Cross-section Paint Microscopy Report

Interior Paints
Historic Sandusky, Lynchburg, Virginia

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Historic Sandusky Parlor early to mid 20th-century

HistoricSanduskyFoundation.org

Purpose:

The goal of this project is to use cross-section and polarized light microscopy analysis techniques to identify the coatings remaining on selected areas of the woodwork and walls in the Parlor and Entry of ca. 1810-12 Historic Sandusky. If the original paints, and/or the paints related to the Greek Revival era (1849) renovation, can be identified they will be color-matched for interpretation and possible replication with a tristimulus colorimeter/microscope.

Procedures:

Travis McDonald visited the site three times (November 13, 2012, January 5 and February 27, 2013) to remove paint samples from relevant areas of woodwork and wall plaster. The samples were submitted for analysis in labeled baggies, along with floor plans showing the sample locations. After completion of the revised draft dated March 25, 2013 there were still areas of missing and/or unresolved paint evidence, so after discussions with Gregory Starbuck and Travis McDonald it was agreed that Susan Buck would visit the site on April 26, 2013 to examine the evidence remaining *in situ*, and take any additional samples needed to decipher the different periods of decoration in the parlor and the entry hall.

Before each round of sample casting, the baggies of samples were examined at 45X magnification under a binocular microscope to screen them for duplicates and to reduce the total number of samples analyzed to meet the budget constraints. The samples that retained the most complete stratigraphies 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 analyzed with a Nikon Eclipse 80i epi-fluorescence microscope equipped with an EXFO X-Cite 120 Fluorescence Illumination System fiberoptic halogen light source and a polarizing light base using SPOT Advanced software (v. 4.6) for digital image capture and Adobe Photoshop CS for digital image management. Digital images of the best representative cross-sections are included in this report. Please note that the colors in the digital images are affected by the variability of color printing and do not accurately represent the actual colors.

Brief History:

Some of the changes in the paint sequences found in the cross-section samples may be related to changes in the interior of the 1810-12 house made by the Hutter family, who purchased the house in 1841 and upgraded the exterior in 1849. Travis McDonald provided some helpful background on the timing for ownership of, and alterations to, the house based on the HSR research:

> I think the question will be whether there is an identifiable paint color change in the Greek Revival era to which the room might be restored. I don't know what Greg told you regarding the history. Here's what I see in the HSR that might provide clues as to when trim is painted:
>
> The original owner/builder, Charles Johnston, finished the house ca. 1810-12. That would be the first paint.
>
> The Otey family next lived in the house in 1826 with a son inheriting it in 1831 and living there until 1841.

> The Hutter family got it in 1841 (George C. married to Harriet). There is a reference to architectural work, upgrading to a Greek Revival style, on the exterior in 1849. This might also be when the interior was changed.
>
> Son Risque Hutter moved in with his wife Charlotte (daughter of Poplar Forest Hutters) in 1877; George dies in 1879; Harriet dies in 1898; Charlotte died in 1930; son Ferdinand there from 1930-1950 (mention of wallpaper put up in house in 1932; perhaps some painting at that time too); Ferdinand's wife Janie sold the house in 1952.
>
> Neville and Louise Adkinson live in the house from 1952 to 2000. They do a lot to the house, taking out the Greek Revival mantels and replacing them with Federal style mantels from somewhere else, and adding the dentil cornice. They also added a new dropped plaster ceiling in room 101 and replastered a good deal of the walls in that room. The new plaster looks like it only has one cream-colored paint on it.[1]

Paint Analysis Results:

When the first group of samples was submitted for analysis, the parlor woodwork samples were deemed the priorities, but it was also thought that the parlor (room 101) and the adjacent entry space, or passage, (room 100) woodwork might have similar early finishes. So, seven samples from representative areas of woodwork in the parlor were selected for cross-section microscopy analysis, and three woodwork samples were chosen from the entry for comparison.

After the first round of analysis, one additional sample from a baseboard and one from a surbase in room 100 were added to the group of cross-sections to fill in missing information. Two samples of wall plaster from the parlor and one sample of entry plaster were also initially cast in cross-section to search for the earliest decorative finishes. After submission of the first draft of the report, Travis McDonald revisited the site to take two more plaster samples from both rooms, and two more trim samples from room 101, to hopefully find better comparative evidence. Despite the additional samples, there were still unresolved questions about certain periods of woodwork paints.

These questions were clarified and resolved by the April 2013 work on site conducted by Susan Buck, in consultation with Travis McDonald, which revealed that the paint scheme in the parlor, in particular, was much more complex and colorful than indicated by the early phases of analysis. It also revealed that after the original gray and blue paints in the parlor, all the doors in the parlor and entry had been grain-painted on the interior and exterior surfaces, at least twice. This graining evidence will be discussed further in the following section on the woodwork paint evidence.

[1] Travis McDonald, email communication, January 23, 2013.

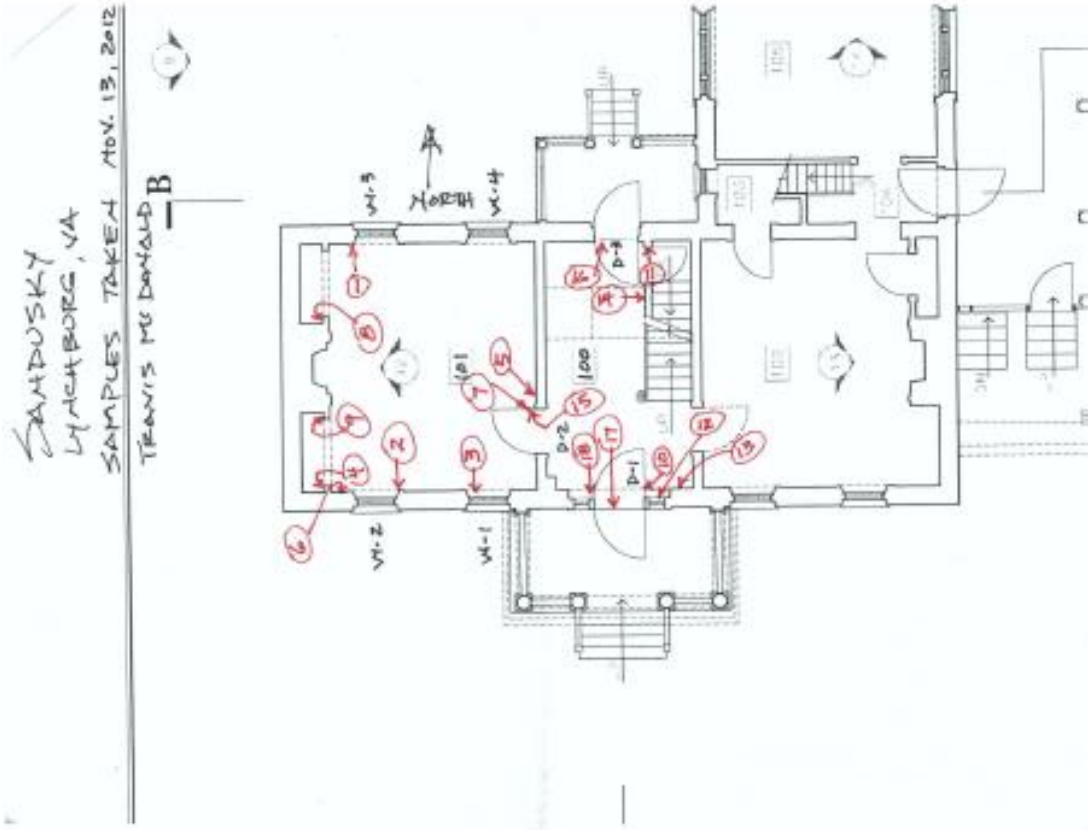
The results of the analysis of the parlor and entry woodwork samples are presented first, followed by the results of analysis of the parlor and entry plaster samples.

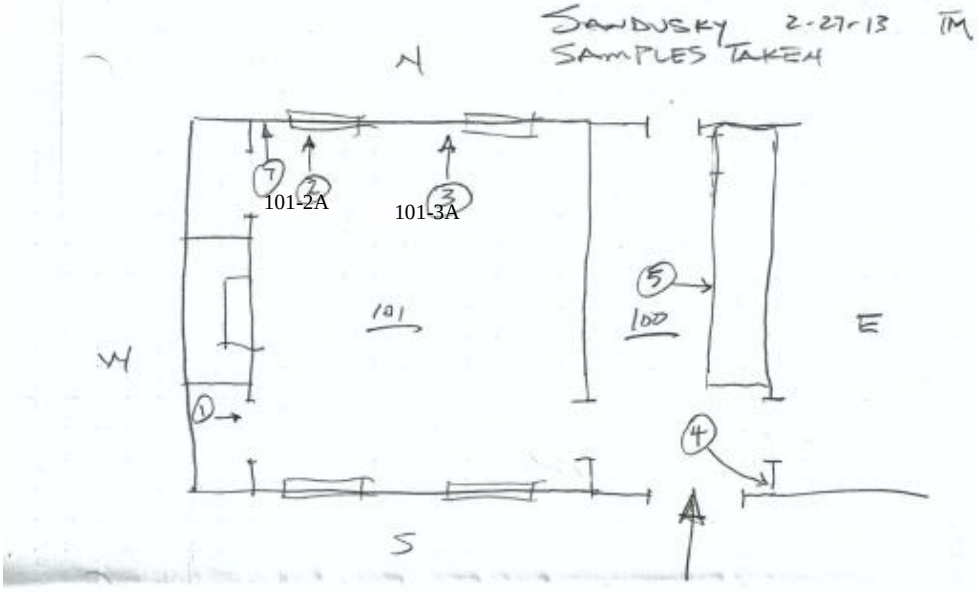
Parlor (101) and Entry (100) Woodwork Paint Findings

Comparative cross-section analysis shows that the earliest coatings on the woodwork are quite disturbed, and there is clear evidence that some of the original paint on the woodwork was stripped or cleaned away. The earliest gray and blue paints remain trapped in the wood substrate of the cross-sections from the original door and trim elements (101-2, 101-3, 101-6, 101-7, and 100-12). In sample 100-12 from the tripartite door trim and 101-3A from below the surbase, this first gray paint has an eroded, dirty surface, confirming it was a final coating, not a primer.

The original gray paint on the door (101-7) and one baseboard (101-3) were found to be the same gray paint observed on the trim elements. The first layer in sample 101-5, from an applied molding on the wainscoting, is a coarsely ground light blue paint, not gray. The work on-site revealed that the original palette in the parlor actually consists of gray and blue to pick out alternating moldings. The gray/blue palette is followed a dull pink paint identified as the second generation on the woodwork in the parlor. This dull pink paint coincides with the use of dull green to pick out specific moldings. There is also a recognizable grain-painting sequence on the door (100-10) and surbase (101-3A) in the second generation, which may have been a faux finish to replicate mahogany. The sample locations are shown in the sketches provided by Travis McDonald.

Parlor and Entry Woodwork Sample Locations





Three Phases of Room 101 Parlor Wooden Trim Samples Analyzed

101-2. West window trim, south wall (similar to 1).
101-3. South wall base molding below east window (compare to 4).
101-4. West wall baseboard in alcove to see if alcove pilaster is first period.
101-5. East wall, small applied molding on wainscot.
101-6. South wall, flat field of wainscot, southwest corner.
101-7. East wall, one sample from unpainted top of door, other samples from painted face of door.
101-9. Pilaster of south alcove (similar to 101-8).

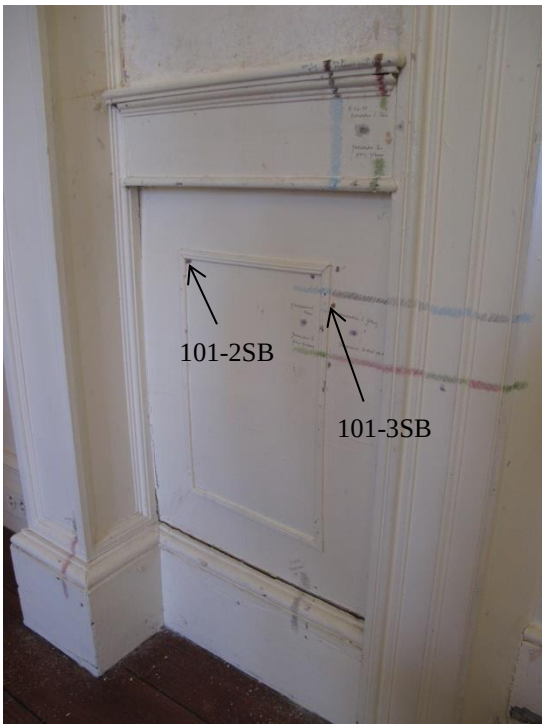
101-2A. North wall window sill (compare to trim of 101).
101-3A. North wall just below cap of surbase, to left of east window (compare to trim of 101).

101-1SB. Door on east wall, upper left corner, middle left panel.
101-2SB. Wainscot, northwest corner, inner panel, upper left corner.
101-3SB. Wainscot, northwest corner, outer panel, right of applied molding.
101-4SB. North wall east window, upper sash, upper right corner, upper panel (not much paint).

Locations of Samples Removed From Room 101 on April 26, 2013

East Wall Door

Northwest Corner Wainscot



North Wall Window

Comparative analysis suggests that the doors (samples 101-7 and 100-10) were initially painted the same gray as the wainscoting and trim, then they were grain-painted in the second generation (samples 101-1SB and 100-10). This may have been mahogany graining as the base coat is a pink color that was typical of traditional graining craft practice to replicate mahogany, with the base color as the lightest color of the figure of the wood being imitated.

Cross-section analysis also suggests that the elements related to the alcoves (101-4 and 101-9) were installed later as the paint sequences on these elements do not start until a cream-colored primer and a dull pink paint found as generation 2. This dull pink corresponds to a two-tone dull pink and dull green paint scheme that may relate to 1826-41. The third generation consists of a monochromatic cream-colored paint scheme on the woodwork and possibly oak graining on the doors and may date to changes made by the Hutters in about 1849. A chart showing the key comparative layers follows, and then the paints found in each woodwork sample are described and illustrated. Some of the layers are dated based on the assumption that changes in ownership in the nineteenth century inspired repainting campaigns.

Room 101 Comparative Woodwork Paint Histories on Selected Elements

Generation/ Coating	101-2 window trim	101-3 base molding	101-4 alcove baseboard	101-5 applied wainscot molding	101-6 panel of wains cot	101-7 & 101-1SB door	101-9 alcove pilaster	101-2A window sill	101-3A surbase
9 -11. Most recent coatings	x	x	x	x	x	x	x	x	x
8. Off-white	Varnish	Varnish	x	x	x	x	x	x	x
7. Gray/White	Varnish	Pigmented varnish	x	x	x	x	x	x	x
6. White	x	Brown	x	Missing	x	x	x	x	x
5. White with zinc white (post-1845 pigment)	Resinous brown	Black	Light green	x	x	x	Light green	x	x
4. Off-white Possibly 1877	x	Off-white	x	x	x	x	x	x	x
3. Cream color Possibly ca. 1849	x	x	x	x	x	Possible oak graining on yellow base coat	x	x	x
2. Dark dull pink/green paint scheme Possibly 1826-41	Pink/ green	Pink	Pink	Pink	Pink/ green	Mahogany graining on pink base coat	Pink	Pink	Mahogany graining on pink base coat
1. Blue/Gray paint scheme 1810-12	Blue/gray	Gray	Missing	Blue	Blue/ gray	x	Missing	x	x
1. Shellac sealant in wood	x	x	Missing	x	x	x	Missing	x	x

Original woodwork paint colors 1810-12

Possible Greek Revival paint colors ca. 1849

When the most intact cross-sections of woodwork paint in both rooms are aligned, it is possible to see quite clearly where the first gray paint remains trapped in the wood, and on the surface of the wood. It is also possible to see the color variations in generations 2 through 11.

The most remarkable discovery took place during the April site visit, where it was the cross-section evidence was compared to small openings made with a scalpel. When these "paint windows" were examined at 10X and 30X, it was possible to see that although the woodwork had initially been interpreted as painted uniformly gray with darker gray baseboards, in fact, the original paint scheme consisted of alternating bands of gray and blue on the architraves, wainscoting and door. It appears the window sash was originally

solid gray (101-4SB). The color patterns were marked on the woodwork with colored pencils to help decipher the pattern of gray and blue color application.

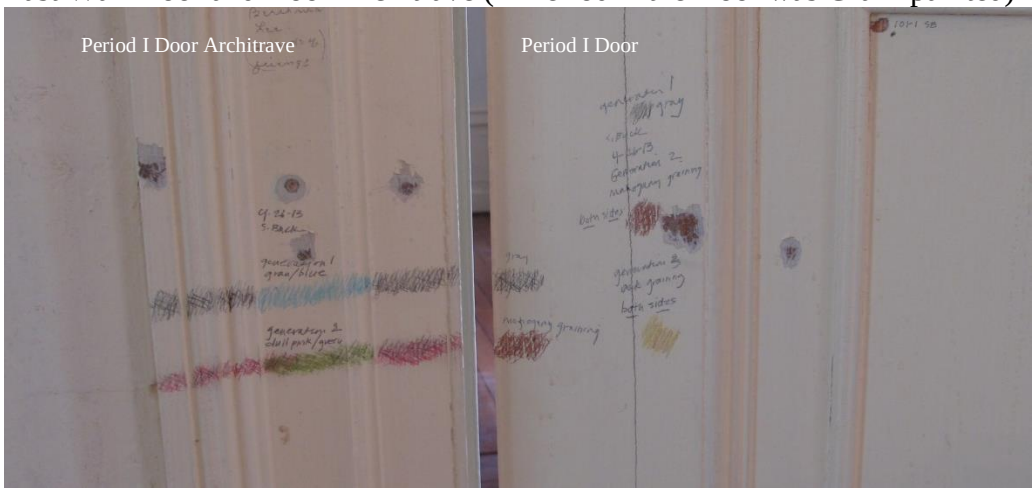
Moreover, in the second generation it was discovered that the palette consisted of alternating bands of dull pink and dull green on the wainscoting, architraves and alcove woodwork. The wainscot cap and surbase, and all the doors were grain-painted to resemble mahogany in this period. The alcove woodwork paints begin with the dull pink/dull green paint scheme, which indicates that the alcoves were installed in the room between 1826-41. In the third generation, possibly 1849, the parlor woodwork was uniformly cream-colored, possibly with oak-graining on the doors. Photographs of the color call-outs for the first and second-generation paint treatments are shown below, followed by the descriptions and illustrations of the comparative cross-sections.

