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# Filling and retouching techniques in outdoor tiles with saline efflorescence problems. A case study

Sara Isabel da Silva Botelho de Araújo

**Abstract:** This article will be focusing on a retouching conservation and restoration treatment, of two figurative ceramic tiles panels belonging to the Baroque artistic period. The ceramic tiles of blue and white colors dating from the final of the 18th century are inserted in a relevant historical period for the Portuguese tiles art entitled *Grande produção Joanina*. The purpose of the intervention was the return the readability of the scenes in the panels, without hiding major signs of degradation. This conservation treatment was made within a rehabilitation project of the building that holds them, which had its own intervention criteria and in which the conservation criteria had to fit. One of the issues during this case study, was to find a commitment between the conservation ethical approaches, considering the panels will continue to be exposed outdoors and there are soluble salts present on the wall where they are settled. The intervention criteria chosen was made, using diverse solutions within materials and techniques such as the application of new ceramic elements, filling gaps with lime mortars and al fresco retouching. A capillarity and permeability based method was used to fill the glazed gaps. Retouching methods were tested including neutral tone or continuing the shapes and tones. In the end al fresco retouching method was chosen and the preparation of the new ceramic elements supported by a study of graphic and photographic documentation, completing the big gaps in the panels. The results of the chosen al fresco technique show a satisfactory level of mimicry, enough to return the readability of the panel. This technique revealed to be suitable for the retouching of ceramic substrates affected by soluble salts. The reading of the scene panels became passively also, by completion the missing parts, with the introduction of new elements what, was achieved with success too.

**Keywords:** outdoor tiles, baroque ceramic tiles, retouching, al fresco, salts, scene reconstruction, rehabilitation, lime mortars, readability

## Técnicas de relleno y retoque en azulejos de exterior con problemas de eflorescencias salinas. Un caso de estudio

**Resumen:** El presente artículo se centra en el tratamiento de reintegración cromática de dos paneles de azulejos figurativos pertenecientes al periodo artístico barroco. Los azulejos de color azul y blanco, datados de finales del siglo XVIII, se insertan en un periodo histórico relevante para el arte de la azulejería portuguesa conocido como *Grande Produção Joanina*. El objetivo de la intervención era recuperar la lectura de la obra sin ocultar los signos de degradación más acentuados. Los trabajos de conservación de los revestimientos de azulejería estaban contemplados dentro del proyecto de rehabilitación del propio edificio, con unos criterios ya establecidos sobre los que los criterios de conservación tenían que ajustarse. Una de las dificultades planteadas durante este caso de estudio fue encontrar el equilibrio entre los principios éticos de conservación, teniendo en cuenta que los azulejos continuarían expuestos al aire libre sobre paredes con presencia de sales. El criterio de intervención seleccionado empleó diversas soluciones entre materiales y técnicas, como la aplicación de nuevas piezas cerámicas, el estucado de lagunas con morteros de cal y la reintegración cromática al fresco. El método seleccionado para el estucado de las lagunas de vidriado fue basado en la capilaridad y permeabilidad. Los métodos de reintegración probados fueron la tinta neutra o la continuación de las formas y tonos. El método seleccionado para la reintegración fue el fresco y la preparación de los nuevos elementos cerámicos se realizó con el apoyo de la documentación gráfica y fotográfica, completando las lagunas de mayor tamaño de los paneles. Los resultados obtenidos a través de la técnica al fresco muestran un nivel de mimetismo satisfactorio, suficiente para devolver la lectura a la obra. Esta técnica reveló ser adecuada para la reintegración de soportes cerámicos afectados por sales solubles. Se restableció la lectura de las escenas de los paneles, completando las partes faltantes, con la introducción de nuevos elementos, que también se lograron con éxito.

