Perspectives of Italian Fresco: Creation and Conservation

Sarah Linder
Western Kentucky University, sarah.linder515@topper.wku.edu

Follow this and additional works at: https://digitalcommons.wku.edu/stu_hon_theses
Part of the Art and Materials Conservation Commons, and the History of Art, Architecture, and Archaeology Commons

Recommended Citation
https://digitalcommons.wku.edu/stu_hon_theses/758

This Thesis is brought to you for free and open access by TopSCHOLAR®. It has been accepted for inclusion in Honors College Capstone Experience/Thesis Projects by an authorized administrator of TopSCHOLAR®. For more information, please contact topscholar@wku.edu.
PERSPECTIVES OF ITALIAN FRESCO:
CREATION AND CONSERVATION

A Capstone Project Presented in Partial Fulfillment
of the Requirements for the Degree Bachelor of Arts
with Honors College Graduate Distinction at
Western Kentucky University

By
Sarah W. Linder
May 2018

CE/T Committee:
Dr. Chris Keller
Dr. Guy Jordan
Professor Michael Nichols
This thesis is dedicated to my parents, Mark and Elizabeth Linder, who instilled the drive required to complete this project.
ACKNOWLEDGEMENTS

This project was completed thanks to the encouragement of Professor Michael Nichols and the opportunities provided by Alma Ortolan and the Ortolan Studio team. Funding for the trip was made possible through a Lifetime Experience Grant and Honors Development Grant from Western Kentucky University. Further thanks goes to Professor Guy Jordan for advising through the writing process.
ABSTRACT

The purpose of this study is to survey the history of Italian fresco technique and tradition and modern conservation practices employed to preserve works. Fresco, a medium used by masters, such as Michelangelo, is a method of painting directly onto wet plaster. This method incorporates pigment and surface as one. This project analyzes the most prevalent examples of traditional fresco found in Pompeii and nearby villas in Boscoreale, Italy. Since their discovery, these locations have undergone and continue to exist under varying conservation projects. In order to further the study of modern conservation techniques, I attended the Ortolan Studio in Vittorio Veneto, Italy. While at the workshop, I gained hands-on experience with traditional Italian fresco technique and engaged with local conservation projects under the guidance of Alma Ortolan. Here, I learned about advanced methods of modern conservation in detail, and gained an understanding of current and future trends in the field.
VITA

EDUCATION

Western Kentucky University, Bowling Green, KY May 2018
  B.A. in Art History and B.S. in Chemistry, Mahurin Honors College Graduate
  Honors Capstone: Perspectives of Italian Fresco: Creation and Conservation

Eastern High School, Louisville, KY May 2014

AWARDS & HONORS

1906 Founder’s Scholarship, WKU, 2014-2018
Honors Development Grant, WKU, 2017
Lifetime Experience Grant, WKU, 2017
Fulbright Research/Graduate Study Award, 2018

INTERNATIONAL EXPERIENCE

Harlaxton College, Grantham, United Kingdom, Spring 2016
Ortolan Workshop, Vittorio Veneto, Italy, Summer 2017
CONTENTS

Acknowledgements...........................................................................................................iv
Abstract..............................................................................................................................v
Vita.....................................................................................................................................vi
List of Figures....................................................................................................................viii
Introduction to Fresco & Conservation.............................................................................1
The Pompeii Case................................................................................................................11
Modern Restoration: Research at the Ortolan Workshop...............................................21
Bibliography.......................................................................................................................31
Appendix............................................................................................................................34
LIST OF FIGURES

Figure 1. Fra Angelico, Virgin and Child, 1435, detached sinopia

Figure 2. Spring Fresco (detail, Lilies and Swallows), 1650 BCE

Figure 3. Michelangelo, Sistine Chapel, 1508-1512

Figure 4. Pompeii, Italy, 6th-7th century BCE

Figure 5. Map of Major Volcanoes and Plate Boundaries in Italy

Figure 6. Map of Mount Vesuvius eruption, 79 BCE

Figure 7. Streets of Pompeii, Italy, 6th-7th century BCE

Figure 8. Human Figures discovered in Pompeii, Italy

Figure 9. Example of Fourth Style painting, Ixion Room, House of Vettii, Pompeii, 1st century CE

Figure 10. Peristyle of Villa of P. Fannius Synistor, Boscoreale, Italy, 40-30 BCE

Figure 11. Villa of Publius Fannius Synistor, Boscoreale, Italy, 40-30 BCE

Figure 12. Cement filler in Pompeii fresco following earthquake, 62-79 BCE

Figure 13. Scratches on Pompeii fresco following earthquake, 62-79 BCE

Figure 14. Scratch on Pompeii fresco following earthquake, 62-79 BCE

Figure 15. Burning on Pompeii fresco following volcanic eruption, after 79 BCE

Figure 16. Alma Ortolan showing color palette, Vittorio Veneto, Italy, 2017

Figure 17. Grotte del Caglieron, Italy, 2017

Figure 18. Stephanie Wilhelm, Alma Ortolan, and Ann Molitor (left to right) at Grotte del Caglieron, Italy, 2017

Figure 19. Alma Ortolan measuring lime to prepare plaster, Vittorio Veneto, Italy, 2017
Figure 20. Sifting sand to prepare plaster, Vittorio Veneto, Italy, 2017

Figure 21. Measuring lime to prepare plaster, Vittorio Veneto, Italy, 2017

Figure 22. Stephanie Wilhelm mixing plaster, Vittorio Veneto, Italy, 2017

Figure 23. Example of Graffito, Vittorio Veneto, Italy, 2017

Figure 24. Example of punching technique, Vittorio Veneto, Italy, 2017

Figure 25. Façade of Palazzo Galletti, Vittorio Veneto, Italy, 2017

Figure 26. Alma Ortolan, Stippling in San Giovanni Chapel, Vittorio Veneto, Italy, 2017
INTRODUCTION TO FRESCO & CONSERVATION

Fresco has been one of the most enjoyed and studied art forms since the Ancient Greek and Roman civilizations. Frescoes, known for their durability, have long been employed to decorate homes and public buildings. Their ability to defy erosion under natural elements allows people to continue to enjoy them. The chemical composition involved in the creation of fresco makes it some of the most well preserved art, and therefore provides the clearest view of historical society, including social value structure, politics, family units, and daily activities. Frescoes can be found throughout the globe, from Italy to India. However, they are primarily found in their place of origin around the Mediterranean Sea.

