Conservation of Roman Wall Painting Fragments from Issa: Research and Reconstruction of the Original Scheme

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1. Introduction

Issa is an archaeological site located on the island of Vis, Croatia and was established in the 4th century BC. Issa was the largest independent Greek colony in the Adriatic Sea until 47 BC, when it was conquered by the Romans.

Once the Romans took control of Issa, a large part of its Hellenistic culture was irrevocably altered. This occurred due to the arrival of a significant number of Romans, and numerous of battles. Despite this, Issa remained an important town, having a highly organized public area along its harbor, while the upper part of the town was mainly built and organized for residential use.\(^1\)

2. Archaeological site

In 2012 and 2013, extensive archaeological research conducted on the edge of the southeast side of the city revealed remains of antique insula with remains of two houses\(^2\) (Figure 1).

\(^1\) B. Kirigin, *Issa*, 1996

\(^2\) B. Čargo, *O urbanizmu Isse*, 2016
In one of the houses a significant number of fragments of wall paintings and stuccowork was found. Originally built during the Hellenistic period, after the arrival of the Romans the house received a new storey and was most probably decorated with wall paintings and stuccowork\(^3\). After the collapse of the house, the fragments remained buried for c. 2000 years. This is the main reason why at the moment of discovery they were mostly intact and in a good state of preservation. It is believed that a systemic recording, conservation and reassembly of the now scattered fragments will result in one of the most significant examples of Roman wall paintings in the area. Unfortunately, due to the extensive number of fragments, only one third of them have received conservation treatment so far.

### 3. Documentation

The first and foremost step of every accurate conservation process proper is documentation. Due to the large amount of fragments which had to be recorded and the importance of documenting the paint layer as accurately as possible, it was decided that

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\(^3\) B. Čargo, *O urbanizmu Isse*, 2016
the best documentation method would be digital scanning of each fragment. The fragments were scanned with the *Tiffen* color control patch and measuring scale, as references, which guarantees the uniformity of criteria in the evaluation of colour tones (Figure 2).

![Figure 2. A scanned fragment (Photo: M.L. Bošković, November, 2015)](image)

Before scanning, all fragments were cleaned from surface dirt, with brushes and a wet sponge. Each item was labelled with a tracking number.

4. **Fragments**

The excavated material was transported to the Department of Conservation of Wall Paintings and Mosaics Studio at the Arts Academy in Split in 27 fragile wooden crates (Figures 3, 4).
The first step was to buying firmer plastic crates, into which the fragments were moved with respect to their original layout and archaeological documentation (Figure 5).

Around 1620 fragments of wall paintings and 40 fragments of stucco were placed in 27 crates.

The fragments were in relatively good condition. This applies in particular to the surfaces executed in *buon fresco* technique, where pigments make permanent bond to the plaster due to carbonation of lime. However, part of the painted surfaces were made in *fresco secco*, probably to facilitate the production. There were cracks of various sizes and other small mechanical damages to the surface of the fragments. The plaster was brittle due to the loss of the binding properties of lime.

The fragments are of various sizes and the painted surfaces are of different colours. Although most of them are in monochrome, or decorated with simple geometric patterns, many fragments depict everyday objects, such as candle holders or antique plates, while some depict floral and animal motifs. However, the fragments with parts of mythological characters of high artistic quality attracted greatest attention (Figure 6).
5. Laboratory analyses

In order to obtain information about the techniques and materials used, and to establish the possible presence of harmful compounds, laboratory analysis of pigments, plaster and soluble salts was carried out.

5.1. Pigments

Seven samples with red, blue, yellow, green, white, purple and pink pigments were taken from different fragments. The analysis was made using Fourier Transform Infrared Spectroscopy (FTIR). By comparing the obtained results with the spectra database of ancient pigments, the presence of earth and mineral pigments typical of Roman wall paintings was confirmed. Terra di Siena was used for the red pigment, azurite for blue, ochre for yellow, green earth for green and chalk for white\(^4\). Other colours such as purple, pink or orange were obtained by mixing these basic pigments. (Table 1).

