

Cross-section Paint Microscopy Report

Exterior Paints and Washes -- Phase II

**The Montpelier Foundation
Montpelier Station, Virginia**

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Purpose:

The goal of this project is to use cross-section and polarized light microscopy analysis techniques to compare the paint evidence in 23 additional samples from representative, intact areas of the exterior of Montpelier and from a small group of architectural fragments to the results of the earlier exterior analysis work. Four samples were also taken from selected areas of brickwork at Pavilions I and VIII at the University of Virginia to compare the reddish coatings there to the brick wash evidence found at Montpelier.

This report is an addendum to the December 14, 2004 report entitled "Montpelier Exterior Paint Microscopy Analysis" and it is intended to help answer questions about the timing of specific exterior woodwork paint layers and the composition of the reddish exterior brick wash raised at the Montpelier Advisory Board Meeting on January 11, 2005. All sample locations were chosen in consultation with architectural historian Mark R. Wenger.

Procedures:

Eighteen samples were taken from selected areas of the Montpelier exterior and from exterior architectural fragments by Susan Buck on February 1, 2005. On that same day one area of darkened, slightly shiny brick on the UVA Pavilion I was sampled to

determine if there is evidence of it having been “oiled” as some point.¹ Three areas of red coatings on the bricks at Pavilion VIII noted earlier by historic brickwork consultant Dr. Gerard Lynch were also sampled for analysis. Mark R. Wenger later provided additional Montpelier cellar window fragments and decking floor elements for sampling to determine their comparative dates and paint histories. All sample location descriptions are included at the end of this report.

After removal all samples were placed in labeled polyester bags for transport to the lab. Before casting, the samples were examined at 30X magnification and portions of each sample were cast into polyester resin cubes for permanent mounting. The cubes were ground and polished for cross-section microscopy analysis and photography. The sample preparation methods and analytical procedures are described in the reference section of this report.

The cast samples were photographed with Kodak Portra 160vc print film. Photographs of the best representative cross-sections are included in this report. Please note that the colors in the photographs may not accurately reflect the actual color of the samples because of the inherent variability of color film and commercial processing.

Background Information:

One major area of discussion during the Montpelier Advisory Committee meeting on January 11, 2005 was the nature of the reddish coatings found on the Periods I, II and III brickwork elements. Dr. Gerard Lynch, a historic brick expert from the UK, presented a synopsis of his research and practical experience with traditional “colour washes” in England. He contended that the red wash on the brickwork at Montpelier is most likely composed of a slurry of iron oxide red pigments in water with perhaps alum and another organic component such as beer.² He doubted that bricklayers from England arrived here in the eighteenth and nineteenth centuries and abandoned this color wash technique for limewash (although documentary research suggests that craft practices were different in Colonial America).³ Dr. Lynch identified several areas at UVA Pavilion VIII that he believes represent this color wash technique, as well as other areas that he felt were later pigmented limewashes. These areas were later sampled with Mark R. Wenger advising on the areas identified by Dr. Lynch as color washes versus limewashes.

During the Advisory Committee meeting Jimmy Price of Virginia Lime Works presented one mock-up of a “colour wash” and four mock-ups of pigmented limewashes with

¹ Travis C. McDonald provided a reference from the construction records for Benjamin Borden being paid for “oiling and penciling down” some of the brickwork on the University of Virginia Rotunda. Email correspondence, January 24, 2005.

² See the Montpelier Restoration Advisory Committee Minutes for January 11, 2005.

³ In the Chesapeake region eighteenth-century newspaper advertisements suggest that there was considerable overlap in craft practices as there was a paucity of skilled masons, plasterers and painters. This resulted in less specialization within professions so plasterers might be employed to do carpentry work, plastering, and painting, for example. See Susan L. Buck and Willie Graham. “Architectural Finishes in the Early Chesapeake”, *The Chesapeake House*. Carl R. Lounsbury, ed., unpublished manuscript.

different proportions of red ochre to lime that he had mixed in consultation with Dr. Lynch. The purpose of these mock-ups was to demonstrate that a stable pigmented limewash (at or below a ratio of 10% pigments to lime, according to Price) could not produce a deep red color because the proportion of colorants to lime was too high for a stable limewash. The lime-based mock-ups were at 3%, 6%, 10%, and 36%. The 36% pigment to lime ratio was the proportion Price used to replicate what he felt was the approximate depth of color of the Montpelier brick wash.

I later took these mock-ups and left them outside to monitor the resistance of the various mock-up coatings to weathering (snow, rain, ice, and freeze-thaw cycles). The results after approximately 16 weeks of weathering show that there is little appreciable change in the surface and color of any of the mock-up washes, despite the difference in pigment to lime ratio. The photographs below look slightly different because they were taken under different illumination conditions.



