Cross-section Microscopy Report

54 Hasell Street
Charleston, South Carolina

Investigation of the Interior Paints

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South Elevation, The Colonel William Rhett House
HABS, Louis J. Schwartz, 1963

Purpose:

This paint research project was intended to answer important questions about the early paint treatments in the primary rooms of 54 Hasell Street, known as the Colonel William Rhett House. This paint analysis investigation was done in tandem with a study of the architectural evidence conducted by architectural historian Edward A. Chappell. Cross-section and polarized light microscopy analysis techniques have been used to identify the coatings that remain in each area sampled, and to help relate the paint chronologies in adjacent spaces. This process makes it possible to identify the original paints, or the target period paints, for color-matching for documentation and possible replication with the help of a colorimeter/microscope.

Procedures:

The work began with a meeting at the site on July 11, 2018 with the owner Cheryl Skoog Tague, Historic Charleston Foundation Director of Museums Lauren Northup, and Ed Chappell, to review the potential areas for sampling and to discuss the goals of this project. The sample locations were limited to not more than 30 to meet the priorities and constraints of the project budget. A total of 26 samples were taken for analysis, with two additional samples supplied by Chappell for reference and comparison. Before sampling, all the surfaces were first examined at 30X with a monocular microscope and at 10X with an illuminated loupe to find the most promising sample locations. The samples were about 200 to 400 microns in size and were removed with a microscalpel and placed in labeled baggies for transport. When the paint flakes cleaved away from the wood and plaster substrates they were stored in the same baggies so they could be cast together for analysis.

Before casting, the samples were examined at 45X magnification under a binocular microscope to screen them for duplicates. 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. 5.1) 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 capture and rendering do not accurately represent the actual colors.

Paint Analysis Results

This is a challenging project because of the significant degree of paint removal that has taken place during at least two campaigns of repainting. The first-floor woodwork was particularly aggressively stripped, making paint archaeology (comparisons of paint stratigraphies on original and replacement elements) far more difficult. There are a few areas of woodwork that retain early paints, including the trim for the north door opening in the southwest room, and the cornice in the northeast room, but there are not enough other areas of woodwork that retain intact paint chronologies for comparison. Fortunately, some compelling and informative samples were found on protected areas of plaster, and these can provide some insights into alterations, early colors, and comparative dating. The discussions and illustrations of the paint evidence begin with the southwest room.

Southwest Room:

The decorations in the southwest room are the most complex and ornate of all the spaces, with some elements that can be dated to the 1941 renovations undertaken by Albert Simons under the new ownership of Mr. and Mrs. Benjamin A. Kittredge. The 1940 HABS photograph (below) shows the window in the center of the wall with raised plaster paneling on the walls. This window was closed up and new plaster paneling installed in its stead in 1941. In this photograph the ornate plaster decorations above the windows and north wall door are swags with drops, while the decoration above the north door on the east wall are the leafy scrolls which remain *in situ*.

HABS, C.O. Greene, September 1940

The 1941 renovations also included moving a mantel from the cellar and installing in place of the marble mantel shown in the 1940 HABS photograph below.

HABS, C.O. Greene, September 1940

The decorative plaster and woodwork may date to the 1807 remodeling, based on observations by Chappell. But the entry for this house in *The Buildings of Charleston*, by Jonathan Poston, interprets this as rococo plaster ornamentation as probably added in the third quarter of the eighteenth century. This entry describes the house as being constructed 1712-1728, altered in 1800 and restored and renovated in 1950. The only way to solidly confirm the earliest dates is through dendrochronology because of the extensive interior and exterior alterations.

Relatively protected areas of the applied plaster swags and overmantel were sampled for comparison with what appears to be contemporary raised paneling. One section of 1941 raised plaster paneling on the west wall (where the middle window was closed up) was also sampled for comparative dating of the 1941 and later coatings.

Most of the woodwork in this space was thoroughly stripped of early paints, including the doors. There could have actually been several campaigns of paint stripping on the woodwork, the most recent being in 1941. The door on the north wall was sampled to see if any early coatings remain, as was the cornice of the door opening. The wooden mantel is a replacement and was noted in the 1941 restoration plans as "Mantel from basement reset here." This mantel was examined, but not sampled, as no promising areas were found for sample removal.

Two 1915 black-and-white photographs provided by Cheryl Skoog Tague for reference show the applied plaster decorations are comparatively intact at that time. They also show that the swag decorations above the north wall above the door must have been replaced during the 1941 renovation.

East Wall of Southwest Room c. 1915

Northeast Corner of Southwest Room c. 1915

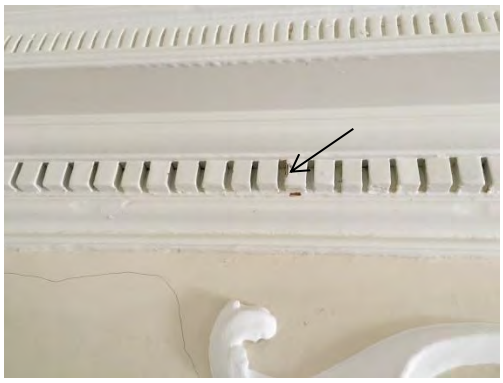
Southwest Room Sample Locations
SW-1. South wall, southeast corner, at right lower edge of raised plaster panel, in chamfer.
SW-2. South wall, southeast corner, at right lower edge of raised plaster panel, at corner of panel.
SW-3. East wall, over north door, plaster below lower right swag.
SW-4. East wall, over north door, on applied plaster leaf form.
SW-5. West wall, replacement section of plaster, chamfer of plaster panel.
SW-6. East wall, cornice in northeast cornice above door, edge of dentil molding.
SW-7. North partition wall door. Top left corner, top right panel.
SW-8. North wall door architrave, cornice, edge of fluting.
SW-9. West wall, swag above door, edge of top left bellflower.

SW-1 and SW-2

SW-3 and SW-4

SW-5

SW-6 cornice



SW-7 and SW-8

Northwest Corner

SW-9

Paint Evidence on Southwest Room Plaster. The most intact paint stratigraphies were found in the cross-sections from the plaster above the north door on the east wall, and on the overmantel decoration. These surfaces retain precious paint accumulations that have never been stripped. Investigations on site suggested that the paints on the overmantel panel decorations matched those on the ornaments above the north door on the east wall.

The paints in samples SW-3 from the wall and sample SW-4 from the applied plaster leaf form can be neatly aligned from generations 1 through 20. Sample SW-3 is missing the off-white paint that appears in generation 21. That particular layer contains the pigment zinc white which dates it to after 1845 when zinc white became commercially available. The comparative plaster stratigraphy can be reconstructed to show that 21 generations of paint were applied to the west wall plaster and the raised plaster paneling before the clear sealant layer that marks the 1941 plaster was applied. This sealant layer has a distinctive

bluish-white autofluorescence and is the first layer on the plaster in sample SW-5 from the 1941 replacement paneling on the west wall.

The comparative evidence in SW-3 and SW-4 suggests that the applied decorations were most often painted the same colors, beginning with deep yellow in the first two generations of paint, followed by off-white in generation 3. In generation 4 the plaster wall was off-white while the decorations were tan. Then in generations 5, 6 and 7 the plaster and raised decorations were all dull pink, then off-white, then dull pink again. The films of dirt between some of the paint generations, and the subtle darkening of the paint surfaces, help to distinguish the paint generations. These long and intact sequences of paints, with notably coarsely ground pigments from generations 1 through 15, suggests the proposed third quarter of the eighteenth century date for the wall plaster is plausible.

Binding media analysis of the plaster paints in SW-3 suggests that all the early paints are bound in oils (with the fluorochrome DCF), with no other organic additives.

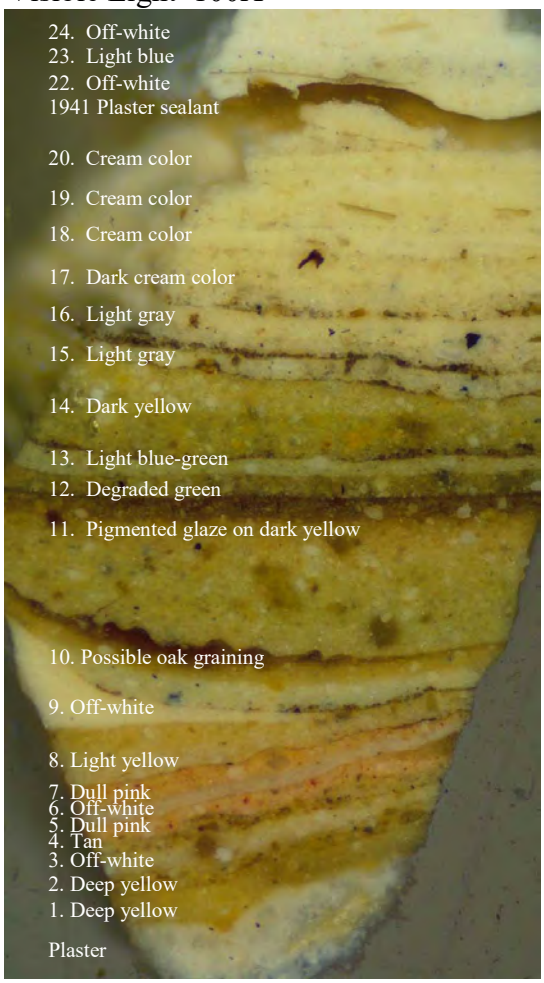
The plaster substrate for SW-3 is a coarse off-white color with clear and tannish sand particles. This plaster matches the plaster substrate in samples SW-1 and SW-2 from the raised paneling on the south wall, helping to confirm that the east wall plaster is the same period as the raised paneling on the south, west and north walls.

It is interesting to note that the plaster used to create the paneling in the southwest room is not nearly as coarse and sandy as the plaster used to create the original raised panel walls in the 1767-84 James Brice House in Annapolis, Maryland. Raised plaster panels have been found in the highest status rooms of many eighteenth-century brick houses in Annapolis, but raised plaster panel walls are unusual in Charleston.

The expanded visible light photomicrographs for samples SW-3 and SW-4 are aligned and labeled on the following page to show the relationships between the paint generations.

SW-3. East wall, over north door, plaster below lower right swag.
Visible Light 100X

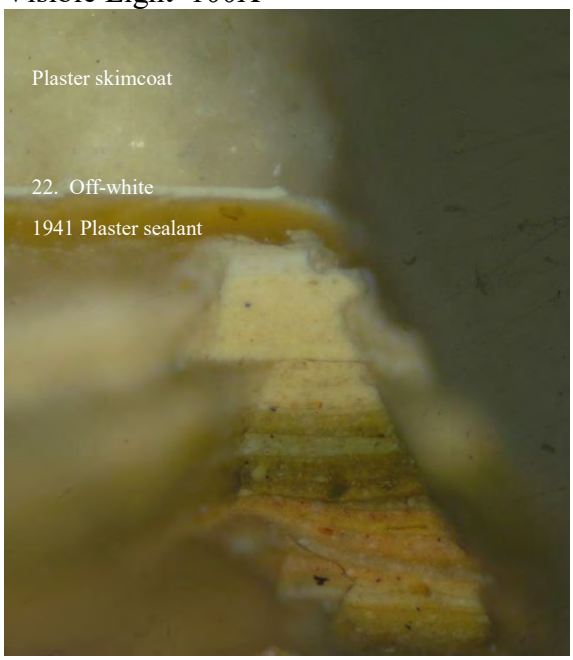
SW-4. East wall, over north door, on applied plaster leaf form.
Visible Light 100X



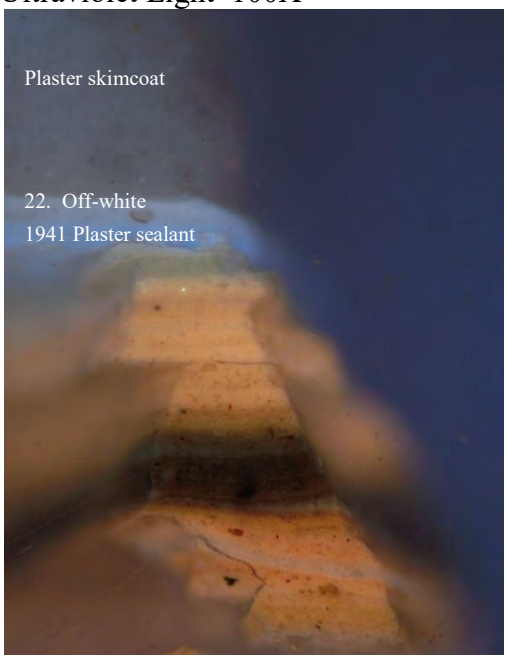
The labeled photomicrographs for samples SW-3 and SW-4 in reflected visible and ultraviolet light follow to show how the variations in autofluorescence colors can help to align the paints and identify the 1941 plaster sealant by its bluish-white autofluorescence,

SW-3. East wall, over north door, plaster below lower right swag.

