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Study of the Wall Paintings of the Cenador Del Leon in the Real Alcazar of Seville

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Abstract. The paintings on the walls of the Cenador del Leon located in the gardens of the Real Alcazar in Seville next to the Pabellon de Carlos V in the Jardin Ingles area have been studied. The components of the wall paintings cross-sections, which were prepared using small samples taken from the walls of Cenador del Leon, were characterized using infrared spectroscopy (FTIR), X-ray diffraction (XRD) and scanning electron microscopy (SEM) with energy dispersive X-ray (EDX) analysis. The cross-sections of the collected samples indicated that the paint layer is well adhered to the preparation layer without any discontinuity, and only one carbonation layer exists at the top of the sequence of layers. These data suggest that the paint was applied on a fresco surface, and therefore, the adopted technique was fresco. Based on the different elements detected by EDX analysis of the cross-sections, the detected pigments included iron oxides accompanied by clay minerals (or earths) in the red pink, golden yellow and yellow colours, blue smelt for the blue colour and basic copper chloride (atacamite) for the green colour. In one sample, the particles were composed of Ba and S from barium sulphate and Ti and O from rutile titanium oxide due to a modern pigment.

1. Introduction

The Cenador del Leon is located in the gardens of the Real Alcazar of Seville next to the Pabellon de Carlos V in the Jardin Ingles area. Designed in the 17th century, this garden is dominated by a pond and sculpture of a lion. The structure of the building recall the old typology of the Muslim “qubba” but interpreted as a transition to the baroque style this gives rise to its name. The simple volumes recall the old typology of the Muslim "qubba" but interpreted as a transition to the baroque language. The building is one of the most interesting examples of Sevillian Mannerism, where we also observe the influence of the “retablistica” of the time.

In 1644, the building was decorated with paintings by the painter Juan de Medina. Visual, architectural and landscape studies of the wall paintings in the gardens of the Real Alcazar have been performed. The wall paintings with iconographic compositions represent a dialogue with the architectural space and transmit a message in their images and contribute to the monumental character. In the Cenador del Leon, the fresco paintings contain a series of mythological subjects, grotesques and imitations of false marbles, and these decorations suggest that it is dedicated to love [1].

Figures 1, 2, 3, 4. From left to right: Interior elevations north, east and south, and view of the interior of the dome, of the wall paintings in the Cenador del Leon

Fresco and stucco techniques were used for the wall paintings in the Alcazar [2] [3]. The *fresco* is produced by applying pigments diluted in water to recently applied lime. During the drying process, the colour remains embedded in a crystallized surface layer of calcium carbonate. The term *stucco* refers to all the decorations in relief created with mixed mortars (i.e., mixtures of binders, such as lime and plaster, or other retardant additives, and in later epochs, mixtures of plaster and animal glue). In the Alcazar, most of the wall paintings appear to have been made using early fresco techniques, distinguishing them from wall paintings that exist in the *Mudejar Palace*. Therefore, we were motivated to analyse the difference between the two techniques [4].

Observation and analysis methods can provide detailed and accurate information on archaeological artefacts to identify the range of pigments available on local and regional scales or understand the techniques of colour preparation and applications through the centuries [5-10]

Cross-section samples taken from the artworks are helpful for identifying all the components of a painting from the foundation to the surface. These samples are characterized by using experimental techniques, such as micro Fourier Transformed Infrared (micro-FTIR), X-ray diffraction (XRD), and scanning electron microscopy (SEM-EDX).

In this study, we combined XRD that was performed directly on the samples and infrared spectroscopy and SEM-EDX characterization of cross-sections to characterize the technique and polychrome of a selection of wall paintings from Cenador del Leon. Our analysis offers additional information on the history, confirming the attribution of the wall paintings. In addition, we determined the various kinds of materials from the different construction and restoration steps to determine if they were modified over time due to alteration, providing key information for their further conservation.

2. History and description of the wall paintings in the Cenador del Leon

The Jardin Nuevo o del Leon was the last garden created in the Modern Age in the Alcazar. This garden was created from the Huerta de la Alcoba, and the works were managed by the master Juan

Bernardo de Velasco from April 1638 to December 1639. This garden consists of a rectangular space separated by a wall from the rest of the garden. The Jardin Nuevo o del Leon includes a pool and a waterwheel. During the construction of the garden, the pool was improved by building the Cenador del Leon.

