

**The Reconstruction of Francesco Bassano's *The Adoration of the Shepherds*:
*Late sixteenth-century Italian painting materials and techniques***

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INTRODUCTION

Historical reconstructions of artwork are exceptionally instructive in deepening one's understanding of materials and techniques from a particular period or artist. When Francesco Bassano's *The Adoration of the Shepherds* (Fig. 1) came to the Conservation Center for treatment, I could never have anticipated the deep relationship I would build with it over the course of two years of study; I suspect I may never know a painting so well as I have come to know this one. Conservators often gain an intimate understanding of an artist's techniques through treatment and close observation. However, crafting a reconstruction of that artwork builds another level of appreciation for the artist's great skill and effort. I often found myself wondering how quickly I would have been kicked out of the Bassano workshop for my many transgressions.



Figure 1. Attr. Francesco Bassano the Younger, *The Adoration of the Shepherds*, c. 1580, oil on canvas, H. 37 ¼ x W. 52 ¼", Arkansas Arts Center (gift of the Samuel H. Kress Foundation), K-105. (After Treatment, E. Kimmel)

For this project I started treatment and conducted a full technical study of the painting before beginning the reconstruction. This study included x-radiography, Raman spectroscopy, surface-enhanced Raman spectroscopy (SERS), Fourier-transform infrared spectroscopy (FTIR), scanning electron microscopy and energy dispersive x-ray spectroscopy (SEM-EDS), and tetramethylammonium hydroxide (TMAH) pyrolysis-gas chromatography-mass spectrometry

(Py-GC/MS). The information from this analysis – largely the identification of the pigments and binders used throughout – helped dictate the course of the reconstruction and materials selected.

While analysis served as a starting point, it provided no context for the handling of those materials, nor the preparation of the painting's support. To fill in these gaps, I relied heavily on the (often vague) instructions of painting treatises from the period. My own training as an oil painter prior to graduate school was useful for having a basic sense of how the paints should be handled. However, modern materials are, not surprisingly, quite different from those used during the sixteenth century. Where I could not find answers in the historic literature, I relied on my instincts. On occasion I consulted research by other conservators to inform my reconstruction, but largely avoided doing so to follow the treatises as closely as possible.

CONTEXT AND REFERENCES

Any research into early Italian painting techniques and materials typically begins with Cennino Cennini's instructional manual for artists *Il libro dell'arte*. Although his manual is thought to have been written in the late fourteenth century, almost 200 years before Francesco Bassano would paint *The Adoration of the Shepherds*, several of his suggestions remained pertinent to my reconstruction. Giorgio Vasari's *The Lives of the Artists* is more contemporary to the Bassano with two editions published in 1550 and 1568, and provides some commentary on the techniques and materials used during that period. Oil painting became increasingly widespread in Italy between the late fifteenth and early sixteenth centuries. Commenting on the innovative oil painting medium, Vasari famously says:

“This manner of painting kindles the pigments and nothing else is needed save diligence and devotion, because the oil in itself softens and sweetens the colours and renders them more delicate and more easily blended than do the other mediums. While the work is wet the colours readily mix and unite one with the other; in short, by this method the artists impart wonderful grace and vivacity and vigour to their figures, so much so that these often seem to us in relief and ready to issue forth from the panel, especially when they are carried out in good drawing with invention and a beautiful style.”¹

Oil painting allowed for an entirely different aesthetic, and opened the door for more individualistic painting styles. By the time Francesco Bassano was painting, approaches to oil painting would have been widespread and well understood by artists.

The main sources of information for my reconstruction came from Mary Merrifield's two volumes *Original Treatises*. Merrifield translated several historical artist manuscripts; the first most pertinent to me was the Marciana manuscript. The Marciana manuscript was written in a Tuscan dialect during the sixteenth century, and now resides in the Library of S. Marco in Venice, Italy. It includes many recipes, particularly on pigments and varnishes, useful to artists. The second treatise, referenced most frequently throughout this report, is the Volpato manuscript. It was written by Giovanni Batista Volpato, a painter born in Bassano, Italy in 1633. While written in the 17th century, Volpato's advice seems to derive from the practices of the Bassano family workshop. This manuscript, therefore, may provide the greatest insight into the materials and techniques used in *The Adoration of the Shepherds*. It is an enjoyable read, written in the

¹ Giorgio Vasari, *Vasari on Technique*, Trans. Louisa Macle hose, Ed. G. Baldwin Brown, (New York: Dover Publications, Inc., 1960): 230.

format of a conversation between an elder and younger apprentice who drink wine while discussing the finer details of oil painting materials and techniques.

While these sources, and others, provided much of the necessary information to construct the painting, there were many important details that were omitted. Specific recipes were scarce, as artistic knowledge was largely handed down orally through apprenticeships. Much of what was omitted may have been obvious to artists from the time, and without question many of my mistakes were the result of inexperience and misunderstanding of these centuries-old manuscripts. I hope, still, that this reconstruction is a close approximation of how Bassano's painting may have looked originally.

THE MODEL

Francesco Bassano's *The Adoration of the Shepherds* was acquired by the Kress Foundation from dealer Count Alessandro Contini-Bonacossi in 1930 (Rome, Italy). It was then exhibited for a year on the Kress Foundation "Art Train" travelling exhibition entitled *Italian Paintings Lent by Mr. Samuel H. Kress*. Its journey began in Atlanta, GA in October 1932 and ended in Salt Lake City, UT in September 1933. In April 1934 it was then presented to the Arkansas Arts Center (formerly the "Fine Arts Club of Arkansas") by Samuel Kress. Two years later in 1936, the Kress Foundation consulted with many prominent art historians on the attribution of the painting, who all unanimously agreed belonged to Francesco Bassano "Da Ponte," the son of artist Jacopo Bassano.² Francesco was one of four sons who worked in the Bassano family workshop started by their father, Jacopo. Many variations of this composition were created by the workshop, which are found across Italy and in various museum collections. The closest known compositions are housed at the North Carolina Museum of Art (Fig. 2) and the Museu de Arte de São Paulo (Fig. 3).



Figure 2. Francesco Bassano, *The Adoration of the Shepherds*, c. 1585-1590, oil on canvas, H. 44" x W. 66", NCMA, 52.9.144



Figure 3. Jacopo Bassano, *Adoration of the Shepherds*, c. 1580-1590, oil on canvas, H. 55 1/3" x W. 75", MASP, 26

The painting's last known treatment was in 1932 by Stephen Pichetto working for the Kress Foundation. The notes from the Kress Foundation file records that the varnish and retouching were adjusted at this time:

² Notes from the K-105 Kress Foundation file. These art historians include: Giuseppe Fiocco, Roberto Longhi, F.F. Mason Perkins, William Suida, and Adolfo Venturi.

“Restoration and Protective Coating since Acquired: Cleaned and restored with dry colors and damar medium. French varnish isolator. Damar varnish coating.”³

At an unknown date Mario Modestini of the Kress Foundation also noted: “Good condition, some restorations. – M.M.” Upon arrival at the Conservation Center in the fall of 2018, it was clear the painting had undergone other restorations prior to the Kress acquisition where its tacking edges were removed and the entire painting was lined.⁴ The painting was in good condition, though had a draw in the upper left corner and suffered aesthetically from a discolored varnish and retouching. Removal of the old varnish and retouching revealed vibrant, well-preserved paint layers with losses exclusively around the borders.

