

ANALYSIS REPORT

Robert Rauschenberg, *Barely There*, c. 1950s – 1960s

Scientific analysis of materials



Figure 1. Overall, recto.



Figure 2. Overall, verso.

Date: 12/18/17

Prepared by: Emily MacDonald-Korth

Artist: Robert Rauschenberg

Title/Subject, Date: *Barely There*, c. 1950s – 1960s

Materials: Paint, metal, fabric, wood, newsprint, photographic film, photographic reproductions on paper, printed paper, plastic, and other materials on canvas adhered to a Masonite panel

Dimensions: 33 ¾" x 24 ½"

Distinguishing marks: signature, lower PL corner

Executive Summary

Longevity Art Preservation carried out analysis of *Barely There* (Rauschenberg, c. 1950s – 1960s); a abstract collage painting made from various art materials and found objects. The purpose of the investigation was to evaluate the condition of the painting and define the construction, image the painting under ultraviolet and infrared light, analyze paint, adhesives, modeling paste, metal, fabric, photographic film, photographic reproductions on paper, printed paper, plastic, and other materials on a canvas support that is adhered to a Masonite panel, with a focus on adhesive identification and their timeline. The following analytical techniques were employed: condition examination; digital imaging under visible, ultraviolet (UV), and infrared (DIR) lights; X-ray fluorescence (XRF); cross-sectional optical microscopy with fluorochrome staining and microchemical testing; polarized light microscopy (PLM), and Fourier transform infrared spectroscopy (FTIR). The painting is stable and in good condition; the overall appearance and condition are consistent with a painting of this type from circa 1950. UV and DIR imaging did not reveal any major restorations, alterations, or compositional changes. Based on the outcomes of cross-sectional optical microscopy with fluorochrome staining and microchemical testing, the results indicate the painting is on canvas without a ground layer, the paint is likely alkyd-based (possibly acrylic), and the photographic film is cellulose acetate- and/or polyester-based. PLM analysis identified titanium white, cobalt blue, and cadmium red and/or orange pigments. Elemental analysis indicates the presence of the following materials: cobalt blue pigment, alum, barium-based pigment or filler, calcium-based pigment, cadmium red and/or orange pigment, copper alloy metal (e.g. brass), possibly phthalocyanine green, iron-based pigments including umber, silicon-based fiber (e.g. fiberglass), photographic film, and titanium white pigment. FTIR analysis identified acrylic polymer emulsion modeling paste bulked with calcium carbonate and calcium sulfate, acrylic polymer emulsion (used as adhesive), and cellulose nitrate used as adhesive). All materials identified on the object were available in the 1950s. The colorant in the signature, likely carbon-based pigments, correspond to the pigments identified in other regions of similar color (black). The results of this study correspond to seminal descriptions of the artist's work from the 1950s (see References: Dickerman, 2016 and 2017; Lanchner, 2009), namely the artist's "Combine" period.

Introduction

Longevity Art Preservation, LLC (or Longevity) was contacted by [REDACTED] representing [REDACTED] (the client), regarding the analysis of an artwork attributed to Robert Rauschenberg (also referred to as the artwork, painting, or object in this document). Webber explained his interest in having testing carried out to characterize the materials used on the object. The following analytical techniques were employed in this study: condition examination; digital imaging under visible, ultraviolet (UV), and infrared (DIR) lights; X-ray fluorescence (XRF); cross-sectional optical microscopy with fluorochrome staining; microchemical testing; polarized light microscopy (PLM); and Fourier transform infrared spectroscopy (FTIR). The findings from the scientific investigation will be discussed in the following report. A total of 21 samples were collected from the painting (see Sample Table); a selection of the sample set was analyzed to identify and characterize adhesives, pigments, binding media, and coatings.

Purpose

Phase I: In situ condition examination, technical photography, elemental analysis, and sampling

- i. Travel to and from the object (Miami, FL to Houston, TX) to carry out in situ examination, analysis, and sampling
- ii. Carry out a written conservation condition examination to document the condition and construction of the object, including detail photography, in situ microscopy and photomicrography, and graphic condition mapping
- iii. Perform the following methods of technical photography:
 - a. High-resolution digital photography under visible light to document the current condition of the front (recto) and reverse (verso) of the object to the standards set by the American Institute of Conservation
 - b. High-resolution digital photography under ultraviolet (UV) light to document the location and character of varnish layers, identify autofluorescent materials, and distinguish areas of restoration
 - c. High-resolution digital infrared photography (DIR) to image layers beneath the design layer, such as underdrawings, inscriptions, and compositional alterations
- iv. Carry out in situ elemental analysis using X-ray fluorescence (XRF) to gather information about the elemental composition of the adhesives used on the artwork
- v. Collect a selection of samples for use in Phase II

Phase II: Chemical analysis and reporting

- vi. Characterize the adhesives present on the artwork using chemical analysis techniques, with a focus on identification of the adhesive type/s and their relationship to the artwork and its timeframe of creation
- vii. Carry out provenance and literature review for comparative analysis
- viii. Prepare a comprehensive forensic analysis report with a focus on the adhesives used in the construction of the object

Condition examination

Description

The painting is a rectangular, abstract collage, featuring white, blue, brown, red-orange, yellow, and green paint on canvas which is fixed to a panel with adhesive, and framed with an artist-made strip frame. Various materials applied to the canvas include: paint, adhesive, modeling paste, photographic film, photographic reproductions on paper, printed paper, metal, fabric, non-woven textiles such as honeycomb net and fiberglass, and plastic. The paint is layered beneath and over the applied materials creating a complex laminate structure. The painting is signed on the front in black on the lower right corner (recto, lower PL) (see Figure 8).

Support and frame

The primary painting support is a medium weight canvas adhered to an approximately ¼" wooden particle board panel (see Figure 3) with an artist-made strip frame (see Figure 4). The panel is not coated on the reverse. Overall the panel is stable and in good and stable condition. The canvas support is adhered to the panel; the tacking margins are not visible because they are behind the fixed frame. The edges of the canvas are visible on the reverse and appear cut suggesting the support is artist-stretched. The canvas support is in good and stable condition. The frame is wooden, ~ ¼" x 1 ¾", and painted white. The frame has a small crack at the upper PR edge and a dirt layer (see Figure 5). Overall the frame is in good and stable condition.

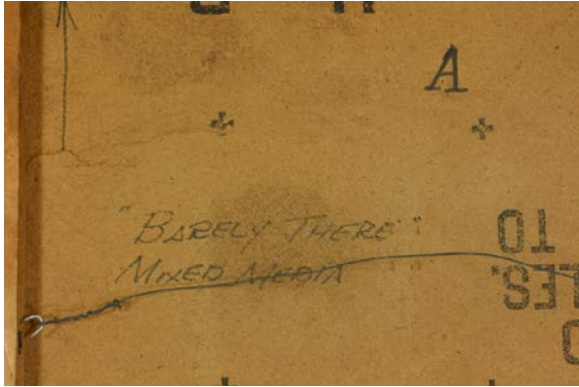


Figure 3. (left) Detail of inscription on wooden support on the reverse of the painting at the central PL half, verso.



Figure 4. (right) Detail of the lower PR corner, showing strip frame and bare canvas.



Figure 5. Graphic condition map.

Paint/design layer

No ground layer is applied. The paint layer has a low sheen and features low to high impasto with some high points; the high impasto is executed using a hard modeling paste. The paint layer varies greatly between heavy application to very thin washy layers. A layer of surface dirt and grime is visible; some of this material may be the artist's original technique. The paint layer is in good and stable condition. Other art materials

and found objects are applied to the canvas support (see Figures 6 and 7). These materials include: adhesive, modeling paste, photographic film, photographic reproductions on paper, printed paper, metal, fabric, non-woven textiles such as honeycomb net and fiberglass, and plastic. Some areas of adhered paper are delaminated and/or lifting away from the substrate. The photographic film exhibits signs of deterioration including warping and discoloration. A layer of surface dirt and grime is visible; some of this material may be the artist's original technique. Overall the design layer is in good condition with some discrete areas of fair condition. The painting is unvarnished. There is no evidence of restoration.



Figure 6. (left) Detail of various materials applied to the canvas support.
Figure 7. (right) Detail of various materials applied to the canvas support.

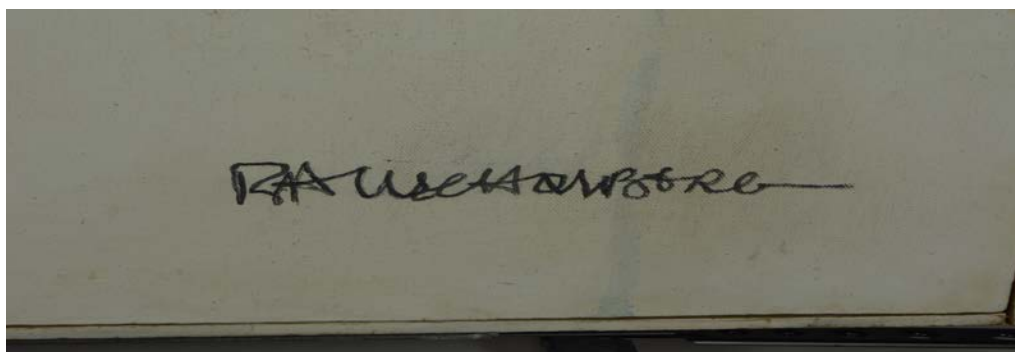


Figure 8. Detail of the signature.

Imaging

The following high-resolution digital imaging techniques were carried out: visible light (VIS), ultraviolet (UV), and infrared (DIR). This section will describe the results and observations of UV and DIR imaging. See Appendix I for Analytical Techniques, Appendix II for UV Images, and Appendix III for Digital Infrared Images.

Ultraviolet light imaging



Figure 9. Overall image, under UV light.

The painting is unvarnished. The painting has an overall autofluorescence consistent with certain types of pigments including: titanium white pigment, calcium-based pigment, synthetic organic pigments and/or dyes; paper (possibly with optical brightener); and cellulose acetate or nitrate adhesives, roll films, and possibly plastics. UV imaging of the reverse showed a light layer of fibers on the surface consistent with dust (see Appendix II). No signs of alteration or restoration are evident on the recto or verso of the object.



Figure 10. Overall image, infrared light; IR950.

Infrared photography was carried out on the painting recto using a IR950/950 nm filter. Carbon black and most earth pigments absorb infrared light and appear black, as seen in Figure 10 by the strengthened brown regions of paint and black printed areas. Cadmium and organic red pigments do not absorb infrared light and appears transparent, visible in many areas such as adjacent to the two '8's and surrounding the dancing figure at the central PL edge. Cobalt blue absorbs approximately 25% on infrared light which accounts for the partial transparency of the blue regions. No signs of compositional alteration are visible on the object. DIR imaging was not carried out on the verso of the object.

Analytical procedure

In October 2017, Longevity carried out a condition assessment, technical photography, and in situ XRF elemental analysis at a storage location in Houston, TX to identify materials used in the painting; each paint color, representatives of all materials present on the piece, the signature, and the wooden panel were analyzed. Longevity also collected 21 samples to identify the materials used on the object. Samples were taken on a very small scale (microns of powder to 0.5 – 1 mm x 0.5 - 1 mm fragments) to preserve the work in its most intact form and to limit the need for later intervention. Low power magnification was used to determine the most appropriate areas. The sampling site was first photographed, then a microscalpel was used to remove the sample from the painting, the sample was transferred onto a glass slide and labeled. All samples were named and numbered according to the order in which they were collected.

In the laboratory, the samples were examined with a stereomicroscope under low power magnification (20x) to identify the purest areas of sample and those with the most complete layering structure; accordingly, having the potential to give the most information during analysis. Remaining sample material that was not mounted for examination was retained for future studies. Samples aimed at studying the stratigraphy of the painting were cast in resin cylinders, sanded, and polished to expose the cross-section surface. Samples intended for pigment identification were mounted on glass slides. Once mounted, the cross-section samples were examined and digitally photographed under lights of different wavelengths at 40x – 400x. Sample intended for FTIR were sectioned, named with a “_A” suffix and transferred to a separate glass slide; samples were delivered by hand to an external laboratory for analysis.

Cross-sectional optical microscopy provided information about paint layer stratigraphy and some characterization of binders and coatings, based on the morphology of layers and particles, and autofluorescence of the layers under varying wavelengths. Fluorochrome staining and microchemical testing provided information about binding media and adhesives in discrete layers. Polarized light microscopy was used for pigment characterization based on the appearance and optical properties of the samples compared to established physical characteristics and reference samples. FTIR was used for adhesive and modeling paste identification; spectra were compared and matched to established reference spectra.

See Appendix I for Analytical Techniques, Appendix IV for Photomicrograph Data Sets including sampling site images, Appendix V for XRF Data, and Appendix VI for FTIR Data.

