

Technical Study and Treatment of Paintings by Clementine Hunter

ABSTRACT

*Twenty-two paintings by self-taught artist Clementine Hunter (1886 or 1887–1988) underwent treatment, analysis, and framing prior to exhibition at the National Museum of African American History and Culture. The examination of works ranging from the 1950s to 1980s revealed the artist's use of underdrawing as well as her evolving technique. Analysis detected the presence of zinc soaps in passages of paint exhibiting unusual morphologies and protrusions in the painting *Zinnias*, ca. 1970. Materials were documented and compared with previous analyses carried out on known Hunter paintings from a concluded Federal Bureau of Investigation forgery case. The exhibition and framing of selected works are also explored.*

1. INTRODUCTION

The 23 paintings by Clementine Hunter (1886 or 1887–1988) represent the largest number of works by a single artist in the National Museum of African American History and Culture (NMAAHC) collection. Clementine Hunter has become known as one of the most important American folk artists of the 20th century. Born in Natchitoches Parish, Louisiana, Hunter spent much of her life as a farm laborer and domestic servant at the Melrose Plantation along the Cane River. She began painting in 1939 around the age of 52 and is estimated to have created over 5,000 works of art prior to her death in 1988 (Shiver and Whitehead 2012). Known to paint on window shades, ceramic jugs, cardboard, and other readily found materials, Hunter often depicted scenes of work, religious ceremonies, flowers, and memories from life at the Melrose Plantation (fig. 1) (Morgan 2005). Hunter eventually gained recognition for her work and was awarded an honorary doctorate of fine arts from Northwestern State University in 1985.

The NMAAHC works, acquired between 2012 and 2017, were found to be in varying conditions, many with significant accumulations of surface grime and localized areas of cracking that necessitated cleaning and stabilization. A technical study was undertaken when deterioration in the form of protrusions, cracking, and waxy, translucent passages of paint was observed on three paintings. The investigation sought to characterize the artist's materials and identify the underlying causes of deterioration in order to inform strategies for treatment and exhibition.

2. TECHNIQUE

The paintings in the NMAAHC collection were executed primarily in oil on a variety of supports, including plywood, cardboard, Masonite, paperboard, and a fabric window shade. Clementine Hunter typically began a painting by drawing the composition in graphite—a step she referred to as “marking” the painting (Shiver and Whitehead 2012). An example of Hunter's compositional marking can be seen on the reverse side of *Dancing*, ca. 1970, which was discovered after the painting was unframed for treatment (fig. 2).

In her earlier works, Hunter painted with lean, economical washes of color. According to Shriver and Whitehead (2012), Clementine Hunter made her first paintings using the dregs of oil paint tubes discarded by Alberta Kinsey (1875–1952), an impressionist artist who painted while in residence at Melrose Plantation in the late 1930s. From this early period until around the mid-1950s, Hunter tended to first paint her “marked” figures and then fill in the background around them. Later in her career, Hunter began a work by laying in a wash of color overtop her marked compositions. As she gained recognition and access to materials, Clementine Hunter's technique gradually gave way to a wet-into-wet paint application, with heavy impastos on details of flowers, clothing, and cotton bolls for which she is best known. The progression of Hunter's signature is also well documented. Her earliest works were signed “Clemence” by friend and supporter Francois Mignon. Hunter began signing her initials “CH” in the late 1940s to early 1950s (fig. 3a) (Barabe 2012). In the 1960s, she reversed the “C” and



Figure 1. Clementine Hunter, *Zinnias*, ca.1970, oil on paperboard, 40.3 × 61 cm, Collection of the Smithsonian National Museum of African American History and Culture, Gift from the Collection of Sabra Brown Martin, © Cane River Art Corporation, Object No. 2017.68.13

gradually decreased the space between the letters, with the backwards “C” eclipsing the “H” in the 1980s (figs. 3b–3d). The time period in which the NMAAHC paintings were created could be approximated using this system.

3. ANALYSIS

As paint degradation was noted in three works from the 1970s, several other paintings from the same time period in the NMAAHC’s collection were examined and compared. In collaboration with conservation scientists at MCI, discreet



Figure 2. Drawing on verso of Clementine Hunter’s *Dancing*, ca. 1970s, oil on paperboard, 17.1 × 30.3 cm, Collection of the Smithsonian National Museum of African American History and Culture, Gift from the Collection of Sabra Brown Martin, © Cane River Art Corporation, Object No. 2017.68.9

paint samples were obtained from edges and areas of loss from these three paintings, mounted in cross-section, and analyzed with reflectance μ -Fourier transform infrared spectroscopy (μ -FTIR) [1] and scanning electron microscopy–energy dispersive x-ray spectroscopy (SEM–EDX) [2] in order to characterize the materials and degradation products. Loose samples of paint associated with the cross-sections were analyzed with attenuated total reflection (ATR) FTIR where possible. Additionally, 22 of the 23 paintings were analyzed with portable XRF to qualitatively characterize the pigments present (one painting remained on view for the duration of this project). The results of these analyses indicate a modern palette containing both mineral-based and organic pigments (Table 1).

Analysis of the binder with FTIR showed that oil paint was used in all except one painting, *Going to Church*, ca. 1950s, which had a casein binder. Three paintings, *Zinnias*, *Wash Pot Scene*, and *Dancing*, all from the 1970s, exhibited paint degradation in the form of protrusions, waxy-textured and wrinkled paint, a crystalline efflorescence, and localized cracking. For the purpose of this postprint, only the degradation phenomena observed in *Zinnias* will be presented.