In the spring of 2019, before starting my reconstruction in earnest, I performed a technical analysis of the painting under the guidance of my advisor Dianne Modestini, Shan Kuang, and Marco Leona, a scientist at the Metropolitan Museum of Art. X-radiography revealed the density of lead white paint used throughout, as well as the extent of cusping of the canvas fibers near the edges of the composition (Fig. 4).



Figure 4. X-radiograph of *The Adoration of the Shepherds*. (E. Kimmel and S. Kuang)

Several cross-sections were taken to understand the layered structure of the painting, which were crucial for my re-creation of different colors. Raman, SERS, and SEM-EDS analysis aided in the identification of specific pigments, all typical of the sixteenth century, and dictated those I used

³ Notes from the Art Collection Data sheet in the K-105 Kress Foundation file.

⁴ Emma Kimmel, Unpublished examination and treatment report, 2018-2020.

in the reconstruction. FTIR and TMAH Py-GC/MS analysis identified the binders used; GC/MS revealed the unanticipated, but period-appropriate, addition of walnut oil with linseed oil to lead white passages specifically.⁵

THE RECONSTRUCTION

Secondary Support: Strainer

Ideally the reconstruction would be supported by a strainer composed of four strips of wood nailed at the joints with no crossbars. In the x-ray, marks from the interior edge of the original strainer bars are visible along all edges. This strainer could not have been more than 2 - 2.25" wide based on the original projected dimensions of the canvas, and how far the marks extend into the composition. I imagine this would not have been a particularly strong support for the painting, but adequate for the artist's purposes.



Figure 5. Stretcher assembled before stretching canvas.

In lieu of a strainer, we ordered a stretcher with no crossbars that I assembled with a mallet (Fig. 5).⁶ This was not the highest quality stretcher, chosen to hopefully reflect the attitudes of some sixteenth-century artists who seemed less concerned with the quality of their strainers. The Marciana manuscript makes no mention of canvas supports; Volpato merely mentions: "... you must take a good canvas, stretch it on the frame."⁷ Predicting that I may have some trial and error during stretching and sizing of the canvas, I decided not to fix the joints so that I may have some leeway adjusting canvas tension with keys at a later stage; this was a good decision.

⁵ Emma Kimmel, Unpublished technical study, 2019.

⁶ Humorously, much to the objection of the art supplier that warned a canvas of this size should have at least one crossbar for support.

⁷ Mary Merrifield, *Original Treatises, dating from the XIIIth to XVIIIth centuries, on the Arts of Painting*, Vol. 2, (London: J. Murray, 1849): 728.

Primary Support: Canvas

Like the strainer, there are little instructions on choosing a canvas. Volpato vaguely stipulates: “First, you must be told that the canvas must be good, strong, smooth, and well made... and must be so durable as to last as long as the picture, and it is the duty of him who buys the canvas to ascertain this, for if the canvas is bad it decays in short time.”⁸ This advice did not help me greatly in my search.

Choosing an appropriate canvas was a difficult task, particularly to find a canvas that matched the specifics of the original: a fine weave, bast-fiber canvas with roughly 30x30 threads per inch (Fig. 6). This is a more open weave compared to most modern canvases. I began my search for canvas on Etsy, which has numerous sellers of vintage fabrics. However I found that most options were too tightly woven, or executed on looms not wide enough to accommodate the dimensions of the Bassano (which is one piece of canvas).



Figure 6. Detail of original canvas uncovered during treatment in an old loss.

Instead I decided to search in fabric stores, as surely somewhere in New York City there was similar linen I could use. Armed with some canvas samples from our drawer of swatches, as well as photographs of the original canvas, I went on the hunt. I ended up purchasing a raw linen canvas very close to the weave of the original at Mood Fabrics in the garment district. I was immediately struck by how delicate this fabric was, and was skeptical that it would be strong enough to withstand the painting process. I bought enough fabric in order to stretch two canvases, allowing me a “test” canvas to practice with. With no explicit instructions on how to prepare the canvas in the treatises, I proceeded with the canvas as-is – no washing – before stretching it onto the stretcher.

Stretching the canvas was somewhat complicated – I originally started to stretch it by tacking the canvas at the centers of each stretcher member, a common technique for restretching paintings in conservation treatments. However Dianne warned me that with a new canvas this technique runs the risk of overly distorting the canvas fibers at the corners, potentially ripping the fabric. Instead, Dianne assisted me in tacking the canvas at the corners of the stretcher, being sure to align the weave with as little distortion as possible, and gradually stretching the fabric

⁸ Merrifield, Vol. 2, 728.

from all sides to gain adequate tension overall.⁹ At this point I kept the canvas stretched using thumbtacks, as I knew that I would need to restretch the canvas during sizing. The canvas was quite translucent because of its open weave (Fig. 7), and I wondered again if I had chosen a canvas that was too delicate, despite its similarities to the original.

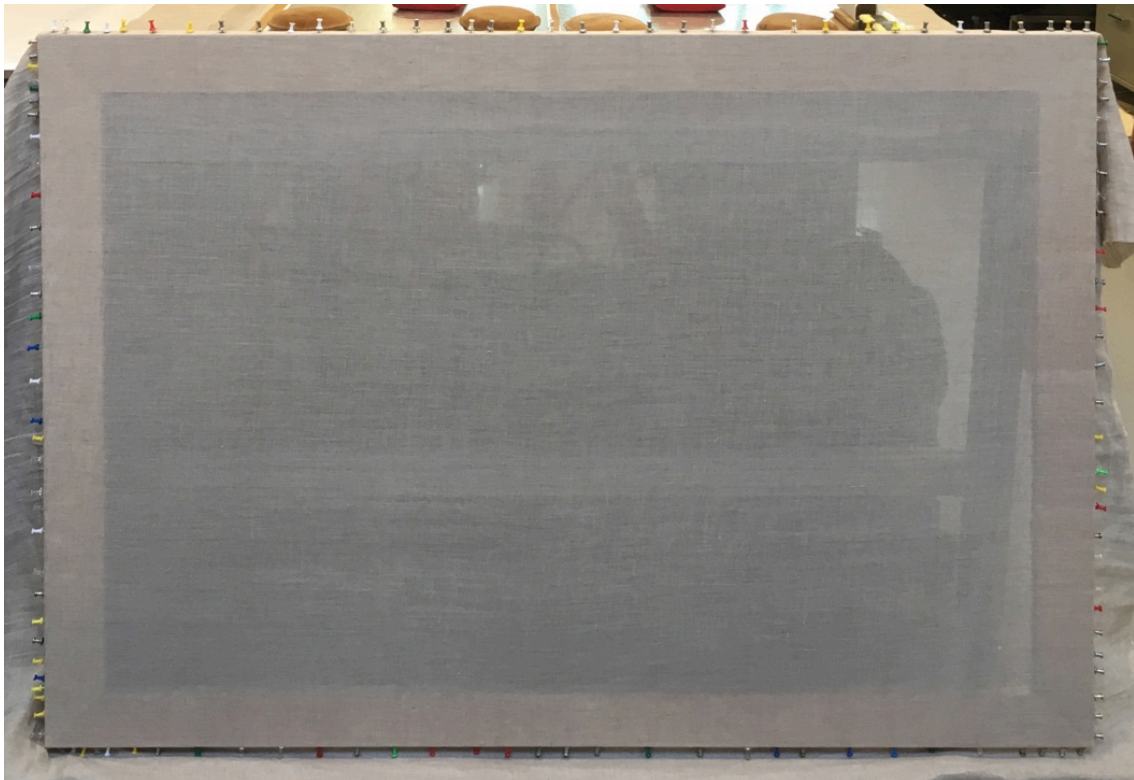


Figure 7. Canvas on stretcher with thumbtacks, before sizing.