Fresco is an Italian word meaning fresh and is the method of painting on wet plaster. Most pigments are mixed with water and then applied after the plaster has been spread.\textsuperscript{1} Calcium carbonate ($CaCO_3$) is the common substance found in limestone rocks as minerals calcite and aragonite. This calcium carbonate is strongly heated until it undergoes thermal decomposition to form calcium oxide ($CaO$) and carbon dioxide ($CO_2$). This calcium oxide, or unslaked lime, is then dissolved in water to form calcium hydroxide ($Ca(OH)_2$). Calcium hydroxide is a colorless, crystal powder. The plaster used in fresco consists of micron-sized calcium

hydroxide, also known as slaked lime. As the plaster, a mixture of sand and lime, begins to “dry,” the organic substance goes through a chemical reaction in which calcium carbonate forms. This occurs through the reaction between carbon dioxide from the air and calcium hydrate in the lime in which they form the solid crystal structure. The pigments and plaster are incorporated into this solid crystalline mass. Because of this, frescoes are extremely durable. The pigments are incorporated into the wall instead of being applied on a surface like a traditional painting.

The first step in creating a fresco is applying the arriccio, a thick coarse layer of plaster. Traditionally the design of the piece would be sketched on this layer in red pigment. This drawing is also known as the sinopia (Figure 1). Top layers peeled away have revealed the red pigment underneath. On top of these two layers, the intonaco, or upper layer of plaster, was spread for the daily work. The top layer is fine-grained and thin and would not be completely spread out across the work’s area. The plaster dries quickly and therefore small sections of intonaco would be spread for a given workday, also known as giornatta. The paint was dry pigment mixed with water. However, some pigments, most often the blues, could not be applied with water without initiating an additional chemical change. In these cases,

---

5 Meiss, The Great Age of Fresco: Discoveries, Recoveries and Survivals: 16.
a method called *secco* would be used. This entails mixing the pigments with a binder and then applying it onto dry plaster.⁶

The art of creating frescoes required a high level of talent. Artists were required to work quickly. *Giornatta* allowed for more time. However, the plaster still “dried” nonetheless and was permanent once crystallized.⁷ Though the end result is stable and resilient, editing or fixing mistakes is extremely difficult with fresco.⁸ On top of this, greater attention from the artist was required because many wet pigments changed their hue as they dried.⁹ As paints dry, the color often shifts a few shades and could therefore completely throw off the tonality of the piece and an artist’s intended composition. One must make a commitment to time and attention to detail when embarking on the creation of a fresco.

Though the method to produce them was daunting, frescoes became increasingly common in Mediterranean buildings. With the rapid growth of Italian city-states, meeting halls, churches, public buildings, and even houses were embellished with artworks depicting everyday life, beliefs, and values.¹⁰ These images included landscapes, scenes from Greek mythology, and Christian stories. One fresco found in the city of Akrotiri on the island of Santorini, Greece depicts a landscape with swallows (Figure 2). It is dated from around 1650 BCE during the

---

¹⁰ Meiss, 13.
Late Bronze Age. 11This particular scene is attributed as the first painting of a nature scene and gives the viewer a look into everyday life. Depicted in this landscape are pairs of swallows flying around saffron plants. Then and now, Saffron is an extremely valuable spice. In Ancient Greece it was believed to aid in fertility and was often used in cooking. Women would sometimes spend all day gathering the plant to use later. The addition of the pair of swallows suggests that this room would not have been intended for everyday use but instead was a special room for the family that lived in this villa.12

This fresco is one of our best examples because it has been so well preserved. The archipelago of Santorini experienced a volcanic eruption during the mid-second century BCE. Layers of volcanic ash covered the city and preserved many of the buildings and the artwork that was incorporated into them. A similar situation occurred with the city of Pompeii. In both cases, the frescoes were located in the interior of buildings and were covered in organic materials from the volcanic activity. Therefore they remained protected from weather and later pollution created by the increase in human activity. Humidity is one of the main challenges for the life expectancy of these works of art. Moisture can be a catalyst for the degradation of the plaster and pigments. Cycles of excessive humidity and dryness lead to mechanical stress on surfaces, which leads to salt crystallization followed by detachment of materials. Water is a strongly polar material in comparison to the

12 Chloe Lovelace, “Swallow Imagery in the Spring Fresco.”
weakly polar mortar, which allows it to quickly spread through the medium.

Humidity often forces conservators to manually detach full frescoes and transfer them onto panels until they are stable enough to return to their original locations. This is also known as the strappo technique.\textsuperscript{13} Hot glue is applied to the painted surface with layers of thin muslin cloth. Ten layers are applied and left to dry. Then the topmost layer of plaster is peeled off the wall.