In the following years, two important buildings were constructed in this garden including the Pabellon del Leon and the Pabellon Ochavado, which were both works of the master Diego Martin Orejuela. The buildings were built in anticipation of a visit from D. Luis Mendez de Haro and Guzman, nephew of the Count Duke and the heir of the Alcazar´s Alcaidia.

The new pavilion was conceived similar to a Muslim “qubba” but with baroque language. The new deck consists of a dome on a high tambour supported by pendentives. The surface of the dome is covered with white and blue ceramic tiles. With beautiful proportions, its facade and internal space are in the Mannerist style. The flooring completes the pavilion but it was possibly modified because the original flooring was completed by the painter Juan de Medina according to the technique introduced a few decades earlier in Seville by Niculoso Pisano and built by the Valladares family. Currently, the floor of the pavilion contains a few ancient tiles. However, more tiles are most likely contained in the pool linings.

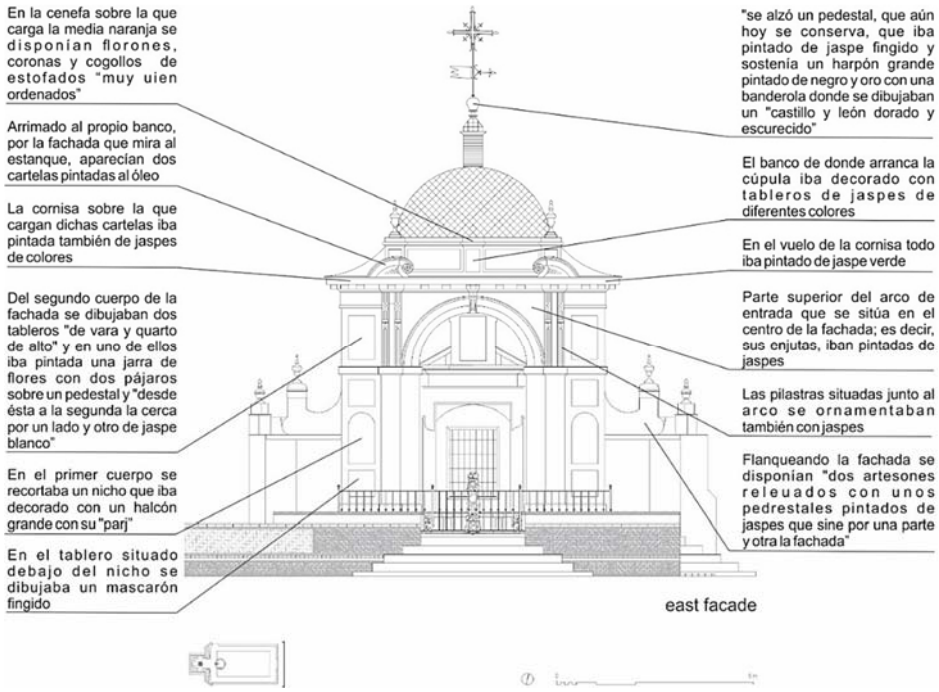

Figure 5. Drawing of exterior wall paintings from 16th century in the Cenador del Leon according the report of Juan de Medina [1]

The walls of the finished Pabellon del Leon were painted by Juan de Medina between November 1644 and January 1646. In this study, an interesting "Memorial" written by the painter and a document on the works done in the Alcazar observer were found. These documents allowed us to identify the ancient paintings due to their descriptions. The ornamentation of the pavilion was achieved with various techniques (i.e., fresco and temper). However, today, the paintings are so transformed that the original figures cannot be observed. The paintings contained mythological themes, puttis, perhaps grotesques and many imitations of false marbles (figures 5 and 6). These are the examples of Renaissance painting, which continued in Spain until the middle of the 17th century. Until the end of the 18th century, painting using the fresco technique continued in the religious and civil architecture of Seville as well as in the Alcazar.

Currently, some fresco paintings remain but their exact ages are unknown. In addition, these paintings may not be the originals. Most of these paintings are blurred by the damp, and up to a metre and a half from the floor, these painting are erased via capillarity. The conserved royal shield of the reign of Felipe IV is not included in the Memorial of the original paintings, which was written by Juan de Medina in 1645. According to the Memorial, in place of the royal shield, a pagan goddess was represented. In the 18th century, the wall paintings were most likely restored because the King's Court remained in the Alcazar of Seville for five years. Finally, the works may have been repainted in contemporary times (i.e., the 19th or 20th century).