After allowing the canvas to rest for several days on the stretcher, I then wet the canvas with slightly warm water. I did this based on previous experience preparing linen for strip linings, as I knew that the canvas would react less to the moisture in the glue if it had already been wet once in advance. To do this I brushed water into the canvas with a stiff brush, alternating vertical and horizontal passes, until the canvas was dripping wet and slack. I then left it to air dry; after just 15 minutes it already regained some tension. I would later restretch the canvas before adding the sizing.

Sizing

When it comes to sizing of the canvas, Volpato had strong opinions about the preparation and application of the glue. He advocates for rendering the glue from young pigs' skins to avoid too much shrinking of the canvas, and warns of the consequences of an unsized support:

“... you must take good canvas, stretch it on the frame, and give it a coat of glue made of the parings of very young pigs' skins, that it may be softer, for such glues as parchment glue, being stronger and harsh, cause a certain shrinking of the canvas, which has a bad

⁹ Dorothy Mahon, paintings conservator at the Metropolitan Museum of Art, has instructional videos on this technique, though in reference to preparing linen for lining.

effect, therefore do as I teach you. When this coat is dry, polish it with a pumice stone, give it another coat of glue, as before, and let it neither be too weak nor too strong; for if too weak it will not defend the canvas from the oil, and if too strong it will cause the color to crack; that which is of the proper consistence will be soft like jelly when it is cooled. [...] When the canvas has no glue to defend it from the oil, it loses its strength, for the oil dries, so that it becomes like the bark of a tree, and when the canvas is taken off the stretching frame it cracks and splits.”¹⁰

From this passage I inferred that the glue was likely applied when warmed, I should apply two coats of sizing, use a pumice stone to smooth it between applications, and be sure not to use glue that was too strong. However, what was “too strong?” At first it seemed the younger apprentice came to my rescue; he inquires:

“How shall I know whether the glue is too strong or too weak, when it is made, since it is used hot?”

The elder apprentice replies:

“I touch it with two fingers, and feel whether it is tacky, and thus I ascertain the fact; if it is too strong, I add water, and do not let it boil any longer; and if too weak, I let it boil until I consider it is of the proper consistence; but take care you do not add to the glue either terretta or gesso, or anything, because these scale off in time; but use the pure glue, in order to spread the priming, and that the canvas may retain its strength, as I have told you.”¹¹

For the elder apprentice it must have been obvious what tackiness was adequate, however this did not assist me in deciding the glue concentration I should use. In Maartje Stols-Witlox’s article on her reconstruction of various historical sizing recipes, she normally opted for glue concentrations between 3-7%, which I used as a guide.¹²

In preparation for sizing, I first did a test with the extra fabric comparing 7% gelatin size and 7% rabbit skin glue size to see which reacted better with the canvas (in the absence of pig skins in our studio). It also gave me a good idea of how much size to prepare for my reconstruction based on the amount of liquid needed to saturate the test canvas, and work out any mistakes.¹³ Ultimately I decided to use rabbit skin glue, though instead applied a 3% solution for both layers of sizing; 7% seemed too strong based on the shrinking of the test canvas.

In general the sizing was the most nerve-wracking part of the reconstruction – without a good support how would I complete the subsequent paint layers? I found in the test canvas that the fabric would stick to the stretcher bars from the glue, which I mitigated in the final reconstruction by placing mylar between the canvas and the stretcher members. Volpato does

¹⁰ Merrifield, Vol. 2, 728.

¹¹ Merrifield, Vol. 2, 732.

¹² Maartje Stols-Witlox, “Sizing layers for oil painting in western European sources (1500-1900): historical recipes and reconstructions,” In *Art technology: sources and methods; proceedings of the second symposium of the art technological source research working group*, ed. Agnès Ballestrém and Stefanos Kroustallis, (London: Archetype Publications, 2008): 161.

¹³ See Appendix III for images of my sizing tests.

make a reference in the above quote to a “stretching frame,” which I now wonder if refers to a separate frame using for sizing before stretching the canvas onto its final strainer.¹⁴

I made 500mL of 3% rabbit skin glue for the first layer of sizing, which I brushed on in alternating vertical and horizontal brushstrokes from the front. Volpato makes no mention of brushing sizing onto the back of the canvas, but I did flip the canvas around and brush the reverse with some glue for full canvas saturation (Fig. 8.3). The canvas maintained good tension during brushing, but I was dismayed to find when dry became quite slack and deformed (Fig. 8.4). I then restretched the canvas before the second sizing, rubbed the surface with a pumice stone to smooth it, and applied a second round of 3% rabbit skin glue (Fig. 8.5). After the canvas dried, the overall tension was significantly improved from the initial application, though was still slightly slack. I then misted the canvas with a Dahlia sprayer to slightly wet it, and tapped in the stretcher keys as the canvas dried. This resulted in a flat, properly tensioned canvas (Fig. 8.6).



1. Before Sizing



2. After Wetting (water only)

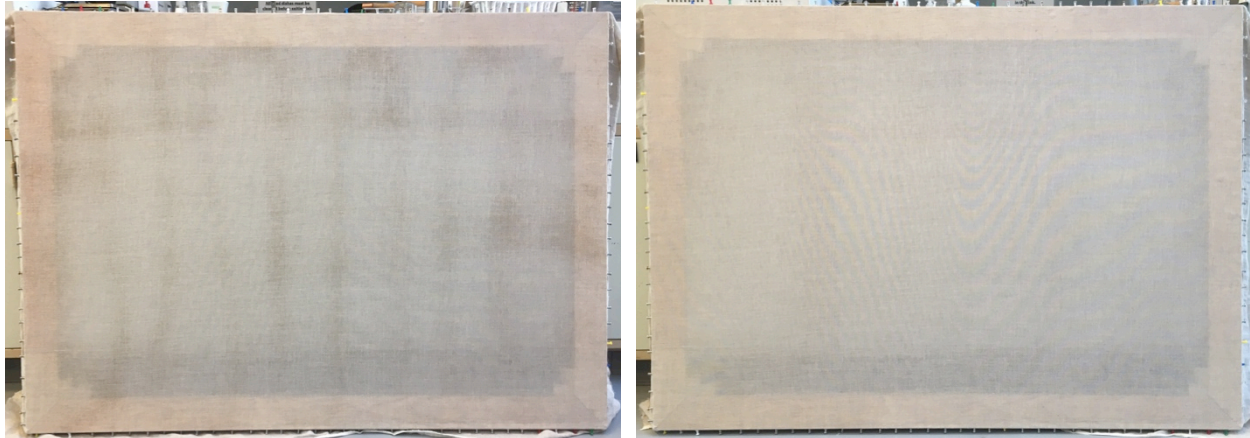


3. First Sizing



4. First Size After Drying

¹⁴ In the Dutch method, painters would lace a canvas onto a large frame for preparation before transferring the canvas to a smaller strainer for final display. There is no mention of this technique in the Italian treatises, hence why I did not lace my canvas. But I wonder how they might have done the sizing step otherwise to avoid the canvas sticking to the strainer members.