Sampling Locations

The following maps show sample locations:

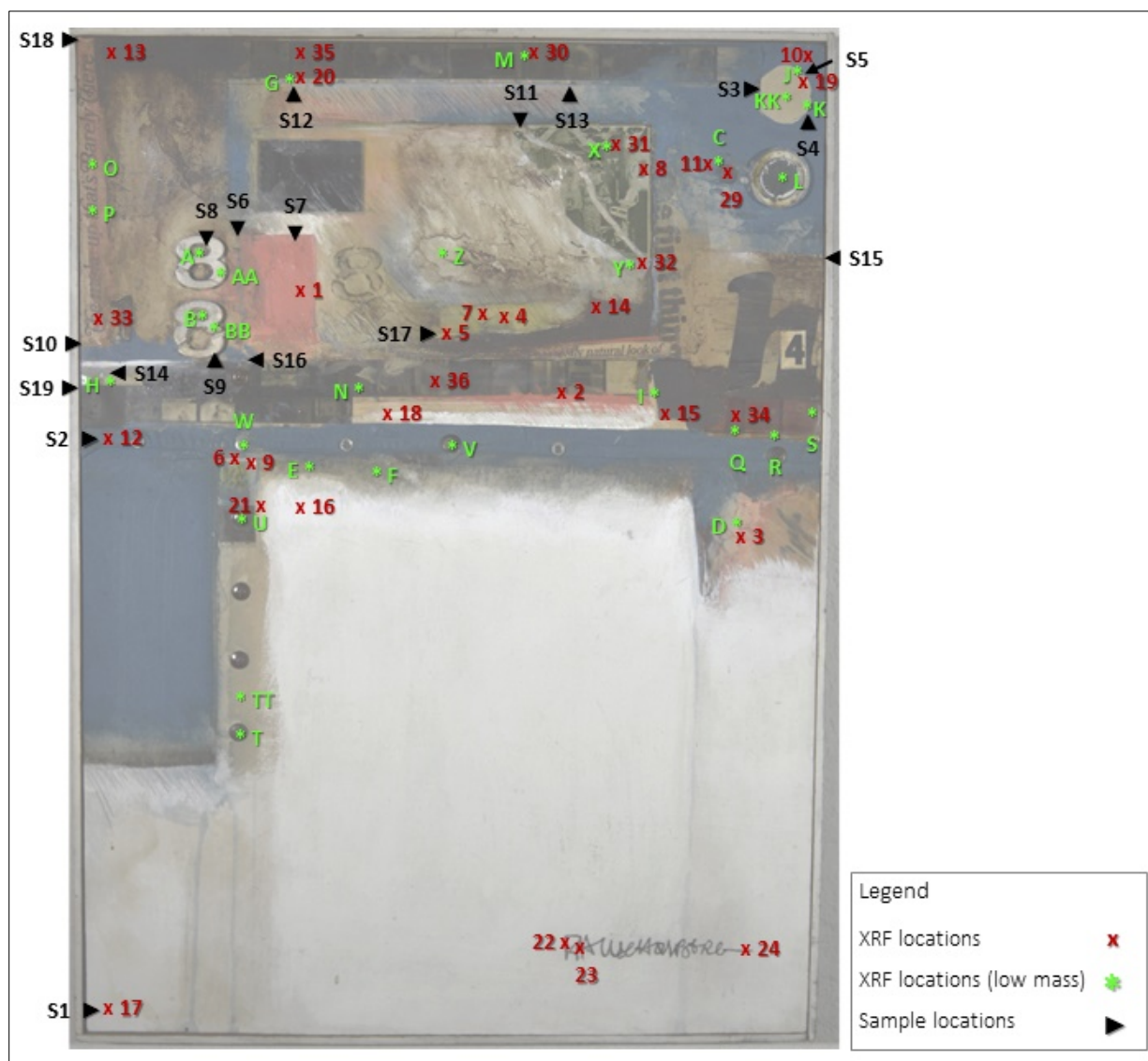


Figure 11. *Rauschenberg, Barely There*; sample and XRF analysis location map. Note: Image partially decolorized for graphic visualization.

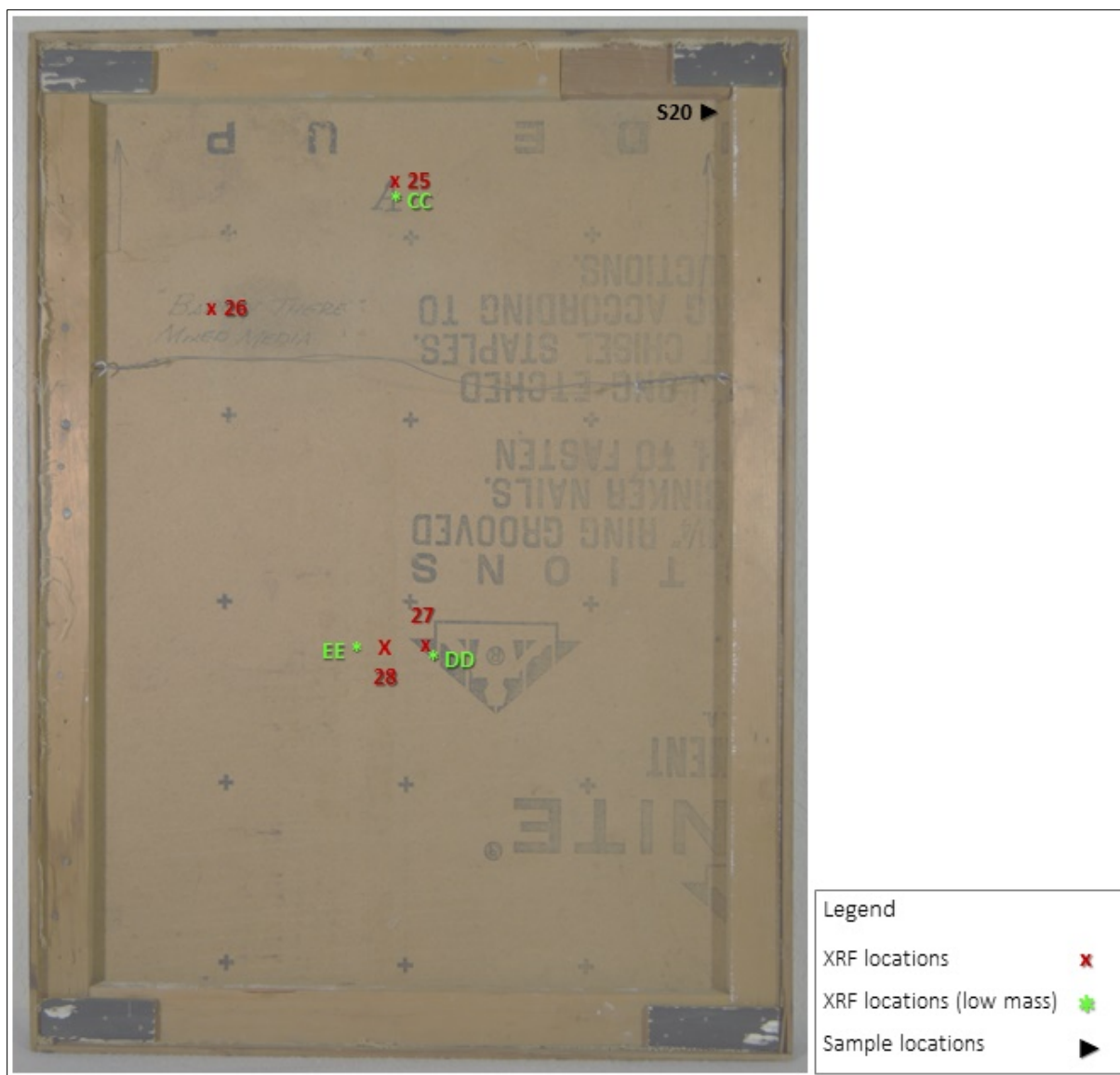


Figure 12. *Rauschenberg, Barely There*; sample and XRF analysis location map, verso.
Note: Image partially decolorized for graphic visualization.

The following samples were collected and/or analyzed from each painting, and selectively analyzed as noted:

Sample number	Sample location and description	Analysis used
S1	White paint; lower PR corner	PLM
S2	Blue paint; central PR edge	NA
S3	Blue paint with adhesive on canvas; upper PL corner	PLM; Cross-sectional optical microscopy; fluorochrome staining

Table 1. Sample table listing sample name, description, and types of analysis used (NA denotes samples that were not analyzed).

Sample number	Sample location and description	Analysis used
S4	Translucent adhesive with blue paint; upper PL corr	Cross-sectional optical microscopy
S5	Translucent adhesive with blue paint; upper PL corner	FTIR
S6	Orange paint over modeling paste; upper PR quadrant	NA
S7	Orange paint over modeling paste and/or paper; upper PR quadrant	NA
S8	Translucent yellow adhesive and brown paint; interior of upper "8", hard	Microchemical testing; FTIR
S9	Translucent yellow adhesive with brown and blue paint; surface of lower "8", soft	FTIR
S10	Orange paint and modeling paste with some fibers; central PR edge	PLM; Cross-sectional optical microscopy; fluorochrome staining
S11	Green printed paper; upper PL quadrant	NA
S12	Photographic film with adhesive; upper edge	Cross-sectional optical microscopy; microchemical testing
S13	Photographic film with adhesive; upper edge	Cross-sectional optical microscopy; microchemical testing
S14	Photographic film with adhesive; central PR edge	Cross-sectional optical microscopy; fluorochrome staining; microchemical testing
S15	Paint over paper; upper PL edge	NA
S16	Modeling paste with blue and orange paint; upper PR quadrant	Cross-sectional optical microscopy; fluorochrome staining; FTIR
S17	Yellow paint; central upper half	NA
S18	Paint over paper with adhesive; upper PR corner	NA
S19	Brown paint over photographic film with adhesive; central PR edge	Cross-sectional optical microscopy; fluorochrome staining
S20	Support panel fibers; upper PL verso	NA
S21	Canvas fibers; loose on edges, verso	NA

Table 1 continued. Sample table listing sample name, description, and types of analysis used (NA denotes samples that were not analyzed).

Results

Cross-sectional optical microscopy and fluorochrome staining were used to visualize the stratigraphy of the painting and characterize paint, adhesive, and coating media types. Polarized light microscopy (PLM) was used to identify pigments in the paint layers. X-ray fluorescence (XRF) was used to gather information about the elements used in the pigments, paper, adhesives, and other components of the artwork. Microchemical testing was used to identify the presence of cellulose nitrate. Fourier transform infrared spectroscopy (FTIR) was used to classify and identify adhesive types and modeling paste.

Summary of structure and materials identified in this study

Based on the results of cross-sectional optical microscopy with fluorochrome staining and microchemical testing, the results indicate the painting is on canvas without a ground layer, the paint is likely alkyd-based (possibly acrylic), and the photographic film is cellulose acetate- or polyester-based. PLM analysis identified titanium white, cobalt blue, and cadmium red and/or orange pigments. Elemental analysis indicates the presence of the following materials: cobalt blue pigment, alum, barium-based pigment or filler, calcium-based pigment, cadmium red and/or orange pigment, copper alloy metal (e.g. brass), possibly phthalocyanine green, iron-based pigments including umber, silicon-based fiber (e.g. fiberglass), photographic film, titanium white pigment. FTIR analysis identified acrylic polymer emulsion modeling paste bulked with calcium carbonate and calcium sulfate, acrylic polymer emulsion (used as adhesive), and cellulose nitrate (used as adhesive).

Results tables per analytical technique

Elements detected using XRF	Pigments and/or materials inferred
Aluminum (Al)	Cobalt blue pigment ($\text{CoO} \cdot \text{Al}_2\text{O}_3$); alum ($\text{KAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$; component of paper or size layer); possibly component of printing ink
Barium (Ba)	Barium-based filler pigment in cadmium-based pigments
Calcium (Ca)	Calcium-based pigment such as chalk (CaCO_3 , calcium carbonate) or gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$, calcium sulfate); component of silicon-based fiber
Cadmium (Cd)	Cadmium red ($\text{CdS} \cdot \text{CdSe}$) or cadmium orange ($\text{CdS} \cdot \text{CdSe}$)

Chlorine (Cl)	Component of photographic film and plastic
Chromium (Cr)	Component of plastic
Cobalt (Co)	Cobalt blue ($\text{CoO} \cdot \text{Al}_2\text{O}_3$)
Copper (Cu)	Copper alloy (metal button); copper-based colorant such as phthalocyanine green ($\text{C}_{32}\text{H}_{16}\text{N}_8\text{Cu}$) on printed paper
Iron (Fe)	Iron-based pigments ($\text{Fe}_2\text{O}_3 \cdot \text{H}_2\text{O}$ + varied, iron oxide); possible adhesive component; component of paper, film, and plastic
Potassium (K)	Alum ($\text{KAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$; component of paper or size layer)
Manganese (Mn)	Mineralogical association with iron-based pigments, suggests umber; component of printed paper (source unclear; possibly black colorant)
Nickel (Ni)	Copper alloy (metal button)
Phosphorous (P)	Component of photographic film
Selenium (Se)	Cadmium red ($\text{CdS} \cdot \text{CdSe}$) or cadmium orange ($\text{CdS} \cdot \text{CdSe}$)
Silicon (Si)	Silicon-based fibers such as fiberglass; component of paper and film
Silver (Ag)	Silver photographic film colorant
Sulfur (S)	Alum ($\text{KAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$; component of paper or size layer)
Titanium (Ti)	Titanium white (TiO_2)
Zinc (Zn)	Copper alloy (metal button)

Table 2. Elements detected using XRF and the pigments inferred (see Appendix V for more detailed information and images).