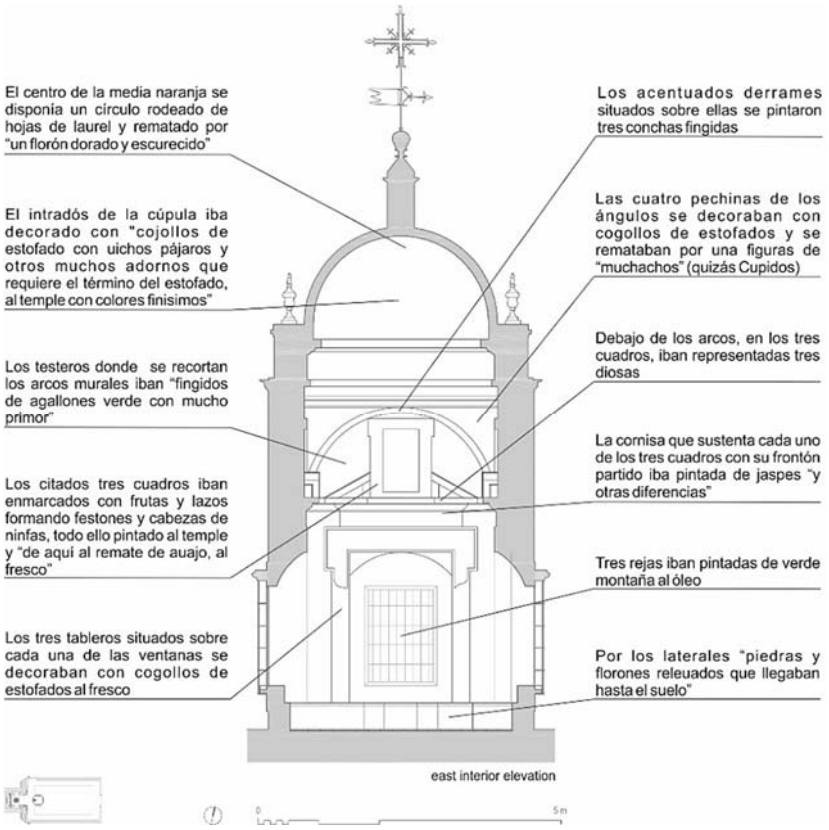

Figure 6. Drawing of interior wall paintings from 16th century in the Cenador del Leon according to report of Juan de Medina [1]

In the interior and exterior of the pavilion, some remains of fresco paintings simulating marbling and marbling ashlars with different colours are preserved. In the wall paintings, the shield of king Felipe IV in front of the arch of access, puttis borders on the interior frames of the windows, and vegetal elements in the “albanegas” of the interior vaults over the windows can be observed. The rest of the walls have mouldings and whitewashed walls in white, yellow "calamocha", and red "almagra".

3. Experimental

3.1. Materials

Six samples of the wall painting (M-3, M-4, M-5, M-6, M-7 and M-8) were taken (figures 7 and 8).

In addition, powder was taken from the wall painting (sample 9), crust was taken from the ceramic located on the floor near of the fountain (sample 1), and mortar was taken from the wall (sample 2).

