

Treatment Report

Kress Number: K231 A and B

Artist: Giusto de' Menabuoi

Title: *Saints Catherine of Alexandra and John the Baptist*

School/Period: Padua, Late 14th Century c. 1363

Support/Medium: tempera on wood panel
(based on visual appearance; no media analysis)

Dimensions: 22 3/8 in. x 12 1/2 in. x 1 1/4 in.

Painted surface as displayed with panels aide by side

Owner: The Georgia Museum of Art, University of Georgia, Athens, GA

Frame: unframed

Date of Treatment: Fall 2016

Conservator:

Kimberly Frost, Master's Candidate, Conservation Center, Institute of Fine Arts, NYU

Under the supervision of

Dianne Dwyer Modestini, Conservator of the Kress Program in Paintings and Research Professor and **Shan Kuang**, Samuel H. Kress Fellow in Paintings Conservation



Image 1: Before Treatment photograph

Photography:

Camera: Nikon D700 camera with 60mm lens, ISO100, f8.0

Nikon D610 camera with 60mm lens, ISO 200 f8.0

(with filters for Multi-Spectral Imaging)

Before treatment: digital photography in normal and ultraviolet light; front and reverse

During treatment: digital photography in normal and ultraviolet light; front

digital photography in normal and ultraviolet light with spectral band filters; front

After treatment: digital photography in normal and ultraviolet light; front

Analytical techniques performed:

Examination under ultraviolet radiation

Infrared reflectography, FLIR SC2500 Camera and IR Vista software

X-radiography, Phillips MG161 X-ray Radiography system and Carestream INDUSTREX HPX-1 Digital system with 14x17" Flex XL Blue Digital Imaging Plate, 35KeV, 5 mA, 30 sec.

X-ray Fluorescence, Bruker Tracer III-V+ (Rhodium source and silicon detector) 40 kV, 15 mA

Analysis of Cross-Sections:

Microscopy, Leica DM4000 B light microscope with Spot Flex camera and SpotFlex Basic Software. Reflected and Ultraviolet light.

Scanning Electron Microscopy, Hitachi TM3000 Table scanning electron microscope

Electron Dispersive Spectroscopy, Bruker Nano Xflash MIN SVE Quantax 70 software

Raman Spectroscopy, Renishaw Raman System 1000, featuring a Leica DM LM microscope and 785-nm laser to analyze single particles using a 50x objective with Opus 6 software

Cross Section Sample Locations:

Saint Catherine, Panel B

1. X – 1.0 cm, y - 2.3cm. Red lake with darkened coating layer.
2. X – 13.8 cm Y - 20.1cm -Red lake layer in good condition, no dark coating.
3. X – 7.2 cm Y – 9.2 cm - Grey paint layer possibly over pink with some ground attached

Saint John, Panel A

4. X – 0.5 cm Y – 33cm. Sample of red robe with some darkened areas at center, thick gesso ground.

*X measuring from right corner Y measuring from bottom to top

Signature, Marks, Labels and Notations:

Reverse of St Catherine: 231 B, and 4826 “B” with strikethrough

Reverse of St John: 231 A, and 7886 “A” with strikethrough

Provenance:

This panel has been identified by Count Alessandro Contini-Bonacossi as part of a polyptych altarpiece by Giusto de’Menabuoi. Its central panel, *Madonna and Child Enthroned*, formerly in the Schiff-Giorgini Collection, Rome, is now in the Museo Nazionale di Palazzo Reale in Pisa, Italy. It bears an inscription which states the work was commissioned by Suor Isotta Terzaghi in 1363. This group of two panels is one of three pairs of matched saints which were purchased by Samuel H. Kress. *Saints Catherine of Alexandra and John the Baptist* were purchased on September 19, 1931 and then gifted to the National Gallery of Art in 1939. They remained in the National Gallery collection until being de-accessioned in 1952. In 1961, the paintings were gifted to the Georgia Museum of Art at the University of Georgia, Athens.¹

Treatment History:

According to documentation on file at the Kress Foundation, the panels were examined and treated in 1933. Their condition is noted as “heavily restored, quite damaged and with a protective coating applied”. The treatment entailed cleaning and applying the current cradle. The paintings were then restored with “dry colors and damar medium, French isolator varnish and Damar varnish coating.”² The conservator is not recorded.

In the same year, a further report by Alan Burroughs notes the condition as thin and rubbed, with greater damage to Saint John than to Saint Catherine. He notes some small holes in the raised hand of Saint Catherine at the left margin of the panel.

Since this time, at least one modern campaign of treatment has taken place on the Saint Catherine panel, as evidenced by some water-soluble retouches and fill materials. During examining with ultraviolet light, a thick natural resin varnish was observed on the painting before treatment.

Examination and Condition Report:

Support

Construction

The panels are made of a single piece of a wood, light in color, possibly poplar. The wood grain is oriented vertically in both panels and both have been thinned to 0.5cm, which has exposed extensive damage due to wood worm tunneling throughout the back of the panel. The edges of both panels have been cut and a thin strip of new wood placed around the straight side edges, with some original edges exposed at the top of their rounded arch shape. A cradle of 6 vertical mahogany members and 10 horizontal crossbars made of clear pine has been applied to the reverse of both panels.

Condition

The panels are flat with no warping, even when the cradle restraints are removed. The exposed reverse of the panels has been coated with a thick layer which appears to be a wax-resin. Some areas of the added wood strips are covered with excess fill materials to create an even level with the original panel surface.

¹ See information on related paintings *Saints Paul and Augustine*, and *St. Thomas Aquinas and St. Anthony Abbot* at www.kressfoundation.org

² Summary of information, for more details see Kress Foundation files on K231 A and B.



Ground Layer and Underdrawing

Construction

Analysis of cross-sections using visible microscopy and SEM show that the white ground consists of calcium and sulfur components, consistent with a calcium sulfate gesso likely bound in animal glue. Over the white ground is a sealant layer which appears a dark translucent brown, likely animal glue. Further analysis of cross-sections would be necessary to understand the medium of this layer. In one sample the sealant layer is followed by a thin second ground of an unidentified white material. Large areas of the ground are prepared with a red bole directly over the sealant layer to receive water gilding and punched decoration.

The ground layer is thick with an embedded fabric covering the entire panel surface. Its tight plain weave pattern is visible in X-ray images. The striated pattern which appears in the x-ray may be due to lead content in a later finishing material, or due to the ground application or scraping.³

The planning of the composition is evident through visible incisions which mark the outside contours of the figures. Under close examination original gilding is seen to extend 1-2 cm beyond the incisions under the paint layer. In some areas, underdrawing is slightly visible under thinly applied paint layers. In order to understand the type and extent of the underdrawing, Infrared Reflectography (IRR) was performed using an FLIR SC2500 Camera and IR Vista software.