Sample number	Pigments identified using PLM
S1	Titanium white
S3	Cobalt blue
S10	Cadmium red (or orange)

Table 3. Pigments identified using PLM (see Appendix IV for more detailed information and images).

Sample number	Layering structure (description starts from the lowest layer)	Media type Based on the morphology of layers and particles, autofluorescence of the layers under varying wavelengths, and the results of fluorochrome staining reactions, the results suggest:	Cellulose nitrate test
S3	Canvas, followed by an adhesive layer, with two layers of blue paints	The adhesive layer is likely synthetic polymer-based and the paint layers are likely acrylic- or alkyd-based	NA
S4	Adhesive layer, with two layers of blue paints	NA; sample was not tested for binding media	NA
S8	Translucent yellow adhesive fragment with brown paint	NA; sample not mounted in cross-section	Positive. Indicates cellulose nitrate adhesive.
S10	Canvas with blue paint; an adhesive layer with black, yellow, and green paints; paper; modeling paste with orange paint	The adhesive layer is likely synthetic polymer-based; the paper may have animal glue-based size layer; the modeling paste is likely synthetic polymer-based, and the orange paint layer is likely acrylic- or alkyd-based	NA
S12	Toned adhesive (brown particles in a clear binder) followed by photographic film	NA; sample was not tested for binding media	Negative. Indicates the film is not cellulose nitrate-based; and instead is likely cellulose acetate or polyester-based

Table 4. Layering structure and materials identified using cross-sectional optical microscopy with fluorochrome staining and microchemical testing (see Appendix IV for more detailed information and images). NA denotes samples that were not analyzed with the listed method.

S13	Blue paint; possibly an adhesive layer; translucent orange paint or adhesive; photographic film	NA; sample was not tested for binding media.	Negative. Indicates the film is not cellulose nitrate-based; and instead is likely cellulose acetate or polyester-based
S14	Brown paint layer; adhesive layer; photographic film	Brown paint layer possibly alkyd- or acrylic-based; the adhesive layer is likely synthetic polymer-based; the film layer is positive for localized protein indicating gelatin layer location	Negative. Indicates the film is not cellulose nitrate-based; and instead is likely cellulose acetate or polyester-based
S16	Modeling paste; orange and blue paints	The modeling paste is likely synthetic polymer-based, and the orange and blue paint layers are likely acrylic- or alkyd-based	NA
S19	Possible adhesive layer; photographic film; blue paint layer 1; blue paint layer 2; brown paint layer	Binding media of the adhesive layer is unclear; the film layer is positive for localized protein indicating gelatin layer location; paint layers are likely alkyd-based (possibly acrylic, but less likely)	NA

Table 4 continued. Layering structure and materials identified using cross-sectional optical microscopy with fluorochrome staining and microchemical testing (see Appendix IV for more detailed information and images). NA denotes samples that were not analyzed with the listed method.

Sample number	Materials identified using FTIR
S5_A	Acrylic polymer emulsion, based on ethyl acrylate
S8_A	Acrylic polymer emulsion, based on ethyl acrylate; cellulose nitrate
S9_A	Acrylic polymer emulsion, based on ethyl acrylate
S16_A	Acrylic polymer emulsion, based on ethyl acrylate; calcium carbonate; calcium sulfate

Table 5. Materials identified using FTIR (see Appendix VI for more detailed information, images, and spectra).

Discussion

Panel

The panel is made of ~ ¼" particle board. Elemental analysis identified typical amounts of iron and calcium found in wood; some amounts of manganese and sulfur were also identified and may be present as additives to the particle board. Particle board is manufactured from wood chips and adhesive that are pressed together to make a flat sheet; it is a common building material and has been commercially available throughout the 20th century. The board has a printed label on the reverse that includes a partial word "NITE" and a logo; these labels are consistent with Masonite. Masonite has been available since the first quarter on the 20th century; the logo may correspond to those from the 1950s (more art historical research required).

Canvas support and other textiles

No ground layer is present. No major colorant is present as an imprimatura layer. Areas of unpainted canvas were analyzed using elemental analysis and identified calcium and sulfur, these elements may be present in the size layer and/or adhesive coating. A fibrous non-woven fabric is adhered to the canvas support; elemental analysis identified significant amount of silicon, suggesting fiberglass. Fiberglass fabric was commercially available in the middle of the 20th century. Canvas fragments of a finer weave and a honeycomb net are also adhered to the canvas support.

Adhesives

Two types of adhesives were identified in this study. Sampling and analysis were focused on areas of adhesive that were located beneath applied materials such as plastic, photographic film, and paper.

Adhesive type 1: Translucent colorless, soft, flexible

Elemental analysis did not identify any significant elemental signal differentiating it from other materials on the object, suggesting the use of organic adhesives including synthetic polymers. Optical microscopy with fluorochrome staining identified materials consistent with synthetic polymer emulsion adhesive. FTIR identified acrylic polymer emulsion, based on ethyl acrylate. Acrylic polymer emulsions have been commercially available since the 1950s.

Adhesive type 2: Translucent yellow, hard

Elemental analysis did not identify any significant elemental signal differentiating it from other materials on the object, suggesting the use of organic adhesives including synthetic polymers. Optical microscopy with microchemical testing identified cellulose nitrate (i.e. nitrocellulose). FTIR identified cellulose nitrate. Cellulose nitrate has been commercially available since the 1920s.

Modeling paste

Elemental analysis identified significant amounts of calcium and sulfur indicating the use of calcium-containing pigments and/or fillers such as calcium carbonate (i.e. chalk) and calcium sulfate (i.e. plaster of Paris). Optical microscopy with fluorochrome staining identified materials consistent with synthetic polymer emulsion with a filler or bulking agent. FTIR identified acrylic polymer emulsion based on ethyl acrylate, calcium carbonate, and calcium sulfate. Acrylic polymer emulsions have been commercially available since the 1950s. Calcium-based pigments and fillers have been used since antiquity.

Colorants

Red-orange

Elemental analysis identified significant amounts of cadmium (Cd), selenium (Se), and some barium (Ba) suggesting the paint is colored with cadmium red and/or orange pigment. Optical microscopy identified cadmium red and/or orange pigment. Cadmium red and orange pigments became commercially available in the first quarter of the 20th century.

Yellow

Elemental analysis identified significant amounts of iron (Fe), suggesting the paint is colored with iron-based pigments. Iron-based pigments have been in use since antiquity.

Green

Elemental analysis identified significant amounts of cobalt and iron in one location suggesting the use of cobalt blue pigment mixed with iron-based yellow pigment; in other locations elemental analysis did not identify any significant elemental signal indicating a colorant, suggesting the possible use synthetic organic colorants such as phthalocyanine green. Iron-based pigments have been in use since antiquity. Cobalt blue became commercially available in the early 19th century. Phthalocyanine green became available in the second quarter of the 20th century.

Blue

Elemental analysis identified significant amounts of cobalt (Co) and aluminum (Al) suggesting the paint is colored with cobalt blue pigment. Optical microscopy identified cobalt blue. Cobalt blue became commercially available in the early 19th century.

Brown

Elemental analysis identified significant amounts of iron (Fe) and some manganese (Mn), suggesting the paint is likely toned with iron-based pigments (e.g. earth pigments; presence of manganese suggests umber). Iron-based pigments have been in use since antiquity.

White

Elemental analysis identified significant amounts of titanium (Ti) indicating the paint is primarily toned with titanium white pigment. Optical microscopy identified titanium white pigment. Titanium white pigment became commercially available in the first quarter of the 20th century.

Signature

Elemental analysis did not identify any significant elemental signal indicating a colorant, suggesting the possible use of carbon-based black pigment (carbon-based

pigment do not show an elemental signal using XRF, and the lack of signal indicates its possible presence). Carbon-based pigments have been used since antiquity.

Verso, inscription

Elemental analysis did not identify any significant elemental signal indicating a colorant, suggesting the possible use of carbon-based black pigment (carbon-based pigment do not show an elemental signal using XRF, and the lack of signal indicates its possible presence). Carbon-based pigments have been used since antiquity.

Verso, printed

Elemental analysis did not identify any significant elemental signal indicating a colorant, suggesting the possible use of carbon-based black pigment (carbon-based pigment do not show an elemental signal using XRF, and the lack of signal indicates its possible presence). Carbon-based pigments have been used since antiquity.

Paint binding media

Based on the morphology of layers and particles, autofluorescence of the layers under varying wavelengths, and the results of fluorochrome staining reactions, the results suggest the paint is alkyd-based, acrylic-based, or both types of paint are used on the object. Alkyd paints have been available since the 1920s. Acrylic emulsions have been commercially available since the 1950s.

Photographic roll film

Elemental analysis identified significant amounts of silver, indicating the presence of silver colorant and suggesting the use of photographic film based on cellulose nitrate, cellulose acetate, or polyester. Optical microscopy with fluorochrome staining and microchemical testing identified materials consistent with photographic film; possible types include cellulose acetate and/or polyester. Cellulose acetate roll film became available in the mid-1940s. Polyester roll film became available in the mid-1950s.

Metal button

Elemental analysis identified copper and zinc in an approximate proportion of 5:1, indicating a copper alloy metal (e.g. brass).

Conclusions

Longevity Art Preservation carried out analysis of *Barely There* (Rauschenberg, c. 1950s – early 1960s). The study employed the following analytical techniques: condition examination; digital imaging under visible, ultraviolet, and infrared lights; XRF; cross-sectional optical microscopy with fluorochrome staining and microchemical testing; PLM; and FTIR. The purpose of the investigation was to evaluate the condition of the painting and define the construction, document the painting with high-resolution imaging, analyze paint, adhesives, modeling paste, metal, fabric, photographic film, photographic reproductions on paper, printed paper, plastic, and other materials on a canvas support that is adhered to a Masonite panel, with a focus on adhesive identification and timeline. The following analytical techniques were employed: The painting is stable and in good condition; the overall appearance and condition are consistent with a painting of this type from circa 1950. UV and DIR imaging did not reveal any major restorations, alterations, or compositional changes. Based on the outcomes of cross-sectional optical microscopy with fluorochrome staining and microchemical testing, the results indicate the painting is on canvas without a ground layer, the paint is likely alkyd-based (possibly acrylic), and the photographic film is cellulose acetate- or polyester-based. PLM analysis identified titanium white, cobalt blue, and cadmium red and/or orange pigments. Elemental analysis indicates the presence of the following materials: cobalt blue pigment, alum, barium-based pigment or filler, calcium-based pigment, cadmium red and/or orange pigment, copper alloy metal (e.g. brass), possibly phthalocyanine green, iron-based pigments including umber, silicon-based fiber (e.g. fiberglass), photographic film, and titanium white pigment. FTIR analysis identified acrylic polymer emulsion modeling paste bulked with calcium carbonate and calcium sulfate, acrylic polymer emulsion (used as an adhesive), and cellulose nitrate (used as an adhesive). All materials identified on the object were available in the 1950s. The colorant in the signature, likely carbon-based pigments, correspond to the pigments identified in other regions of similar color (black); however, beyond the inscription on the verso, other blacks were not artist applied (i.e. printed material). The results of this study correspond to seminal descriptions of the artist's work from the 1950s, namely his "Combine" period (see References: Dickerman, 2016 and 2017; Lanchner, 2009). The results of this study may correspond with new research about Rauschenberg's use of titanium white pigment (see References: Rogge, C. and J, Arslanoglu. 2016); more research may confirm results.

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Appendix I: Analytical Techniques

Visible light imaging was carried out to document the current condition of the painting. Imaging was carried out using a Nikon D5200 DSLR camera and a 5500K fluorescent light source.

Ultraviolet light (UV) was used to locate and characterize varnish layers, identify fluorescent pigments, and distinguish areas of restoration. Imaging was carried out using a Nikon D5200 DSLR camera with a Kodak Wratten 2 filter, and a long wave ultraviolet fluorescent light source.