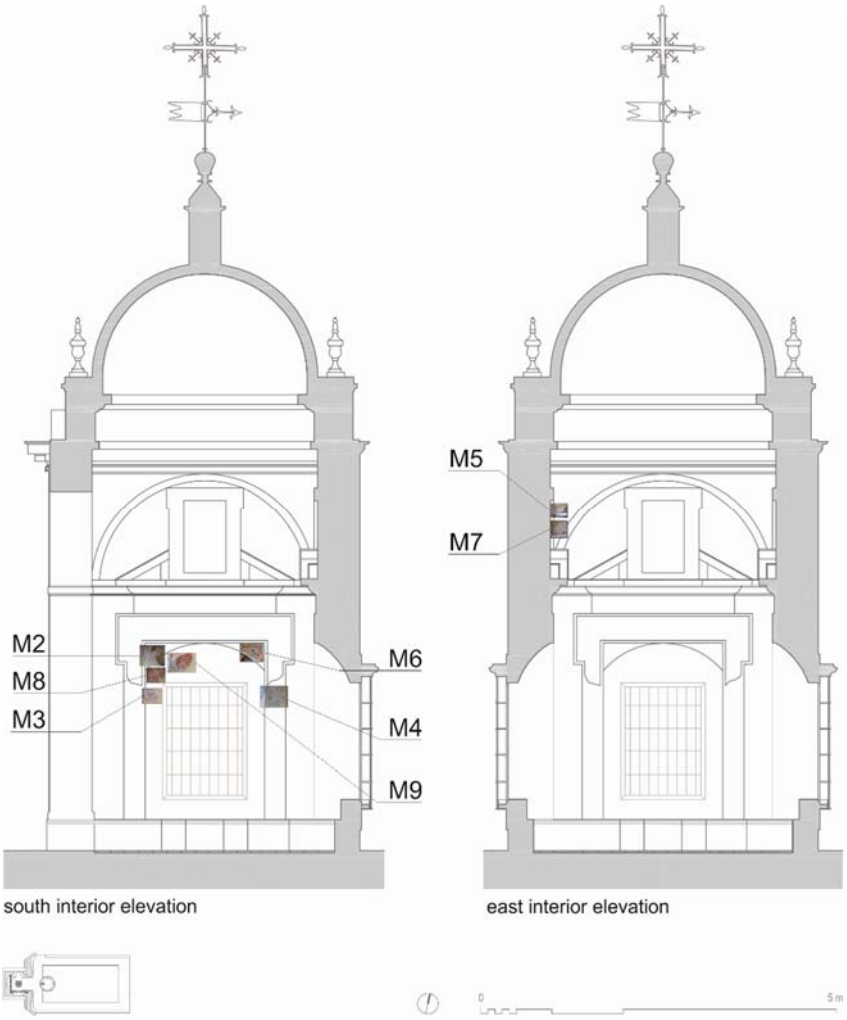

Figure 7. Samples of wall paintings in the Cenador del Leon: M3, blue fresco paint; M4, pink fresco paint; M5, red fresco paint; M6, green fresco paint; M7, golden yellow fresco paint; M8, red fresco paint; and M9, powder covering the wall painting.

3.2. Methods

The cross-section samples were prepared according to the methodology described by Khandekar (2003) [11]. After embedding in resin, the cross-sections were examined and analysed with laboratory instruments to systematically study the materials in the different paint layers. The samples were imaged using an optical microscope (Nikon OPTIPHOT). A HITACHI S-4800 SEM equipped with a Link ISIS EDX analyser (accelerating voltage 20 kV) provided high-resolution images and elemental analyses of the cross-sections. XRD was used to study small extracted samples prior to preparation of the cross-sections. X-ray powder diffraction was performed on a PANalytical X'PERT Pro MPD diffractometer using $\lambda = 1.54$ Å at 45 kV and 40 mA as well as a solid-state detector PIXcel. The Fourier transform infrared study was performed using a Jasco FTIR 6200.

4. Results and discussion

The cross-section (figure 8) that was prepared with the extracted fragments was studied using SEM-EDX to investigate the various layers that make up the wall painting.