Period I (Blue/Gray) and Period II (Dull Pink/Dull Green) Color Palettes For Room 101 Alcove Woodwork and Window Architraves Based on On-site Investigations

Period I (Blue/Gray) and Period II (Dull Pink/Dull Green) Color Palettes For Room 101 Alcove Pilaster, Baseboards and Wainscoting Based on On-site Investigations

Period I (Blue/Gray) and Period II (Dull Pink/Dull Green) Color Palettes for Room 101 Wainscoting and Window Architrave Based on On-site Investigations

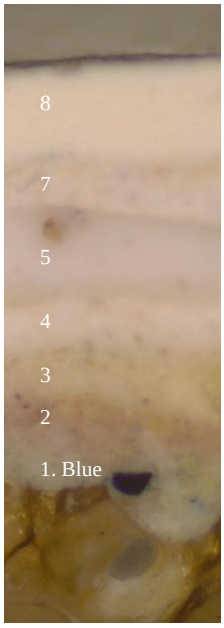
Period I (Blue/Gray) and Period II (Dull Pink/Dull Green) Color Palettes for Room 101 East Wall Door and Door Architrave (in Period II the Door was Grain-painted)



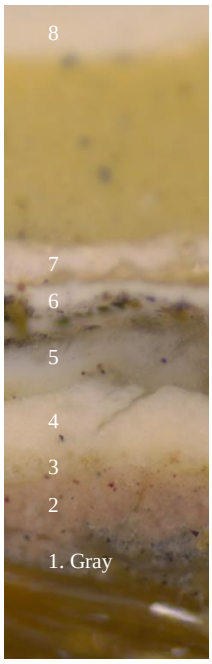
Selected Comparative Trim Paint Cross-sections

101-4. Alcove baseboard

101-5 Wainscot applied molding

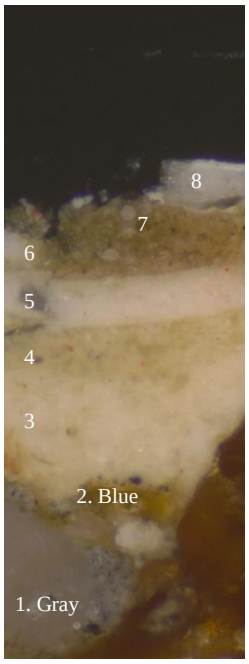


101-6 Wainscot Panel

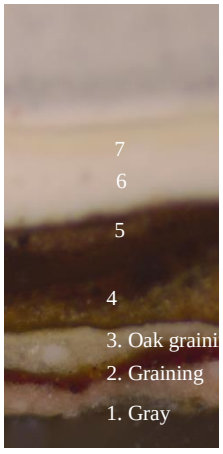


101-9. Alcove pilaster

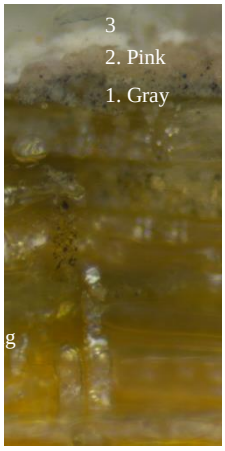
100-12 Entry tripartite doorway



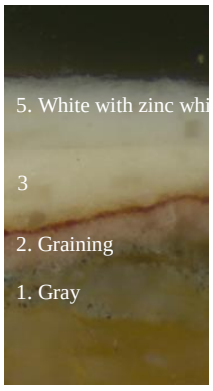
100-10. Door



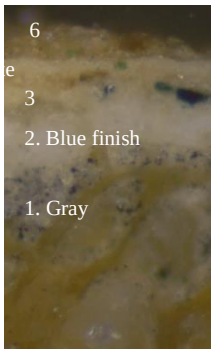
101-2A. Sill



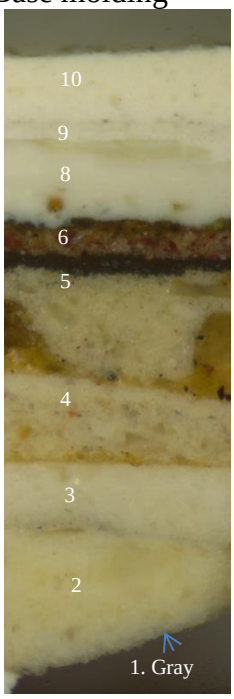
101-3A. Surbase



100-12. Doorway



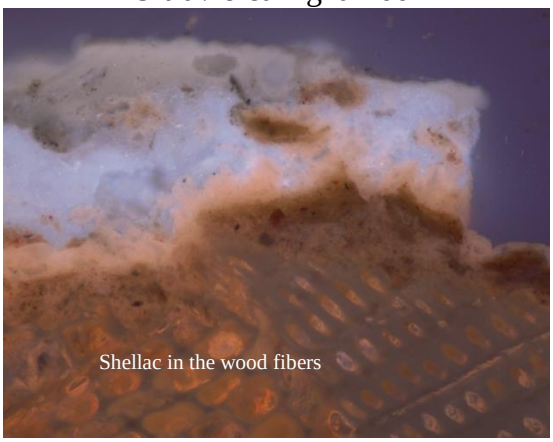
100-14. Base molding



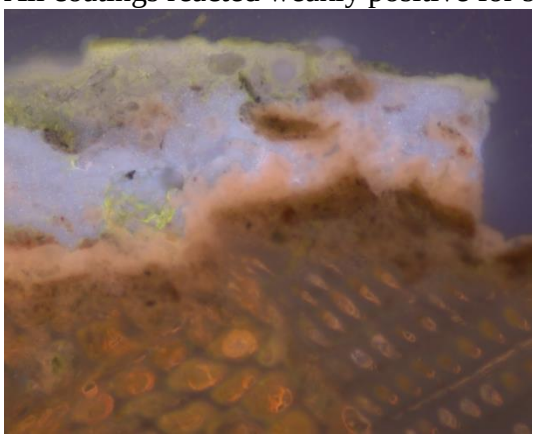
Sample 101-2. West window trim, south wall (similar to 1). The layers on the window trim are quite disrupted and uneven, but the original gray paint remains trapped in the wood, above a shellac sealant (identified based on its orange autofluorescence under reflected ultraviolet light). The first gray paint is so eroded that in some areas the wood fibers are exposed. In an uncast portion of this sample it is also possible to see the dark pink paint found as generation 2. The cream-colored and off-white paints found as generations 3 and 4 in this room are missing. The glossy brown paint in generation 5 was not found elsewhere in the room, and it is followed by an off-white paint and several weathered varnishes. When the window trim was examined on site it was possible to see that the window architraves were repainted in the same manner as the door architrave and wainscoting.

Sample 101-2. West window trim, south wall (similar to 1).
Visible Light 200X

Ultraviolet Light 200X



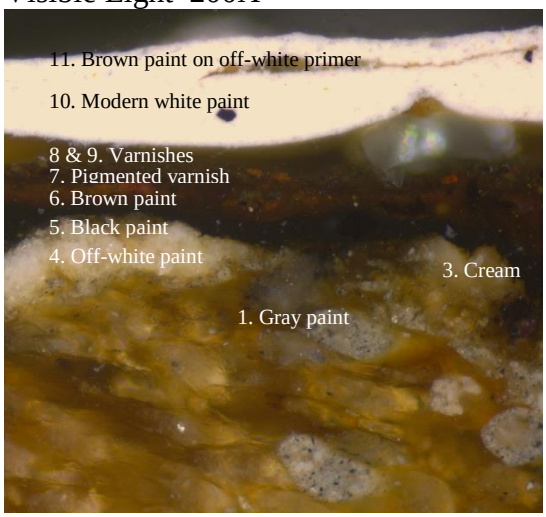
UV Light & DCF for saturated and unsaturated lipids 200X
All coatings reacted weakly positive for saturated (cross-linked) oils



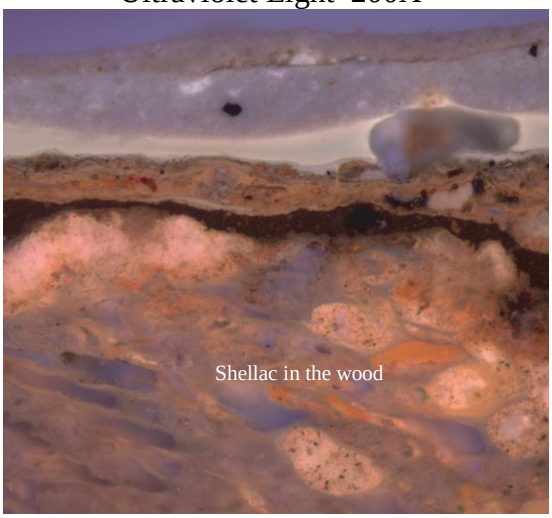
Sample 101-3. South wall base molding below east window (compare to 4). The paint stratigraphy in this cross-section begins with the same eroded gray paint found on the doors (101-7 and 100-10), followed by remnant of cream-colored paint, an off-white paint, and then a thin black paint. Black paint appears in generation 5 in sample 100-14 from the base molding below the stair, so the baseboards in both rooms were most likely painted black at the same time. It also shows that generation 2 is missing in this cross-section, possibly because of abrasion, because examinations of the baseboard plinth in other locations in the room show that it was repainted each time the room was repainted. The baseboard appears to generally have been the same as the woodwork color until generation 5 when it started to be picked out in dark colors.

Sample 101-3. South wall base molding below east window (compare to 101-4).

Visible Light 200X

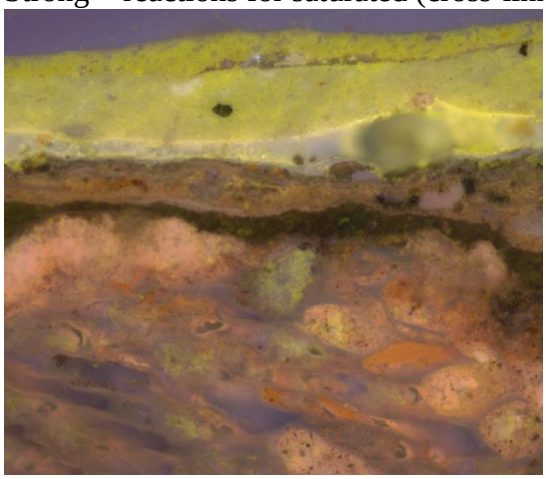


Ultraviolet Light 200X



UV & DCF for saturated and unsaturated lipids 200X

Strong + reactions for saturated (cross-linked) oils in all layers

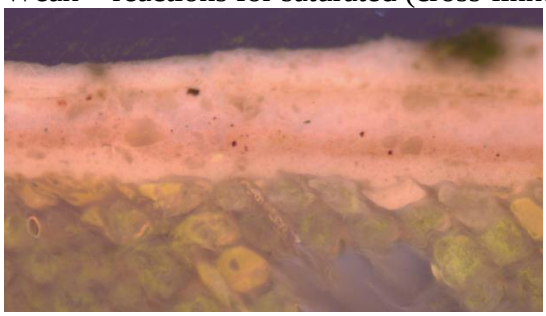


Sample 101-4. West wall baseboard in alcove to see if alcove pilaster is first period.
Sample 101-9. Pilaster of south alcove (similar to 101-8).
The early paints on the west wall baseboard in the alcove exactly match the early paints on an alcove pilaster 101-9, indicating these elements were installed at the same time. The comparative cross-sections and the investigations on site indicate that when the alcove woodwork was installed in the room it was first sealed with shellac, which was followed by a cream-colored primer with the dull pink and dull green finish coats. This is the palette found as the second generation on the original woodwork. The cluster of green particles in the fourth generation cream color appears to be mold spores, not deliberate colorants.

Sample 101-4. West wall baseboard in alcove to see if alcove pilaster is first period.
Visible Light 200X

Ultraviolet Light 200X

UV Light & DCF for saturated and unsaturated lipids 200X
Weak + reactions for saturated (cross-linked) oils in all layers

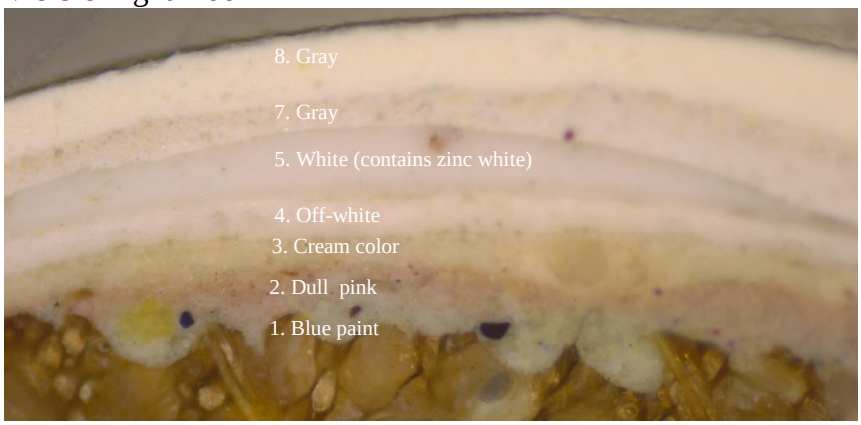


Sample 101-9. Pilaster of south alcove (similar to 101-8).
Visible Light 200X

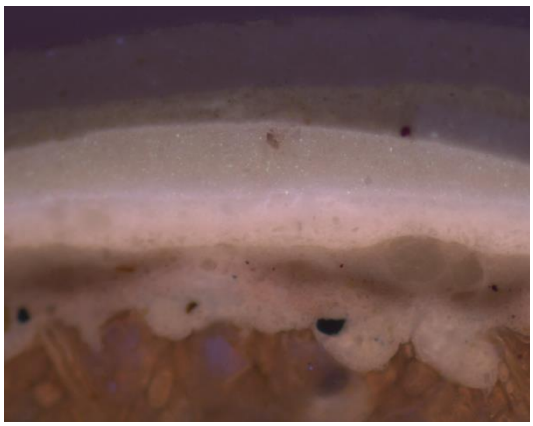
Ultraviolet Light 200X

Sample 101-5. East wall, small applied molding on wainscot. The paint stratigraphy on the applied molding begins with a light blue paint that can be aligned with the first gray paint found on other areas of doors and trim in this room, and in the entry. This is part of the two-tone blue/gray paint scheme identified in this room. The second generation is the same dull pink paint found on the other trim elements, so it appears that this small molding was originally picked out with blue paint against a gray wainscot panel. In the second generation it was painted dull pink to match the center panel of the wainscot. Pigment identification with polarized light microscopy analysis shows that the first blue paint is composed of charcoal black, Prussian blue, white lead and calcium carbonate. All paints on this molding were confirmed as oil-bound with the biological fluorochrome stain DCF.

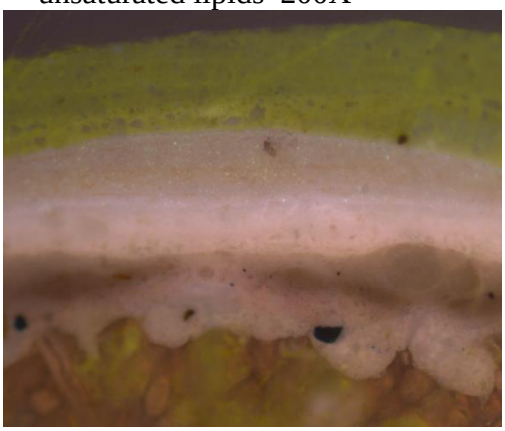
Sample 101-5. East wall, small applied molding on wainscot.
Visible Light 200X



Ultraviolet Light 200X

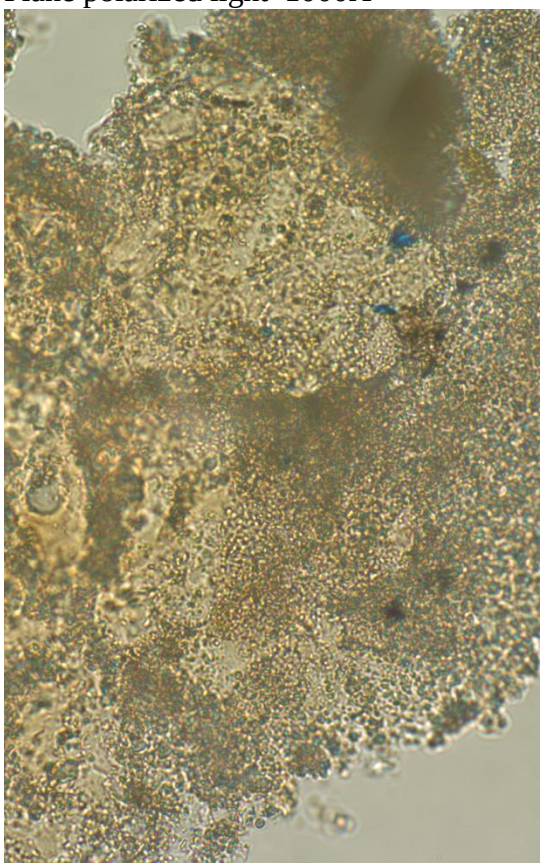


UV Light & DCF for saturated and unsaturated lipids 200X

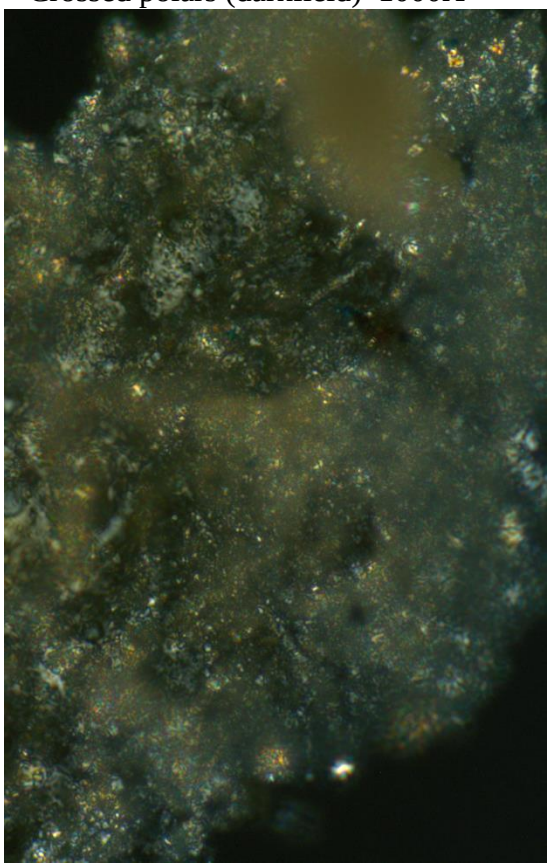


Sample 101-5. East wall, small applied molding on wainscot. Pigments in the first light blue-gray paint layer. Prussian blue, white lead, charcoal black and calcium carbonate.

Plane polarized light 1000X



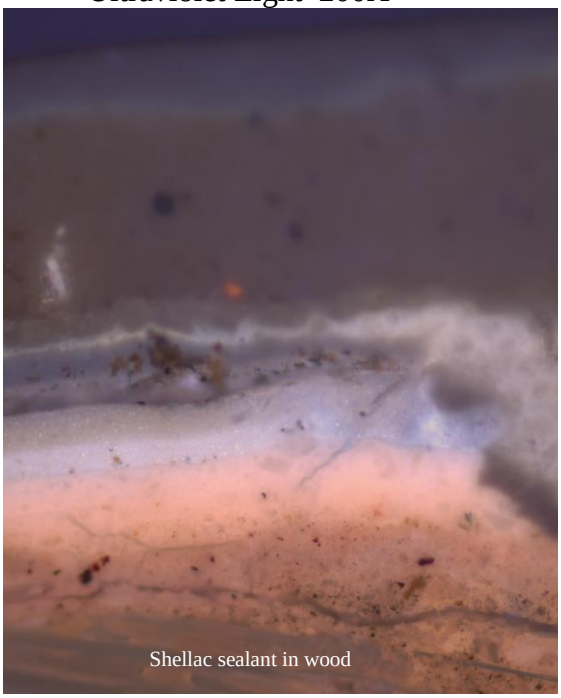
Crossed polars (darkfield) 1000X



Sample 101-6. South wall, flat field of wainscot, southwest corner. The first gray paint on the wainscot is trapped deep in the wood, but it has an eroded surface indicative of it having been mostly cleaned or abraded away. Cleaning with a traditional caustic material such as lye in hot water would produce this type of eroded surface. The second generation is the dull pink paint found on other areas of woodwork in this room. This is followed by a series of cream-colored and off-white paint layers that can be aligned with the later woodwork coatings on other elements in the parlor. Pigment identification shows that the first gray woodwork paint is composed of charcoal black, lampblack, white lead and calcium carbonate.

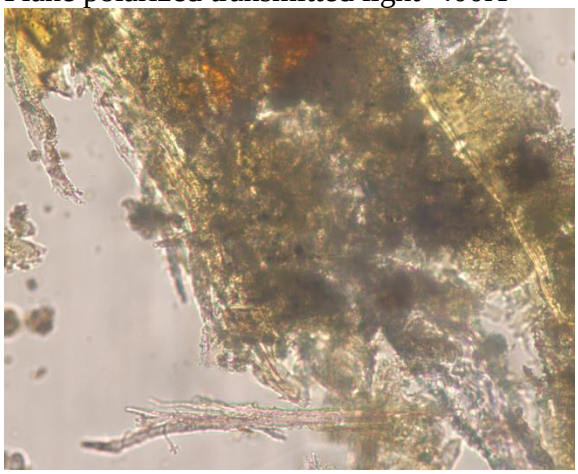
Sample 101-6. South wall, flat field of wainscot, southwest corner.
Visible Light 200X

Ultraviolet Light 200X

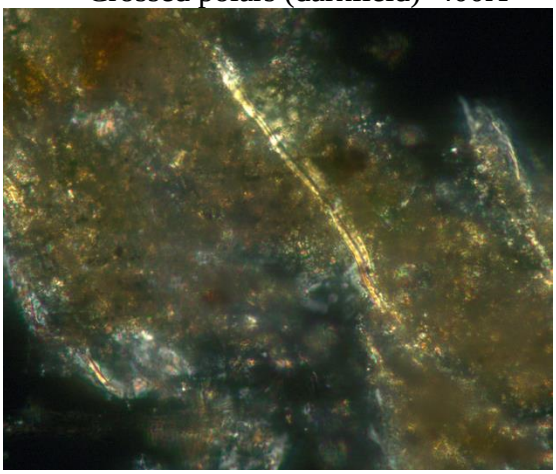


Pigments in the gray paint layer. Charcoal black, white lead, lampblack, calcium carbonate.