Digital infrared photography (DIR) was used to image layers beneath the design layer, such as underdrawings, compositional alterations, and inscriptions. Imaging was carried out using a Nikon D5200 DSLR camera with Neewer IR950 infrared filters and a tungsten light source. The infrared filters allow infrared radiation through the filter but block all visible light.

Non-destructive macroscopic, microscopic, and spectroscopic techniques of examination and analysis were used as much as possible. The observations made through in-situ examination were recorded in writing, with digital photodocumentation, and with digital mapping. To obtain information about the stratigraphy and of the paint layers, pigments, binders, and plant fibers, minimally destructive methods of analysis were employed. Sampling was on a very small scale and isolated to areas with prior damage. Sampling was kept to a minimum to preserve the work in its most intact form and to limit intervention into unstable surfaces.

Polarized light microscopy (PLM) was used for fiber and pigment characterization. Characterization was based on the appearance and optical properties of the samples based on established physical characteristics and reference samples. Characteristics used for comparison include color, morphology, refractive index compared to mounting media, birefringence, and angle of extinction. Dispersed pigment samples were gathered from paint samples by carefully scraping the surface with a stainless steel microscalpel. Pigment samples were mounted in Cargille Meltmount 1.662 mounting medium and examined with a Nikon Optiphot II epifluorescent microscope (Nikon 4X, 10X, 20X, 40X objectives; 10X oculars) with a polarizing filter, analyzer, and rotating stage to examine the samples under high-powered magnification using a Nikon X-cite Mercury Lamp.

Digital images of the magnified samples were taken using the Amscope MU100 digital microscope camera in conjunction with the Amscope software for image captures.

Cross-sectional optical microscopy (with fluorochrome binding media staining and microchemical testing) provides information about paint layer stratigraphy and characterization of binders and coatings, based on the morphology of layers and particles and appearance of the layers under varying wavelengths and in combination with biological stains. Samples were collected using a stereomicroscope and stainless-steel micro scalpel. The samples were cast into clear acrylic resin cylinders and cured under an ultraviolet lamp. After curing, the cubes were rough sanded then fine-sanded and dry-polished using Micro-Mesh silicon carbide sandpaper in grits ranging from 1,500-12,000. A Nikon Optiphot II epi-fluorescent microscope (Nikon 4X, 10X, 20X, 40X objectives; 10X oculars), was used to examine the samples under high-powered magnification using a Nikon LH-M100C-1 Mercury light source. Digital images of the magnified samples were taken using the Amscope MU100 digital microscope camera in conjunction with the Amscope software for image capture. Charts displaying specifications for filter cubes and stains used in this study are listed below.

Filter cubes for the Nikon Optiphot II Microscope and their parameters:

Excitation	Cube	Excitation Range (nm)	Barrier (nm)	Dichroic Mirror Wavelength (nm)
Violet	UV-2B	330-380	435	400
Blue	FITC HYQ	460-500		505
Green	TRITC HYQ	530-560	620	570

Fluorochrome stains and their functions:

Stain Type	Stain Solution	Cube	Test Function	Positive Reaction Effect
Triphenyl Tetrazolium Chloride (TTC)	4% TTC in anhydrous ^[1] methanol (Sigma-Aldrich T8877)	BV-2A	Carbohydrates	Dark red to brown
Fluorescein isothiocyanate (FITC)	0.02% in anhydrous acetone (Sigma-Aldrich F7250)	B-2A	Proteins	Yellow/green
Rhodamine B (RhoB)	0.06% in ethanol (Sigma-Aldrich 83689-1G)	G-1B	Oils	Bright orange/red

Microchemical tests and their functions:

Test Type	Stain Solution	Cube	Test Function	Positive Reaction Effect
Diphenylamine	0.5% diphenylamine in 90% sulfuric acid	NA [visible reflected light]	Cellulose nitrate	Blue/purple

Energy dispersive x-ray fluorescence (XRF) is a qualitative and quantitative surface analysis technique that can determine the elemental compositions at the sample site. XRF was used to provide information about the elemental compositions of the materials used in select locations. The XRF spectrometer used in this study was a Bruker ArtTAX at 12µA current, 40kV, and 29 seconds live time irradiation, with a Ti/Al filter. Low mass XRF analysis was carried out using a Bruker ArtTAX at 25µA current, 15kV, and 58 seconds live time irradiation, with helium (He) and without a filter. Note: Rhodium (Rh) and Palladium (Pd) are present in every spectrum because of the instrument.

Fourier transform infrared spectroscopy (FTIR) can give information about classes or groups of materials and can be used to characterize and identify paint colorants, binders, grounds, varnishes, adhesives, and other material based on the spectra of the samples compared to established reference spectra libraries. FTIR was carried out by an external laboratory. Small fragments of larger samples were mounted on sodium chloride windows and flattened for analysis. Library searching was performed against the Bio-Rad “KnowItAll” spectral databases (approximately 250,000 spectra).

Appendix II: Visible and UV Images

Rauschenberg, *Barely There*, c. 1950s-60s

Imaging technique: Visible light

Comments: See report.



Visible light, overall, recto



Visible light, overall, verso

Longevity

Rauschenberg, *Barely There*, c. 1950s-60s

Imaging technique: Reflected ultraviolet (UV) light

Comments: See report.



Visible light



UV light

Longevity

Rauschenberg, *Barely There*, c. 1950s-60s

Imaging technique: Reflected ultraviolet (UV) light

Comments: See report.



Visible light, verso



UV light, verso

Longevity

Appendix III: Digital Infrared Images

Rauschenberg, *Barely There*, c. 1950s-60s

Imaging technique: Digital infrared (DIR); IR950 filter

Comments: See report.



Visible light



DIR, 950nm

Longevity

Appendix IV: Photomicrograph Data Sets

Rauschenberg, *Barely There*, c. 1950s-60s

Sample Number: S1; dispersed pigment sample

Sample Description: White paint

Results

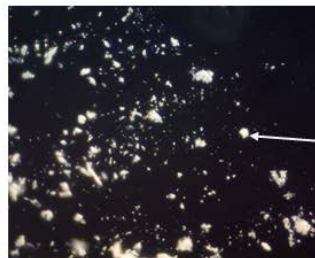
Results of PLM are consistent with the following materials:

- Titanium white pigment

All images were photographed at 200x magnification.

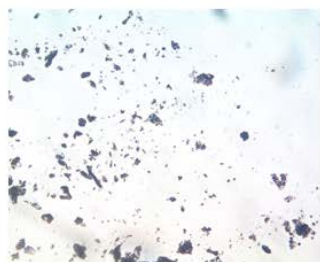


Detail of sample location

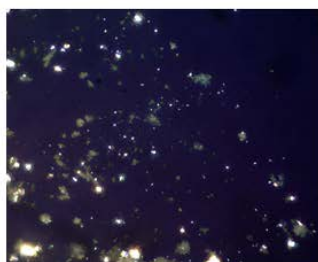


Titanium white

Reflected light (RPL)



Transmitted light (PPL)



Crossed-polarized light (xPL)



Ultraviolet light (UV)

Longevity

Rauschenberg, *Barely There*, c. 1950s-60s

Sample Number: S3; dispersed pigment sample

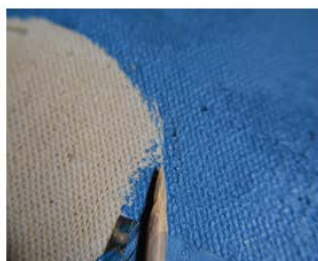
Sample Description: Blue paint

Results

Results of PLM are consistent with the following materials:

- Cobalt blue pigment

All images were photographed at 200x magnification.



Detail of sample location



Cobalt blue

Reflected light (RPL)



Transmitted light (PPL)



Crossed-polarized light (xPL)



Ultraviolet light (UV)

Longevity

Rauschenberg, *Barely There*, c. 1950s-60s

Sample Number: S10; dispersed pigment sample

Sample Description: Orange paint

Results

Results of PLM are consistent with the following materials:

- Cadmium red (or orange) pigment

All images were photographed at 200x magnification.



Detail of sample location

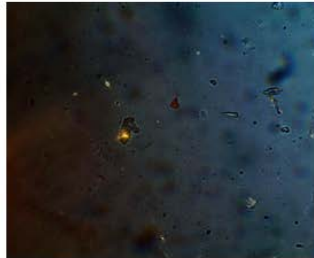


Reflected light (RPL)

Cadmium red
or orange



Transmitted light (PPL)



Crossed-polarized light (xPL)



Ultraviolet light (UV)

Longevity

Rauschenberg, *Barely There*, c. 1950s-60s

Sample Number: S3

Results: See report

Sample Description: Blue paint with adhesive on canvas



Detail of sample location



Visible light (vis) 100x magnification



UV light (uv) 100x magnification

Stratigraphy

1. Canvas
2. Adhesive
3. Blue paint 1
4. Blue paint 2

Before TTC (carbohydrates), UV

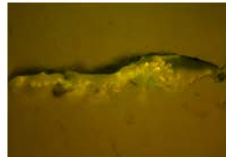


After TTC (carbohydrates), UV

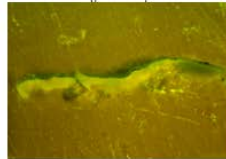


Positive
in layers:
Negative
in all

Before FITC (protein)

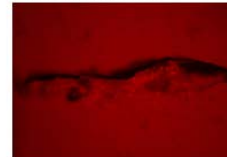


After FITC (protein)

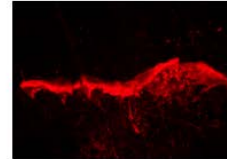


Positive
in layers:
4, 3, 2

Before RhoB (lipids)



After RhoB (lipids)



Positive
in layers:
2

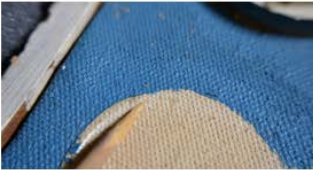
Longevity

Rauschenberg, *Barely There*, c. 1950s-60s

Sample Number: S4

Results: See report

Sample Description: Translucent adhesive with blue paint

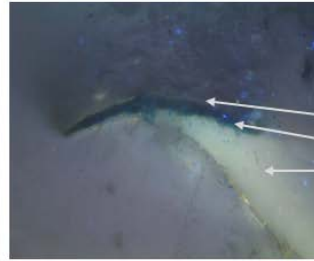


Detail of sample location



Visible light (vis)

200x magnification



UV light (uv)

200x magnification

Stratigraphy

- 3. Blue paint 2
- 2. Blue paint 1
- 1. Adhesive

Longevity

Rauschenberg, *Barely There*, c. 1950s-60s

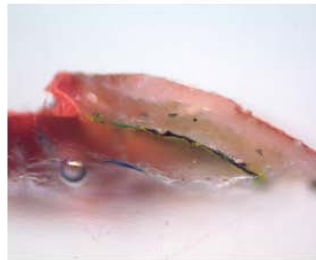
Sample Number: S10

Results: See report

Sample Description: Orange paint and modeling paste with some fibers

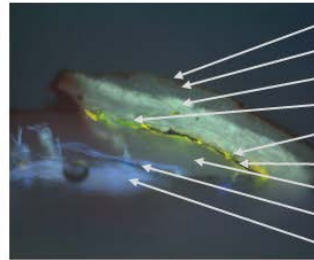


Detail of sample location



Visible light (vis)

100x magnification



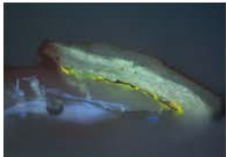
UV light (uv)

100x magnification

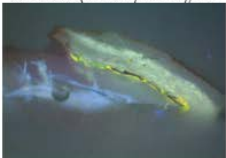
Stratigraphy

- 9. Orange paint
- 8. Modeling paste
- 7. Paper
- 6. Green layer
- 5. Yellow layer
- 4. Black layer
- 3. Adhesive
- 2. Blue paint
- 1. Canvas

Before TTC (carbohydrates), UV

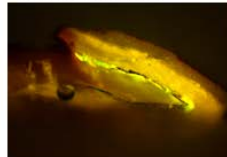


After TTC (carbohydrates), UV

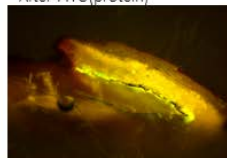


Positive in layers:
Negative in all

Before FITC (protein)

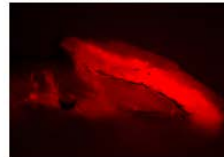


After FITC (protein)

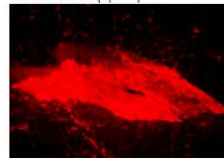


Positive in layers:
Slight positive in 7

Before RhoB (lipids)



After RhoB (lipids)



