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Christ Child Bearing the Instruments of the Passion Technical Study and Treatment of a Painting on Copper from the Viceroyalty of Peru

Daniela González-Pruitt
State University of New York College at Buffalo - Buffalo State College, gonzall06@buffalostate.edu

PATRICIA H. AND RICHARD E. GARMAN ART
CONSERVATION DEPARTMENT
BUFFALO STATE UNIVERSITY

Christ Child Bearing the Instruments of the Passion
Technical Study and Treatment of a Painting on Copper from the Viceroyalty of Peru

CNS 695 Master's Project

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Advisor: Fiona Beckett
Co-Advisors: Jiuan Jiuan Chen, Dr. Rebecca Ploeger, Dr. Aaron Shugar

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ABSTRACT

Christ Child Bearing the Instruments of the Passion (acc.# 228017) is a 17th century Peruvian Viceregal painting on copper belonging to the Carl & Marilynn Thoma Art Foundation. The painting depicts the Christ Child on a flower laid path as he carries the instruments of the passion also known as the *Arma Christi* Paintings executed on copper convey new and challenging preservation issues based on their materials and techniques.. The work had been heavily restored and exhibited several condition issues, including significant overpaint and broad losses. The painting was photographed using multimodal imaging techniques as well as reflectance transformation imaging and multispectral imaging. Analytical techniques including Raman, reflected FTIR, and scanning XRF were performed to better understand the painting's materials and history. The palette was consistent with historical materials of the region and the period, and indicated the use of earth colors, vermillion, lamp black, lead white, and azurite. Finally, conservation treatments were undertaken to reduce the previous overpaint and improve the aesthetic legibility. The treatment was successful and restored unity to the composition.

Keywords*:* Christ child, Instrument of the Passion, Peruvian Viceregal, Multispectral imaging, Hyperspectral imaging, Spanish Colonial, Raman, XRF, Copper

1. Introduction

1.1. General Description of the Painting

Figure 1. *Christ Child Bearing the Instruments of the Passion*, Thoma Foundation. Before treatment, in frame, normal illumination.

Christ Child Bearing the Instruments of the Passion (Christ Child) is an oil painting executed on a copper plate (fig. 1). The small painting (16.5 cm x 22.2 cm x 0.18 cm) depicts the Child Christ in mid-step carrying the instruments of passion in a basket while walking on a flower laid path. Over Christ's right shoulder he carries the True Cross with the Latin notice *INRI* ("Jesus of Nazareth, the King of the Jews") and a crown of thorns is looped around the cross. Christ holds a basket in his left hand containing five symbolic objects from the Passion including: 1- the Veil of Veronica used to wipe Christ's face during the Sixth Station of the Cross; 2- a pair of dice soldiers used to cast lots for Christ's robe; 3-rope used for raising the cross; 4- four nails and hammer used during the crucifixion; and 5-pincers to later remove the nails from the cross. Christ is depicted in a purple robe and red cape worn over his right shoulder. A halo of holy light surrounds his head as he solemnly looks down at the path in front of him. The painting is modeled on the 16th-century engraving by Flemish engraver Hieronymus Wierix (1553–1619) titled *The Christ Child Carrying The Instruments of The Passion* in the Metropolitan Museum of Art's print collection.

The painting, measuring 16.5 cm x 22.2 cm x 0.18 cm, and is undated and unsigned, underscoring the prevailing tendency during this historical era for painters to forego such formalities. This absence of specific dating and signatures aligns with the broader tradition observed in many artworks from the Spanish Americas, where artists often prioritized the depiction of religious or thematic content over personal attribution.

The painting on copper was acquired at auction in November of 2021 by the Carl & Marilynn Thoma Foundation for their Art of the Spanish Americas Collection. The prominent collection consists of more than 175 historical works from the 17th to 19th centuries that capture the expressions and intertwined history of European and Andean cultures. This collection provides insight into the melding of traditions, the colonial resonance, and the artistic style forged by the interaction of indigenous cultures and the Spanish Empire over hundreds of years.

1.2. Painting in the Viceroyalty of Peru

Before the Spanish invasion of South America in 1532, the Andes was home to many indigenous groups who developed stunning visual traditions of both aesthetic and practical objects from ceramic, stone, wood, bone, gourds, feathers, and cloth (Stone 2012). The Spanish conquest of the Andes wielded a significant impact on the religious traditions and art production of the indigenous groups of this region. Spanish missionaries in the Viceroyalty of Peru sought to ensure that it's indigenous inhabitants would become devout Catholics and loyal to the Spanish crown. Early painting of colonial Peru served the didactic purpose of instructing indigenous people in the beliefs of Catholicism through the language of images. European iconography traveled to the Andes through robust transatlantic trade networks that brought prints, pigments, paintings, brushes, and other art-related materials from Italy and Flanders by way of Seville, Spain (Alcala 2014). Another means of transference was the significant introduction of Flemish engravings from Antwerp, as well as small paintings on copper. Artists from Seville and Flanders travelled to the Viceroyalty of Peru to assist with the growing demand for altarpieces and retablos needed to fill erected churches, while local indigenous and mestizo artist were trained in colonial established paintings workshops to work in European materials and stylistic techniques (Damien 1995).

1.3. Depictions of the Christ Child in the Spanish Americas.

The visual traditions born out of the Viceroyalty of Peru led to the widespread veneration and established cults of Christian figures depicted in colonial art. Commonly depicted by Cusco School artists, these cults consisted of compositions dedicated to Christ, the Virgin Mary, Joseph, Angels, Virgin Martyrs, and Portraits of Officials. Compositional depictions of the Child Christ represent the adoration of Christ as a young child or youth in which tenderness and sacrifice is evoked by the image. The youth stages of Christ's life are not commonly depicted in European painting because they are not referenced in the New Testament (Stanfield-Mazzi 2013). As a result of the limited scriptural information about Jesus' youth, European artists have historically focused more on depicting scenes from his adult life, such as his miracles, teachings, crucifixion, and resurrection. However, in the Spanish Americas, the adaptation of the child Christ was modelled from Flemish engravings that made their way to the Colonial Andes and were then reimaged with local cultural motifs and flora by Andean artists. The portrayal of Christ Child in these paintings became an important aspect of religious art in the colonies, the intimate scale of the *Child Bearing the Instruments of the Passion* and its subject matter suggests that this work was utilized for private contemplation within a domestic setting.

1.1. Methods and Materials of Spanish Colonial Paintings on Copper

The emergence of paintings on copper and other unusual supports arose in the spirit of experimentation in Italy in the early 16^{th} century and spread throughout Europe and Spanish America. The manufacturing and preparation of copper plates for painting involved hammering and sometimes rolling sheets of copper. The surface was typically roughened to provide adhesion for the paint, and preparatory layers, often containing lead white and earth pigments, were applied. Linseed oil was used for both the ground and paint layers, and a green transparent layer could form between the copper plate and the ground due to the interaction of copper ions with fatty acids in the oil (Horowitz, 2017). Spanish Colonial paintings on copper represent a captivating genre of art that emerged during the colonial period in the Americas, serving as a testament to the complex interplay of cultural influences. The creation of these artworks was informed by a unique combination of materials and techniques. Copper, chosen as the primary support, was favored for its resilience and resistance to corrosion. Spanish artists meticulously applied layers of pigments using tempera or oil-based mediums, echoing European miniature painting traditions (Pierce 2014). Moreover, these painters were influenced by Baroque and Mannerist styles, which added dynamism and intricate detailing to their works. Indigenous artists, contributing their skills and iconography, brought a rich layer of tradition and local flavor to these paintings. The fusion of materials and techniques facilitated the production of vibrant, intricate, and highly reflective artworks

2. Materials and Condition

2.1. Support

The painting was executed on a sheet of copper, which is approximately 1.3mm thick. There are several marks attesting to the preparation of this metal support. The support was most likely flattened with a planishing hammer, creating round impressions that are visible in raking illumination. This was done to impart a smooth and even surface to the metal support. Planishing renders copper sheets less flexible, while assuring a thin profile. All the edges were cut slightly irregularly and were sanded to round sharp edges. Overall, the support exhibits soft planar deformations related to the initial hammering. Prior to applying the ground layer, the front of the support was scratched repeatedly with a fine sharp tool to ensure proper adhesion between the layers. This roughening is visible through pinpoint paint losses under microscopic magnification (fig. 2). Overall, the plate has been well preserved; minor areas of damage include an out-of-plane dent in the right-hand corner of the support attesting to its susceptible nature if mishandled. On the peripheral

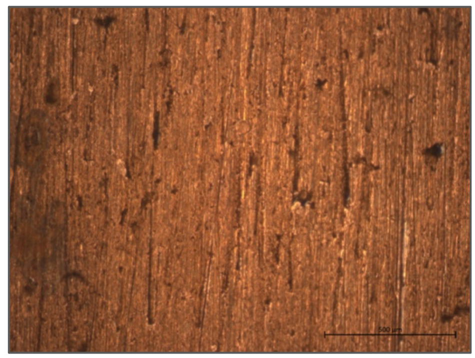

Figure 2. Recto, Normal illumination. Photomacrograph of copper roughening in an area of loss

Figure 3. Verso, normal illumination. Varnish residues (green), transferred retouching media (red), and localized corrosion (blue).

borders of the verso, there are areas of green corrosion, varnish residues, and inpainting media present (fig. 3).