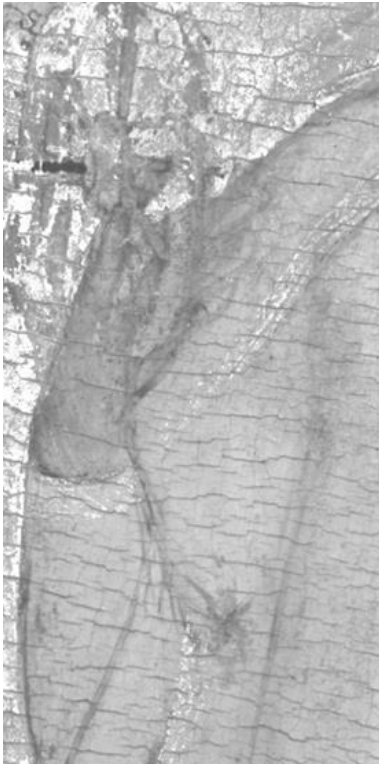


Image 2: Detail of Infrared Reflectography capture showing carbon underdrawing with changes in the hand of Saint Catherine, See Appendix for full infrared image.

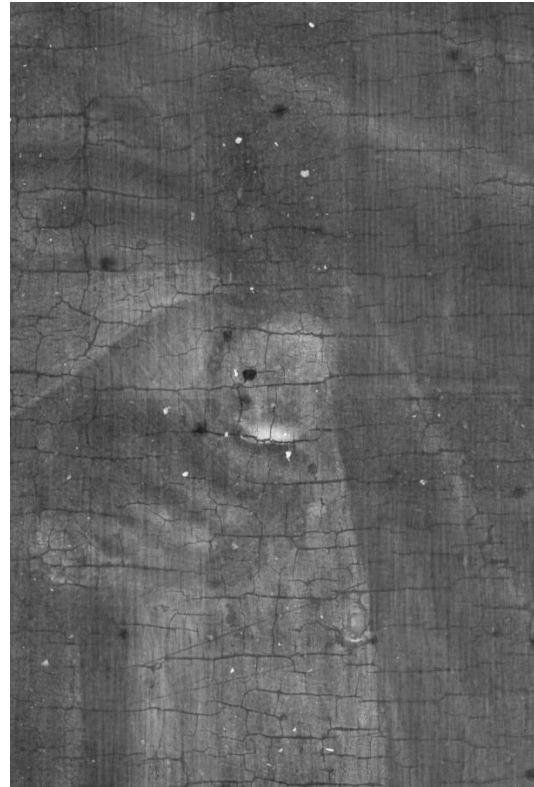


Image 3: Detail of X-radiograph capture of Saint John the Baptist's right hand showing textile weave

This examination showed a sketched outline in a carbon containing medium, with no clear indications of the transfer method. Though the outline of the figures remains the same, small changes in composition can be seen in

³ See Appendix

the St Catherine panel. Most notably, a change in the orientation of the proper right hand from a curved horizontal position to its current vertical placement.

There is no evidence of raised gesso from an engaged frame (a *barbe*) on any of the edges. This was likely removed when the panels were cut down. X-radiography of the panels show two similar semi-circular losses along the left edge of each panel. The punched decoration of the border curves around these shapes, suggesting that these areas contained no further original decoration. The related painting of *Saints Paul and Augustine*, which is painted on one panel, retains traces of its engaged frame. A central point extends down the middle of the panel, connecting the two semi-circles into a slender elongated pinnacle. The split semi-circles on opposite sides of *Saints Catherine of Alexandria and John the Baptist* proves that these two panels were not originally joined to one another in their original orientation.

Condition

In both panels, many losses and small abrasions have left the ground layer exposed. This is most noticeable in *Saint John the Baptist* where large areas of lost gilding have left the soft bole layer susceptible to abrasion. Deep losses in the ground layer near his halo have exposed the underlying fabric. The gesso material is strong but internally brittle and appears to crumble at the edges of deep losses. The ground layer is in good condition and has a strong adhesion to both the paint layers and the underlying wood support.

Paint Layer

Construction

The character of the paint layers is consistent with egg tempera medium, applied in thin strokes with no impasto. Analysis of samples removed from the cloaks of each figure, shows that the artist used the same materials and varied his painting technique to achieve different effects. In cross-sections from *Saint John the Baptist*, ground layers are followed by three opaque paint layers with varying amounts of fine white pigment mixed with a larger size red pigment. In the cross-sections from *Saint Catherine of Alexandria*, ground layers are followed by alternating layers structures where layers of opaque pink color rich in lead white are followed by deep red translucent glazes. After cleaning, examination of the painted surfaces and cross-sections from both panels with ultraviolet light, showed a characteristic red-orange fluorescence suggesting both were made with a red lake.⁴

Analysis by EDS mapping with SEM microscope was not able to distinguish between the alpha lines of lead and sulfur, and could not distinguish these elements. Further Raman spectroscopic studies were performed under the supervision of Marco Leona of the Metropolitan Museum using the Renishaw Raman System 1000, featuring a Leica DM LM microscope and 785-nm laser to analyze single particles using a 50x objective with Opus 6 software. These analyses were able to confirm the sole presence of gypsum, calcium sulfate, in the ground layer. It also detected the presence of vermilion particles mixed into the opaque pink paint layers.

A Surface Enhanced Raman spectroscopy (SERS) technique was performed with a small scraping from the red glaze layer. Spectra from the test were inconclusive and did not show a strong signal for the purpurin compound expected in madder lake dyes. The sample also did not show the color change during a pre-treatment step of exposure to Hydrogen Flouride, expected with madder lake. Though the test did not lead to clear results the point to greater probability that a different dye compound such as carmine, was used.

Condition

There is a uniform network of craquelure across the panels; the pattern associated with the gilded areas is somewhat more pronounced than in the painted passages. The craquelure is raised and abraded along some edges, especially in *Saint John the Baptist*. Minor losses have occurred around the outlines of the figures where the paint was laid over of the gilding. Overall, the paint layer has good adhesion and no flaking.

⁴ See Appendix for UV luminescence image and Appendix II for cross-section images.

Some areas of the gilding and paint layer are covered by a dark gray coating. In cross-sections the coating was found to contain dark pigment particles in a binding medium, and cover cracks in the original paint layer. This coating layer is assumed to be a non-original intervention, possibly the protective coating recorded in the historical condition assessment. A similar coating was recorded on *Saints Paul and Augustine* and analyzed with Bruker's Alpha FTIR by fellow student, Hae Min Park. Results were closest to oxalate, which can develop from the interaction and ageing of coatings and paint layer mediums. The patchy appearance of the remaining dark coating was disruptive in *Saint Catherine of Alexandria*, where it covered highlights and masked the modeled form presented in the original layers.

The paint layer of *Saint Catherine of Alexandria* is in good condition. The red glazes are well-preserved, especially in darker passages around the shadowed edges of the robe. Two small recesses in the paint layer at the bottom of the Saint Catherine panel, likely result from impact damages. These areas remain stable and modern fills covering the recesses were removed to reveal the original paint layer. The most grievous damage to the paint layer is of the proper right hand and the wheel that it holds.

Saint John the Baptist is worn and abraded throughout, likely the result of a harsh cleaning in the past. The dark brown paint of the beard and robe are particularly damaged along the raised craquelure, suggesting that the paint was crushed by mechanical force, perhaps when the cradle was applied. In the lower left corner there is a passage painted with a copper containing pigment, possibly copper resinate, which has darkened over time.

Varnish

Construction

Both gilded and painted areas were covered with thick varnish. Its yellow-green fluorescence in UV and extensive yellowing suggested that it was a natural resin varnish.

