

A NEW APPROACH TO THE CONSERVATION OF METALLIC EMBROIDERY THREADS IN HISTORIC TEXTILE OBJECTS FROM PRIVATE COLLECTIONS

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Abstract

The object under study represents a standard sample of the metallic embroidery threads in a late Ottoman historic textile object. The object is part of the textile collection of Sheikh Yusuf Jameel - Saudi Arabia. It is richly decorated with multicolored plant motifs and with written decorations. The object dimensions are 185x280 cm. It was fixed on a plywood holder. Some of the metallic threads were coated with white oil paint. The uncontrolled conditions affect the identification of certain kinds of damages and deteriorations of metallic and natural threads. Different parts of the object were highly faded and discolored. A close examination of the textile was followed by various non-invasive analyses, in order to plan an appropriate conservation treatment. Our research revealed the practical strategies which have to be followed in maintaining and conserving textiles. The effects of cleaning substances on the natural dyes were tested. Different types of solvent were used to remove the corrosion layer from the metallic threads. Dry cleaning was used to remove resistant stains. The process of maintenance and restoration was recorded step by step, beginning from the historical record of the textile, to the various cleaning processes used. Additionally, we indicated the processes of fixing cleaned pieces on a new holder, as a preparation for their display in the Sheikh Yusuf Jameel museum.

Keywords: *Metallic threads; Corrosion; Cleaning; SEM; Natural dyes; Dirt.*

Introduction

The Ottoman period provided a rich treasure of different types of textiles. Many of those textiles contain metal threads as decorations, usually made of gilded silver, silver, or brass. Decorative metals have been incorporated into textiles for thousands of years. Embroideries were one of the most sumptuous kinds of textiles produced in sixteenth-century Europe and among those costly goods, gold embroideries were the most precious. Metal threads deteriorate over time and corrode, due to chemical attacks by different corrosive factors, such as high and fluctuating relative humidity, air pollutants and elevated temperatures [1-3].

Textiles employing metal threads are generally in a poorer condition than those that do not contain metal, because of the extra stresses from the high mass of the material and the multiplicity of degradation processes. The condition of the metal textiles depends on various

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factors, related to the quality of the materials from which they were made and to their manufacturing techniques, in addition to the surrounding environmental factors. This type of objects, consisting of composite materials of different origin and nature, pose a major conservation challenge [4-5].

Nevertheless, for an effective restoration and conservation planning and treatment of such composite objects, it is necessary to carry out a diagnosis of the materials that constitute the object. For this type of composite objects, many studies have already focused on investigating the technology and types of materials used for the metal threads [6]. The corrosion products of metal are mainly crystalline materials: oxides, hydroxide and simple or basic metallic salts. The metals used to make the metal threads found in historical textiles are compounds containing covalent bonds, with varying degrees of ionic covalent compounds of liked water solubility [1].

Examination of the metal threads

Optical microscopy was used for a preliminary examination of the metal threads. Scanning electron microscopy with energy-dispersive X-ray microanalysis (SEM/EDS) is the most frequently used analytical technique to determine the chemical composition. The X-rays can be analyzed with an energy-dispersive system (EDS), and they provide qualitative and quantitative information. The SEM images provide a characteristic surface morphology and are useful for judging the surface structure of the investigated sample, its fiber quality as well as its damage aspects. A combination of transmitted light microscope and SEM was used to reveal diagnostic features of the fibers, necessary for their identification [7-9]. The morphology of the surface of the fibers was investigated by using a Joel- Scanning Electron Microscope. The EDX results showed that the metal threads in sample one were manufactured from different types of elements, such as copper (Cu) and zinc (Zn). This shows that the material of the metal fibers alloys. That may indicate the nature of the corrosion found on the threads.

Description of the object under study

The object dates back to the late Ottoman era (Fig. 1). It contains the two foundational texts indicating the date of manufacture and name of the Ottoman Khalifa and the Egyptian Khedive.