5. Second Sizing

6. After Misting and Final Tensioning

Figure 8. Stages of sizing the canvas.

In hindsight, I wonder how this process might have been more controlled. Certainly using a larger frame for canvas preparation would have been useful, and made retensioning of the canvas easier. I also wonder if the reaction of the canvas to sizing could have been mitigated by either: washing the canvas before stretching, and/or using a higher concentration size (say, 5%). In any case I was able to create a useable canvas, but had to resort to more modern materials and techniques to do so (like the mylar, stretcher keys, and Dahlia sprayer).

Binders: Linseed Oil and Walnut Oil

Before applying any paint layers, I needed to prepare the binder; for the majority of my painting this was linseed oil, and for lead white paint specifically some walnut oil was added. Walnut oil, referred to as “nut oil” in the manuscripts, did not have any specific instructions for preparation before use.¹⁵ However Volpato and the Marciana manuscript offer two different approaches for preparing linseed oil, which dries more quickly if pre-polymerized through heating and/or the addition of driers. Volpato’s method is the more complex of the two with the addition of litharge or umber while heating the oil:

“The linseed oil is put into a clean pipkin or saucepan with some litharge of gold, which is tied up in a rag, and fixed to a small piece of wood, which being laid across the pipkin or saucepan, suspends the rag so that it does not touch the bottom, because, if it should touch, it would burn, and the oil would become black, and when the oil boiled it would rise to the brim of the pipkin and flow over, but when the litharge is suspended these effects are not so easily produced. If the oil is boiled very much it will be more drying, and so whether you use much or little litharge; you may also boil with it a little umber, this will have the same effect, except that the oil will not be so light coloured. Sometimes also the oil, soiled with the colours pressed from brushes, is boiled with olio di abezzo,

¹⁵ Tad Spurgeon, “Refining Linseed Oil,” Tad Spurgeon oil paintings, November 2019, https://www.tadspurgeon.com/pdf/Refining_Linseed_Oil.pdf, 6. Tad Spurgeon notes that the fatty acid structure of walnut oil means the speed of drying is not affected greatly through boiling, nor washing with driers.

and is applied to the backs of old pictures, which are scaling off their grounds, in order to fix them.”¹⁶

The Marciana manuscript, on the other hand, is much simpler:

“Linseed oil is thus purified: - Boil it over the fire with water for 3 or 4 hours, then let it settle and separate it from the water.”¹⁷

Curious about the efficacy of the Marciana method, and without any specific technical evidence indicating litharge or umber in the binder, I decided to simply boil the linseed oil in water as indicated (Fig. 9). This technique seemed straightforward enough, though I was unsure of the ratio of water to oil required. Doing additional research into this process, I came across artist Tad Spurgeon’s website who has done extensive research on refining linseed oil. He includes a variation of the Marciana method in which he adds sand to the process, which he claims results “in a cleaner and faster drying oil.”¹⁸ I did not add sand to my recipe, but did follow his basic ratio of 1 part oil to 6 parts water.



Figure 9. Boiling linseed oil in water on a hot plate.

I first poured the water into a pot, followed by the oil that floated on top. It took an exceptionally long time to heat the pot until the water began to boil through the oil, about an hour as I increased the heat up to 350°C on the hot plate. I then lowered the heat to about 275°C to maintain a low boil for four hours in the fume hood. I could see that the air bubbles would come up from the water through the oil, which is presumably the mechanism by which the linseed oil is pre-polymerized in this process. About an hour or two into boiling I noticed a lower layer of the oil looked cloudy, which cleared up after around hour three; this was likely mucilage separating out from the linseed oil. I then left the oil to cool overnight before decanting it into a jar with a ladle. It was slightly thicker, and appeared more yellowed after this process. Comparison with the walnut oil makes it obvious why artists preferred walnut oil for white paint specifically (Fig. 10).

¹⁶ Merrifield, Vol. 2, 740.

¹⁷ Merrifield, Vol. 2, 620.

¹⁸ Spurgeon, 14. He also says in lieu of sand, salt can be added for the same effect.



Figure 10. Boiled linseed oil (left) compared to walnut oil (right).

Ground Layers

Volpato is quite opinionated about what grounds are suitable for oil paintings. He asserts that gesso should not be used as a ground for oil paintings, with the exception of some thinly prepared gesso canvases he has seen by the Bassano workshop:

“... I have observed in the works of Bassano, that those pictures which have been primed with but little gesso are in good preservation, while those on which too much gesso has been used scale off; and you may distinguish these from the others by the texture of the canvas, the threads of which are visible, although being painted they are covered with gesso, priming, and colors; while the others which have smooth surfaces, from having too much gesso, scale off. [...] In order to avoid this difficulty, I use simple glue, as I have told you, which I lay on twice, using the pumice stone after each coat when dry, that the canvas may become smooth. I afterwards give them the priming ground up with linseed oil. All earths are good for this purpose according to the taste of him who uses them.”¹⁹

This earth-based ground he mentions is consistent with *The Adoration*, which is composed of two layers of a dark ground made with carbon black, an earth pigment, and lead white. On application, Volpato suggests an initial layer of coarse ground applied with a palette knife, followed by a more finely ground second layer:

“I use “terra da bocali,” terra rosa, and a little umber finely powdered mixed with linseed oil and stirred together for a short time, but not ground, over the fire. I spread this preparation over the canvas with a knife, and when dry and pumiced, I give the canvas another coat of the same colours, but these must be previously ground, and thus the canvas will be well primed; this is the best mode and the most certain in its results.”²⁰

This description matches the preparation of *The Adoration* that has an initial layer of coarse, large pigment particles followed by a fine, secondary ground layer of carbon black and earth pigment.

¹⁹ Merrifield, Vol. 2, 730.

²⁰ Merrifield, Vol. 2, 730 & 732.