**Palabras clave:** azulejos en exterior, cerámica barroca, reintegración al fresco, sales, reconstrucción de escena, rehabilitación, morteros de cal, lectura

## Técnicas de preenchimento e reintegração em azulejos exteriores com problemas de eflorescência salina. Um caso de estudo

**Resumo:** Este presente artigo centra-se no tratamento de reintegração cromática de dois painéis figurativos pertencentes ao período

artístico barroco. Os azulejos de cor azul e branco, datados do final do século XVIII, fazem parte de um período histórico relevante para a arte dos azulejos portugueses, conhecida como Grande Produção Joanina. O objetivo da intervenção foi recuperar a leitura da obra sem ocultar os sinais mais pronunciados de degradação. O trabalho de conservação de revestimentos estava contemplado no projeto de reabilitação do próprio edifício, com critérios previamente estabelecidos com base nos quais os critérios de conservação tinham de se ajustar. Uma das dificuldades encontradas durante este estudo de caso foi encontrar um equilíbrio entre os princípios éticos de conservação, tendo em conta que os azulejos continuariam expostos ao ar sobre paredes com presença de sais. O critério de intervenção escolhido fez uso de diferentes soluções entre materiais e técnicas, como a aplicação de novos azulejos, o reboco de lacunas com argamassas de cal e a reintegração cromática a fresco. O método selecionado para o preenchimento de lacunas no vidroado foi baseado na capilaridade e permeabilidade. Os métodos de reintegração testados foram a tinta neutra ou a continuação de formas e tons. O método selecionado para a reintegração foi *al fresco* e a preparação dos novos elementos cerâmicos foi realizada com o apoio da documentação gráfica e fotográfica, preenchendo as lacunas do maior tamanho dos painéis. Os resultados obtidos através da técnica *al fresco* mostram um nível satisfatório de mimetismo, suficiente para devolver a leitura à obra. Essa técnica mostrou-se adequada para a reintegração de suportes cerâmicos afetados por sais solúveis. Restabeleceu-se a leitura das cenas dos painéis, completando as partes faltantes, com a introdução de novos elementos, com os quais se alcançou sucesso.

**Palavras-chave:** azulejos ao ar livre, cerâmica barroca, reintegração *al fresco*, sais, reconstrução de cena, reabilitação, argamassas de cal, leitura

## Introduction

This case study is about two ceramic tile panels dated between 1725 and 1750, that integrate the architectonic complex of the Grijó Monastery (Porto, Portugal). This Augustinian monastery, classified as public interest, presents mainly architectural mannerist features, applied to the renovation carried out by the architect Francisco Velasquez, which began in 1572. However, it also has baroque characteristics resulting from the construction and decorative campaigns of the VXIII century. The monastery is currently divided into two administrative parts, with the church, the cloister and its chapels as well as the adjacent rooms handed over to the clergy, while the rest of the monastery complex corresponding to the garden, the guesthouse and dormitories, is privately owned.

The panels are situated outdoors supported by a wall facing south on a terrace of the house of friar monks in the farm area, an 18th century construction, once connected with the cloister.(Raimundo 2020)

The style of these panels can be inserted in a historic artistic period. This period corresponds to a time of great production of high aesthetic value tile panels(Carvalho 2012). This is due to the contribution of painters specialized in canvas paintings, that introduced a superior quality in the decoration of these panels.

In the past, it was common to partially decorate interior spaces with tile panels of various kinds. However, during the 18th century, exterior spaces became more important in architecture and society alike, introducing the tile panels to decorate them as well. (Meco 1989)

The studied panels are defined as figurative, representing palatial, bucolic and hunting scenes, amongst others, having landscape scenery and architectonic elements

connecting them. The panels are limited by frames lined with *rocaille* elements painted in tones of blue and white. It is an assembling of high-quality artistic tiles and even though they are not signed, it is most likely a work from Valentim de Almeida's workshop. This hypothesis is based on the fact that the north of Portugal is significantly punctuated with works by this author, such as the panels that line the cloister of the Porto cathedral or even the tile panels inside the Braga cathedral. It is also based on the observation of similarities of graphic and pictorial values found in these works, as exemplified by the technique in drawing the faces and hands, and the expression of the brushstroke that shows security and correctness, which is a characteristic of this author. ( Mangucci 2013)

This conservation and restoration intervention was part of a rehabilitation project of one of the monastery's areas, the south wing of the monastery, where there is a ruined structure that served as a link between the friars' house and the monastery. This area, the result of several constructive interventions, is fragmented, with a lack of constructive elements and a lack of connection between them. The rehabilitation intervention sought to interconnect and enhance the pre-existences with the new functionalities of the area, and to evaluate the potential of the elements. (Raimundo 2020). In this way, it was intended that the panels keep the tiles in their original location, as the backrest of the benches on the terrace of the old friars' house, and that they became readable once again. This dependence, which was once covered and a closed wing, was taken advantage of, partially accepting its state of ruin, becoming an open-air area, where an infrastructure of acceptance was created to the adjacent areas of the complex.