Fig. 1. The Ottoman textile object from the front and back. One can see the decorations, the colors of the object, and the damage aspects of the object (the first foundational text of the object indicating the date of manufacture and the name of the Egyptian Khedive Abbas Helmy)

The text shown in figure 2 contains the name of Sultan Mohammed V Khalifa (Mohamed V Rahadv was the 35th Ottoman Sultan). He was born at Topkapı Palace, Istanbul, like many other potential heirs to the throne. His reign lasted from April 27, 1909 until 1918). It also contains the name of the Khedive Abbas Helmy (Abbas II Hilmi Pasha (14 July 1874 – 19 December 1944) was the last Khedive of Egypt and Sudan (8 January 1892 – 19 December 1914). Abbas II was the great-great – grandson of Muhammad Ali. He was born in July 1874 and died on December 19, 1944 in Geneva). According to the text the textile object was made in Egypt. As with other textile objects from the same historical period, it contains the date of manufacture.



Fig. 2. Details from the front of the object. One can see the damage aspects of the object, such as dirt, stains, corrosion, lost parts, oil paint on metallic threads. (B) The second foundational text of object that shows the date of manufacture and contains the name of the Ottoman Khalifa (Sultan Mohammed V)

The historic object is decorated with plant motifs and written text, such as diverse verses from the Koran. It contains different types of decorations such as floral patterns, geometric pattern and written decorations. Two types of metal threads (black and yellow threads) were used. SEM images show that the structure of the metal thread is a solid metal wire and the natural fiber is cotton. Visual inspection revealed that all the investigated objects have accumulated dust and dirt, mainly due to many years of bad storage under unsuitable and

uncontrolled conditions. One can see easily that the embroidery of metal threads is fragile and in very poor condition. Furthermore, there are lost parts in the objects. The textile fabric suffered greatly from aging and poor storage conditions and it contains a black stain, dust and dirt, as shown in figure 1 and 2. Furthermore, SEM images show that there is a corrosion layer on the surface of the metal parts, as shown in figure 3. The object was fixed on a cloth, from behind. The object showed severe dryness. The EXD of the metallic threads is shown in figure 4.