Most of the wet plaster was spread thin and perfectly flat to maintain the smoothness of the wall. This method, originally used for the purpose of aesthetics, has now helped conservators because the smooth surface allows water droplets from rain or humidity to run off instead of pooling in irregularities, inevitably causing damage.\textsuperscript{14} In the case of Pompeii, buildup of volcanic ash also protected these frescoes from air pollution, oxygen, and light.\textsuperscript{15}

Teams of conservators are increasingly finding new ways to try to reverse damage caused by natural processes and earlier conservators who utilized problematic restoration methods in the past. The scientific analysis of art began in Europe in the 1870s. In the United States the period of marked progress in this field was 1925 to 1975. The transition was initiated by the director of the Fogg Art

Museum, Edward W. Forbes, in the late 1920s when he deemed the “practice of wholesale retouching of paintings” insufficient and “encouraged technical investigation and x radiography.” The purpose of art restoration, conservation, and preservation is to respond to the degradation of art in order to expand and extend its lifespan and impact. Though driven to sustain creativity, there are numerous aesthetic improvements and ethical drawbacks of altering art in order to extend its lifetime. Professionals define the main challenges experienced in conservation science as the “characterization of cultural heritage objects, understanding material degradation, and materials stabilization, monitoring, and repair.” The use of organic materials introduces a very real time limit to the lifespan of major works of art. Art conservation thus focuses on cleaning, restoring, and preserving artwork. Scientific investigation reveals how masterpieces have changed and the methods required to deal with them. Both centuries old materials and those used in contemporary art are susceptible to damage, keeping this an ever-changing field.

Conservation professionals do not have free-reign on how they approach saving a masterpiece. Laws have been passed in order to regulate the field, however, inconsistent standards sometimes complicate the restoration process. For example, Europe’s Berne Convention defined the methods of conservation as “distortion,

mutilation, or other modification” whereas the US Visual Artists Rights act disagreed.  

The purpose of the Visual Artists Rights Act of 1990 was to protect the moral rights of modern artists. Therefore, under the Visual Artists Rights Act, there is preservation legislation that focuses on society’s goal in preserving its treasures independent of private ownership.  

Additionally, the published “Code of Ethics and Guidance for Practice of the Canadian Association of Professional Conservators” consists of a code of ethics, guidance for practice, a glossary of terms, and a list of principal references and resources. The main goal is that “all actions of the conservation professional must be governed by an informed respect for the integrity of the property, including physical, conceptual, historical, and aesthetic considerations.”  

Due to regional discrepancy, institutions now rely on individual negotiations with living artists and historians to define their wishes on conservation and processing. In the case of many frescoes, communication with the artist is unavailable. In these cases, one must apply to undertake a conservation project and obtain approval of plans from the owning body.  

The purpose of restoration when it comes to frescoes is to firm up the paint and slow the degradation as much as possible. In the 1970s, many frescoes were coated in resins made of acrylic polymers. However, these additional layers of materials closed off the pores of the paint and therefore made natural perspiration

---

20 Miller, “State of the Art.”  
virtually impossible. Damaging salts gathered underneath the coating while the outside layer began to shrink and yellow. Later in the 1990s, these organic solvents were removed and scientists transitioned to water-based microemulsions, which are uniform liquid mixtures of substances including water, oil, and other compounds that lower surface tension.\textsuperscript{24} Containing these solvents in microscopic droplets of water reduced the concentration of hazardous materials by 95\%. These microdroplets, commonly consisting of calcium hydroxide, enter the pores of the paint and plaster and absorb the resin. The smaller size of the droplets allows a greater level of dispersion and penetration.\textsuperscript{25}

Civilizations with incredibly clean frescoes continue to be found. The Ancient Roman port of Ostia, about 15 miles west of Rome, includes multiistory homes and public halls that are full of frescoes.\textsuperscript{26} The city was not discovered until the early 20\textsuperscript{th} century and excavation continues at a slow pace in tandem with funding. Because they had not been excavated until recently, they seem to be some of the best examples of what life would have been like in the Mediterranean Sea region around 128 AD, around the time it was constructed. Women’s names, dancing

\begin{flushright}
\end{flushright}
figures, and depictions of the nine muses suggest the presence of an emerging middle class and depict a healthy civilization full of growing culture and longstanding beliefs. However, because the groundwater in this area is so high, the humidity poses a problem. Excavators are keeping much of the site under the care of its natural protector, the dirt, until they are able to fully preserve it. Additionally, the number of visitors to this area is limited due to the increase in toxins that come with human interaction.27

Many resources are available concerning this subject, making them an integral part in the study of ancient art. Agnolo Gaddi and Cennino Cennini, students of Giotto, wrote *Libro dell’Arte*, a written work including the entirety of techniques regarding fresco.28 Creation of fresco was a trained skill due to the extremity of details required to be successful and long-lasting. However, many methods were edited in order to make it easier for the artist. For example, one of the earliest changes was making full-scale drawings on paper or cloth instead of creating the *sinopia*, or preliminary drawings.29 Likewise, as artists began to rise in society, one’s usage of time was more strictly regulated. With fame came commissions and in order to continue to become more successful, one had to work faster to complete more works of art. Dry plaster was used much more often and oils were adopted because they were easier to fix or change.30 Likewise, the strict style of *intonaco*

27 Povoledo, “Archaeologists Unveil Restored Roman Dwellings Rich with Frescoes.”
including small, smooth brushstrokes was replaced with a new style of large, free brushwork. Many changes took place in order to make it easier on the artist. When Michelangelo was painting the Sistine Chapel, assistants originally applied the plaster on the walls for him to do it in secco, the dry method, with oil paints. However, he made them remove it all and start over with true fresco (Figure 3).  

Despite this situation, most artists surrendered the original resilient methods in favor of a less durable but more rapid technique.