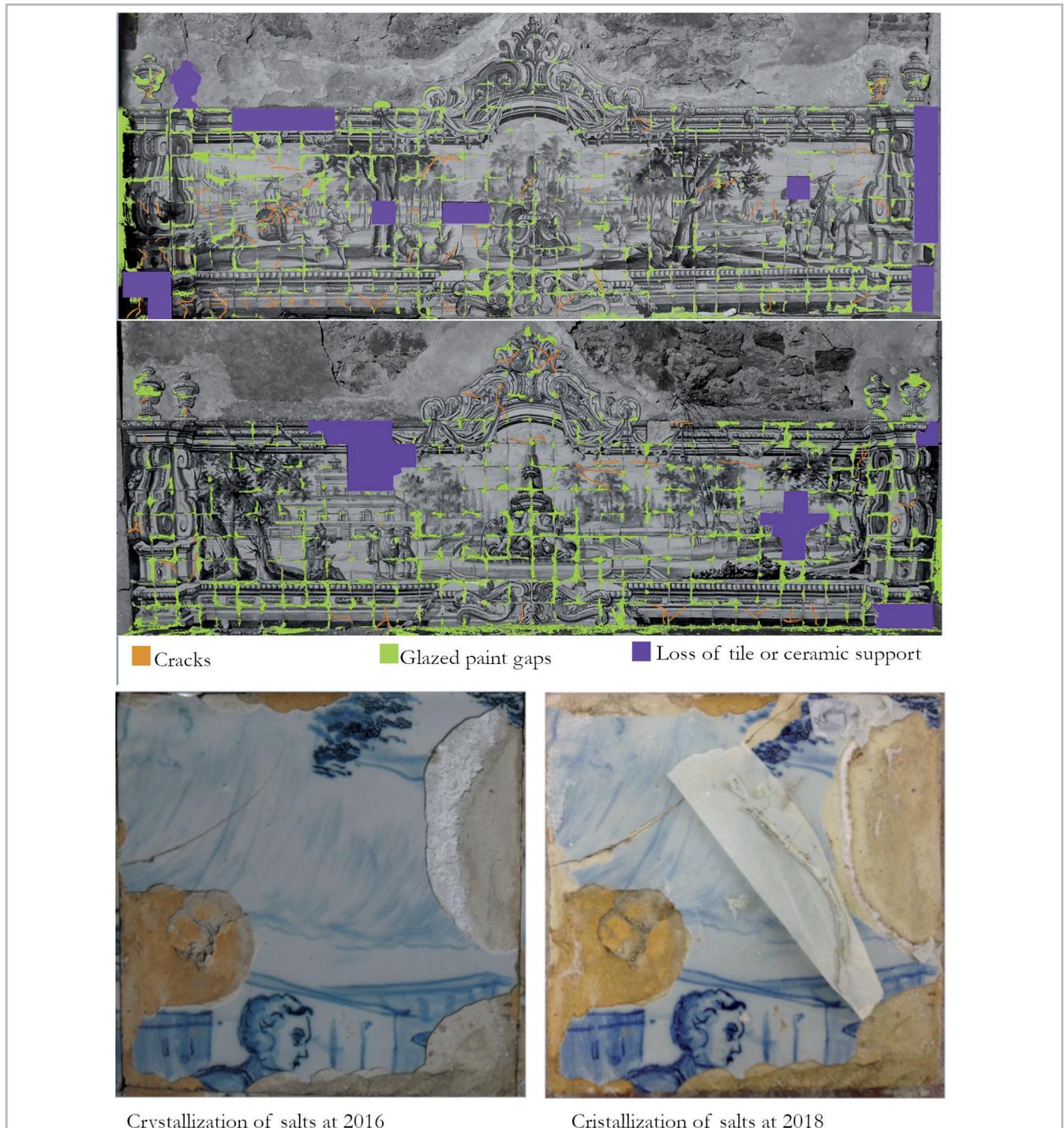
The walls of the building have been maintained, one of which is the wall that supports the panels and which now becomes a completely exterior wall, where some aspects of its ruin have been accepted, such as plastering

gaps. However, the wall was intervened at the level of its structure and for that it was necessary to remove the tiles from its support. However, the structural intervention did not completely solve the salinity problems, and the tiles would continue to be exposed to degradation. They would return to their original location after the conservation and restoration intervention, it was in that way to find a method that could answer the conservation measures imposed in this specific case, but also to explore the reintegration hypothesis for the glazed surface fillings

and the new tiles that have to be inserted, so that the readability of the work is re-established.