Positive in layers:
3, 7, 8, 9

Longevity

Rauschenberg, *Barely There*, c. 1950s-60s

Sample Number: S12

Results: See report

Sample Description: Photographic film with adhesive

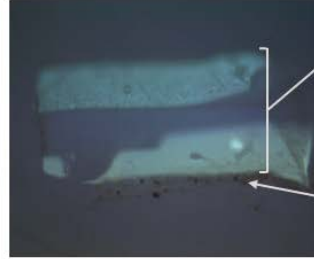


Detail of sample location



Visible light (vis)

100x magnification



UV light (uv)

100x magnification

Stratigraphy

2. Photographic film

1. Brown layer

Longevity

Rauschenberg, *Barely There*, c. 1950s-60s

Sample Number: S13

Results: See report

Sample Description: Photographic film with adhesive

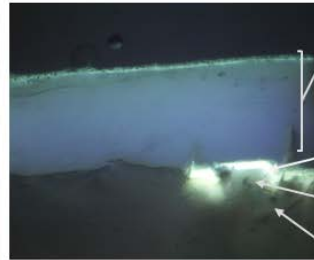


Detail of sample location



Visible light (vis)

200x magnification



UV light (uv)

200x magnification

Stratigraphy

4. Photographic film

3. Translucent orange layer

2. Possibly adhesive

1. Blue paint

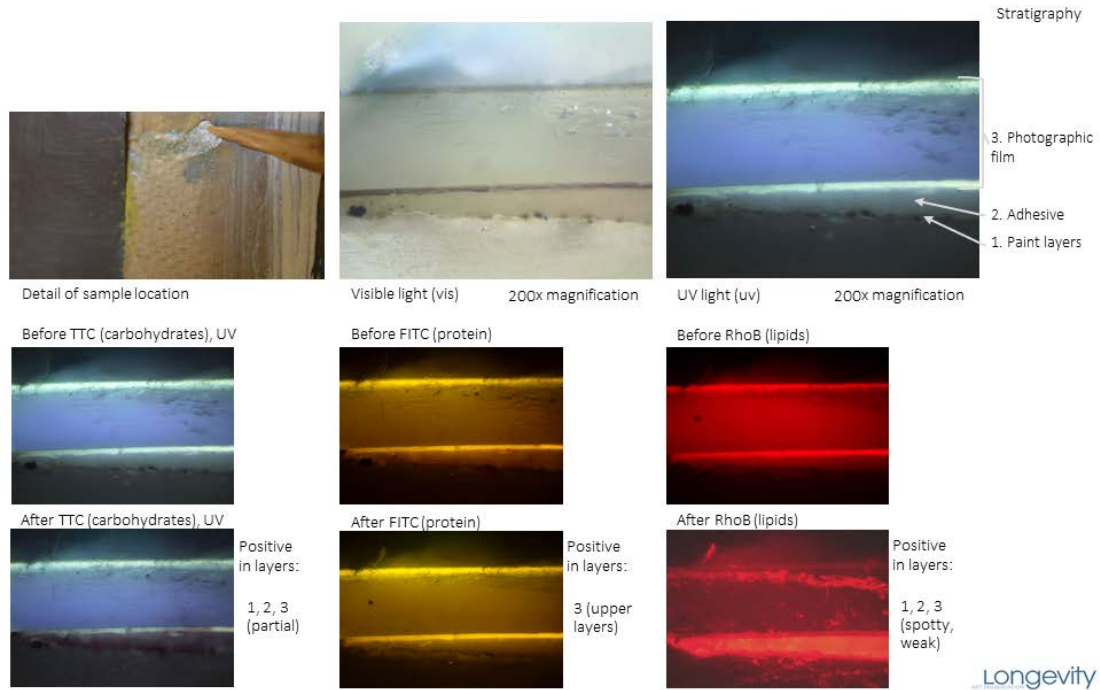
Longevity

Rauschenberg, *Barely There*, c. 1950s-60s

Sample Number: S14

Results: See report

Sample Description: Photographic film with adhesive

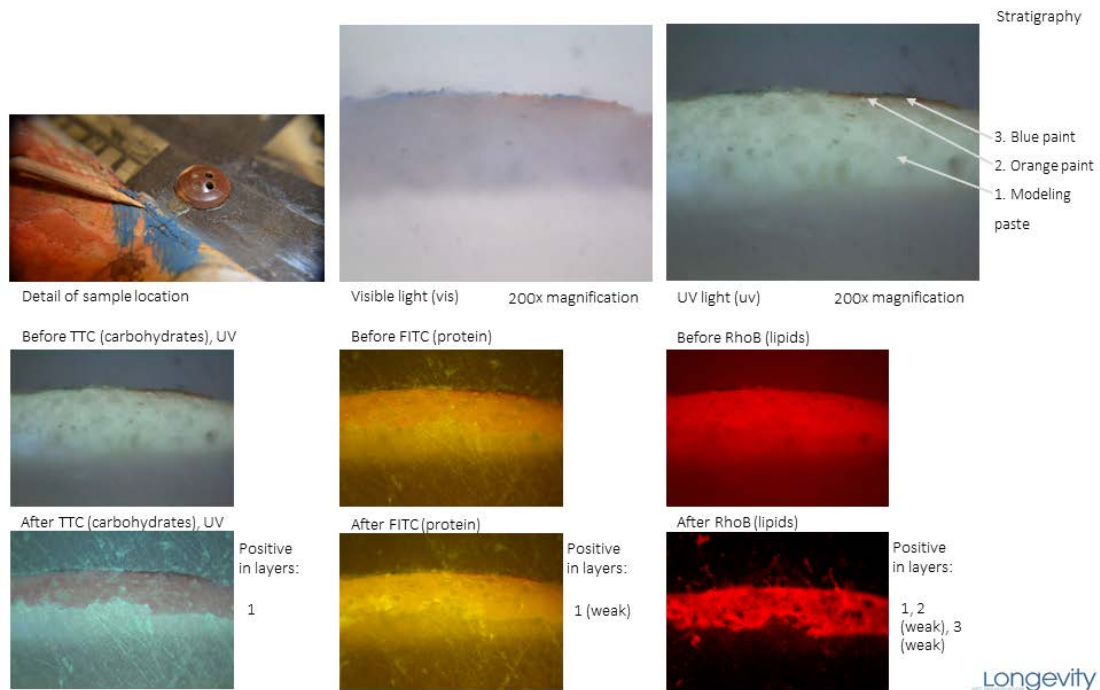


Rauschenberg, *Barely There*, c. 1950s-60s

Sample Number: S16

Results: See report

Sample Description: Modeling paste with blue and orange paint

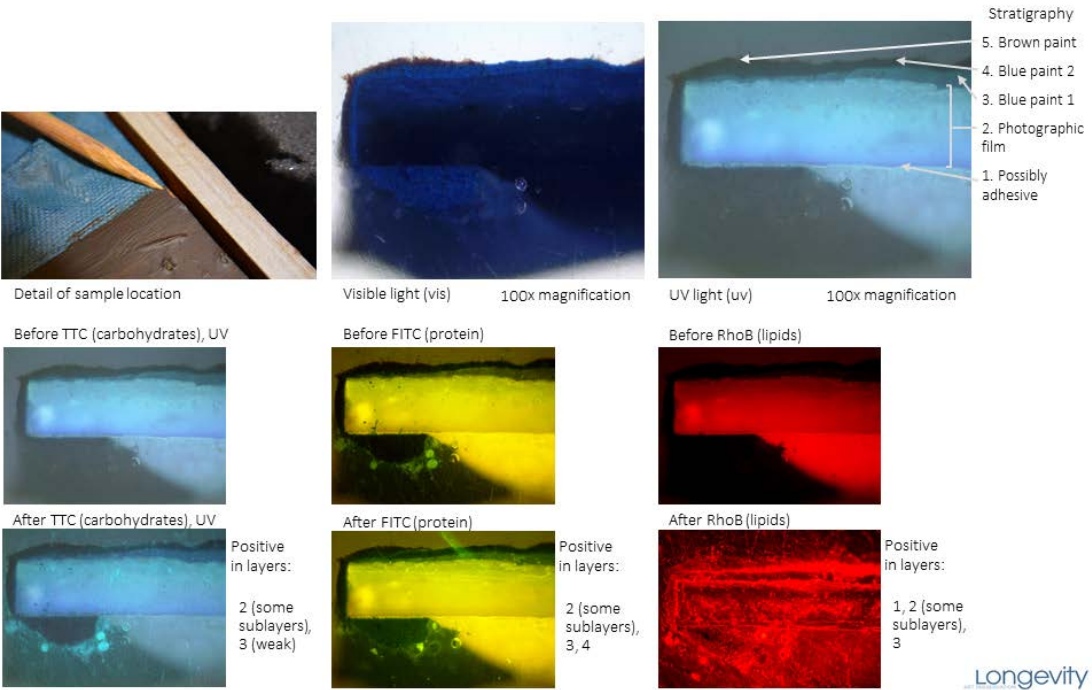


Rauschenberg, *Barely There*, c. 1950s-60s

Sample Number: S19

Results: See report

Sample Description: Brown paint over photographic film with adhesive

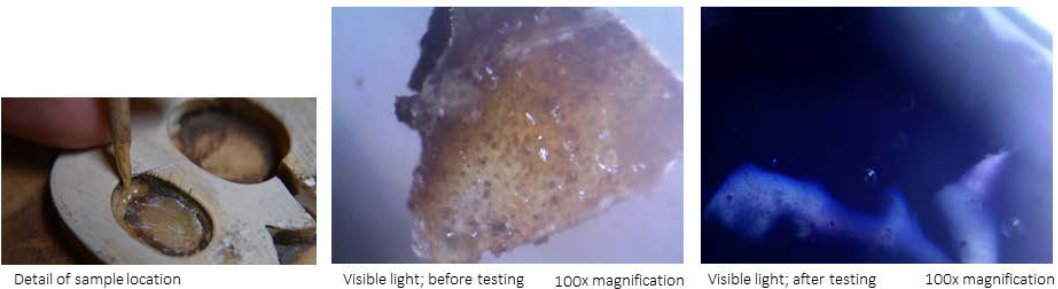


Rauschenberg, *Barely There*, c. 1950s-60s

Sample Number: S8

Results: Diphenylamine test for cellulose nitrate. Strong positive. Indicates cellulose nitrate adhesive.

Sample Description: Translucent yellow adhesive with brown paint



Rauschenberg, *Barely There*, c. 1950s-60s

Sample Number: S12

Sample Description: Photographic film with adhesive

Results: Diphenylamine test for cellulose nitrate. Negative.
Indicates the film is not cellulose nitrate-based; and instead is likely cellulose acetate or polyester-based.



Detail of sample location



Visible light; before testing

100x magnification



Visible light; after testing

100x magnification

Longevity

Rauschenberg, *Barely There*, c. 1950s-60s

Sample Number: S13

Sample Description: Photographic film with adhesive

Results: Diphenylamine test for cellulose nitrate. Negative.
Indicates the film is not cellulose nitrate-based; and instead is likely cellulose acetate or polyester-based.



Detail of sample location



Visible light; before testing

100x magnification



Visible light; after testing

100x magnification

Longevity

Rauschenberg, *Barely There*, c. 1950s-60s

Sample Number: S14

Sample Description: Photographic film with adhesive

Results: Diphenylamine test for cellulose nitrate. Negative.
Indicates the film is not cellulose nitrate-based; and instead is likely cellulose acetate or polyester-based.