3.1 *Zinnias*, 1970s

Zinnias (fig. 1) was observed to be in stable structural condition, with an overall layer of surface grime and debris. The work was executed in oil on an unprimed, 3/16-in. thick, four-ply laminated paperboard panel known as Upson board, identifiable by a green finishing sheet on the verso (U.S. vs. William Toye 2010). It is signed “CH” (with a backward “C”), painted into wet paint toward the lower right. The work was executed with thick and thin passages of paint with visible brushstrokes and some color mixing done directly on the painting. Characteristic of the artist’s working method, several fingerprints are present along the edges where it was handled while still wet.

Closer examination with optical microscopy revealed several passages of degradation and unusual paint morphology [3]. The red and green passages of paint exhibited the most significant states of deterioration, particularly in areas where they were layered over one another. Among the notable features, waxy agglomerations were observed below the paint layer in areas of loss (figs. 4a, 4f). Brushstrokes that dried with a ribbon-like, wrinkled texture were found on the surface of the red paint as well as where green was layered over the red (figs. 4b, 4d). In addition, cracks were noted in red and green passages, and protrusions were observed between the yellow and green paint layers (figs. 4c, 4e). A white, crystalline efflorescence found near cracks was identified as stearic acid, a free fatty acid, by FTIR (fig. 4b).

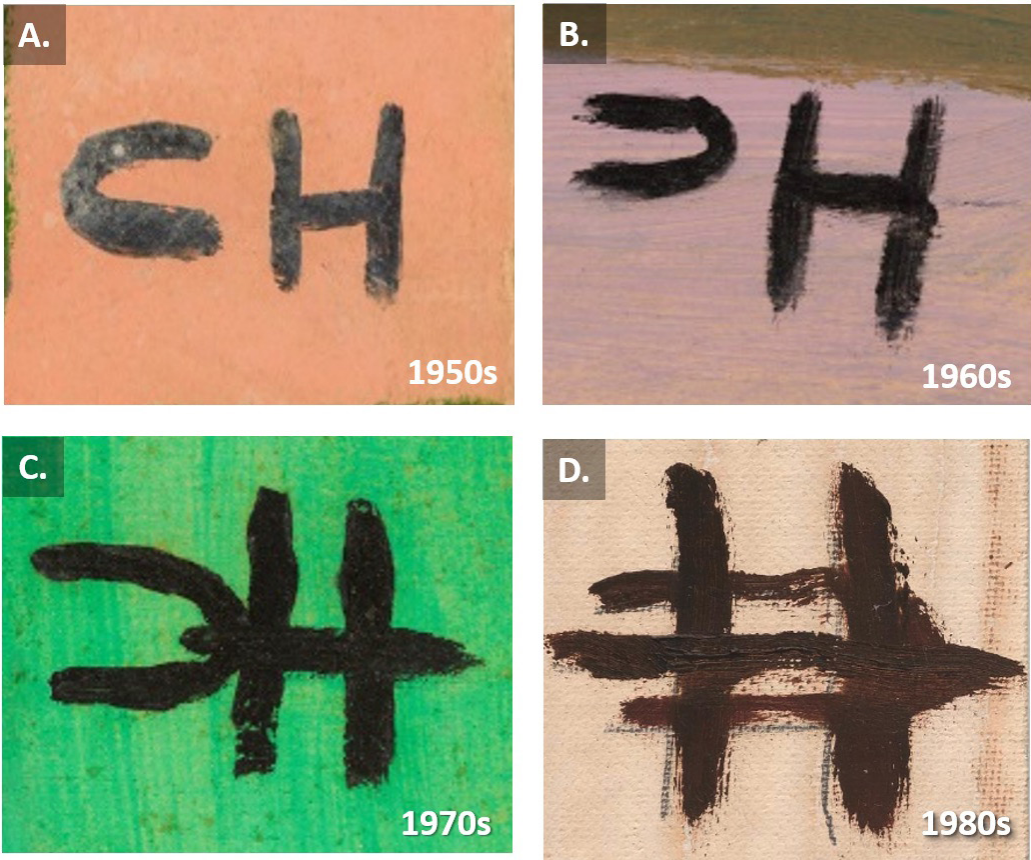


Figure 3. Details of the progression of Clementine Hunter's signature: a. *Wash Day*, ca. 1950s; b. *Baptism Scene*, ca. 1960s; c. *Zinnias*, ca. 1970s; d. *Black Jesus*, ca. 1980s.

Table 1. Selection of Pigments Characterized in Clementine Hunter Paintings from the NMAAHC Collection

White	Black	Red	Orange	Yellow	Brown	Green	Blue	Violet	Fillers
Titanium white	Ivory black	Cadmium red	Cadmium orange	Cadmium yellow	Raw/burnt umber	Viridian or chromium-based green	Prussian blue (in one early work)	Organic violet	Barium sulfate
Zinc white	Mars/iron black	Organic red	Organic orange	Organic yellow	Iron earths	Organic green	Organic blue		Calcium carbonate
Lead white						Cadmium green or Cadmium yellow + organic	Manganese blue		Zinc oxide
									Lithopone (possibly)