Freshly painted mock-ups February 2005



Mock-ups on June 16, 2005

Dr. Lynch's conviction that the reddish coatings at Montpelier are "colour washes" are not borne out by the physical evidence. Most specifically, the even distribution of iron and calcium carbonate in the cross-section samples from the west elevation strongly suggests the intentional use of a pigmented limewash, not contamination from lime residues on the brick. Key cross-section samples were analyzed with SEM-EDS by Catherine Matsen at the Winterthur Scientific Research and Analytical Laboratory

(SRAL) to clarify their elemental composition.⁴ Fluorochrome binding media analysis did suggest the presence of organic additives, based on positive reactions for the presence of proteins and carbohydrates. But my conclusion, based on the combination of analysis results, was that the reddish washes are limewashes with organic additives, not the “colour washes” described by Dr. Lynch.

Dr. Lynch’s definition of colour washes as pigments in water with organic additives and/or alum is not consistent in other current research on pigmented brickwork coatings. Most notably, Danish architect and paint researcher Bente Lange describes colour washes as “lime water to which red pigment was added, presumably red ochre or pulverized brick.”⁵ Her description of colour washes in Copenhagen provides a different perspective on the tradition of coloring brick buildings:

The most unusual surface treatment in the Renaissance and well up into the 1700’s was the application of a red colour wash, presumably to hide uneven masonry. Brick varied in colour from yellow to red to almost black, depending on type of clay and firing. The red wash also covered over mortar residue as the hydrochloric acid for removing it was not known at that time. Masonry was often pointed with whiting, but since pointing did not always follow the actual spaces between bricks, that masonry often looked more regular than it really was. In other words, surface treatment adjusted the imperfections of the building materials. The fashion of painting even new masonry presumably originated from German and Dutch master builders, and was imitated by Danish craftsmen returning home after working abroad.

The technique was to give the newly erected masonry a layer of red colour wash, that is, lime water to which red pigment was added, presumably red ochre or pulverized brick. Fresh animal blood was also most probably added to the lime water to improve durability. A colour analysis of a building from 1601 in Nyborg shows that the pointing was smoothed out flush with the masonry, and given a beaded joint. Then, while the mortar was still fresh, the masonry was given a coat of red wash. This meant that the pointing was washed in a highly durable fresco technique, which at the time of the analysis was still preserved under the whiting of the points. This surface treatment was repeated at 50-year intervals, approximately, until the year 1750, at which time the building was given a blue-grey wash, perhaps in imitation of the grey sandstone facades of Rococo mansions.⁶

In her book *The Colours of Copenhagen* Lange later defines a colour wash as a pigmented limewash:

⁴ See Catherine Matsen’s analysis report dated January 21, 2005. The preliminary results of this report were presented during the January 2005 Advisory Committee meeting.

⁵ Bente Lange. *The Colours of Copenhagen*. Denmark: The Royal Danish Academy of Fine Arts School of Architecture Publishers, 1997. 16.

⁶ *Ibid.*

Colour wash is made by adding limeproof pigment to whitewash, which can bind a maximum of one part softened pigment to nine parts milk of lime.⁷ Dark colours are achieved by brushing on several layers of colour wash, or by adding casein. All earth colours are limeproof, and it is also these yellow or red colours that have traditionally been used for facades.

The “temperature” of colour wash is controlled by the amount of lime water added; this can have great significance for pink or grey colour wash in particular.⁸

Lange describes “lime water” as clear as water and it is produced using the following method:

Precipitated lime water is made from wet lime that has been aged in lime pits for a long period of time. One part aged lime is stirred into 5-6 parts of ordinary tap water, which is then left for one or two days until the lime precipitates. The film that has formed on the surface of the container should be skimmed off and the clear water drained off. The process should be repeated five or six times with the same lime, which is then discarded.⁹

The four samples from UVA Pavilions I and VIII were taken to help clarify Dr. Lynch’s observations about colour washes versus limewashes.¹⁰ The rest of the samples were taken from exterior woodwork in situ and in fragment form at Montpelier.

⁷ Limeproof pigments are primarily iron-oxide and carbon-based pigments that are not affected by the caustic nature of the lime. A pigment such as Prussian blue cannot be used in limewashes as it turns brown on exposure to high pH environments.

⁸ Ibid., 177.

⁹ Ibid., 198.

¹⁰ In the future, it is hoped that samples taken by Dr. Lynch from buildings in the UK that he has identified as coated with a “colour wash” can be compared to the Montpelier and UVA brick wash samples.