2.2 Ground and Paint Layers

A translucent thin brown ground was applied evenly throughout and can be seen along edges of losses, under magnification. The ground was carefully applied over the copper support to create a polished, smooth surface to receive oil paint. Pinpoint losses of the ground and paint are visible throughout exposing the copper support (fig. 4). The composition has a luminous quality imparted by the brilliance of the copper support and the smoothness of the ground layer. The lively palette showcases greens, blues, and reds, which harmonize the pale flesh tones of the figures. The artist used gestural brushwork; however, his work has the quality of a controlled miniaturist. The oil paint layers vary in application from slight impasto to thin washes of paint. In some areas it is possible to see wet on wet mixture of different colors. Linear brushwork is evident in the robe of Christ. The image was skillfully rendered with delicate details, such as Christ's expression and the instrument in the basket carried by Christ (fig. 5). Details in the figure were further accentuated with a filament like application of gold paint. This is most prominent in Christ's garments and halo.

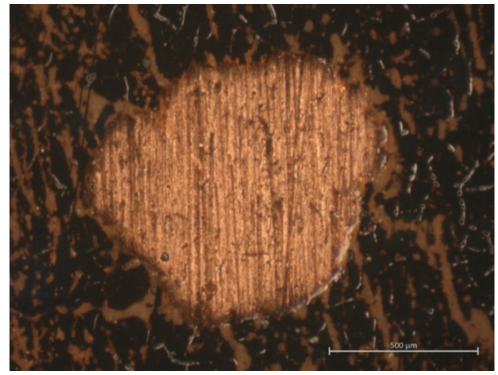

Figure 4. Recto, normal illumination. Photomacrograph of ground and paint loss.

Figure 5. Recto, normal illumination. Detail instruments in the basket held by Christ.

The painting appears to have maintained its original tonality; no obvious color degradation is noticeable in normal viewing conditions. Under microscopic examination the paint surface appears to be heavily overpainted in the black background surrounding the figure. There are several fine scratches throughout the flower laid path and beside the basket that extend to the copper support (fig. 6). Upon first inspection overall, the paint losses are relatively minor and amount to less than `10% of the painted surface. In addition, there are minor accretions and splatters on the surface of the painting.

Figure 6. Recto, normal illumination. Detail of fine scratches reveal support beneath.

2.2. Surface Coatings

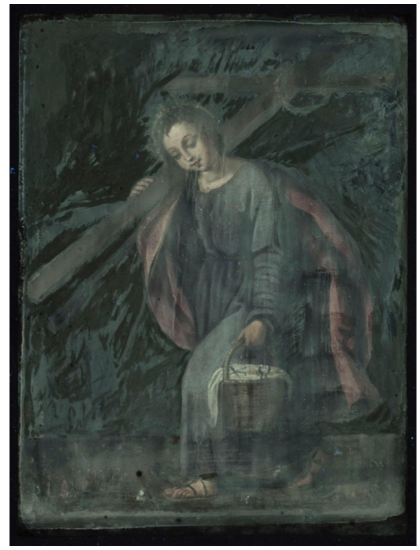

Figure 7. Recto, Overall UVA induced visible fluorescence illumination. Greenish hue is the fluorescence of a varnish, while dark regions are restoration.

Prior to treatment, the painting had a high gloss coating that appeared varied due to the unevenly applied painted areas of retouching in the background (fig. 7). Normal viewing conditions revealed a fingerprint left in the surface coating located in Christ's mantle. When examined under UVA induced visible fluorescence, the brush-applied coating was observed to emit a greenish hue, indicatively of a natural resin. On the verso, varnish drips were observable on the top edge of the work and emitted the same color as the varnish applied to the front of the work. UVA examination revealed localized retouching in the figure of Christ and significant amount throughout the background. Following the removal of the varnish, revealed that the original paint layers did not emit any fluoresce under UV illumination (see section x for additional imaging).

2.3. Frame

The painting was housed in a historic reproduction frame, made of carved wood with gold painted accents (fig 8). Despite minor losses to the paint, the frame was in generally good condition. The painting was accompanied with a thin wood panel on the back (though not secured). The panel contains a stamp, an adhesive label, and writing in both graphite and dark media. The text located at the top of the panel reads "de las sies piezas firmadas" (from the six signed works), while the text at the bottom appears to have been a possible signature that is now illegible

Figure 8. Frame, photograph under normal illumination.

Figure 9. Recto, normal illumination. Overall panel backing board with writing and labels.

(fig. 9).

3. Imaging and Materials Analysis

3.1. Imaging Techniques and Results

All images were taken with a modified Nikon D810 camera and a 60mm lens. Filtration and lighting setup are specified in greater detail in appendix A.

3.1.1 Normal, Raking, and Specular Illumination Imaging

Normal, raking, and specular images were illuminated by two Profoto Tungsten lamps. An X-Nite CC1 filter was applied to the lens of the modified camera to control the wavelengths passing through for visible light photography. The lamps were manipulated for each image to approximate standard viewing conditions (normal light), record surface topography (raking), or emphasize surface gloss (axial specular).

Figure 10. Recto, Overall raking illumination showing surface dust and grime.

Figure 11. Recto, Overall visible axial specular illumination showing the texture of the brushwork.

Normal, Raking and Specular Illumination Imaging Results

The visible light images taken of the *Christ Child* prior to treatment document several condition issues visible to the naked eye, including liberally applied overpaint in the black background, abrasions of the shell gold, along with scratches and losses extending to the copper support. Raking illumination (fig. 10) captured the planar irregularities of the copper plate including an out of plane dent to the left corner of the plate. The axial specular image (fig. 11) was valuable in documenting the black overpaint surrounding Christ. In addition to the discernable brushstrokes in the areas of overpaint, the image captures delicate impasto in the Christ's garments, as well losses and sheen inconsistencies along the edges of the plate most likely from varnishing the work while in the frame.

3.1.2 Ultraviolet Induced Visible Fluorescence Imaging

Ultraviolet induced visible fluorescence involves the temporary absorption by a material of ultraviolet energy, which is then reemitted as lower-energy radiation in the visible light region. Factors including the nature of a material, the extent of degradation, and the excitation energy all influence the florescence response, as well as the resulting photographs (Kushel 2017, 148). UVA-induced visible fluorescence images were taken before, during, and after treatment. The painting was illuminated by two SuperBright UVA lamps positioned at forty-five degrees on either side of the camera.

Ultraviolet Induced Visible Fluorescence Imaging Results

UV-induced visible fluorescence images revealed a brush applied varnish. The varnish appears slightly green under UVA fluorescence and does not extend to the edges of the plate. Signifying that the painting may have been varnished while still in its frame. Broad areas of overpaint in the background appear as darkened small brushstrokes. Additional overpaint was observed in the garments of Christ. On the verso, varnish residue in the form of drips emitted green in UVA fluorescence like the varnish applied to the recto of the work.

Figure 12. During Treatment, Overall UVA induced visible fluorescence illumination. No fluorescence observed.

Following varnish removal, UVA- induced visible fluorescence imaging revealed that the blue-green hue from the surface coating was no longer present and that the original applied paint layers did not process any fluorescent properties and therefore did not fluoresce (fig.12). The lack of fluorescent properties in the original media proved challenging when attempting to capture a UVA induced image of the painting. The image captured appears dark but does demonstrate that there is no evidence of any fluorescent containing media proving that the work is from its estimated time period.

3.1.3 Infrared Imaging

Figure 13. During Treatment, Overall reflected infrared illumination at 750nm. Areas of overpaint appear darker.

Infrared imaging is a valuable tool for examining paintings and can reveal various aspects of the artwork that are not visible to the naked eye. The same modified camera was utilized to capture infrared images, with the exception that the X-Nite CC1 filter was removed, to capture light in the infrared region (about 700-1050 nm) (fig.). This technique is valuable for revealing under drawings, pentimenti, overpaint/retouching, pigment identification, and paint layering structure. Visible induced infrared luminescence (IRLUM) was also utilized as it records the infrared energy emitted by certain materials after excitation by a blue/green visible light source (Kushel 2017, 146). The technique can be very useful in the characterization and comparison of materials, as very few materials appear bright in IRLUM. An infrared luminescence image was captured after varnish removal to observe if any specific pigments would luminesce.

Infrared Imaging Results

Three different IR filters, a 750, 875, and 950nm were tested and utilized to capture infrared images of the painting before removing the surface coating and reducing the over paint. The 750nm filter revealed that the overpainted background was composed of a carbon rich media that heavily absorbed the IR light in the near infrared producing a stark dark background around the figure. The intensified filters of 875nm and 950nm did not reveal any carbon-based underdrawings or modifications in the composition. However, these captured images did distinguish overpaint from areas of corrosion in the copper plate that appeared throughout as small spots in the image, which are caused when the copper plate is exposed to atmospheric elements and humidity (Sanchez 2014)(fig 13). An infrared luminescence image was captured after varnish removal to observe if any specific pigments would luminesce. IRLUM is a useful technique in distinguishing Egyptian blue, cadmium red and yellow, and madder lake however there was no luminescence exhibited by any of the original paint layers, signifying that those colors are not present in this work.