Table 1: Pigment Analyses of the paint layer

\(^4\) FTIR analysis was made by Josipa Marić, (FT-IR analize uzoraka pigmenata s fresaka i kamenih umjetnina, Umjetnička akademija Sveučilišta u Splitu, September, 2016)
<table>
<thead>
<tr>
<th>Sample Code</th>
<th>Color</th>
<th>Pigment</th>
</tr>
</thead>
<tbody>
<tr>
<td>S_8_U_57</td>
<td>red</td>
<td>terra di siena</td>
</tr>
<tr>
<td>S_1_U_8</td>
<td>blue</td>
<td>azurite</td>
</tr>
<tr>
<td>S_1_U_4</td>
<td>green</td>
<td>green earth</td>
</tr>
<tr>
<td>S_1_U_2</td>
<td>yellow</td>
<td>ochre</td>
</tr>
<tr>
<td>S_3_U_33</td>
<td>white</td>
<td>chalk</td>
</tr>
<tr>
<td>S_1_U_3</td>
<td>pink</td>
<td>terra di siena</td>
</tr>
<tr>
<td>S_1_U_3</td>
<td>purple</td>
<td>mixture of pigments</td>
</tr>
</tbody>
</table>

5.2. Plaster
The plaster sampling was carried out on the cross-sections of three small fragments. The samples were mounted in a mixture of epoxy resin and catalyst. After the resin had set, the samples were cut, polished and scanned using Dino Lite Electron microscope (Figure 8).

It was found out that the samples were composed of two layers of plaster. The analysis also revealed the aggregate composition of various types and sizes of grain. Different kinds of sandstone, pebbles, parts of shellfish, remains of carbons and remains of yellow, red and grey mineral pigments have been identified. Lime clusters, admixtures of limestone and sand, and small structural cracks have also been noticed and examined. Average size of aggregate particles in the samples is c. 0.3 mm.

5.3. Salts

Knowing that the structure of plaster could contain harmful soluble salts, originating from soil or already present in plaster due to the use of sea sand (which in this case was very likely considering the vicinity of the sea), the presence of chlorides was suspected.

For the detection of possible chlorides presence the reagent of silver nitrate was applied to 14 samples (from various excavation sectors). The test was made after the samples had been immersed in distilled water and left to soak for six days. First, the aqueous
extract as acidified with concentrated nitric acid, and then a few drops of silver nitrate were added. If chlorides are present cloudiness with white sediment of silver nitrate occur.

Since the cloudiness didn’t occur, it was concluded that chlorides were not present in the fragments’ structure. (Table 2).

*Table 2: Chloride presence in samples*

<table>
<thead>
<tr>
<th>Sample</th>
<th>The date of immersion in distilled water</th>
<th>Mass of the sample (g)</th>
<th>The date of the analysis</th>
<th>The results of the analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ua (S_1_D-6')</td>
<td>22.2.2017.</td>
<td>11.27</td>
<td>23.2.2017.</td>
<td>-</td>
</tr>
<tr>
<td>Ub (S_1_D-6')</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ua (S_24_F-6')</td>
<td>22.2.2017.</td>
<td>8.78</td>
<td>23.2.2017.</td>
<td>-</td>
</tr>
<tr>
<td>Ub (S_24_F-6')</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ua (S_13_E-6')</td>
<td>22.2.2017.</td>
<td>6.53</td>
<td>23.2.2017.</td>
<td>-</td>
</tr>
<tr>
<td>Ub (S_13_E-6')</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ua (S_6_D-6')</td>
<td>23.2.2017.</td>
<td>5.57</td>
<td>1.3.2017.</td>
<td>-</td>
</tr>
<tr>
<td>Ub (S_6_D-6')</td>
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<td></td>
<td></td>
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</tr>
<tr>
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<td>5.91</td>
<td>1.3.2017.</td>
<td>-</td>
</tr>
<tr>
<td>Ub (S_10_F-6')</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ua (S_12_F-6')</td>
<td>23.2.2017.</td>
<td>6.95</td>
<td>1.3.2017.</td>
<td>+</td>
</tr>
<tr>
<td>Ub (S_12_F-6')</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ua (S_23_D-5')</td>
<td>23.2.2017.</td>
<td>7.6</td>
<td>1.3.2017.</td>
<td>-</td>
</tr>
<tr>
<td>Ub (S_23_D-5')</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Other ten samples were used to check the presence of sulphates and nitrates. This time the samples soaked in distilled water for 13 days. The sulphates presence was tested by adding 4 mL of sulphate reagent and a small amount of BaCl₂·2H₂O to the bathwater. The absence of cloudiness proved that sulphates were not present in the fragments. The presence of nitrates was tested by pouring the sample of allegedly contaminated bathwater into a glass with acid for nitrates. Subsequently, 5 mL of dimethylphenol were added to each glass. If nitrates are present, the water turns reddish. The absence of reaction proved that nitrates were not present. Since neither sulphates nor nitrates were found, there was no need for the desalination of the fragments (Figure 9).
6. Cleaning tests