Unsure of how quickly the paint would dry, Shan Kuang suggested that I do a test comparing the ground just in linseed oil to the ground with a couple drops of cobalt drier. While the cobalt drier certainly quickened the drying process, I found that just linseed oil alone dried fully within 2-3 days. This was satisfactory, and I felt it would be more authentic to leave out the cobalt drier.²¹

Based on my technical analysis, I composed the first ground layer of lead white, carbon black, and umber dry pigment in linseed oil (Fig. 11). I mixed and applied this layer with a palette knife, which took a while but created a more level surface. Initially I underestimated the ratio of pigment to oil, and made the mixture too thin and had trouble applying it without some dripping onto the floor. After adding more pigment it was much more workable. I was able to apply more pressure on the canvas where it was supported by the stretcher members, and it occurred to me that this step of the process may be largely responsible for the lines we see in x-rays indicating the interior edge of strainer members. An unexpected finding was that the openness of the canvas allowed for some paint to go through the interstices of the weave to the back, even after I thickened the paint, particularly along the outer edges near the stretcher bars (Fig. 12).



Figure 11. First ground layer after drying.

²¹ See Appendix III for images of my test grounds.



Figure 12. Reverse of the canvas (left). Detail of paint coming through to the back (right).

This initial ground layer was uneven once dry and the oil seemed to absorb differently across the canvas; this was eventually mitigated by the second ground layer (Fig. 13). The second ground layer was composed only of carbon black and umber pigment that I ground into the linseed oil with a muller. I started to apply this coat with a brush for a thinner layer, but found this took a long time as the brush soaked up the paint. Instead I began to apply it by hand (with a glove on), which was much faster and created a satisfactory, smooth surface.



Figure 13. Second ground layer after drying.

The second ground seems to serve multiple purposes. First, it makes the ground much more even and smooth. Less oil is absorbed by the canvas, which provides a velvety preparation for the subsequent paint layers. It also helps to plug the remaining gaps in the canvas where the first ground layer went through to the back, and I imagine it “seals” the canvas to a certain extent from absorbing more oil. Up close you can see just how dry the first layer of ground is in comparison to the second (Fig. 14). I was also surprised by how dark the ground actually was. I knew it was fairly dark from observing the original painting, but in the reconstruction it is nearly black in appearance.



Figure 14.

Top:	Sized canvas
Middle:	First ground layer
Bottom:	Second ground layer

Underdrawing

There are several techniques Volpato describes for transferring the design of one painting onto another. The first is to use oiled papers for tracing:

“Some sheets of huckster’s paper, I do not exactly know what it is called, are glued together, according to the size of the picture or figure which is intended to be traced; these sheets are then anointed with common oil, or, still better, with nut oil. [...] Spread the oiled paper over the picture, and with a pencil or charcoal outline the figures, which are visible through the paper very clearly... A leaf of paper is covered with dry white lead or gesso, which, being placed between the tracing paper and the canvas, where it is oiled, the outlines of these figures are pressed with a needle of bone, and the coloured paper, which is placed between the two, leaves impressed all those marks which you have indented with the needle.”²²

The young apprentice also inquires about the use of a “velo” on a cartoon as an alternative method, which the elder apprentice replies:

“It [the velo] is applied on the painting like the tracing paper, and the outline is drawn on it with gesso. It is then removed to the primed canvas, and the marks, being pressed with

²² Merrifield, Vol. 2, 734 & 736.

a piece of linen held in the hand, are this transferred to the primed canvas, or the gesso is again passed over the outlines which are transferred to the priming.”²³

The last method Volpato suggests for transfer is using a *graticola*, essentially an apparatus used to square a painting for transfer to another canvas:

“The Graticola is used in two ways: the picture which is to be copied is either crossed with white threads, or the Graticola, being made on a frame, is applied over the picture and the same number of squares are to be struck on the primed canvas, which, whether it is larger or smaller than the painting, is to be divided in the same proportion. [...] A thread is rubbed with dry gesso or white lead, and is beaten over the compartments exactly as the joiners do with terra rossa over their wood; and the painters strike the lines of the architecture in their paintings in the same manner, drawing lines to the point of sight.”²⁴

The young apprentice inquires why painters use tracings or a *graticola*, to which the elder replies to “avoid the tediousness of drawing their works,” but also to enable their works to be copied “with greater perfection.” He specifically mentions the Bassano workshop in this respect:

“... this plan was employed by Bassano, and my master has a chest half full of the tracings by the sons of Bassano from the works of their father, which, being touched up by the master, pass as his works.”²⁵

We can infer, then, that the preferred method of transfer in the Bassano workshop was to make tracings of their frequently used compositions.²⁶ However, I did not want to put oiled papers on the surface of *The Adoration*. I brainstormed with Dianne and Shan about ways to transfer the design using mylar, or perhaps projecting an image of the painting onto the canvas. But ultimately squaring seemed to be the most authentic, and least invasive, method of transfer I could use.



Figure 15. Squaring of the original painting (left), and reconstruction (right).

²³ Merrifield, Vol. 2, 736.

²⁴ Merrifield, Vol. 2, 736 & 738.

²⁵ Merrifield, Vol. 2, 738.

²⁶ One wonders if there was once such a tracing of *The Adoration*, a composition copied several times.

To do this I taped white strings across the original painting to create a 6 x 8 grid (mimicking a *graticola*), each square measuring 6.25 x 6.5". I then squared the reconstruction to the same dimensions using a ruler and white chalk (Fig. 15). From there I put the two paintings next to each other, gradually transferring the design by hand as I looked back and forth between them. It was easy to correct the chalk by using a little water or saliva to "erase" mistakes, and the end product was a close approximation of the original design (Fig. 16).



Figure 16. Mid-transfer (top), and final underdrawing in chalk (bottom).

Paint Layers

Brushes

Before beginning in earnest on the paint layers, I needed to source proper brushes. There is no mention of brushes by Volpato or in the Marciana manuscript, but Cennini offers specific instructions on assembling your own brushes:

“In our profession we have to use two kinds of brushes: minever brushes, and hog’s-bristle brushes. [...] First get bristles of a white hog, for they are better than black ones; but see that the come from a domestic hog. And make up with them a large brush into which go a pound of these bristles; and tie it to a good-sized stick with a plowshare bight or knot. [...] And make some into those which have the tips of all the bristles quite even – those are called “blunt” brushes; and some into pointed ones of every sort of size.”²⁷

Although I did not construct my own brushes, I was able to find white hog-hair bristle brushes at an art supply store in Brooklyn. To stay as “traditional” as possible, I only bought round brushes in various sizes. I neglected to purchase any minever brushes at that time, but would only have needed them for finer details. In the smaller sizes the hog-hair bristles are not as easy to control, and do not maintain a fine point after use.

Lead White Preparation

Before starting on individual colors, it was necessary to lay in areas that needed preparation with lead white. All of the blues were underpainted with lead white, including several garments and the sky. Technical analysis identified the white pigment as lead white, bound in a mixture of linseed and walnut oil. This is consistent with the Marciana manuscript, as well as Volpato’s instructions:

“If, then, you wish to make *white*, take good white lead...”²⁸

“The white lead is ground with nut oil...”²⁹

The walnut oil was presumably added to prevent the white paint from yellowing over time. I wonder if the Bassanos may have mixed linseed and walnut oil to exploit properties from each: the clarity of the walnut oil, combined with the faster drying time of linseed oil. They were working in a busy workshop, after all, and needed to work through paintings quickly.