Condition

Darker patches over the faces indicated that the varnish had been selectively removed in the past from the drapery passages. The varnish is easily soluble in a 1:1 mixture of acetone and mineral spirits.

Treatment Report:

Cleaning

Cleaning tests to determine the proper type and strength of solvents for removing the yellowed natural varnish were performed on a small, inconspicuous area of the painting. Varying ratios, from weak to strong, of acetone in mineral spirits were applied with rolled cotton swabs. It was determined that a 1:1 ratio of the solvent was gentle on the original paint, but removed both the varnish and most retouches. For stubborn areas of overpaint this ration was increased to 2:1 for effective cleaning of the extensive retouches in St John's beard and St. Catherine's hand and wheel.

Remains of modern fills covering the curved punchwork at the margins were removed mechanically under an Olympus SZX9 microscope. This uncovered original gilded areas and exposed the original gesso along the top sides of the arch shaped panels to reveal the original shape of the panel's edge where it met an engaged frame.

After testing, it was found that the unoriginal and disfiguring dark coating on *Saint Catherine of Alexandria* could be swelled using a gel made from 12g Klucel G, and 90 ml dimethylsulfoxide (DMS) in 210 ml ethyl acetate, safe for use near the water gilded background. Heavy patches of the coating were softened and then removed mechanically with a scalpel under the microscope. Any residue of the gel was cleared with mineral spirits.



Image 4: During Treatment stereomicroscope image of Saint Catherine showing removal of the patches of dark coating.

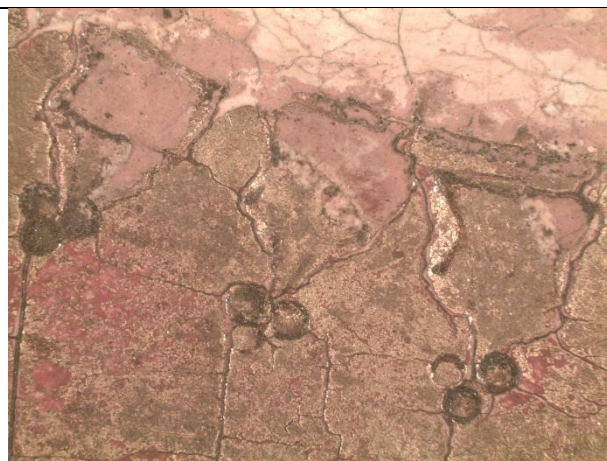


Image 5: During Treatment stereomicroscope image of Saint Catherine showing removal of excess fills over gilding.

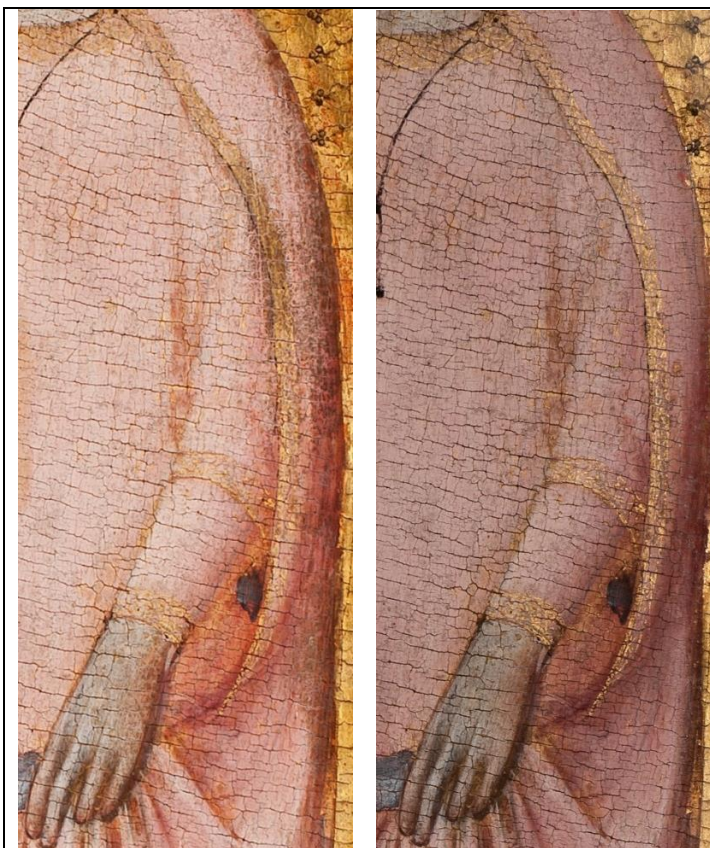


Image 6: Left, detail of *Saint Catherine of Alexandria* before treatment and Right, detail after treatment.

Fills and Isolating Varnish

The painted surface was then re-saturated with a brush applied isolating varnish of Mastic resin diluted at 8% in turpentine with the addition of Tinuvin UV stabilizer. Losses in the original gesso and painted surfaces were filled with a putty made from 10% rabbit skin glue and a 1:3 ratio of Kaolin clay and calcium carbonate. Once dried, the fills were mechanical scraped to level them to the painted surface. In large areas, a metal point was used to create a craquelure pattern following the surrounding original.

Inpainting

For body color, dry pigment mixed with a small amount of AYAB medium (PVA) diluted in ethanol was used to inpaint losses. The inpainting were toned with watercolor as necessary to imitate the aged paint layer. Matte areas of inpainting were locally varnished with additional dilute AYAB medium.

In specific areas other mediums were needed to achieve a satisfactory effect. Maimeri Restoration Colors re-wetted with xylene were used to create the deep tones achieved in the foregrounds, especially in the area of the copper resinate glaze. Gamblin conservation colors with Larapol A81 medium were used for retouching craquelure and abrasions in the earth pigment passages of the face and hair-robe of Saint John.

Gilding

Repairs to the abraded gilded backgrounds were needed, especially in *Saint John the Baptist*. Pigmented wax/resin from Gamblin was thinned with xylene and painted into areas of filled losses or abrasion where no original bole remained. Once dried the pigmented wax was buffed with silk and clear shoe polish wax was applied to areas that required integration of new gold leaf, once again the wax surface was buffed flat. Moist, hot breath activated the wax and thin sheets of ribbon gold were quickly place over the warmed wax and tamped down with a wad of cotton. After a short amount of time, the freshly applied gold leaf could be abraded with cotton or other tools. Sharp edges of the applied gold leaf were broken up using a wooden skewer point dipped in mineral spirits or using a sharp metal scalpel. The new gold was firmly burnished with loose cotton to the desired color and transparency. Finally, the new gold was toned with the application of watercolors as needed to re-integrate it to the original gilding, particularly in areas that retained the oxalate coating.