Frescoes were one of the most solid forms of art known at this time. The slaked lime used for plaster is not strong enough to physically support structures but can add to a space through decoration. Thus reinforcing the structure of these ancient buildings. Because of this, many architects designed buildings with the expectation that frescoes would be added after construction. An artist could transform stone and brick into wonderful gardens and scenery. Painting directly on the wall versus on panels could display the architecture of the building or create new architectural details that would otherwise have been impossible. Plaster could be spread along curves and structural details in a much more unique way than any other form of art that would simply be hung on the wall. Frescoes were also used as a replacement for sculptures, decorating the space while still leaving room for functionality. The sturdiness and strength of frescoes was practical and instilled

34 Meiss: 14.
35 Meiss: 13.
the beliefs that many of these new Italian city-states needed. In churches and meeting halls, the appearance of permanence was extremely important.

Though not quite as well known, because frescoes cannot be put on traveling exhibits and shared throughout the world, they can be the best look into everyday life. Due to their chemical makeup and home locations, they have so far stood the test of time. But, this doesn’t mean that they can’t be damaged or, over time, degraded by fluctuations in humidity, air pollution, or other environmental and human-induced factors. An interesting case study to convey the lifespan, preservation, and current challenges facing both is that of Pompeii. The unique historical circumstances of Pompeii preserved the city to provide unparalleled insight to scholars today. However, the paradox remains that as the city is excavated, relics are exposed to the elements, they then cease to be preserved and protected. Thereby, their very study puts them in danger of being lost to time once and for all.

THE CASE OF POMPEII

Pompeii was built by the Oscans around the 9-8th century BC.36 The Oscans included a group of tribes that settled on the Italic peninsula. Many of these tribes had no permanent dwellings; therefore not much archaeological evidence is found

beyond gravesites and written sources.\textsuperscript{37} Due to this fact, physical evidence does not go back beyond the 6\textsuperscript{th} century BC. Based on architecture found in Pompeii, settlers clearly had contact with nearby Greek colonies and quickly absorbed their way of life and religion. This can be seen in buildings, specifically temples, found throughout the city. Pompeii was then subject to the Etruscans for almost 50 years until the civilization returned under Greek influence.\textsuperscript{38} The Etruscans were the group that set the stage for later Roman civilizations. Neighboring the Greeks, they were one of the great Mediterranean powers.\textsuperscript{39} During the 5\textsuperscript{th} century, Pompeii saw remarkable growth under Samnite expansion, a group from south-central Italy. They were an Oscan-speaking people, taking Pompeii back to its roots. The historical center provides the main evidence for this growth.\textsuperscript{40}

Pompeii was under Roman control by 298 BC. The Samnites and Romans fought small wars until it was an official colony in 80 BC. Continually developing, Pompeii was hit by an earthquake in 62 AD and then on August 24\textsuperscript{th}, 79 AD a volcanic eruption of Mount Vesuvius covered Pompeii and nearby Herculaneum and Stabiae.\textsuperscript{41} Herculaneum and Stabiae were much smaller towns similar to Pompeii. These cities lay forgotten until discovered at the end of the 16\textsuperscript{th} century. Proper

\textsuperscript{41} “History of Pompeii.”
excavation, however, did not begin until the 18th century and still continues to this day.  

Pompeii was established and developed on lava terracing formed many centuries earlier. Though seemingly unwise, the terracing provided a natural defense. City-states such as these were in constant conflict with neighbors. Thus providing a topographic advantage and a natural boundary along one side, Mount Vesuvius was a natural fortress (Figure 4). Additionally, the soil surrounding volcanoes is extremely fertile, much more so than much of Italy. Making this area even more attractive for settlement. Scientists have mapped the city and determined it covers around 140 square miles in the Sarno River Valley.  

Volcanoes are found at plate boundaries. The collision of plates causes an uplift of overlying crust (Figures 5 and 6). The crust on both plates melts due to frictional heating, creating magma. This movement of the crust creates tremors and earthquakes exactly like the one in 62 AD. The movement of magma and the release of gases cause these tremors during this shifting of plates. Based on scientific knowledge today, the earthquake would have been a warning sign for what was to come.

Volcanic stone contains many minerals that are broken down in the soil

---

when oxidized.\textsuperscript{46} This helped create a successful agricultural economy. Supporting the population and providing tradable materials, Pompeii possessed fertile soil and access to a seaport that allowed it to prosper and grow as a leading economic, social, and artistic center. That is, until the eruption in 79 AD.

The ash emitted from a volcanic eruption contains carbon dioxide, sulfates such as sulfur dioxide, hydrochloric acid, hydrofluoric acid, and additional toxins extremely hazardous to humans.\textsuperscript{47} The solidifying magma thus deoxygenates the atmosphere by burying the area, harming any living thing while covering and protecting the architecture and frescoes. In the aftermath, time was paused.

After the eruption, almost an entire city was left intact. The original streets can be seen in Figure 7. Loaves of bread were found left in ovens, bodies of men, women, children, and pets were found frozen (Figure 8), remains of meals were left discarded on the pavement, and walls of houses and shops were covered in signs and electoral propaganda.\textsuperscript{48} The discovery was a window into Pompeian life.

One particular group of frescoes that depict daily life are those found in the House of Vettii. This was a Roman townhouse that illustrates evidence for trends in domestic decoration in the final years of Pompeii. The chronology of the wall paintings has been a topic of debate since its discovery mostly due to the knowledge of the 62 AD earthquake.\textsuperscript{49}

\textsuperscript{46} Williams, “Volcanic Ash: More Than Just a Science Project.”
\textsuperscript{47} Williams.
The frescoes in this home serve as a representative of the key transitional phase between the third and fourth styles of Italian fresco design. The third style emerged when Augustus became concerned the Roman Empire was falling into excess. It was a much more restrained, reticent style compared to the preceding first and second styles, which encouraged opulence and decadence by imitating marble veneers and gardenscapes. The third style was thus a simple, linear reductive style. The fourth style, en vogue 70-79 AD, gaining popularity right before the volcanic eruption, was a mixture of all three (Figure 9).