3.1.4 X-radiography

Figure 14. DT, X-radiograph taken on the work showing lighter areas of higher atomic weight

X-radiography is an imaging technique that is often used in conjunction with IR imaging to reveal information about materials, an artist's working methods, compositional changes, and the condition of an artwork (Wallert, et al., 2009: 160). X-ray energy wavelengths are less than 10nm, thus higher energy than ultraviolet, visible, and infrared. The degree of x-ray penetration through a painting or object depends on the atomic weight of the material; materials that contain elements with higher atomic weights absorb more x-rays, allowing fewer x-rays to pass through to expose the plate, resulting in lighter areas in the radiograph. Materials of lower atomic weight allow more x-rays to pass through to the plate, resulting in dark areas in the radiograph.

X-radiography Results

The x-radiograph was performed after the liberal overpaint in the background had been reduced revealing a thin brown ground layer and significant expanses of paint loss to the bare copper plate. These areas of the subject appear lighter in tone in the radiograph due to the copper containing a higher atomic weight thus absorbing more x-rays, diminishing penetration (fig. 14). Regions contained lead white seen in the mantle also appear lighter in contrast to the flesh tones of the figures The subject was penetrated by a beam of x-rays and the extent of x-ray penetration was recorded on a digital imaging plate, the was recorded to be kV: 300 mAS: 5.00.

3.1.5 Multispectral Imaging (MSI)

Multispectral imaging involves the creation of a set of images recording the spectral reflectance of a subject at different wavelength bands within a certain range of the electromagnetic spectrum (Kushel 167). Multi-Spectral Imaging (MSI) was completed using a modified Canon Rebel T3i[1] with a 60 mm Coastal Optics APO lens, and 14 different filters from 400 to 1000 nm[2]. Several of these images are shown in (fig 15.). Data was extracted from the processed images to create a reflectance spectrum (fig. 16).

Figure 15. a-d. Images of the painting at 450, 600, 850, and 1000 nm.

Spot/Series Number	1	2	3	4	5	6	7
Pigment	Light Red	Dark Red	Purple	Flesh	Brown Cross	Brown Basket	Green Leaf
365	38	35	62	72	170	169	121
405	40	45	80	105	175	167	140
440	45	87	68	113	191	183	157
490	86	90	86	129	190	190	172
550	61	72	69	172	192	192	192
615	64	80	84	172	196	196	185
650	85	85	68	192	192	196	187
700	153	123	62	185	197	187	186
750	165	156	74	187	197	196	187
800	195	185	80	181	201	205	181
850	186	183	96	192	195	181	182
900	192	187	115	187	199	193	183
950	207	194	133	193	196	201	191

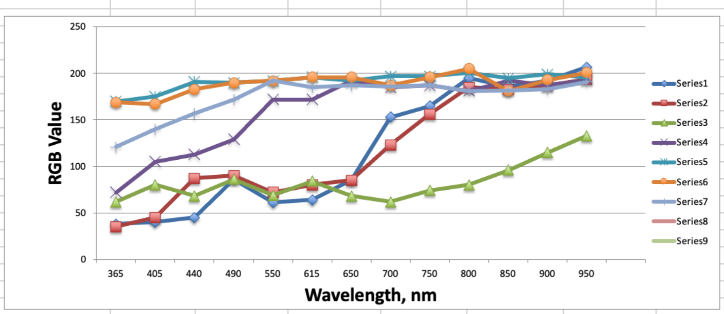

Figure 16. Reflectance spectrum and sample locations on the painting for comparing and contrasting similar pigments

MSI Results

The technique can be useful for differentiation of materials. For example, spots 1 and 2 are both in areas of original red paint and had similar values throughout the spectrum. Spot 3, which is from an area of overpaint on the purple mantle, had similar values to the first two points at lower wavelengths, but differed from them significantly at wavelengths above 600 nm.

Spots 5 and 6 are from the brown regions found in the cross and the basket that are original paint. Whereas spot 4 in the figures hand is likely in an area of overpaint, as revealed under UVA and has a different spectral response.

A false color image was also created (fig. 17). The 1000 nm image was used for the red channel, 800 nm for green, and 400 for blue. In this image, overpaint in the mantle appears gray and is visually distinct from original paint.

Figure 17. False color image created from images at 400, 800, and 1000 nm.

3.1.6 Reflectance Transformation Imaging (RTI)

Reflectance Transformation Imaging (RTI) is a technique in which 30-40 images of the same subject are taken with a stationary camera, exposed under different lighting angles, and combined to create an interactive, virtually lit image. Examination of surface texture and sheen can thus be enhanced (Cultural Heritage Imaging, 2016). RTI was performed on the verso of the copper support to better understand and observe the hand tooling that went into preparing this support for painting (fig.18).

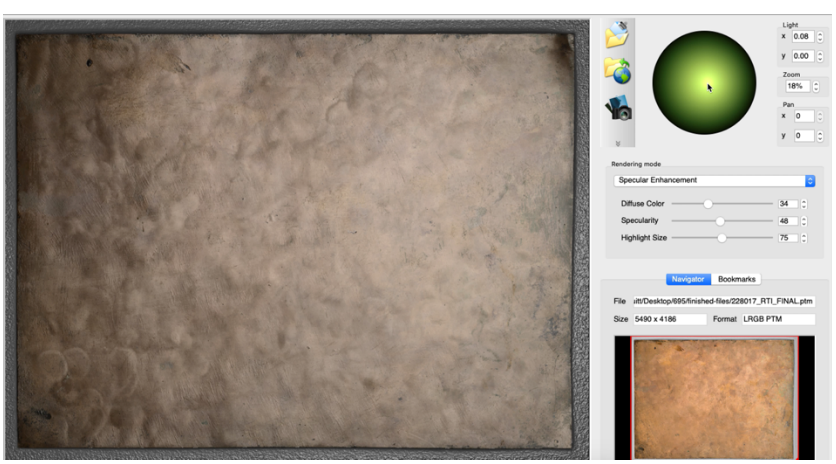

Figure 18. Reverse of painting as seen in RTI in viewing software with specular enhancement applied. Note the enhanced

visibility of the hammering marks used to create the support.

RTI Results

RTI provided valuable results that revealed an overall uniform hammering and scoring of the plate with a sharp tool to roughen the surface to receive preparatory paint layers. The use of specular enhancement brought out the groves within the plate that were not visible with normal illumination techniques.

3.2. Analytical Techniques and Results

3.2.1 X-Ray Fluorescence (XRF)

X-ray fluorescence spectroscopy, a nondestructive and noninvasive technique, was performed in order to identify elements present in the paint and ground layers. XRF works by irradiating a sample with high energy x-rays. When an atom in the sample is struck by an x-ray of greater energy than the atom's K or L binding energy, an electron from one of the atom's inner orbital shells is dislodged. An electron from one of the atom's higher shells fills the vacancy, dropping the electron to a lower energy state and emitting a fluorescent x-ray in the process. The energy of the x-ray is measurable and characteristic of the element's electron configuration, thus allowing heavy elements to be identified (ThermoFisher Scientific, 2021). A DeWitt MPS-400E scanning gantry was used to collect XRF elemental maps, utilizing a Bruker 5i XRF. The scanner has a total scanning range of 330 mm in the X axis and 440 mm in the Y Axis at as low as 1x1mm pixel collection. Scans were taken using a 2 mm collimator at a rate of 2x3 mm in the X and Y axes, respectively. The total area scanned was 273x344 mm. The XRF was set at 35kV 110uA with no filter. Data was collected in DeWitt proprietary software and exported into Artax for analysis. The deconvoluted area under peak for each element identified was exported into excel and processed in GoldenSoftware's Surfer Software to create the individual elemental maps. The produced elemental maps were compared to the original image to understand what colors related to what elements (fig. 19). The XRF maps were incredibly valuable in the analysis of this work because cross sections were not possible due good condition of the paint layers.

Figure 19. a-p. Top: Scanned area, Aluminum (Al), Arsenic (As), Gold (Au) L-lines. Second row: Barium (Ba) L-lines, Calcium (Ca), Copper (Cu), Iron (Fe). Second row: Lead (Pb) M-lines, Sulfur (S). Second row: Potassium

(K), Silicon (Si), Calcium (Ca), Aluminum (Al). Third row: Mercury (Hg) L-lines, Phosphorus (P), Manganese (Mn), Lead (Pb) L-lines. Fourth row: Sulfur (S), Silicon (Si).

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XRF Results

XRF revealed the palette to include lead white, earth colors, vermillion, carbon black, and bone black; all pigments that would have been used in workshops in the Spanish Americas during the 17th century. Mercury (Hg) was found on Christs red cape. This suggests mercuric sulfide: either the natural mineral form, which is simply ground cinnabar, or the synthetic form, vermillion. Phosphorus was found in background of the work that had a section intact overpaint. In conjunction with visual examination, this presence suggests bone black. Phosphorous distinguishes bone black from carbon black, though both are made from burned materials.

