

**The Technical Examination of an Eighteenth-Century Wallpaper  
from the Wentworth-Coolidge Mansion,  
Portsmouth, New Hampshire**

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In August of 1988, the Center for Conservation and Technical Studies in the Harvard University Art Museums was asked by Elizabeth Baybut of the Wentworth-Coolidge Commision to perform analyses on a sample of late-eighteenth-century wallpaper from the Wentworth-Coolidge Mansion in Portsmouth, New Hampshire. The purpose of the examination was to determine the origin appearance, materials, and manufacturing techniques of the wallpaper in order to reproduce it.

**Background**

In the summer of 1986, two conservators from the New England Document Conservation Center, T. K. McClintock and Mimi Batchelder, had performed a survey of the wallpaper in the Wentworth-Coolidge house. They had found the wallpaper in the bedroom to be in poor condition, having rips, tears, and insect damage, and in some places, exposing earlier wallpaper or plaster. The wallpaper was particularly brittle because the background had been overpainted some years after the paper was hung. In their survey report, the conservators recommended that a reproduction be made because the condition of the original wallpaper did not allow for restoration (Batchelder, 1986).

The Wentworth-Coolidge Mansion is located on the seacoast just south of Portsmouth, New Hampshire. The structure stands at the terminus of a neck of land overlooking Little Harbor. The rambling thirty-room house, which combines several earlier freestanding structures, reflects three periods of New England architecture between 1710 and 1750.

Governor Benning Wentworth inherited the mansion in 1741, the same year he was appointed the first Royal Governor of the Colony of New Hampshire. He moved from Portsmouth to Little Harbor in 1753 and lived there until his death, in 1770. The house is now owned by the New Hampshire Division of Parks and Recreation. The Wentworth-Coolidge Commission is responsible for refurbishing the interior of the mansion in a historically accurate manner.

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**Figure 1: Pattern of the Wallpaper in the parlor. The bedroom wallpaper is of the same pattern.**

### **Description**

The wallpaper in the parlor of the Wentworth-Coolidge mansion is a bold floral pattern of flocked brown flowers on a gray background (figure 1). The individual sheets of wallpaper, 22-1/2 inches wide by 19 inches long, are joined overlapping lengthwise. The wallpaper covers the upper half of the walls, a length of 54 inches from the chair rail to the ceiling cornice. Around the perimeter is a border with a red, blue, and yellow geometric

pattern, which is not original. In places the brown flowers have been touched up with brown paint (Batchelder, 1986).

The Governor Wentworth bedroom, on the second floor directly above the parlor, has wallpaper of the same pattern. As in the parlor, the paper is hung above the chair rail, measuring 52 inches to the ceiling. The striking difference is that the background of the wallpaper in this room has been overpainted yellow, around the flowers. The borders on the bedroom wallpaper are original, of the same flocked floral design, and also overpainted. An earlier paper with a blue, flocked diaper pattern underlies the yellow paper (Batchelder, 1986).

The pattern repeat of this wallpaper is at intervals of twelve feet. Because the wallpaper is not used on any wall greater than 54 inches, there is nowhere in the house that the complete pattern can be seen.

### Examination

Our initial examination of a sample of wallpaper from the bedroom raised many questions. What colors were the background and the floral pattern originally? What color was the flocking, and what kind of adhesive held it in place? Why had the background been overpainted? To address these questions, we looked for a remnant of the original paper that had neither faded nor been overpainted. Fortunately, our sample had a border strip pasted along one edge. When it was steamed off, a strip of wallpaper in very good condition was revealed. We discovered that the background had originally been yellow, the floral pattern an orange-pink color, and the flocking bright yellow. Because the yellow background was colored with a highly fugitive dye, it faded rapidly. The overpainting, which is a significantly duller shade than the original, was probably matched to the faded paper.

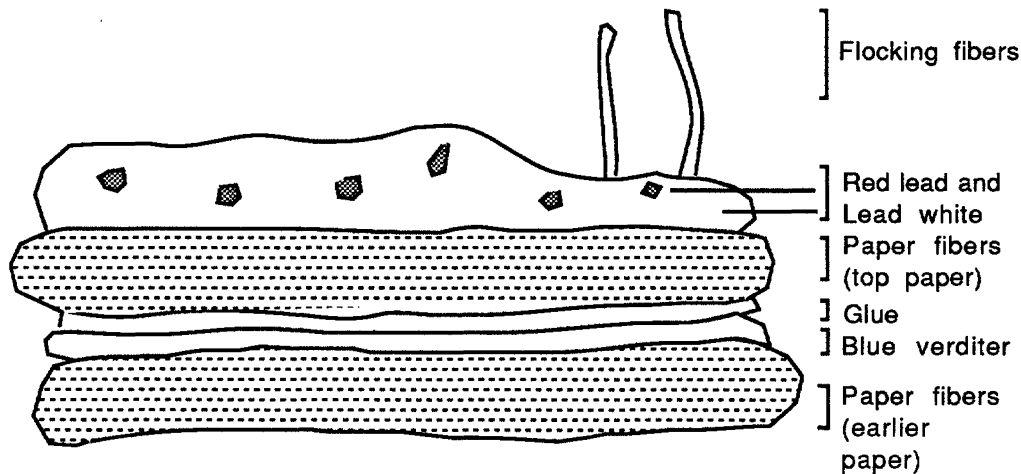


Figure 2: Wallpaper cross-section

The next step in our examination was to prepare a cross-section (figure 2),

which confirmed the disposition of the colors and added information about the wallpaper's construction. The bottom layer of the cross-section is paper fibers from the earlier wallpaper. The next layer is the blue pigment of the earlier paper and a white stripe of the glue joining the two papers. Next are fibers from the upper layer of wallpaper, then the pink ground, and on the top a few flocking fibers.