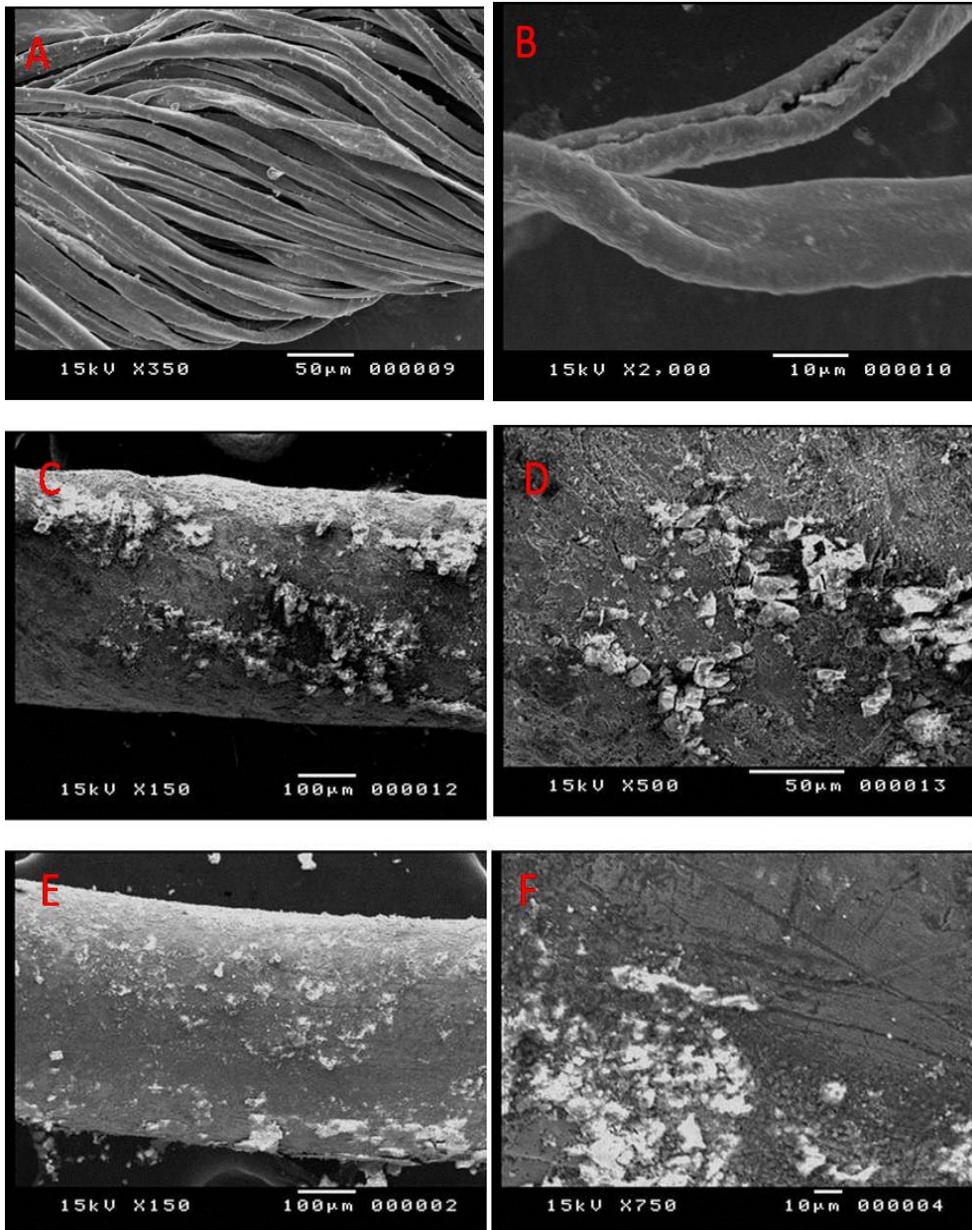


Fig. 3. SEM images of the natural fibers (Cotton fiber) (A and B), the yellow metal threads (C and D) and black metal threads (E and F) and we can see the corrosion over the threads

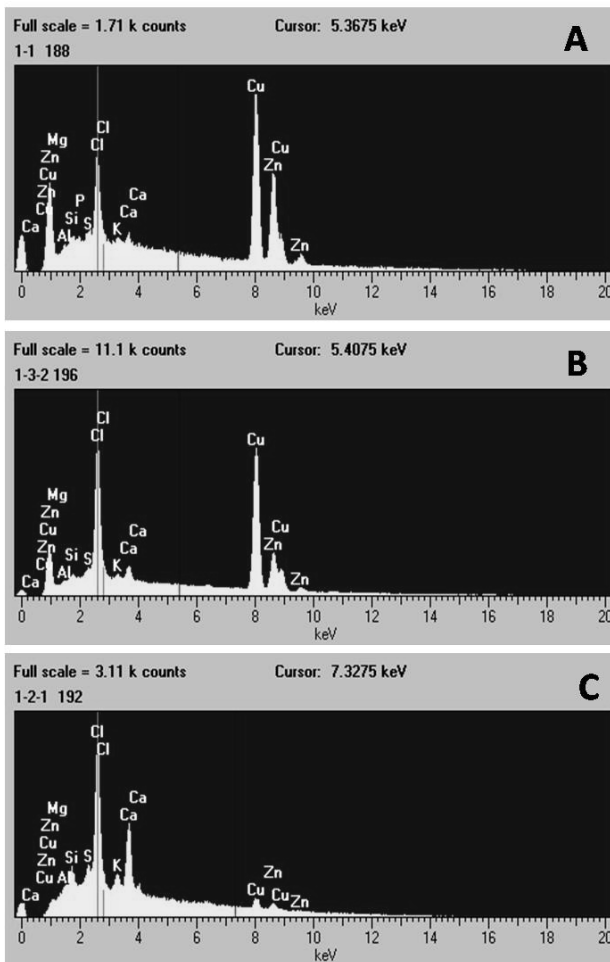


Fig. 4. EDX analysis of the yellow metal thread (A), the EDX analysis of the black metal thread (B) and the EDX analysis of the natural fiber (C)

Cleaning procedure

Testing the stability of dyes

Firstly, we performed a visual investigation and all the deterioration aspects were recorded by photograph. Then we removed the white background canvas lining. One can see dirt and stains on the canvas lining. The important step was to test the stability of the natural dyes to wet cleaning, by immersing a piece of cotton wrapped round a wooden stick into the cleaning solutions and placing it in contact with the colorful parts of the ribbons. Each color was individually tested. We found that all the dyes were stable and did not bleed in contact with the wet cleaning solution.

Mechanical cleaning

The object was thou roughly dusted. The aim of conservation cleaning is to remove harmful soils, which may be disfiguring or cause physical or chemical damage to a textile. The selection of the appropriate cleaning method depends on the nature of the soil present and on the materials, structure and condition of the textile. Thorough testing should always be carried

out first, to determine the response of the textile to cleaning and to identify the most suitable method [10]. Various types of fine brushes are used to remove free dust, dirt and fragile superficial layers of corrosion. Aerobic aspiration of dust was done by using a vacuum cleaner [3].