Plane polarized transmitted light 400X



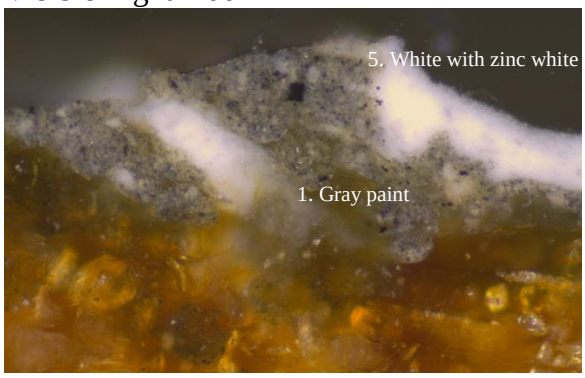
Crossed polars (darkfield) 400X



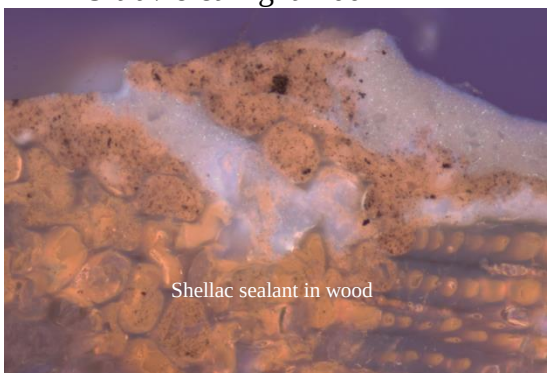
Sample 101-7. East wall, one sample from unpainted top of door, other samples from painted face of door, door may have originally been varnished. The first gray woodwork paint remains trapped deep in the wood fibers and it is also present as an inconsistent layer above the wood in this cross-section. The coating directly on top of the gray remnants is a white paint containing zinc white which was found as generation 5 in this room. The evidence suggests that many of the early paints were removed during later restorations, but there are still protected areas where the gray paint remains despite the stripping. Sample 101-1SB, removed on April 26, 2013, contains the full stratigraphy of door paints, including a mahogany graining sequence in generation 2 and an oak graining sequence in generation 3.

Sample 101-7. East wall, one sample from unpainted top of door, other samples from painted face of door.

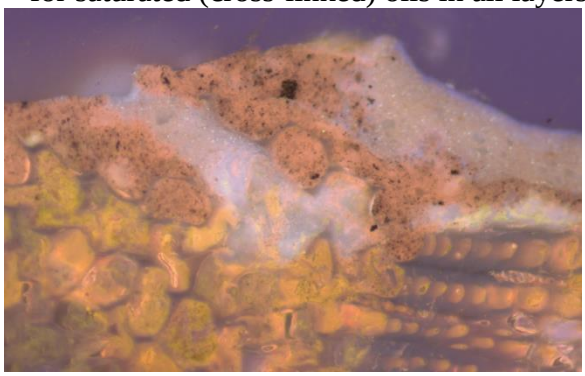
Visible Light 200X



Ultraviolet Light 200X

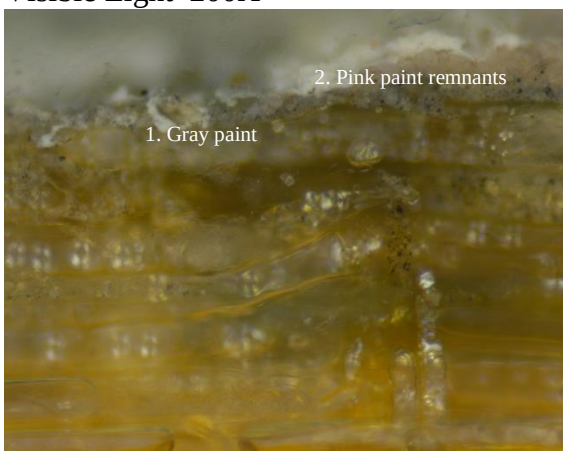


UV Light & DCF for saturated and unsaturated lipids 200X
+ for saturated (cross-linked) oils in all layers



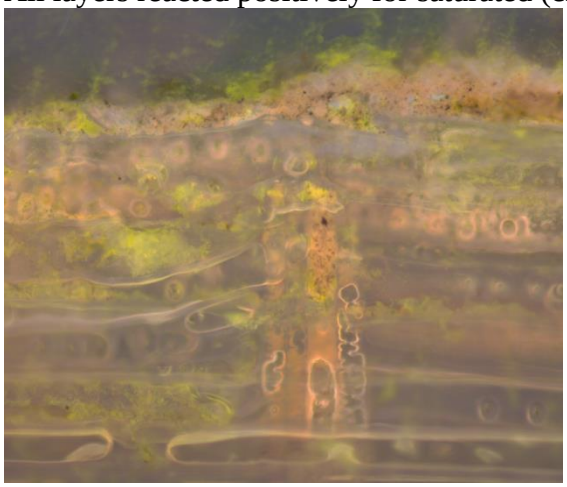
Sample 101-2A. North wall window sill (compare to trim of 101). The comparative evidence shows that the window sill was originally gray when the room was painted with a gray and blue palette in generation 1. This is followed by the second-generation dull pink. The paint stratigraphy is compromised in this cross-section as only modern white paints remain above the dull pink layer. It is likely the window sill was painted cream-color to match all the other woodwork in generation 3 as this was suggested by the investigation on site.

Sample 101-2A. North wall window sill (compare to trim of 101).
Visible Light 200X



Ultraviolet Light 200X

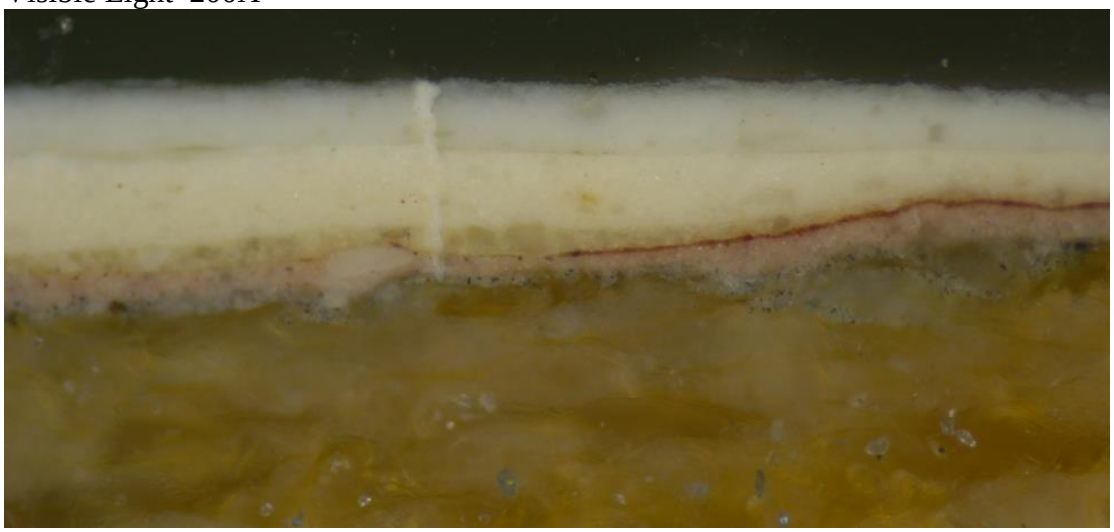
UV & DCF for saturated and unsaturated lipids 200X
All layers reacted positively for saturated (cross-linked) lipids



Sample 101-3A. North wall just below cap of surbase, to left of east window (compare to trim of 101). The cross-section evidence confirms that the surbase was originally gray, followed by a paint sequence consisting of a pink base coat, a red glaze and remnants of a varnish coating. This is typical of mahogany graining, suggesting this element was grain-painted like the doors (100-10 and 101-1SB) in the second generation. Generation 3 is a cream-colored paint, followed by off-white in generation 4 and a white paint containing zinc white in generation 5. The later coatings cleaved off during sampling, but are present in uncast portions of the sample. On site investigations confirmed that the cap molding was also mahogany-grained in generation 2.

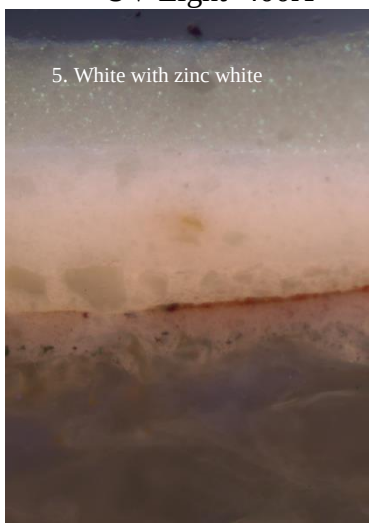
Sample 101-3A. North wall just below cap of surbase, to left of east window (compare to trim of 101).

Visible Light 200X



Visible Light 400X

UV Light 400X



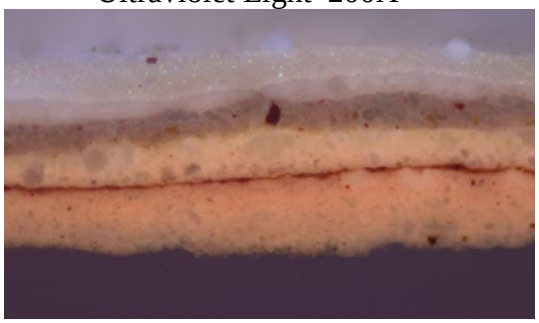
UV Light & DCF for lipids

Sample 101-1SB. Door on east wall, upper left corner, middle left panel. The door was examined and re-sampled during the April site visit, and although the embrittled paints cleaved apart, it is possible to see that the original gray paint on the panel remains in the wood and as an uneven film below the second-generation mahogany graining. On-site investigations suggested that both sides of this door were originally painted a monochromatic gray color, and then both sides of the door were mahogany grained. The same type of pink base coat and reddish glaze sequence for the graining were found on all the doors in the entry hall. In the cross-section the third generation may be oak graining with a brown glaze on a yellow base coat, which is followed by off-white and white paints.

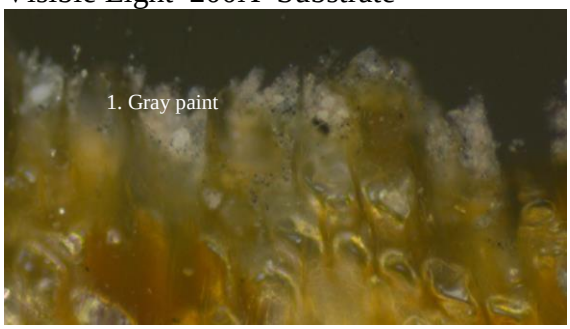
Sample 101-1SB. Door on east wall, upper left corner, middle left panel.

Visible Light 200X Separated flake

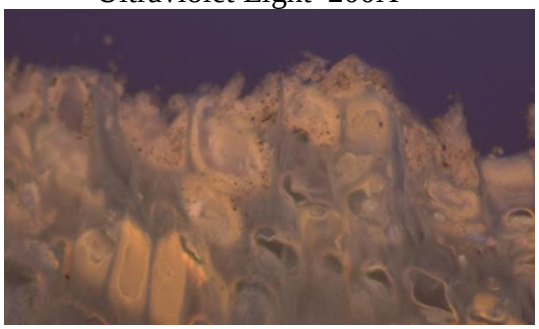
Ultraviolet Light 200X



Visible Light 200X Substrate

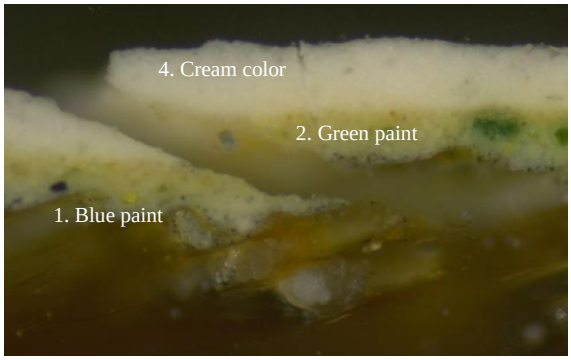


Ultraviolet Light 200X

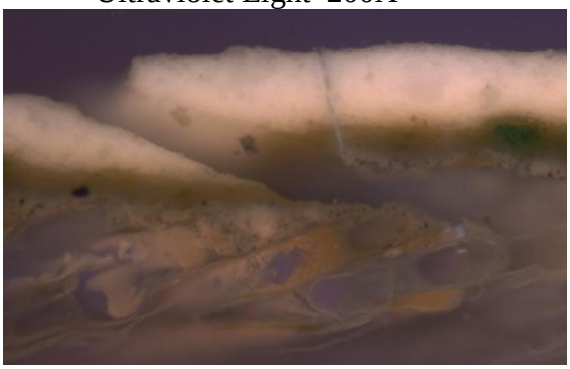


Sample 101-2SB. Wainscot, northwest corner, inner panel, upper left corner. The later layers cleaved away when the sample was removed, but this cross-section retains the first generation of blue paint, followed by the second generation of green paint. So, the center of the wainscot was initially blue as part of the two-tone palette, then it was green in the second generation two-tone palette. It was then repainted with cream color and then with off-whites to match the later monochromatic woodwork paint treatments.

Sample 101-2SB. Wainscot, northwest corner, inner panel, upper left corner.
Visible Light 200X



Ultraviolet Light 200X

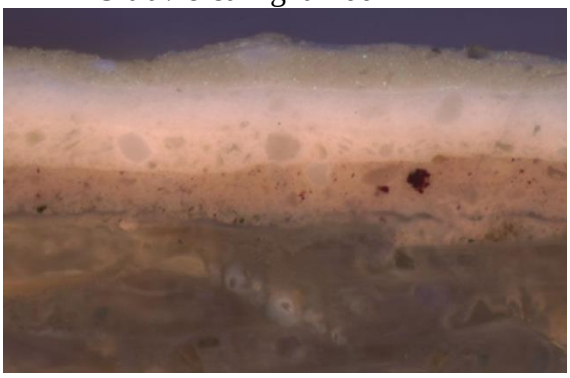


Sample 101-3SB. Wainscot, northwest corner, outer panel, right of applied molding. The evidence in this cross-section helps to confirm that the outer portion of the wainscot panel was originally gray, then it was repainted dull pink in the second generation. All the subsequent layers are cream-colored and off-white paints which were all monochromatic paint schemes.

Sample 101-3SB. Wainscot, northwest corner, outer panel, right of applied molding.

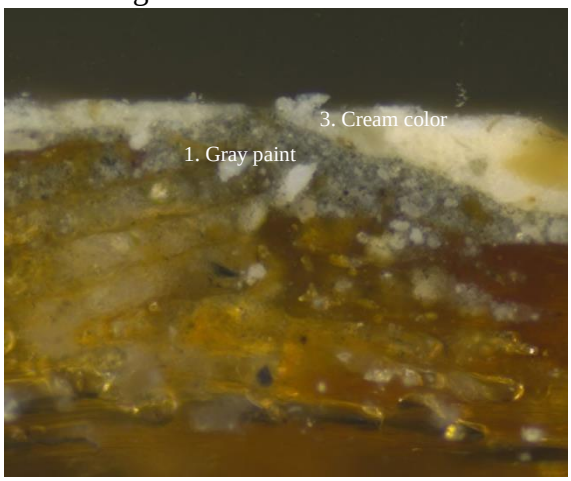
Visible Light 200X

Ultraviolet Light 200X

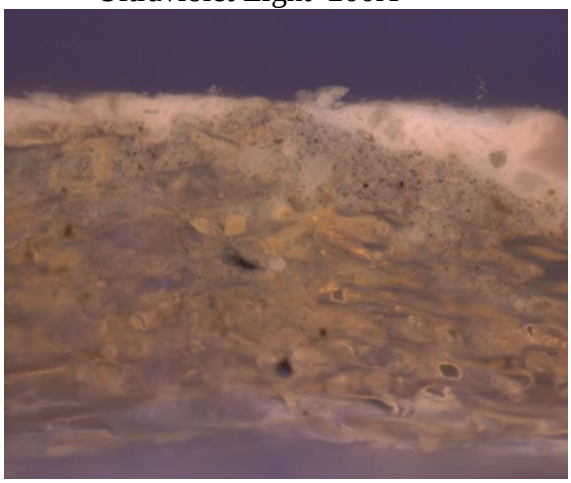


Sample 101-4SB. North wall east window, upper sash, upper right corner, upper pane.
The paints on the sashes are damaged from condensation, movement and reputtying, but a distinct layer of the original gray paint remains on top of the wood substrate. The second generation of paint is missing, but later cream-colored and off-white paints remain in the uncast portions of this sample. It appears that the sash were always painted to match the woodwork colors, although it is not clear whether the sashes were dull pink or dull green in the second generation.

Sample 101-4SB. North wall east window, upper sash, upper right corner, upper pane.
Visible Light 200X



Ultraviolet Light 200X



Room 100 Entry

During the early phases of analysis four samples were analyzed from representative areas of woodwork in the entry for comparison with the cross-section findings in the parlor. During the work on-site in April 2013, four woodwork samples and one plaster sample were removed from protected areas for additional analysis. There are similarities between this space and the parlor, although no two-tone paint schemes were found. Monochromatic gray paint was identified as the original coating in all the woodwork samples analyzed from this room, followed by a solid color light blue-gray in the second generation with possible gray marbleizing on the baseboards. Each sample is discussed and illustrated in this section of the report. The third generation of paint, which may date to 1849, is the same cream-colored paint found in the parlor.

The paints on the door (100-10) are consistent with the findings in the parlor. There is clear evidence that the south wall door (100-10) was originally gray, and that it may have been grain-painted to simulate mahogany in generation 2. Generation 3 appears to be oak graining, like the parlor. Then in generations 4 and 5 this door was either mahogany-grained or dark brown. The investigations on site suggested that the north and south exterior doors were painted inside and out in the same manner as the door leading to the parlor.

Room 100 Woodwork Sample Locations
100-10. Door D1, south wall, possible varnish under layers of paint.
100-11. North wall, back door architrave (similar to 12 and 18).
100-12. South wall, part of tripartite doorway with sidelight (similar to 11 and 18).
100-13. South wall, surbase east of doorway.
100-14. East wall, base molding below stair
100-18. Front door architrave.
100-2SB. Tripartite window, left architrave of left sidelight, about 5-feet up.
100-3SB. Surbase, west wall, right of door.
100-4SB. West wall, baseboard below location of 100-3SB.
100-5SB. North wall, window at landing, upper left corner of lower sash.

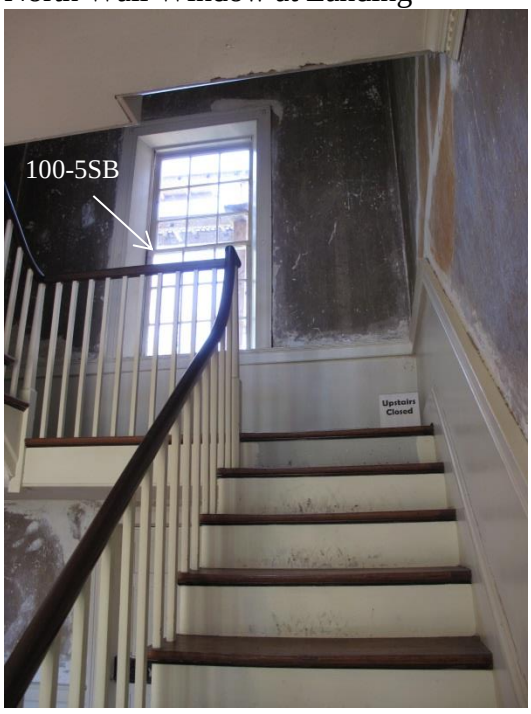
A table showing the comparative paint stratigraphies found in the woodwork samples analyzed from the entry is included on page 28.