Much of Pompeii consisted of villa homes constructed around courtyards. The atrium of the House of Vettii is richly decorated, as are the rooms opening onto the peristyle (Figure 10). Two of these rooms were in the course of being painted at the time of destruction, while three remain finished. Through this one can see that Pompeii was still developing and improving when Mount Vesuvius erupted. The house itself is architecturally significant. The Vitruvian canon, or standard, proposes a range of plans, suggesting strongly to the organization of interior space seen in the House of Vettii. Vitruvius wrote ten books of architecture around 25 BC that reference Pompeii’s expansion.

In addition to architecture, Vitruvius also outlined the process of fresco. Liquid lime plaster, made of calcium hydroxide, combines with paint during

---


51 Becker.
crystallization, making a perfectly smooth, shiny surface.\textsuperscript{52} This smooth surface adds to the resilience of this art form. The crystallization and attention to smoothing down the plaster creates little opportunity for buildup of materials on the surface that could cause damage or degradation over time. Vitruvius specifically described the process of applying and polishing up to seven layers of plaster with trowels and floats.\textsuperscript{53} Thus an extremely extensive process went into the decoration of this home.

The Villa of Publius Fannius Synistor at Boscoreale is another perfectly intact example that specifically gives insight into Italian fresco at the time of Pompeii’s burial (Figure 11). Boscoreale is located about 1.5 kilometers north of Pompeii but was also buried under the ash of Mount Vesuvius. All wall paintings found within the villa are true \textit{buon fresco} as described by Vitruvius in his canon.

One main contribution of these frescoes is providing a list of colors available to Roman painters at the time. These include naturally occurring earth pigments such as red and yellow ochers, green earth, calcium carbonate (or chalk), black from soot or charcoal, blue imported from Egypt, and bright red cinnabar. These pigments would then have been mixed to obtain the shades necessary for the details.\textsuperscript{54}

These frescoes also supported the idea that at this time, painting villas such as these was a craft. It was not customary for Roman craftsmen to sign or initial

\footnotesize{\begin{itemize}
\item \textsuperscript{53} Meyer, “The Conservation of the Frescoes from Boscoreale in the Metropolitan Museum,” 36.
\end{itemize}}
their work at this time. A team of workers would have finished the decoration of the house together in the same way a team of carpenters would build or stonemasons would support. Consequentially no signatures were found on these walls.

The roman wall paintings in the villas situated near Mount Vesuvius show a significant amount of ancient intervention; both in commissions and restoration efforts. Primarily, they give insight into the patronage and social workings of the time. Originally, Roman villas were rural farmhouses that would have been prominent along the Italian landscape, especially in such an agriculturally rich region in which Pompeii was found. However, as the Roman Empire continued to expand and colonies such as Pompeii gained wealth, these villas emerged as dwellings for the upper class. The homes were meant to display wealth and prominence. This was done through the extensive covering of interior spaces.

Other intervention was shown in handiwork in response to the strong earthquake preceding the eruption. Fissures can be seen in some of the frescoes from cracking during the tremors. Some layers of plaster even popped or slid off the walls as the buildings bent and shook. Many of these frescoes were restored in the fresco technique to match the original painting. In areas that pigment and plaster were structurally insufficient, mixtures of concrete were inserted to fill in cracks

(Figure 12). Thus current conservation professionals can see the original conservation efforts of Pompeians.

Through research, scientists have discovered the actual volcanic eruption following the earthquake occurred in two phases. The first is called the Plinian phase. Ash and pumice fell for eighteen hours, burying the area in a layer of coarse dust that was as much as nine feet deep in places. The ash rain also contained stones up to four and a half inches in diameter, which explains scratches found on a few frescoes (Figure 13). Some ceilings caved in under the weight of ash deposits, which caused even more damage (Figure 14).

The second phase of the eruption was the Pelean phase. This eruption lasted several hours during which glowing avalanches of hot ash streamed from the crater at enormous speeds. Pieces of wood were found that had experienced heat up to 750°F and bones that experienced more than 900°F. The heat of pyroclastic flow seemed to have loosened the plaster and paint in certain places. Surprisingly, the only other damage was to yellow ocher, the only color affected by the heat. It oxidizes and turns red when exposed to temperatures higher than 572°F (Figure 15). Yellow and red ocher both contain hydrated iron oxide. The discovery of this change in ancient frescoes was concluded by the fact that heating yellow ocher at a certain temperature for a certain amount of time specifically creates shades of red ocher. Modern artists use these different pigments on purpose. However, art


historians assume due to the tint of red ocher found in the Pompeii frescoes that many of the sections were originally meant to be yellow. Based on analysis, scientists can differentiate between original red pigments and these sections that experience scorching. This eruption validated the stability and longevity of the medium *buon fresco*. From this analysis, one can guess that save minor scraping damage and changes in color, what is seen when these frescoes are unearthed is what was seen by the ancient Romans that lived and worked in these villas day by day.