Removing the corrosion

Different types of solvents such as acetone, carbon tetrachloride and methanol were used to remove the corrosion from the metal threads. This step was done by immersing a piece of cotton wrapped round a wooden stick into the solvent solutions and by placing it in contact with the surface of the metal threads. Then, we wiped the metal threads with a piece of cotton wrapped round a wooden stick and we used different types of brushes to brush off all the corrosion products, as shown in figure 5. One can see the metallic threads before and after corrosion removal in figure 6.



Fig. 5. The removing of old background cloth (A), the cleaning process of metal threads with solvents (B and C) and isolating metal threads by using Paraloid B-82 (D)



Fig. 6. Samples of the metal threads before cleaning and after cleaning, in the red box

Coating and isolating the metallic threads

The aim of this step was the protection of the metal threads, after cleaning and removing the corrosion layers, from washing water, as well as from the effect of the relative humidity during storage or display in the museum. Thus, the metal threads were isolated by using Paraloid B-82 (an ethyl methacrylate/methyl acrylate copolymer) with a concentration of 10%, used for isolating and protecting metallic threads, as shown in figure 5.

Dry cleaning

The object contains different types of stains and dirt. The researchers tried to test different cleaning methods. The mechanical and wet cleaning processes helped remove mud dirt, but those methods were ineffective in removing dark black dirt. Only dry cleaning, by using ethanol, was very effective in removing the black stain. In general, dry cleaning solvents, such as aliphatic hydrocarbons, aromatic hydrocarbons, alcohols, ketones, esters, ethers, chlorinated solvents, nitrogen compounds, organic bases and sulphur compounds will attack greasy, oily soils and waxes at room temperature [1]. Thus, we attempted using ethanol in a localized way for the soiling parts, by using smooth brushes to help remove spots after 15 minutes. Two baths of ethanol were used for 15 minutes, with smooth brushes used to remove soiling. The results were very satisfactory and we can note the pictures before and after use, which show the extent of the ethanol's efficiency. A bath without soap for five minutes, to remove any undesired remnants and to equalize the effect of ethanol on fibers was done. Furthermore, the white oil paint was removed from the metallic threads by applying ethanol [1, 11].

The wet cleaning procedure

For the wet cleaning procedure we used water with other detergent agents, to assist the cleaning process. The ratio was one part of a neutral synthetic anionic detergent - Orvus WA Paste (sodium lauryl sulfate) - to 100 parts of distilled water. The water was agitated to allow it to penetrate between the fibers to release the dirt particles, for 15 minutes. The bath solution temperature was 30°C. Then a second cleaning bath, with distilled water only was applied for 10 minutes again, with water agitation and then a third bath with distilled water only, for 10 minutes, as shown in figure 7. The wet cleaning reduced the soiling, relaxed the fibers, removed the creasing and brightened the colors [12-13].



Fig. 7. Preparation of the temporary bath (A), the cleaning process of the object (B), samples of the fourth washing water after cleaning (C) and the drying process of the object after cleaning by using a white cotton towel(D)

Removing the water from the textiles

Three different methods were used to remove the water from the object after cleaning. The first method was using a white cotton towel, pressed directly onto the surface of object. The second method was using the Japanese paper (Acid free paper) pressed directly onto the surface of the textile and again, pressed carefully by hand. We always keep in mind that the textile, at this stage, was still soft, due to its wet state and could easily be damaged during handling. Thus, we handled the objects with extreme care. The sheets of Japanese paper were set over the pieces for absorbing the water from the textiles at different times. Eventually, the object was left uncovered to complete its drying at ambient conditions. In air drying, the process can be shifted towards evaporation in several ways: by ensuring that the wet textile is set in a place (i.e. workroom) that is sufficiently large in comparison to the size and surface area of the drying textile and by ensuring that water vapors are removed as soon as they form e.g. with the help of dehumidifiers and/or effective ventilation [1, 14].

Fixing the object on a new support

A new linen support was prepared and washed to remove chemical residues and to prevent shrinkage at a later time, due to humidity changes. Then the new linen support was ironed to remove creases. The new support consisted of three layers adhered together by stitching (non woven textile between two layers of linen). A new support was used after supporting the edges, which were perforated. Then, we reinforced the perforations by metallic rings. Wooden frames were used in this project for mounting the processed objects. The rings were fixed on perforations for easy stretching on the wooden frame. Then, a thick cotton thread was used for fixing the linen support on the wooden frame as shown in figure 8.