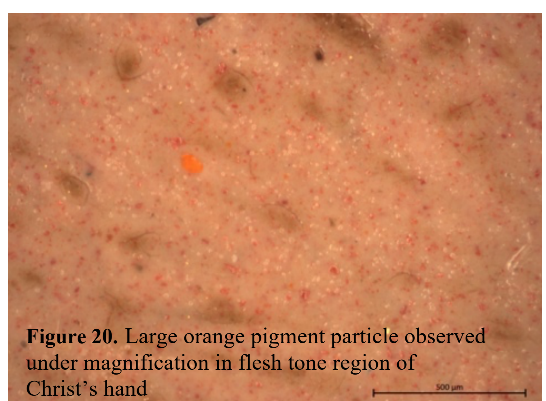

Figure 20. Large orange pigment particle observed under magnification in flesh tone region of Christ's hand

This finding was valuable and reassured the possibility that most of the black background had been liberally overpainted with an opaque layer bone black during its previous restoration campaign.
Arsenic (As)
is also present in the painting, most notably in in the red robe of Christ. Orpiment and Realgar are two arsenic-containing pigments that were used in colonial art during the 17^{th} century, they both are arsenic sulfides and differ in color (Siracusano 2011). Orpiment is described as lemon yellow in color, while realgar is typically red or orange (Seldes 2002). Visual examination suggests that realgar is the likelier of the two: orange particles are visible under magnification in the red robe (fig. 20).

3.2.2 Fourier Transform Infrared Spectroscopy

Fourier Transform Infrared Spectroscopy (FTIR) measures the absorption of IR radiation by a sample to determine its molecular composition. IR radiation is passed through a sample and a unique spectrum is produced that represents the characteristic absorption of the sample. An IR spectrum contains peaks that correspond to the frequencies that produce vibrations between the bonds of atoms (Thermo Nicolet, 2001). Infrared spectra were collected using a Thermo Scientific Nicolet iS5 FTIR spectrometer with a ConservatIR external reflection accessory. Spectra were collected from 4000-600 cm^{-1} and are the average of 64 scans at 4 cm^{-1} spectral resolution. Sample identification was aided by searching a spectral library of common conservation and artists' materials (Infrared and Raman Users Group, http://www.irug.org) using Omnic software (Thermo Scientific).

FTIR was utilized to analyze the varnish by placing the copper plate on the microscope stage and focusing in on an area of varnish and the following spectra was generated (fig. 21).

FTIR Results

The varnish was revealed to be a natural resin varnish matching spectrums for dammar. The sampled surface coating although not original does inform that the original varnish was most likely removed during a previous conservation campaign and that this most recent coating is part of the restoration campaign because it was applied over the retouching.

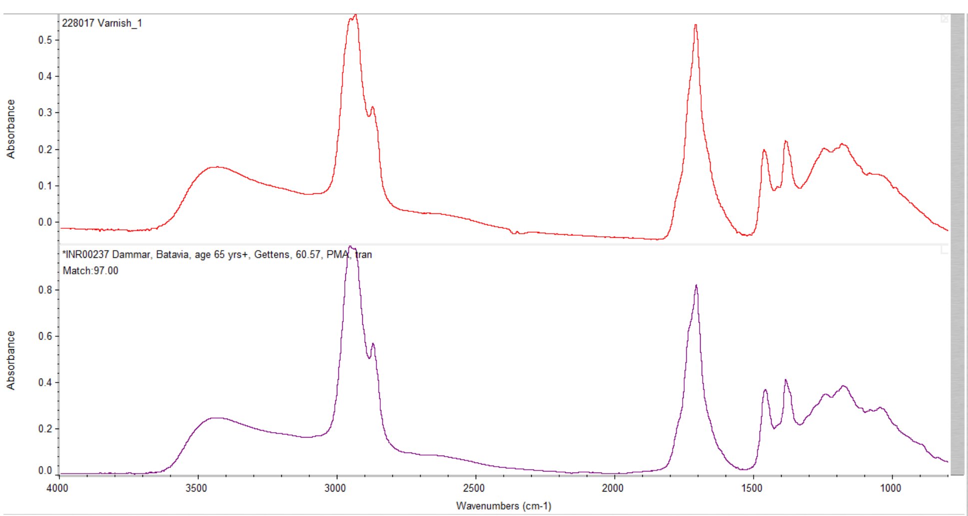

Figure 21. Comparative spectra of the surface coating sample taken from the artwork (upper spectrum) matching a library spectra for a natural resin such as dammar (lower spectrum).

3.2.3 Raman Spectroscopy

Raman spectroscopy is a non-destructive analytical technique where a monochromatic wavelength of light is shone onto a sample, and some of the light induces vibrations of the sample's constituent groups (Mills, 1994). This information is then used to create a Raman spectrum. Raman spectroscopy was performed in four discrete locations where the presence specific elements were indicated by XRF analysis. The sample locations consisted of the purple robe, the red cape, and original black in the background (fig 22).

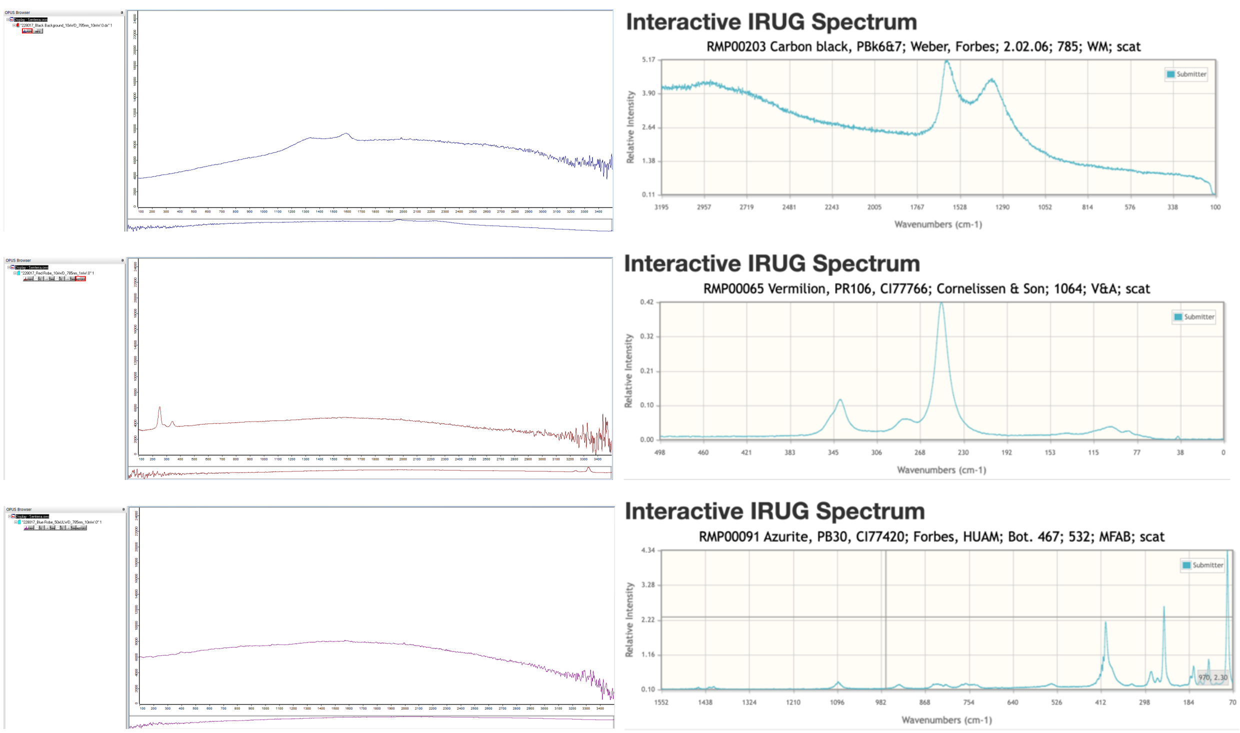

Figure 22. a-c Comparative spectra of the three examined regions viewed with library spectra from IRUG. More infor needed here, what are we looking at and what samples are you analyzing

Raman Spectroscopy Results

The black paint samples produced spectra revealing the overpaint to be carbon black and signifying that the overpaint is bone black based off XRF analysis. A location on the cape was analyzed and found to have significant peaks that aligned well with a reference spectrum, indicating that the red paint is vermilion. The robe was found to be a combination of both a blue and red pigment, an area with blue particles was analyzed and found to have peaks matching to azurite.

3.2.4 Discussion

The results of this analytical and technical imaging study of a copper 17th-century Colonial Andean painting *Christ Child Bearing the Instruments of the Passion* have significantly enhanced our understanding of this artwork. The multimodal imaging techniques, such as reflectance transformation imaging and multispectral imaging, provided a comprehensive visual analysis of the painting's construction and condition, revealing extensive overpaint and broad losses. Simultaneously, analytical methods including Raman, reflected FTIR, and scanning XRF shed light on the materials and historical context of the artwork. These techniques correlated well with the images and pigments throughout the painting, confirming the use of earth colors, vermillion, lamp black, lead white, and azurite, which were consistent with materials from the Colonial Andean region of that period. The restoration efforts to improve the aesthetic legibility and unity of the composition were also informed by these findings.

This study on *Christ Child Bearing the Instruments of the Passion* contributes to the broader context of works from the Viceroyalty of Peru. By showcasing the preservation challenges inherent in paintings on copper, it underscores the need for a specialized approach to their conservation. The use of traditional pigments and materials in the palette reaffirms the artistic and historical connections of this painting to the Viceregal Peruvian tradition.