These particular frescoes were taken from the villa in the early 20th century and now reside in the Metropolitan Museum of Art. There was a campaign to restore them while in the Met from 2002-2007. This restoration included setting the frescoes up in the correct order to mirror how they would have been oriented in the villa. They also attempted to deal with the original conservation work following the 62 AD earthquake.60

After hundreds of years of work, about a third of the city still lies buried. The exploration of Pompeii began in 1748. Most uncovering has been fairly easy due to the light nature of the volcanic ash. The original purpose of excavation was to find artifacts for the Bourbon King Charles III. Everything discovered was sent to Naples where they remain in the Museo Nazionale. Many frescoes were stripped from the buildings and framed. A succession of various archaeologists then took their turns unearthing parts of the city. From 1806 to 1815, France was in control of Naples. Under this new management, the excavation was organized, itineraries were drawn,

and scholars were brought in. The goal was to uncover the city in a systematic way from east to west. In 1863, Guiseppe Fiorelli took command of the project. Deviating from the original method of uncovering streets first and then working from the ground up, Fiorelli initiated uncovering houses from the top. This proved a more successful method of preserving what was uncovered, reducing the risk of collapse. During the final twenty years of his oversight, many roofs were restored using tiles and wood to protect the frescoes within the buildings from the elements.

Today’s greatest challenge, according to leading archaeologists on the project, is the preservation of what has been uncovered. Through the combination of relocation as discussed earlier with the frescoes from the Villa of Publius Fannius Synistor, weather, pollution, and the continuous stream of tourists, there is now great danger of losing it. Problems occurred through both faulty excavation efforts and natural disasters. In 1924, Amedeo Maiuri used incorrect methodology under inadequate funding, thus making him the most controversial archaeologist that has worked with Pompeii. Maiuri’s successors thus had to fix the damage done. There were also numerous problems caused by an earthquake in 1980. Much of the contemporary work on Pompeii has involved working primarily with that already discovered, instead of uncovering new. According to current researchers involved, “today 44 of the 66 hectares of urban area are visible, and it is unanimously

---

considered that the other 22 hectares must be left under the volcanic debris, in order to preserve this important part of our past for future generations.”

An inventory of the frescoes of Pompeii has been digitized. This initiative began in 1987. Primarily, it was a way to record the progress being made throughout the excavation process. They also, however, wanted to create a database of information that would aid in the understanding of identification and purpose. On the program, relationships between artifacts, buildings, and landscape were combined. Inventories of civil and religious buildings create comprehension of city planning and Pompeii life. The IBM program also serves as a map to any fresco discovered thus far. The properties recorded include “1) the type of wall and the material and pigment used; 2) environmental data; earlier restoration activities, and analysis of chemicals employed; 3) damage by physical, chemical, biological agents and related analysis; and 4) graphic documentation and imaging.” All of this data provides continual support for the preservation and conservation efforts in Pompeii.

MODERN RESTORATION: RESEARCH AT THE ORTOLAN WORKSHOP

Conservation and preservation of frescoes is not just happening in unique places such as Pompeii, but throughout areas where frescoes are facing decay. As mentioned before, frescoes were a technique used commonly in construction practices to reinforce buildings while beautifying them. One such example of a city

---

63 Nappo, “Pompeii: Its Discovery and Preservation.”
and group dedicated to fresco conservation is the Ortolan Studio. The Ortolan Studio, led by Alma Ortolan was established in 1992 and completes an extensive range of conservation projects primarily in Italy. The studio is located in a 15th century palazzo in the historic center of Serravalle, Vittorio Veneto, Italy.

I performed research on the process of fresco at the Ortolan Studio in Vittorio Veneto, Italy working and studying alongside Alma Ortolan, an expert in the field of conservation of Italian fresco. The workshop included hands-on study of traditional fresco techniques. The studio’s mission is to preserve and continue this craft, supporting my interest in art conservation and preservation so that it can be enjoyed for years to come.

While at the Ortolan workshop, each morning we traveled to view original frescoes in-situ and modern conservation efforts on those frescoes. In the afternoon we created frescoes using materials from the region. Initial study pertained to traditional fresco creation techniques. In order to understand how to save a piece, one must understand how it is made. This understanding began with materials. There are twelve natural pigments in fresco (Figure 16). These pigments are collected from nature and stored as fine powder in jars in the studio. Additional hues are created both naturally and artificially. Naturally altered hues include burnt sienna, which is simply created by exposing the dry sienna pigment to an open flame. Mixing natural pigments or introducing additional synthetic materials creates artificial pigments. I learned firsthand the creation of fresco is an extremely time

---

sensitive endeavor. Before applying plaster, one must first prepare paint and tools. Mixing desired pigments with deionized water creates the paints. Deionized water is used in modern fresco creation to avoid impurities possibly found in the local water source.

Following the study of pigments, the plaster must be understood. There are three types of plaster used in the Ortolan studio. The initial layer is a mixture of lime and coarse sand. On a warm afternoon, this sand was collected from the Clagieron Caves, a local grotto embedded in the foothills of the Alps (Figures 17 and 18). The tools required for collection included a container for the filtered sand, a sifter to remove large rocks, and a trowel. Though this layer is meant to be rough, rocks exceeding half a centimeter must be removed. If too large, cracking and sliding of the plaster can occur. However, the mixture must remain gritty because the last layer requires teeth to hold on to. The second type of plaster is a mixture of lime and filtered sand. This plaster is meant to be smoother than the initial layer but still have some texture. This third type of plaster, made for the top, is a mixture of lime, extremely fine sand, and marble dust. The marble dust creates a soft, smooth, layer while adding a shimmer for the surface of the fresco. Most frescoes will have a shine due to the crystallization of lime as well. In order to prepare these different types of plaster, first the lime is put in a cup with gauze stretched across the mouth (Figure 19). This is to break apart the lime and filter out any larger pieces, thus making the mixture as smooth as possible. This lime is then mixed in a container with the desired sand mixture (Figures 20 and 21). A trowel is used to combine the elements. It is important to not only mix but also break down both the sand and plaster.
chunks so that they are completely incorporated together (Figure 22).