Working with the lead white was much different than the initial ground layers. It grinds very easily into the oil; the walnut oil is slightly less viscous than the linseed, making the paint runnier without adequate pigment added. I had to be very conscious of where I put in the lead white because it has surprising covering power – mistakes would be difficult to reverse. I immediately made a mistake in painting the sky; I was supposed to leave areas of reserve for the tree branches, but forgot this and applied the lead white over that area. However, I was much more careful to apply the paint only where needed in other areas: to the shirts, cradle, Madonna’s veil, and beneath blue garments (Fig. 17). I only did one coat of lead white for the sky, as I knew there was a high proportion of lead white in the blue layer as well. For the blue garments it was a guessing game on how much lead white to apply; the blue overtop in *The Adoration* now conceals how thickly the lead white was laid in beforehand.

²⁷ Cennino Cennini, *The Craftsman’s Handbook: The Italian “Il libro dell’arte,”* trans. Daniel Thompson, (New York: Dover Publications, 1933): 112-115.

²⁸ Merrifield, Vol. 2, 610.

²⁹ Merrifield, Vol. 2, 738.



Figure 17. After underpainting with lead white.

Colors

For all other colors, the instructions are fairly straightforward from the manuscripts. Volpato says simply:

“...[Mix] “verde eterno” [verdigris], indigo, and all other blues, charcoal and the other colours, with linseed oil.”³⁰

The Marciana manuscript offers a bit more guidance on preparation:

*“Colours tempered with oil are prepared in the following manner. – Grind up the colour with linseed or nut oil as stiff as you can, that is, with as little oil as possible, and so that it may be very fine, and that on being felt between the fingers, no hard grains can be perceived; and when you paint with it, if you find the colour too stiff, dip the pencil in a little oil and incorporate it well with the colour.”*³¹

Specific instructions are provided in the Marciana manuscript for particular colors:

³⁰ Merrifield, Vol. 2, 738.

³¹ Merrifield, Vol. 2, 626.

“... if you wish *red*, take lake or minium or cinnabar. The lake has no body, therefore take cinnabar, and according as you wish the colour to be more or less dark, take more or less lake. If you wish to make it still lighter add a little white lead.

If you wish to make *flesh color* take white lead and lake, and make it lighter or darker as you please.

If you wish *green*, take verde azurro, and mix it with giallolino and white lead, making it darker or lighter as you please. If you have no verde azurro, take giallolino, or orpiment and azure; mix them together and you will have a green, adding more or less of one or the other according to the degree of obscurity which you may desire.

“*Paglione*” [*pavonazzo*.]³² – Take white lead and azure and red lake, mix well together, and if you wish the colour to be darker, add more azure; if lighter, add more white lead, and if you wish it redder, put more lake.

Yellow – take pure giallolino, item pure orpiment, item ochre; and because these colours have no body, lay white lead underneath.

Black – Take peach stones and char them, or burn ivory, which will make perfect black...

Grey – Take white lead, verde terra, ochre, and black; mix together, and put more or less of one or the other until the colour is to your mind.

The colours which have no body are these: Verdigris, lake, ochre, and verde terra, and they are very proper for mixing with those colours which have body.”³³

These suggestions do not entirely reflect the range of pigments found throughout *The Adoration*, or their application, but overlaps in many respects. Each of the colors I used throughout the painting I ground in linseed oil. I often found that pigments that were difficult to incorporate into the oil were aided by pre-grinding with a mortar and pestle, or the addition of a small amount of lead white. This was particularly true for azurite, which I found would separate out of the oil while still on the glass palette if not prepared properly. It was much more stable with the addition of lead white, which is what I needed for the sky (Fig. 18.1). This second layer composed of azurite and lead white was sufficient to completely conceal the dark ground layers. I added an additional layer of azurite to areas of the sky requiring a more concentrated blue (Fig. 18.2).

³² This likely means purple; an earlier manuscript Merrifield translated includes *pavonazzo* that was made from an *amaranthus tricolor*, a plant with deep red and purple leaves. Merrifield, Vol. 2, 438.

³³ Merrifield, Vol. 2, 610.



1. Adding Azurite to the Sky



2. Painting the Landscape with Earth Pigments



3. Underpainting Yellow and Pink Vests



4. Underpainting Madonna's Red Robe



5. Repainting Pink Vest and Joseph's Robe



6. Underpainting for Green Vest

Figure 18. Adding the preparatory paint layers, at various stages.

In general the blue tone of the azurite in the reconstruction is much cooler than in the original painting. This may be due to several factors, including: the fineness of the pigment size, the quality of the azurite, and the ageing linseed oil binder.

Although I did not do any analysis on the landscape paints, they all looked to be done in earth pigments. I used Vagone green earth, yellow ochre, burnt umber, and small highlights of lead tin yellow II painted wet into wet in one sitting (Fig. 18.2). All of these pigments were easily ground into oil, and sheer in application unless I added a disproportionate amount of pigment to binder.

I then laid in the initial layer of the shepherd's yellow vest, a mixture of lead white and lead tin yellow II (Fig. 18.3). This was slightly complex, because I needed to leave areas of the dark ground in reserve for shadows at a later stage of the painting. In my opinion, the skill of the painter is revealed in their ability to do this technique, which requires ample forethought and economy of paint application.

My first attempt at the shepherd's pink vest was not successful (Fig. 18.3). I did not grind the cochineal properly before mulling it with the lead white and linseed oil, causing the paint to settle into small clumps on the canvas after about 30 minutes. The next day I scraped some of this layer off with a palette knife, and applied another layer at the same time as the first preparation layer of Joseph's robe. This time I ground the cochineal in a mortar and pestle, and chose only the finest pigment particles; it resulted in a perfectly smooth, translucent rosy glaze that did not clump after application (Fig. 18.5).

The Madonna's robe is painted largely with vermilion, which is what I used for the first layer. The vermilion is much more opaque than I anticipated – you can see along her shoulder where I first applied the paint more thickly. I then adjusted my technique, removing as much vermilion as possible from the brush in order to create more subtle variations in tone that allowed some of the ground layer to come through (Fig. 18.4).

For the shepherd's green vest I used verdigris mixed with a small amount of lead tin yellow II. I tested the verdigris with both lead tin yellow II and yellow ochre before application, as the yellow pigment was not identified in the cross section during analysis. The lead tin yellow II created a green much closer to the vibrancy of the original painting, however overall the green tone was much cooler. Verdigris on its own seems quite gritty at first, but grinds easily into linseed oil to make a translucent, hot teal glaze. Without the addition of a yellow pigment it would not look green on the canvas. And because the pigment is so translucent, I had to mix a lot of paint in order to lay in an entire, brushy preparation layer (Fig. 18.6).

Lastly the skin tone – a mixture of lead white, vermilion, and lead tin yellow II. The trick with this particular color is I needed to mix a much more saturated paint on the palette than I anticipated so that the skin did not appear chalky. The amount of vermilion and lead white I used was also key, as too much of either could quickly throw off the entire tonality of the mixture. It was also important to maintain some of the shading of the anatomy, and make certain areas of the paint more sheer than others (Fig. 19).³⁴

³⁴ See Appendix III for painting details and images of the pigments during preparation.