Detail of sample location

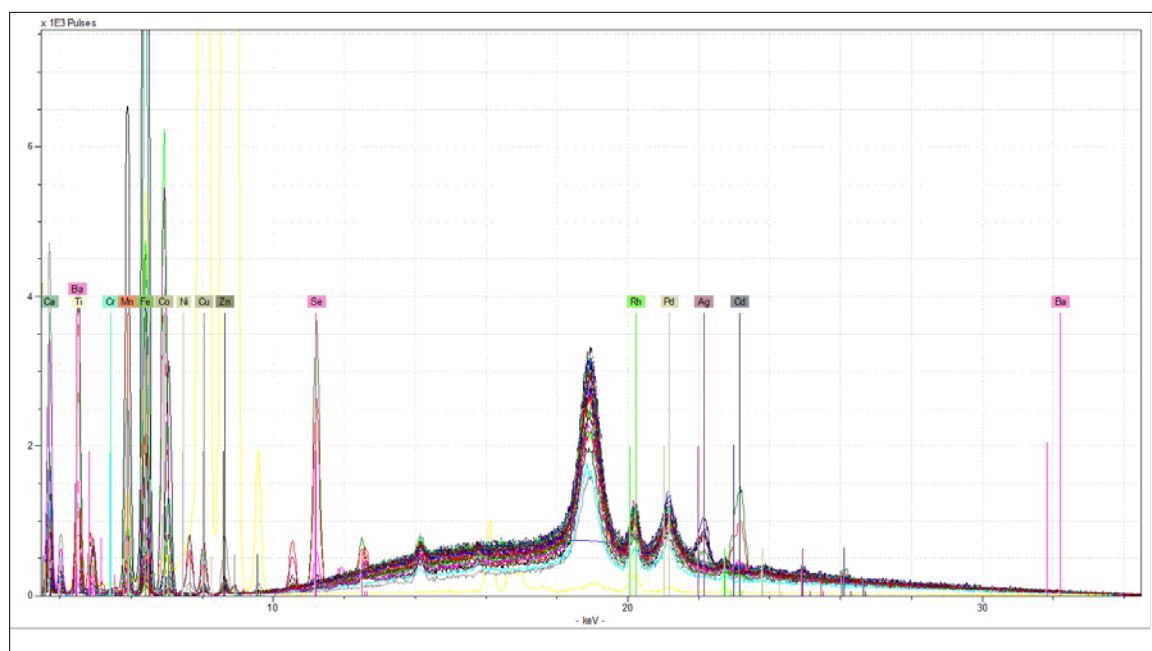


Visible light; before testing 100x magnification



Visible light; after testing 100x magnification

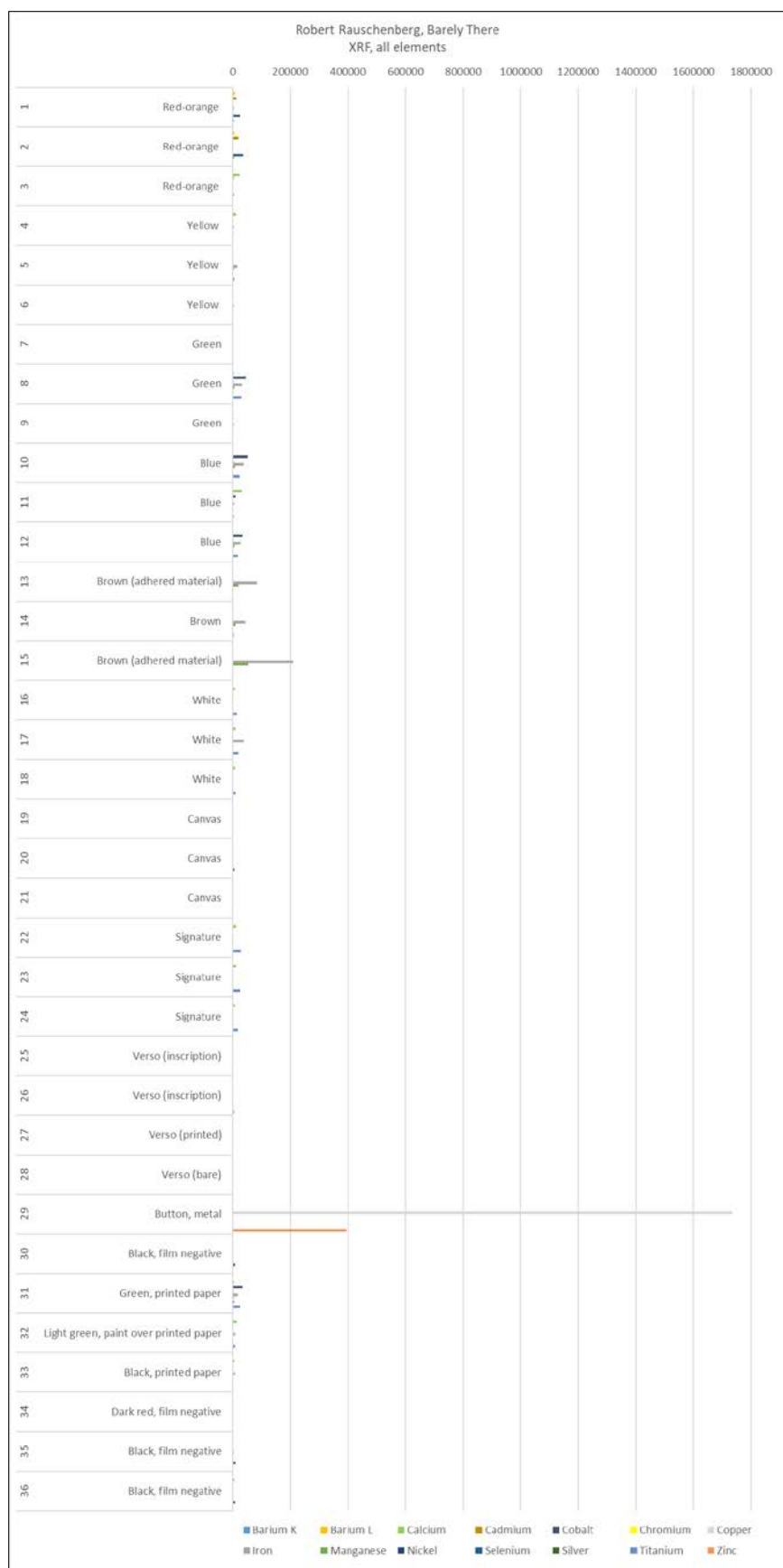
Appendix V: XRF Data



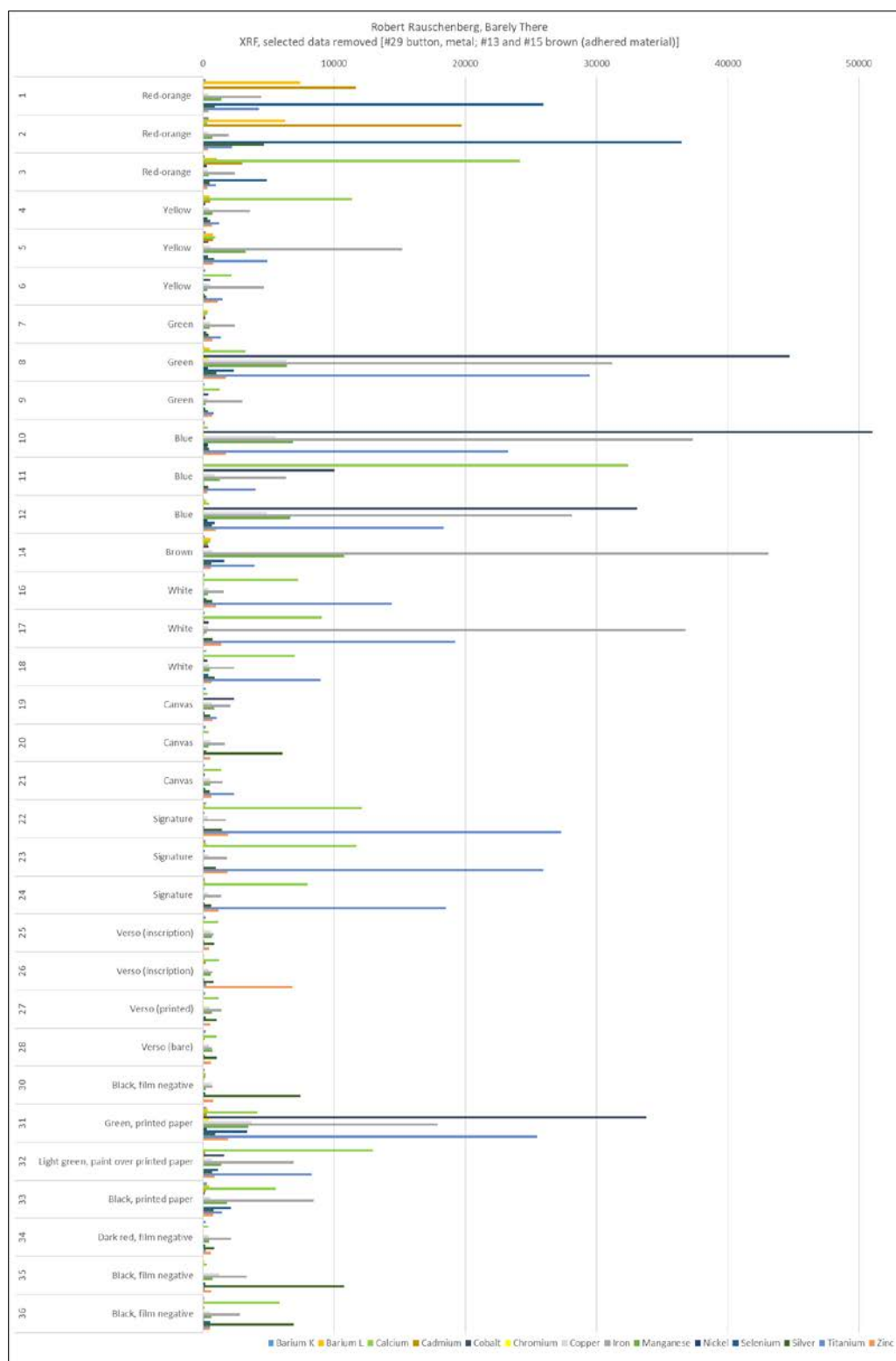
XRF spectrum, Rauschenberg, *Barely There*; showing the full spectrum of elements present in the data; low mass elements are excluded. Note: Rhodium (Rh) and Palladium (Pd) are present in every spectrum because of the instrument.

Sample Name	Sample Description	Ba K12	Ba L1	Ca K12	Cd K12	Co K12	Cr K12	Cu K12	Fe K12	Mn K12	Ni K12	Se K12	Ag K12	Ti K12	Zn K12	Pd K12	Rh K12
		Barium K	Barium L	Calcium	Cadmium	Cobalt	Chromium	Copper	Iron	Manganese	Nickel	Selenium	Silver	Titanium	Zinc	Palladium	Rhodium
1	Red-orange	233	7425	85	11684	53	1	463	4451	1427	38	25932	905	4249	422	14343	8065
2	Red-orange	436	6276	339	19714	50	1	416	1966	742	36	36483	4635	2224	392	13722	8396
3	Red-orange	140	1077	24176	3002	310	3	426	2435	455	42	4880	527	960	342	12321	6981
4	Yellow	86	515	11359	569	194	1	499	3567	746	18	355	555	1245	674	13773	7851
5	Yellow	224	793	955	774	426	57	515	15179	3229	38	388	857	4894	787	14272	7120
6	Yellow	168	25	2184	3	555	51	526	4660	335	44	161	259	1511	1125	14028	7120
7	Green	37	396	326	179	175	1	562	2456	528	16	247	437	1356	759	14725	7562
8	Green	102	523	3262	77	44729	378	6374	31185	6403	374	2346	1019	29511	1757	14655	9284
9	Green	143	59	1294	55	405	42	366	3031	216	12	202	389	815	671	9678	4965
10	Blue	145	106	362	7	51026	98	5556	37319	6890	391	344	490	23256	1788	12464	6533
11	Blue	14	2	32420	32	10030	23	861	6343	1273	56	90	421	4014	321	10017	7034
12	Blue	116	263	503	67	33095	106	4865	28106	6628	322	908	694	18358	971	15563	8752
13	Brown (adhered material)	226	466	715	488	474	9	744	85048	20497	54	1588	997	361	719	16917	8628
14	Brown	147	591	580	389	453	1	715	43116	10774	50	1639	631	3916	590	12978	6532
15	Brown (adhered material)	94	803	2224	733	966	58	1011	209220	52837	141	2893	504	525	788	11206	6207
16	White	148	89	7250	63	74	80	442	1571	390	64	266	724	14405	965	14262	7387
17	White	139	2	9064	103	459	46	401	36787	311	58	-26	747	19243	1390	12696	7485
18	White	270	71	7015	114	319	37	497	2387	509	31	394	885	8931	641	14311	8079
19	Canvas	231	24	335	6	2375	23	690	2106	861	9	132	557	1042	745	14282	6811
20	Canvas	206	73	445	-22	3	25	587	1671	453	25	270	6082	108	578	16191	8677
21	Canvas	160	26	1403	16	144	17	551	1499	552	20	193	532	2359	646	14690	7818
22	Signature	258	202	12118	44	99	71	372	1770	76	48	110	1482	27315	1917	15622	9615
23	Signature	201	274	11722	21	134	72	406	1830	75	33	69	996	25958	1872	14407	8385
24	Signature	157	170	7967	77	81	22	368	1393	156	51	145	653	18495	1220	13876	7595
25	Verso (inscription)	240	95	1166	0	43	57	585	832	676	13	96	856	114	476	15751	8491
26	Verso (inscription)	107	81	1251	212	12	41	462	742	607	33	107	819	249	6852	14388	7832
27	Verso (printed)	178	80	1223	20	4	114	510	1450	663	38	226	1050	77	566	16408	9967
28	Verso (bare)	237	95	1069	161	20	89	472	659	736	3	142	1070	73	586	16084	9096
29	Button, metal	27	0	484	114	2482	1	1734416	2655	422	1730	58	145	1361	395162	1343	3747
30	Black, film negative	146	115	241	179	63	74	639	740	227	43	202	7441	76	791	17389	8962
31	Green, printed paper	279	366	4152	298	33787	483	3746	17862	3486	300	3396	927	25454	1921	13010	7849
32	Light green, paint over printed paper	28	1	12966	171	1603	161	705	6910	1389	43	1165	729	8316	885	13796	7429
33	Black, printed paper	306	478	5559	229	146	73	546	8458	1836	33	2153	815	1456	775	17273	9389
34	Dark red, film negative	233	1	430	48	35	49	443	2133	480	22	190	864	213	619	14866	7992
35	Black, film negative	12	126	291	47	51	24	1231	3320	737	7	189	10775	130	639	16720	9582
36	Black, film negative	124	123	5835	-2	115	101	536	2835	656	69	559	6924	569	519	14123	8282

XRF data table, Rauschenberg, *Barely There*; showing the location of each analysis site corresponding to the XRF location analysis maps (see Figures 11 and 12), the description of each site, and the amount of each element present in that location; low mass elements are excluded.