Locations of Woodwork Samples Removed From Room 100 on April 26, 2013

South Wall Sidelight Architrave

West Wall Surbase and Baseboard

North Wall Window at Landing



Room 100 Comparative Woodwork Paint Histories on Selected Elements

Generation/ Coating	100-10 Door	101-11 Tripartite doorway	100-12 Tripartite doorway	100-13 Surbase	100-14 Base molding below stair	100-18 Tripartite door architrave	100-2SB tripartite window architrave	100-3SB Surbase	100-4SB Baseboard	100-5SB Sash
11-13. Most recent nonfluorescent coatings	x	x	x	x	x	x	x	x	x	x
10. Grayish-tan	x	x	x	x	x	x	x	x	x	x
9. Off-white	x	x	x	x	x	x	x	x	x	x
8. Off-white with zinc white	x	x	x		x	x	x	x	x	*
7. Dark brown paint	x	x	*	x	Brown	x	*	x	*	*
6. Resinous brownish paint	x	x	x	x	Black on tan primer	x	*	x	*	*
5. Off-white	Brown paint with varnish	x	x	x	x	x	x	x	*	*
4. Tannish Possibly 1877	Pinkish-brown with varnish	x	x	x	x	x	x	x	x	*
3. Cream color Possibly ca. 1849	x	x	x	x	x	x	x	x	x	x
2. Light blue-gray with possible marbleized baseboards Possibly 1826-41	x	x	x	x	Possible gray marble-izing	x	x	x	Possible gray marble-izing	x
1. Gray paint scheme 1810-12	x	x	x	x	x	x	x	x	x	x
1. Shellac sealant in wood	x	x	x	x	x	x	x	*	x	x

Original woodwork paint colors 1810-12

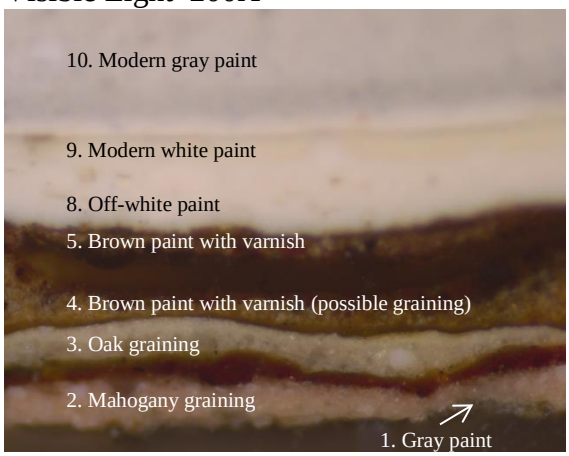
Possible Greek Revival paint colors ca. 1849

* Missing from abrasion or flaking

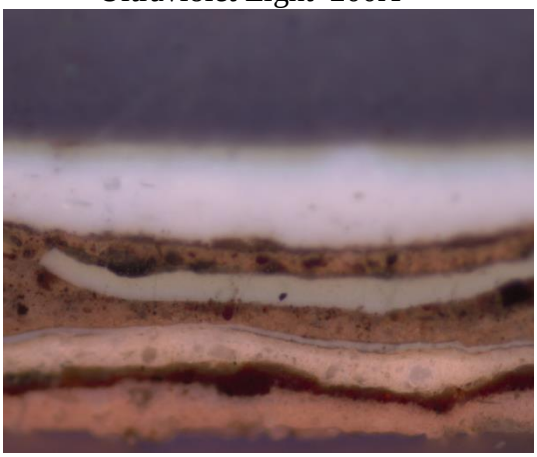
Sample 100-10. Door D1, south wall, possible varnish under layers of paint. The cross-section from the south wall door in the entry is surprisingly intact. This cross-section begins with the same dark gray paint found on the parlor door and baseboard. This is followed by what is likely a graining sequence to replicate mahogany, which consists of a pinkish base coat, a red-brown glaze and remnants of a varnish coating. The third generation is likely an oak graining sequences consisting of a cream-colored base coat, a thin brown glaze and a plant resin varnish coating. Generation 4 may also represent mahogany graining with a pinkish-brown base coat. Generation 5 is a brown paint with a varnish. The most recent paints are off-white and gray. If generation 3 is the target period for interpretation of the parlor and entry, then it seems that this door was oak-grained in the same manner on both sides. Fluorochrome binder analysis confirms that all the paints in this coating sequence are traditional oil-bound paints.

Sample 100-10. Door D1, south wall, possible varnish under layers of paint.

Visible Light 200X

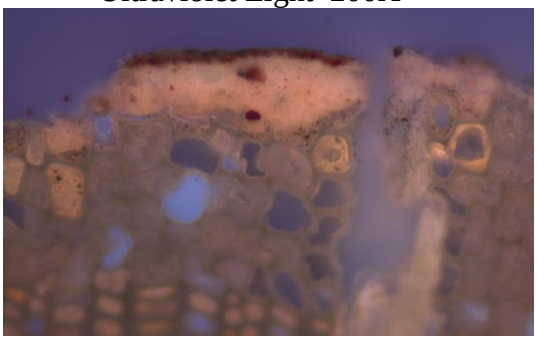


Ultraviolet Light 200X

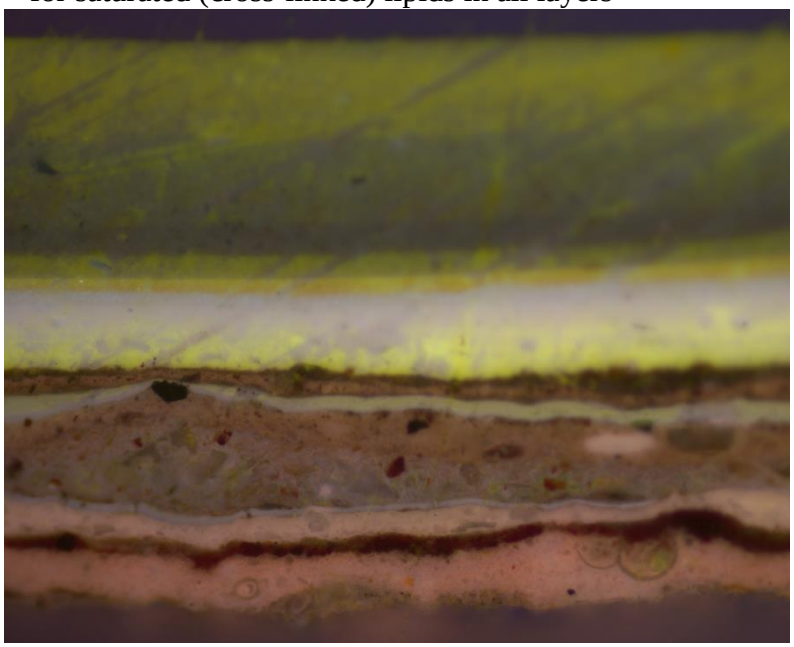


Visible Light 200X (substrate)

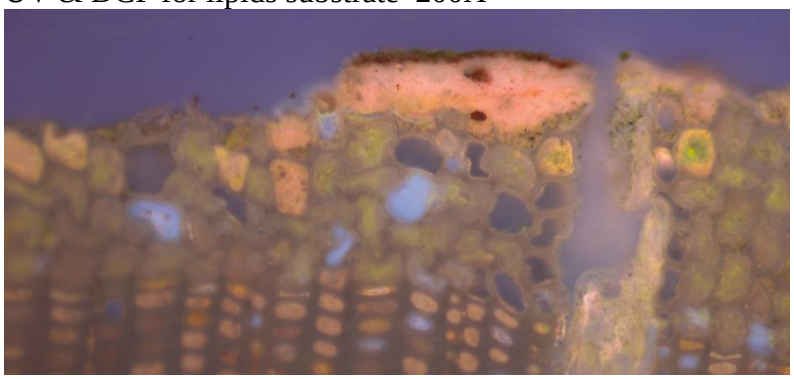
Ultraviolet Light 200X



Sample 100-10. Door D1, south wall, possible varnish under layers of paint.
UV & DCF for saturated and unsaturated lipids 200X
+ for saturated (cross-linked) lipids in all layers



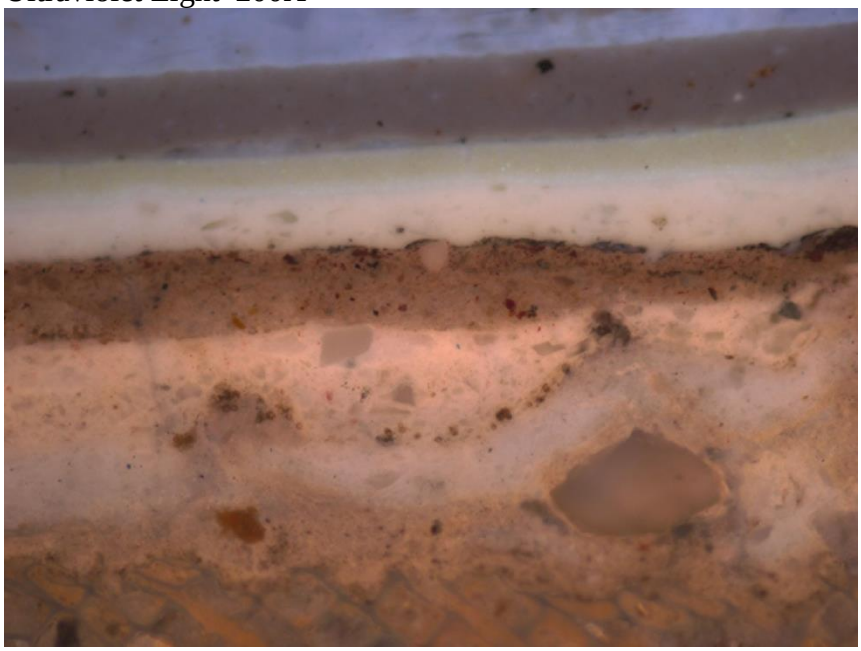
UV & DCF for lipids substrate 200X



Sample 100-11. North wall, back door architrave (similar to 12 and 18). Sample 100-12 retains an almost complete paint stratigraphy. The cross-section sample is missing the cream-colored paint applied in generation 3, but this layer is present in the uncast portions of this sample.

Sample 100-11. North wall, back door architrave (similar to 12 and 18).
Visible Light 200X

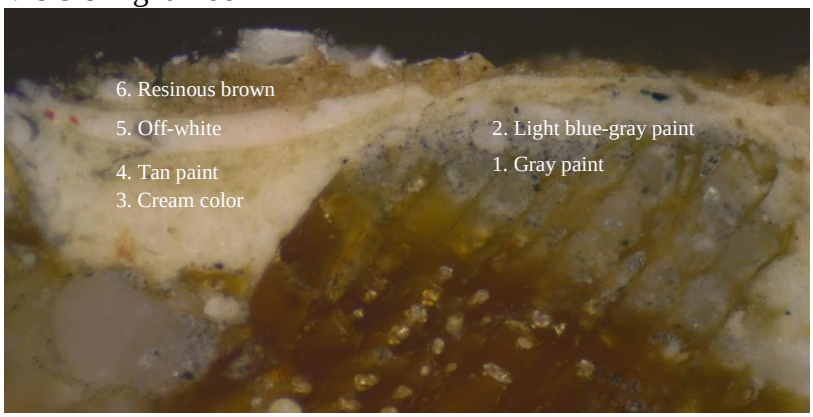
Ultraviolet Light 200X



Samples 100-12 and 100-18. South wall, part of tripartite doorway with sidelight (similar to 101-11). The first gray paint layer in the uncast portion of samples 100-12 and 100-18 closely resembles the first gray layer found on the woodwork in the parlor. A second sample from this location was cast for comparison and in this cross-section the first gray paint remains above the wood, followed by the second-generation light blue-gray paint. These cross-sections are important because there is a defined boundary at the surface of the gray paint, as well as evidence of erosion and cracking, which help to confirm that this first gray paint is a finish coat, not a primer. There is a cream-colored paint in the third generation that lines up with the third generation on the woodwork in the parlor, which may relate to an 1849 redecoration.

Sample 100-12. South wall, part of tripartite doorway with sidelight (similar to 11 and 18).

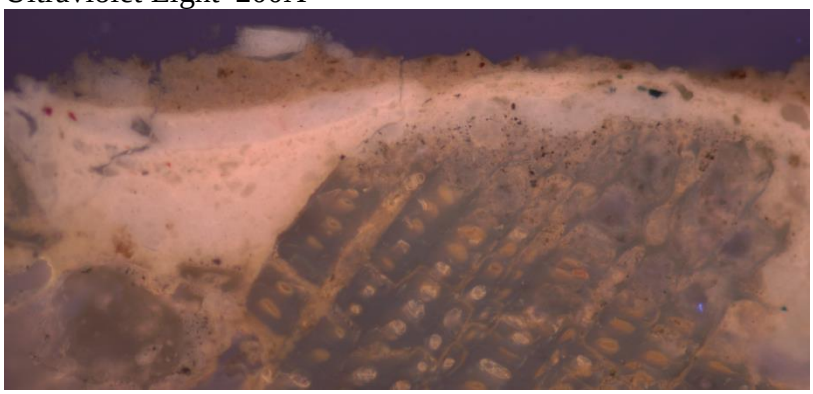
Visible Light 200X



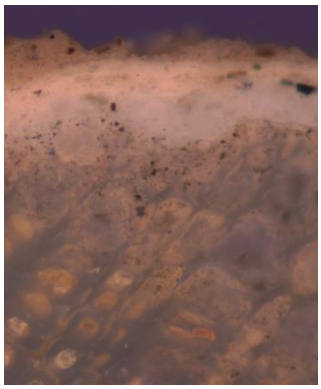
400X

Gray paint is eroded and cracked

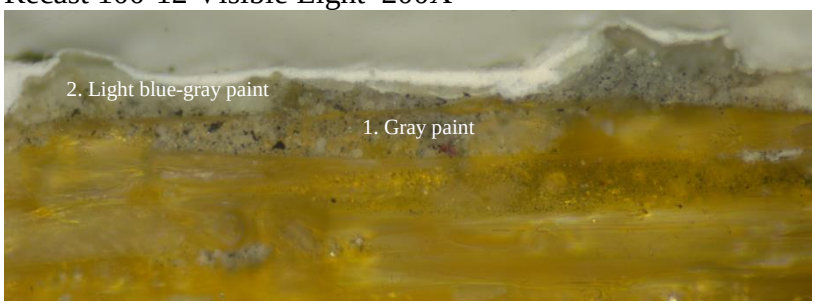
Ultraviolet Light 200X



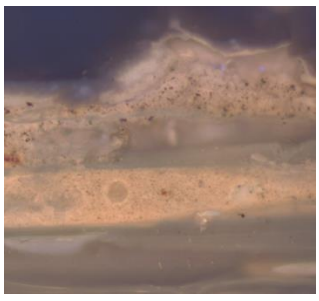
400X



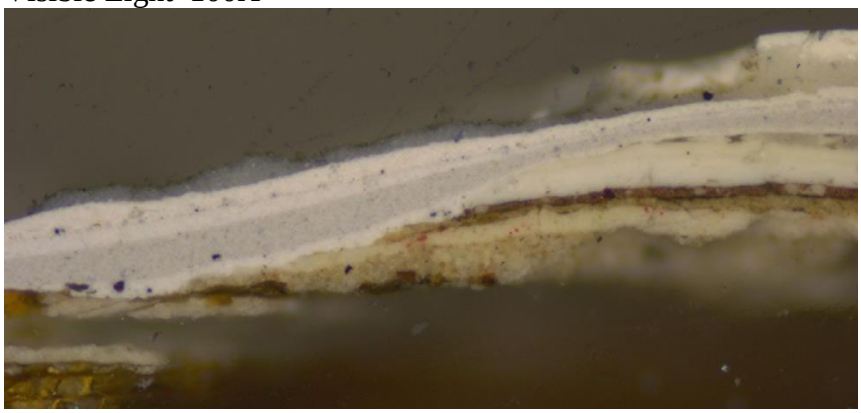
Recast 100-12 Visible Light 200X



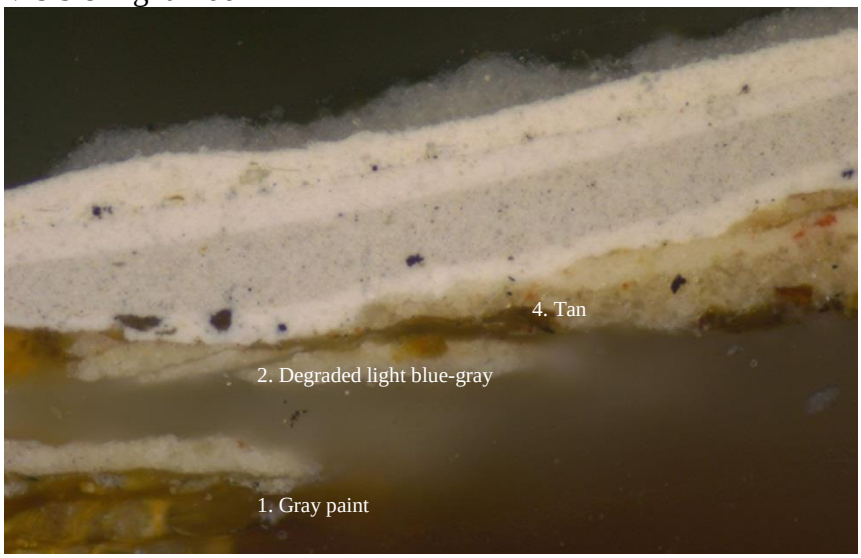
UV 200X



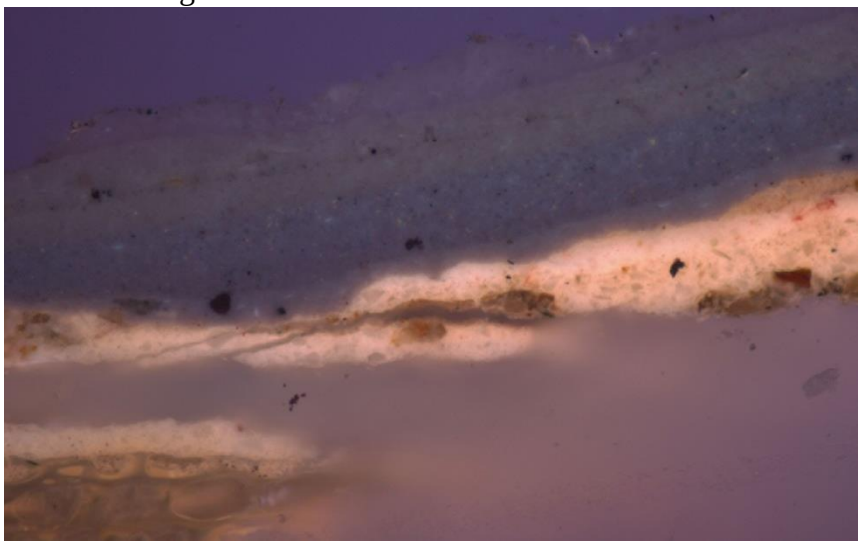
Sample 100-18. Front door architrave.
Visible Light 100X



Visible Light 200X

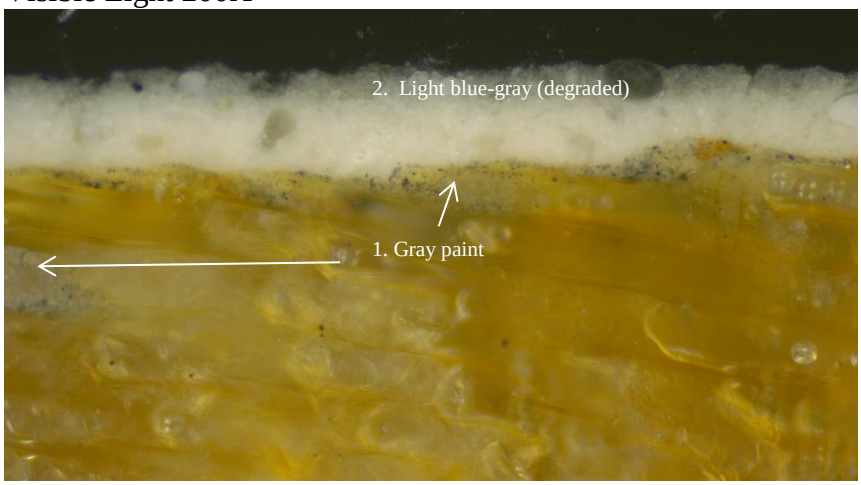


Ultraviolet Light 200X

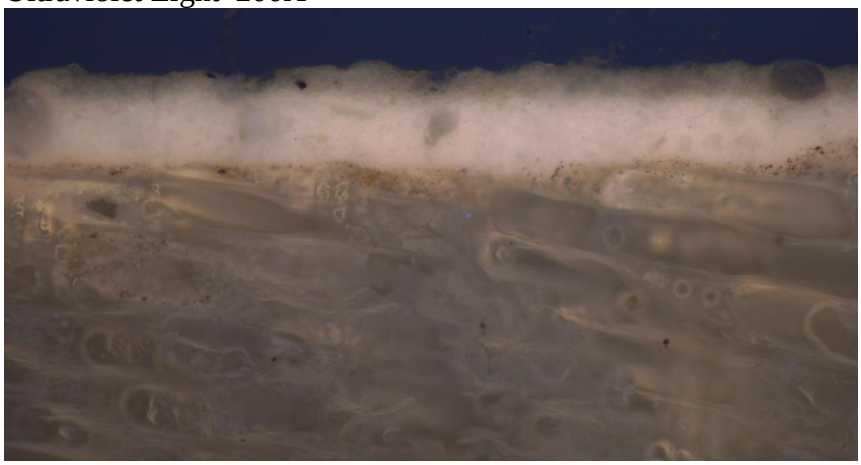


Sample 100-13. South wall, surbase east of doorway. The evidence of an uneven film of gray paint on the surface of the wood, and trapped in the wood fibers, is consistent with woodwork that has lost most of its original paint. This sample helps to confirm that the surbase was originally the same gray as the tripartite doorway woodwork. The second generation represents the light blue-gray paint, but the layer appears bleached and eroded in this cross-section. Uncast portions of the surbase sample retain the later paints observed on the architraves and another area of surbase (100-3SB).