Figure 19. Current state, with underpainting added for flesh tones.

Varnish

While my reconstruction was put on pause due to COVID-19 and is not at the stage of varnishing, there are many recipes I noted in the Marciana manuscript to test at a later date. It includes thirteen distinct varnish recipes, though not all are intended specifically for paintings. These recipes include various preparations of benzoin resin mixed with wine spirits, linseed oil with naphtha or wine spirits, sandarac with nut oil and alum, linseed oil with Greek pitch and/or mastic, mastic with naphtha and nut oil, or Greek pitch and mastic with nut oil. The two recipes most likely intended for oil paintings both contain mastic and nut oil. The first recipe stipulates:

*“Item. A most excellent mastic varnish. – Take one pound of mastic, half a pound of naphtha, and half an ounce of clear nut oil; melt them together in a bottle or glass over a charcoal fire, and strain through an old linen cloth.”*³⁵

The second recipe:

“Item. A most excellent clear and drying varnish proper for colours, both in oil-painting and other kinds of painting. – Take 2 ounces of clear and good nut oil, one ounce of clear and good Greek pitch, and half an ounce of clear and good mastic; grind the pitch and the mastic [separately] to a very fine powder, and place the oil in a clean glazed pipkin over a charcoal fire, and let it boil gently until it is done sufficiently, that is, until one-third has evaporated; then put in the powdered pitch a little at a time, mixing and incorporating it

³⁵ Merrifield, Vol. 2, 632.

well; afterwards throw in the mastic in the same manner, and when it is dissolved, take the varnish off the fire and strain it through a fine and old linen cloth.”³⁶

Volpato also includes some instructions for varnishing paintings. In general he recommends a mastic varnish, but in particular cases would apply an egg white varnish:

“I apply the white of egg upon those [pictures] which he [the master] finishes without having varnished the abozzo, and which he completes merely “oiling out” and then retouching until finished, and on the others I apply mastic varnish. I beat up this white of egg well with a spoon, agitating it till it flows well through a rag, and adding to it a little garlic cut small, which has a good effect, and this was used by Canziani on his paintings. Your master will order all the rest that you may have to do.”³⁷

Because a mastic varnish is mentioned in both the Marciana and Volpato manuscripts, I would be most inclined to try the first mastic varnish recipe indicated in the Marciana manuscript. It is a straightforward recipe very similar to current natural resin varnish recipes (aside from the addition of walnut oil), and I would be curious to see how it compares. I would also be keen to try the second recipe as well, which must be quite a high concentration varnish.

Conclusion

This reconstruction has been an invaluable learning opportunity for me to explore the materials and methods of sixteenth-century Italian painters. Coming into this project with a background in oil painting, I anticipated many aspects of the project would be simple for me. However, quite rightly I found the use of historical materials an entirely different process than those of modern ones, and at many times frustrating. I found myself relying on instructions from the historical treatises, and bemoaning any sections that were particularly sparse. There were times reading the Volpato manuscript I felt I (the young apprentice) was having a conversation with Francesco himself. And there is something quite magical about finding yourself agreeing and commiserating with the observations of artists over 400 years ago, whose insights have stood the test of time. I have come away from the project with a great respect for Francesco’s artistic abilities, and the great effort required to prepare all the necessary materials; no wonder artists sought to build workshops where apprentices would do the grunt work!

I hope that it may serve as an instructional tool for future conservation students and researchers, and perhaps one day I will be able to work on it further. But for the meantime, I would like to end this report with Volpato’s final dialogue between the two apprentices:

F: [...] before you go, I beg you will take a glass of wine, come.

S: This cellar is very cool.

F: Take this wine and taste it, it will taste as if it were iced.

S: To the health of our masters!

F: To theirs and to our own!

[...]

S: I will take another glass.

F: Two or three, if you like.

S: One will do for the present.

³⁶ Merrifield, Vol. 2, 632 & 634.

³⁷ Merrifield, Vol. 2, 748.

F: Take it.

S: And with this I will drink to your good health.

F: May you long continue in good health.”³⁸

I raise a glass of wine to the masters before me, without whom I could not have done this project.

Alla salute!



Figure 20. Comparison of *The Adoration of the Shepherds* (left) with my reconstruction (right).

³⁸ Merrifield, Vol. 2, 754.

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APPENDIX I: Materials and Tools

Secondary Support: Strainer

Stretcher without any crossbars³⁹ (Upper Canada Stretchers)

Primary Support: Canvas

100% Linen canvas (Mood Fabrics)

Mallet

Thumbtacks

Metal tacks

Sizing

Rabbit skin glue (Kremer 63028)

Water

Wide brush

Pumice stone

Ground Layers

Palette knife

Hog-hair brushes

Boiled linseed oil

Bone black (Kremer 47100)

Burnt umber (Kremer 4072)

Stack lead white (Rublev Colours, Dutch Method)

Underdrawing

White chalk

String

Tape (or tacks)

Ruler

Paint Layers

Palette knife

Hog-hair brushes

Minever brushes

Mortar and pestle

Sheet of glass and a muller

Turpentine

Boiled linseed oil

Walnut oil (M. Graham & Co.)

Stack lead white (Rublev Colours, Dutch Method)

Bone black (Kremer 47100)

Azurite MP (Kremer 10201)

Varone green earth (Kremer 4175)

³⁹ A more historically accurate support would be a strainer of 4 strips of wood nailed at the joints, without any crossbars.

Burnt umber	(Kremer 4072)
Yellow ochre	(Kremer 40220)
Cochineal	(Prepared by Tech & Structure, precipitated onto calcium carbonate and pre-ground in water)
Lead tin yellow II	(Kremer 10120)
Vermilion	(Kremer 42000)
Verdigris	(Kremer 44450)

APPENDIX II: Recipes

To Prepare 20% Stock Glue

100 grams of rabbit skin glue
500 mL water

Put rabbit skin glue in an airtight container and pour the water over top, stir slightly. Leave the mixture at room temperature to swell overnight. The next day the glue should have absorbed most of the water. Put the swollen glue into a double boiler on a low heat to gradually warm it until it dissolves completely. Remove enough glue as needed and dilute with water for desired concentration. Keep remaining glue refrigerated for future use.

To Prepare Linseed Oil, Marciana Method

300 mL linseed oil
1800 mL water

Pour water into a large pot, and then pour in the linseed oil. The oil should float on top of the water. Put the pot on a stove or hot plate. Turn up the heat high enough to bring the mixture to a boil (I needed to raise the hot plate to around 350°C, heating took an extremely long time). Once reaching a boil, lower the temperature to maintain a low boil. Leave on a low boil for 4 hours, then leave to cool slowly overnight. During boiling you may see the linseed oil get cloudy, this should clear around the third hour of boiling. Decant oil with a spoon or baster into another airtight container. Oil should be slightly thicker, and will be ready for use after decanting. Can be kept at room temperature for storage.