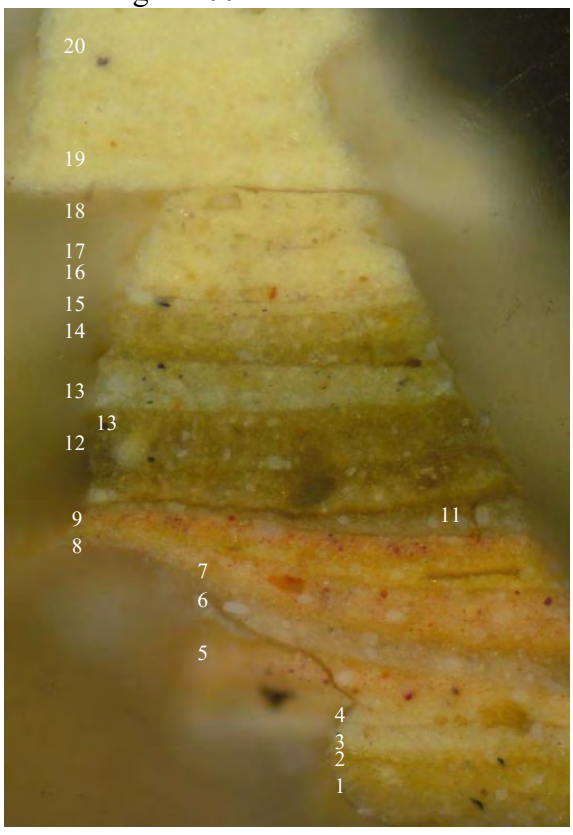
Visible Light 100X



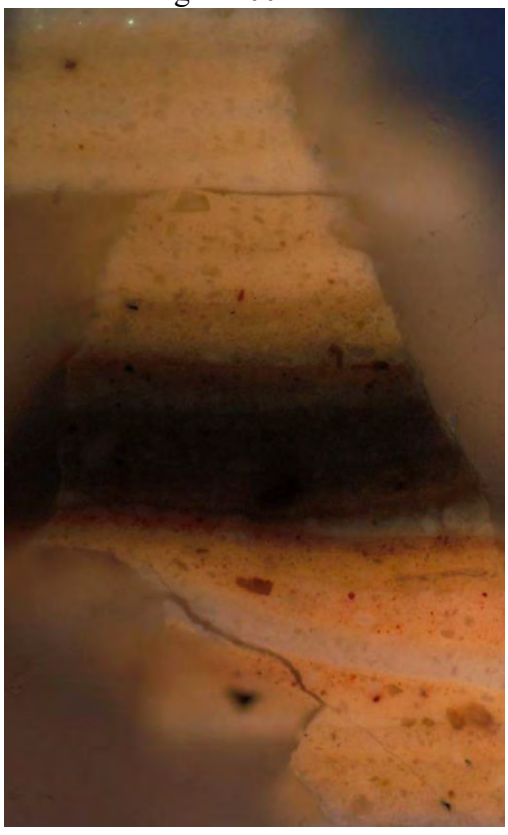
Ultraviolet Light 100X



Visible Light 200X



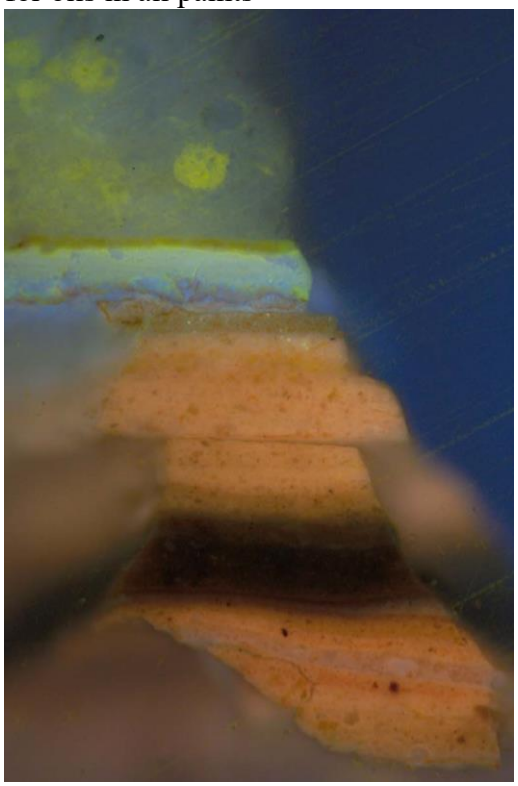
Ultraviolet Light 200X



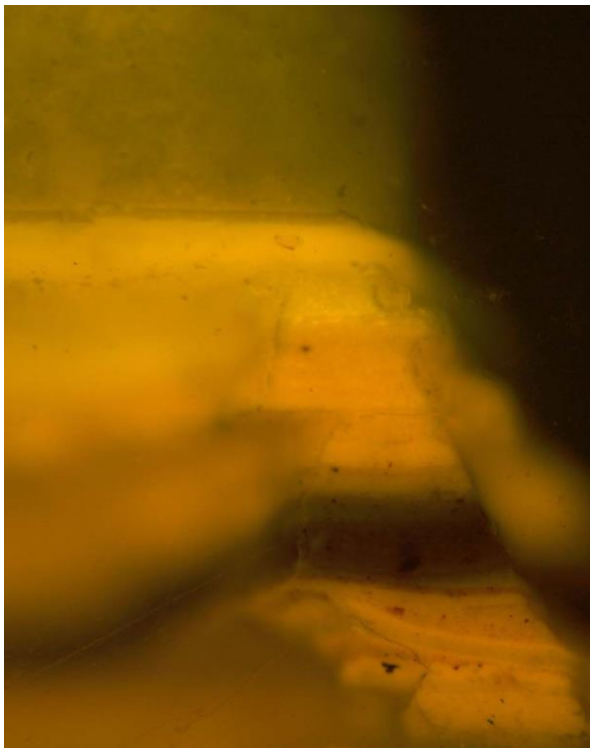
SW-3. East wall, over north door, plaster below lower right swag.

UV Light & TTC for carbohydrates
No reactions

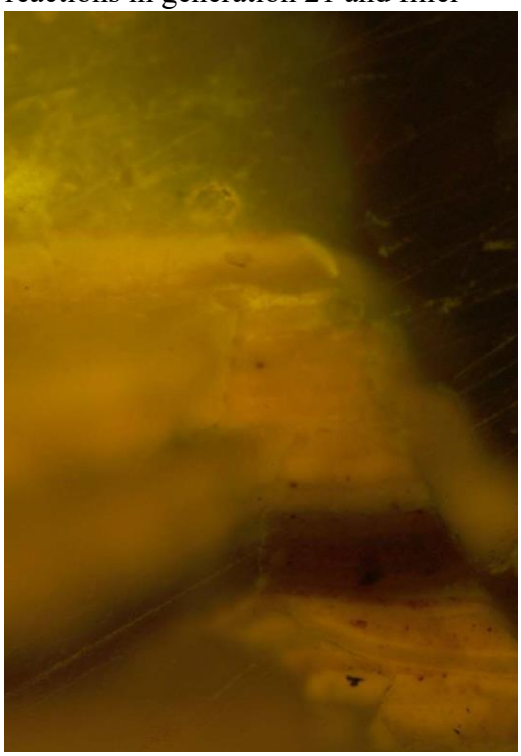
UV Light & DCF for lipids
+ for oils in all paints



B-2A filter 100X

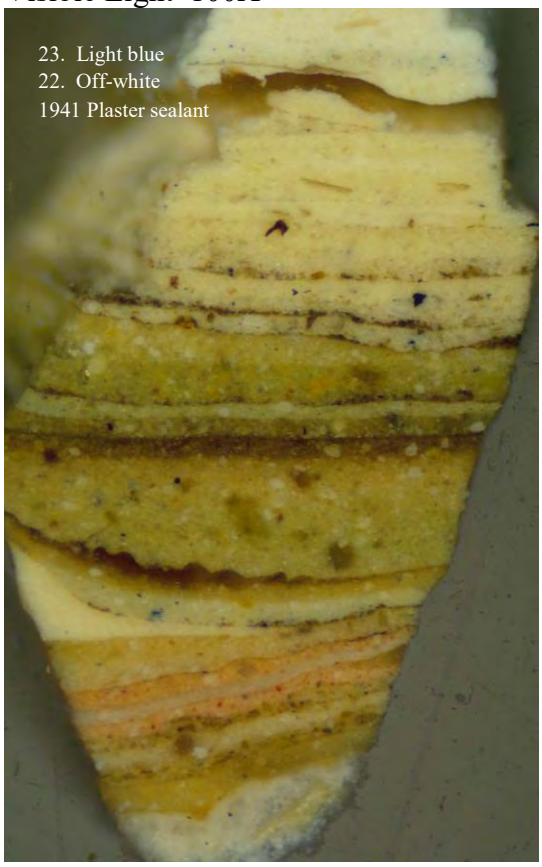


B2-A filter & FITC for proteins
+ reactions in generation 21 and filler



SW-4. East wall, over north door, on applied plaster leaf form.

Visible Light 100X



Ultraviolet Light 100X

Visible Light 200X

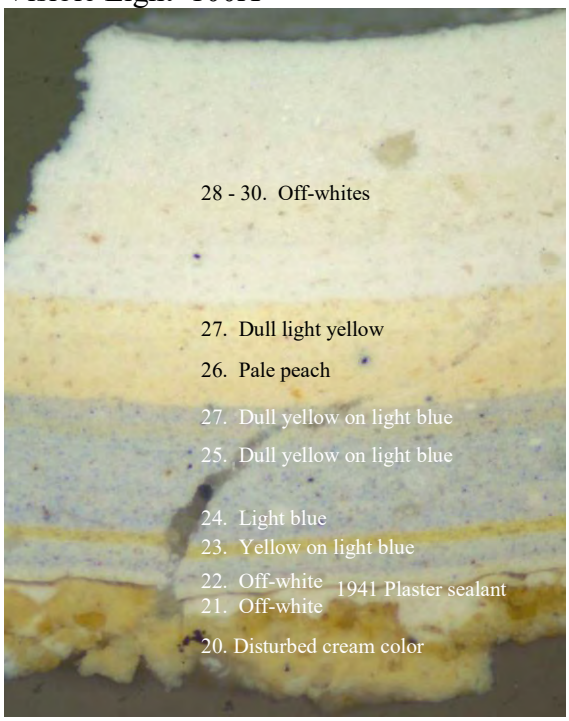
Ultraviolet Light 200X

Four samples from different areas of plaster paneling provide compelling evidence that most of the wall plaster was aggressively stripped at least once before 1941, as well as again during the 1941 restoration. Sample SW-1 from the chamfer for the raised paneling in the southeast corner of the south wall retains just remnants of the cream-colored paint identified as generation 20, followed by the off-white paint in generation 21 that flowed over and around the disrupted cream-colored paint below. The 1941 plaster sealant is on top of this off-white paint, and it is followed by generations 22 through 30. Sample SW-2 from raised panel surface retains the off-white paint applied on top of the coarse plaster in generation 21, followed by the 1941 plaster sealant, and then all the paints applied from 1941 onwards.

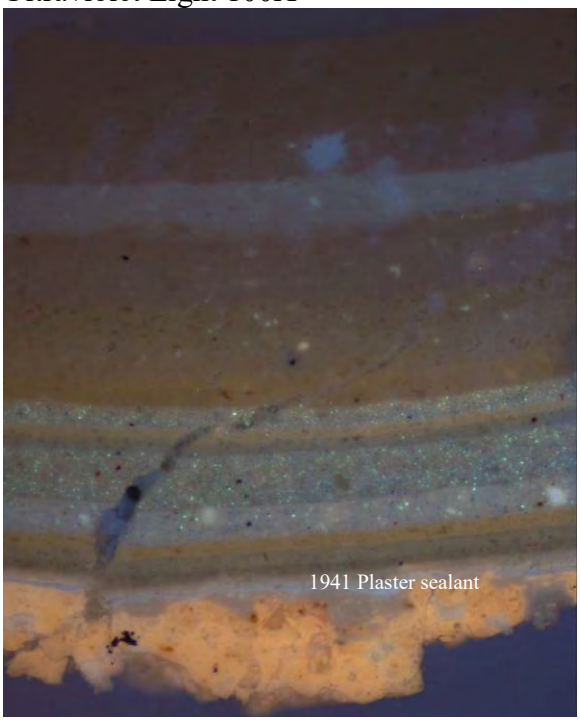
The colors applied just after the 1941 restoration are light blues in generations 23 through 27, and in two generations – 23 and 25 – the chamfers for the panels were picked out in dull yellow, while the panels were light blue. Generation 26 was pale peach and generation 27 was dull light yellow. The most recent paints on the chamfers were whites while the panels were painted in beige or tan colors. Sample SW-1 (below) came from the chamfered section while sample SW-2 came from the raised panel. The evidence in sample SW-2 shows that in some areas the earliest paints were complete scraped away to expose the plaster substrate before repainting.

SW-1. South wall, southeast corner, at right lower edge of raised plaster panel, in chamfer.

Visible Light 100X

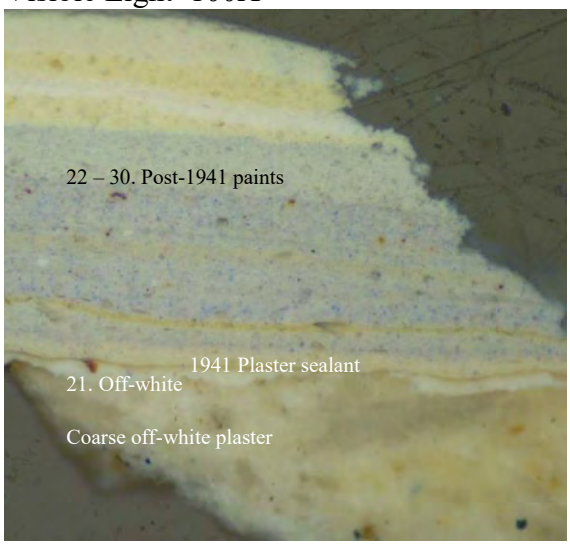


Ultraviolet Light 100X

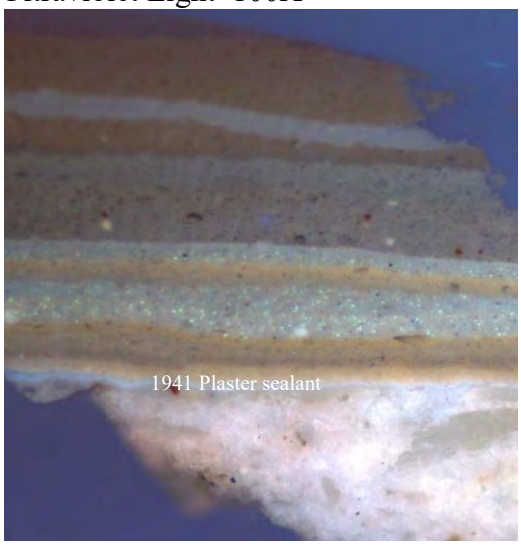


SW-2. South wall, southeast corner, at right lower edge of raised plaster panel, at corner of panel.