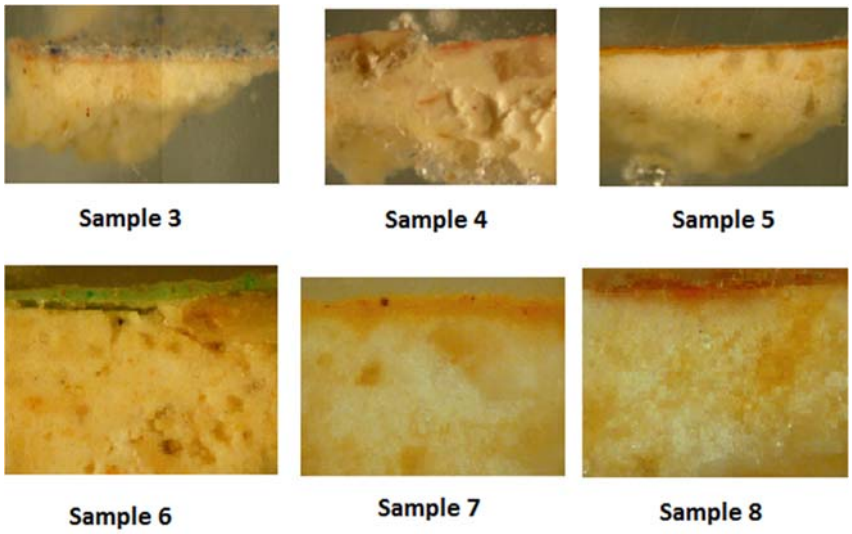

Figure 8. Cross-sections of samples 3, 4, 5, 6, 7 and 8

Characterization of colour layers observed in the cross sections

Sample 3. Blue colour

A thin layer exists on the top of the cross-section (figure 8) and consists of a mixture of blue and white particles. The blue particles are composed of Si, Ca, Fe and Co. The Co is responsible for the blue colour (figure 9a). The composition is typical of a ceramic glassy phase. Arsenic was also detected due to the presence of cobalt arsenide pigment, which is used to obtain the blue colour of the ceramic. The white particles are composed of Si, Ca and K (figure 9b) due to the presence of silicates and calcite. This layer is deposited over a thick white layer composed of Ca (from calcite) and a small proportion of Si (from quartz) (figure 9c). The presence of calcite and quartz was confirmed by FTIR (figure 14a) and XRD analyses.

Sample 4. Pink colour

The cross-section of this sample (figure 8) is composed of two layers: one of them thin and pink, and the other one thick and white. The pink colour is composed of a high percentage of Ca accompanied by Si. Fe is also present (figure 10a) and responsible for the pink colour. The thick white layer is composed of a high proportion of Si accompanied by Ca, Al and Mg (figure 10b). Particles containing Si have also been detected. In addition, calcite and quartz were detected using FTIR and XRD analyses.

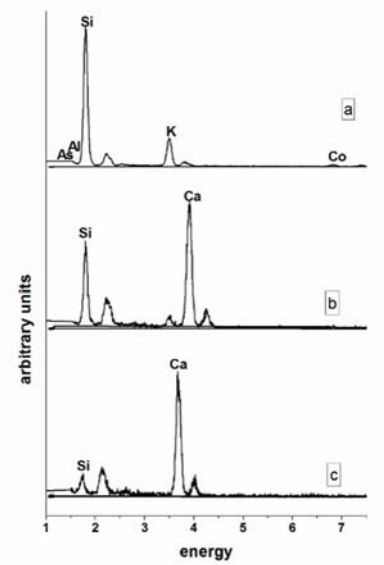

Figure 9. EDX analysis of sample 3.

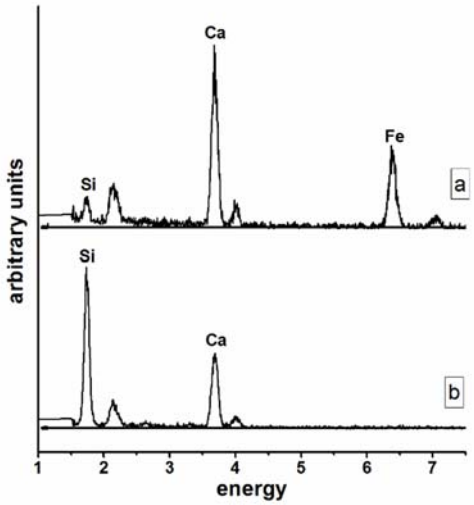

Figure 10. EDX analysis of sample 4.

Sample 5. Red colour

Two layers were observed in the cross section (figure 8). Fe has been detected as the pigment in the red layer (figure 11a). In addition, the particles were composed of Ba and S due to the presence of barium sulphate (figure 11b) as well as Ti and O due to rutile titanium oxide in a modern pigment (figure 11c). The composition of the thick white layer is similar to that of previously studied samples. The calcite and quartz in this layer were confirmed by FTIR analysis (figure 15c).