### Conservation

The condition of the panel was alarming due to the quantity of gaps in the glazed surface and the number of missing elements, but also due to fractures in its elements and blisters between the tiles and the support [Figure 1]. This state of conservation was due to the state



**Figure 1.-** Mapping of the pathologies and images of tiles with salt crystallization.

of degradation of the support wall, which was cracked causing shifts that broke the tiles and also by water infiltrations of both ascending and descending origin. The wall had degraded plaster which amplified the degradative action of the water causing the rotting of mortar support but also contamination with salts in the whole system, becoming harmful, since the panels are severely exposed to wetting cycles and drying due to their facing south.

It was possible to determine that the majority of the glaze losses were mainly caused by saline efflorescence which was determined by observing the morphology of the gaps, located at the ends of the tile, in a process of detachment from the outside to the interior in the shape of a half moon, but also due to the crystallization of salts that was visible to the naked eye. It was also possible to analyze, that in a space of two years the crystallization of salts, at the glaze interface with the ceramic support was able to detach about 2mm of the glazed surface [Figure 1]. This problem would continue to exist because of the support's nature and its exterior condition, something that the panels would still be bound to. Being so, it was necessary to find a conservative solution to counter the saline efflorescence problem, making the fillings with a lime mortar - marble powder, fine siliceous sand/grit and lime putty, with the proportions of 1:3 - to make them porous and pervious, so that through their capillary strength they could contain the salt crystallization within themselves, impeding the efflorescence's from crystallizing between the glaze and the ceramic body, preventing the glaze's degradation.

The formulation of this mortar, aimed to create a material with similar chemical nature to the ceramic material, that also has both carbonated and siliceous components. The proportion of the mortar was based on the same portions of the old mortars, (Damas et al 2016) and a fine granometry was chosen, so that its application could be carried out in a thin and smooth layer.

In this manner, the fillings would act as sacrificial material, and since its degradation is expected, a maintenance plan which estimates to evaluate, every two years, the stability of the sacrifice filling and substitution fillers if they are degraded, in this way to restore the mortar system of sacrifice, and continue the glaze preservation process. (Faria 2004)

As for the losses caused by complete missing tiles or those with more than 40% of missing ceramic material, a choice was made to make fillings with new ceramic elements.

In this way to re-establish the structural system of the ceramic panel that depends on the homogeneity of

the materials that constitute it so that the physical stresses between the constituent elements are similar. Thus, new ceramic elements were created with material characteristics similar to the original ones, produced with the shape and size of the existing gaps to complete the system.

### Restoration

After deciding on the materials that would fill the gaps, the re-integration techniques were adapted to the new materials. Since the permeability of the lime mortar filling's material is imperative was selected a *al fresco* technique, to retouch the filler.

The new ceramic elements were re-integrated with the hot glazing technique, which makes permeability of the ceramic, similar to the originals.

### Reintegration of the lime mortar fillings

Since the permeability of the filling's material is imperative for the glaze's conservation, the chromatic retouching had to be adapted to these features. An *al fresco* technique was selected.

This technique consists in applying this painting *la fresco* techniques to retouching. Lime-resistant pigments diluted in lime water, in the mortars still fresh, so that it is incorporated in the mortar matrix. (Mayer 1993) In this way the pigment is fixed with the carbonation process, allowing the pigment to be kept in open air conditions, without needing a protective layer that would harm the mortar's permeability.

However, this kind of retouching implies major finishing problematics such as the contrast of a glossy glazed coating, opposed to a textured matte surface, which immediately reveals the different materials used. It is also difficult to paint precise details at this scale despite of the good continuity of shapes and tones, these factors compromise the level of retouching mimesis. The imposition of this filling and retouching techniques implies that on close observation the differences amongst the fillers and the original are clear, revealing the damage that the tiles suffered and how much the state of degradation advanced. Even though these differences between materials are a consequence of the measures taken for the conservation of the glaze and not an intended effect of the intervention, these came in accordance with the aesthetic criteria of the rehabilitation intervention that accepted the ruinous features of this part of the building. In this way the differences of texture had to be embraced for the sake of the chromatic layer, accepting the ruinous state of the panel. [Figure 2].