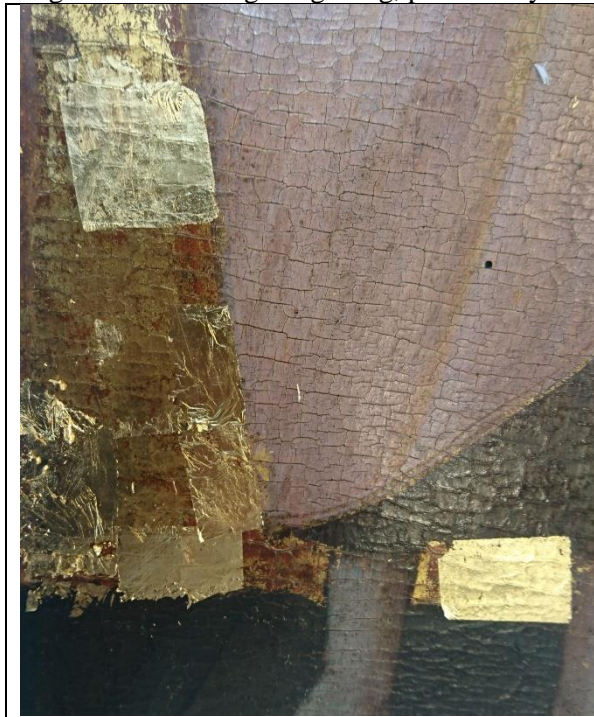


Image 7: During Treatment Detail of applied gold leaf.

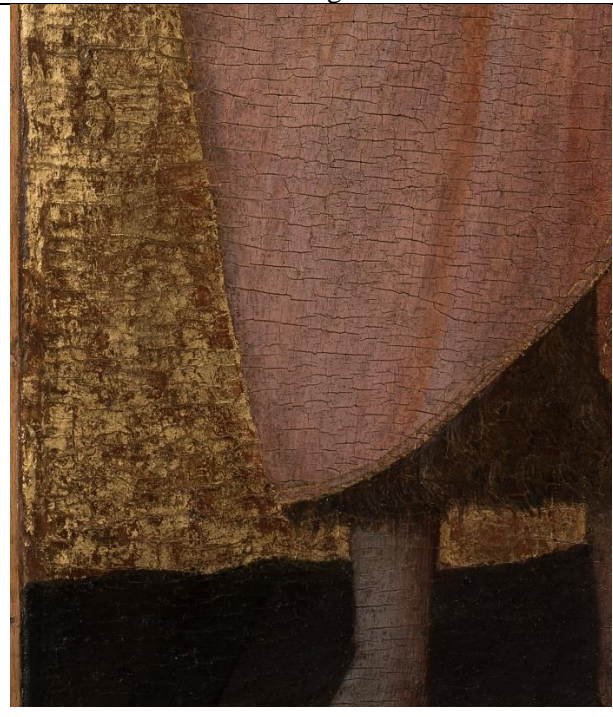


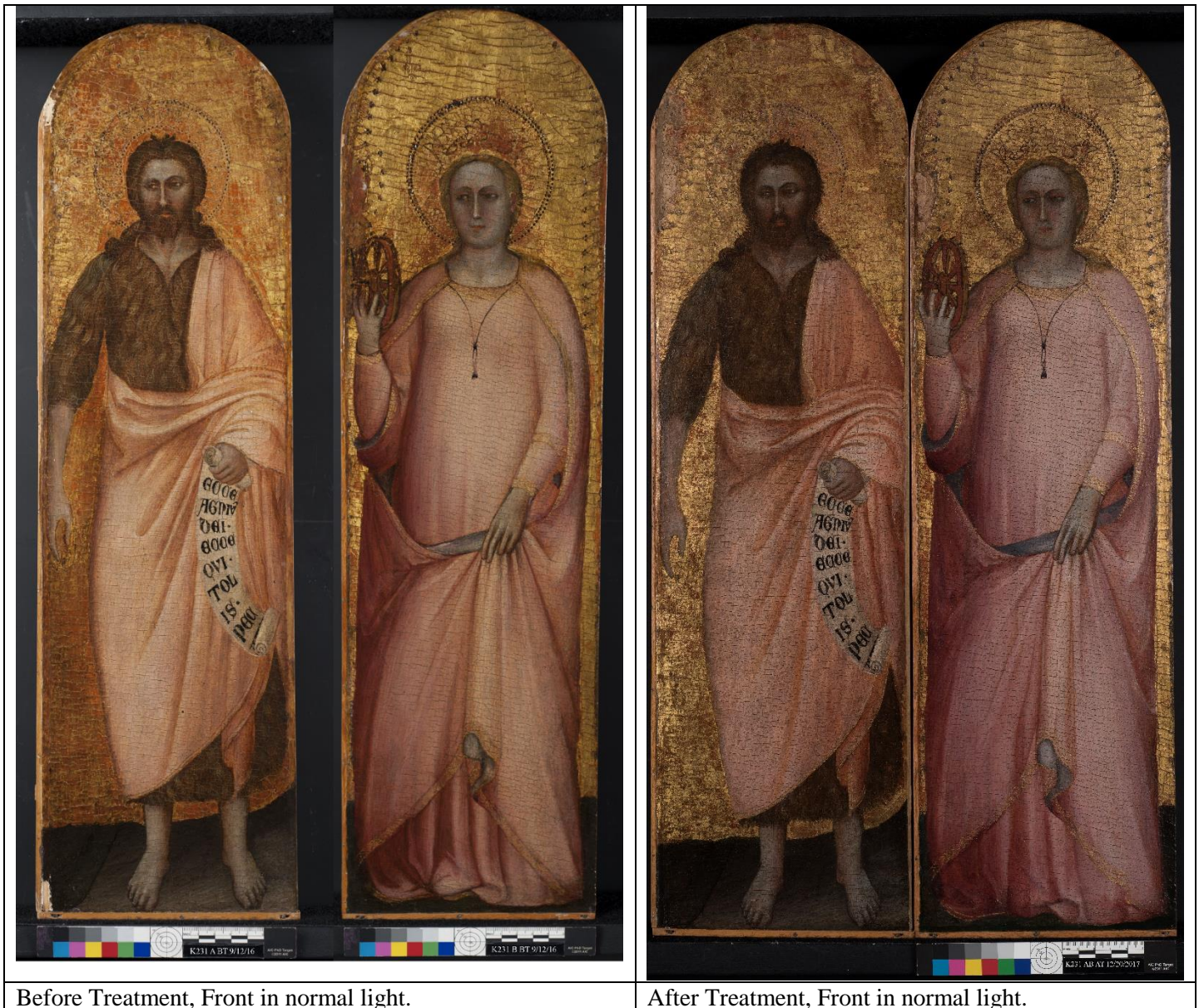
Image 8: After Treatment detail of restored gilding

Final Varnish

A final varnish of mastic resin 5% dilute in turpentine with Tinuvin UV stabilizer was spray applied to fully saturate the paintings.



APPENDIX





Giusto de'Menaboui, *Saints Catherine of Alexandria and John the Baptist*, c.1363
Before Treatment, recto, X-ray.



Giusto de' Menabou, *Saints Catherine of Alexandria and John the Baptist*, c.1363
During treatment. recto, infrared reflectography



Giusto de' Menabou, *Saints Catherine of Alexandria and John the Baptist*, c.1363
During treatment. recto, ultraviolet visible luminescence.



Giusto de' Menaboui, *Saints Catherine of Alexandria and John the Baptist*, c.1363
During treatment. recto, during varnish removal, visible light.