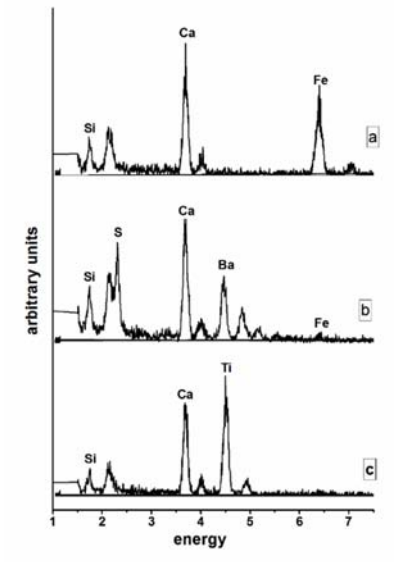

Figure 11. EDX analysis of sample 5

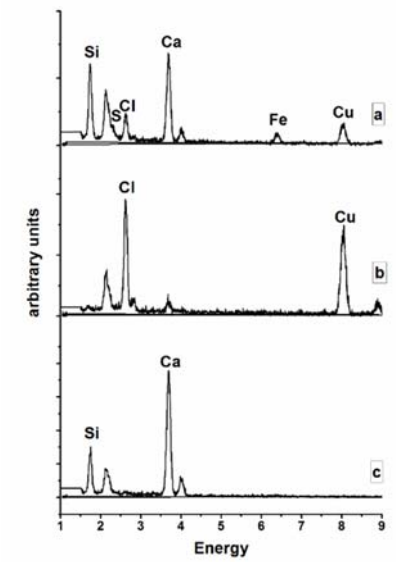

Figure 12. EDX analysis of sample 6

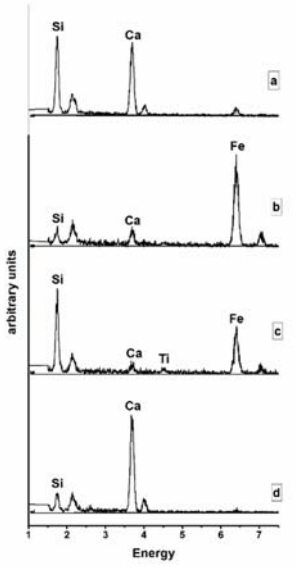

Figure 13. EDX analysis of sample 7

Sample 6. Green colour

Two layers were observed in the cross-section of this sample (figure 8). The thin green layer is composed of Si, Cl, Ca, Fe, Cu, and S (figure 12a). The Cu and Cl were due to basic copper chloride

(atacamite, $Cu_2Cl(OH)_3$) (figure 12b). Other particles were composed of Si, Ti and Fe. S and Ca have also been detected in low proportions due to the presence of gypsum. The white layer possessed a composition similar to that in the other white layer studied in this manuscript (figure 12c). The XRD and FTIR results confirm the presence of calcite and quartz in high and low proportions, respectively. A mapping showing the distributions of the different elements present in the green layer is shown in figure 14. The Cl appears along with Cu in only in some zones of the sample.

The Fe and Si also accumulated in the same zone of the photo.

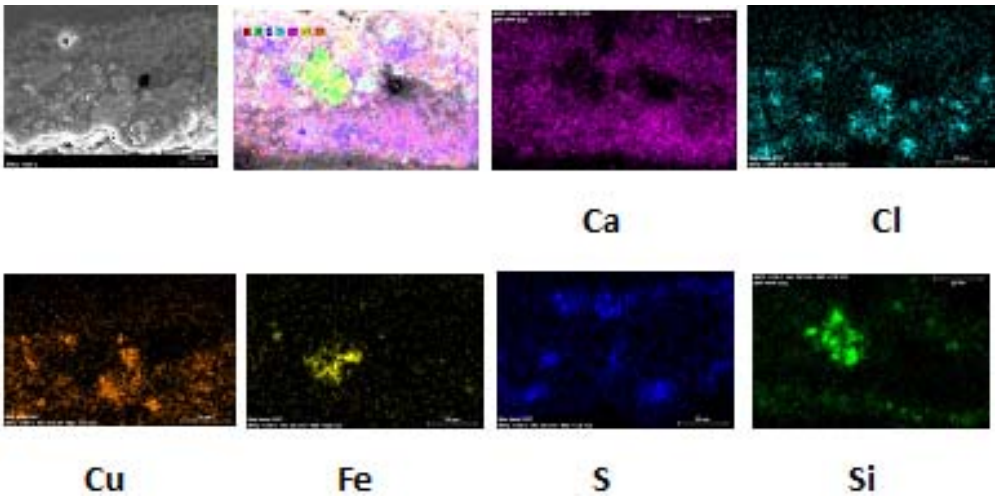

Figure 14. Mapping of the elemental chemical distribution of sample 6.