**Figure 2.-** Photograph of a detail of the panel before and after treatment with lime mortars and retouching with al fresco technique.

### Reintegration of new ceramics elements tiles

The losses of pictorial information made some scenes clearly incomplete, a fact that profoundly disturbs a formal reading of the painted themes. This fact alters our perception of the painting itself, altering its intent, and what it represents. When looking at the panels, they would only be perceived as an incomplete fragment of the general theme. The inception of the scenery was based on the degraded existing information, becoming a general decorative scenario and not a painting produced to be a piece of fine art. (Carbonara 2006)

The return of fluidity in the reading of the panel, was an important valorization factor of the architectural area. Even though this wing of the complex had been rehabilitated accepting some losses of elements caused by its ruinous state, it was decided to maintain and improve certain parts of the pre-existing works, as was the case of these two panels and the terrace.

This intervention criterion improved, and due to its rehabilitation, the architectural space gained an interesting and pleasurable aesthetic effect, creating a cohesion between the various dependencies, accepting some of the consequences of its degradation but adapting the area to new functions. All of these aspects justified the need to reconstruct the losses of the panels so they would function as a focus of interest and not as a visual noise point. The loss of the ceramic elements or loss of a part of ceramic support on a tile greater than 40% was completed with ceramic elements, created with the shape of the gap but also whole tiles when this element no longer existed.

Some of the reintegration's of the new ceramic elements were easily resolved because they were

on the frames, composed by friezes of repeated ornaments or architectonic elements, and were reconstructed through the principle of the continuous repetition of shapes and symmetry. (Castelo 2018) It was the application of criterion

of differentiation between new and old material, through the difference in value of the applied colors with glazed paint, made with a sub-tone of blue customized for this purpose.

With relation to the material losses of the figurative scenes, three reintegration methods were tested by digitally illustrating photographs of the panels.

The first method started by experimentation based on the principle of minimal intervention, applying a glazed painting with a neutral tone on the new ceramic elements, as it had already been applied in another case study on a panel with the same artistic characteristics. (Triães et al 2018).

However, the test of this method was not satisfactory due to the fact that the ceramic elements on neutral tone accentuate their square shape, garnered excessive attention to the existence of the gap, which did not favor the reading of the panel for breaking the original texture made from fluid lines and brushstrokes

For this reason, another solution was tested, attempting to follow the mimetic method basing the retouching on continuation of the shapes and tones, and abstracting the forms when there was no more pictorial information. Such was applied in another case study of similar tile panels with positive results (Triães 2013). In the case of the figurative scenes of these panels, it proved to be an insufficient slate for the return of the fluidity of the panel reading. (Castelo 2018) This method was also unsatisfactory, because the main scenes continued, with their actions incomplete, which meant that their reading was interpreted as a background and not as a main scene in the pictorial composition (Carbonara 2006 ), which diminished the interest of the panel's interpretation.

The third method includes a graphic study then initiated to reconstruct the missing shapes. It is known that these artists were inspired by engravings of various themes that circulated through Europe to create their own pictorial compositions (Carvalho 2009). It is also known that even though every artist possessed their own personal creative style, they all revolved around the same thematic (Carvalho, Mangucci 2018). Being so, there are panels created by different authors following the same figurative traits.

In order to understand what was represented in these incomplete scenes and to study possible reconstructions, a graphic study was conducted, comparing other tile panels from national authors in the same period of production to the Grijó panels, iconographic studies about the thematic, (Carvalho 2009) but also with engravings and paintings, originally from central Europe dating from the 18th century .

Based on the data collected, it was possible to complete the scenes by completing the drawing of the figures or the action representation. (Gironés 2014) In this way it was

possible to return the fluidity of the reading of the panels, valuing all the representative scenes of the pictorial work. Three figurative scenes were identified, and retouching by this method:

**First scene**

The first scene shows one figure, with closed eyes on a relaxing state and next to her, an incomplete person was standing on his knee, but the corresponding tile of the head was not found. After analyzing and making a comparative study, it is suggested that it is a musical theme. This conclusion was drawn from the collected data of other panels with musical scenes, which frequently represent two shepherds playing the flute, coinciding with the context and garbing of these figures. (Rocha 2012) It was then possible to determine that the first figure is hearing something pleasant based on the face's expression, and the second incomplete figure is positioned as if it were playing music. Based on this information, the second figure was reconstructed with a face of a person playing the flute [Figure 3].