In alignment with various published sources on the subject, the findings of this study resonate with the existing understanding of the technical and material aspects inherent in copper-based paintings from the Spanish Americas. Drawing parallels with established research, particularly that of renowned experts such as Horowitz (2009, "Copper Canvases: The Preparation, Degradation, and Conservation of a Complex Medium in Early South American Painting") and Lazarte (2020, "Bold Gestures in a Devotional New Spanish Painting on Copper by Juan Francisco de Aguilera"), the study reinforces the consensus on the intricate nature of these paintings and the nuanced conservation strategies required to preserve their integrity over time.

Additionally, the study aligns with the insights provided by Sanchez (2015, "Metals and Mastery: The Material Culture of Colonial Quito") and Ortiz (2017, "Painting the Andean Cosmos: The Material Culture of Oil on Copper in Colonial Cuzco"). Sanchez delves into the broader material culture of Colonial Quito, offering valuable context on the artistic techniques and material choices prevalent in the region during the colonial period. Ortiz, on the other hand, focuses specifically on the use of oil on copper in Colonial Cuzco, providing a comprehensive examination of the technical intricacies involved in creating artworks on this medium. By synthesizing the findings of this research with the insights from these sources, the study contributes to a more comprehensive understanding of the technical and material dimensions of colonial Andean paintings on copper. It places the examined artwork, *Christ Child Bearing the Instruments of the Passion*, within a broader artistic and cultural context, enhancing our appreciation for the complexities involved in the creation and preservation of these works created in the Viceroyalty Peru during Spanish Colonial empire.

4. Conservation Treatment

4.1. Cleaning

Following removal from the frame, treatment of the painting began. Mention gloves here and a special support created to house the work to avoid damage while handling. Mineral spirits was used to remove dirt, grime, and corrosion from the surface of both recto and verso. Solvent testing was conducted to determine the solubility of the varnish layer, and isopropanol was found to effectively remove the varnish without affecting the original paint layers. During varnish removal, an image of the painting in ultraviolet fluorescence was regularly consulted to better distinguish overpaint. As expected, overpaint readily lifted with the varnish throughout the work (fig. 23). It was revealed during these stages that most of the black background had indeed been liberally overpainted concealing the instruments of the passion held by Christ. Removal of overpaint in the figure of Christ exposed pinpoint losses small dark spots of corrosion. FTIR analysis revealed that the restoration media is in a linseed oil medium, however it remains unclear when this paint was applied, and by whom. Areas of "green" corrosion were cleaned/degreased in order

Figure 23. Removing restoration varnish and reducing liberally applied overpaint. The losses from previous damages are now visible.

to restore the surface and protect it.

4.2. Varnishing and Aesthetic Compensation

Following the varnish and overpaint removal, varnish was applied to the recto of the work as protective coating to protect from handling and corrosion. While on the verso an initial isolating varnish would be applied in preparation for the retouching stages (fig. 24). Laropal A-81was chosen for this step for its stability and its low molecular weight. A varnish layer of 12% Laropal A81 in 1:1 xylene and ShellSol A100 was brushed applied to the verso and left to dry overnight. The resulting varnish layer proved to be evenly saturated and imparted a nice shine to the copper surface, with the success of this application an 8% layer of the Laropal A81 mixture was brushed applied to the to the recto. However, it was soon after the varnish application that a slight reticulation formed as the solvents evaporated out of the solution leaving behind the resin. This was prominent due to the smooth surface of the copper plate and thinly painted composition. Through additional mockups, it was determined that using Laropal A81 in low resin percentages to a copper support was not ideal, as it formed a slight texture on the smooth copper surface upon evaporation of the solvent in many cases. Thus, the varnish was carefully removed from both sides of the copper plate. After additional experiments on a sample plate of copper using (Laropal A8 and Regalrez), Paraloid B-72 yielded the most suitable results for use as a varnish. As mentioned by Horowitz, in "Copper as Canvas" Paraloid B-72 is compatible with copper supports and is utilized in loss compensation (Phoenix Art Museum 1990). Based on the results of the mock-ups, a varnish layer of 15% Paraloid B-72 in a ratio of 1:1 xylene to ShellSol A100 was brushed applied to the verso and left to dry afterwards a 10% layer of the Paraloid B-72 mixture was brushed applied to the to the recto. The varnish was monitored after application and did not form ant patterning on the surface as the solvents evaporated out of the mixture.

Figure 24. Apply isolating B-72 varnish layer by brush

Due to the shallow nature of the losses, a separate fill layer was not required. Instead, inpainting media was layered to fill these areas of loss (and is a common practice in the treatment of paintings on copper supports). Inpainting was conducted under the microscope with loose pigments in Laropal A81 low molecular weight resin, with 1-methoxy-2-proponol as the diluent (fig. 25). Restraint was exercised as much as possible: many thinned or abraded areas, including the angels' faces, were left untouched. Inpainting was focused on broad distracting losses in the background, scratches in the foreground, and dark corrosion spots in the figure.

Figure 25. Aesthetic compensation performed under the microscope.

4.3 *Ethical Considerations during inpainting*

The aesthetic compensation steps of this treatment were guided by a multifaceted approach, considering both the rationale for unifying the composition and the ethical boundaries of a work with significant losses. The primary justification for inpainting is preserving the artwork's cultural and historical significance while ensuring its longevity and aesthetic unity. Ethical considerations prioritized minimal intervention, transparency, and documentation throughout the treatment process to maintain the integrity of the original work. In addressing the different types of losses, such as abrasion, hard-edge losses, corrosion, and spots, the approach was tailored to each specific issue using many mockups and testing various inpainting techniques on pieces of copper panel before commencing on the artwork (fig. 26). All of the inpainting was completed with a microscope to ensure precision and gloves properly handling the copper surface. Abrasions necessitated inpainting to reintegrate affected areas, focusing on color and texture matching. Hard-edge losses required meticulous inpainting to recreate missing details and respect the surrounding context. Corrosion and spots, which were prominent throughout the

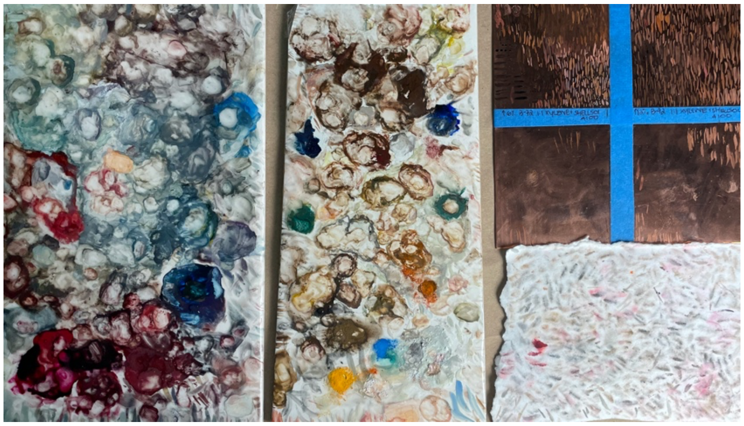

Figure 26. Inpainting mockups and mark making practice alongside

work and distracted from the composition, only required pinpoint toning to push them back. For challenging scratches and spots, a conservative approach was adopted, addressing only what was essential to the artwork's overall visual integrity and authenticity while leaving select minor scratches without intervention to retain the age and natural wear of the copper painting.

4.4 Preventive Conservation Measures and Display Recommendations

A fitted backing board constructed of blue board had been attached to painting when it arrived. The board will be kept as it protects the work from any impacts to the back that may occur during handling and transport. It will also minimize air flow, prevent dust accumulation on the verso, and provide additional support to the work. Works on copper are robust and are not affected to environmental changes as drastically as works on canvas. However, it is recommended that a work on copper still be kept in a sealed environment, it recommended that the Thoma Foundation consider adding a glazing the work as a preventive measure. After leaving the department, the painting will be returned to the Thoma Foundation’s Santa Fe location in the same custom-made blue board box in which it came. In preparation for travel, the painting has been wrapped in polyethylene sheeting sealed with tape, which will reduce exposure to abrasion, moisture, and limit environmental fluctuations.

5. Conclusions

In conclusion, the study of paintings executed on copper, exemplified by the 17th-century Colonial Andean artwork *Christ Child Bearing the Instruments of the Passion*, presents a compelling exploration of preservation challenges due to their unique materials and techniques. The examination of this painting from the Carl & Marilynn Thoma Art Foundation revealed significant condition issues, such as extensive overpaint and substantial losses, which prompted the need for comprehensive investigation and conservation efforts.

The research involved a multidisciplinary approach, incorporating various imaging techniques, including multimodal imaging, reflectance transformation imaging, and multispectral imaging. Additionally, analytical methods like Raman spectroscopy, reflected FTIR, and scanning XRF were employed to gain a deeper understanding of the painting's materials and historical context.

The findings indicated that the palette used in the artwork was consistent with the materials commonly employed in the Colonial Andean region during the 17th century. Notably, earth colors, vermillion, lamp black, lead white, and azurite were among the identified pigments. This knowledge contributes to our understanding of the painting's artistic and historical significance.

Furthermore, the study included aesthetic conservation treatments aimed at improving the painting's visual clarity and restoring unity to the composition. These efforts not only enhance the artwork's presentation but also contribute to its long-term preservation.