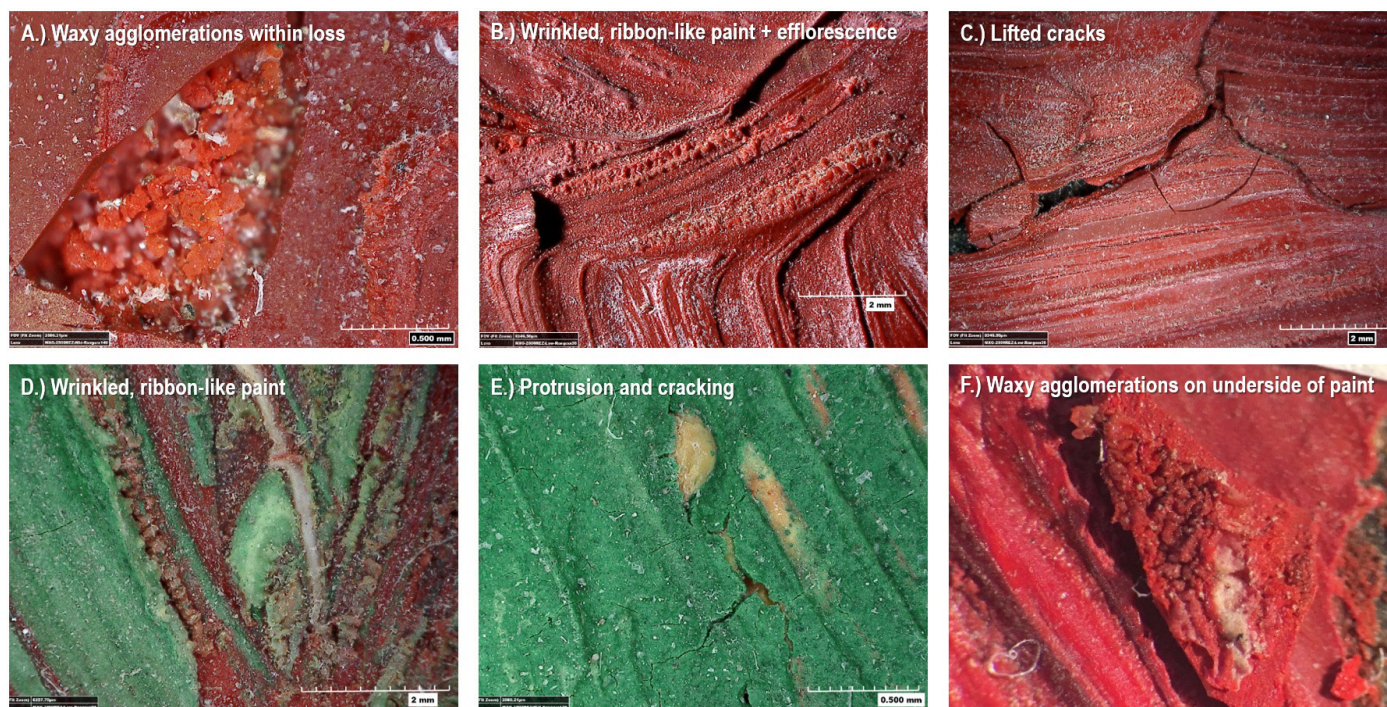


Figure 4. Details of degradation and unusual paint morphologies in *Zinnias*: a. Waxy agglomerations within loss; b. Wrinkled, ribbon-like paint and efflorescence; c. Lifted cracks; d. Wrinkled, ribbon-like paint; e. Protrusion and cracking; f. Waxy agglomerations on underside of paint.

FTIR analysis also indicated that the red and green passages contained organic, dye-based pigments and crystalline zinc soaps. The FTIR spectrum of a wrinkled, waxy agglomeration from an area of loss is compared to zinc stearate in figure 5. The red agglomeration sample shares several characteristic peaks with zinc stearate, including carboxylate stretches at 1538 and 1396 cm^{-1} , and methylene

(CH_2) absorptions at 2918, 2849, 1456, 743, and 722 cm^{-1} (Robinet and Corbeil 2003). The lack of a broad absorption around 1580–1590 cm^{-1} suggests that the zinc stearate is present in the sample as a crystallized zinc soap (Hermans et al. 2016).

3.2 Sample X4: Protrusion

The protrusion shown in figure 4e was removed from the painting, mounted in cross-section (referred to in this section as Sample X4), and analyzed with SEM-EDX. An adjacent paint sample was analyzed with ATR-FTIR and found to contain both crystalline and amorphous zinc carboxylates. The optical image in figure 7a shows a lower black layer, a yellow and red protruding layer, and a portion of the green paint through which the protrusion emerged. The upper left portion of the yellow layer is translucent.

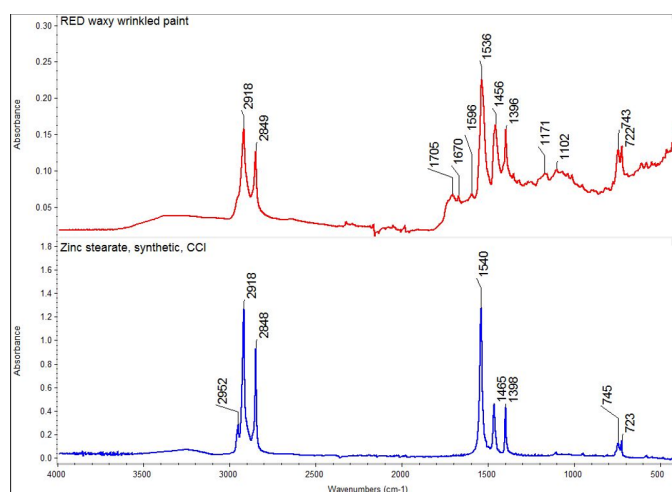


Figure 5. Comparison of FTIR spectra of the red waxy, wrinkled agglomerations from *Zinnias* and synthetic zinc stearate