In some cases, pigment can be included in the plaster mixture. In order to fully understand the different types of layers, a method called *graffito* was introduced. Though not a traditional fresco painting technique, it aided in learning how the plaster behaved in the studio environment. In *graffito*, instead of painting on the finest layer, the finest layer was removed following its application in order to leave behind a design (Figure 23). As in a traditional fresco, the initial rough layer of plaster is applied and allowed to harden. When preparing the smoother type of plaster, either black or sienna pigment is added to the mixture. This is the layer that will be exposed when the work is finished. Finally, the finest layer of plaster is mixed and added to the fresco. These layers get thinner as applied. Once the plaster layers are at the perfect level of dry, then the drawing can be prepared. The test for the perfect level of dryness for the plaster is if a water droplet quickly absorbs on the surface. One can also test it to touch, however, gloves must be worn so that oils from the skin do not interfere with the carbonate crystallization.

Prior to preparing paints or plaster for the fresco, the method of “punching” is used in the Ortolan studio (Figure 24). The initial step, besides making sure all materials required are available, is determining the subject of the fresco. In the Ortolan studio, inspiration was found in numerous books of past fresco masters’ works. Once an image was chosen, a sketch was made of the desired fresco on a roll of paper. This sketch was made to the size of the available tile. Practice frescoes were completed on tiles instead of walls due to available material and portability. Following the sketch, tiny holes were punched with a needle on the drawn lines.
These holes were ideally about a centimeter apart and included only the outline of the drawing. When a fresco was later prepared and the plaster set, this punched paper was placed over the tile and a light dusting of a chosen pigment was spread across the paper. The color was chosen that would stand out against the base layer of paint. This was so that when the paper was removed, a dotted outline of the desired image remained on the tile.

This method was also used for traditional fresco painting. Plaster layers often took approximately fifteen minutes to crystallize. This time varied based on the temperature and humidity of the studio per day. During the Italian summer, heat exceeded 35°C with little breeze and therefore the wait was extended. The paintings were then built from dark to light, starting with the base layer. In fresco, small, short strokes are required. This is to allow the plaster to absorb the water in the paint. The strokes must also be light, putting little pressure on the brush as not to disrupt the crystallization of the surface. In the studio, Alma Ortolan described the proper time to paint a fresco from start to finish as the “golden hour.” About one hour is a good gauge for the plaster to be dry enough to add paint while still crystallizing to incorporate the paint.

By creating personal frescoes, potential issues were seen firsthand that result when the traditional techniques are not done properly. A few of my pieces reveal mistakes such as disruption of the crystallization on the surface, bubbling after applying plaster on an excessively wet surface, among others. Following understanding of fresco creation, the Ortolan conservation methods were then observed. While studying at the workshop in Palazzo Galletti, we traveled to various
conservation locations. Damage to frescoes in these locations occurred both through natural buildups of organic materials and through incorrect conservation efforts. Primarily, the Palazzo itself, which houses the studio, was a large conservation project. The Palazzo Galletti was constructed in the 15th century (Figure 25). At some point in time, the frescoes on the façade were painted over until they were discovered in 2006. The Palazzo is located in the historic center of Serravalle, and the detail of the façade confirmed the area’s cultural affluence and wealth of the time.\(^67\)

Just up the cobblestone streets from the Palazzo stands San Giovanni Battista Church. The church was constructed in 1367. The frescoes were added to the interior during the late 15th century. The local nobleman, Cristoforo Galletti, and his wife commissioned frescoes of San Nicola’s life in Gothic style. The artist was simply known as “Maestro of the Cappella Galletti.”\(^68\) At an unknown period in history, the frescoes were covered in a coat of plaster and lime, to disinfect the walls during a plague. The frescoes were not rediscovered until 1944, during the Second World War, after a bomb explosion caused some of the plaster to fall from the wall. Initial restoration projects were completed in 1949 and 1950. The 1950 restoration methods, however, did not follow modern restoration standards. Missing parts of the fresco and plaster wall underneath were filled with cement fillers and much of the original works were overpainted. In 1997, the Ortolan Studio undertook a second restoration of the church’s frescoes. Through this project, the cement fillers

---


and excess paint were removed. Layers of dirt and lime wash were removed as well. The gaps left were filled with freshly mixed lime, sand, and marble dust.\textsuperscript{69} This was the third and smoothest type of plaster created in the Ortolan workshop. It was imperative that both local materials and methods were used in order to fill the spots of the original fresco.

In order to complete the fresco and make the scene recognizable, Alma Ortolan explained the paintings were completed “according to principles of recognizability and reversibility.”\textsuperscript{70} The purpose of art restoration, conservation, and preservation is to respond to the degradation of art in order to expand and extend its impact. Though driven to sustain creativity, there are numerous aesthetic improvements and ethical drawbacks of altering art in order to extend its lifetime. For many frescoes, in-painting was the long accepted method as historians deemed completeness took priority over originality. In-painting essentially consists of connecting the dots of the original work and trying to match the style, material, and hue of paint to finish the work. However, modern conservationists value transparency in their work. Ortolan expressed the desire to make clear that parts were added to the frescoes instead of trying to disguise these additions and fixes as original work. For Ortolan, the chosen painting method is thus stippling (Figure 26). In the frescoes in San Giovanni Battista Church, empty sections were filled with small dots that matched the missing color. From a distance, the entire scene of San Nicola’s experience could be understood, however, upon close inspection it is clear what parts were not from the hand of the original “Master of the Capella Galletti.”

\textsuperscript{69} Ortolan, “San Giovanni Battista Church.”
\textsuperscript{70} Ortolan, “San Giovanni Battista Church.”
The Ortolan Studio retains funding to sustain conservation efforts through commissions and writing grant applications. A professional must provide sufficient research and a detailed plan when applying for funding. This purpose is to provide checks for the alterations so that irreversible damage cannot take place. Everything a conservationist does should be reversible as methods and technology develops.