In conclusion, this research highlights preservation challenges specific to copper-based paintings, echoing observations made by experts like Horowitz regarding preparation and condition issues. It emphasizes the significance of interdisciplinary approaches and advanced analytical techniques in preserving and comprehending Peruvian Viceroyal art. While enriching our understanding of this particular piece, it also underscores the need for further exploration within this focused area of study, acknowledging its limitations and inviting continued research.

6. Acknowledgements

The author would like to extend deep gratitude Fiona Beckett, Jiuan Jiuan Chen, Dr. Aaron Shugar, and Dr. Rebecca Ploeger. All have been generous with their time and provided thoughtful guidance during this project. Thank you to the Carl & Marilynn Thoma Foundation for entrusting the Garman Art Conservation department with this painting. It was a pleasure to work on the *Christ Child*, and to contribute to advancement and research of paintings from the Spanish Americas.

7. References

7.1 Bibliography

Alcalá, Luisa Elena, and Jonathan Brown, eds. 2014. Painting in Latin America, 1550-1820: From Conquest to Independence. New Haven: Yale University Press.

Damian, Carol. 1995 [b]. “Artist and Patron in Colonial Cuzco: Workshops, Contracts, and a Petition.” Colonial Latin American Historical Review 4, 1 (25-52). Accessed September 24, 2021. https://digitalrepository.unm.edu/clahr/vol4/iss1/2

Horovitz, Isabel. “Copper Canvases: The Preparation, Degradation, and Conservation of a Complex Medium in Early South American Painting” 2009. New York: Oxford University Press. 63–92.

Kushel, Dan. 2017. “Photographic Techniques for Conservation.” In *The AIC Guide to Digital Photography and Conservation Documentation, Third Edition*, edited by Jeffrey Warda. Washington, D.C.: American Institute for Conservation of Historic and Artistic Works. 109-172.

Lazarte, José L., Silvia A. Centeno, and Federico Carò. "Bold Gestures in a Devotional New Spanish Painting on Copper by Juan Francisco de Aguilera." Materia-Journal of Technical Art History, Vol. 1, Issue 1., 2020, 1-16.

Pierce, Donna, Ronald Y. Otsuka, and Frederick and Jan Mayer Center for Pre-Columbian and Spanish Colonial Art, eds. 2012. *At the Crossroads: The Arts of Spanish America & Early Global Trade, 1492-1850: Papers from the 2010 Mayer Center Symposium at the Denver Art Museum*. Denver: Denver Art Museum.

Phoenix Art Museum, Nelson-Atkins Museum of Art, and Mauritshuis (Hague, Netherlands), eds. 1999. *Copper as Canvas: Two Centuries of Masterpiece Paintings on Copper, 1575-1775*. New York: Oxford University Press.

Sanchez Fernandez, Antonio J. "Pintura sobre Cobre: Estudio Técnico-Material, Indicadores de Alteración y Conservación.," 2014 Cuadernos De Los Amigos De Los Museos De Osuna, No 16. 139-145.

Seldes, Alicia, José E. Burucúa, Gabriela Siracusano, Marta S. Maier, Gonzalo E. Abad, Andrea Jáuregui and Gabriela Siracusano. 1999. “Blue Pigments in South American Painting, 1610–1780,” *Journal of the American Institute for Conservation*, 38 (2), 100-123, DOI: https://doi.org/10.2307/3180041

Seldes, Alicia, José E. Burucúa, Gabriela Siracusano, Marta S. Maier & Gonzalo E. Abad.

2002. “Green, Yellow, and Red Pigments in South American Painting, 1610–1780,” *Journal of the American Institute for Conservation*, 41(3), 225-242, DOI: 10.1179/019713602806082548

Siracusano, Gabriela, and Ian Barnett. 2011. *Pigments and Power in the Andes: From the Material to the Symbolic in Andean Cultural Practices, 1500-1800*. London: Archetype Publications Ltd.

Stanfield-Mazzi, Maya. 2013. *Object and Apparition: Envisioning the Christian Divine in the Colonial Andes.* Tucson: University of Arizona Press.

Thoma Foundation. What We Do. Accessed October 6, 2021. https://thomafoundation.org/about/what-we-do/

8. Autobiographical Statement

Daniela González-Pruitt is a conservation student in the Garman Art Conservation Department at SUNY Buffalo State, specializing in paintings conservation, and will earn her M.A. and M.S. in Art Conservation in 2024. She previously graduated from the University of Toronto with a degree in Art History and performed pre-program work at The Academy Museum of Motion Pictures and the Art Gallery of Ontario. In the summer of 2022, she interned at the Dallas Museum of Art. She will spend her third year at the Walters Art Museum and will be completing a 2023 summer internship at the Museo Nacional del Prado in Madrid, Spain.

9. Appendix

9.1 Appendix A: Photography Specifications

PRE-TREATMENT PHOTOGRAPHS

No.	DESCRIPTION	TECHNICAL NOTES	COMMENTS
A1N	**Front, framed, normal illumination, before treatment**	Lighting approximates standard viewing conditions. A UV-Vis-IR modified camera was used with an X-Nite CC1 filter.	The frame is in good condition, the outside perimeter edges and corners appear to be discolored and could possibly benefit from surface cleaning
A2N	**Back, framed, normal illumination, before treatment**	Same as A1N	Mending plates have been added to hold in the original backing board that appears to be in good condition
A3N	**Front, normal illumination, before treatment**	Same as A1N	The work appears dark when captured under standard conditions for normal illumination. Adjusting the exposure allows for further details in the composition to be revealed. There are losses on the perimeter edges showing through the copper support. There are light scratches in the foreground.
A4N	**Back (wood backing board), normal illumination, before treatment**	Same as A1N	The wooden backing board is in good condition, there are frass droppings concentrated around the perimeter edge and a line o of dark discoloration on the bottom

			edge of the board. Various media have been used to either stamp or handwrite notations about the work.
A5N	**Back (copper plate), normal illumination, before treatment**	Same as A1N	Note the drips marks running from the top horizontal edge of a possible applied varnish or surface coating. There is corrosion to the copper plate around the bottom edges.
A6RK	**Front, raking illumination (Top), before treatment**	The light was positioned at the left at a low angle to the surface of the subject in order to emphasize the surface topography. A UV-Vis-IR modified camera was used with an X-Nite CC1 filter.	Note that the copper plate is not completely planar, the left corner is distorted and has a slight upward bend. The accumulation of thinly applied oil paint layers has created surface topography with each application on the surface. There is small raised accretion in the center of the bottom edge.
A7SP	**Front, axial specular illumination, before treatment**	The light was positioned adjacent to the camera to create specular reflections on the surface. These reflections provide information about surface characteristics (e.g., matte versus glossy) as well as information about surface topography (dents, bulges, cracks, etc.). A UV-Vis-IR modified camera was used with an X-Nite CC1 filter.	The painting has been varnished or has an applied surface coating that has a very reflective surface sheen as can be seen by the two light reflections captured in the image.
A8IR	**Front, reflected near infrared photograph, before treatment**	The subject was illuminated with incandescent lamps. A special camera, sensitive to the invisible near infrared radiation emitted by the bulb was used to record how the radiation penetrated the subject, or was absorbed or reflected by the materials in the subject. Infrared radiation may penetrate overlying layers to reveal underlying information or may help to characterize materials or to distinguish different materials that are similar in appearance. A UV-Vis-IR modified camera was used with a X-Nite 850 filter.	The paint application is not unform creating surface that is distracting to the composition. There are dark spots scatted throughout the figure and the foreground that appear to either by corrosion behind the paint layers or voids in the copper plate
A9RIR	**Front, reflected near infrared photograph, before treatment**	Same as A8IRwith the exception that a X-Nite 1000 filter.	The dark spots mentioned above appear darker and more pronounced. Underdrawings can be observed in the garments worn by the Christ Child.
A10RIR	**Back (copper plate), reflected near infrared photograph, before treatment**	Same as A8IR	A possible coating has been applied to the reverse of the plate.
A11RUVA	**Front, reflected longwave ultraviolet, before treatment**	The subject was placed in front of a longwave ultraviolet lamp (blacklight). A camera with sensitivity to the invisible ultraviolet radiation was used to record how the ultraviolet was absorbed (area appears dark) or reflected (area appears light) by materials in the subject. This image can aid in differentiation or characterization of materials. Because the ultraviolet penetrates little beyond the surface, the visibility of anomalies in the surface can also be enhanced. A UV-Vis-IR modified camera was used with X-Nite CC1 and B+W 403 filters.	Due to the applied surface coating/varnish, the captured image appears dark and does not reveal any further information.
A12UVA	**Front, longwave ultraviolet (UVA) induced visible fluorescence, before treatment**	The subject was photographed in a darkened room while irradiated by a longwave ultraviolet lamp (blacklight). The ultraviolet radiation causes some materials in the subject to fluoresce (emit light). A UV-Vis-IR modified camera was used with X-Nite CC1, PECA 918, and Kodak Wratten 2E filters.	A surface coating/varnish can be observed, it was applied by brush in several scattered passes.
A13IRLUM	**Front, infrared luminescence, before treatment**	The subject was illuminated with an infrared-free visible light source. The visible light energy is absorbed by some materials in the subject and released as invisible near infrared luminescence. The luminescence is photographed using a special camera filtered to record only infrared radiation. A UV-Vis-IR modified camera was used with a X-Nite 715 filter.	Small sections in the crown of thorns luminesce along with the cross.
A14UVA	**Front, longwave ultraviolet (UVA) induced visible fluorescence, before treatment**	Same as A12UVA	The reverse of the support shows coating drips that emit an icy green color when exposed to UVA induced fluorescence.