Sample 100-13. South wall, surbase east of doorway.
Visible Light 200X



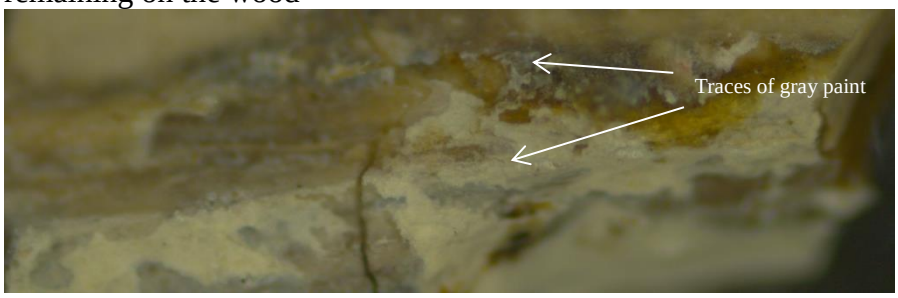
Ultraviolet Light 200X



Sample 100-14. East wall, base molding below stair.
Sample 100-4SB. West wall, baseboard plinth just south of parlor door. One sample from below the stair in the entry was analyzed for comparison with the two baseboard samples (101-3 and 4) from the parlor. There are traces of the first gray paint that was found on one section of baseboard in the parlor in uncast portions of this sample. This gray paint is followed by a cream-colored base coat and a gray paint. A second baseboard sample was taken for analysis during the April site visit (100-4SB) and it helps to confirm that the baseboard was originally gray. The baseboard may have been marbleized to simulate a gray stone in generation 2, with a cream-colored base coat and two different gray glazes.

The photomicrograph of an uncast portion of 100-4SB shows the uneven dark and light gray pattern that may have been intended to mimic a gray stone. The baseboard paints line up with the architrave and surbase paints after generation 3, suggesting that the woodwork was painted in a monochromatic manner from generation 3 to the present.

Uncast portion of 100-14 photographed upside-down at 40X to show traces of gray paint remaining on the wood

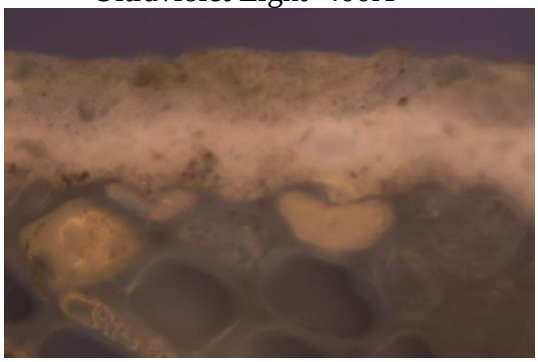


Uncast portion of sample 100-4SB

Sample 100-4SB. West wall, baseboard below location of 100-3SB.

Visible Light 400X

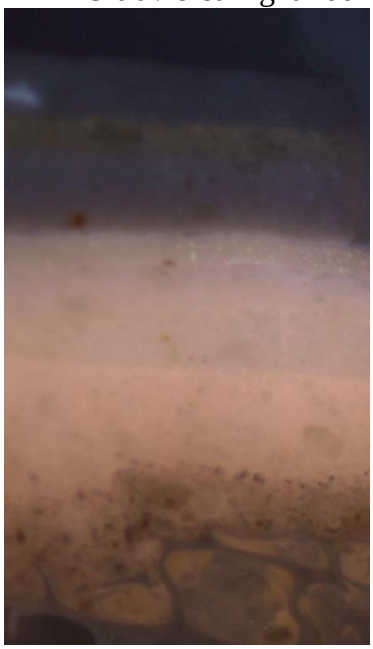
Ultraviolet Light 400X



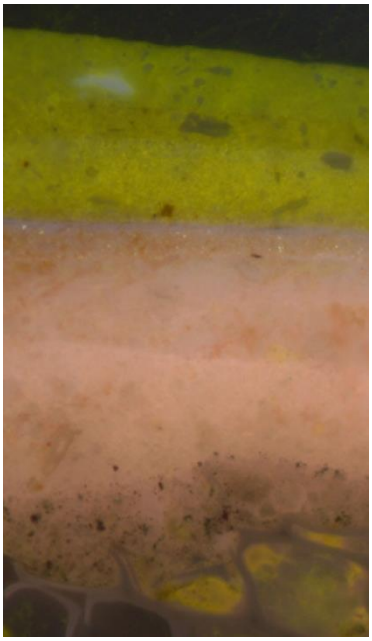
Sample 100-4SB. West wall, baseboard below location of 100-3SB. (Recast sample to show later layers.)

Visible Light 200X

Ultraviolet Light 200X

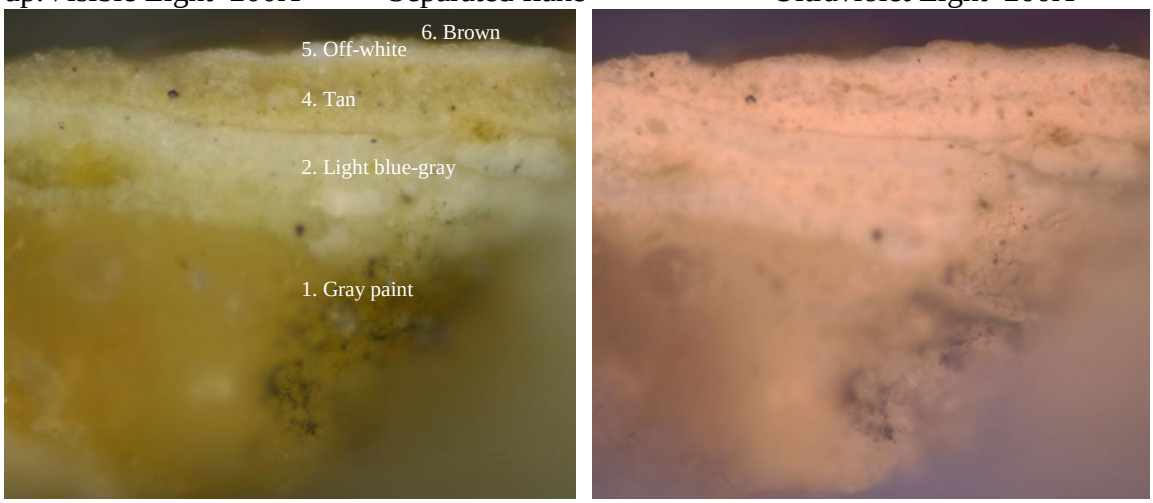


UV & DCF for lipids

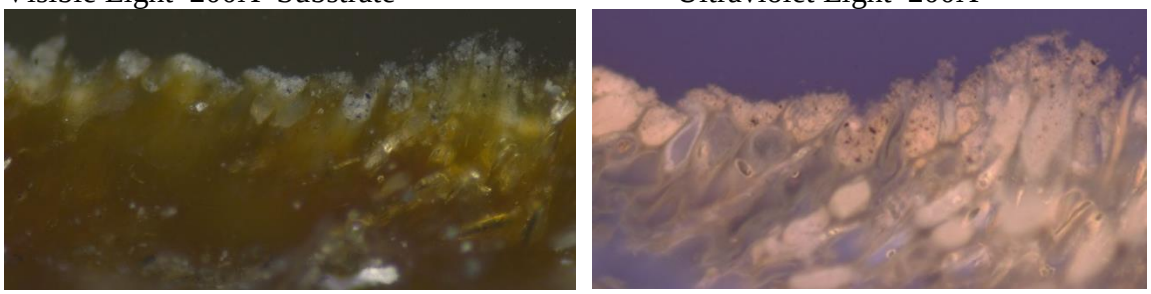


Sample 100-2SB. Tripartite window, left architrave of left sidelight, about 5-feet up.
Samples from the tripartite window architrave confirm the woodwork was initially painted gray, followed by light blue-gray in the second generation. The third generation cream-colored paint is missing the cast cross-section, but is present in uncast portions of the same sample.

Sample 100-2SB. Tripartite window, left architrave of left sidelight, about 5-feet up.Visible Light 200X Separated flake Ultraviolet Light 200X



Visible Light 200X Substrate Ultraviolet Light 200X

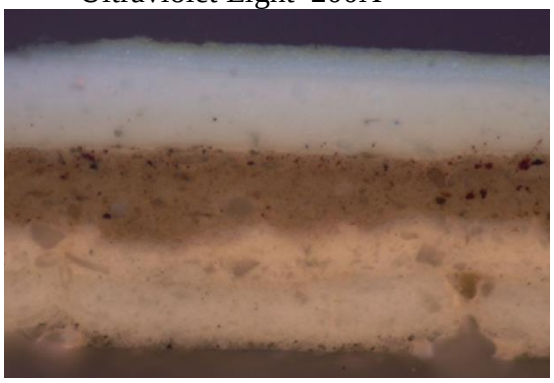


Sample 100-3SB. Surbase, west wall, right of door. The cast and uncast portions of the surbase sample confirm that the surbase was painted in the same manner as the rest of the woodwork from generation 1 through 13.

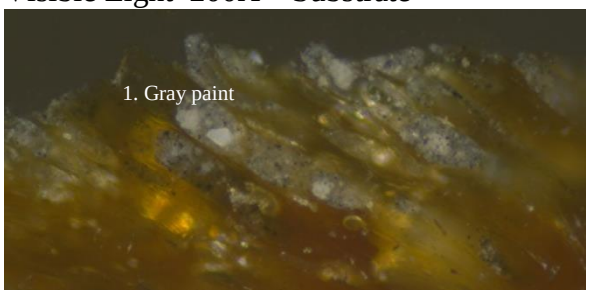
Sample 100-3SB. Surbase, west wall, right of door.

Visible Light 200X Separated flake

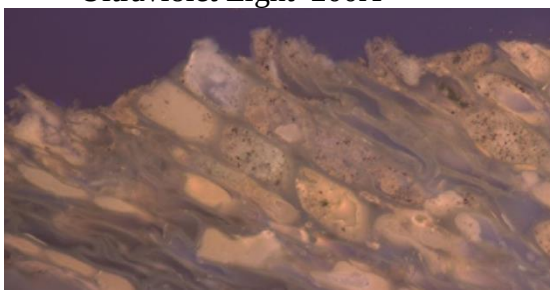
Ultraviolet Light 200X



Visible Light 200X Substrate

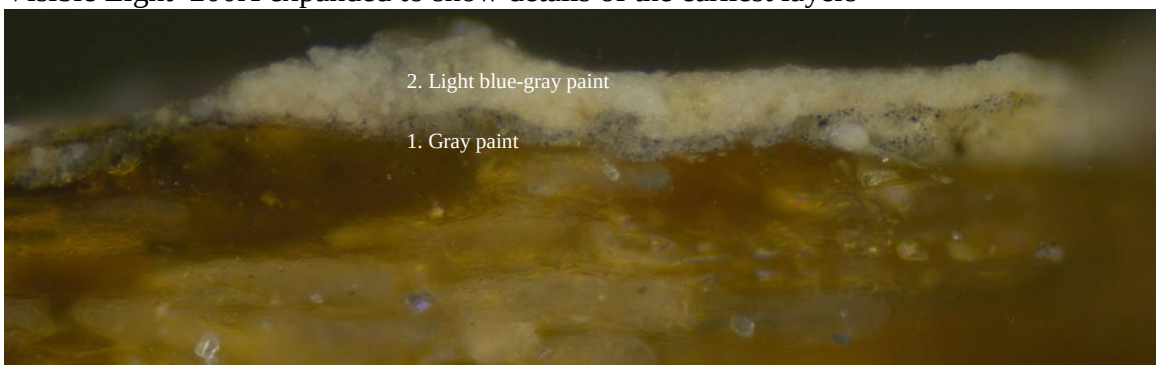


Ultraviolet Light 200X



Sample 100-5SB. North wall, window at landing, upper left corner of lower sash. Very little paint remains on the sash, most likely because of general repairs to the sash, as well as to flaking from condensation and movement. The three earliest paints remain on protected areas of the sash, indicating that the sash was painted the same color as the rest of the woodwork from generations 1 through 3.

Sample 100-5SB. North wall, window at landing, upper left corner of lower sash. Visible Light 200X expanded to show details of the earliest layers

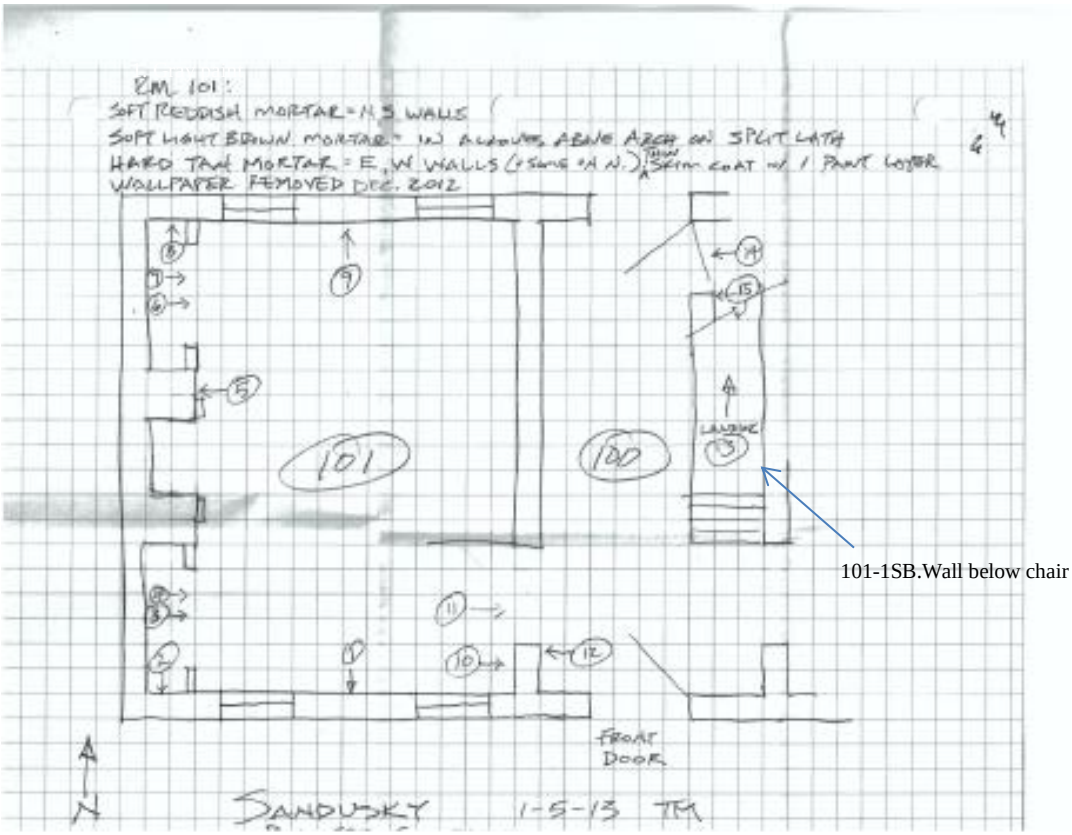


Parlor (101) and Entry (100) Plaster Findings

When the first group of plaster samples was sorted and reviewed, there were two samples from room 101 and one sample from room 100 that seemed to retain the most information when examined under a binocular microscope at 40X. These three samples were cast for cross-section analysis. Travis McDonald noted that from 1952 to 2000, when the Adkinsons lived in the house, they replastered many of the walls in the parlor. The limited paint evidence found on the walls in the first group of plaster samples is consistent with the walls being thoroughly scraped or cleaned down before replastering. A second group of plaster samples (designated "A") was taken by Travis McDonald in February 2013 to try to search for early paints on the Period I plaster, and to establish the most recent modern (post-1950s restoration) coatings.

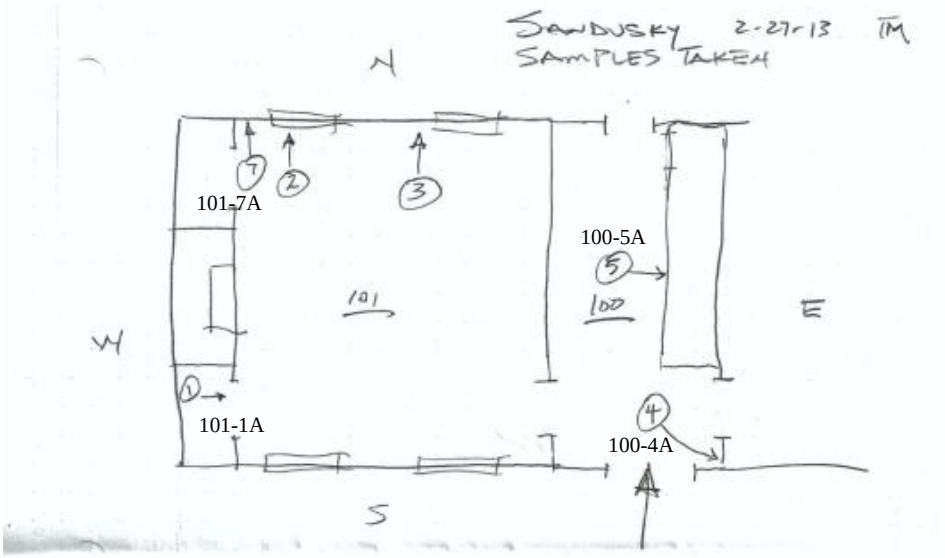
During the work on-site in April 2013, Susan Buck sampled one additional area of plaster in the entry below chair rail level on the east wall, along the staircase, in an area that seemed to retain a complete plaster sequence, significantly predating the Adkinson period of restoration.

Phase I Parlor and Entry Plaster Sample Locations



101-1SB.Wall below chair rail

Phase II Parlor and Entry Plaster Samples



Parlor and Entry Plaster Samples Analyzed in Cross-section
101-1. Wall plaster from south wall between windows at about 6' above floor.
101-3. Wall plaster from inside of south alcove, east wall above arch on riven lath. Sample has wallpaper on it. Soft tan mortar is different from soft reddish mortar and is possibly first period mortar.
101-1A. South arch inside alcove (compare to 101-9).
101-7A. North wall, to the left west window. Looks like 1950s plaster – should have modern history.

100-12. Taken from under current wallpaper to the left of the door into room 101 at just above the chair rail area. Looks to be original plaster.
100-4A. Plaster, east wall, southeast corner. (Compare to #100-12 and 100-5A).
100-5A. Plaster under stair. (Compare to #100-12).
100-1SB. Plaster wainscot, east wall along stair, early plaster?

The findings for the parlor and entry are discussed separately as there is no early wall paint evidence in the parlor that can be related to the entry plaster.

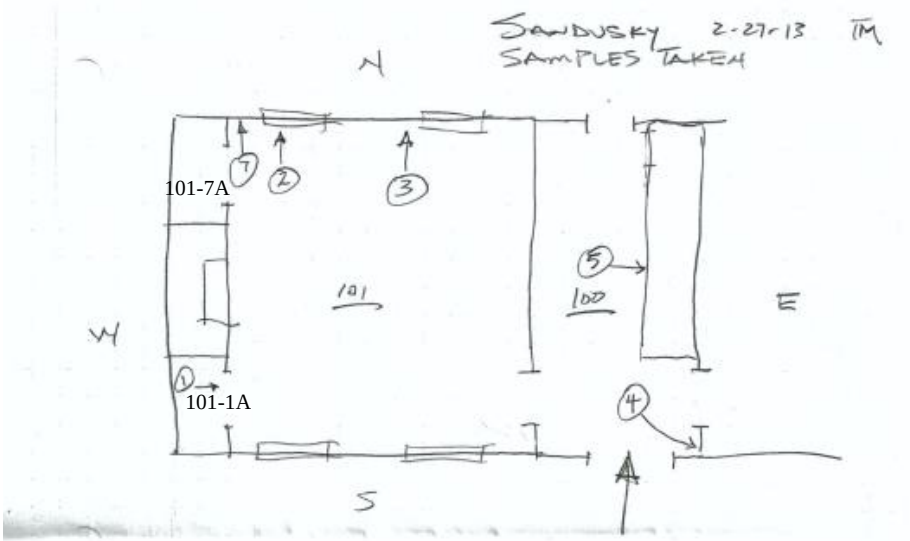
Parlor (101) Plaster Paint Findings

In the notes accompanying the plaster samples Travis McDonald observed that: "Room 100's wall plaster sample should show evidence of current 20C wallpaper glue whereas the recent removal of 20C wallpaper in room 101 was done with a vinegar wash to remove glue residue." The evidence in the samples from the parlor suggests that the wall plaster surfaces were quite thoroughly cleaned of early coatings before the most recent paint and wallpaper applications. However, there do appear to be early plaster coatings remaining in some areas of the entry. McDonald also noted the color and quality of two types of plaster of interest: "Soft tan mortar is different from soft reddish mortar and is possibly first period mortar."

In the second round of sampling in room 101, sample 101-1A was taken from early plaster to look for more evidence of early finish below the later wallpaper, and sample 101-7A was taken from what McDonald felt could be 1950s plaster with a modern paint sequence.