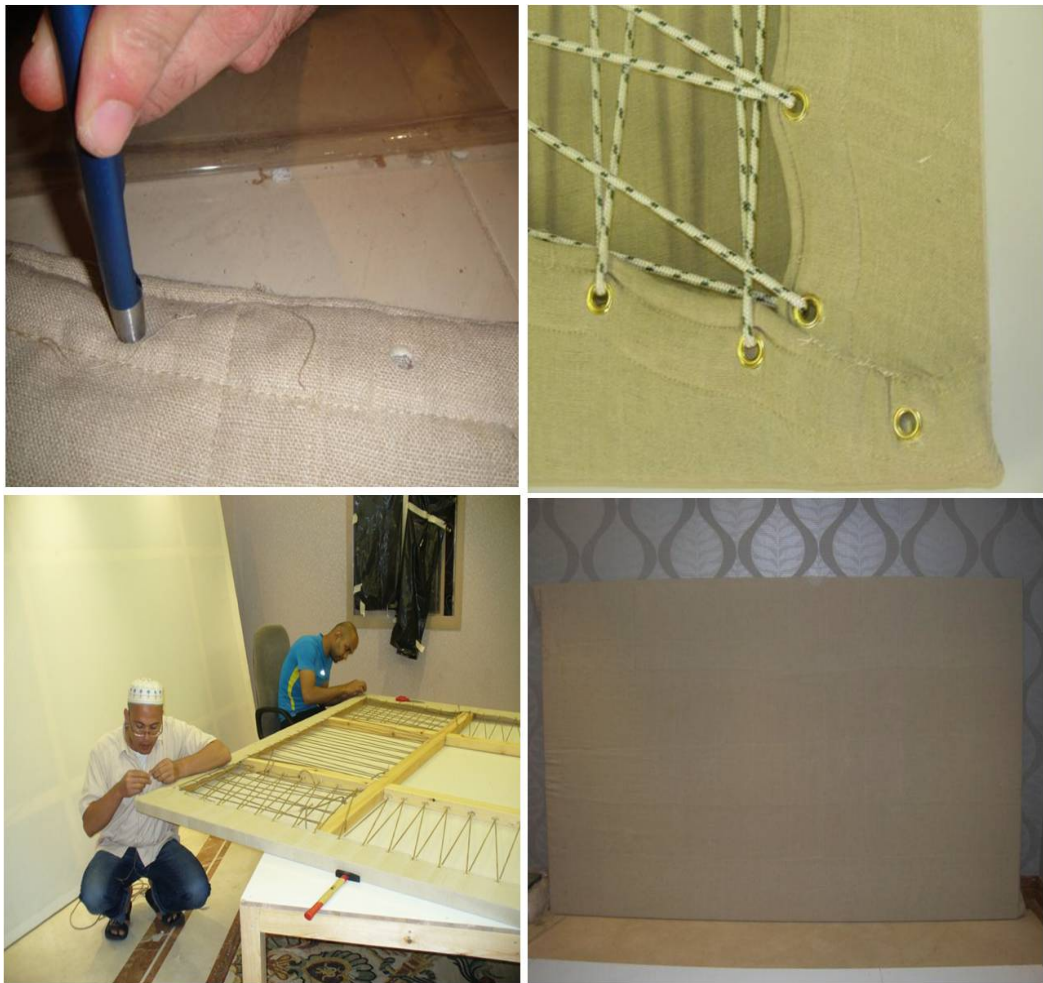


Fig. 8. Preparation of the new linen support that adhered on the wooden frame, by using thick cotton threads. One can see the edges of linen which were perforated and supported by using the metallic rings

Completion and final support of lost parts

Replacing the lost parts of an object is a very important step. In that regard, new, dyed cotton was made, by using the same color. A mixture of indigo and turmeric dyes was used to obtain the green color.

