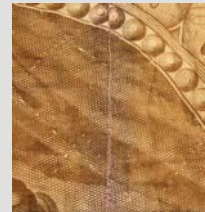
### RESULTS & OBSERVATIONS:

Some of the main points that emerged during the investigation were:

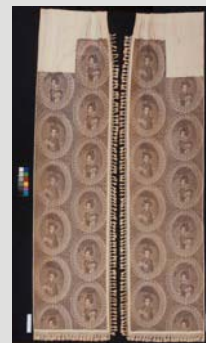
- The furnishings were constructed from fabric coming from at least two different printing runs – this is based on the presence and absence of the engraver's signature. However, no correlation was found between the color shift and the presence/absence of the signature, and not enough information is known about the original printing process to draw any conclusions about its possible links to the color shift.



- From the presence of purple darning found in discolored areas, it can be concluded that the color shift began sometime after 1953 when the furnishings were constructed.



- Observed along with the color shift was a yellowing in the cotton, especially on the backing fabric of the curtains, which would have been the most exposed to visible and ultra-violet radiation from the windows. A correlation was observed between the most yellowed areas on the reverse of the curtains and brown areas on the front – in vertical bands that correspond to the folds in opened curtains.



### CONCLUSIONS:

The most promising area for further investigation relates to the possible relationship between degrading cellulose and the color shift. This may be causing a change in pH (as the degraded cellulose ages and oxidizes, becoming acidic), which in turn may be affecting the oxidation state of the iron mordant. A change in the oxidation state could effect the conjugation of the dye molecules and may be enough to shift the color, explaining why no *degraded* colorant molecules were detected with LC-MS.

Analysis to confirm this hypothesis could be conducted using X-ray photoelectron spectroscopy (XPS).