APPENDIX II: SCIENTIFIC ANALYSIS

XRF Analysis Sites

K231A, Saint John



Sample Site	Visual Description	Major Elements	Minor Elements	Trace Elements
1	Flesh tone, red in cheeks	Pb, Ca, Fe	Sr,	Ni, Cu, Zn, Rh (tube)
2	Shoulder of red robe in good condition	Pb, Ca, Sr,	Fe	Sn, Cu, Ni, Rh (tube)
3	Exposed ground in halo	Ca, Sr,	Pb, Fe, Au	Ni, Cu, Rh (tube)
4	White in scroll	Pb	Ca, Sr, Fe	Ni, Cu, Rh (tube)
5	Hand on scroll	Pb, Ca, Fe	Sr,	Ni, Cu, Zn, Rh (tube)
6	Red robe bottom glaze	Pb, Ca	Sr, Fe, Ni, Cu, Zn	Rh (tube)
7	Brown hair robe	Ca, Fe,	Sr, Pb	Ni, Cu, Zn, Rh (tube)
8	Background green	Fe, Pb	Ca, Sr	Ni, Cu, Zn, Rh (tube)
9	Background green near glaze	Fe, Pb	Ca, Sr	Ni, Cu, Zn, Rh (tube)
10	Background green glaze	Fe, Cu, Pb	Ca, Sr	Ni, Zn, Rh (tube)
11	Exposed ground at top	Ca	Fe, Pb, Sr	Ni, Cu, Zn, Rh (tube)
12	Robe near Cross Section Sample 1	Pb, Ca	Fe, Sr	Fe, Ni, Cu, Zn, Rh (tube)

XRF Analysis Sites
K231, Saint Catherine



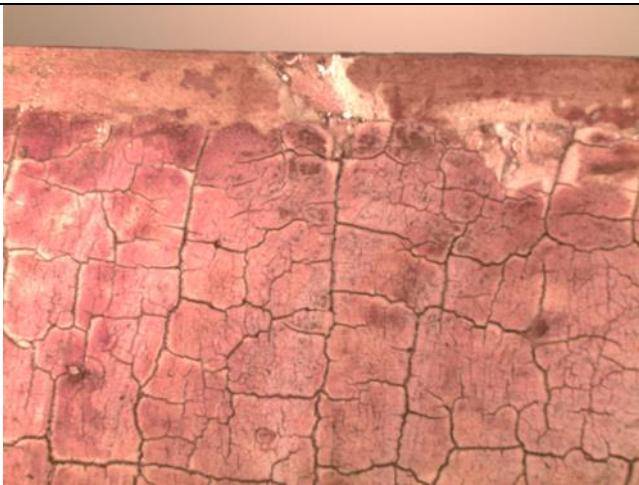
Sample Site	Visual Description	Major Elements	Minor Elements	Trace Elements
1	grey in center of robe	Pb	Ca, Sr, Fe	Ni, Cu, Zn, Rh (tube)
2	red in wheel	Fe, Pb	Ca, Sr	Ni, Cu, Zn, Rh (tube)
3	red on PR of robe	Pb	Ca, Sr	Fe, Ni, Cu, Rh (tube)
4	Gold with darkened area of coating	Au, Fe, Ca	Sr, Pb	Ni, Cu, Rh (tube)
5	Area of gold with no coating.	Au, Fe, Ca,	Sr, Pb	Ni, Cu, Rh (tube)
6	Area of pink robe with no coating	Pb	Ca, Sr	Fe, Ni, Cu, Rh (tube)
7	Area of pink robe with heavy coating	Pb	Ca, Sr	Fe, Ni, Cu, Zn, Rh (tube)
8	Area of exposed ground layer	Pb, Ca, S	Sr,	Fe, Ni, Cu, Zn, Rh (tube)
9	Red robe near wheel	Pb, Ca	Fe, Sr	Ni, Cu, Zn, Rh (tube)
10	Flesh tones in neck	Pb, Ca	Fe, Sr	Ni, Cu, Zn, Rh (tube)
11	Flesh tones red PL	Pb, Ca	Fe, Sr	Ni, Cu, Zn, Rh (tube)
12	Flesh tones red face PR	Pb, Ca	Fe, Sr,	Ni, Cu, Zn, Rh (tube)



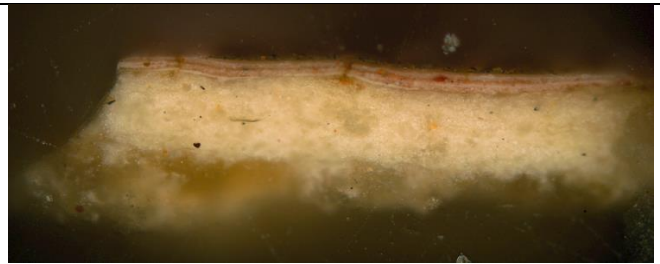
CROSS SECTION SAMPLE ANALYSIS

Sample 1: *Saint John the Baptist*

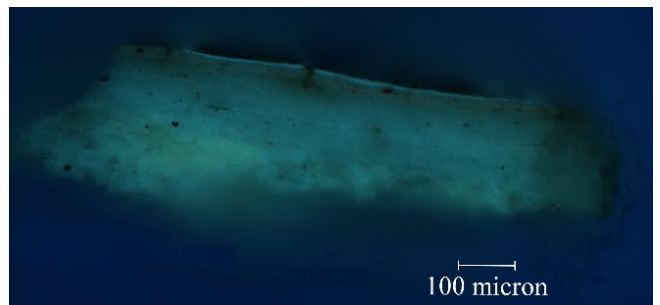
Sample 2: *Saint Catherine of Alexandria*



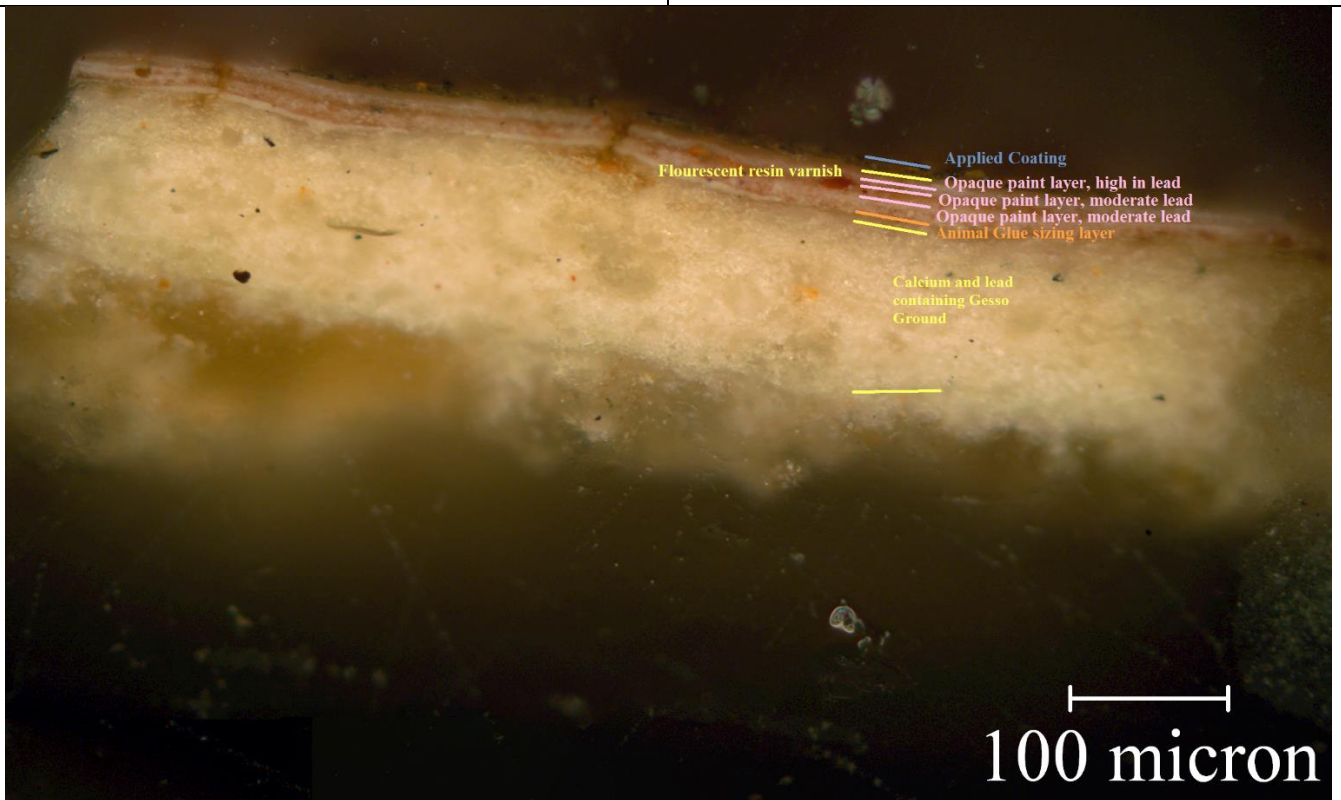
Sample 1 Saint John the Baptist location photomicrograph