TREATMENT PHOTOGRAPHS

No.	DESCRIPTION	TECHNICAL NOTES	COMMENTS
B1N	**Front, normal illumination, during treatment**	Lighting approximates standard viewing conditions. A UV-Vis-IR modified camera was used with an X-Nite CC1 filter.	The over paint and varnish have been removed from the figure, there is a difference in sheen between the figure and background.

B2UVA	**Front, longwave ultraviolet (UVA) induced visible fluorescence, during treatment**	The subject was photographed in a darkened room while irradiated by a longwave ultraviolet lamp (blacklight). The ultraviolet radiation causes some materials in the subject to fluoresce (emit light). A UV-Vis-IR modified camera was used with X-Nite CC1, PECA 918, and Kodak Wratten 2E filters.	The overpaint and varnish on the figure have been removed showing the distinction in fluorescence in the background where it is still present.
B3N	**Front, normal illumination, during treatment**	Same as B1N	One section of the overpaint and varnish has been removed revealing losses to the original composition
B4N	**Front, normal illumination, during treatment**	Same as B1N	At this stage the varnish and overpaint has been reduced on the right half of the work.
B5N	**Front, normal illumination, during treatment**	Same as B1N	The overall varnish and overpaint has be reduced.
B6UVA	**Front, longwave ultraviolet (UVA) induced visible fluorescence, during treatment**	Same as B2UVA	The robe and certain flowers emit icy bright colors
B7RUVA	**Front, reflected longwave ultraviolet, during treatment**	The subject was placed in front of a longwave ultraviolet lamp (blacklight). A camera with sensitivity to the invisible ultraviolet radiation was used to record how the ultraviolet was absorbed (area appears dark) or reflected (area appears light) by materials in the subject. This image can aid in differentiation or characterization of materials. Because the ultraviolet penetrates little beyond the surface, the visibility of anomalies in the surface can also be enhanced. A UV-Vis-IR modified camera was used with X-Nite CC1 and B+W 403 filters.	Now that the restoration overpaint and varnish have been reduced, the composition can be observed.
B8RIR	**Front, reflected near infrared photograph, during treatment**	The subject was illuminated with incandescent lamps. A special camera, sensitive to the invisible near infrared radiation emitted by the bulb was used to record how the radiation penetrated the subject, or was absorbed or reflected by the materials in the subject. Infrared radiation may penetrate overlying layers to reveal underlying information or may help to characterize materials or to distinguish different materials that are similar in appearance. A UV-Vis-IR modified camera was used with a X-Nite 850 filter.	The extent of loss to the plate can be seen, including corrosion spots that appear dark
B9XR	**X-radiograph, during treatment**	The subject was penetrated by a beam of x-rays and the extent of x-ray penetration was recorded on film (or a digital imaging plate). Areas of the subject that are denser, thicker, and/or composed of materials that contain elements of higher atomic weight absorb more x-rays, diminishing penetration. They thus appear lighter in tone in the radiograph kV: 300 mAS: 450 FFD: 48" Tube filtration: 1mm brass, 8.5 mm Cu, 5mm Al Screens: n/a Imaging plate: Kodak Industrex Flex HR Digital Imaging Plate 2174. 10" x 17" no coating	The are visible distinction in the materials utilized based on their atomic properties. The overall background appears lighter than the pigments used to render flesh tones.
B10N	**Front, normal illumination, during treatment**	Same as B1N	The painting appears bright and saturated, after the application of the isolating varnish.

B11DET	**Front, normal illumination, during treatment**	Same as B1N	Detail image of losses surrounding the bottom of the holy spear, the background and the true cross.
C1N	**Front, normal illumination, during treatment**	Same as B1N	First stages of aesthetic compensation, inpainting of the hard loss surrounding the tip of the holy spear is halfway completed. The right section of the background has been lightly inpainted.
C2N	**Front, normal illumination, during treatment**	Same as B1N	The top section of the background has been lightly inpainted along with areas on the bottom left section in order to slowly bring together the broad losses in the background.
C3N	**Front, normal illumination, during treatment**	Same as B1N	The first light-handed pass of inpainting has been completed on the background. The broad losses are no longer present.
C4N	**Front, normal illumination, during treatment**	Same as B1N	The previous losses surrounding the holy spear have been inpainted. The instrument in the composition is now whole. Preliminary inpainting of Christ's garments such as the purple robe has reduced dark spots within the garments.
C5N	**Front, normal illumination, during treatment**	Same as B1N	The inpainting on the figure of Christ is just about complete, the foreground and ladder remain to be inpainted.
D1N	**Front, framed, normal illumination, after treatment**	Same as B1N	The frame appears brighter and the work fits securely within the accompanied frame.
D2N	**Back, framed, normal illumination, after treatment**	Same as B1N	The clips have been modified with volara in order to ensure that no abrasion is caused to the wooden backing board.
D3N	**Front, normal illumination, after treatment**	Same as B1N	The result of the successful treatment shows the newly revealed instruments of the passion that had previously been concealed by restoration overpaint. The background has been unified with a light-handed approach that allows for distinction between the original black painted background that remains intact and the inpainting.

D4N	**Back, normal illumination, after treatment**	Same as B1N	The reverse of the copper plate appears luminous and saturated. Local areas of corrosion have been reduced while overpaint and varnish residues have been removed. The application of a protective varnish brings out the natural qualities of the copper while also protecting it from the environment and handling.
D5RK	**Front, raking illumination, after treatment**	The light was positioned at the left at a low angle to the surface of the subject in order to emphasize the surface topography. A UV-Vis-IR modified camera was used with an X-Nite CC1 filter.	The previous distracting brush texture that had been left from the restoration overpaint is no longer present. The imperfect nature of the copper surface and paint application by the artist can be observed. Aesthetic compensation completed on the work did not impart any additional surface level to the work.
D6SP	**Front, axial specular illumination, after treatment**	The light was positioned adjacent to the camera to create specular reflections on the surface. These reflections provide information about surface characteristics (e.g., matte versus glossy) as well as information about surface topography (dents, bulges, cracks, etc.). A UV-Vis-IR modified camera was used with an X-Nite CC1 filter.	The work has a uniform surface sheen that no longer contain distracting irregularities from previous conservation campaigns.
D7IR	**Front, reflected near infrared photograph, after treatment**	The subject was illuminated with incandescent lamps. A special camera, sensitive to the invisible near infrared radiation emitted by the bulb was used to record how the radiation penetrated the subject, or was absorbed or reflected by the materials in the subject. Infrared radiation may penetrate overlying layers to reveal underlying information or may help to characterize materials or to distinguish different materials that are similar in appearance. A UV-Vis-IR modified camera was used with a X-Nite 850 filter.	This particular imaging technique clearly shows the inpainting that was completed in the dark background to unify the losses that were present.
D8UVA	**Front, longwave ultraviolet (UVA) induced visible fluorescence, after treatment**	The subject was photographed in a darkened room while irradiated by a longwave ultraviolet lamp (blacklight). The ultraviolet radiation causes some materials in the subject to fluoresce (emit light). A UV-Vis-IR modified camera was used with X-Nite CC1, PECA 918, and Kodak Wratten 2E filters.	Inpainting in the background emits an icy blue color when exposed in longwave UVA induced fluorescence.
D9UVA	**Back, longwave ultraviolet (UVA) induced visible fluorescence, after treatment**	The subject was photographed in a darkened room while irradiated by a longwave ultraviolet lamp (blacklight). The ultraviolet radiation causes some materials in the subject to fluoresce (emit light). A UV-Vis-IR modified camera was used with X-Nite CC1, PECA 918, and Kodak Wratten 2E filters.	The back of the copper plate does not display fluorescence when exposed because the restoration overpaint and varnish residues have been removed. The small red spot in the image is an anomaly and does not represent any result on the surface.
D10UVA	**Front, framed, longwave ultraviolet (UVA) induced visible fluorescence, after treatment**	The subject was photographed in a darkened room while irradiated by a longwave ultraviolet lamp (blacklight). The ultraviolet radiation causes some materials in the subject to fluoresce (emit light). A UV-Vis-IR modified camera was used with X-Nite CC1, PECA 918, and Kodak Wratten 2E filters.	Local areas in the frame were treated by toning and filling losses. These areas can be distinguished by the icy blue that they emit seen in the top left and bottom right corners of the frame.
D11DET	**Front, normal illumination, after treatment**	Same as B1N	Detail image of inpaintg completed on the previous losses surrounding the bottom of the holy spear, the background and the true cross. The scratch on the true cross was not treated because it is natural wear and displays the age and history of the work.