Dying procedure of the new part***Blue color with indigo on silk***

In a beaker glass we mixed 15g of indigo powder with 75mL of warm water until it formed a paste. We dissolved 30g of soda in 120mL of warm water, in a second vessel. We poured 60–70mL of this solution over the indigo paste and stirred vigorously. 30g of sodium dithionite was added and stirred again. After that, the one liter of warm water was added and we stirred carefully until the whole solution was thoroughly mixed. The mixture was heated to 55°C. One can see that the liquid became a yellowish color. After leaving it for 20 minutes, the color turned yellow-green. 30g of sodium dithionite was added to the solution. We heated the 1L dye bath to 55°C, immersed 30g of cotton fabric in warm water until the material was thoroughly wet and then submerged it into the dyeing solution. We let the dye bath stand still, so that no oxygen entered into the vat. We kept the fabric in the vat for 20 minutes and then took it out of the vat and squeezed the liquid out thoroughly. When we removed the cotton from the vat, it had a green-yellow color, which turned blue when the fabric was exposed to the air. After 20 minutes, the cotton was completely blue. We rinsed thoroughly with water, but only after the fabric was dried completely [15-17].

Green color with indigo and turmeric dye on silk

To get the green dyed sample, the cotton fabric dyed with indigo was immersed again in turmeric dye. The dyeing with turmeric dye was carried out according to the following steps:

- Soak the 10% dye in the distilled water for 24h to extract the color from the powder;
- Heating the extract to boiling temperature for 2 h with continuous stirring. It may require addition of water to compensate the evaporated water during the heating process;
- Allow the extract to be cooled and then filter it many times to get a clear colored solution.

Dyeing procedures

The dying procedures were performed by the exhaustion method, using a liquor ratio (LR) of 1:20 (1 g of fabric per 20 ml of bath). The dyeing experiments were performed in glass beakers according to the temperature-dyeing diagram given in figure 9. In the experiments mordant (alum), was added as concentrated solution (50 g/l) to give a final dye bath concentration of 2.5 or 5 g/L. After dyeing, the unfixed dyestuff was removed by rinsing three times with cold water (5 min, at room temperature [25 °C], LR 1:20.) [15-17].

Replacement of the separate parts

Fine silky stitches, which have the same color of the part we wanted to support, were used. At first, a piece of the linen band was fixed under the textile and then the separated edge was moved to the textile and fixed to the linen band. Small stitches were used to stitch the edge and textile together as shown in figure 9 [1, 3].

Replacement of the lost parts

The added parts were fixed by fine stitches of cotton dyed in the same color. The lost parts were replaced by using cotton parts of similar color, which were slightly lighter. When the lost part is free, i.e., present at the textile margin to the outside, the cotton parts are fixed at first to the linen band by fine stitches followed by adjustment of the band under the lost part to be fixed by fine stitches in the back using silk thread that has the same color as the lost part, as shown in figure 9 [1, 3].



Fig. 9. The object after cleaning processes and the researcher trying to remove the temporary support of the weak parts (A), fixing object on new linen support by stitching processes (B), the fixing of the separated metallic threads on the object (C) and replacing the lost parts by using new dyed cotton (D)

The final support process

After completion of the object treatment, tacking stitches were used with a very fine needle and fine silk thread to fix it into the object. In the beginning of the final stage, the edges of the object all around were attached by sewing with a small stitch technique (blanket stitch) and afterwards the edges of the missing and vulnerable parts were attached by small stitches. Similarly, sized stitches were used to attach the body of the object. After completing the cleaning process and fixing the object, it could be displayed in a suitable manner according to the requirements of the museum. One can see the object in a final stage in figure 10 [18-19].



Fig. 10. The object after cleaning and fixing onto new linen support

Conclusions

The present article describes the analysis and conservation intervention on historic textiles decorated with metal threads. The textile was dated to the late Ottoman period. Analyses by SEM have shown that the textile object is made of cotton decorated with metal threads. The object's surface presented an intense accumulation of dust and dirt, affecting its mechanical properties and the appearance of the object, giving it a dull grey and opaque tone. The conservation intervention, which included removing the corrosion layers and cleaning and mounting on a proper support, had the objective of increasing its stability. Although there was a noticeable improvement in the appearance and integrity of the object after the intervention, there was one type of dirt that could not be removed by wet or dry cleaning. After cleaning and remounting, the object was free from dirt. It was softer and aesthetically more pleasing. Physically, the wrinkles and folds were also much less obvious. It is recommended that the textiles we processed should be moved from their current place to the museum storage room as soon as possible, for safe keeping of the items. It is also recommended that further research be carried out, to study the materials used in the manufacture of the textile, namely the metallic threads, the natural dyes and mordents.

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