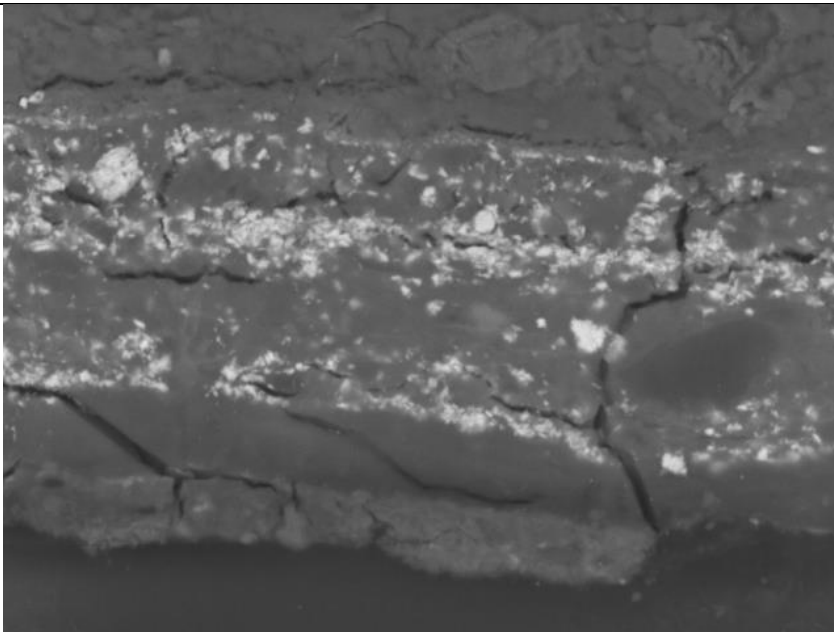
K231A Cross Section Sample 1
Darkfield 200X



K231A Cross Section Sample 1
Ultraviolet 200X



K231A Cross Section Sample 1 with assigned layer structure and composition.

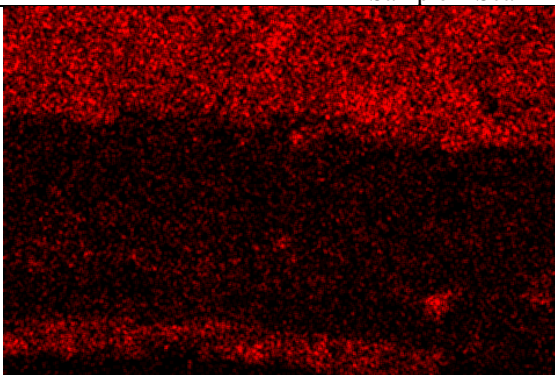


K231A_S1

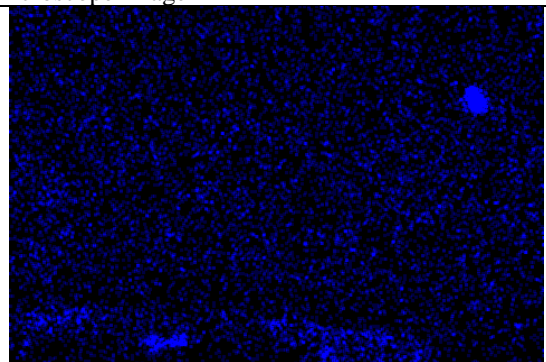
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AL D8.5 x2.5k 30 um

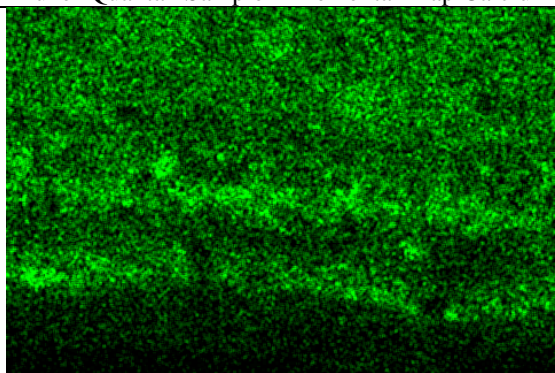
Sample 1 Scanning Electron Microscope Image



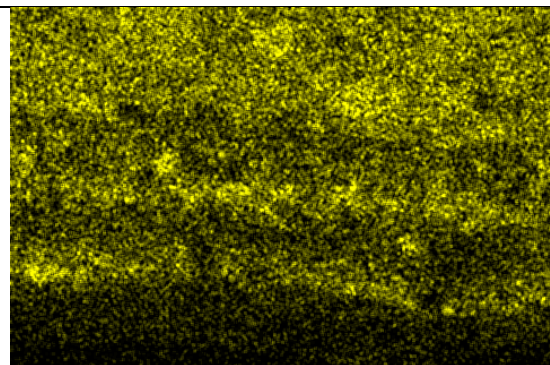
Bruker Quantax Sample 1 Elemental Map Calcium