Though not viewed while at the Ortolan workshop, the Ortolan studio has undertaken various other conservation projects primarily in collaboration with the Pontifical Commission for Sacred Archaeology (PCAS), the National Council for Research (ICVBC CNR), and the University Ca’ Foscari of Venice’s Department of Conservation. PCAS is based in Rome, and for the Vatican State, the Ortolan Studio took on a conservation project of the fresco paintings in San Tecla. San Tecla is a catacomb located close to St. Paul’s Basilica. The frescoes depict the Cubiculum of Apostles. Prior to conservation, calcium deposits were so thick that the scenes were unidentifiable. The frescoes are located in an underground chamber of the San Tecla compound. In this chamber, the temperature remains around 14°C and humidity around 98%. The conservation project was initiated in 2006. Initial methods involved micro-drills and scalpels, attempting to manually chip off the calcium deposits. In some conservation cases, gentle scraping of the initial layer is sufficient. However, in the case of the San Tecla frescoes, it was putting them more at risk than successfully removing the buildup. The Ortolan team, in collaboration with PCAS...
and ICVBC CNR, went back to further investigation of more advanced conservation methods. A laser system was chosen, making this project the first to use this technology in an underground chamber environment. The laser was loaned to the Ortolan team from the *Istituto di Fisica Nello Carrara del CNR di Firenze.*

Alma Ortolan and her team developed this technique for removing incrustations using medical lasers. The laser burns away the calcium without damaging the fresco layers underneath. According to Ortolan’s colleague and the project’s leader, Barbara Mazzei, “The laser can be calibrated to remove certain colours, in this case the white of the calcium, which just fell away. We are used to finding faded colours, but here they are exceptional.”

Advancements in technology allow conservationists to reverse outdated fixes and prolong the life of many frescoes. However, the challenges facing fresco conservation are all but over. As frescoes continue to be uncovered, more work needs to be conserved. Through study on Pompeii and at the Ortolan workshop, I gained insight into modern conservation regulations and developing techniques. Education on traditional techniques allows for more governmental regulation on the extent of conservation a piece can undergo. As learned from Alma Ortolan, modern perspective in the field accepts the idea of conservation being recognizable. It should not pretend to be the original masters’ work but instead provide a complete picture for the viewer and prolong the life of the work. In particular to fresco, this technique is needed to battle failing infrastructures, calcium deposit and buildup,

---

73 Trivellato, “St. Paul’s Ancient Face at Long Last Revealed.”
flaking of the surface, and reversing effects of improper past conservation. In order to preserve these masterpieces for years to come, the conservation world continues to grow and innovate, incorporating raw elements and hardening to the test of time, much like the frescoes they are saving.
Amrosi, Moira, Dei, Luigi, Giorgi, Rodorico, Neto, Chiara, and Baglioni, Piero.

_**Colloidal Particles of Ca(OH)2: Properties and Applications to Restoration of Frescoes.**_ Department of Chemistry and CSGI, University of Florence. 2001.

Retrieved from

http://pubs.acs.org.libsrv.wku.edu/doi/pdf/10.1021/la010269b


http://web.a.ebscohost.com.libsrv.wku.edu/chc/detail?sid=1f5bcd6f-b2d9-4fba-a507-2c894ac488686%40sessionmgr4003&vid=0&hid=4207&bdata=JnNpdGU%3d


APPENDIX

Figure 1. Fra Angelico, Virgin and Child, 1435, detached sinopia

Figure 2. Spring Fresco (detail, Lilies and Swallows), 1650 BCE

Figure 3. Michelangelo, Sistine Chapel, 1508-1512
Figure 4. Pompeii, Italy, 6th–7th century BCE

Figure 5. Map of Major Volcanoes and Plate Boundaries in Italy

Figure 6. Map of Mount Vesuvius eruption, 79 BCE
Figure 7. Streets of Pompeii, Italy, 6th-7th century BCE

Figure 8. Human figures discovered in Pompeii, Italy

Figure 9. Example of Fourth Style painting, Ixion Room, House of Vettii, Pompeii, 1st century CE

Figure 10. Peristyle of Villa P. Fannius Synistor, Boscoreale, Italy, 40-30 BCE

Figure 11. Villa Publius Fannius Synistor, Boscoreale, Italy, 40-30 BCE

Figure 12. Cement filler in Pompeii fresco following earthquake, 62-79 BCE
Figure 13. Scratches on Pompeii fresco following earthquake, 62-79 BCE

Figure 14. Scratch on Pompeii fresco following earthquake, 62-79 BCE

Figure 15. Burning on Pompeii fresco following volcanic eruption, 79 BCE

Figure 16. Alma Ortolan showing color palette, Vittorio Veneto, Italy, 2017
Figure 17. Grotte del Caglieron, Italy, 2017

Figure 18. Stephanie Wilhelm, Alma Ortolan, and Ann Molitor (left to right) at Grotte del Caglieron, Italy, 2017

Figure 19. Alma Ortolan measuring lime to prepare plaster, Vittorio Veneto, Italy, 2017
Figure 20. Sifting sand to prepare plaster, Vittorio Veneto, Italy, 2017

Figure 21. Measuring lime to prepare plaster, Vittorio Veneto, Italy, 2017

Figure 22. Stephanie Wilhelm mixing plaster, Vittorio Veneto, Italy, 2017

Figure 23. Example of graffito, Vittorio Veneto, Italy, 2017
Figure 24. Example of punching technique, Vittorio Veneto, Italy, 2017

Figure 25. Façade of Palazzo Galletti, Vittorio Veneto, Italy, 2017

Figure 26. Alma Ortolan, Stippling in San Giovanni Chapel, Vittorio Veneto, Italy, 2017