Sample 7. Golden yellow

Two layers were observed in the cross section of this sample (figure 8). The thin colour layer is composed of high and medium amounts of Si and Ca, respectively, along with Fe (figure 13a). Some particles were composed of Fe (figure 13b), which is responsible for the colour. In addition, some particles were composed of Si and Fe along with a small percentage of Ti (figure 13c). The white layer possessed a composition similar to that of the other white layer studied in this manuscript (figure 13d).

Sample 8. Red colour

This sample (figure 8) has a composition similar to that of sample 5.

Sample 9. Powder covering the wall painting

The FTIR spectrum of this sample is shown in figure 15b.

In this sample, products associated with environment contaminants produced by environmental pollutants in the urban atmosphere near the Cenador del Leon have been detected as previously described [12].

The FTIR study (figure 15b) of sample 9 indicates the presence of absorption bands that correspond gypsum (1.143 cm^{-1}) carbonates (1.443 cm^{-1}), silicates (1.030 cm^{-1}), nitrates (1.316 cm^{-1}) alkanes (2.986 cm^{-1}) and fatty acids (1.633 cm^{-1}). These products formed by environmental contamination produce hydration, dehydration and migration of salts, causing disintegration of materials and the formation of efflorescence.

The XRD patterns for samples 1 and 2 are shown in figure 16. The results for sample 1 indicated the presence of calcite produced by the evaporation of water from the fountain that was sprayed on the floor of the Cenador del Leon. Sample 2 is composed of calcite and quartz.

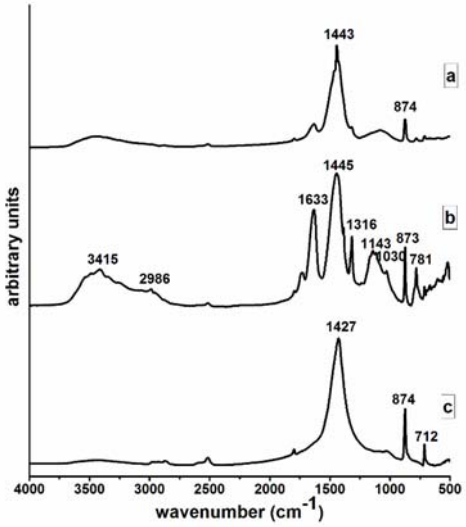

Figure 15. FTIR. a) White colour layer in sample 3 b) powder sample 9, and c) white layer in sample 5.

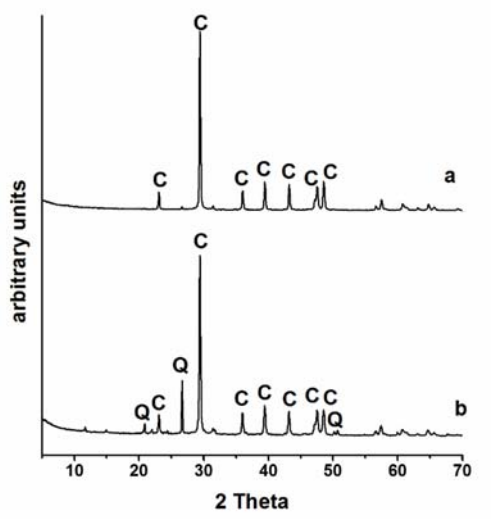

Figure 16. XRD diagrams: a) sample 1 and b) sample 2. C=Calcite, Q=Quartz.

5. Conclusions

The differences between fresco and lime painting techniques of these wall paintings are based on the cross-section sequences and the presence of a carbonation layer. The cross-sections and SEM-EDX results of the studied samples indicated that the paint layer is well adhered to the preparation layer without any discontinuity, and only one carbonation layer was present at the top of the sequence of layers. In addition, a thin carbonation layer between the plaster, and painting films are not clearly present. These data suggest that the paints were applied on a fresco surface, and therefore, the adopted technique was fresco [13].

The detected pigments included iron oxides accompanied by clay minerals (or earths) for red pink, golden yellow and yellow colours, blue smelt for blue colour and basic copper chloride (atacamite) for green colour.

The Seville Alcazar has undergone several restorations over time with various levels of success. Similar to all monuments, this garden is constantly subject to conservation work. The detected barium sulphate and titanium oxide were due to a restoration.

Time and successive restorations have erased much of the pictorial decorations of the pavilions, fountains and walls of the gardens of the Alcazar. Currently, a whitewashed image of "calamochas" and a reddish colour are present, which is a very different landscape from that in the 18th century.

Acknowledgments

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