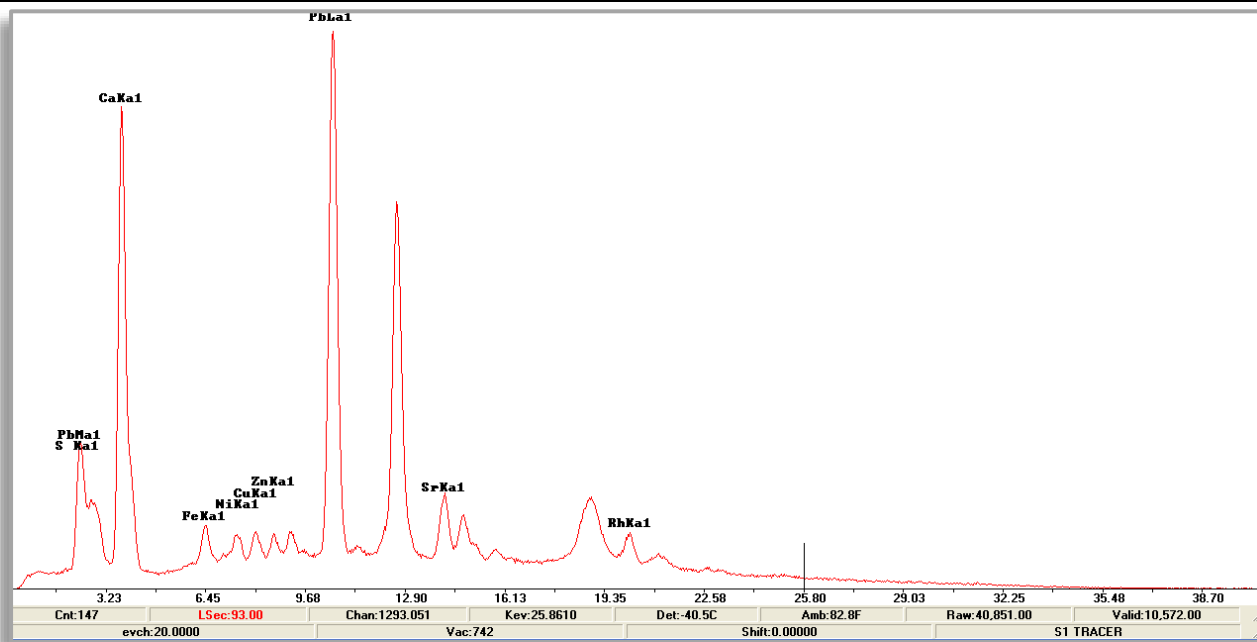
Bruker Quantax Sample 1 Elemental Map Aluminium



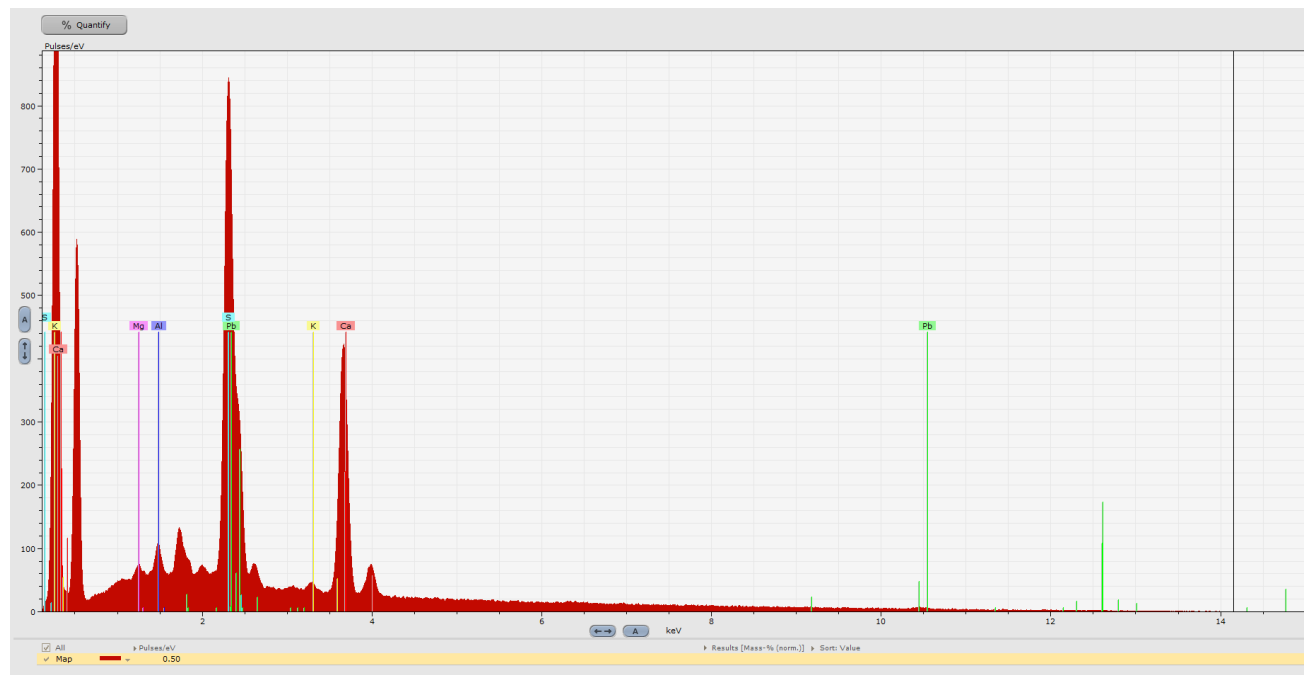
Bruker Quantax Sample 1 Elemental Map Lead



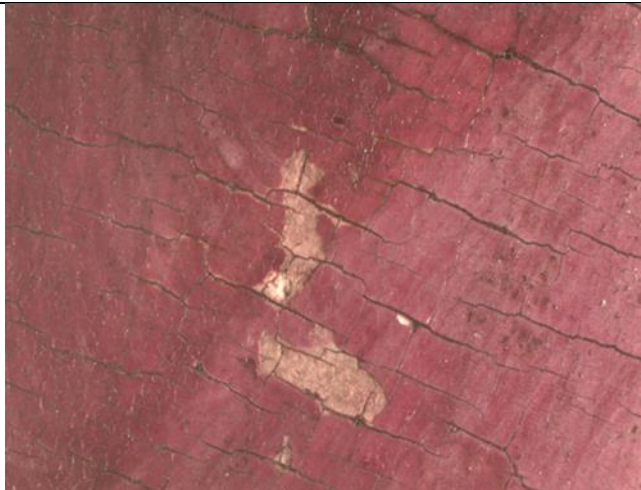
Bruker Quantax Sample 1 Elemental Map Sulfur



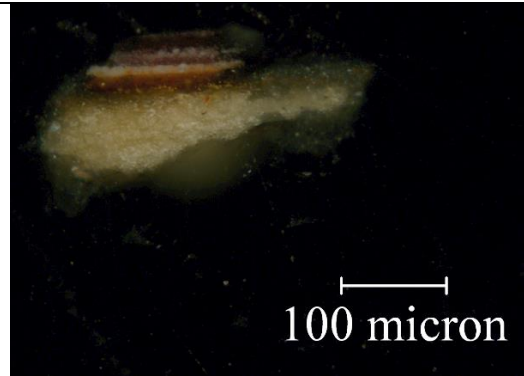
Bruker Tracer Analysis spectrum from surface of sample 1 location.



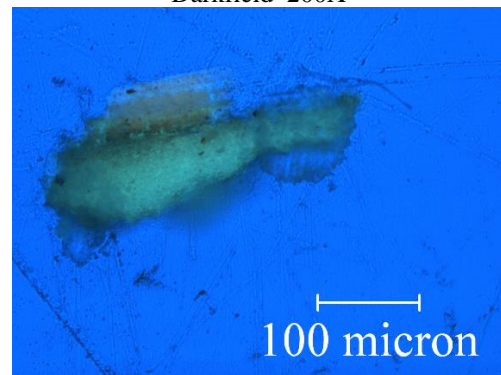
Bruker Quantax Analysis from sample 1 cross-section SEM.