Visible Light 100X



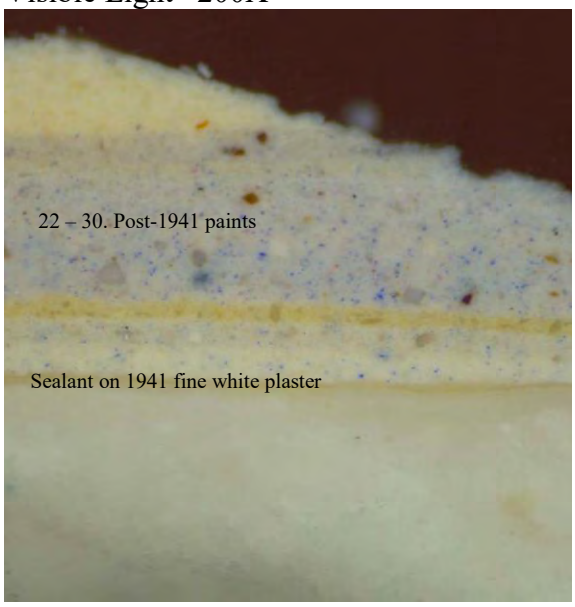
Ultraviolet Light 100X



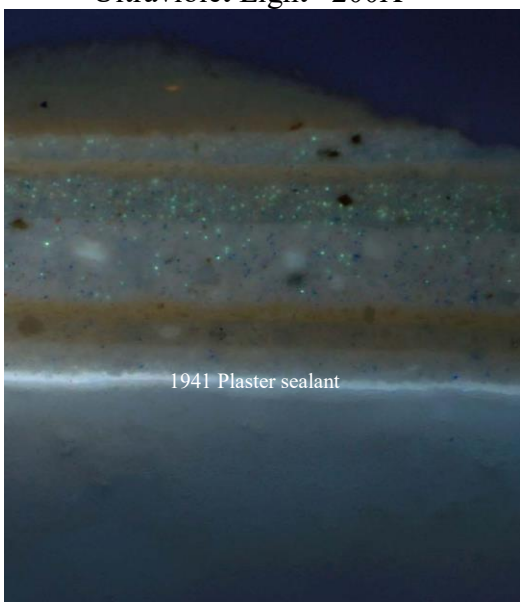
The evidence in sample SW-5 from the 1941 plaster paneling is important as it provides a reference for the plaster and paints applied in 1941. The plaster sealant is quite obvious in the reflected ultraviolet light image, and the plaster finish coat is smooth and bright white.

SW-5. West wall, replacement section of plaster, chamfer of plaster panel.

Visible Light 200X



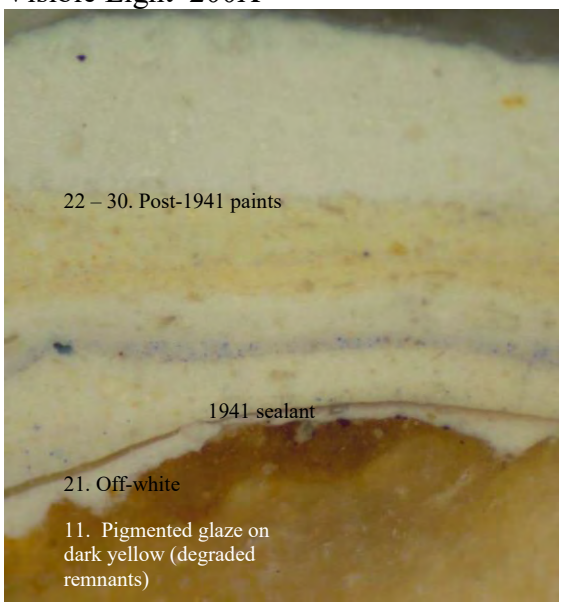
Ultraviolet Light 200X



One cross-section from the decorative swag about the north door on the west wall retains remnants of degraded paint that appears to be generation 11 – a pigmented glaze on a deep yellow base coat. Uncast portions of from this same area retain remnants of the first deep yellow distemper paint found in samples SW-3 and SW-4. This is followed by the off-white paint identified as generation 21 and then the 1941 coatings. While the early paints in this cross-section are fragmentary, the presence of early hand-ground paints suggests this swag and ribbon decoration is the same date as the more exuberant leafy rococo decoration above the north door on the east wall.

SW-9. West wall, swag above door, edge of top left bellflower.

Visible Light 200X



Ultraviolet Light 200X

Paint Evidence on Southwest Room Woodwork. The only early paint evidence on the woodwork in this room was found in sample SW-8 from the north wall door architrave. There are approximately 21 generations of aged, grimy, white lead-based paints in this cross-section, beginning with cream color, followed by glossy tan paint (which contains a varnish component) in generation 2. Most of the woodwork colors are variations of creams and dull yellows, as shown in the photomicrographs below.

The most recent trim paints cleaved off when this sample was removed, but the paints in uncast portions of SW-8 match the finely ground off-white paints identified on the north wall door in sample SW-7. The comparative evidence suggests that the woodwork in this room was repainted as frequently as the walls, and that the applied ornaments, raised plaster paneling, door and window architraves were installed in the same period. The exceptions are the woodwork and plaster in the center of the west wall which date to 1941. So, the combined evidence suggests that the earliest palette on the plaster and woodwork in this room consist of matte dark yellow walls and cream-colored woodwork.

SW-8. North wall door architrave, pediment, edge of fluting.

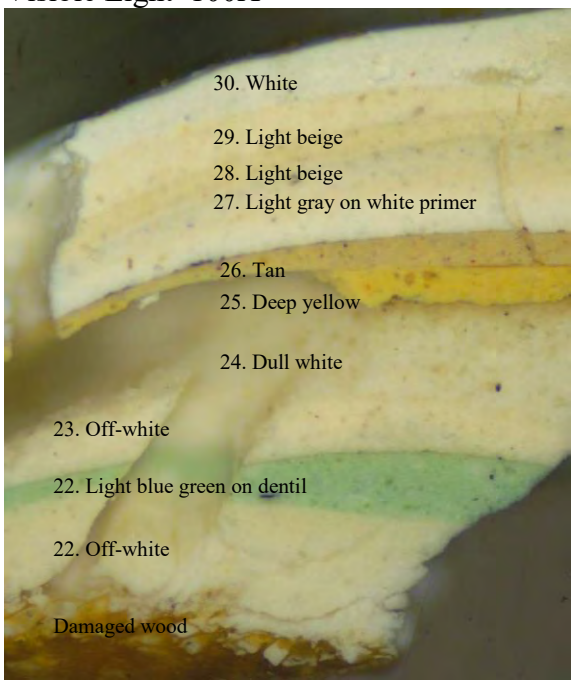
Visible Light 100X

Ultraviolet Light 100X

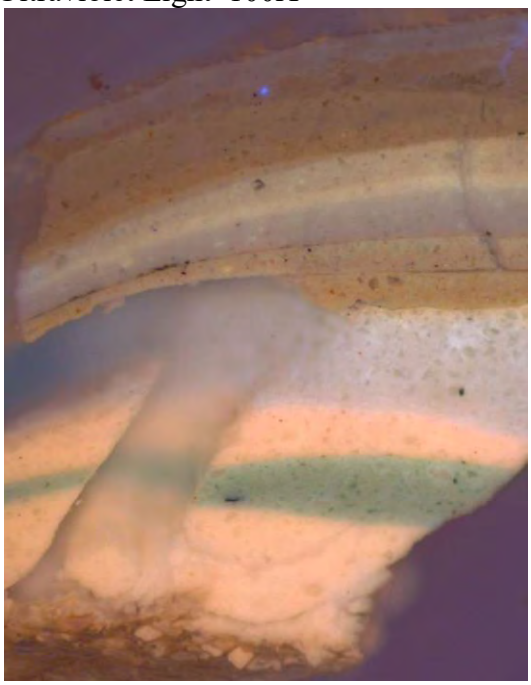
The wood substrate in SW-6 from a cornice dentil is fibrous and disturbed, which is likely the result of aggressive paint stripping. This stripping may have been done in 1941, which would date the off-white primer directly above the wood and the light blue-green finish coat to 1941. It is possible that in 1941 certain elements of the cornice, like the dentils, were picked out in light blue-green, while the rest of the cornice was white. Other elements, such as the north wall door trim, seem to have been off-white in 1941. No early paints were found on the cornice, but stylistically it fits with the rest of the woodwork, and the evidence of thorough paint stripping suggests it was treated harshly in the 1941 restoration.

SW-6. East wall, cornice in northeast cornice above door, edge of dentil molding.

Visible Light 100X



Ultraviolet Light 100X

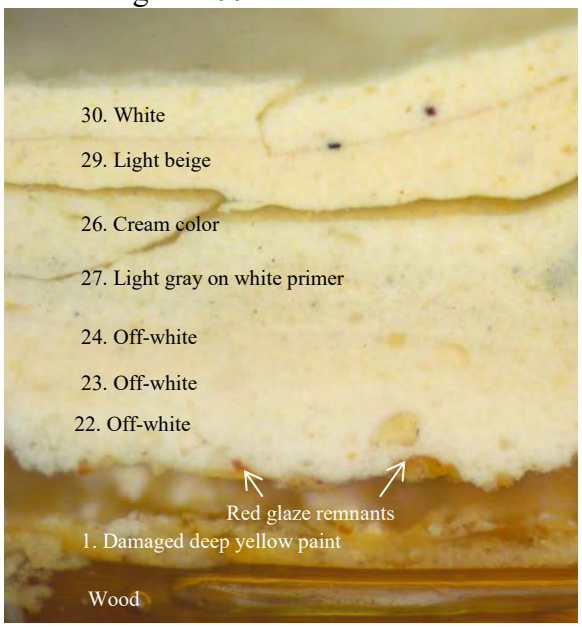


The door leaf for the north partition wall was also sampled to search for early paints. Like the the other woodwork in this room it has been quite thoroughly stripped. But, there are remnants of the original paint treatment remaining on top of the wood. The earliest layers are fragmentary, but there is a coarsely ground deep yellow paint on the wood, and remnants of a reddish glaze on top of the deep yellow. It is possible that this represents a graining treatment to replicate a figured wood like mahogany. This type of decorative painting is common for doors in entertaining rooms in Charleston from about the third quarter of the eighteenth century into the early nineteenth century.

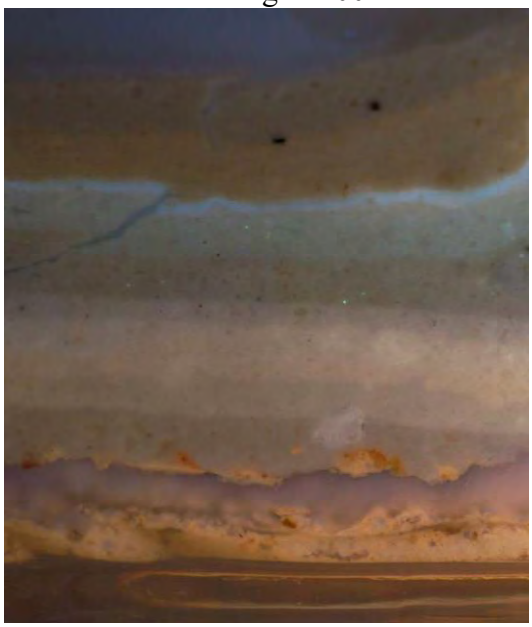
The graining fragments are followed by finely ground, nonfluorescent paints that are consistent with the post-1941 woodwork paints found in this room.

SW-7. North partition wall door. Top left corner, top right panel.

Visible Light 200X



Ultraviolet Light 200X



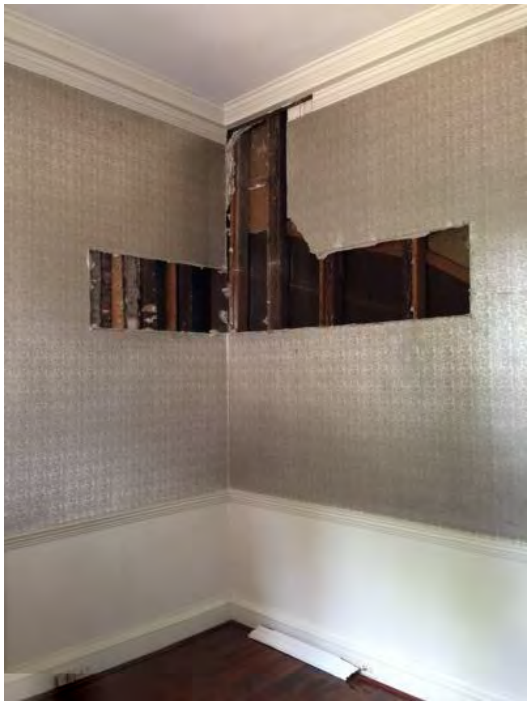
Northeast Room:

The northeast room is the only one of the first-floor spaces that retains a cornice that stylistically might date to the first period of the house. Fortunately, there are sections of this cornice above the fireplace that were never stripped, despite the other significant physical changes to this room, like the installation of an elevator on the north wall and the insertion of a closet in the southwest corner. On site explorations indicated that the wainscoting, baseboards and architraves had been quite thoroughly stripped of early paints, perhaps during the 1941 restoration. Some of the areas of woodwork actually have a charred appearance, which would have been caused by stripping with a heat gun.