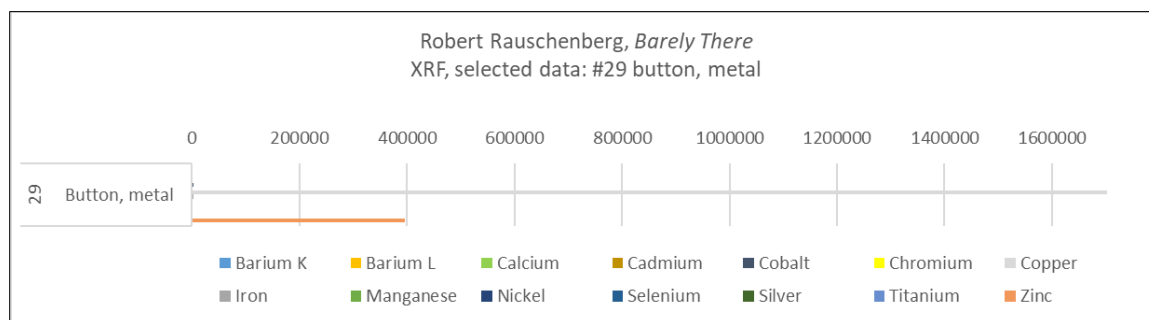


Bar graph of XRF data, Rauschenberg, *Barely There*; this graph shows the proportion of elements present in each location; low mass elements are excluded.

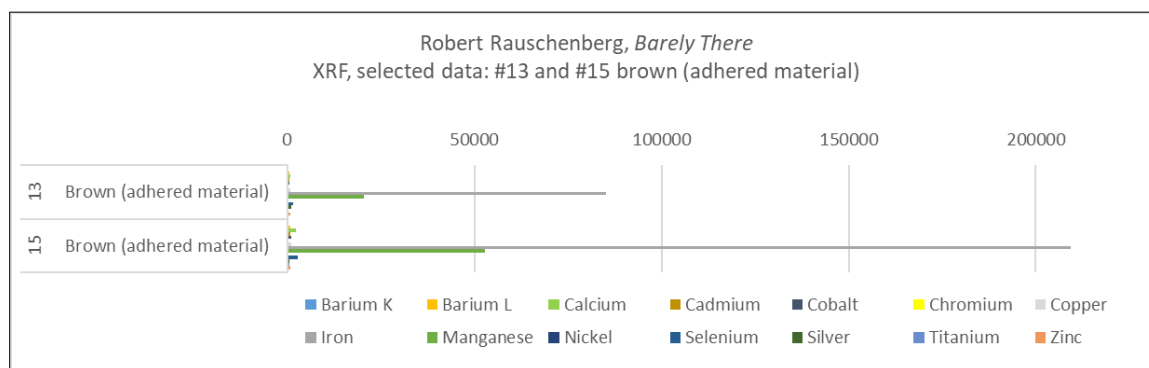


Bar graph of XRF data, Rauschenberg, *Barely There*; this graph shows the proportion of elements present in each location; low mass elements are excluded. The following

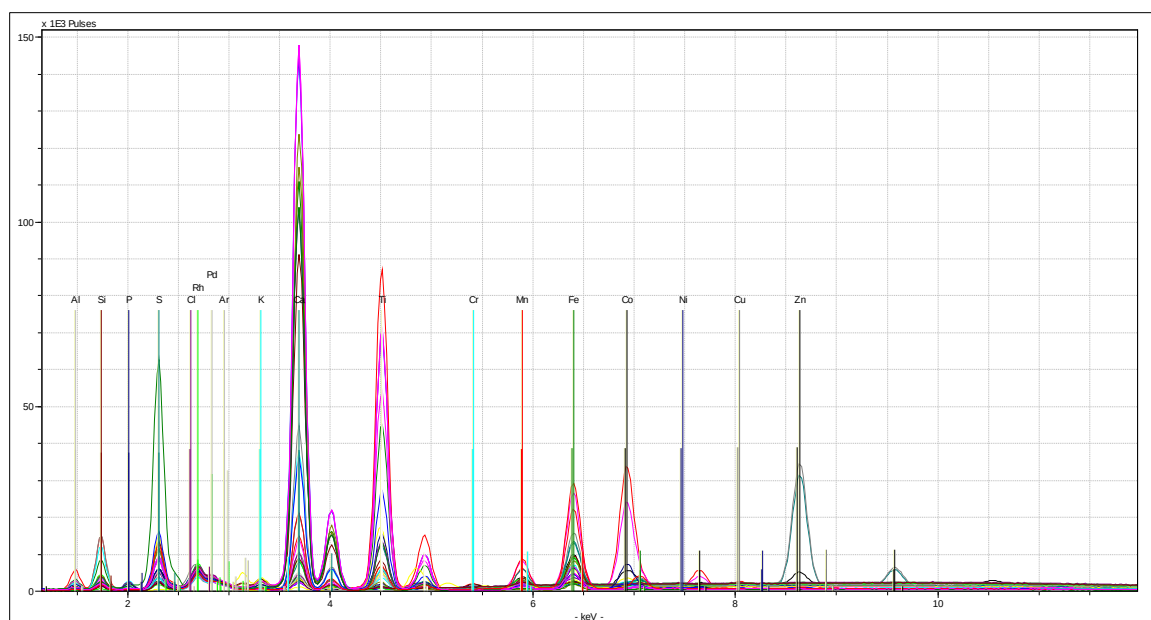
selected data was removed from the graph to allow the presence of other elements to be visualized: 29, button, metal; 13 and 15, brown, adhered material.



Bar graph of XRF data, Rauschenberg, *Barely There*; this graph shows the proportion of elements present in location 29.



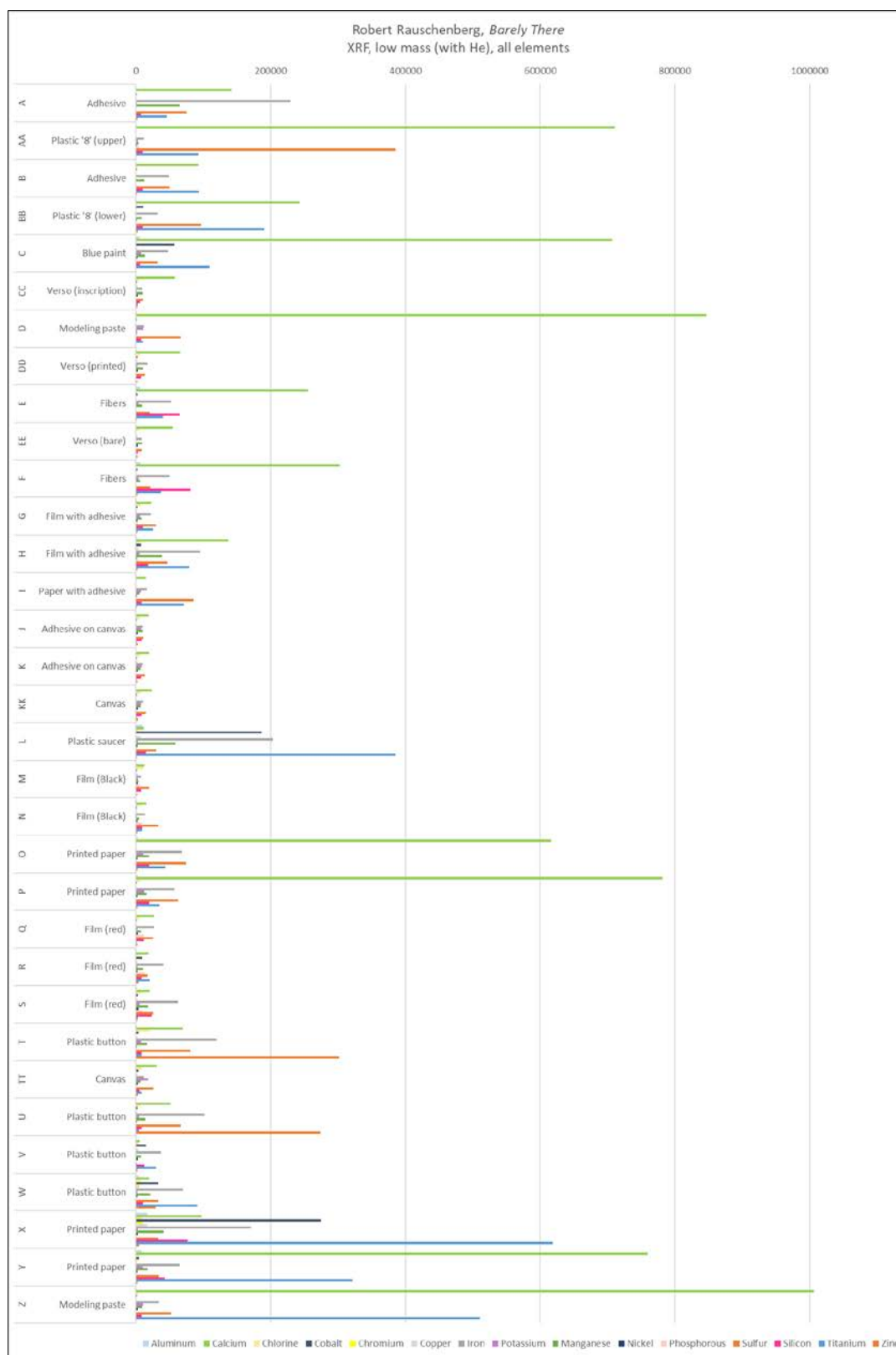
Bar graph of XRF data, Rauschenberg, *Barely There*; this graph shows the proportion of elements present in locations 13 and 15.



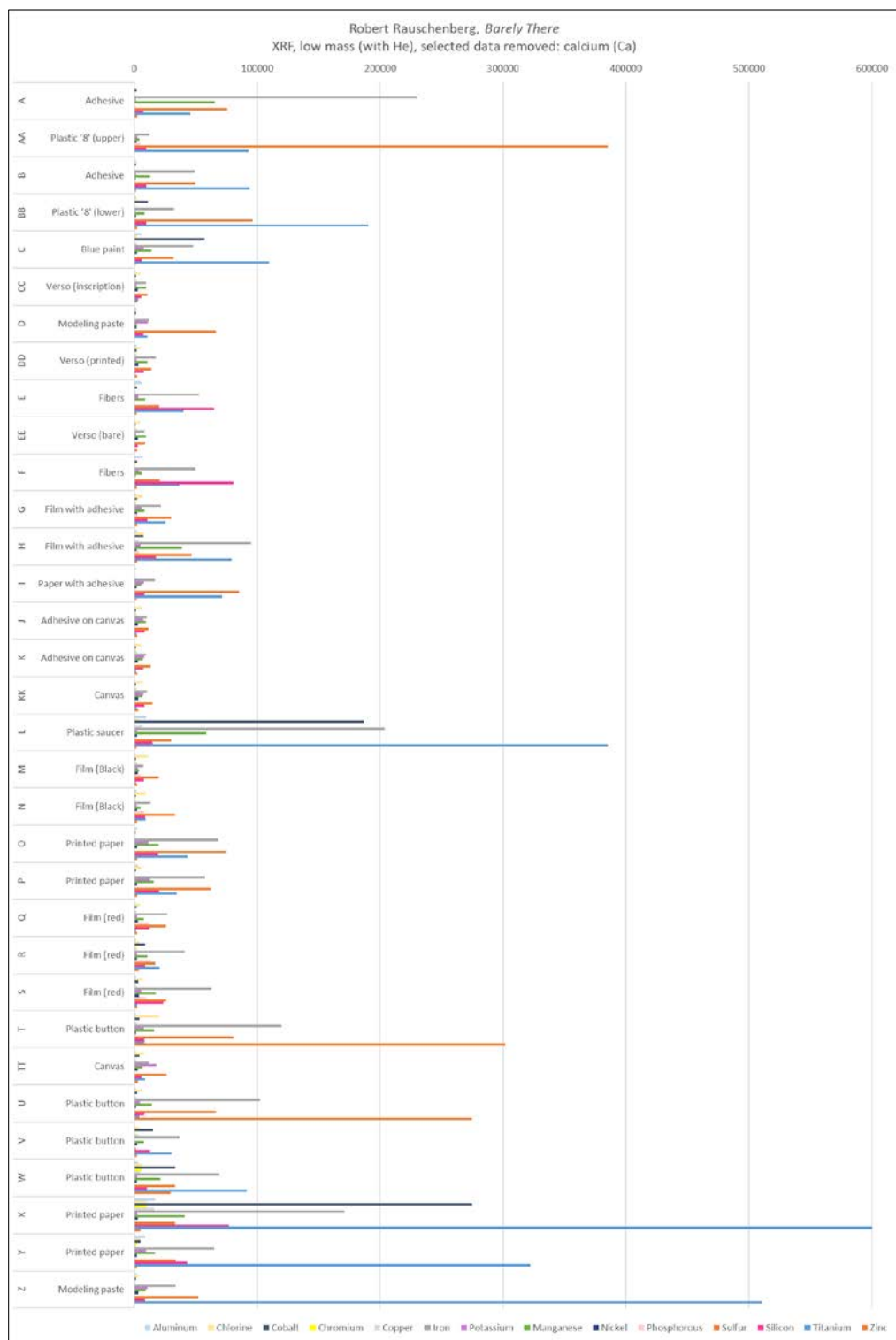
XRF spectrum, Rauschenberg, *Barely There*; showing the full spectrum of low mass elements present in the data. Note: Rhodium (Rh) and Palladium (Pd) are present in every spectrum because of the instrument.