The pigments and fillers can be characterized based on elemental mapping, shown in figure 6b. The lower black layer containing both calcium and phosphorus (indicated in yellow) is presumed to be bone black; the top green layer (indicated in green) contains a chromium-based pigment, such as viridian; the yellow layer is abundant in zinc (indicated in red) and likely contains a dye-based yellow pigment with zinc oxide fillers, based on the absence of other elements. Finally, barium sulfate filler particles (indicated in blue) are present in the lower portion of the sample.

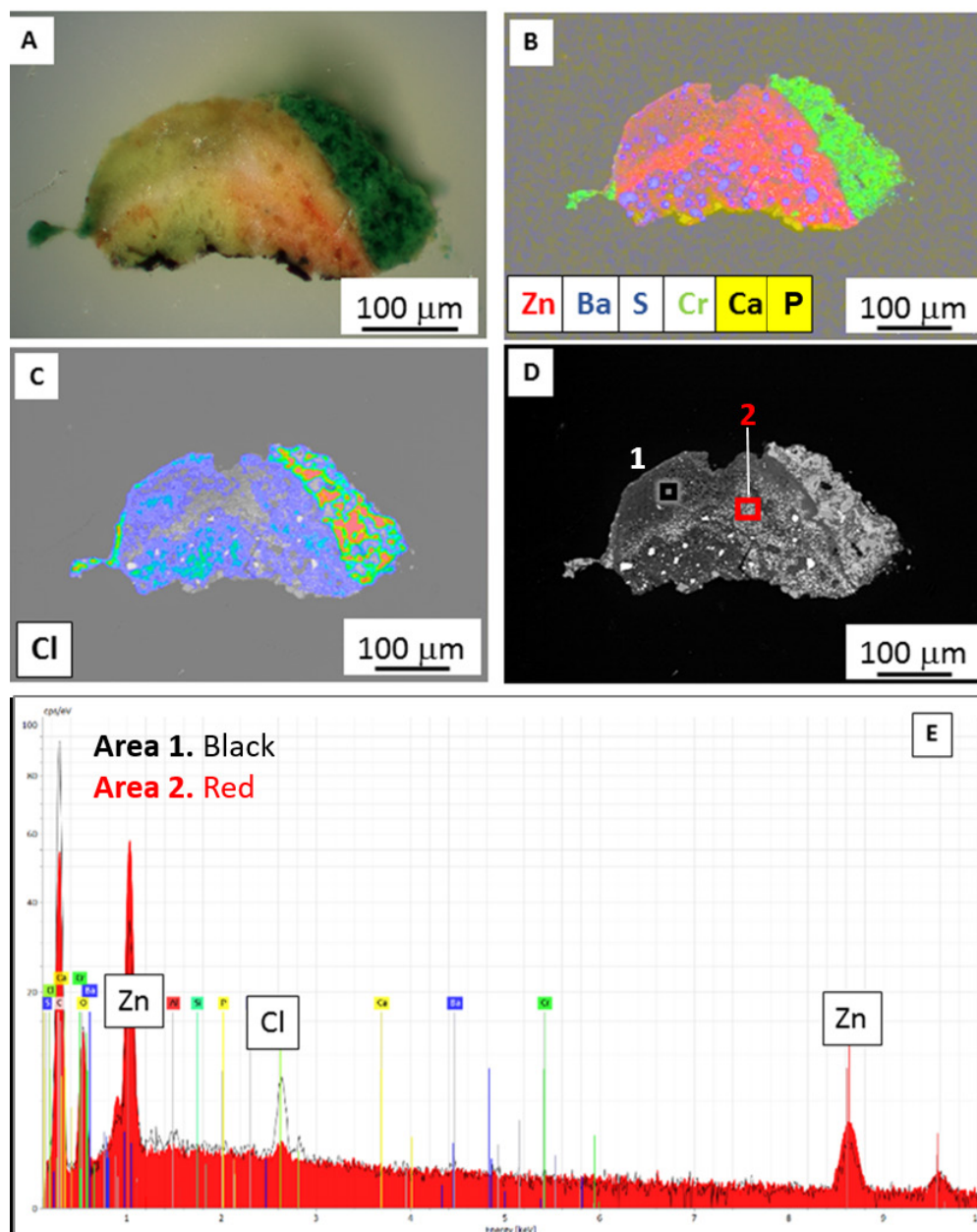


Figure 6. SEM-EDX analysis of a protrusion from *Zinnias*: a. Optical image; b. Composite EDX maps for zinc (red), barium (blue), sulfur (blue), chromium (green), calcium (yellow) and phosphorus (yellow); c. Intensity map showing concentrations of chlorine within paint cross-section; d. Back-scattered electron micrograph with the regions of interest selected for EDX analysis in black (Area 1) and red (Area 2) boxes; e. Corresponding EDX spectra for the black (Area 1) and red (Area 2) boxed regions of interest selected in (d).