The plaster walls were not promising for sampling as they all appear to date to 1941, although one section of earlier plaster to the north of the closed-up window on the east wall was exposed when an opening was made to examine the trapped window. This plaster was sampled for comparison with the three areas of trapped plaster on the north wall of the stair passage.

West Wall of Northeast Room

Southeast Corner of Northeast Room



Northeast Room Sample Locations
NE-1. West wall, cornice about fireplace.
NE-2. North wall, northeast corner, wainscot just below chair rail.
NE-3. North wall, northeast corner below window, surbase of chair rail.
NE-4. East wall, exposed plaster left of closed-up window opening.
NE-5. Fireplace, multiple coatings on left side of interior of firebox.

NE-1

NE-2

NE-3

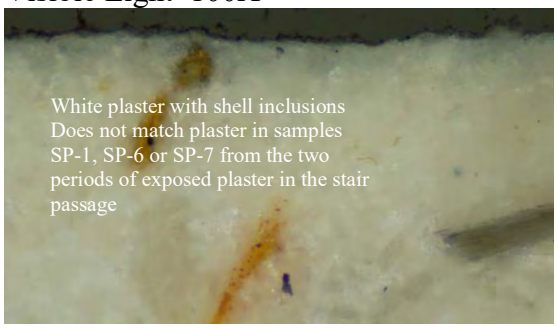
NE-4

NE-5

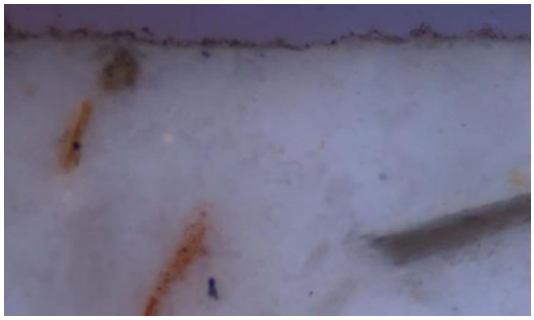
Paint Evidence on the Northeast Room Plaster. Only two samples were taken from areas in the northeast room that might be early plaster. Sample NE-4 came from a section of coarse white plaster on the east wall which was revealed when an opening was made in the southeast corner to reveal the staircase and the closed-up window. This plaster was applied directly to the brick and there is defined edge on its right side where it met some type of vertical element. It consists only of coarse white plaster with large shell and wood fiber inclusions, and there is a thick film of soot on its surface. This plaster does not match any of the plaster exposed on the north wall of the stair passage. This plaster clearly never had any sort of paint or wallpaper on it, so it remains a puzzle.

NE-4. East wall, exposed plaster left of closed-up window opening.

Visible Light 100X



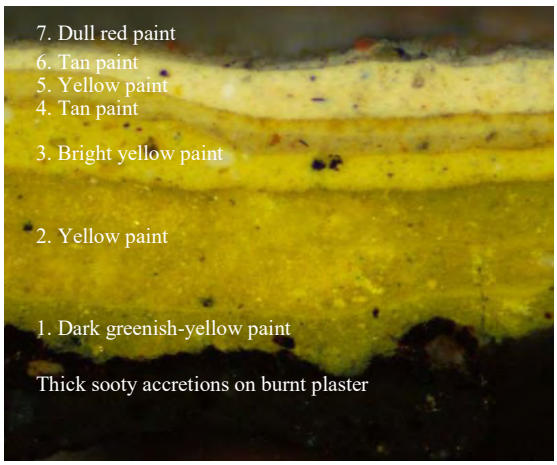
Ultraviolet Light 100X



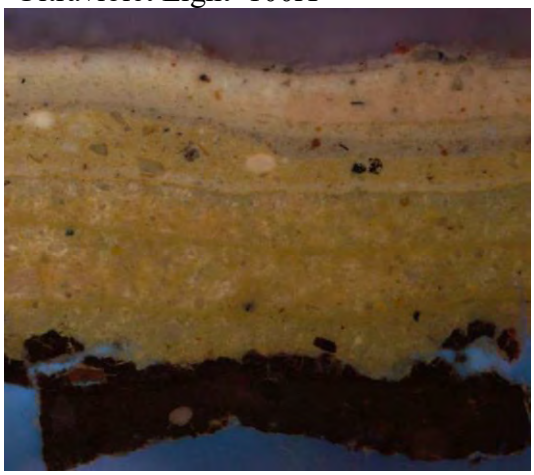
The interior of the firebox has a thick accumulation of darkened materials, and there are many patchy colored coatings present. In cross-section there is a darkened plaster or stucco at the bottom of the sample, followed by a thick black layer of burnt plaster, soot and oily materials. There are seven generations of opaque, oil-bound paints on top of the blackened substrate which are mostly variations of yellows. The most recent coating is a thin dull red paint. None of these paints can be dated by composition or context, but the absence of soot between most of the layers suggests that they were applied after the fireplace stopped being used on a regular basis. These paints could all date to the twentieth century.

NE-5. Fireplace, multiple coatings on left side of interior of firebox.

Visible Light 100X



Ultraviolet Light 100X



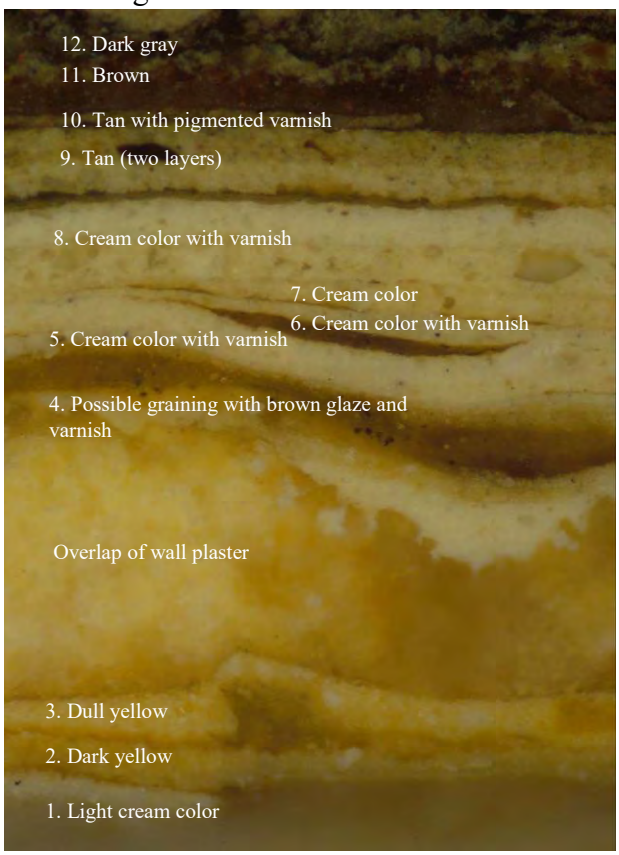
Paint Evidence on the Northeast Room Woodwork. An extraordinarily complete stratigraphy of early paints was found on the cornice, which remains undisturbed and could date to the first period of the house. There are 20 generations of coarsely ground, white-lead-based paints on top of the wood in sample NE-1, beginning with a thinly applied cream-colored paint, followed by deep yellow in the second generation. Most of the earliest colors are creams, tans and dull yellows, as shown in the detail images of NE-1 at 200X magnification below. The most recent green paints, followed by bright whites, cleaved away when the samples were removed, but they are shown in separate photomicrographs on page 23.

Binding media analysis with the fluorochrome DCF confirms that all the paints in this woodwork paint sequence are oilbound.

The wainscoting and chair rail were very aggressively stripped, and the off-white paint above the damaged wood (see sample NE-3 from the chair rail) must represent the 1941 layer, which is labeled generation 21 in the reconstructed paint stratigraphy for the woodwork in the northeast room.

NE-1. West wall, cornice about fireplace.

Visible Light 200X

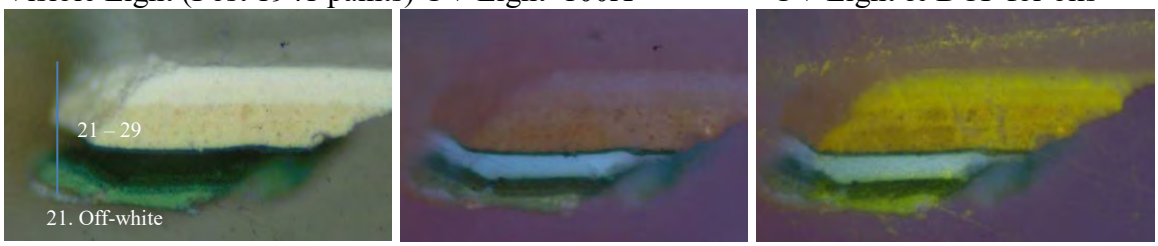


Ultraviolet Light 200X

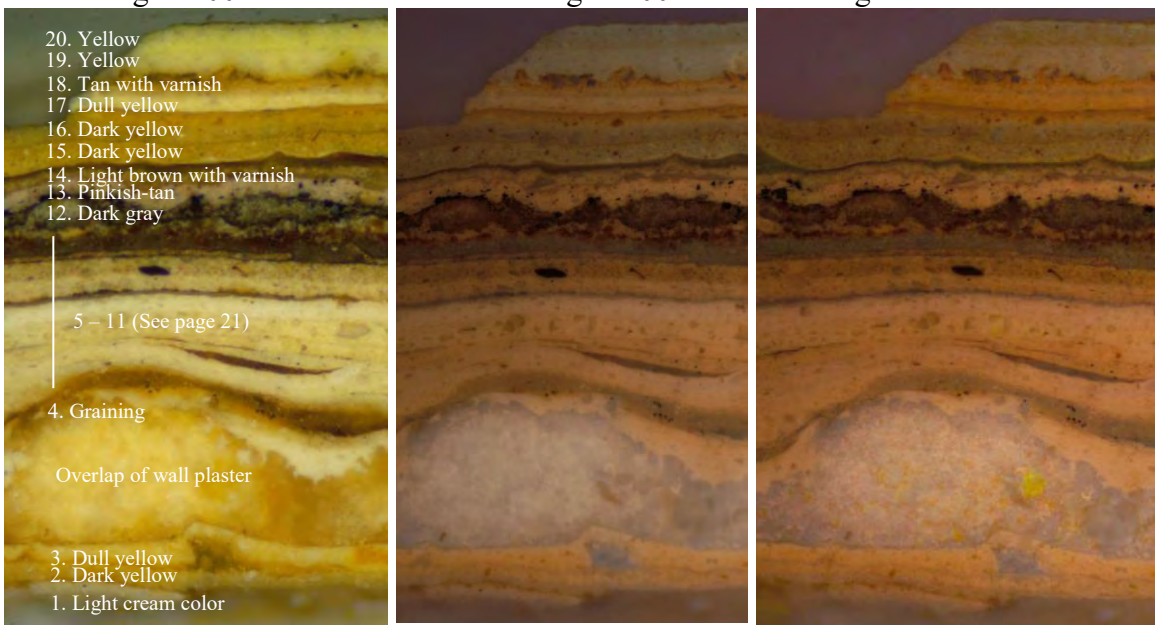
The complete stratigraphy of paints on the cornice can be reconstructed from the layers that cleaved apart. There are approximately 29 generations of paint. Generations 21 through 29 can be aligned with the paints found on the wainscoting and chair rail. An uncast portion of this sample was also photographed to help put this complex paint sequence into context.

NE-1. West wall, cornice about fireplace.