9.2 Appendix B: Paintings Treatment Report

PATRICIA H. and RICHARD E. GARMAN
ART CONSERVATION DEPARTMENT
BUFFALO STATE • The State University of New York

1300 Elmwood Avenue
Rockwell Hall 230
Buffalo, NY 14222-1095
P: 716-878-5025 F: 716-878-5039
artconservation.buffalostate.edu
artcon@buffalostate.edu

OWNER/AGENT	The Carl & *Marilynn Thoma Foundation*
PROPOSED BY	Daniela González-Pruitt
FACULTY SUPERVISOR(S)	Fiona Beckett
DATE OF REPORT	10.11.2022
RTIST/MAKER (Owner's Attribution)	Anonymous.
TITLE	*Christ Child Bearing the Instruments of the Passior*
DATE	17th century (approx.)

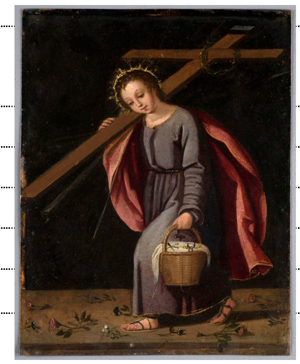

Figure 1. *Christ Child Bearing The Instruments of The Passion*, Front, DT

I. OBSERVATION DURING TREATMENT

While reducing the overpaint from previous restoration campaigns, it was discovered that the painting had substantial loss in the background that had been concealed by restoration campaigns. This previous overpaint had also obscured some of the composition. As a result, for this treatment, a slightly more light-handed approach to inpainting was adopted and allowed some of the additional elements to be more discernible. Nevertheless, the inpainting is more substantial than originally anticipated due to the amount of damage.

II. TREATMENT PERFORMED

1. Performed written and photographic documentation before, during and after treatment.
2. The face and reverse of the work were surface cleaned using mineral spirits[3] with rolled swabs to remove accumulated dirt and dust. Since aqueous cleaning methods cannot be used with copper supports, mineral spirits was utilized to remove oily residues and accretions from the work.
3. Performed solvent solubility testing for varnish removal and repeated as needed in several discrete areas of the painting.Both the natural resin varnish and the overpaint were soluble in isopropanol[4] without affecting the original paint

[3] Shell Solvents (71, 340HT, 320, A100, TS28, TS28B, TS28R) Guard-All Chemical Co., P.O. Box 445, Norwalk, CT 06856; (203) 838-5515 OR: Conservation Support Systems, P.O. Box 91746, Santa Barbara, CA 93190. (805) 682-9843. [obtain product literature from manufacturer: Shell, 3200 Southwest Fwy., Suite. 1230, Houston, TX 77027; (800) 457-2866].
[4] Isopropanol, molecular biology grade, Fisher BioReagents; Fisher Scientific Company LLC, 300 Industry Drive, Pittsburgh PA 15275; (800) 766-7000

layers.

4. The varnish and over paint were carefully removed using isopropanol on custom-rolled cotton swabs.
5. Mock ups of varnish tests were performed on copper test panels to select a varnish that wouldn't impart a significant amount of gloss on the painting's already luminous surface.
6. A barrier layer of 20% Laropal A-81[5] (with 2% Tinuvin 292[6]) in xylene[7] was brush applied to reverse of the copper plate (as a protective coating), resulting in a well-saturated surface.
7. An isolating15% Laropal A-81 in xylene was brush applied to the front of the painting.
8. The appearance of the varnish resulted in some irregular undulations, possibly due to the lower percentage of resin in the varnish solution and the slow evaporation of the solvent. Due to the smooth surface of the copper support, the undulations were distracting. As a result, the varnish was removed with xylene.
9. Further mock ups of varnish tests were performed with other resins such as a B-72, a compatible material that has been used for making low relief fills in areas of loss on copper paintings.
10. An isolating varnish of 10% Paraloid B-72[8] 1:1 Shellsol A100[9], xylene was spray applied to the work resulting in a successful isolating coating for receiving inpainting media.
11. Inpainting was performed with stable dry pigments in Laropal A81, and using 1-methoxy-2-propanol[10] as the diluent.
12. A light-handed approach to inpainting was taken to unite areas of loss while also preserving the remaining original artist-applied paint layers in the background. The inpainting was delicately applied to avoid causing any buildup of medium on the smooth copper surface. Numerous mock-ups were done to experiment with the right approach. Additionally the painting was checked and cleared for any dust frequently, as even the smallest dust particle could get stuck in the inpainting and cause a discrepancy in the surface texture of the painting. The result was successful in unifying the previously obscured elements of the passion in the composition.

Four additional thin spray applications of 10% B-72 1:1 Shellsol A100, xylene were applied to the surface of the painting to saturate the inpainting media. The varnish was applied thinly and evenly to avoid excess varnish build

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[5] Laropal A81 (condensation product of urea and aliphatic aldehydes) manufactured by Badische Aniline und Soda Fabrik [BASF], supplied by Conservation Resources International, LLC, 5532 Port Royal Road, Springfield, Virginia 22151; 800-634-6932 [703-321-7730]

[6] Tinuvin292 (hindered amine light stabilizer: HALS) Ciba-Geigy Corporation, Additives Division, Seven Skyline Drive, Hawthorne, NY 10532. available from Talas 330 Morgan Ave Brooklyn, NY 11211; 212-219-0770

[7] Fisher Chemical Xylenes (mixture of ortho, meta, and para isomers; may contain ethylbenzene); Fisher Scientific Company LLC, 300 Industry Drive, Pittsburgh PA 15275; (800) 766-7000

[8] Paraloid B-72 (a copolymer of ethylmethacrylate and methyl acrylate) Rohm & Haas, Philadelphia, PA.

[9] Shell Solvents (71, 340HT, 320, A100, TS28, TS28B, TS28R) Guard-All Chemical Co., P.O. Box 445, Norwalk, CT 06856; (203) 838-5515 OR: Conservation Support Systems, P.O. Box 91746, Santa Barbara, CA 93190. (805) 682-9843. [obtain product literature from manufacturer: Shell, 3200 Southwest Fwy., Suite. 1230, Houston, TX 77027; (800) 457-2866].

[10] 1-methoxy-2-proponal (99+%); Thermo Scientific Chemicals; Fisher Scientific Company LLC, 300 Industry Drive, Pittsburgh PA 15275; (800) 766-7000

13. up and to not disturb any of the delicately applied inpainting.
14. Some additional inpainting was done between the light sprays of varnish. Due to the complex system of media and varnish coatings that were layered, special attention was taken to ensure that inpainting was not solubilized during the aesthetic compensation stages.
15. A final varnish layer of 10% Regalrez 1094[11] in ShellSol D38[12] with 2% tinuvin 292 (measure to the weight of the resin) was brush applied to the surface, resulting in an evenly saturated appearance. Regalrez 1094 was chosen because the resin is soluble in mineral spirits and would not disturb the applied inpainting layers below.

FRAME

16. Volara[13] foam pads were applied with double sided tape to the face of the clips in contact with the backing board. The foam pads ensure that there is no abrasion to the backing board from the metal clips.
17. Areas of paint loss along the perimeter edges were toned using QoR watercolors[14].
18. All four corner joins of the frame were stabilized using high-tack fish glue[15] and clamped until dry.
19. Gaps along the corner joins were filled using a 2:1:1 mixture of beeswax[16], microcrystalline wax[17], and resin[18] was fed into the corners joins using a small brush.
20. The loss on the interior molding of the frame located in the top left was filled using Modostuc[19] and toned using QoR watercolors colors.

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[11] Regalrez 1094 (a fully hydrogenated, low molecular weight hydrocarbon resin) Hercules Inc. Wilmington, DE 19894. available from Talas 330 Morgan Ave Brooklyn, NY 11211; 212-219-0770

[12] Shell Solvents (71, 340HT, 320, A100, TS28, TS28B, TS28R) Guard-All Chemical Co., P.O. Box 445, Norwalk, CT 06856; (203) 838-5515 OR**:** Conservation Support Systems, P.O. Box 91746, Santa Barbara, CA 93190. (805) 682-9843. [obtain product literature from manufacturer: Shell, 3200 Southwest Fwy., Suite. 1230, Houston, TX 77027; (800) 457-2866].

[13] Volara (fine celled, irradiation crosslinked, polyolefin foam) manufactured by Voltek, 100 Shepard Street, Lawrence, MA 01843 [contact the manufacturer/importer for a distributor in your area.]

[14] QoR Watercolors (stable pigments in Aquazol binder); Golden Artist Colors, Inc.188 Bell Road New Berlin, NY 13411-9527 USA 607-847-6154

[15] Fish Glue High Tack (extracts from cod fish skins, about 45% solids) Distributed by Lee Valley Tools, Ltd., 1080 Morrison Drive, Ottawa, Ontario, K2H 8K7 Canada.

[16] Beeswax, natural; Conservation Support Systems, P.O. Box 91746, Santa Barbara CA 93190; (805) 682-9843.

[17] Multiwax w445 (microcrystalline wax), Witco Corporation; ConservationSuppoer Systems, P.O. Box 21746, Santa Barbara CA93190; (805) 682-9843.

[18] Zonarez, #7085 (polyterpene resin); ArizonaChemical, 4600 TouchtonRoad East, Suite 1200, Jacksonville FL 32246. No longer manufactured.

[19] Modostuc, a calcium carbonate spackle with barium sulfate and a PVA binder; Plasveroi SpA, Via Camussone 38, Franzione Giovernenzano, Vellezzo Bellini, PV, Italy