SEM-EDX also detected distributions of chlorine in the green and yellow layers of the protrusion (fig. 6c). Shown in an intensity map (where red indicates a relatively high and blue indicates a relatively low concentration), chlorine is especially abundant in the green chromium-containing paint layer, suggesting a chlorine-containing pigment such as phthalocyanine (copper(II) complex with chlorinated

phthalocyanine) may also be a component. The presence of chlorine detected in low abundance within the yellow layer, however, is less easily explained. Overlaid spectra from two regions of interest, indicated by a black and red box in figure 6d, are compared with figure 6e. The red boxed region (Area 2), representing a zinc-rich area, has more counts of zinc, and fewer counts of chlorine and carbon than the spectrum for

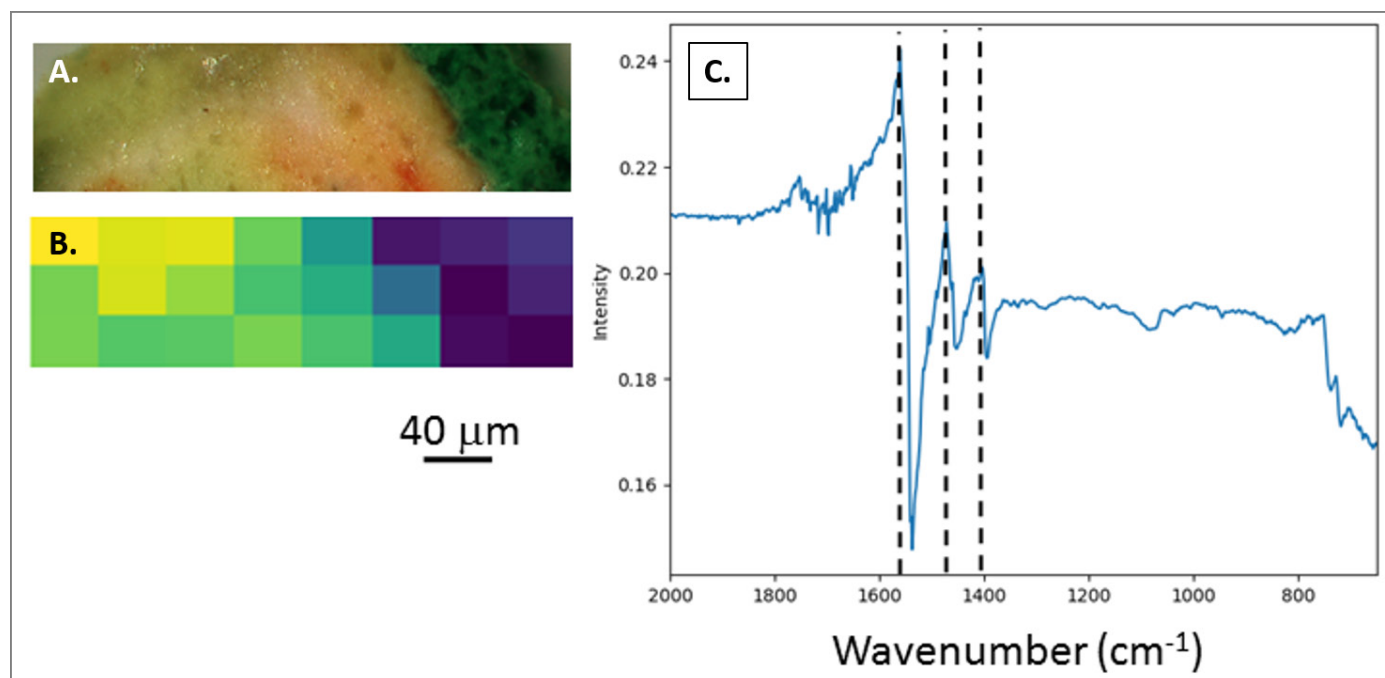


Figure 7. a. Optical image of the region where the reflectance μ -FTIR map was performed; b. Reflectance μ -FTIR component map image from nonnegative matrix factorization (NMF); c. Reflectance μ -FTIR component spectrum from NMF image where the dashed lines at 1562 cm^{-1} , 1470 cm^{-1} , and 1400 cm^{-1} are characteristic features for discussion.

the black-boxed region (Area 1). The protrusion's distribution of zinc through an otherwise carbon-rich layer and the detection of zinc carboxylates in a nearby passage of the same material suggest that the protruding layer contains zinc soaps. Further, is it possible that the chlorine detected in the protruding layer may be associated in some way with metal soaps, as it has been detected at the core of lead soap protrusions by other researchers (Keune and Boon 2007).

In addition to ATR-FTIR and SEM-EDX, reflectance μ -FTIR mapping was carried out on the same mounted protrusion cross-section (Sample X4). The purpose of performing reflectance μ -FTIR mapping was to create a visual map of the protrusion's organic material phases for correlation with inorganic data from SEM-EDX. Reflectance FTIR is a comparatively noisier technique than ATR-FTIR owing to atmospheric and specular interference. Therefore, a nonnegative matrix factorization was applied to the reflectance μ -FTIR map using HyperSpy, an open-source library for the programming language Python. The component optical image (top left) and component μ -FTIR map (bottom left) related to the yellow layer of the protrusion (in which SEM-EDX detected carbon, zinc, and chlorine) are presented in figures 7a and 7b. The pixelated appearance of figure 7b is caused by the $40 \times 40 \mu\text{m}$ aperture of the reflectance FTIR setup. Despite this, the map accurately shows three main material components of the cross-section:

the green paint layer, the zinc-rich area of the protrusion layer, and the carbon-rich area of the protrusion layer (shown in fig. 7b as gradients of dark blue, green, and yellow, respectively). Figure 7c shows a component reflectance spectrum, with the representative phase indicated by different color gradients. In this instance, the most zinc soap-rich areas appear yellow, while materials that are the most contrasting in composition (i.e., the green paint passage at the right side of the sample) are represented in dark blue. Characteristic asymmetric carboxylate stretches ($\nu_a \text{COO}$, 1558 cm^{-1}) and symmetric carboxylate stretches ($\nu_s \text{COO}$, slightly shifted to 1470 cm^{-1}) and the CH_2 bending typical in zinc stearate (δCH_2 , at approximately 1400 cm^{-1}) are observable.

Visualizing both the inorganic and organic phases within the protrusion allowed us to approximate a scenario for the protrusion's development. Presuming that the yellow paint layer was once flat rather than protruding, the distribution of the layer's zinc oxide particles (fig. 6d) in relation to the carbon-rich areas illustrates a path of upward migration of zinc soaps, which corresponds with the upward eruption of the protrusion. It is also possible that the pigment volume concentration of the organic yellow pigment in the protrusion layer was relatively low owing to the small particle size, thus allowing for the comparatively greater amount of linseed oil and associated fatty acid species to react with the zinc oxide filler.

In order to further support our analyses, expert analytical reports were obtained from a concluded 2012 Federal Bureau of Investigation (FBI) case that investigated suspected Clementine Hunter forgeries. The documents included technical studies carried out by two well-known analytical firms (Orion Analytical and the McCrone Group) in which suspected forgeries were compared with paintings by Hunter with established provenance. The suspected and known paintings were analyzed to identify differences in technique, pigments, supports, and surface characteristics using optical microscopy, polarized light microscopy, SEM-EDX, FTIR, and Raman spectroscopies. Among the differences were the detection of dolomite (anhydrous calcium magnesium carbonate) in the forgeries and the student-grade paints seized from the house of the now-convicted forger (U.S. vs. William Toye 2010). Data related to pigments and additives from the genuine paintings in the FBI case were found to correlate well with that obtained from the NMAAHC paintings, providing further confirmation of Hunter's palette and working methods.

4. TREATMENT AND FRAMING

The group of 22 paintings by Clementine Hunter were examined and individually tailored treatment strategies were proposed and undertaken for each work. Following documentation, the unvarnished surfaces of each painting

were cleaned and stabilized. As many of the colors analyzed contained zinc carboxylates or exhibited water sensitivity, dry cleaning was carried out with cosmetic sponges, Mr. Clean melamine sponges, and a semirigid Pemulen-based gel (applied only where it was safe to clear with water). Crushed, distorted edges of laminated paperboard supports were consolidated with wheat starch paste and brought back into plane using gentle weight. Areas of loss were inpainted using chalk pastels, watercolor, and gouache. Each of the works was documented before, during, and after treatment with detailed photographs and reports.

One work in particular, *Window Shade*, ca.1950s, required structural treatment. The painting, which was executed on a thin canvas window shade with a commercially prepared oil-containing surface, had been glued, stapled, and sewn to a fabric-covered Fome-Cor board along the painting's bottom edge and on either side of the top roller bar. In addition, the window shade support exhibited distortions from years of uneven tension as well as staining and tidelines from previous contact with water. The painting was unframed, mechanically removed from its backing, and the front and back surfaces were dry cleaned using cosmetic sponges. Areas of loss and staining were inpainted using gouache and pastels. In spite of local and overall humidification attempts, distortions continued to return in the support. Following consultation with curators, the