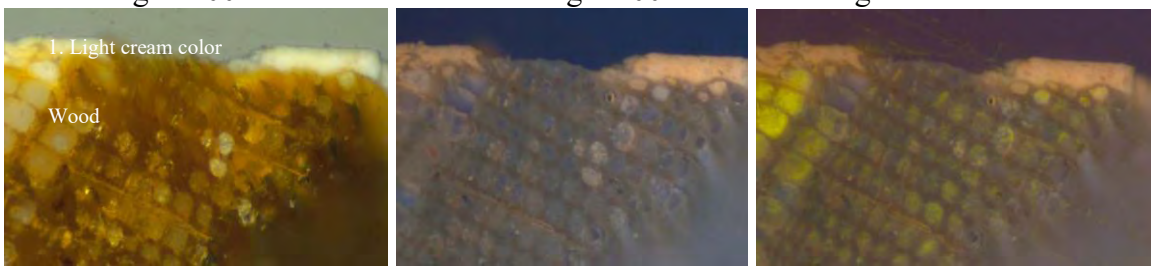
Visible Light (Post 1941 paints) UV Light 100X UV Light & DCF for oils



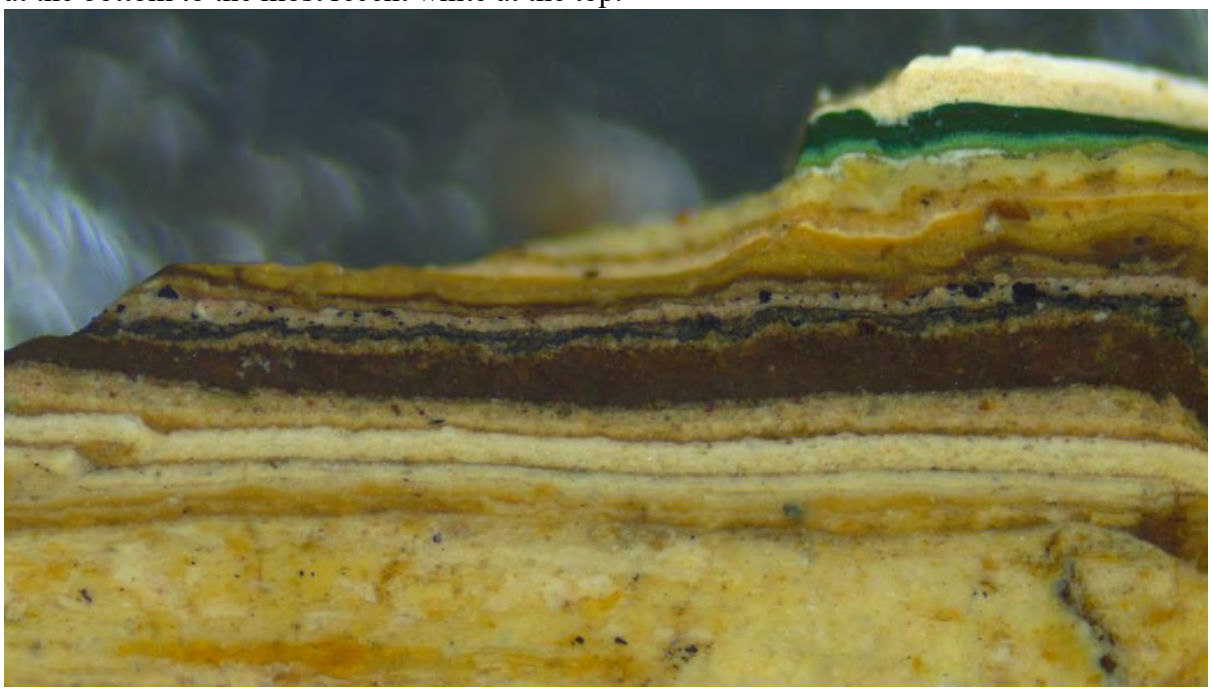
Visible Light 100X UV Light 100X UV Light & DCF for oils



Visible Light 100X Substrate UV Light 100X UV Light & DCF for oils



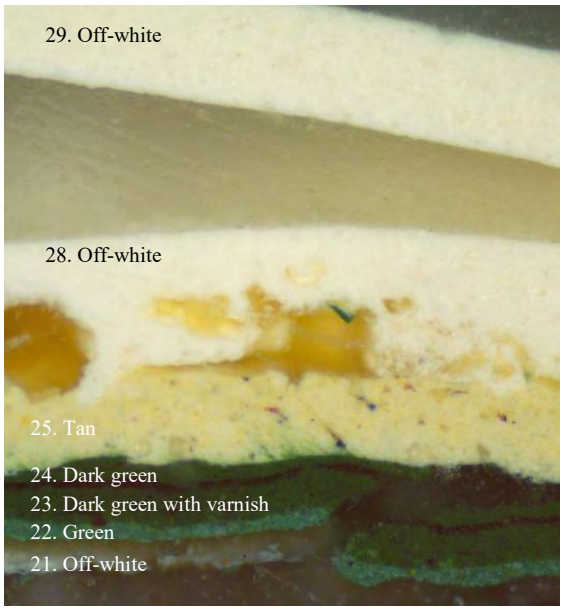
NE-1. West wall, cornice about fireplace.
Uncast sample photographed at 40X to show all the paints, from the original cream color at the bottom to the most recent white at the top.



The paints on the wainscot (NE-2) and chair rail (NE-3) retain paint histories that only seem to date to 1941, with an off-white paint labeled generation 21 on top of blackened and fibrous wood. These elements cannot be comparatively dated based on their paints.

NE-2. North wall, northeast corner, wainscot just below chair rail.

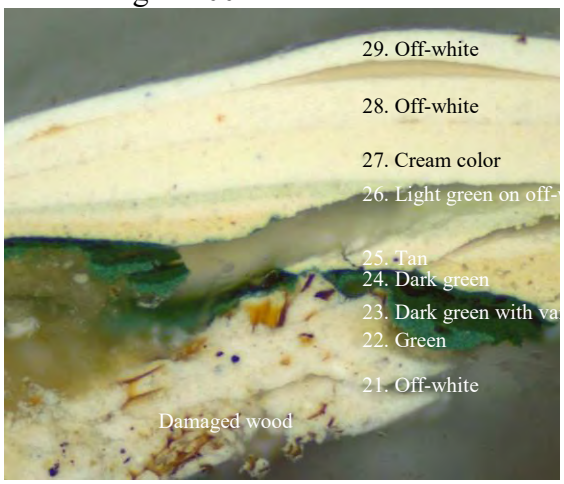
Visible Light 200X



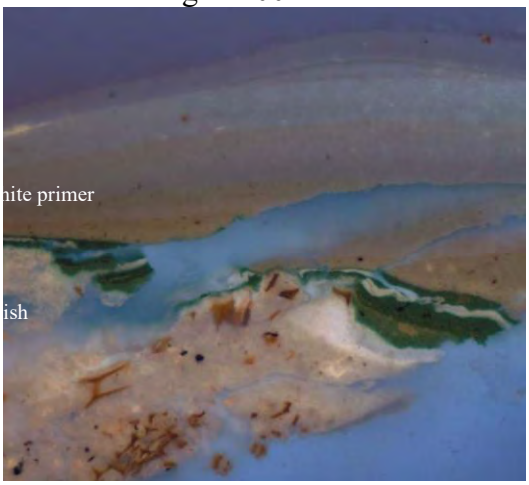
Ultraviolet Light 200X

NE-3. North wall, northeast corner below window, surbase of chair rail.

Visible Light 100X



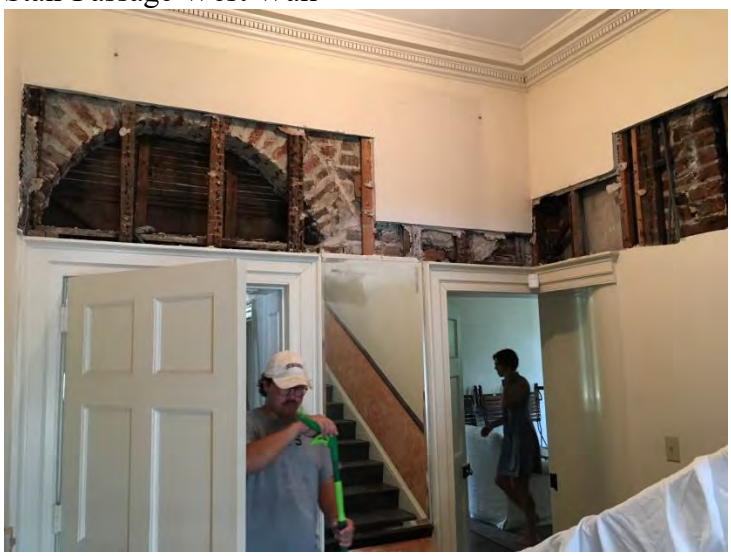
Ultraviolet Light 100X



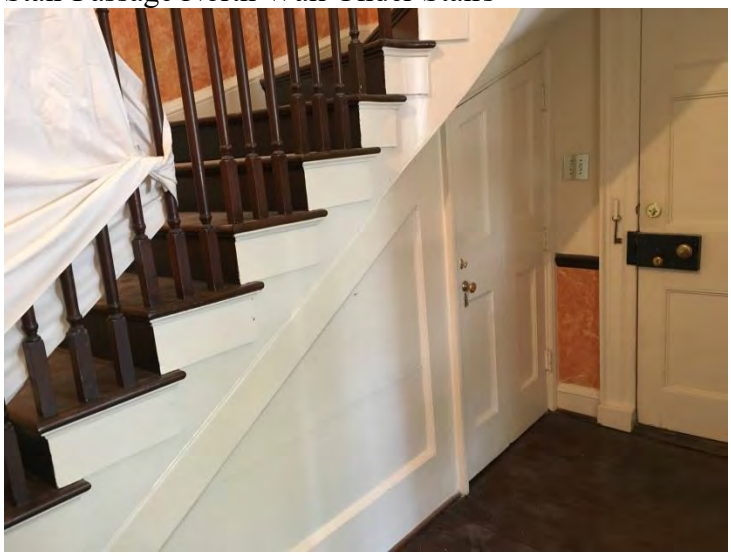
Stair Passage:

The stair passage is a complex space, with questions to be answered about the timing of the stair, the original configuration of the west wall and access to the west entertaining rooms, and whether there had originally been an arched opening leading into the southwest room. Openings were made above the doors leading to the southwest and northwest rooms, and in the northeast corner along the stairs to look for trapped elements that might provide clues to the changes made to this space.

Stair Passage West Wall



Stair Passage North Wall Under Stairs

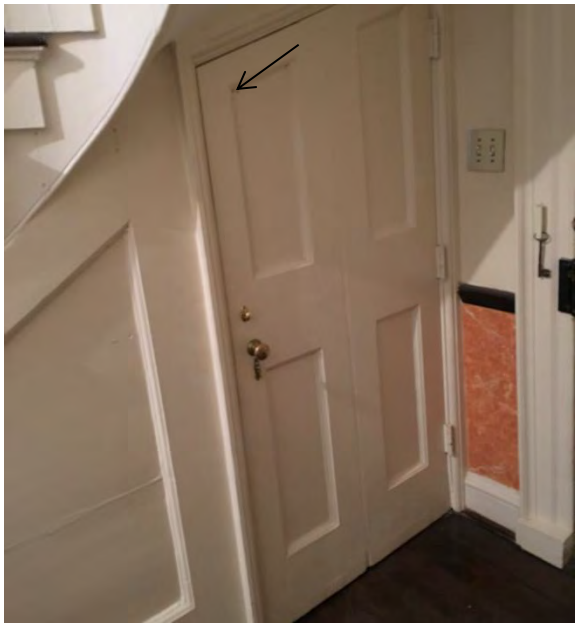


Stair Passage Sample Locations
SP-1. North wall, exposed plaster behind wallboard.
SP-2. North wall, small hinged door under stair, top left corner of left leaf.
SP-3. North wall, horizontal paneling under stair, top edge of middle board.
SP-4. North wall, end block below stair, sixth step up from bottom.

SP-5. North wall, inner surface of hinged door, left corner of top rail, where it meets left stile.
SP-6. North wall, plaster directly on brick face exposed above wainscot in opening.
SP-7. North wall, second plaster layer in exposed section.
SP-8. North wall, curved end block below stair, tenth step up.
SP-9. West wall, plaster from arch (EAC sample).
SP-10. North wall, exposed plaster behind wallboard (EAC sample).

SP-1

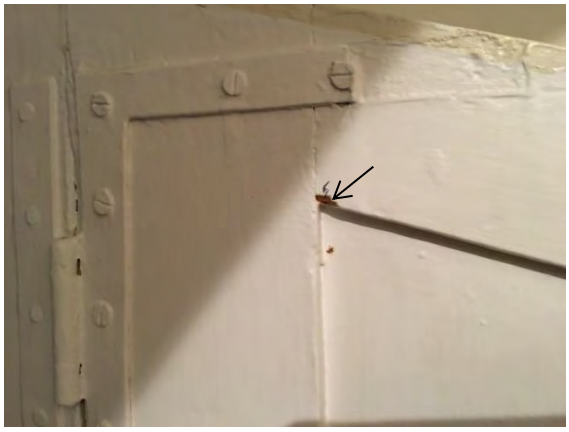
SP-2



SP-3

SP-4

SP-5



SP-6 and SP-7 Exposed plasters

SP-6 and SP-7

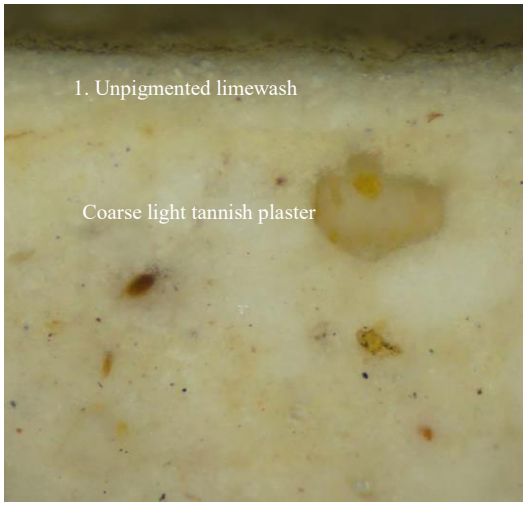
SP-8

SP-9

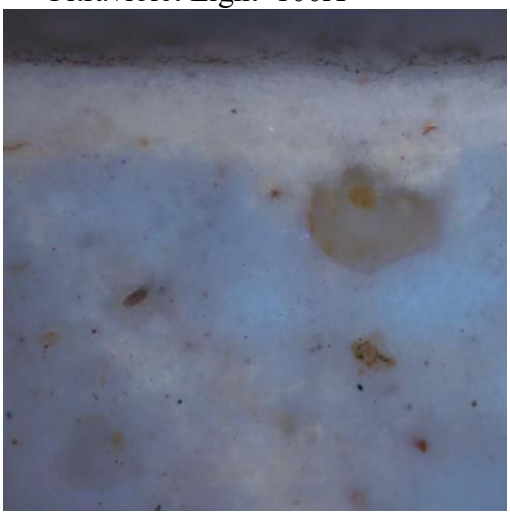
Paint Evidence on Stair Passage Plaster. There is intriguing evidence associated with the plasters exposed in the openings on the north wall adjacent to the staircase, and on the underside of the arch. These trapped areas of early plaster yield insights into which surfaces were likely never exposed, and which surfaces received many limewashes and paints. Ed Chappell removed one sample from the underside of the arch and described it as: "Mortar and conceivably plaster on the underside of the brick arch over the door from the first-floor stair passage and the southwest room, 2" from the west face of the arch and 8'8" above the floor. I assume this arch was never exposed, but it seemed prudent to determine whether this white material includes any plaster or is only mortar."[1] This sample is SP-9 and when it was examined at 45X magnification it was obvious that it is comprised of one tannish, sandy mortar, and there is no finished plaster surface, nor evidence of limewashes. This suggests the underside of the arch was never exposed. By comparison, sample SW-1 from the plaster on the north wall, in the northwest corner, has one layer of unpigmented limewash on top of coarse light tannish plaster. This is from an area believed to have originally been a closet for the northwest room, so it is not surprising that it was only limewashed once before it was trapped when the stair passage was altered. Sample SW-1 is below.