Room 101 Plaster Wall Paint Evidence. Four samples from three phases of analysis were analyzed to comparatively date the wall coatings, where possible, and to compare them with the surviving evidence in the entry.

Room 101 Plaster Wall Sample Locations
101-1. Wall plaster from south wall between windows at about 6' above floor.
101-3. Wall plaster from inside of south alcove, east wall above arch on riven lath. Sample has wallpaper on it. Soft tan mortar is different from soft reddish mortar and is possibly first period mortar.
101-1A. South arch inside alcove (compare to 101-9).
101-7A. North wall, to the left west window. Looks like 1950s plaster – should have modern history.



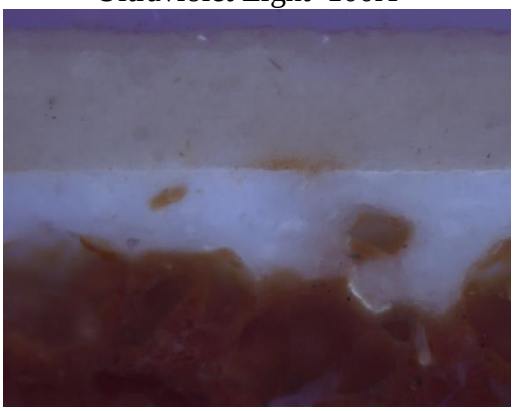
The cross-section evidence in the first three samples analyzed from the wall plaster in the parlor (101-1, 101-3) and the second group of samples (101-1A and 101-7A) are discussed and illustrated below. None of the samples taken in the parlor offer early wall coating evidence, even in the alcoves where it was hoped that protected areas above the arches might retain intact early paints or papers. Of all the samples of wall plaster taken, comparative analysis shows that the most complete sequence of early wall coatings is in sample 100-1SB from the east wall of the passage, which is discussed and illustrated in the next section of this report.

Sample 101-1. Wall plaster from south wall between windows at about 6' above floor. This sample was from an area of plaster that represents the soft reddish mortar that McDonald observed as later than the soft tannish plaster. There is a white finish plaster coating on top of the sandy reddish plaster, but there are no coatings remaining on top of the white finish plaster. However, there is an uneven film of reddish dirt particles and soot on this plaster, suggesting it was left unpainted for long enough to become dirty. The layer directly on top of the early white finish plaster is a bright white plaster skimcoat, which was likely applied to even out the walls before the most recent off-white paint was applied to the walls. Fluorochrome binding media analysis showed positive reactions for starches in the reddish mortar, and in the white finish coating. This may be an indication of starch paste residues from now removed wallpaper. There is no early paint evidence in this cross-section.

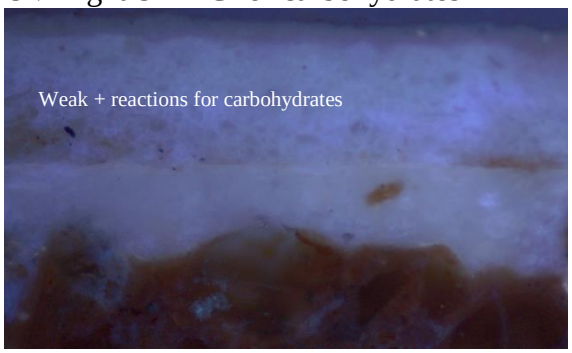
Sample 101-1. Wall plaster from south wall between windows at about 6' above floor.

Visible Light 100X

Ultraviolet Light 100X



UV Light & TTC for carbohydrates

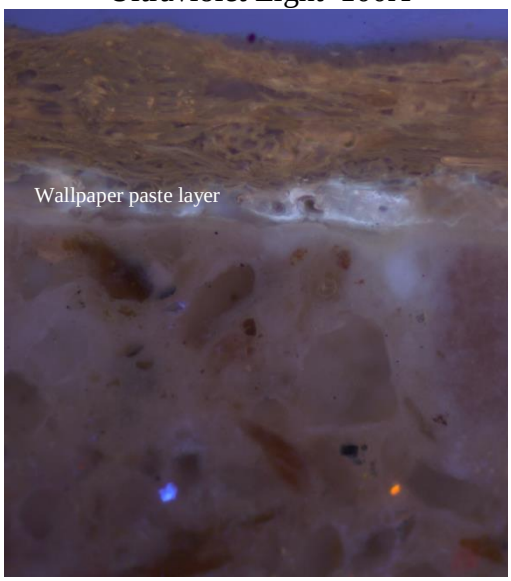


Sample 101-3. Wall plaster from inside of south alcove, east wall above arch on riven lath. This sample was taken with attached wallpaper, and McDonald noted that the: "Soft tan mortar is different from soft reddish mortar and is possibly first period mortar". In this cross-section it appears that all early wall paint and wallpaper evidence was removed, leaving the more recent wood pulp-based wall paper directly adhered to the sandy tannish plaster.

Sample 101-3. Wall plaster from inside of south alcove, east wall above arch on riven lath.

Visible Light 100X

Ultraviolet Light 100X

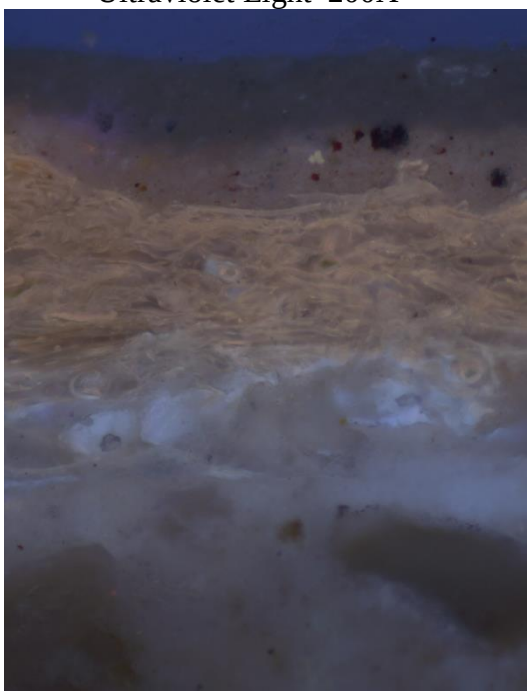


Sample 101-1A. South arch inside alcove (compare to 101-9). This sample was taken with the goal of learning more about the coatings that predate the wood pulp-based wallpaper observed in sample 101-9, a sample that was not cast for cross-section analysis. However, the evidence in this sample shows it is virtually identical to sample 101-3, also from inside the alcove. In this sample there is no paint remaining above the soft tannish plaster, as the wood pulp-based paper was applied to the plaster substrate. Examination of the uncast portion of sample 101-9 shows at least three generations of cream-colored paint above a thin white finish plaster layer that was applied to the later reddish browncoat, none of which were found in this sample from the plaster inside the alcove.

Sample 101-1A. South arch inside alcove (compare to 101-9).

Visible Light 200X

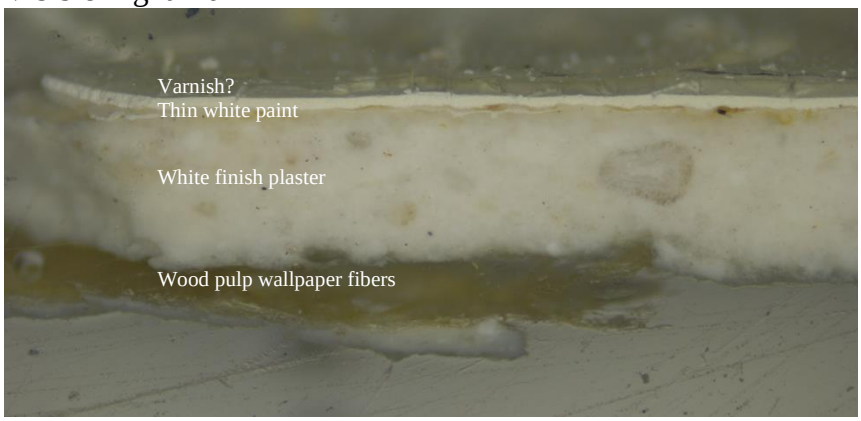
Ultraviolet Light 200X



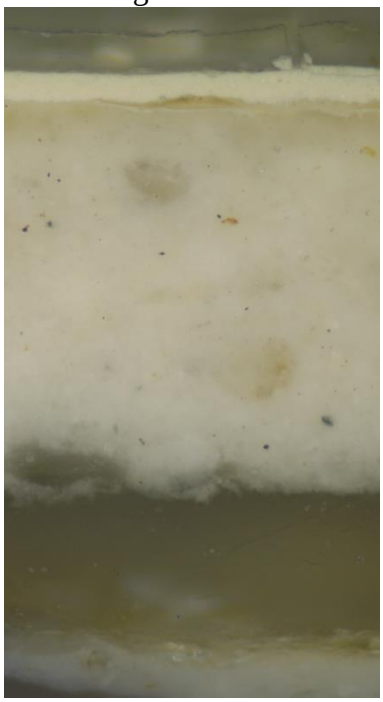
Sample 101-7A. North wall, to the left west window. Looks like 1950s plaster – should have modern history. This cross-section contains one layer of white finish plaster with a few wood pulp wallpaper fibers attached at the bottom. There is just one thin, nonfluorescent, oil-bound white paint on top of the plaster, followed by a thin clear layer of modern varnish.

Sample 101-7A. North wall, to the left west window. Looks like 1950s plaster – should have modern history.

Visible Light 40X

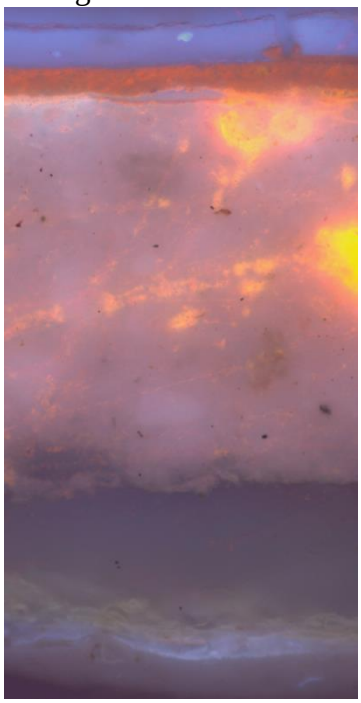


Visible Light 100X



UV Light 100X

UV Light & RHOB for oils



Room 100 Plaster Wall Evidence. One sample of wall plaster in the entry was analyzed during the first phase of analysis, two additional samples were removed on February 23, 1013 by Travis McDonald for comparison, and one additional sample was removed from the wainscot along the stairs by Susan Buck during the on-site work. The most complete samples of this group are 100-5A and 100-1SB, which offer what appears to be a complete early paint stratigraphy for comparison with the other wall plaster samples.

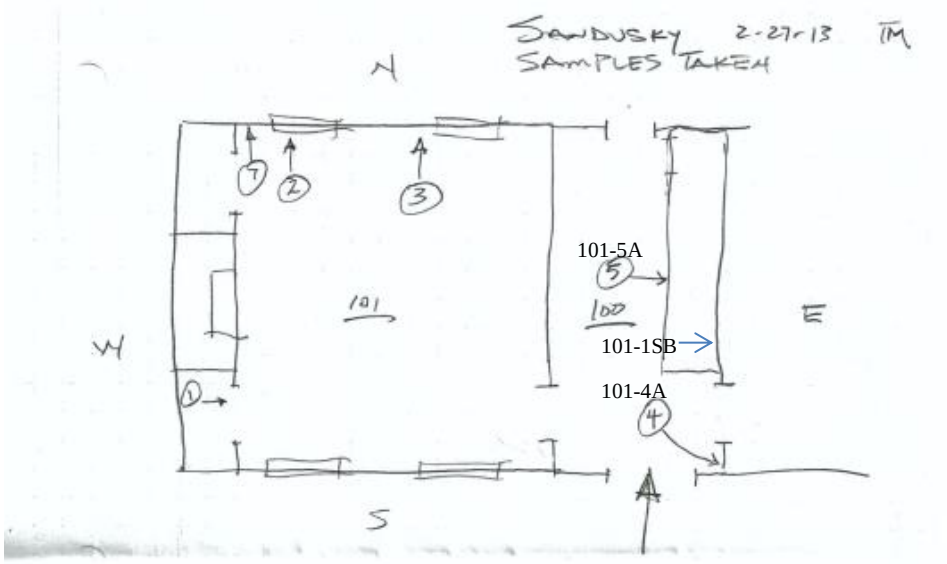
When McDonald looked at the entry area wall paints he observed what he thought were four layers on top of the plaster. His notes are included below:

> Room 100 Plaster Wall
> Observation with a 30X scope
> 1. Plaster
> 2. White (paint? white coat?)
> 3. Greenish-brown (streaky) (Is this the yellow or lavender distemper?)
> 4. White
> 5. Red (only visible in a few places in the SE corner)
>
> Check out new samples 4 or 5 for this sequence (could not get a definite sample of red area).
>
> After modern wallpaper was removed in the passage it was apparent that the reddish lime plaster seen and sampled in the parlor was a 2nd period plaster used for patching – and because it has no finish on it in the passage, it was covered by an earlier wallpaper. Tan mortar of passage looks to be first period. (Likely this found only in room 101 in the alcoves on the inner arches).[2]

Room 100 Entry Plaster Sample Locations
100-12. Taken from under current wallpaper to the left of the door into room 101 at just above the chair rail area. Looks to be original plaster.
100-4A. Plaster, east wall, southeast corner. (Compare to #100-12 and 100-5A).
100-5A. Plaster under stair. (Compare to #100-12).

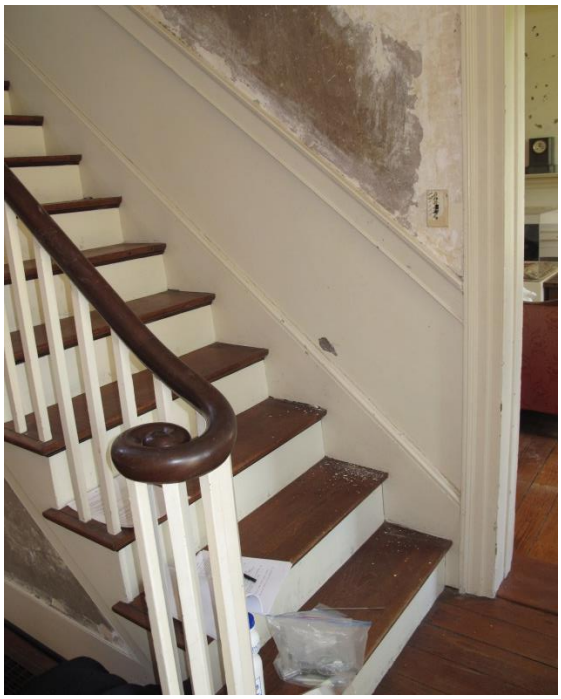
100-1SB. Plaster wainscot, east wall along stair, early plaster?

[2] Travis McDonald, sampling notes, 2-27-13.



Locations of Plaster Sample Removed From Room 100 on April 26, 2013

East Wall Plaster Wainscot



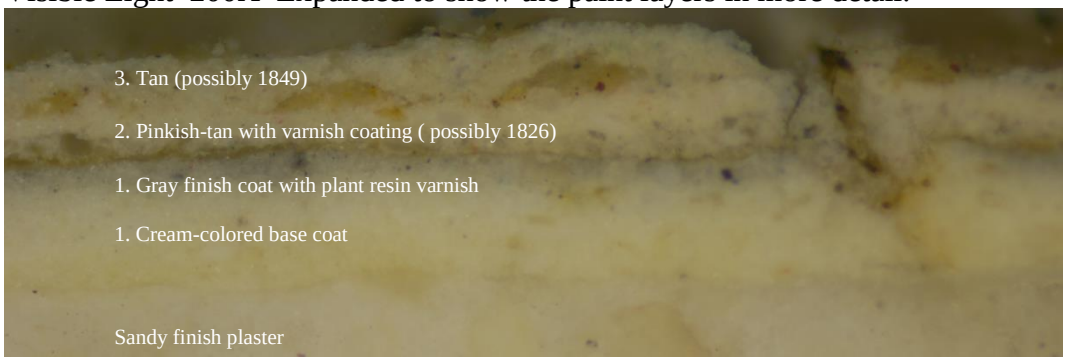
Plaster Wainscot Sample Location

Of all the samples of wall plaster taken, comparative analysis shows that the most complete sequence of early wall coatings are in sample 100-5A from the east wall of the passage, and sample 100-1SB from the east wall below the chair rail along the staircase. Both samples are discussed, compared and illustrated in this section of this report.

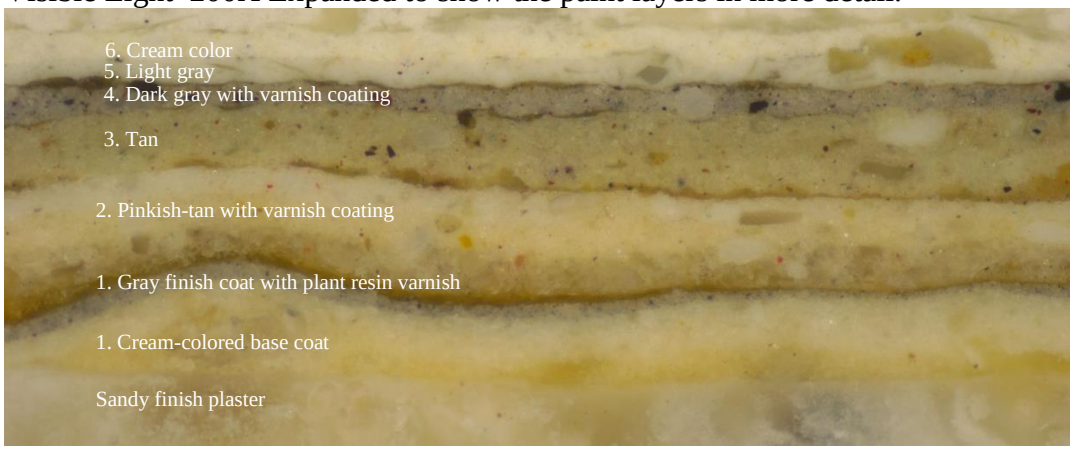
There are three generations of coatings on the sandy white coat of plaster in the cast and uncast portions of sample 100-5A. The substrate is the soft tannish plaster observed by McDonald as the earliest plaster, which means that the first pale gray, varnished finish coat on a cream-colored base coat may date to the first period of the house – ca. 1810-12. The second generation is a pinkish-tan paint which became dirty and cracked before it was painted over with a dark tan paint in generation 3. Binding media analysis with biological fluorochrome stains suggests that generations 1 through 3 are leanly oilbound paints, so the lime plaster must have been allowed to cure for at least several years before the first oil-based layer was applied.

Sample 100-5SB contains what seems to be a complete chronology, with approximately ten generations of paints, beginning with the first three observed in sample 100-5A. But it is even more obvious in this sample that the first generation of paint may be some sort of faux-painted finish because of the uneven nature of the gray layer and the consistent varnish application. Layer-by-layer overpaint removal would be required to reveal any pattern or design in the original finish sequence. If the walls were repainted at the same time as the woodwork, then generation 2, the pinkish-tan, may date to approximately 1826 and generation 3, the tan paint, may date to 1849. The dark gray paint that can be seen on the walls where more recent paints have been removed is generation 4 in sample 100-1SB.

Sample 100-5A. Plaster under stair. (Compare to #100-1SB).
Visible Light 200X Expanded to show the paint layers in more detail.

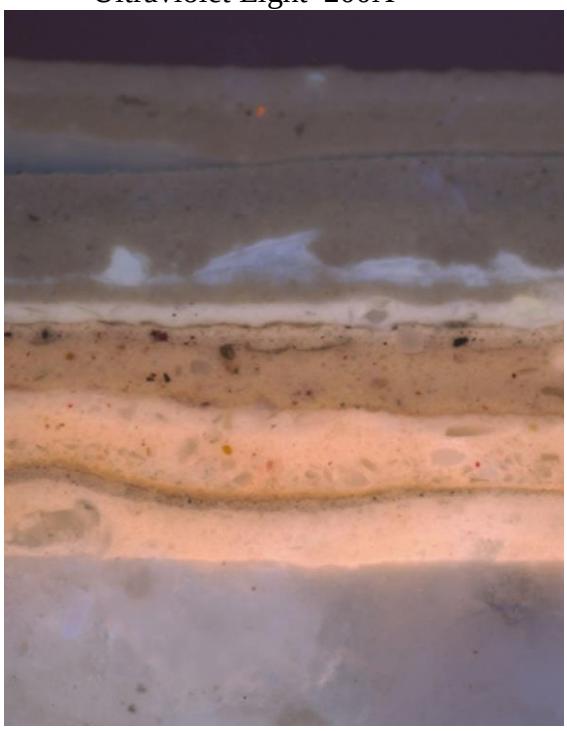


Sample 100-1SB. Plaster wainscot, east wall along stair, early plaster?
Visible Light 200X Expanded to show the paint layers in more detail.