**Second scene**

This scene is about two hunters with a dog, but it was missing the face of one of the hunters. A very similar

picture of the same theme, was found on another panel. Based on this representation and on the remaining traces, namely the existence of the finger of the hunter pointing to the dog, a tile was created with the head of the hunter facing down to the dog [Figure 4].

**Third scene**

This one is a bit more complex, presenting the arrival of a coach, inside which was possible to identify a lady on a tile fragment. In the surrounding space, it was possible to identify a person running with a dog towards the coach's and a knight on a horse. An investigation of that period's coaches was conducted, as well as representations of coaches in artistic tiles, from which it was possible to reconstruct the shape of the coach and the lady inside it. Still through the observation of other panels, it was possible to understand the representation of the figure with the dog running towards the coach. The shapes were created based on the continuation of pre-existing ones and on data collected through the investigation, reestablishing the readability of the scene [Figure 5].

The reconstruction of the incomplete scenes results perfectly well on the return of the legibility, making the reading of the painting fluid again. [Figure 6].



**Figure 3.-** Original state of the panel (a); final result (b); other images from the same period: c) detail of a panel from the National Tile Museum; d) tiles from Vicente de Fora Monastery and e) tiles from central Europe



**Figure 4.-** The original state of the panel, the final result and samples of the graphical study applied in this case.



**Figure 5.-** The original state of the panel, the final result and samples of the graphical study applied in this case.



**Figure 6.**-The final result of the intervention.

## Conclusion

When a conservation intervention is involved in a project of rehabilitation and regeneration of an architectonic space, it is necessary that the conservation intervention is already adapted to the context in which it is being incurred, as well as promoting its valorization in the space it occupies. In this rehabilitation project, the decision to keep the tiles in their original place aimed to create a focus of aesthetic interest for the group. The valuation of this pictorial work as an element of interest, made it necessary that all the work of retouching for the legibility of the panel to be achieved in a fluid and noiseless way, making the most of all pre-existing information

It is possible to conclude that utilizing the *al fresco* technique greatly contributed to the return of the panel's legibility, but it is worth noting the disadvantage that exists caused by the difference in finish aspects between the original and the restoration material. Although it is good that there is a differentiation between materials, due to the nature of the techniques used, the fills are extremely different from the tile in textural appearance, contrasting a smooth and shiny material with a textured and opaque surface, creating a clear difference between

the gap and the tile. However due to the tones of colour wheel and its dimension, these panels are usually appreciated from a certain distance, in order to see the whole image, and that distance makes the original and the retouched areas naturally blend without altering the readability of the work. In spite of this disadvantage, it was possible to improve on the reading of the panel, and the clear difference between the materials was an aesthetic aspect accepted taking into account the context of the rehabilitation project which framed some consequent aspects of the degradation of the construction.

The reconstruction of the incomplete scenes was a factor that contributed to the return of the legibility. Since the pictorial representations were completed, the interruptions were diminished, inviting the observer to focus on the main scenes and not on the potentially perceivable gaps.

This enabled the return of the readability of the panels, while respecting the imperative conservation measures without hiding the signs of degradation that they have suffered, resulting in an outcome consistent with the rehabilitation project valuing the architectural ensemble and working as a focus of interest throughout the area.

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## Author/s



**Sara Isabel da Silva Botelho de Araújo**

[sara.botelho.araujo@gmail.com](mailto:sara.botelho.araujo@gmail.com)

Freelance conservator.

Sara Botelho de Araújo holds a degree in Conservation and Restoration(2012) from the Polytechnic Institute of Tomar and holds a master's degree in conservation and restoration of integrated heritage(2015) by the same institute with a master's thesis "The Conservation of Facade Tiles in Oporto" and was an interdisciplinary student of Master of Urban Rehabilitation. She dedicates her academic career to the study of decorative arts on buildings, but also to the structural pathologies of buildings. Since 2012 she is a freelance conservator, experiencing the contact with the built heritage, where she has already assumed the coordination of intervention in tile heritage.



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