SP-1. North wall, northwest corner, exposed plaster behind wallboard.

Visible Light 100X



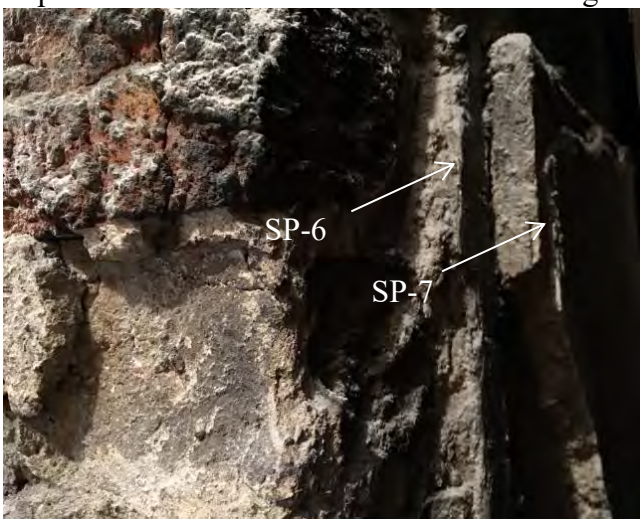
Ultraviolet Light 100X



[1] Edward A. Chappell, Memo, August 7, 2018.

The most intriguing and puzzling evidence came from the two separate generations of plaster exposed on the north wall above the staircase. The location of these plasters suggest they were originally on the west wall of the northeast room, with the finished surfaces facing east, and were cut through when there were alterations to the stair passage or the northeast room. Sample SP-6 was taken from the earliest plaster layer (on the left side of the image below). This plaster contains brick dust, brownish hairs, and small tan and clear sand particles.

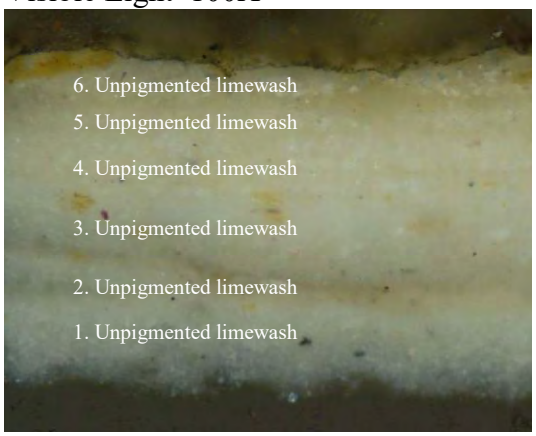
Exposed Plaster on North Wall of Stair Passage



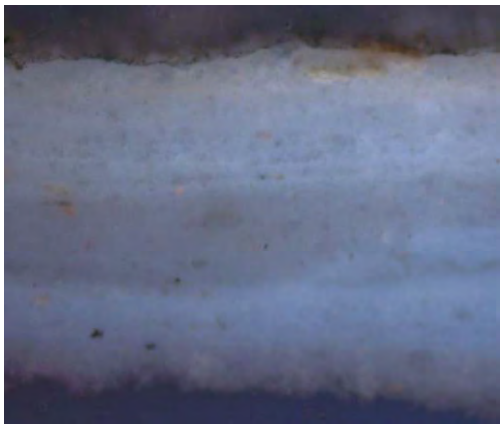
There are six generations of unpigmented limewash on top of the coarse light tannish plaster substrate in sample SP-6. This suggests this plaster was exposed for a number of years before the second layer of plaster was applied.

SP-6. North wall, plaster directly on brick face exposed above wainscot in opening.

Visible Light 100X



Ultraviolet Light 100X



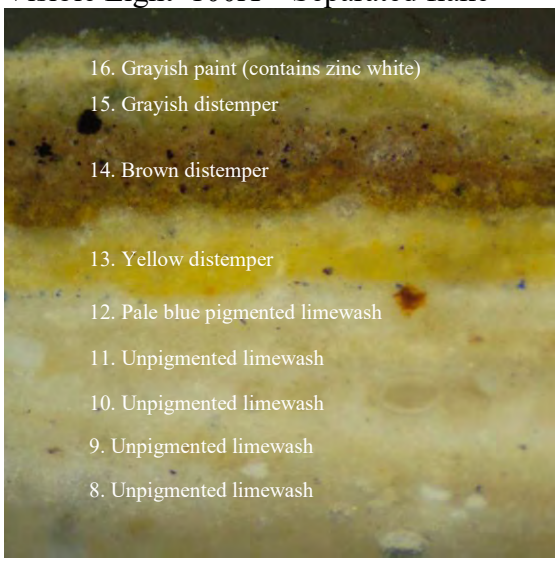
There are many coating layers in sample SP-7 which was taken from the second generation of plaster. The whitish plaster substrate is finer than SP-6 and has clear sand, brownish hair, and brick dust inclusions. It does not resemble the plaster exposed on the east wall of the northeast room where an opening was made to reveal the closed-up window. The coating layers in this sample have been labeled sequentially as 7 through 16 as this plaster is directly on top of the first plaster which retains six generations of unpigmented limewashes. Generations 7 through 11 are unpigmented limewashes, followed by a light blue-pigmented limewash is generation 12 and a yellow distemper in generation 13. Generation 14 is an opaque brown paint which may be distemper, followed by a gray distemper in generation 15 and an opaque gray paint in generation 16 that contains zinc white. The presence of zinc white means this layer could not have been applied before about 1845 when zinc white became commercially available. It also means that the earliest date that the plasters on the west wall of the northeast room could have been cut through was well after 1845.

Staining with biological fluorochrome stains suggests that generations 13 through 15 are traditional distemper paints (bound in dilute hide glue) because of the strong positive reactions with the fluorochrome FITC. Generation 16 must be an oil-bound paint as it reacted strongly positive when DCF, a fluorochrome tag for oils, was applied. Limewashes and distempers were traditional wall paints which were chalky, slightly translucent, and not very durable. Their advantages are that they were inexpensive, easy to apply, and easily painted over.

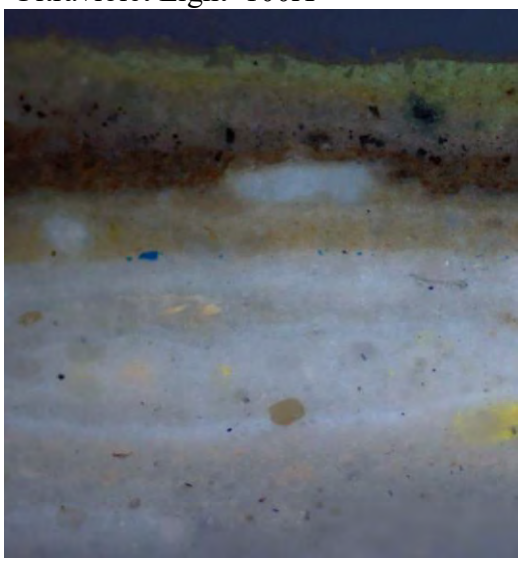
If the two layer of plaster do, in fact, relate to the northeast room, the evidence indicates that the walls in the northeast room were initially repeatedly coated with inexpensive limewashes. No distinctive color was applied to the walls until generation 13, a yellow distemper. The walls were repainted three more times with brown and gray distempers, then a gray oil-bound paint, before it was somehow trapped by alterations to the staircase or the northeast room.

SP-7. North wall, second plaster layer in exposed section.

Visible Light 100X Separated flake

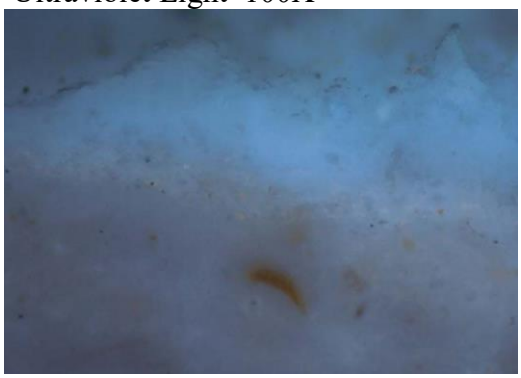


Ultraviolet Light 100X



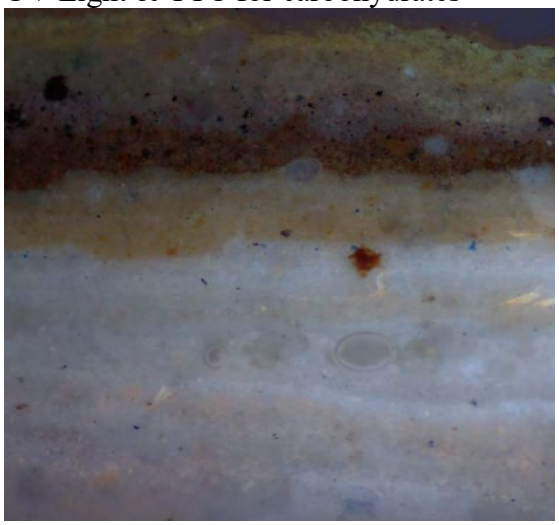
Visible Light 100X Substrate

Ultraviolet Light 100X

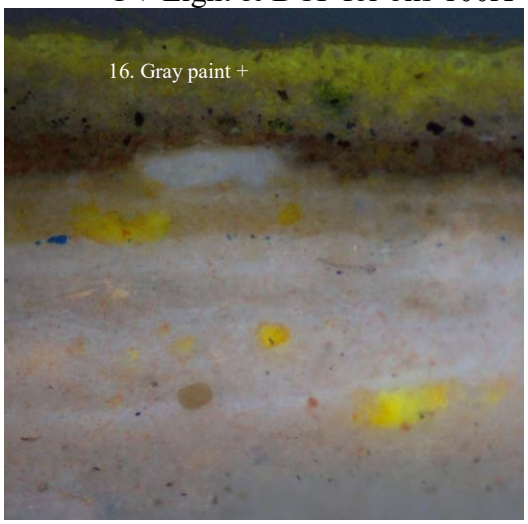


SP-7. North wall, second plaster layer in exposed section.

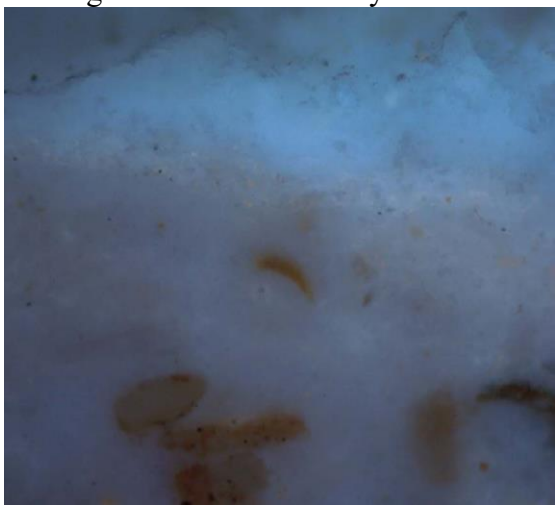
UV Light & TTC for carbohydrates



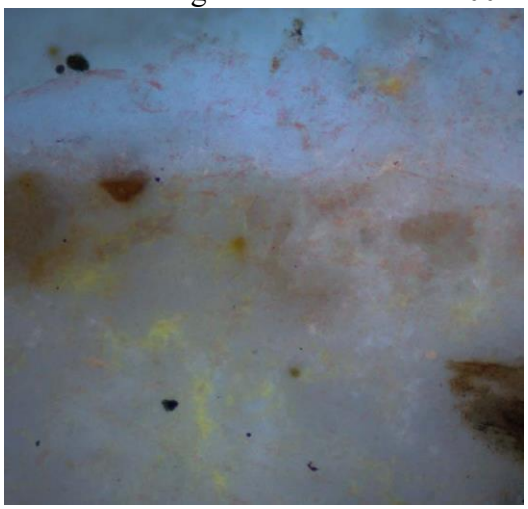
UV Light & DCF for oils 100X



UV Light & TTC for carbohydrates substrate

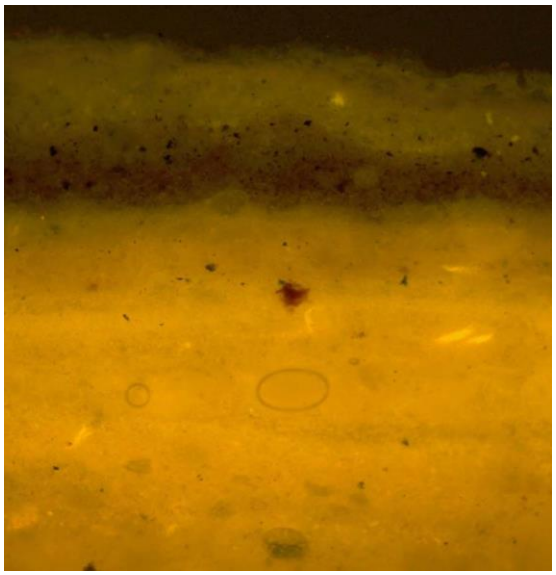


UV Light & DCF for oils 100X

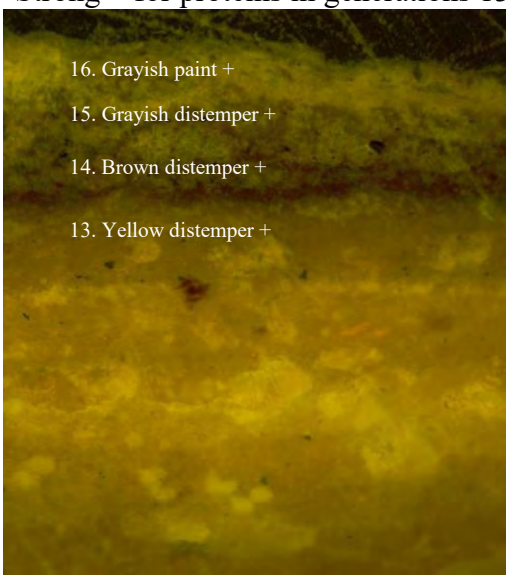


SP-7. North wall, second plaster layer in exposed section.