Sample 100-1SB. Plaster wainscot, east wall along stair, early plaster?
Visible Light 200X

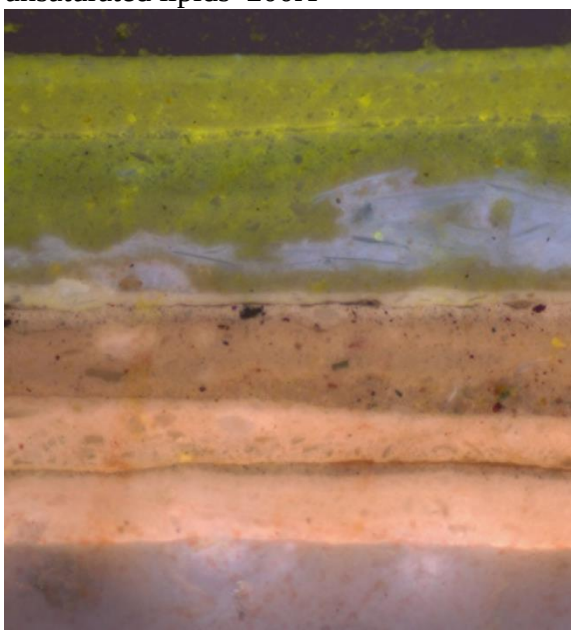
Ultraviolet Light 200X



Sample 100-1SB. Plaster wainscot, east wall along stair, early plaster?

Ultraviolet Light 200X

UV Light & DCF for saturated and unsaturated lipids 200X



Based on the evidence in samples 100-1SB and 100-5A the wall paint stratigraphy below the chair rail in the entry can be reconstructed in the following manner:

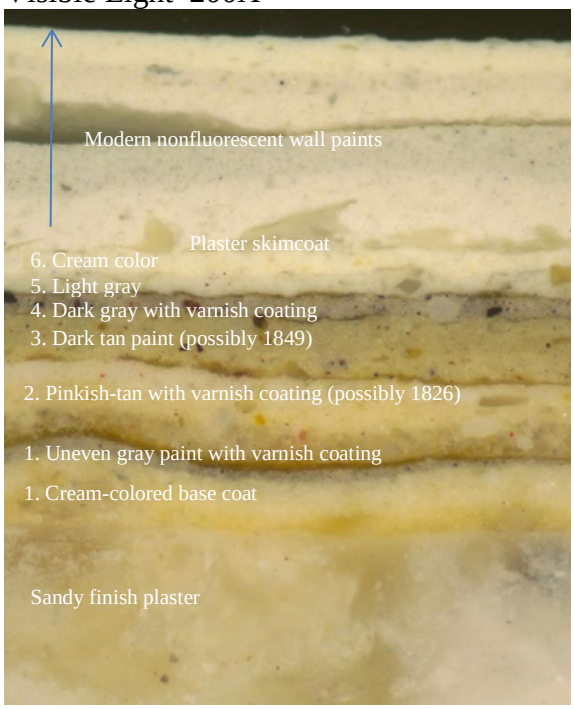
Room 100 Plaster Coatings Chronology

Generation/Layer	Observations
10. Cream-colored oil paint	Possible 1950s
9. Wood-pulp-based wallpaper	
Bright white skimcoat	
8. Lavender distemper with red glaze	Possible decorative scheme
7. Cream-colored distemper	
White plaster skimcoat	
6. Cream color	
5. Light gray	
4. Varnish coating	
4. Dark gray	Dark gray exposed in patches on the walls
3. Tan paint	Possible 1849
2. Plant resin varnish	
2. Pinkish-tan paint	Possible ca. 1831-41
1. Plant resin varnish	
1. Gray finish coat	Possible faux finish ca. 1812
1. Cream-colored base coat	
Sandy white finish plaster	
Sandy tannish browncoat	

Uncast portion of sample 100-1SB photographed at 40X to show the earliest layers on the sandy white finish plaster

The samples taken from under the current wallpaper seem to represent paint schemes that were applied only above the chair rail, not below the chair rail, as none of the coating layers match up with samples 100-1SB or 100-5A. When the cross-sections are compared it is possible to see that the sandy whitish plaster substrate is the same in all the samples, and that the first cream-colored distemper on the plaster above the chair rail may relate to the possible gray faux finish below the chair rail. Similarly, the second generation above the chair rail seems to consist of a lavender base coat paint with a thin red layer, possible a decorative design layer, above the lavender paint. The absence of any other early paint evidence above generation 2 suggests the walls were wallpapered on top of the lavender paint scheme.

Sample 100-1SB. Plaster wainscot, east wall along stair, early plaster?
Visible Light 200X



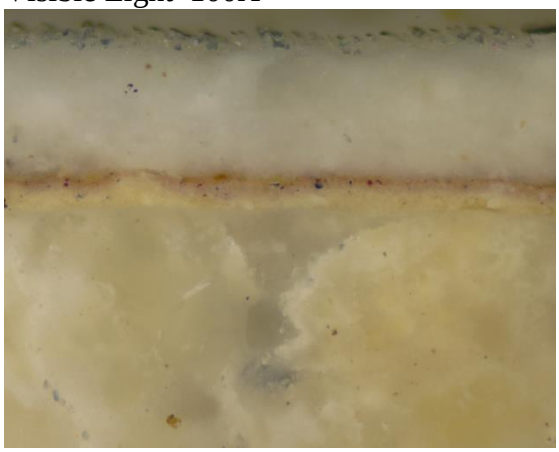
100-4A
Visible Light

100-12

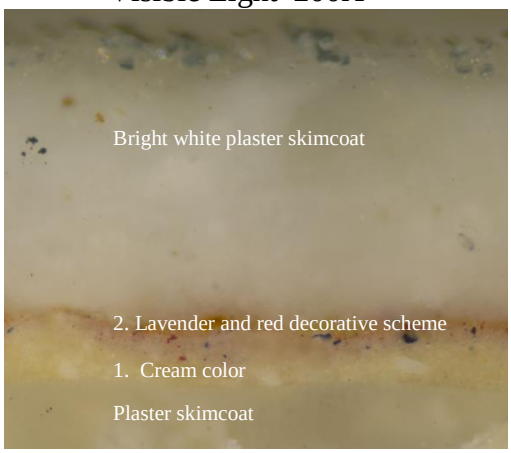
Sample 100-12. Taken from under current wallpaper to the left of the door into room 101 at just above the chair rail area. This sample was taken from an area of wall thought by Travis McDonald to be original plaster. There are three thin, slightly translucent coatings on top of whitish plaster that could represent two periods of decoration. The first layer is a cream-colored distemper (pigments bound in dilute hide glue) that has a thin film of dirt on its surface. The second generation appears to be two thin layers of distemper – deep lavender followed by red – that may represent an early decorative scheme. There is a later white bright skimcoat of plaster which has trapped these early paints. All the layers in the cross-section reacted positively for the presence of proteins with the fluorochrome FITC for proteins. The distemper paints in this sample are essentially the same as those found in sample 100-4A.

Sample 100-12. Taken from under current wallpaper to the left of the door into room 101 at just above the chair rail area.

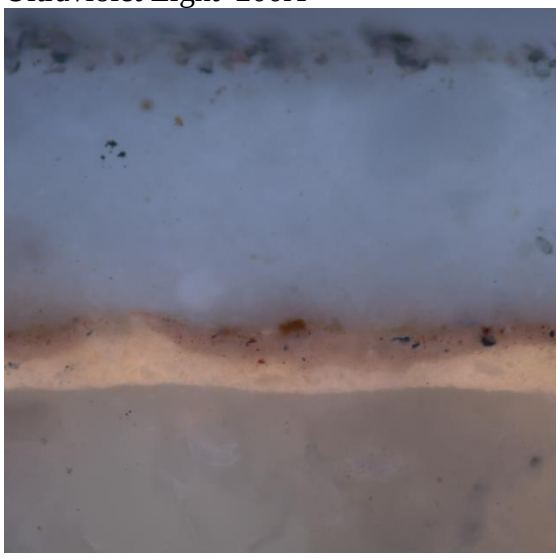
Visible Light 100X



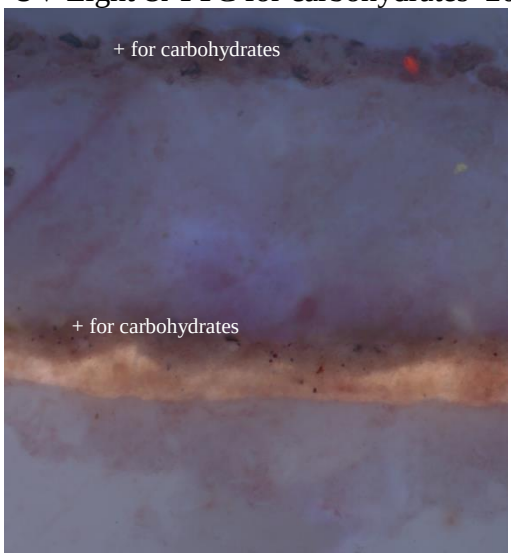
Visible Light 200X



Ultraviolet Light 200X

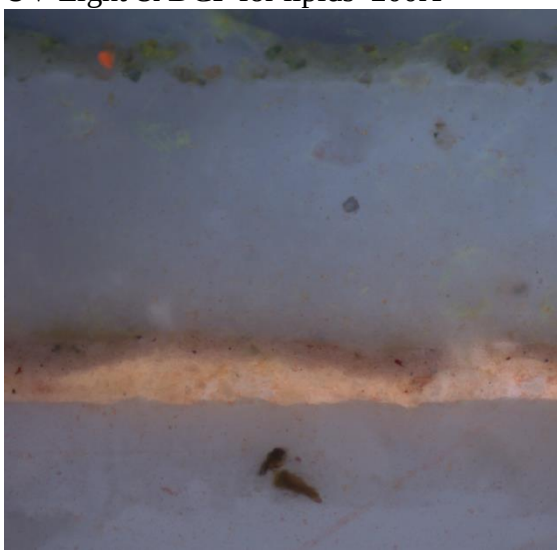


UV Light & TTC for carbohydrates 200X

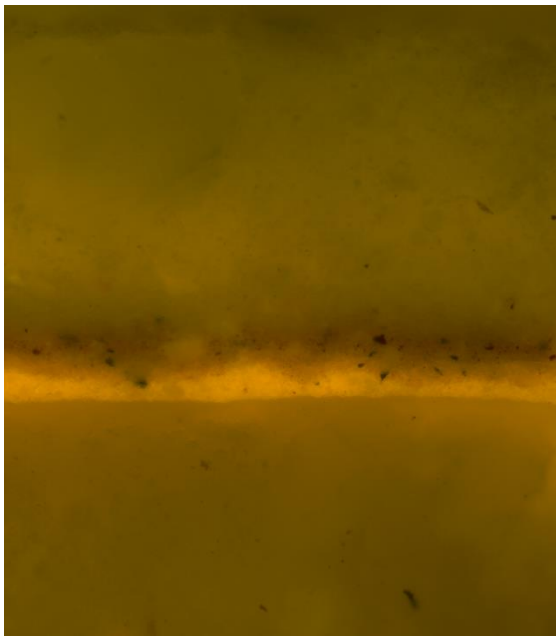


Sample 100-12. Taken from under current wallpaper to the left of the door into room 101 at just above the chair rail area.

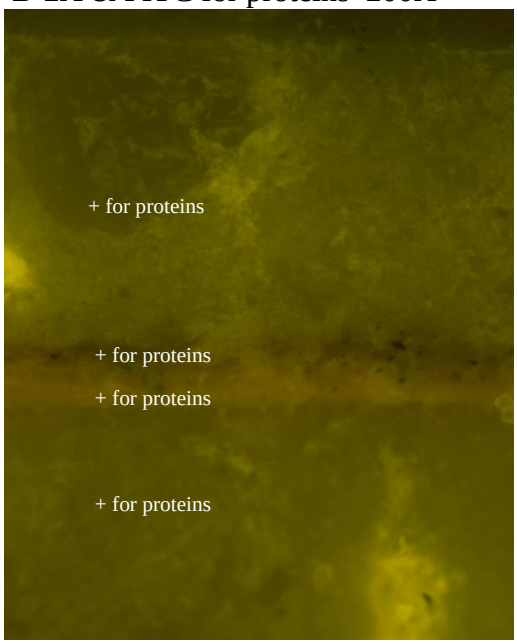
UV Light & DCF for lipids 200X



B-2A filter 100X



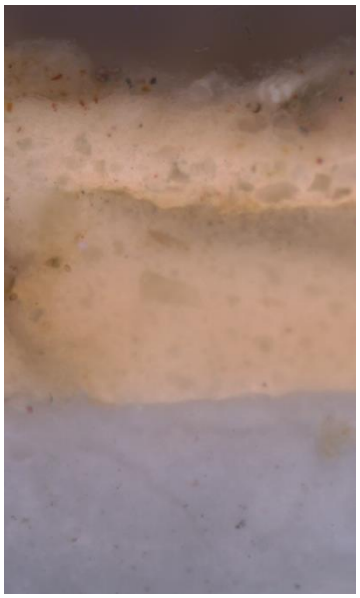
B-2A & FITC for proteins 200X



Sample 100-5A. Plaster under stair. (Compare to #100-12).
Visible Light 200X

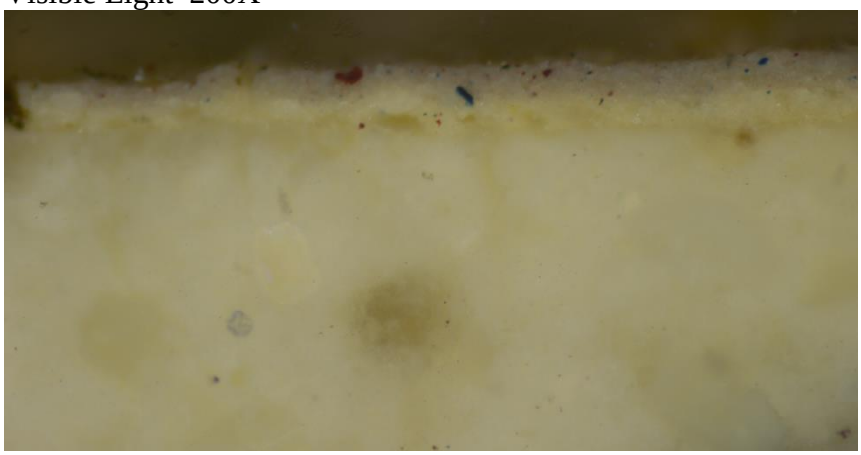
Visible Light 400X

UV Light 200X

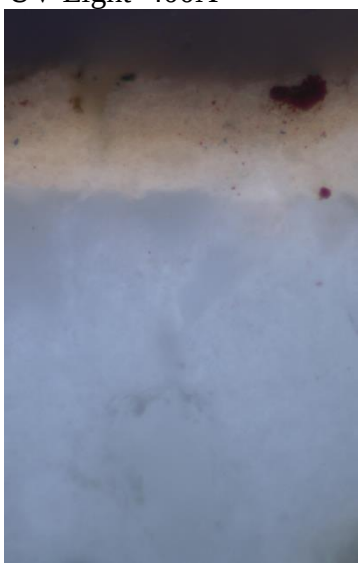


UV Light & DCF for lipids 200X
Weak + oil reactions in paints

Sample 100-4A. Plaster, east wall, southeast corner. (Compare to #100-12 and 100-5A).
Visible Light 200X



Visible Light 400X UV Light 400X UV Light & DCF for lipids



Conclusion:

There is enough early oil-based paint evidence remaining on the original entry woodwork to suggest that when it was first painted the entry was a monochromatic gray. At the same time there appears to have been a gray-painted faux finish on the plaster walls below the chair rail and cream-colored distemper paint above the chair rail in this space.

The original woodwork paint scheme in the parlor was a two-color combination of alternating blue and gray paints on the trim, with gray baseboards, door and window sashes. The same gray paint was used in the entry and parlor woodwork at this time. Unfortunately, there is no early wall paint evidence remaining in the parlor.

Paint archaeology indicates that paint generation 2 coincides with the installation of the alcove woodwork in the parlor. Perhaps this change dates to 1826-41 when the Otey family acquired the house. The first paint treatment on the alcove woodwork consists of a dull pink/dull green paint scheme found on the original woodwork as generation 2 in the parlor. At the same time, the surbase, cap molding and door were grain-painted, possibly to replicate figured mahogany.

The second generation of woodwork paint in the entry (possibly 1826) was a light blue-gray paint with the same type of mahogany graining on the doors as the parlor. In generation 3 the evidence suggests that the entry and parlor woodwork were painted in a monochromatic manner with the same cream-colored, oil-bound paint. There is more wall paint evidence remaining in the entry, and some of the early coating sequences above and below wainscot level on the walls seem to represent decorative painting. Cross-section analysis can only provide a glimpse into the colors of these early decorative finishes, not their patterns. Selective overpaint removal will be needed to reveal larger areas of the early decorative finishes on the walls and the woodwork to better understand their pattern and appearance.

Important early wall coatings are missing in the parlor, which might mean that the parlor walls were generally wallpapered early on, but it is not possible to date or identify early wallpaper treatments in either space. It is possible that the east parlor may retain more wall and woodwork evidence which will help to interpret how these three room related in terms of paint and wallpaper treatments.

The discovery of important early paint evidence in both of these rooms reinforces the importance of saving all historic paint evidence when the rooms are repainted. There is always more to learn about traditional painted surfaces as analytical techniques and overpaint removal methods are improved and refined, but this cannot be done if evidence is lost through sanding and/or paint stripping.

The following table provides a synopsis of the paint findings in generations 1 through 4 in both rooms.

Comparative Paint Findings By Period in the Parlor and Entry

Room/Element	1810-12	1826-41	1849	1877	Observations
Parlor					
Woodwork	Gray/blue	Dull pink/dull green, with grained surbase and wainscot cap	Cream color	Off-white	
Walls	Unknown	Unknown	Unknown	Unknown	
Doors	Gray	Grained, possibly mahogany	Grained, possibly oak	Off-white	Layer-by-layer overpaint removal required to reveal graining patterns on doors
Baseboards	Gray	Dull pink	Cream color	Off-white	Cross-section analysis suggested the baseboards were darker gray, but color-matching showed the baseboards were the same gray
Sash	Gray	Dull pink	Likely cream color	Likely off-white	
Entry					
Woodwork	Gray	Light blue-gray	Cream color	Tan	
Walls, above and below chair rail level	Cream-colored distemper above/gray faux finish below	Lavender/thin red distemper above/glossy pinkish-tan below	Wallpaper above/tan below	Wallpaper above/tan below	Layer-by-layer overpaint removal required to reveal decorative painting on the walls
Doors	Gray	Grained, possibly mahogany	Grained, possibly oak	Dark glossy brown	Layer-by-layer overpaint removal required to reveal graining patterns on doors
Baseboards	Gray	Grained, possibly marbleizing	Cream color	Likely tan	Layer-by-layer overpaint removal required to reveal marbleizing pattern on baseboards
Sash	Gray	Light blue-gray	Likely cream color	Likely tan	

COLOR MATCHING PROCEDURES

Uncast portions of the most intact samples taken from the woodwork in the Entry and Parlor were used for matching with the Minolta Chroma Meter CR-241, a tristimulus color analyzer/microscope with color measurement area of 0.3mm. This instrument has an internal, 360-degree pulsed xenon arc lamp and provides an accurate color measurement in a choice of five different three-coordinate color systems.

The target (original or early) paint layers were exposed with a scalpel at 30X magnification to provide clean areas for color matching. The exposed layers were measured three times in three different areas of the exposed target layers to establish the color coordinates. The measurements were first generated in the Munsell color system (a color standard used in the Architectural Preservation field), and after the measurements were taken the closest Munsell color swatches from a standard Munsell Book of Color (gloss paint standards) was compared under 30X magnification to the actual samples. The measurements were also generated in the CIE L*a*b* color space system, which is currently one of the most widely accepted industry color space measuring systems.

When the earliest paints were too degraded or transparent to allow accurate color measurement, a second round of color matching was done by eye comparing the Munsell swatches to the samples under 30-45X magnifications and a color-corrected light source. The best visual matches for the Munsell swatches were then used to generate close commercial paint matches.

The best commercial swatches are provided for reference.