We then attempted to identify the materials that compose the layers. As a guide we used Robert Dossie's Handmaid to the Arts, published in London in 1796. An appendix entitled "Of the Manufacture of Paper Hanging" discusses the pigments and media used in eighteenth-century wallpaper. According to Dossie, the most commonly used pigments for orange included vermilion, or red lead mixed with Dutch pink; for yellow, yellow berry wash, Dutch pink, or yellow ochre. About the berry wash he says, "this wash is extremely useful and cheap, and is indeed almost the only yellow used either for grounds or paintings." The vehicles for the colors were based on either water or varnish. The water-based medium was a mixture of size and gum arabic or gum senegal, and the varnish was made of oil of turpentine and the resins and gums that would dissolve in it. The water-based vehicle was more commonly used because it was satisfactory and cheap; however, a varnish ground was frequently used when flocking was to be applied, due to its greater durability.

## Materials

The paper is laid linen. We identified the flax fibers using a polarizing light microscope, which revealed the characteristic V-shaped marks at the transverse nodes of the fiber. Using X-ray fluorescence spectroscopy in the scanning electron microscope, we identified a filler in the paper of gypsum and quartz. The pink ground is a mixture of red lead and white lead, approximately 15% red. The red lead was identified by its blue-green interference colors when seen in polarized light. The scanning electron microscope confirmed the presence of lead.

The vehicle for the lead pigments is linseed oil with a trace of resin. Gas chromatography showed the oil to have a ratio of 1.8 for its palmitic and stearic acid components, which indicates a drying oil, most likely linseed oil. We also found possible traces of resin, but they are too small to permit any certain identification.

The yellow background of the paper appears to be yellow berry wash, also called Persian berries or French berries, made of unripe buckthorn berries with a mordant of alum and tin. Tests confirmed that the yellow dye is a mordanted natural dye, a hydroxyflavone, and the presence of alum and tin is consistent with Dossie's description of the manufacture of yellow berry wash. He says, "The yellow berry wash may be prepared by boiling a pound of French berries with half an ounce of alum in a gallon of water for an hour in a pewter vessel." The trace of tin may have come from the pewter

vessel or have been added as a brightener. To confirm the identity of the yellow dye we will perform thin-layer chromatography.

The flocking is wool, recognized by its scaly fibers. The fibers are about two millimeters long and forty microns wide. They were analyzed by polarizing light microscopy as well as scanning electron microscopy.

The wool was stuck to the ground with copious amounts of adhesive, which was identified as an animal glue using Fourier-transform infrared spectroscopy. The presence of gums in the adhesive was ruled out using gas chromatography.

Although it was not an original pigment, we analyzed the yellow overpaint and identified it as yellow ochre in an oil medium. The ochre is composed of quartz, iron oxide, and calcite, with traces of titanium associated with the iron oxide. The presence of titanium, along with the coarse grain size of the pigment, suggests a natural source for the ochre. We also examined the blue pigment from the earlier wallpaper, and found it to be blue verditer. With the SEM we identified the elements copper, calcium, and lead. This identification was confirmed by X-ray diffraction.

### **Age of the wallpaper**

There is no exact date for the wallpaper. According to Nancy Muller of the New Hampshire Division of Historic Resources, there is architectural evidence to indicate that the wallpaper in the parlor was put up between 1753 and 1770, while Governor Benning Wentworth resided at the mansion. Wentworth undertook major renovations of the house, including alterations to the parlor woodwork. There is evidence that the wallpaper was added at the same time as the woodwork alterations. Yellow damask paper seems to have been quite the rage at that time. Yellow damask wallpaper was added in 1763 to the Moffatt-Ladd house, another historic house of Portsmouth, and in 1769 John Wentworth, a relative of Benning, ordered damask wallpaper for his estate in Wolfeboro.

The technical examination does not help to narrow the date of the paper's manufacture. Wallpaper materials and production techniques changed very little from the middle of the eighteenth century until the 1830s. Before 1835, wallpaper was made by painting, stenciling, or block printing on joined sheets of handmade paper. In 1835, the use of continuous rolls of paper and printing machines was introduced, followed by the invention of synthetic pigments. Therefore the materials and manufacture of the Wentworth wallpaper can be dated only to before 1835 (Lynn, 1980).

In the collection of the Victoria and Albert Museum, there is a fragment of a yellow flocked wallpaper with a pomegranate and pineapple pattern. The paper is from the Eagle House in Bathford, Somerset and, a Georgian excise duty stamp on the back dates it to around 1750 to 1780. The

similarity with the Wentworth-Coolidge paper suggests a common date of manufacture. It is probable that the Wentworth paper was imported from England, because flocked wallpaper imitating damask-woven textiles was an English specialty of the period. Discovery of an excise stamp on the Wentworth paper would confirm its English origin. Therefore, taking into consideration the historic, material and stylistic evidence, we conclude that the wallpaper was manufactured between 1750 and 1770, and is most likely English.

### **Reproduction**

In order to get a sense of how the wallpaper originally appeared, we reproduced one design element using the same pigments as the original. We started with an antique laid linen paper, washed with two coats of Persian berry lake pigment in a gum size. Over the wash we printed the leaf with pink color, made of 15 percent coarse red lead in white lead, with an acrylic medium. A block print of the leaf is shown on the left. Then flocking was applied onto a layer of PVA adhesive using a flour sifter. The final product is shown on the right. Modern media were used because they are easier to work with and would not substantially affect the appearance of the pigments. Because the Persian berry pigment we used was fifty years old, the background is probably not so bright as the original. Even so, the play of the pink ground and the yellow flocking gives the design depth and brilliance. With the information gained through these analyses, the Wentworth-Coolidge Commission should be able to restore the bedroom to its original splendor.

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