Sample Name	Sample Description	Al K12	Ca K12	Cl K12	Co K12	Cr K12	Cu K12	Fe K12	K K12	Mn K12	Ni K12	P K12	S K12	Si K12	Ti K12	Zn K12	Pd K12	Pd L1	Rh K12	Rh L1
		Aluminum	Calcium	Chlorine	Cobalt	Chromium	Copper	Iron	Potassium	Manganese	Nickel	Phosphorous	Sulfur	Silicon	Titanium	Zinc	Palladium	Palladium	Rhodium	Rhodium
A	Adhesive	463	142311	1004	1904	499	781	229623	1348	65238	683	926	75500	7415	45822	2441	6	1	15	29097
AA	Plastic '8' (upper)	401	711036	1	626	231	113	12282	2721	4075	1707	4736	385352	9914	93276	424	3	1	6	24667
B	Adhesive	841	93187	2207	1243	132	588	49182	1166	12711	754	1074	49739	10139	94045	1244	2	674	4	25995
BB	Plastic '8' (lower)	1473	243007	2057	11275	357	754	32380	1074	8413	1366	1052	96492	10103	190551	2729	10	1151	16	30380
C	Blue paint	5659	706677	2703	57176	119	1970	47966	7962	13947	2190	394	32178	6200	109555	847	2	1695	10	29847
CC	Verso (inscription)	1069	58180	5046	1285	638	2098	9436	1836	9839	3094	265	10667	5849	3442	2488	19	5543	23	38091
D	Modeling paste	1289	846369	1811	1539	0	119	12177	11385	1839	1800	316	66663	7572	10883	521	5	2660	6	21433
DD	Verso (printed)	1784	66108	5557	1970	868	2102	17583	1963	10715	3436	242	13999	7861	918	2697	8	6188	39	41558
E	Fibers	6010	255518	1353	2703	692	826	52445	3523	8797	706	455	20265	64961	40389	1707	8	1471	23	22803
EE	Verso (bare)	359	54462	4957	1071	817	1954	8308	1164	9473	2878	167	8676	2856	76	2504	30	4745	58	39226
F	Fibers	6923	302638	1323	2580	1079	618	49884	3814	6389	1027	282	20908	81075	36963	2040	3	1560	5	20991
G	Film with adhesive	1483	22633	7185	2622	783	1284	21695	5963	8377	2579	3114	29984	10615	25580	2420	41	2468	41	37476
H	Film with adhesive	2231	137302	7865	7513	1	4017	94881	5122	38766	1590	3715	46650	17955	79106	2625	25	2334	30	33863
I	Paper with adhesive	1520	15509	212	1	1	1184	16559	7966	5384	1726	518	85358	8500	71351	1699	20	2968	22	29680
J	Adhesive on canvas	693	18667	6333	1521	877	1835	10229	7551	9545	3018	517	11710	8161	1584	2705	20	3865	17	38373
K	Adhesive on canvas	631	19798	5865	1363	881	2010	9575	8189	7097	3048	430	13551	7476	1549	2658	35	4100	30	36688
KK	Canvas	511	23482	7029	1236	855	1905	10513	7369	6881	3230	530	15082	8456	1625	3217	59	4541	56	38132
L	Plastic saucer	10116	12340	3526	186619	545	6498	203589	2768	58699	2545	1278	29967	15014	385170	1732	19	2747	36	38989
M	Film (Black)	748	13115	11294	1198	967	2775	7404	3088	3765	2842	5213	19822	7917	1164	2678	27	4206	18	32224
N	Film (Black)	1814	16241	9471	1562	908	1559	13292	1715	4857	2542	8254	33342	8853	8980	2160	31	3895	39	35709
O	Printed paper	2776	616068	1539	969	311	1249	68067	11738	19896	2574	618	74868	19359	43651	2611	31	444	32	31736
P	Printed paper	2810	781565	5856	1291	162	1096	57644	12764	15897	2697	838	62613	20066	34732	2487	13	2334	29	30566
Q	Film (red)	804	27319	4435	1762	442	1679	26940	2387	7902	2994	11895	26100	12251	1516	2510	36	3007	19	38099
R	Film (red)	1252	15298	3827	8930	1466	2349	40961	2206	10738	2240	13642	17307	8699	20782	3689	14	2988	22	34341
S	Film (red)	1212	20804	7152	3244	429	2269	62758	5561	17877	3633	10073	25984	23335	2793	2664	34	2046	50	42833
T	Plastic button	1489	69808	20426	4040	182	2159	119968	7730	16325	1474	1458	81096	8244	8502	302105	24	2282	34	35560
TT	Canvas	964	30773	8302	4164	527	1964	12084	18372	6726	2970	742	26466	5698	8665	3052	15	3825	32	38302
U	Plastic button	959	51054	6364	2702	1	2119	102119	4676	14668	1456	1080	66663	8410	4365	274329	26	2154	29	33076
V	Plastic button	149	5517	3815	15212	959	3721	36848	223	7852	2716	22	1404	12719	30487	2041	33	4743	25	30708
W	Plastic button	3537	19986	6836	33271	6444	4471	69293	2510	21469	2187	578	33261	10476	91734	29522	23	3162	32	33812
X	Printed paper	17267	97359	9394	274817	9808	16309	171101	7273	41246	2936	564	33373	77434	618502	4959	14	3477	15	26923
Y	Printed paper	8706	759465	5143	4939	2450	1230	64873	9593	17135	2350	981	33829	43037	321891	2416	41	878	31	34379
Z	Modeling paste	1828	1006062	3714	1414	41	760	33915	10799	9246	3305	743	52381	8617	510861	714	9	1137	11	32499

XRF data table, Rauschenberg, *Barely There*; showing the location of each analysis site corresponding to the XRF location analysis maps (see Figures 11 and 12), the description of each site, and the amount of each low mass element present in that location.



Bar graph of XRF data, Rauschenberg, *Barely There*; this graph shows the proportion of low mass elements present in each location.



Bar graph of XRF data, Rauschenberg, *Barely There*; this graph shows the proportion of low mass elements present in each location. The following selected data was removed from the graph to allow the presence of other elements to be visualized: calcium (Ca)

Appendix VI: FTIR Data

Rauschenberg, *Barely There*, c. 1950s-60s

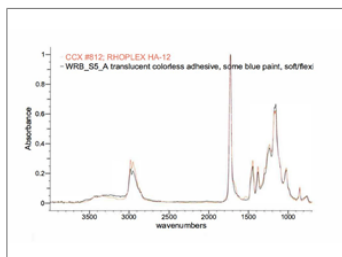
Sample Number: S5_A

Sample Description: Translucent colorless adhesive with some blue paint, soft/flexible

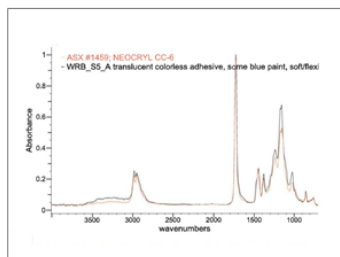
Results: FTIR analysis. Highly consistent with acrylic polymer emulsion, based on ethylacrylate.



Detail of sample location



FTIR spectra of sample and matching spectrum



FTIR spectra of sample and matching spectrum

Longevity

Rauschenberg, *Barely There*, c. 1950s-60s

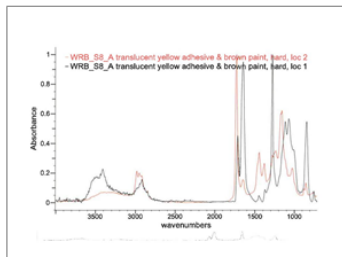
Sample Number: S8_A

Sample Description: Translucent yellow adhesive and brown paint, hard

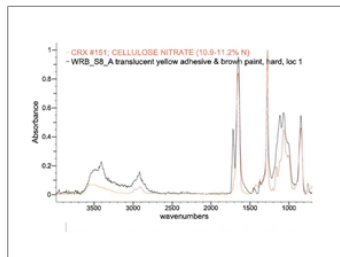
Results: FTIR analysis. Contained two components. One was highly consistent with an acrylic polymer emulsion, based on ethylacrylate. The other was consistent with cellulose nitrate.



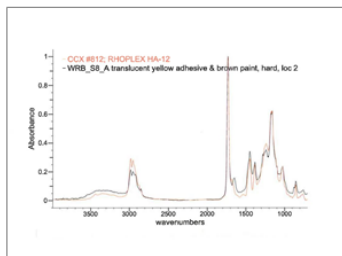
Detail of sample location



FTIR spectra of sample and matching spectrum



FTIR spectra of sample and matching spectrum



FTIR spectra of sample and matching spectrum

Longevity

Rauschenberg, *Barely There*, c. 1950s-60s

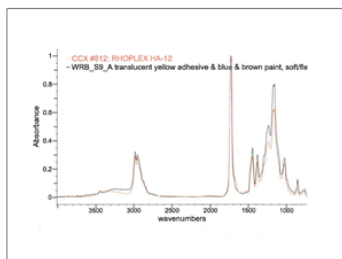
Sample Number: S9_A

Sample Description: Translucent yellow adhesive and blue and brown paint, soft/flexible

Results: FTIR analysis. Highly consistent with an acrylic polymer emulsion, based on ethylacrylate.



Detail of sample location



FTIR spectra of sample and matching spectrum

Longevity

Rauschenberg, *Barely There*, c. 1950s-60s

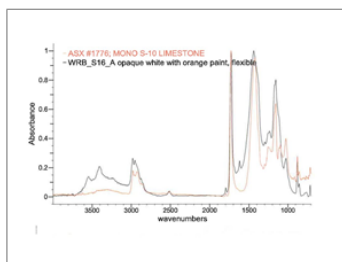
Sample Number: S16_A

Sample Description: Opaque white with orange paint, flexible

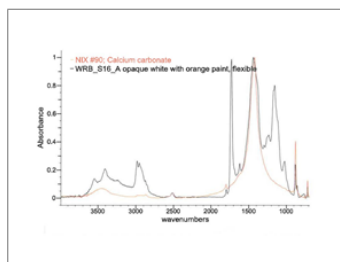
Results: FTIR analysis. Highly consistent with an acrylic polymer emulsion, based on ethylacrylate that was filled with calcium carbonate. Another component that was detected was consistent with hydrated calcium sulfate.



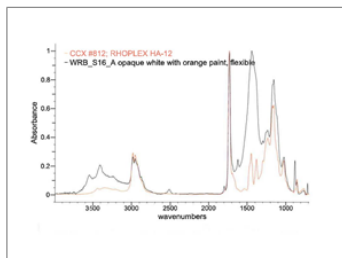
Detail of sample location



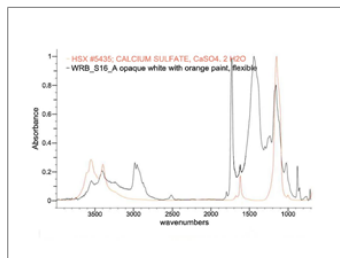
FTIR spectra of sample and matching spectrum



FTIR spectra of sample and matching spectrum



FTIR spectra of sample and matching spectrum



FTIR spectra of sample and matching spectrum

Longevity