To Prepare Most Paints

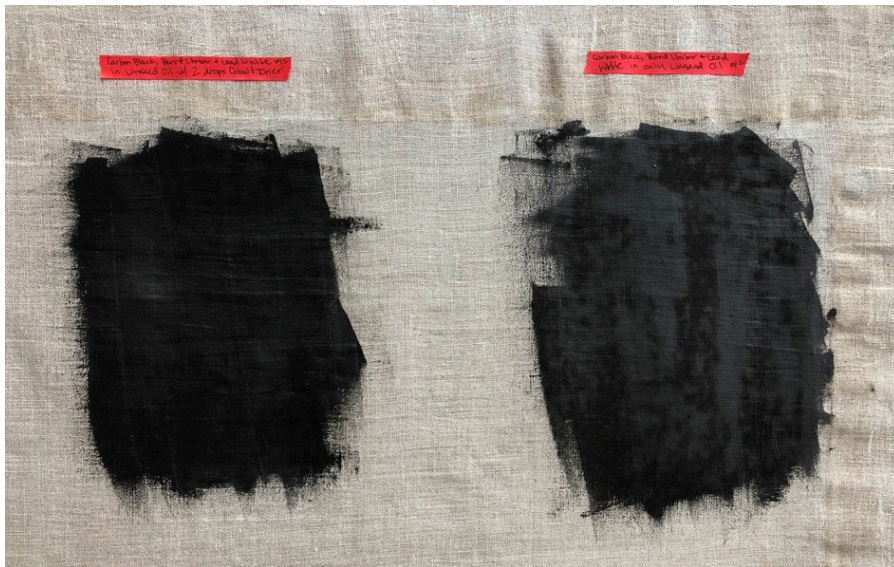
Boiled linseed oil
Dry pigment

If a pigment is particularly coarse (like azurite or cochineal), prepare by grinding in a mortar and pestle. When ground to the desired particle size, put pigment onto a sheet of glass in a mound. Add drops of linseed oil with a pipette. If lead white, add equal parts boiled linseed oil and walnut oil. Use a muller to grind the pigment into the oil until smooth – this may take a while to get the desired consistency. Add more pigment or oil as needed to achieve a workable paint texture; this will likely be thinner than modern oil paints. Different paints can be mixed together using a palette knife. Any leftover paint can be stored in an airtight container at room temperature; pigment may separate from oil, but can easily be mixed back together. If pigment separates from medium while working, it may not be ground finely enough.

APPENDIX III: Additional Images



Test canvas before (left) and after drying (right).
The left half of the canvas was sized with 7% gelatin, and the right half with 7% rabbit skin glue.



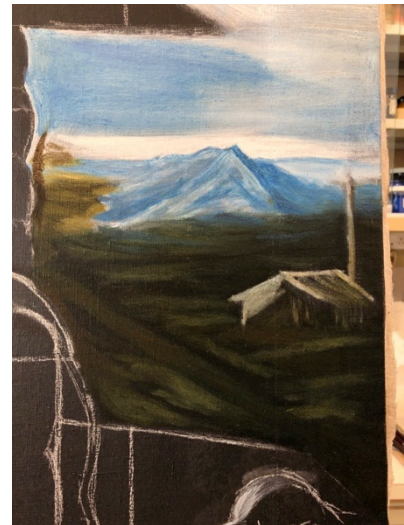
Testing the ground with (left) and without (right) cobalt drier added.



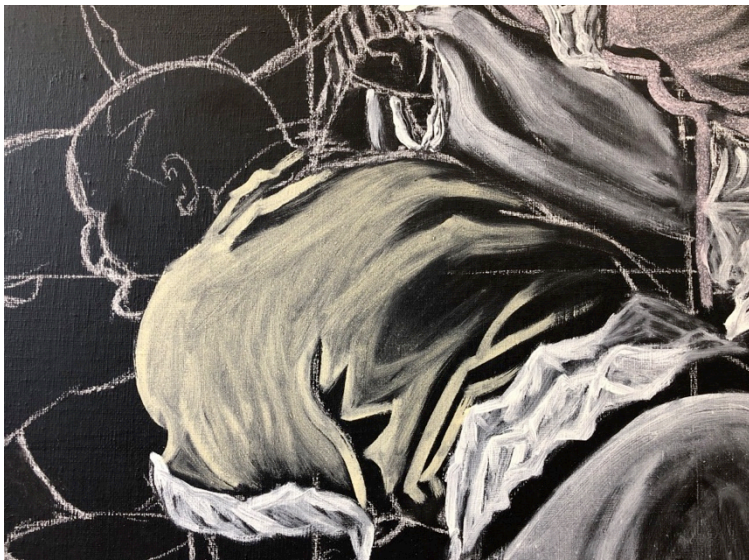
Materials for the first ground layer (left) mixed before application to the canvas (right).



Comparing natural azurite (top) to azurite MP (bottom) before application to canvas. I chose azurite MP for its greater saturation of color.



Detail of sky (left) and landscape (right).



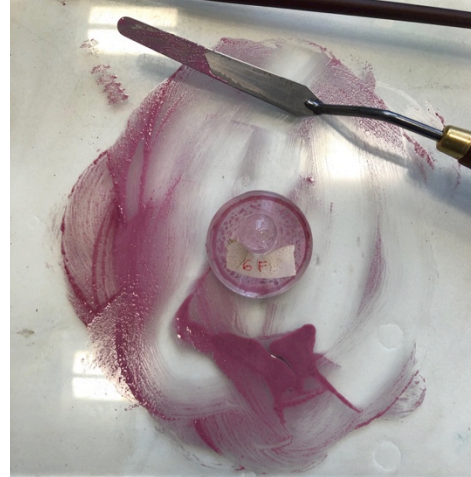
Preparation layer for yellow vest with lead tin yellow II and lead white.



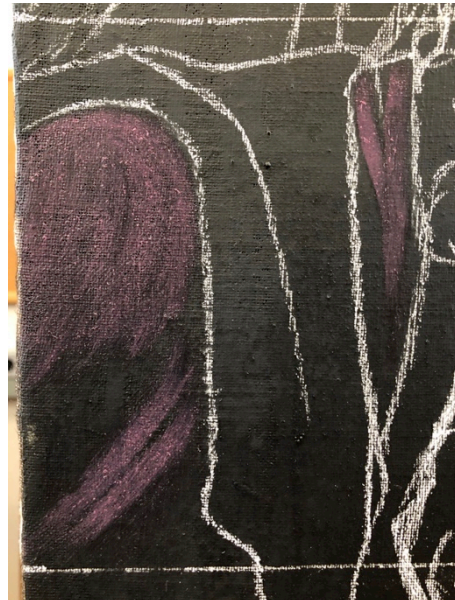
First attempt at preparation layer for pink vest (cochineal and lead white). Note the clumping of the pigment in the detail on the right.



Detail of Madonna's robe preparation with pure vermilion.



Cochineal before (left) and after (right) grinding and mulling in linseed oil and lead white.



Cochineal and lead white reapplied to pink vest (left) and Joseph's robe (right).



Verdigris ground in linseed oil (left) and mixed with lead tin yellow II (right).



Detail of green vest
preparation with verdigris
and lead tin yellow II.



Color of flesh tone on palette (left) versus on the canvas (right).
Mixture of lead white, vermilion, and lead tin yellow II.