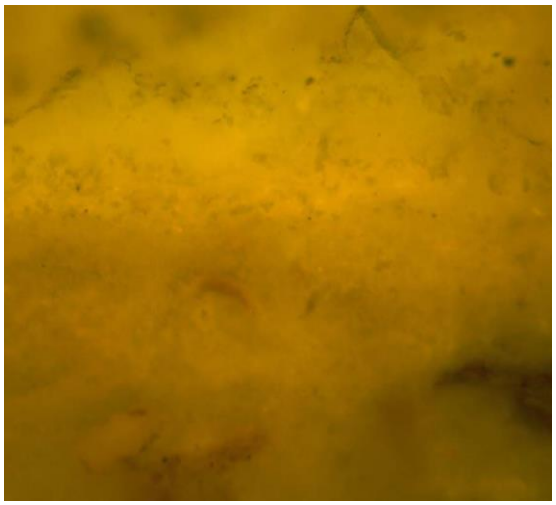
B-2A filter 100X Separated flake



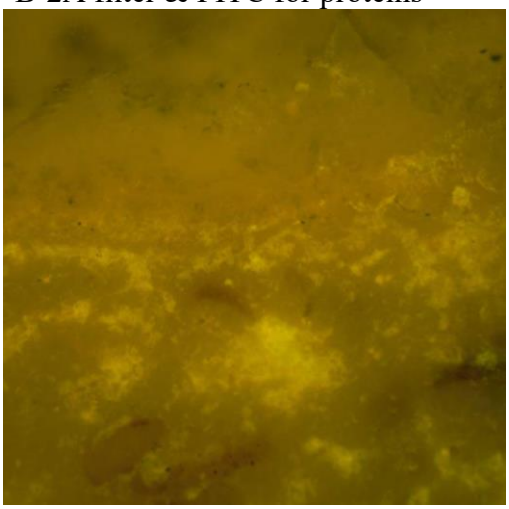
B-2A filter & FITC for proteins
Strong + for proteins in generations 13 - 16



B-2A filter 100X Substrate



B-2A filter & FITC for proteins



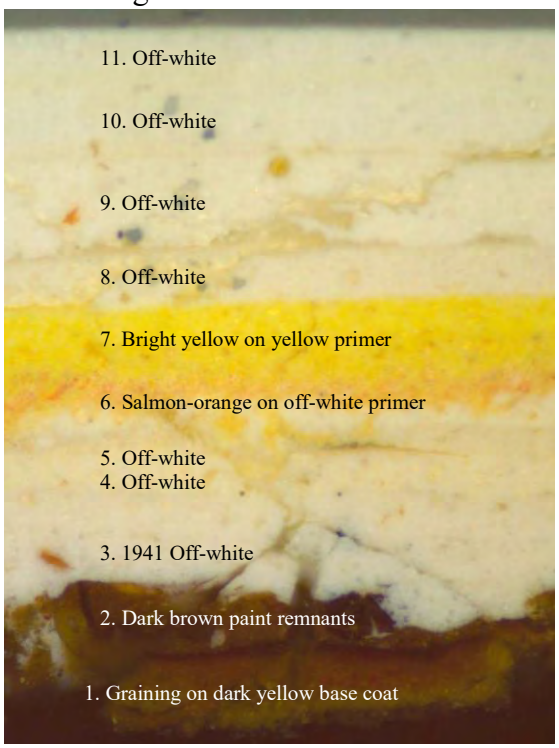
Paint Evidence on Stair Passage Woodwork. The initial investigations of the woodwork in the stair passage suggested that all the woodwork, including the staircase, architraves, paneling and the hinged door below the staircase had been thoroughly and aggressively stripped.

The most intriguing paint evidence was found in sample SP-8 from a curved block below a staircase step. There is less early evidence remaining in SP-4 from a different flat block. The oil-based paints on the curved block are compromised by stripping, but there are still remnants of what seems to be a grain-painting sequence remaining below the post-1941 paints. The graining consists of a dark yellow base coat, a dark red glaze and a darkened varnish. This original decorative treatment became cracked and damaged before it was painted over with a dark brown paint. This second-generation was mostly scraped away and painted over with off-white paint which is likely the 1941 layer. There are eight more generations of paint on this curved block, including a salmon color in generation 6 and bright yellow in generation 7.

The grain-painting evidence is significant because it suggests that when the staircase was first painted the blocks were grained to match mahogany balusters. Unfortunately, the limited paint evidence remaining on the woodwork in the stair passage means that the paint chronologies cannot help to decipher the evolution of this space, nor can it help to date the current staircase.

SP-8. North wall, curved end block below stair, tenth step up.

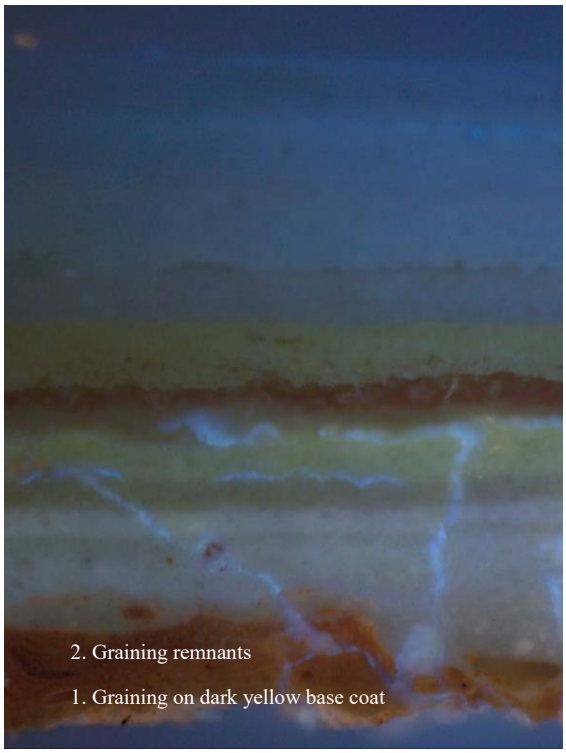
Visible Light 200X



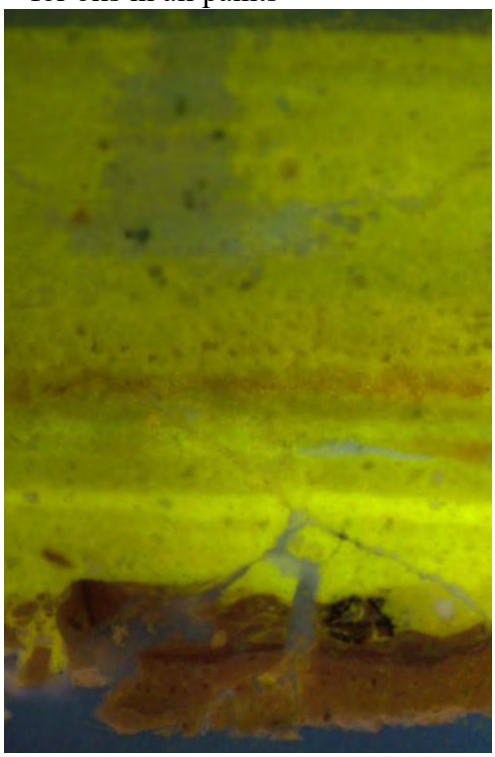
Ultraviolet Light 200X

SP-8. North wall, curved end block below stair, tenth step up.

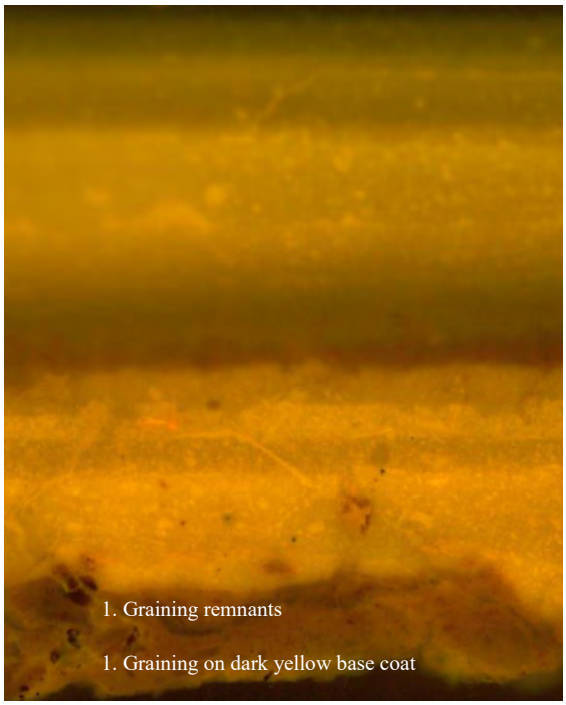
UV Light & TTC for carbohydrates 200X



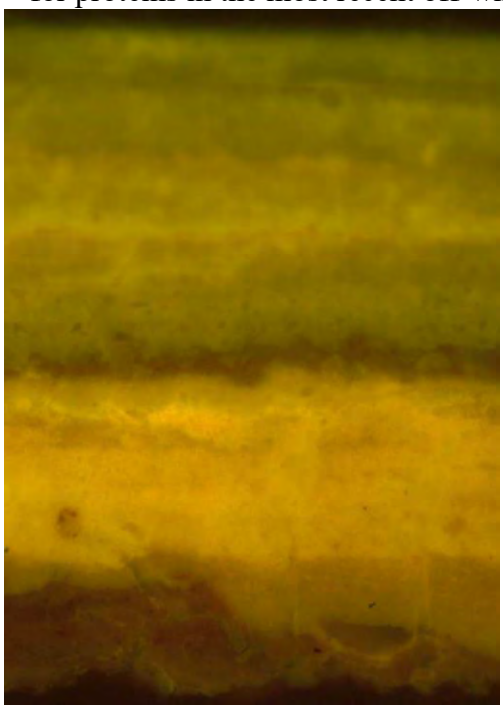
UV Light & DCF for oils 200X
+ for oils in all paints



B-2A filter 200X



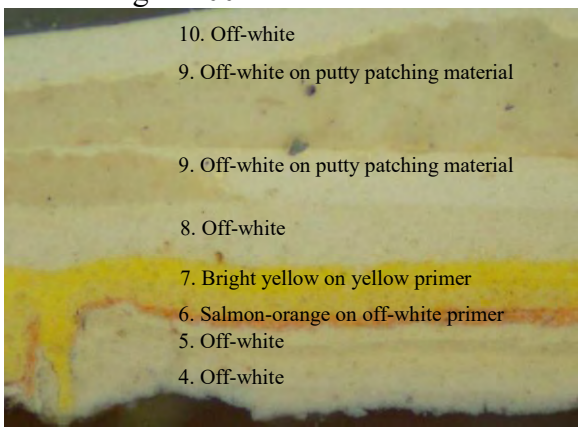
Ultraviolet Light 200X
+ for proteins in the most recent off-whites



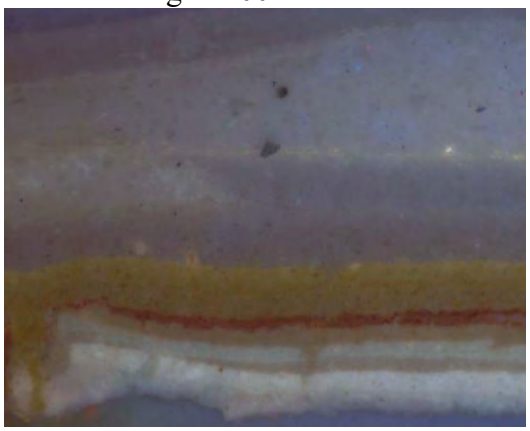
The exterior face of the hinged door did not yield any early paint evidence. It clearly had been completely stripped, as shown in sample SP-2. However, the interior surface of this door does retain remnants of early material. Sample SP-5 was taken from protected area of the inside of the door, and while interior door had also been stripped, there are remnant of shellac trapped in the wood (identified based on its characteristic orange autofluorescence in reflected ultraviolet light). There is grit and dirt trapped in the wood as well, so perhaps in the interior of this door was first shellacked, not painted. Then after considerable amounts of grit and soot was trapped on the wood. The door was painted with a dark tan oil-based paint. The paint on top of this dark tan paint is the finely ground, nonfluorescence off-white paint that seems to be the 1941 trim paint in the stair passage.