When excavated, all fragments were soiled, and a certain number of them was covered with mostly loose deposits. Other fragments were covered with firmly adhering deposits of calcite and carbonate origin (incrustation) which occur due to the melting and precipitation of inorganic material. In some cases, the deposits had to be removed in order to see which pigment or motif was beneath (Figure 10).
6.1. Mechanical cleaning

Cleaning tests were started using mechanical methods and tools such as scalpels, brass brushes, toothbrushes, Wishab sponges, glass fibres and electric micro grinder. The deposits were of variable thickness. Although this time-consuming cleaning method has yielded good results, it was concluded that its applicability to large amounts of material was highly questionable. Namely, it was reckoned that, using this method, it would take around 90 minutes to clean one fragment of average size (Figure 11, 12).
6.2. Solvents

First, tests with different solvents were made, in order to find the most appropriate solvent for the softening of the deposits. First, internment washing with different times of exposure was applied. It was found out that longer exposure periods gave better results. Still, the results were not satisfying. The other possible solution to the problem were poultices. Vulpex (5%) in water, Vulpex (5%) in White Spirit, Ionex OH (20%) in water and BGD 86 were tried. The softened deposits were removed mechanically. Mixtures of two solutions gave better results. Of these, Vulpex in White Spirit gave the best results.

6.3. Gels

Gels are used when it is necessary to control the penetration depth of the solvent in order to preserve the paint film, or when the deposit that needs to be removed represents a thick and often hard layers. The efficacy of several gels was tested: AB57 (recommended by P. Mora)⁵, EDTA, the main component of AB57 and LNE, and NTA gels. The test was carried out on four fragments and gels were applied with a brush to small test areas (Figure 13).

![Figure 13. Gel cleaning tests (Photo: M.L.Bošković, February, 2016)](image)

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⁵ MORA, Paulo, MORA, Laura, Conservation of Wall Painting, 1984
First, the gels were applied for four minutes, and then the exposure time was extended to eight minutes. After four minutes, AB57 showed the best results on all fragments. In this way over 50% of thick deposits in test areas were removed. After eight minutes, EDTA also showed relatively good cleaning, while LNE and NTA didn't give satisfying results.

6.4. Laser

Laser cleaning was tested on tough calcite and carbonate deposits\(^6\). The principle of laser operations lies in different wavelengths: When the wavelength of the ray corresponding to a certain colour recognizes the adjusted colour on the treated material, strong energy which cleans dirt surface is emitted. (Figure 14).

\(^6\) Smart Clean 2 was used for cleaning tests
But, since the polichromy, especially that of *secco* paintings, is very sensitive, it is of great importance to adjust the appropriate specific frequency and pulse energy according to the type and thickness of the deposit.

For the purposes of testing, five fragments with deposits of various thickness and pigments were chosen. With adjustments in average power, frequency and pulse energy, laser has showed different cleaning results. For example, in the case of the blue background with shapes in red and green, the deposits were successfully removed from the red, while the green pigment was slightly damaged by the used energy of 1800 J.