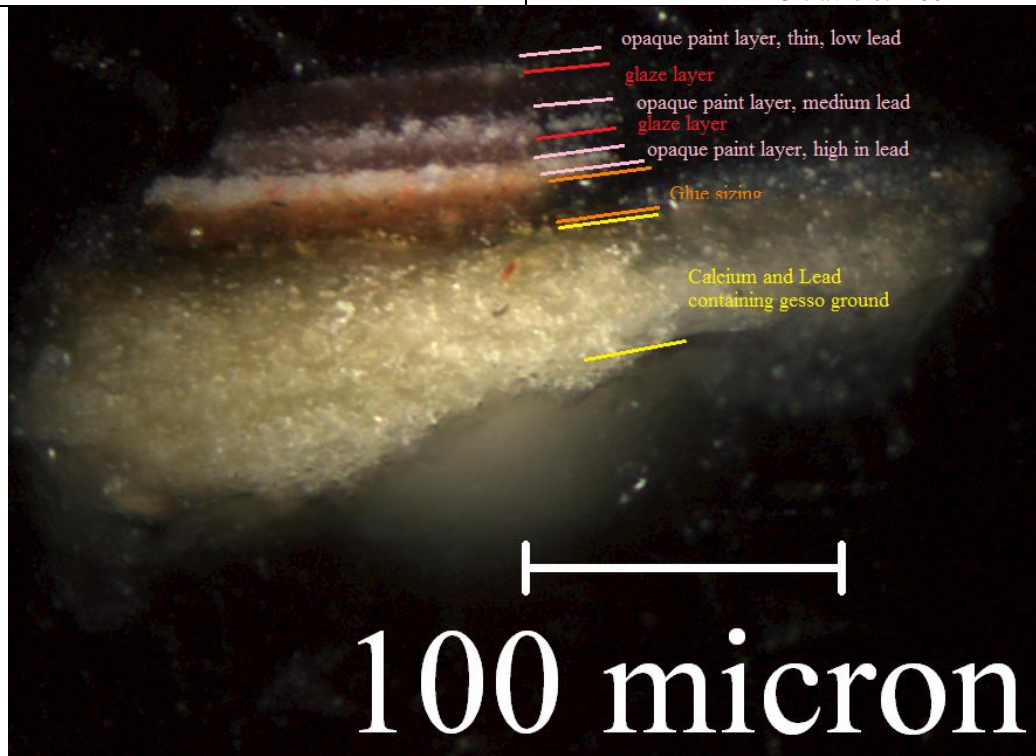
Sample 2 Saint Catherine location photomicrograph



K231B Cross Section Sample 2
Darkfield 200X

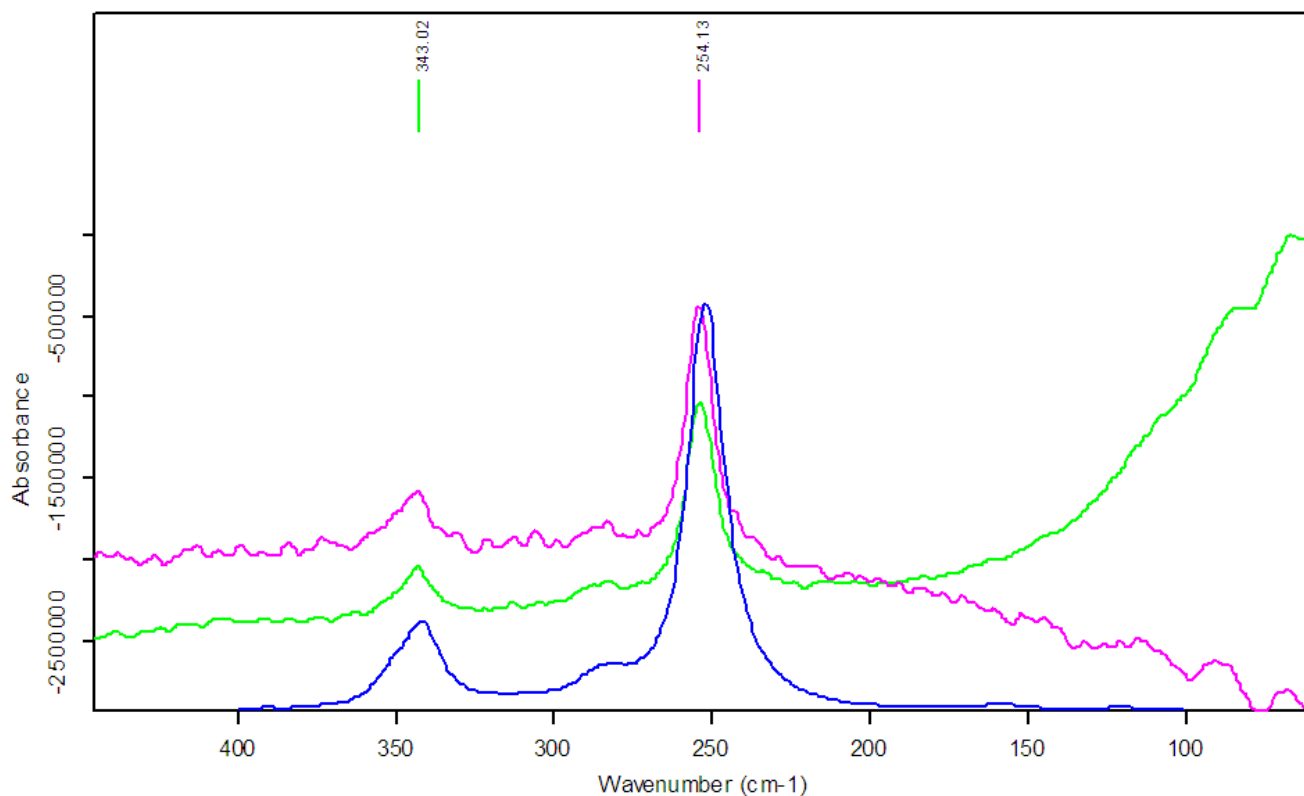


K231B Cross Section Sample 2
Ultraviolet 200X



K231B Cross Section Sample 2 with assigned layer structure and composition.

RAMAN SPECTROSCOPY



C:\Documents and Settings\Administrator\Desktop\SPC pigments\Vermilio.spc			00/00/ 0
E:\MET_RAMAN\K231B_S2_ground.2	K231B_S2_ground	cross section ground layer	
E:\MET_RAMAN\K231B S2 pink 1 layer.1	K231B S2 pink 1 layer	785nm/1mW/100x	

Raman spectrum from sample 2, Saint Catherine with baseline correction in Magenta and Green and UCL reference spectrum of Vermillion in Blue

Name	Composition	Band Wavenumbers ^a / cm ⁻¹ , and Relative Intensities ^b	Excitation Wavelength and Power
Vermillion	mercury(II) sulfide, HgS	252vs; 282w(sh); 343m	632.8 nm 6 mW