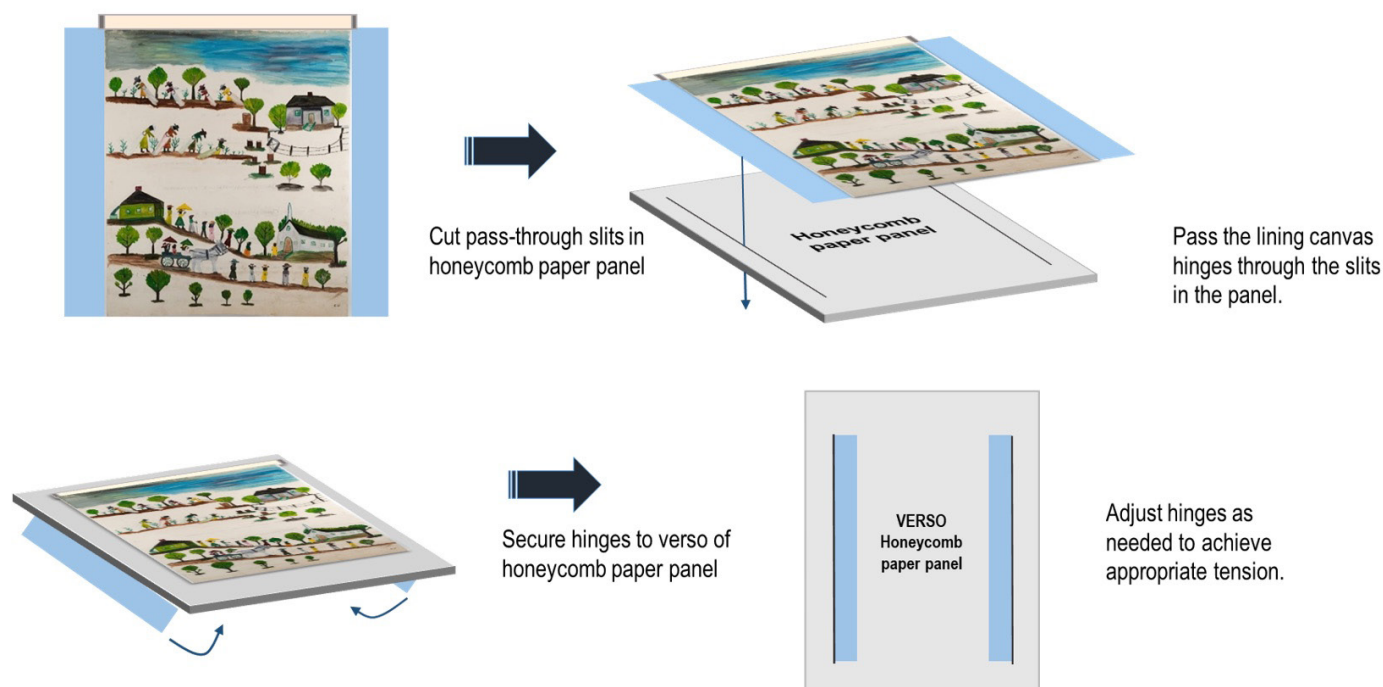


Figure 8. Mounting for framing and exhibition of Clementine Hunter's *Window Shade*.

decision was made to line the window shade to an auxiliary lightweight lining fabric that could also be used in the painting's exhibition mount (fig. 8).

A number of lining tests were carried out on mockups of similar materials. A polyester monofilament fabric (from TestFabrics) was chosen as a lining support, as mockup tests confirmed that BEVA 371 film adhesive remained preferentially adhered to the polyester lining fabric when peel reversed from canvas. The roller bar was removed from the window shade, and the painting was humidified overall prior to the lining. The painting was then lined to the polyester fabric on a heated vacuum suction table using a single sheet of BEVA 371 film as the adhesive.

The decision to honor the material origins of the window shade dictated the approaches to mounting the work for exhibition. In order to reattach the roller bar, a portion of the lining was mechanically reversed with a spatula along the top edge and trimmed to where the composition was intended to begin. An edge lining of the same polyester fabric and BEVA 371 was attached to the top edge of the painting and adhered to the roller bar, which had been isolated with polyester film. The top edge was restapled using original holes, and the top portion was rerolled.

Next, excess polyester lining canvas along the bottom edge was folded into a pocket and secured to the verso. A 1/8-in. piece of plexiglass (3/4 in. in height) spanning the lower length of the window shade was inserted into the pocket on the verso in order to create an anchoring point that added gentle downward weight to the mounting system while also allowing for the work to be read as fabric, with a naturalistic drape. Finally, the excess lining fabric was passed through vertical slits cut in a Hexamount archival honeycomb paper panel, tensioned, and attached to the verso, employing a method similar to pass-through hinges used in float-mounting works on paper. The roller bar was attached to the Hexamount panel using plexiglass "tombstones" fabricated in-house at the NMAAHC. The painting was framed and placed into a secondary exhibition frame intended to invoke a window molding (fig. 9).

5. FRAMING

Of the 22 works treated, 13 were mounted and framed for the exhibition in collaboration and consultation with numerous curatorial, collections, and design professionals within the Smithsonian. Apart from the window shade, the paintings were all executed on acidic supports, including paperboard and plywood. Two types of frames were designed: the first featured a sink mount made of a laminated



Figure 9. Clementine Hunter, *Window Shade*, ca.1950s, oil on window shade, 102.1 × 91.1 cm (image area), displayed in exhibition frame constructed by Eric Dixon, NMAAHC. Collection of the Smithsonian National Museum of African American History and Culture, Gift of the Rand and Dana Jack family, in honor of Rand's grandmother, Blythe Rand, who early recognized and supported the special talents of Clementine Hunter, © Cane River Art Corporation, Object No. 2014.176.1

stack of archival ragboard (chosen to absorb acids and to act as an environmental buffer), with a window mat placed slightly lower than the height of the artwork, allowing space for the edges of the painting to be seen. The second frame type, designed for larger works, comprised a wood backing painted the same color as the window mats (fig. 10). In both styles, the works were secured to their mounts with custom-bent stainless steel headless pins covered by Teflon tubing. The pins were pressure fitted into predrilled holes in the wood backings as well as the laminated stacks of ragboard. The paintings were glazed and exhibited in walnut frames. As a result of this framing process, the paintings, many of which were small, were afforded sufficient visual space, with evidence of the artist's handling of the edges visible to the viewer.