7. **Assembling of the fragments**

In order to re-join the fragments, or at least to place them within a schematic context, fragments with the dominant colour were taken from the crates and placed on the table (Figure 15). Each of them was marked with a documentation label of the crate from which it was taken. Joining the fragments together, albeit the most interesting stage of the project, was neither fast nor simple. Doing such operations, the restorer often can’t be completely sure in which way to proceed. In this case, the fact that only one third of the archaeological material was available made it even more difficult. Mechanical damages to the edges of the fragments, discoloration of the paint layer, but also the lack of funds and appropriate work space additionally complicated the process.

*Figure 15. Assembling process (Photo: M.L. Bošković, May, 2017)*
With the assembling of fragments the iconography of the figural scenes became somewhat more clear, and certain conclusions about the original scheme could be drawn, e.g. the position of a certain coloured field on the wall. Namely, it was discovered that a blue field was conjoined with a purple field. The scenes were usually framed by red-white-blue or red-white-green borders. The place of the stuccowork was probably above the scenes, in the upper parts of the walls, and slightly rounded fragments were probably positioned at the bottom of the walls.

Of the fragments with red background, the biggest attention caught two naked winged humanoid figures placed next to a peacock (Figure 16), and the portrait of Silenus, companion of Dionysus, god of fertility and wine.

![Figure 16. Depiction of mythological character with peacock (Photo: M.L. Bošković, June, 2017)](image)

Other fragments depict gold and green antique plates, candle holders, golden tendrils and garlands. Among the fragments with blue background, motifs depicting green foliage and columns of various colours are common, while several fragments contain parts of naked male body (Figure 17).
On many fragments with green and purple backgrounds human body is depicted, and when they were assembled, three different figures emerged: a man with hair ornaments and flowers (Figure 18), portrait of man character to whom probably belongs the squeezed fist, and parts of a naked female body, all on green background; and a man with long hair, dressed in green robe and a part of a male arm carrying shield, which possibly indicates a battle scene, on purple background.
The fragments with yellow background are more ornamental and less narrative. Although they are generally characterized by geometrical patterns in reddish hues, some carry foliage and floral motifs of high artistic quality, and unidentified round shapes (Figure 19).
The comparison of the Issa paintings with the Pompeian wall painting styles, reveals a striking similarity with the Third style (20 BC – 45 AD), which is characterized by dimensionality, fields separated by borders, columns and tall tendrils, mythological characters, floral garlands and candle holders\(^7\).

8. Storage

During the process of re-joining, the motifs were photographed with the *Tiffen* colour control patch. Due to the current unavailability of the remaining material, it was decided to put the fragments (including joined ones) back in the crates that are now organized by background colour and motifs. The fragments were laid on bubble wrap, or faced down in order to avoid mechanical damage to paint layer and plaster. (Figure 20).

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\(^7\) A.Barnes, *Paintings in Roman Pompeii: Differences in public and private areas of the home*, 2008
9. Conclusion

More accurate answers to the questions whether all of the four walls and the ceiling were painted or not, and how many painted fields/panels there actually were, will hopefully be available after digitalization and analysis of the complete material.

After the complete material is recorded and the soluble salts analysed, all surface deposits will be removed, allowing the process of reassembling of fragments to begin. But prior to any further work taking place, an appropriate work space and work materials should be secured. The reassembling of the original scheme could be done in large sandpits where the fragments would be safely stored and organized. However, due to their extensive number it is planned to develop a computer program which would facilitate the processing of images by categorizing scanned fragments according to shape, size, colour and/or motif. Once the assembling process is completed, the optimal way to display the project will be decided.

Bibliography


KIRIGIN, Branko, Issa, Zagreb: Matica hrvatska 1996.

BARNES, Ashley, Paintings in Roman Pompeii: Differences in public and private areas of the home, 2008.


ČARGO, Boris, O urbanizmu Isse, 2016.

MARIĆ, Josipa, FT-IR analize uzoraka pigmenata s fresaka i kamenih umjetnina, Split: Umjetnička akademija Sveučilišta u Splitu, rujan 2016.

VAHUR, Signe, Expanding the possibilities of ATR-FT-IR spectroscopy in determination of inorganic pigments, doktorska disertacija, Tartu-University of Tartu, 2010.

DONELLI, Ivo; MALINAR, Hrvoje, Konzervacija i restauracija kamena, Split: Umjetnička akademija Sveučilišta u Splitu, 2015.