Period I. Original Gray Woodwork Paint in the Parlor and Entry

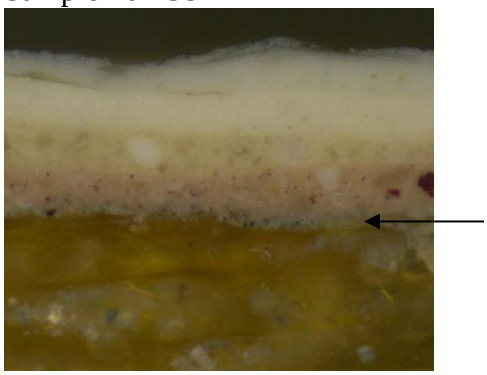
Samples 202-3, 101-6, 101-10, 101-3A, 101-3SB,

Color-matched May 31, 2013

Benjamin Moore #2132-40 "Eclipse"

Color System*		Coordinates	
Munsell	Hue	Value	Chroma
	2.3PB	5.0	1.0
CIE L*a*b*	Black to White	Green to Red	Blue to Yellow
	L50.86	a-0.81	b-4.30

Sample 101-3SB



The ca. 1810-12 gray woodwork and baseboard paint was too darkened and degraded to match accurately, so a color match was made by eye at 30X under a color-corrected light source. The commercial match #2132-40 is an excellent visual match to best surviving areas of the original gray oil-bound woodwork paint.

Period I. Original Blue Woodwork Paint in the Parlor

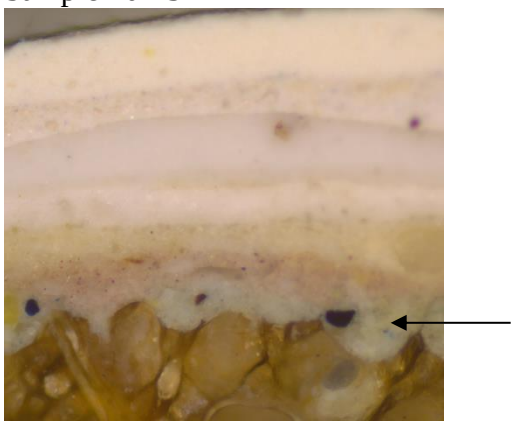
Samples 101-5, 101-2SB

Color-matched May 31, 2013

Benjamin Moore #HC-148 "Jamestown blue"

Color System*		Coordinates	
Munsell	Hue	Value	Chroma
	6.8B	6.1	2.5
CIE L*a*b*	Black to White	Green to Red	Blue to Yellow
	L61.96	a-6.67	b-8.19

Sample 101-5



The ca. 1810-12 blue woodwork paint was too darkened and degraded to match accurately, so a color match was made by eye at 30X under a color-corrected light source. The commercial match #HC-148 is an excellent visual match to best surviving areas of the original blue woodwork paint used as part of a two-tone palette.

Period II. Pink Woodwork Paint in the Parlor

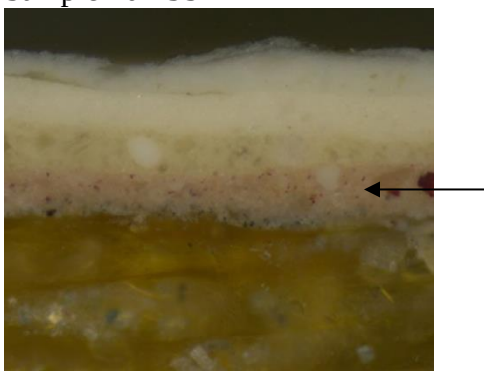
Samples 101-3, 101-6, 101-9

Color-matched May 31, 2013

Benjamin Moore #2173-40 "Antique rose"

Color System*		Coordinates	
Munsell	Hue	Value	Chroma
	8.8R	6.3	4.8
CIE L*a*b*	Black to White	Green to Red	Blue to Yellow
	L63.69	a+19.09	b+16.11

Sample 101-3SB



The ca. 1826 pink woodwork paint was too darkened and degraded to match accurately, so a color match was made by eye at 30X under a color-corrected light source. The commercial match #2173-40 is an excellent visual match to best surviving areas of the second-generation pink paint used as part of the two-tone palette for the woodwork.

Period II. Green Woodwork Paint in the Parlor

Sample 101-2SB

Color-matched May 31, 2013

Benjamin Moore #HC-132 "Harrisburg green"

Color System*		Coordinates	
Munsell	Hue	Value	Chroma
	5.3G	6.5	2.7
CIE L*a*b*	Black to White	Green to Red	Blue to Yellow
	L66.09	a-14.76	b+5.47

Sample 101-2SB

The ca. 1826 green woodwork paint was too darkened and degraded to match accurately, so a color match was made by eye at 30X under a color-corrected light source. The commercial match #HC-132 is an excellent visual match to best surviving areas of the green paint used as part of the two-tone palette in this room.

Period II. Blue-Gray Woodwork Paint in the Entry

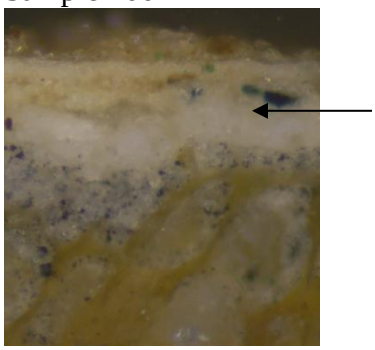
Sample 100-11, 100-12, 100-18, 100-2SB

Color-matched May 31, 2013

Benjamin Moore #2131-50 "Nimbus gray"

Color System*			Coordinates
Munsell	Hue	Value	Chroma
	7.5B	6.8	1.3
CIE L*a*b*	Black to White	Green to Red	Blue to Yellow
	L68.55	a-3.71	b-4.56

Sample 100-12



The ca. 1826 blue-gray woodwork paint was too darkened and degraded to match accurately, so a color match was made by eye at 30X under a color-corrected light source. The commercial match #2131-50 is an excellent visual match to best surviving areas of the monochromatic blue-gray paint in this passage.

Period III. Cream-colored Woodwork Paint in the Parlor and Entry

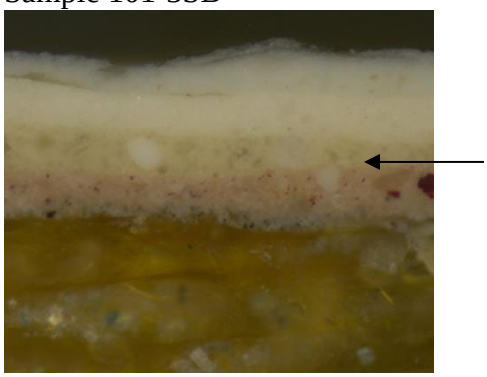
Samples 101-5, 101-3SB, 100-12, 101-3A, 100-14

Color-matched May 31, 2013

Benjamin Moore #OC-36 "Niveous"

Color System*		Coordinates	
Munsell	Hue 6.2Y	Value 8.8	Chroma 1.6
CIE L*a*b*	Black to White L88.76	Green to Red a-2.19	Blue to Yellow b+11.72

Sample 101-3SB



The ca. 1849 cream-colored woodwork paint was too darkened and degraded to match accurately, so a color match was made by eye at 30X under a color-corrected light source. The commercial match #OC-36 is an excellent visual match to best surviving areas of the third-generation cream-colored paint.

*** COLOR SYSTEMS** Derived from the Minolta CR-241 Instruction Manual and Minolta Precise Color Communication

Chroma Meter CR-241 offers five different color systems for measuring absolute chromaticity: CIE Yxy (1931), L*a*b* (1976), and L*C*H* (1976) colorimetric densities DxDyDz; Munsell notation and four systems for measuring color differences.

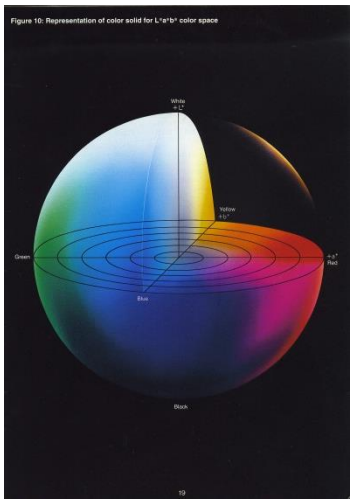
For two colors to match, three quantities defining color must be identical. These three quantities are called tristimulus values X, Y, and Z as determined by CIE (Commission Internationale de l=Eclairage) in 1931.

Color as perceived has three dimensions: hue, chroma and lightness. Chromaticity includes hue and chroma (saturation), specified by two chromaticity coordinates. Since these two coordinates cannot describe a color completely, a lightness factor must also be included to identify a specimen color precisely.

Munsell Color System: The Munsell color system consists of a series of color charts which are intended to be used for visual comparison with the specimen. Colors are defined in terms of the Munsell Hues (H; indicates hue), Munsell Value (V; indicates lightness), and Munsell Chroma (C; indicates saturation) and written as H V/C.

CIE Yxy (CIE 1931): In the Yxy (CIE 1931) color system, Y is a lightness factor expressed as a percentage based on a perfect reflectance of 100%, x and y are the chromaticity coordinates of the CIE x, y Chromaticity Diagram.

CIE L*a*b*: Equal distances in the CIE x,y Chromaticity Diagram do not represent equal differences in color as perceived. The CIE L*a*b* color system, however, more closely represents human sensitivity to color. Equal distances in this system approximately equal perceived color differences. L* is the lightness variable; a* and b* are the chromaticity coordinates.



ΔE: ΔE (Delta E) is the industry measure used to determine how closely two colors match in the CIE L*a*b*. The symbol Δ means "the change in". It is based on calculating the sum of the differences between each measure. The calculation is: $\Delta E = \sqrt{(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2}$, or, the color difference equals the square root of the squared sums of the differences between each of the three L* a* b* tristimulus values. Industry color standards indicate a ΔE of 1 is barely perceptible to the human eye, and ΔE of 6 to 7 is acceptable for color matches in the printing industry.

REFERENCES

Cross-section Preparation Procedures:

The samples were cast into mini-cubes of polyester resin (Excel Technologies, Inc., Enfield, CT). The resin was allowed to cure for 24 hours at room temperature and under ambient light. The cubes were then ground to expose the cross-sections, and dry polished with 400 and 600 grit wet-dry papers and Micro-Mesh polishing cloths, with grits from 1500 to 12,000.

Cross-section microscopy analysis was conducted with a Nikon Eclipse 80i epi-fluorescence microscope equipped with an EXFO X-Cite 120 Fluorescence Illumination System fiberoptic halogen light source and a polarizing light base using SPOT Advanced software (v. 4.6) for digital image capture and Adobe Photoshop CS for digital image management. Photographs and digital images of the best representative cross-sections are included in this report. UV photographs were taken with the UV-2A filter in place (330-380 nanometers excitation with a 400 nm dichroic mirror and a 420 nm. barrier filter). Please note that the colors in the printed photomicrographs may not accurately reflect the actual color of the samples because the colors in the digital images are affected by the variability of color printing.

The following fluorescent stains were used for examination of the samples:

> Alexafluor 488 (ALEXA) 0.02% in water, pH 9.0, with 0.05M borate and 5% DMF. Positive reaction for proteins is yellowish-green under the B-2A filter.
>
> Triphenyl tetrazolium chloride (TTC) 4.0% in ethanol to identify the presence of carbohydrates (starches, gums, sugars). Positive reaction color is dark red or brown.
>
> 2, 7 Dichlorofluorescein (DCF) 0.2% in ethanol to identify the presence of saturated and unsaturated lipids (oils). Positive reaction for saturated lipids is pink and unsaturated lipids is yellow.
>
> Rhodamine B (RHOB) 0.06% in ethanol to identify the presence of oils. Positive reaction color is bright orange.
>
> N-(6-methoxy-8-quinolyl)-p-toluenesulfonamide (TSQ) 0.2% in ethanol to mark the presence of Zn in the cast cross-section. Positive reaction color is bright blue-white.

The best cross-section photographs for each area were included in this report. Photographs were taken at 100X, 200X and 400X magnifications.

Information Provided by Ultraviolet Light Microscopy:

When viewed under visible light, cross-sections which contain ground, paint and varnish may often be difficult to interpret, particularly because clear finish layers look uniformly brown or tan. It may be impossible using only visible light to distinguish between multiple varnish layers. Illumination with ultraviolet light provides considerably more information about the layers present in a sample because different organic, and some inorganic, materials autofluoresce (or glow) with characteristic colors.

There are certain fluorescence colors which indicate the presence of specific types of materials. For example: shellac fluoresces orange (or yellow-orange) when exposed to ultraviolet light, while plant resin varnishes (typically amber, copal, sandarac and mastic) fluoresce bright white. Wax does not usually fluoresce; in fact, in the ultraviolet it tends to appear almost the same color as the polyester casting resin. In visible light wax appears as a somewhat translucent white layer. Paints and glaze layers which contain resins as part of the binding medium will also fluoresce under ultraviolet light at high magnifications. Other materials such as lead white, titanium white and hide glue also have a whitish autofluorescence.

There are other indicators which show that a surface has aged, such as cracks which extend through finish layers, accumulations of dirt between layers, and sometimes diminished fluorescence intensity, especially along the top edge of a surface which has been exposed to light and air for a long period of time.

Pigment Preparation

Pigments from individual paint layers were dispersed and crushed onto microscope slides with a scapel. These dispersed samples were permanently mounted under cover slips with Cargille MeltMount with a refractive index of 1.66. The samples were examined under plane polarized transmitted light and crossed polars (darkfield) at 400X and 1000X, and the unknown pigments were compared to standard pigment reference samples.

Historic Sandusky
Parlor and Entry Woodwork Sample Locations
First Set of Samples removed November 13, 2012 by Travis McDonald
Second Set of Samples ("A") removed February 27, 2013 by Travis McDonald

Room 101 Parlor Woodwork
101-1. West window trim, north wall.
101-2. West window trim, south wall (similar to 1).
101-3. South wall base molding below east window (compare to 4).
101-4. West wall baseboard in alcove to see if alcove pilaster is first period.
101-5. East wall, small applied molding on wainscot.
101-6. South wall, flat field of wainscot, southwest corner.
101-7. East wall, one sample from unpainted top of door, other samples from painted face of door, door may have originally been varnished.
101-8. Pilaster of north alcove (similar to 9).
101-9. Pilaster of south alcove (similar to 8).
101-1A. South arch inside alcove (compare to 101-9).
101-2A. North wall window sill (compare to trim of 101).
101-3A. North wall just below cap of surbase, to left of east window (compare to trim of 101).

Room 100 Entry Woodwork
100-10. Door D1, south wall, possible varnish under layers of paint.
100-11. North wall, back door architrave (similar to 12 and 18).
100-12. South wall, part of tripartite doorway with sidelight (similar to 11 and 18).
100-13. South wall, surbase east of doorway.
100-14. East wall, base molding below stair (similar to 3 or 4?).
100-15. West wall, door to room 101, might have been varnished (similar to 7 or 10?).
100-16. North wall door, might be like 10 and 15.
100-17. Loose window putty on shelf above door from lunette window. Might be similar to architrave trim 11, 12, 18.
100-18. Front door architrave, might be similar to 11, 12, 17.

Historic Sandusky
Parlor and Entry Plaster Sample Locations
Samples removed January 5, 2013 by Travis McDonald
Second Set of Samples ("A") removed February 27, 2013 by Travis McDonald

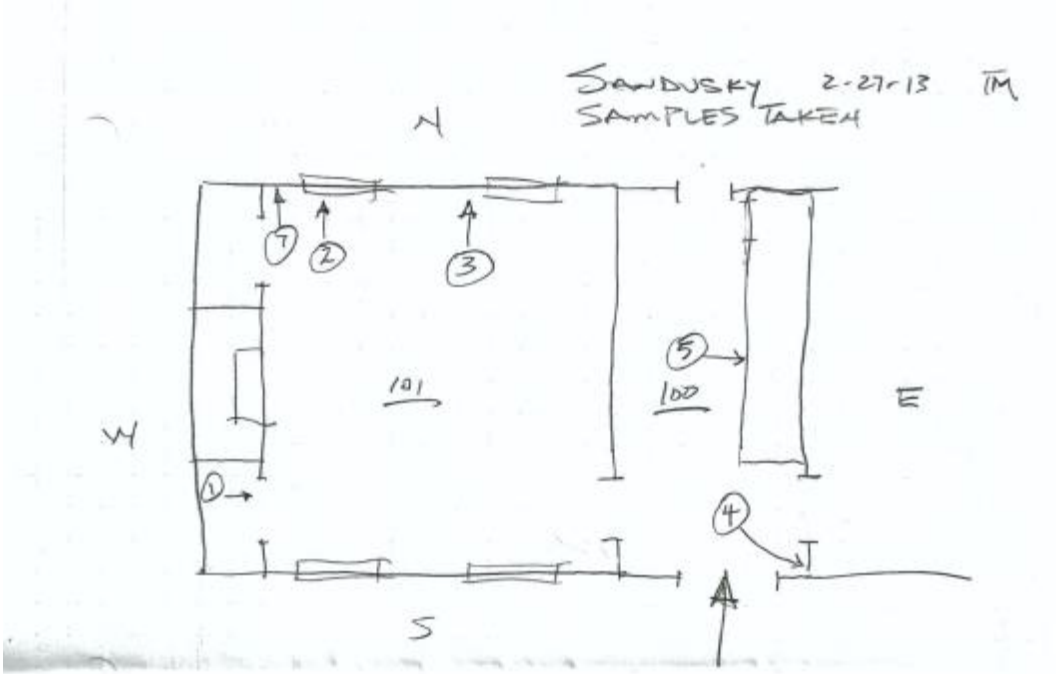
Room 101 Parlor Plaster
101-1. Wall plaster from south wall between windows at about 6' above floor.
101-2. Wall plaster from south wall in alcove. Should be similar to 1 but paint sequence might be different if the inner walls of alcove were not always painted when the room was painted.
101-3. Wall plaster from inside of south alcove, east wall above arch on riven lath. Sample has wallpaper on it. Soft tan mortar is different from soft reddish mortar and is possibly first period mortar.

101-4. Wallpaper on soft tan mortar from above the arch on the inside of the south alcove. Not sent for analysis, but similar to paper in sample 3.
101-5. Wall plaster of soft reddish color to right of fireplace mantel. Should be similar to samples 1, 2, and 9.
101-6. Soft tan plaster from north alcove on the inside above the arch, on riven plaster. Plaster, paint and paper that is probably similar to sample 3.
101-7. Plaster from same area as 6. Not sent for analysis.
101-8. Plaster from north wall in north alcove. Hard tan plaster like that found on the east wall.
101-9. Wall plaster from north wall between the windows near picture nail area of the soft reddish type similar to samples 1, 2, and 5.
101-10. Skim coat of plaster, very thin and not consistently on plaster surface, taken from the wall to the right of the door. Hard tan plaster that is probably mid 20C. Not sent for analysis.
101-11. Same as 10, but from above the doorway. Not sent for analysis.
101-1A. Paper on what appears to be early plaster. At least first period alcove. Is there any better evidence on these samples re: finish on the plaster?
101-7A. North wall, to the left west window. Looks like 1950s plaster – should have modern history.

Room 100 Entry Plaster

100-12. Taken from under current wallpaper to the left of the door into room 101 at just above the chair rail area. Looks to be original plaster.
100-13. Wall plaster sample taken from the stair landing area to the right of the window above the chair rail. One of the two choices with 12 for analysis.
100-14. Room 100 ceiling plaster, probably original, taken from the cellar stair area where the plaster on riven lath is exposed. Not sent for sampling.
100-15. Sample of room wall plaster (plaster key), probably original, taken from the cellar stair area where the plaster is seen on riven lath. Not sent for analysis.
100-4A. Plaster, east wall, southeast corner. (Compare to #100-12 and 100-5A).
100-5A. Plaster under stair. (Compare to #100-12).

Note: Room 100's wall plaster sample should show evidence of current 20C wallpaper glue whereas the recent removal of 20C wallpaper in room 101 was done with a vinegar wash to remove glue residue.



ROOM 100 PLASTER WALL
OBSERVATION W/ 30X SCOPE

1. PLASTER
2. WHITE (PAINT? WHITE COAT?) OR LAVENDE
3. GREENISH-BROWN (STREAKY) (IS THIS THE YELLOW DIS
4. WHITE
5. RED (ONLY VISIBLE IN A FEW PLACES IN SE COR

CHECK OUT NEW SAMPLES #4, 5 FOR THIS SEQUENCE
(COULD NOT GET A DEFINITE SAMPLE OF RED AREA)

AFTER THE MODERN WALLPAPER WAS REMOVED IN THE PA
IT WAS APPARENT THAT THE REDDISH LIME PLASTER SE
AND SAMPLED IN THE PARLOR WAS A 2ND. PERIOD PLA
USED FOR PATCHING – AND BECAUSE IT HAS NO FINISH ON
IN THE PASSAGE, IT WAS COVERED BY AN EARLIER WALLP
TAN MORTAR OF PASSAGE LOOKS TO BE 1ST. PER. (LIKELY TH
ONLY FOUND IN RM. 101 IN THE ALCOVES ON THE INNER ARCHE