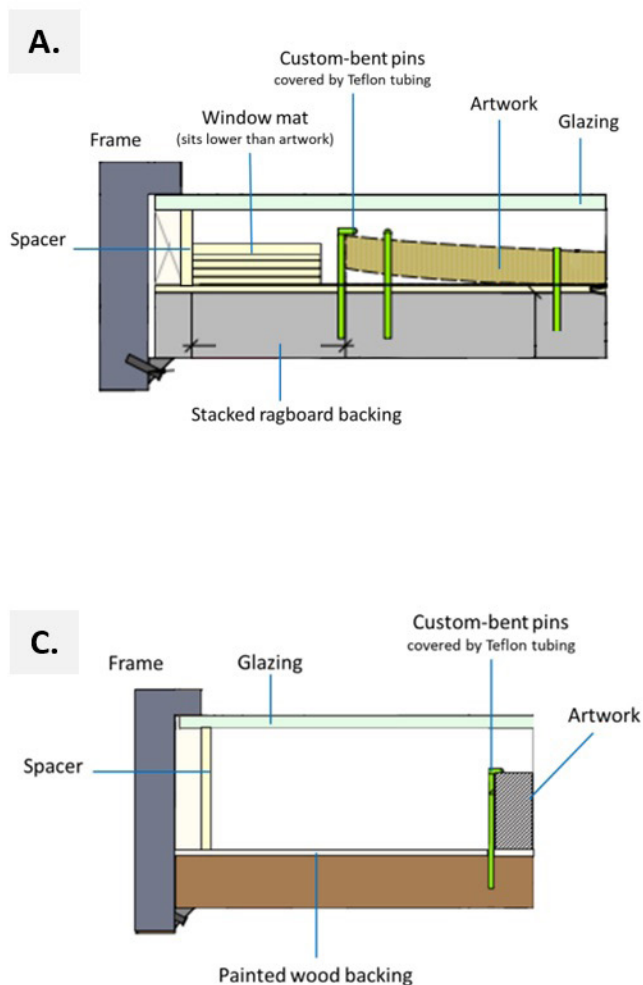


Figure 10. a. Custom frame style #1 includes a window mat placed slightly lower than the artwork, held by pins drilled into a stacked ragboard backing; b. Clementine Hunter, *Wedding*, ca.1970s, oil on paperboard, 17.5 × 18.4 cm, Collection of the Smithsonian National Museum of African American History and Culture, Gift from the Collection of Sabra Brown Martin, © Cane River Art Corporation, Object No. 2017.68.10; c. Custom frame style #2, a painted wood backing into which pins are drilled to support the artwork; d. Clementine Hunter, *African House*, ca.1970s, oil on plywood, 15.2 × 20.5 cm, Collection of the Smithsonian National Museum of African American History and Culture, Gift from the Collection of Sabra Brown Martin, © Cane River Art Corporation, Object No. 2017.68.5. Frames constructed by FramesByRebecca, Inc.

6. CONCLUSIONS

The comparison and study of Clementine Hunter's paintings within the NMAAHC's collection has revealed insights into the artist's evolving style and use of materials. Based on the analysis carried out for both the NMAAHC paintings and genuine works by Hunter in an FBI study, Hunter appears to have used high-quality oil paint lacking dolomite fillers typically found in student-grade paints. Her paints contained both mineral and organic pigments. In three paintings, passages of paint containing zinc soaps also exhibited degradation and unusual morphologies. Based on SEM-EDX

data, red and green dye-based paints in *Zinnias*, ca.1970s, contained zinc oxide fillers that reacted with the oil binder to form zinc soaps. Crystalline zinc soaps were detected in waxy agglomerations and translucent, wrinkled paint passages. The dye-based colors appear to exhibit more zinc soap-related degradation compared with mineral-based pigments, possibly owing to their small particle size and estimated low pigment volume concentration. In addition, low concentrations of chlorine were noted in more than one cross-section containing paint affected by zinc soaps. Future work related to the effects of zinc-containing fillers on modern paints is needed.

The works were treated with little to no use of water, as aqueous and solvent cleaning has been linked to the propagation of zinc soaps (Osmond 2012). The works were mounted and framed to honor the artist's use of materials as well as to absorb acidic materials from the paintings' supports and buffer from environmental fluctuations.

ACKNOWLEDGMENTS

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NOTES

1. μ -FTIR noncontact mapping in reflectance mode was carried out with a Thermo Nicolet 6700 FTIR spectrometer equipped with a mercury cadmium telluride type A (MTC-A) detector, in addition to ATR-FTIR. The mapping analysis of the embedded samples was carried out in a reflection mode with 500 scans taken from 4,000 cm^{-1} to 650 cm^{-1} at a spectral resolution of 1.928 cm^{-1} . Mapping on uncorrected data was performed using a 40 $\mu\text{m} \times 40 \mu\text{m}$ aperture with an overlapping step size of 20 μm in the x and y axes. The FTIR maps were analyzed using HyperSpy version 1.5.2, an open-source Python-based software package for hyperspectral data processing (www.hyperspy.org). Site-specific samples were also extracted for ATR-FTIR and transmission through an infrared microscope (μ -FTIR) using the Thermo Nicolet 6700 FTIR spectrometer with Golden Gate ATR and MTC-A detector. The data were collected at 4 cm^{-1} spectral resolution, using 64 scans in ATR-FTIR mode.
2. SEM-EDX was performed on carbon-coated embedded samples in high-vacuum mode using a Hitachi S3700-N scanning electron microscope (SEM). EDX was performed using a Bruker XFlash 6|60 detector with Esprit software version 2.1.2.17832. Samples were analyzed at a 15-kV primary electron accelerating voltage.
3. Microscopy was performed with a HIROX KH-8700 digital microscope with the MXG-2500REZ dual illumination lens and 2.11 megapixel CCD sensor. The microscope is equipped with a motorized z control,

which allows for the collection of a focal stack that can be rendered into a three-dimensional image with the HIROX KH-8700 embedded proprietary operating system and software package.

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