SP-2. North wall, small hinged door under stair, top left corner of left leaf.

Visible Light 200X



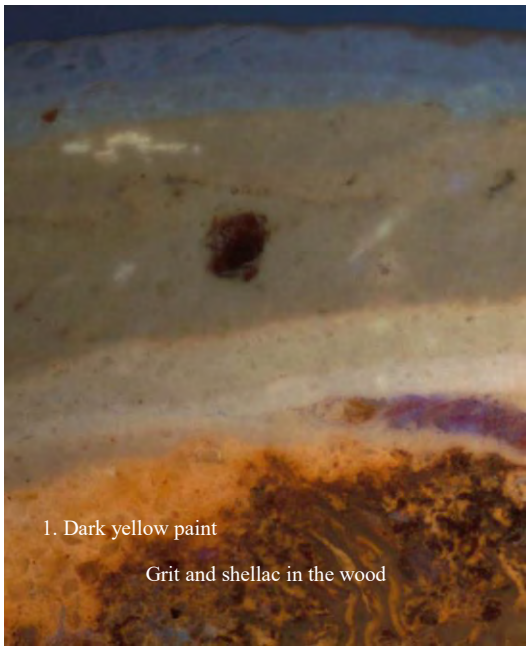
Ultraviolet Light 200X



SP-5. North wall, inner surface of hinged door, left corner of top rail, at left stile.

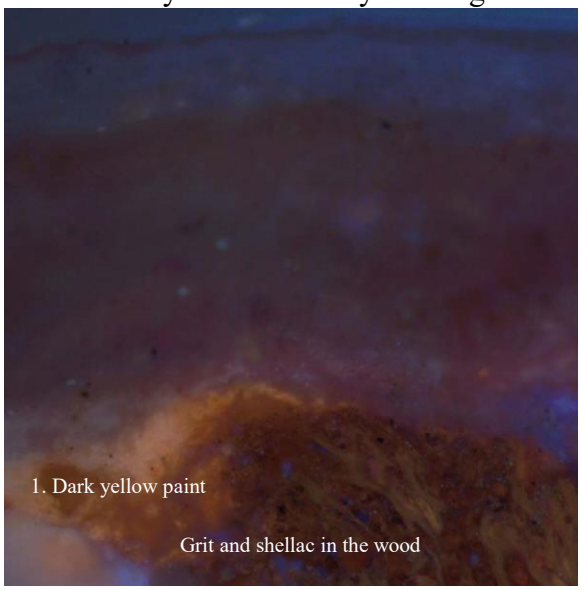
Visible Light 100X

Ultraviolet Light 100X



SP-5. North wall, inner surface of hinged door, left corner of top rail, where it meets left stile.

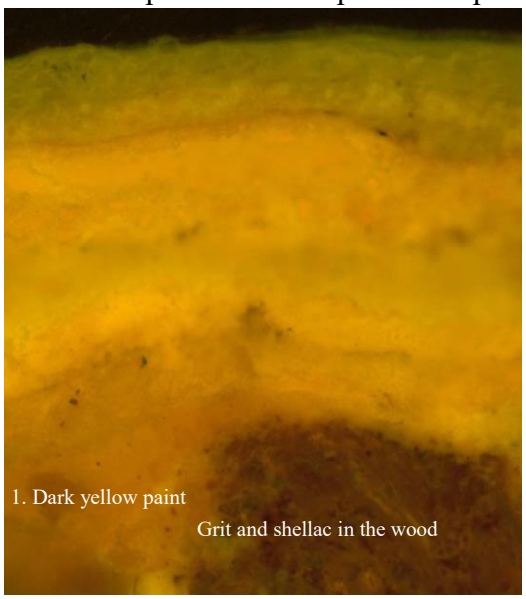
UV Light & TTC for carbohydrates 100X
+ for carbohydrates in all layers but generation 1



UV Light & DCF for oils 100X
+ for oils in all layers

B-2A filter 100X

B-2A filter & FITC for proteins 100X
Weak + for proteins in the post-1941 paints

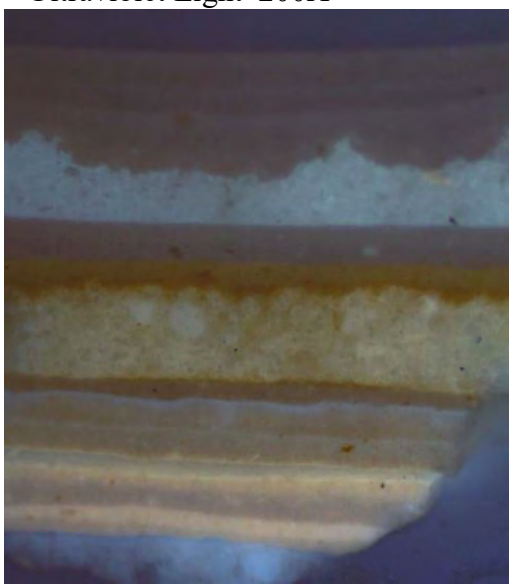


When the surfaces of the horizontal paneling under the stairs were examined at low magnification it was apparent that there are many white putty patches on the paneling, and at the horizontal joins of the boards. The joinery was extensively patched after the woodwork was stripped and before the 1941 off-white paint was applied, and then it was patched again when the woodwork was painted bright yellow in generation 7, and again before the most recent repainting. The chronology in SP-3 from the paneling shows that only coatings dating to 1941 and after remain on this woodwork.

SP-3. North wall, horizontal paneling under stair, top edge of middle board.

Visible Light 200X

Ultraviolet Light 200X



Cellar:

There are chalky, fragile white coatings on the undersides of the floorboards and the sides of the joists which were exposed before the current ceiling was installed. Two samples were taken from these elements to identify the number and nature of the matte white coatings.

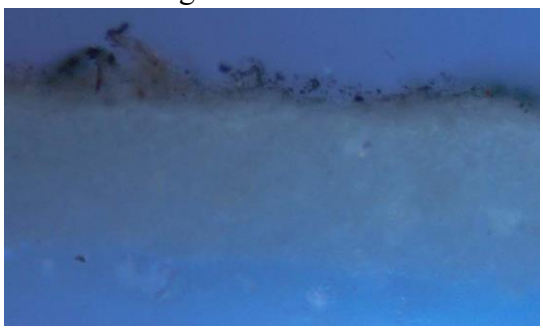
Cellar Sample Locations
C-1. Central west room, south side, side of exposed joist.
C-2. Central west room, south side, underside of exposed floorboards in ceiling.

There is only one layer of unpigmented limewash on top of the dirty wood substrate in sample C-1, and in sample C-2 there are two similar layers of unpigmented limewash. There is very little dirt on the surfaces of these limewashes, and they are not notably discolored or damaged. The combined evidence in these two cross-sections indicates that the joists and ceiling (underside of the flooring) were originally left unpainted and the limewashes might not have been applied until later in the nineteenth century. It is more typical to find many, many layers of limewashes on kitchen, cellar, laundry and dairy spaces in the eighteenth and nineteenth centuries as these alkaline limewashes were considered hygienic coatings.

C-1. Central west room, south side, side of exposed joist.

Visible Light 200X Separated flake

Ultraviolet Light 200X



Visible Light 200X Substrate

Ultraviolet Light 200X

C-2. Central west room, south side, underside of exposed floorboards in ceiling.

Visible Light 200X Separated flake

Ultraviolet Light 200X

Conclusion:

This paint investigation has revealed important information about the paint histories on the plaster and woodwork in the southwest drawing room, which may date to the same period of installation, perhaps late eighteenth or early nineteenth century. The plaster and woodwork paints in this space can be aligned to indicate that the earliest palette consisted of deep yellow oil-painted walls with a matte appearance, and cream-colored woodwork that was moderately glossy. It is possible that at the same time all the door leaves were grain-painted to mimic a figured wood, likely mahogany. The second generation in the southwest room was a slightly different palette, with deep yellow paint on the walls and tan paint on the woodwork, followed by a paler palette of off-white walls and cream-colored woodwork in the third generation. It was not until the fourth generation in the comparative paint chronologies that the applied plaster decorations were picked out in with tan paint while the background wall plaster was white, and the woodwork was dark yellow.

It is not possible to assign firm dates to the approximately 21 generations of wall and woodwork paints found in the southwest room, but the evidence does indicate that generation 21 just predates the 1941 renovation of this entertaining room. Generations 22 to 30 are the paints applied after the 1941. No door paints could be identified after the original decoration, until the off-white woodwork paint that dates to 1941.

There is a long history of twenty generations of woodwork paints in the northeast room, which was found only on the cornice. This is a lower status room, but of all the spaces surveyed for this investigation, it retains what appears to be the only element – the cornice -- from the first period of the house. The cornice paints begins with cream color in the first generation. There is somewhat more variety in the woodwork paint colors on the cornice than found in the southwest room, but the colors are still predominantly creams and yellows, up to the twentieth-generation yellow paint that just predates the 1941 restoration. No early plaster paints were found in this room, but the plaster that was exposed on the north wall of the stair passage offers important evidence about the earliest plasters on the west wall of the northeast room. The original plaster has six generations of unpigmented limewash. This west wall was then replastered, perhaps because of some alteration to the northeast room, and was recoated again with five more unpigmented limewashes. These limewashes were inexpensive coatings, and are consistent with the lower status of this room compared to the oil paints found on walls of southwest drawing room.

In generation 12 a light blue-pigmented limewash was applied to the northeast room walls, followed by distemper paints in yellow, brown and then grayish colors. Generation 16 on the trapped plaster is a grayish paint that contains the pigment zinc white, which was commercially available after about 1845. That means that the alterations that trapped these two plasters could not have been made before that date, and perhaps were made much later. So, the plaster and woodwork paints for the northeast room can be aligned to suggest that for many years the walls were simply limewashed white, while the cornice, and likely the other woodwork, were primarily cream colors or

yellows, with the exception of a possible grain-painting sequence in the fourth generation. This decorative treatment consists of a cream-colored base coat, a tannish glaze and a varnish coating, and it could represent oak graining, which became stylish in this country after the first quarter of the nineteenth century.

The balance of the woodwork in the northeast room – wainscot, chair rails, architraves – could not be comparatively dated with paint archaeology because they were so thoroughly and aggressively stripped. The paint layers on these elements begin quite late when compared with those on the cornice.

The exploration of paints in the stair passage was also severely hindered by the fact that all the woodwork had been so completely stripped, with extensive patching of joinery with whitish putty. This stripping and patching seems to be related to the 1941 renovation. There is enough evidence to suggest that the blocks below each step on the staircase had originally been grain-painted, possibly in a mahogany pattern to match the balusters and railing. Examination of mortar removed from the underside of the arch exposed during the investigation showed no plaster and no coatings on the surface of the coarse substrate. This suggests that the underside of the arch was never open. Unless other areas of woodwork and wall plaster in this space are opened up for further exploration, there is not much more to learn from the surviving paints in this space.

Limited analysis of the chalky white coatings on the underside of the exposed flooring and the joists of what had been the original ceiling in the cellar suggests that the two unpigmented limewashes are later and the ceiling was originally left unpainted. Further explorations and openings in the cellar might reveal more helpful paint evidence.

Further paint research in the house might be undertaken if more openings exposing finished surfaces are made. The finishes on the woodwork and plaster on the second floor of the house were not examined or sampled, but that could certainly be pursued if there are elements that are relevant to understanding the evolution of the house. Pigment analysis has not been conducted for any of the early paints yet, but that could be done if there are specific layers that are of interest for replication and/or color matching. The last phase of work would be color matching with a colorimeter/microscope, which could be done after discussions with the owner of the property.

The exterior wood trim and stucco coatings were not analyzed as part of the investigation, but could be explored in the future, if desired.

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.

54 Hasell Street, Charleston, South Carolina
Paint Sample Locations
Samples Removed July 11 and 12, 2018 by Susan L. Buck

First-floor
Southwest Room
1. South wall, southeast corner, at right lower edge of raised plaster panel, in chamfer.
2. South wall, southeast corner, at right lower edge of raised plaster panel, at corner of panel.
3. East wall, over north door, plaster below lower right swag.
4. East wall, over north door, on applied plaster leaf form.
5. West wall, replacement section of plaster, chamfer of plaster panel.
6. East wall, cornice in northeast cornice above door, edge of dentil molding.
7. North partition wall door. Top left corner, top right panel.
8. North wall door architrave, pediment, edge of fluting.
9. West wall, swag above door, edge of top left bellflower.

Northeast Room
1. West wall, cornice about fireplace.
2. North wall, northeast corner, wainscot just below chair rail.
3. North wall, northeast corner below window, surbase of chair rail.
4. East wall, exposed plaster left of closed-up window opening.
5. Fireplace, multiple coatings on left side of interior of firebox.

Stair Passage
1. North wall, exposed plaster behind wallboard.
2. North wall, small hinged door under stair, top left corner of left leaf.
3. North wall, horizontal paneling under stair, top edge of middle board.
4. North wall, end block below stair, sixth step up from bottom.
5. North wall, inner surface of hinged door, left corner of top rail, where it meets left stile.
6. North wall, plaster directly on brick face exposed above wainscot in opening.
7. North wall, second plaster layer in exposed section.
8. North wall, curved end block below stair, tenth step up.

Cellar
1. Central west room, south side, side of exposed joist.
2. Central west room, south side, underside of exposed floorboards in ceiling.